

13. B.Tech.in Civil Engineering

13. (a) Mission of the Department

Mission Stmt – 1	To move up through international alliances and collaborative initiatives in civil engineering to achieve global excellence
Mission Stmt – 2	To accomplish a process to advance knowledge in a rigorous research environment related to civil engineering and allied disciplines
Mission Stmt – 3	To attract and build people in a rewarding and inspiring environment by fostering freedom, empowerment, creativity and innovation.

13. (b) Program Educational Objectives (PEO)

PEO - 1	Graduates will pursue higher studies in civil engineering, management and other related fields
PEO - 2	Graduates will perform as professional engineers in the fields of civil engineering
PEO - 3	Graduates will perform in diverse fields and gradually move into teamwork and leadership positions.
PEO - 4	Graduates will contribute to the development of the profession, nation and society

13. (c) Mission of the Department to Program Educational Objectives (PEO) Mapping

	Mission Stmt. – 1	Mission Stmt. – 2	Mission Stmt. – 3
PEO – 1	3	3	2
PEO – 2	3	2	3
PEO - 3	3	2	3
PEO – 4	3	2	3

3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

13. (d) Mapping Program Educational Objectives (PEO) to Program Outcomes (PO)

					Р	rogram Ou	tcomes (PC	C)				
	Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning
PEO – 1	3	3	3	3	3	1	1	1	1	1	1	1
PEO – 2	3	3	3	3	3	1	1	1	1	1	1	1
PEO - 3	1	1	1	1	2	2	1	3	3	3	3	3
PEO – 4	1	1	1	1	1	3	3	3	2	2	2	3

3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

13. (e) Program Structure: B.Tech. in Civil Engineering

	Humanities & Social Sciences		Basic Science Courses (B)								
	including Management Courses (H)										
Course	Course	Hou	rs/ V	/eek		Course	Course	Ηοι	urs/ V	Veek	
Code	Title	L	Т	Ρ	С	Code	Title	L	Т	Ρ	С
21LEH101T	101T Communicative English		1	0	3	21MAB101T	Calculus and Linear Algebra	3	1	0	4
21LEH102T	Chinese	_				21MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4
21LEH103T	French	_			0	21CYB101J	Chemistry	3	1	2	5
21LEH1041	German	2	1	0	3	21B1B1031	Biology	2	0	0	2
211 EH106T	Korean	-				21P10104J 21MAR201T	Transforms and Boundary Value Problems	3	1	2	- <u>5</u>
21LEH107T	Spanish					21CEB201J	Applied Geology	3	0	2	4
21GNH101J	Philosophy of Engineering	1	0	2	2	21MAB301T	Probability and Statistics	3	1	0	4
21PDH201T	Social Engineering	2	0	0	2		Total Credits				32
21GNH401T	Behavioural Psychology	2	1	0	3						
	Total Credits	8			13		Professional Core Courses I				
	Engineering Science Courses (S)					0	0.000	11.		Vaalu	
	Engineering ocience oourses (0)					Code	Title	I	T	D	C
Course	Course	Hou	rs/ V	/eek		21CEC101T	Building Materials in the Built Environment	3	0		3
Code	Title	L	Т	Ρ	С	21CEC201T	Hydro Mechanics and Hydraulic Engineering	3	0	0	3
21MES102L	Engineering Graphics and Design	0	0	4	2	21CEC201L	Fluid Mechanics and Machinery Lab	0	0	2	1
21MES101L	Basic Civil and Mechanical Workshop	0	0	4	2	21CEC202T	Engineering Surveying	3	0	0	3
21EES101T	Electrical and Electronics Engineering	3	1	0	4	21CEC202L	Surveying Lab	0	0	2	1
21CSS101J	Programming for Problem Solving	3	0	2	4	21CEC203T	Environmental Engineering and Design	3	0	0	3
21DCS201P	Design Thinking and Methodology	1	0	4	3	21CEC203L	Environmental Engineering Laboratory	0	0	2	1
21CES2011 21CSS303T	Data Scionco	3	0	0	3	21C5C2061	Antificial Intelligence Structural Engineering Design I	2	1	0	3
210000000	Total Credite	2	U	U	20	210202041	Concrete Technology and Strength of Materials	5	0	0	
	Total of our				20	21CEC204L	Laboratory	0	0	2	1
	Mandatory Courses (M)					21CEC205T	Geomechanics	3	0	0	3
Code	Course Title	1	T	P	0	21CEC205L	Geomechanics Laboratory	0	0	2	1
21PDM10	IL Professional Skills and Practices	0	0) 2	0	21CEC206T	Irrigation and Water Resources Engineering	3	0	0	3
21PDM102	2L General Aptitude	0	0) 2	0	21CEC2071	Concrete Technology and Special Concrete	3	0	0	3
21PDM201	IL Verbal Reasoning	0	() 2	0	21CEC3011	Structural Analysis	3	0	0	3
21PDM202	2L Critical and Creative Thinking Skills	0	() 2	0	21CEC301L	Structural Engineering Design-II	2	1	2	3
21PDM301	L Analytical and Logical Thinking Skills	0	() 2	0	21CEC303T	Transportation Engineering	3	0	0	3
21PDM302	2L Employability Skills and Practices	0	($\frac{1}{2}$		21CEC303L	Transportation Engineering Laboratory	0	0	2	1
21CYM10	T Constitution of India	1				21CEC304T	Construction Engineering and Management	3	0	0	3
21LEM101T Constitution of India 1 0 0											
21LEM101	T Professional Ethics	1	(0		Total Credits				46
21LEM201 21LEM202	T Professional Ethics T Universal Human Values	1	0) 0) 0			Total Credits Project Work, Seminar, Internship In				46
21LEM101 21LEM201 21LEM202 21LEM301	T Professional Ethics T Universal Human Values T Indian Art Form	1 1 1	() () ()) 0) 0) 0	0		Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P)				46
21LEM101 21LEM201 21LEM202 21LEM301 21LEM302	T Professional Ethics T Universal Human Values T Indian Art Form T Indian Traditional Knowledge	1 1 1 1 1		0 0 0 0 0 0 0 0 0 0		Course	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title	Нос	urs/ V	Veek	46
21LEM201 21LEM202 21LEM301 21LEM302 21GNM10	T Professional Ethics T Universal Human Values T Indian Art Form T Indian Traditional Knowledge IL Physical and Mental Health using Yoga	1 1 1 1 1) 0) 0) 0) 0) 0		Course Code	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect	Hou	urs/V	Veek	46 C
21LEM001 21LEM202 21LEM301 21LEM302 21GNM10 21GNM102 21GNM102	T Professional Ethics T Professional Ethics T Universal Human Values T Indian Art Form T Indian Traditional Knowledge IL Physical and Mental Health using Yoga 2L NSS J NCC	1 1 1 1 1 				Course Code 21GNP301L 21CEP302L	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project	Hou L 0	urs/V T 0	Veek P 2 6	46 C
21LEM/00 21LEM/202 21LEM/202 21LEM/202 21LEM/202 21GN/102 21GN/102 21GN/102 21GN/102	T Professional Ethics T Professional Ethics T Universal Human Values T Indian Art Form T Indian Traditional Knowledge IL Physical and Mental Health using Yoga 2L NSS 3L NCC 4L NSO	1 1 1 1 1 		$\begin{pmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 2 \\ 0 $		Course Code 21GNP301L 21CEP302L 21CEP303T	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC	Hou L 0 3	urs/ V T 0 0	Veek P 2 6 0	46 C 1 3
21LEM/01 21LEM201 21LEM202 21LEM302 21GNM102 21GNM102 21GNM102 21GNM102	T Professional Ethics T Professional Ethics T Universal Human Values T Indian Art Form T Indian Traditional Knowledge IL Physical and Mental Health using Yoga IL NSS BL NCC 4L NSO Total Cre	1 1 1 1 1 0 0		$\begin{pmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 2 \\ 0 & 2 \\ 0 & 2 \\ 0 & 2 \\ 0 & 2 \\ 0 & 2 \\ 0 & 2 \\ 0 & 0 \\ 0 $	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Course Code 21GNP301L 21CEP302L 21CEP303T 21CEP401L	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project	Hou L 0 3	urs/ V T 0 0 0	Veek P 2 6 0	46 C 1 3
21LEM301 21LEM302 21LEM302 21LEM302 21GNM10 21GNM102 21GNM103 21GNM104	T Professional Ethics T Universal Human Values T Indian Art Form T Indian Traditional Knowledge IL Physical and Mental Health using Yoga IL NSS BL NCC AL NSO Total Cre	1 1 1 1 1 0 dits			0 0 0 0 0 0 0 0 0 0 0 0 0 0	Course Code 21GNP301L 21CEP302L 21CEP303T 21CEP401L 21CEP402L	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credite	Hou L 0 3 0	urs/ V T 0 0 0	Veek P 2 6 0 30	46 C 1 3 15
21LEM01 21LEM201 21LEM301 21LEM302 21GNM10 21GNM10 21GNM10 21GNM10	T Professional Ethics T Professional Ethics T Universal Human Values T Indian Art Form T Indian Traditional Knowledge L Physical and Mental Health using Yoga L NSS L NCC L NSO Total Cre	1 1 1 1 1 0 dits) 0) 0) 0) 0) 0) 0) 0) 2	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Course Code 21GNP301L 21CEP302L 21CEP303T 21CEP401L 21CEP402L	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits	Hou L 0 3 0	urs/ V T 0 0 0	Veek P 2 6 0 30	46 C 1 3 15 19
21LEM301 21LEM202 21LEM301 21LEM302 21GNM10 21GNM102 21GNM102 21GNM103	T Professional Ethics T Professional Ethics T Universal Human Values T Indian Art Form T Indian Traditional Knowledge L Physical and Mental Health using Yoga L NSS J NCC L NSO Total Cre	1 1 1 1 0 0) 0) 0) 0) 0) 0) 0) 2		Course Code 21GNP301L 21CEP302L 21CEP303T 21CEP401L 21CEP402L	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (0) Any 2 Courses	Hou L 0 3 0	urs/ V T 0 0 0	Veek P 2 6 0 30	46 C 1 3 15 19
21LEM301 21LEM202 21LEM302 21LEM302 21GNM10 21GNM10 21GNM10 21GNM10	T Professional Ethics T Universal Human Values T Indian Art Form T Indian Traditional Knowledge L Physical and Mental Health using Yoga L NSS L NCC L NSO Total Cre Open Elective Courses (O) Any 3 Courses Courses	1 1 1 1 1 1 1 1 0 0 dits				Course Code 21GNP301L 21CEP302L 21CEP303T 21CEP401L 21CEP402L	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (0) Any 3 Courses Course	Hou L 0 3 0	urs/ V T 0 0 0	Veek P 2 6 0 30	46 C 1 3 15 19
21LEM01 21LEM201 21LEM202 21LEM301 21LEM302 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10	T Professional Ethics T Professional Ethics T Universal Human Values T Indian Art Form T Indian Traditional Knowledge L Physical and Mental Health using Yoga L NSS L NCC 4L NSO Total Cre Open Elective Courses (O) Any 3 Courses Title	1 1 1 1 1 1 1 1 1 1 0 0 dits	() () () () () () () () () () () () () (/ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		Course Code 21GNP301L 21CEP302L 21CEP303T 21CEP401L 21CEP402L Course Code	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title	Hou L 0 3 0 Hou L	urs/ V T 0 0 0 0	Veek P 2 6 0 30 30 /eek	46 C 1 3 15 19 C
21LEM301 21LEM202 21LEM302 21LEM302 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10	T Professional Ethics T Professional Ethics Universal Human Values Indian Art Form Indian Traditional Knowledge Physical and Mental Health using Yoga NSS NSC NSC Total Cre Open Elective Courses (O) Any 3 Courses Title Maintenance and Rehabilitation of Structures	1 1 1 1 1 1 1 1 1 1 1 0 0 dits	() () () () () () () () () () () () () (/eek		Course Code 21GNP301L 21CEP302L 21CEP303T 21CEP401L 21CEP402L Course Code 21CE0317J	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology	Hou 0 3 0 Hou L 2	urs/ V T 0 0 0 0 0 0 0	Veek P 2 6 0 30 30 /eek P 2	46 C 1 3 15 19 C 3
21LEM201 21LEM202 21LEM301 21LEM302 21GNM10 21GNN10 21	T Professional Ethics T Professional Ethics Universal Human Values Indian Art Form Indian Traditional Knowledge Physical and Mental Health using Yoga NSS NSC NSC Total Cre Open Elective Courses (O) Any 3 Courses Course Title Maintenance and Rehabilitation of Structures Disaster Resistant Structures	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	() () () () () () () () () () () () () (/eek P 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Course Code 21GNP301L 21CEP302L 21CEP303T 21CEP401L 21CEP402L Course Code 21CE0317J 21CE0318T	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management	Hou L 0 3 0 Hou L 2 3	urs/ V T 0 0 0 0 0 0 0 0 T 0 0	Veek P 2 6 0 30 30 Veek P 2 0	46 C 1 3 15 19 C 3 3
21LEM301 21LEM202 21LEM302 21LEM302 21GNM102 21G	T Professional Ethics T Professional Ethics Universal Human Values Indian Art Form Indian Traditional Knowledge Physical and Mental Health using Yoga NSS NSC NSC Open Elective Courses Course Title Maintenance and Rehabilitation of Structures Smart City and Infrastructure	1 1 1 1 1 1 0 dits	() () () () () () () () () () () () () (/eek P 0 0 0 0 2	C 3 3 3	Course Code 21GNP301L 21CEP302L 21CEP303T 21CEP401L 21CEP402L Course Code 21CEO317J 21CEO318T	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources	Hou 0 3 0 Hou L 2 3 2	urs/ V T 0 0 0 0 0 0 0 0 T 0 0	Veek P 2 6 0 30 Veek P 2 0	46 C 1 3 15 19 C 3 3 3
21LEM301 21LEM202 21LEM302 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21CE0302T 21CE0302T 21CE0302T	T Professional Ethics T Professional Ethics Universal Human Values Indian Art Form Indian Traditional Knowledge Physical and Mental Health using Yoga NSS NSC NSC Open Elective Courses Course Title Maintenance and Rehabilitation of Structures Smart City and Infrastructure Real Estate Management	1 1	rs/ W T 0 0 0	/eek P 0 0 0 0 0 0 0 0 0 0 0	C C 3 3 3 3	Course Code 21GNP301L 21CEP302L 21CEP303T 21CEP401L 21CEP402L Course Code 21CEO317J 21CEO318T 21CEO319T	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management	Hou 0 3 0 Hou L 2 3 3	urs/ V T 0 0 0 0 0 0 0 0 0 0 0	Veek P 2 6 0 30 Veek P 2 0 0 0	46 C 1 3 15 19 C 3 3 3 3 3
21LEM301 21LEM202 21LEM301 21LEM302 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21CE0301T 21CE0302T 21CE0304T 21CE0305T	T Professional Ethics T Professional Ethics Universal Human Values Indian Art Form Indian Traditional Knowledge Physical and Mental Health using Yoga NSS NSS NCC NSO Total Cre Open Elective Courses (O) Any 3 Courses Course Title Maintenance and Rehabilitation of Structures Smart City and Infrastructure Real Estate Management Priect Management	1 1	rs/ W T 0 0 0 0 0	/eek P 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Course Code 21GNP301L 21CEP302L 21CEP303T 21CEP401L 21CEP402L Course Code 21CEO317J 21CEO318T 21CEO319T 21CEO320T	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing	Hou 0 3 0 Hou L 2 3 3 3	urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0	Veek P 2 6 0 30 30 Veek P 2 0 0 0 0	46 C 1 3 15 19 C 3 3 3 3 3 3 3 3 3
21LEM301 21LEM202 21LEM302 21LEM302 21GNM102 21G	Torona and the second structures Torona and the second structures Torona and the second structures Total Cre Copen Elective Courses (O) Any 3 Courses Course Title Maintenance and Rehabilitation of Structures Disaster Resistant Structures Smart City and Infrastructure Real Estate Management Project Management Environmental Image Structures	Hou Hou 3 3 3 3 3 3 3 3 3 3 3 3 3	rs/W T 0 0 0 0 0 0	/eek P 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	C 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Course Code 21GNP301L 21CEP302L 21CEP303T 21CEP401L 21CEP402L 21CEO402L 21CEO317J 21CEO318T 21CEO319T 21CEO320T 21CEO320T 21CEO321T	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System	Hou L 0 3 0 Hou L 2 3 3 3 3	urs/ V T 0 0 0 0 0 0 urs/ V T 0 0 0 0 0 0 0 0	Veek P 2 6 0 3 0 3 0 2 0 0 0 0 0 0	46 C 1 3 3 15 19 C 3 3 3 3 3 3 3 3 3 3 3 3
21LEM301 21LEM202 21LEM302 21LEM302 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21CE0301T 21CE0305T 21CE0305T 21CE0306T	Construction of the second secon	Hou dits	rs/ W T 0 0 0 0 0 0 0 0	/eek P 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 <td>Course Code 21GNP301L 21CEP302L 21CEP303T 21CEP401L 21CEP402L 21CEO402L 21CEO317J 21CEO318T 21CEO319T 21CEO320T 21CEO320T 21CEO322T</td> <td>Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in</td> <td>Hot D D Hot L 2 3 3 3 3 3 3 3 3 3 3</td> <td>urs/ V T 0 0 0 0 0 urs/ V T 0 0 0 0 0 0 0</td> <td>Veek P 2 6 0 30 30 Veek P 2 0 0 0 0 0 0</td> <td>46 C 1 3 15 19 C 3 3 3 3 3 3 3 3 3 3 3 3 3</td>	Course Code 21GNP301L 21CEP302L 21CEP303T 21CEP401L 21CEP402L 21CEO402L 21CEO317J 21CEO318T 21CEO319T 21CEO320T 21CEO320T 21CEO322T	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in	Hot D D Hot L 2 3 3 3 3 3 3 3 3 3 3	urs/ V T 0 0 0 0 0 urs/ V T 0 0 0 0 0 0 0	Veek P 2 6 0 30 30 Veek P 2 0 0 0 0 0 0	46 C 1 3 15 19 C 3 3 3 3 3 3 3 3 3 3 3 3 3
21LEM301 21LEM202 21LEM301 21LEM302 21GNM10 21CO307T 21CC0307T 21CC0307T		1 1	rs/ W T 0 0 0 0 0 0 0 0 0 0	/eek P 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 <td>Course Code 21GNP301L 21CEP302L 21CEP303T 21CEP401L 21CEP402L Course Code 21CEO317J 21CEO318T 21CEO319T 21CEO320T 21CEO320T 21CEO322T</td> <td>Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering</td> <td>Hou 0 0 3 0 Hou L 2 3 3 3 3 3 3</td> <td>urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>Veek P 2 6 0 30 Veek P 2 0 0 0 0 0 0 0</td> <td>46 C 1 3 3 15 19 C 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3</td>	Course Code 21GNP301L 21CEP302L 21CEP303T 21CEP401L 21CEP402L Course Code 21CEO317J 21CEO318T 21CEO319T 21CEO320T 21CEO320T 21CEO322T	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering	Hou 0 0 3 0 Hou L 2 3 3 3 3 3 3	urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Veek P 2 6 0 30 Veek P 2 0 0 0 0 0 0 0	46 C 1 3 3 15 19 C 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
21LEM201 21LEM202 21LEM301 21LEM302 21GNM10 21GN0 21GNN0 21GN0 21GNN0		Hou Hou A A A A A A A A A A A A A	rs/W T 0 0 0 0 0 0 0 0 0 0 0	/eek P 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 <td>Course Code 21GNP301L 21CEP303T 21CEP303T 21CEP401L 21CEP402L 21CEO317J 21CEO317J 21CEO318T 21CEO319T 21CEO320T 21CEO322T 21CEO322T 21CEO322T</td> <td>Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial technology in Engineering</td> <td>Hou 0 3 0 Hou L 2 3 3 3 3 3 3 3 3 3 3 3 3 3</td> <td>urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>Veek P 2 6 0 30 Veek P 2 0 0 0 0 0 0 0 0 0 0</td> <td>46 C 1 3 3 15 19 C 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3</td>	Course Code 21GNP301L 21CEP303T 21CEP303T 21CEP401L 21CEP402L 21CEO317J 21CEO317J 21CEO318T 21CEO319T 21CEO320T 21CEO322T 21CEO322T 21CEO322T	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial technology in Engineering	Hou 0 3 0 Hou L 2 3 3 3 3 3 3 3 3 3 3 3 3 3	urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Veek P 2 6 0 30 Veek P 2 0 0 0 0 0 0 0 0 0 0	46 C 1 3 3 15 19 C 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
21LEM301 21LEM202 21LEM302 21LEM302 21GNM102 21GCO301T 21CGO307T 21CGO30		I 1	rs/ W T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	//eek P 0	0 0 0 <td>Course Code 21GNP301L 21CEP303T 21CEP303T 21CEP401L 21CEP402L 21CEO317J 21CEO317J 21CEO319T 21CEO319T 21CEO322T 21CEO322T 21CEO322T 21CEO322T 21CEO322T</td> <td>Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial technology in Engineering GIS and Spatial Analysis</td> <td>Hou L 0 3 0 1 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3</td> <td>игs/ V Т 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>Veek P 2 6 0 3 0 3 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>46 C 1 3 15 19 C C 3 3 3 3 3 3 3 3 3 3 3 3 3</td>	Course Code 21GNP301L 21CEP303T 21CEP303T 21CEP401L 21CEP402L 21CEO317J 21CEO317J 21CEO319T 21CEO319T 21CEO322T 21CEO322T 21CEO322T 21CEO322T 21CEO322T	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial technology in Engineering GIS and Spatial Analysis	Hou L 0 3 0 1 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	игs/ V Т 0 0 0 0 0 0 0 0 0 0 0 0 0	Veek P 2 6 0 3 0 3 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0	46 C 1 3 15 19 C C 3 3 3 3 3 3 3 3 3 3 3 3 3
21LEM301 21LEM202 21LEM302 21LEM302 21GNM102 21GCO301T 21CGO307		I 1	rs/ W T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	//eek P 0	0 0 0 <td>Course Code 21GNP301L 21CEP302L 21CEP302L 21CEP401L 21CEP402L Course Code 21CE0317J 21CE0317J 21CE0318T 21CE0320T 21CE0322T 21CE0322T 21CE0322T 21CE0322T 21CE0322T 21CE0322T 21CE0322T</td> <td>Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial technology in Engineering GIS and Spatial Analysis Web GIS</td> <td>Hou L 0 3 0 Hou L 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3</td> <td>urs/ V T 0 0 0 0 0 urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>Veek P 2 6 0 3 0 3 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>46 C 1 3 15 19 C C 3 3 3 3 3 3 3 3 3 3 3 3 3</td>	Course Code 21GNP301L 21CEP302L 21CEP302L 21CEP401L 21CEP402L Course Code 21CE0317J 21CE0317J 21CE0318T 21CE0320T 21CE0322T 21CE0322T 21CE0322T 21CE0322T 21CE0322T 21CE0322T 21CE0322T	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial technology in Engineering GIS and Spatial Analysis Web GIS	Hou L 0 3 0 Hou L 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	urs/ V T 0 0 0 0 0 urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Veek P 2 6 0 3 0 3 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0	46 C 1 3 15 19 C C 3 3 3 3 3 3 3 3 3 3 3 3 3
21LEM201 21LEM202 21LEM301 21LEM302 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21GNM10 21CE0301T 21CE0307T 21CE0307T 21CE0307T 21CE0307T 21CE031TT 21CE031TT	Construction of the second secon	Hou Hou Hou A A A A A A A A A A A A A	rs/W T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	/eek P 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 <td>Course Code 21GNP301L 21CEP302L 21CEP302L 21CEP401L 21CEP402L 21CEP402L 21CEO317J 21CEO317J 21CEO317J 21CEO319T 21CEO320T 21CEO322T 21CEO322T 21CEO322T 21CEO322T 21CEO322T 21CEO322T 21CEO322T 21CEO322T 21CEO324T 21CEO325T 21CEO401T</td> <td>Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial technology in Engineering GIS and Spatial Analysis Web GIS Building Materials</td> <td>Hou L 0 0 3 0 Hou L 2 3 3 3 3 3 3 3 3 3 3 3 3 3</td> <td>ırs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>Veek P 2 6 0 3 0 3 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>46 C 1 3 15 19 C C 3 3 3 3 3 3 3 3 3 3 3 3 3</td>	Course Code 21GNP301L 21CEP302L 21CEP302L 21CEP401L 21CEP402L 21CEP402L 21CEO317J 21CEO317J 21CEO317J 21CEO319T 21CEO320T 21CEO322T 21CEO322T 21CEO322T 21CEO322T 21CEO322T 21CEO322T 21CEO322T 21CEO322T 21CEO324T 21CEO325T 21CEO401T	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial technology in Engineering GIS and Spatial Analysis Web GIS Building Materials	Hou L 0 0 3 0 Hou L 2 3 3 3 3 3 3 3 3 3 3 3 3 3	ırs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Veek P 2 6 0 3 0 3 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0	46 C 1 3 15 19 C C 3 3 3 3 3 3 3 3 3 3 3 3 3
21LEM201 21LEM202 21LEM302 21LEM302 21GNM102 21GONT 21CC0302T 21CC0304T	Construction of the second secon	Hou Hou Hou Hou A A A A A A A A A A A A A	rs/W T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	//eek P 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 <td>Course Code 21GNP301L 21CEP302L 21CEP302L 21CEP401L 21CEP402L 21CEP402L 21CEO317J 21CEO317J 21CEO3187 21CEO3217 21CEO3217 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227</td> <td>Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial technology in Engineering GIS and Spatial Analysis Web GIS Building Materials Introduction to Environmental Studies</td> <td>Hot 0 3 0 Hot L 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3</td> <td>urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>Veek P 2 6 0 3 3 0 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>46 C 1 3 15 19 C C 3 3 3 3 3 3 3 3 3 3 3 3 3</td>	Course Code 21GNP301L 21CEP302L 21CEP302L 21CEP401L 21CEP402L 21CEP402L 21CEO317J 21CEO317J 21CEO3187 21CEO3217 21CEO3217 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial technology in Engineering GIS and Spatial Analysis Web GIS Building Materials Introduction to Environmental Studies	Hot 0 3 0 Hot L 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Veek P 2 6 0 3 3 0 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0	46 C 1 3 15 19 C C 3 3 3 3 3 3 3 3 3 3 3 3 3
21LEM201 21LEM202 21LEM302 21LEM302 21GNM102 21G		Hou Hou Hou A A A A A A A A A A A A A	rs/ W T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	/eek P 0	0 0 0 <td>Course Code 21GNP301L 21CEP302L 21CEP302L 21CEP401L 21CEP402L 21CEP402L 21CEO317J 21CEO317J 21CEO3187 21CEO3217 21CEO32217 21CEO32217 21CEO32217 21CEO32217 21CEO32217 21CEO32217 21CEO32217 21CEO32217 21CEO32217 21CEO32217 21CEO3237 21CEO3237 21CEO3237 21CEO3237 21CEO3237 21CEO3237 21CEO3237</td> <td>Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial technology in Engineering GIS and Spatial Analysis Web GIS Building Materials Introduction to Environmental Studies Integrated Waste Management</td> <td>Hot L 0 0 3 0 1 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3</td> <td>urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>Veek P 2 6 0 3 3 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>46 C 1 3 15 19 C C 3 3 3 3 3 3 3 3 3 3 3 3 3</td>	Course Code 21GNP301L 21CEP302L 21CEP302L 21CEP401L 21CEP402L 21CEP402L 21CEO317J 21CEO317J 21CEO3187 21CEO3217 21CEO32217 21CEO32217 21CEO32217 21CEO32217 21CEO32217 21CEO32217 21CEO32217 21CEO32217 21CEO32217 21CEO32217 21CEO3237 21CEO3237 21CEO3237 21CEO3237 21CEO3237 21CEO3237 21CEO3237	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial technology in Engineering GIS and Spatial Analysis Web GIS Building Materials Introduction to Environmental Studies Integrated Waste Management	Hot L 0 0 3 0 1 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Veek P 2 6 0 3 3 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	46 C 1 3 15 19 C C 3 3 3 3 3 3 3 3 3 3 3 3 3
21LEM201 21LEM202 21LEM302 21LEM302 21GNM102 21G		I 1	rs/ W T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	/eek P 0 0	0 0 0 <td>Course Code 21GNP301L 21CEP302L 21CEP302L 21CEP401L 21CEP402L 21CEP402L 21CEO317J 21CEO317J 21CEO3187 21CEO3217 21CEO3217 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327</td> <td>Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial technology in Engineering GIS and Spatial Analysis Web GIS Building Materials Introduction to Environmental Studies Integrated Waste Management Principles of Sustainable Development</td> <td>Hou C C C C C C C C C C C C C</td> <td>urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>Veek P 2 6 0 30 30 2 8 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>46 C 1 3 15 19 C C 3 3 3 3 3 3 3 3 3 3 3 3 3</td>	Course Code 21GNP301L 21CEP302L 21CEP302L 21CEP401L 21CEP402L 21CEP402L 21CEO317J 21CEO317J 21CEO3187 21CEO3217 21CEO3217 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327 21CEO327	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial technology in Engineering GIS and Spatial Analysis Web GIS Building Materials Introduction to Environmental Studies Integrated Waste Management Principles of Sustainable Development	Hou C C C C C C C C C C C C C	urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Veek P 2 6 0 30 30 2 8 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	46 C 1 3 15 19 C C 3 3 3 3 3 3 3 3 3 3 3 3 3
21LEM010 21LEM202 21LEM302 21LEM302 21GNM102 21G		I 1	rs/W T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Image: legendress of the second sec	0 0 0 <td>Course Code 21GNP301L 21CEP302L 21CEP302L 21CEP401L 21CEP402L 21CEP402L 21CEO317J 21CE0317J 21CE03187 21CE03207 21CE03217 21CE03227 21CE03227 21CE03227 21CE03227 21CE03227 21CE03227 21CE03227 21CE03227 21CE03237 21CE03247 21CE03257 21CE04017 21CE04057</td> <td>Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial technology in Engineering GIS and Spatial Analysis Web GIS Building Materials Introduction to Environmental Studies Integrated Waste Management Principles of Sustainable Development Road Safety and Audit</td> <td>Hou C C C C C C C C C C C C C</td> <td>urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>Veek P 2 6 0 30 30 Veek P 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>46 C 1 3 15 19 C C 3 3 3 3 3 3 3 3 3 3 3 3 3</td>	Course Code 21GNP301L 21CEP302L 21CEP302L 21CEP401L 21CEP402L 21CEP402L 21CEO317J 21CE0317J 21CE03187 21CE03207 21CE03217 21CE03227 21CE03227 21CE03227 21CE03227 21CE03227 21CE03227 21CE03227 21CE03227 21CE03237 21CE03247 21CE03257 21CE04017 21CE04057	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial technology in Engineering GIS and Spatial Analysis Web GIS Building Materials Introduction to Environmental Studies Integrated Waste Management Principles of Sustainable Development Road Safety and Audit	Hou C C C C C C C C C C C C C	urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Veek P 2 6 0 30 30 Veek P 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	46 C 1 3 15 19 C C 3 3 3 3 3 3 3 3 3 3 3 3 3
21LEM010 21LEM202 21LEM302 21LEM302 21GNM102 21G	Terrofessional Ethics Terrofessional Ethics Universal Human Values Indian Art Form Indian Traditional Knowledge Indian Traditional Knowledge Indian Traditional Knowledge NSS NSC NSS NCC Indian Traditional Knowledge NSS NSC NSC Total Cre Courses Course Title Maintenance and Rehabilitation of Structures Disaster Resistant Structures Smart City and Infrastructure Real Estate Management Project Management Project Management Disaster Mitigation and Management Disaster Mitigation and Management Municipal Solid Waste Management Mater Pollution and its Management Global Warming and Climate Change Indoor and Ambient Air Quality Management Intelligent Transportation Systems Traffic flow Modeling and Simulation Techniques Viscoelasticity Soil Sciences	I 1	rs/W T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Image: New Sector Image: NewSector Image: NewSector	0 0 0 <td>Course Code 21GNP301L 21CEP302L 21CEP302L 21CEP401L 21CEP402L 21CEP402L 21CEO317J 21CEO317J 21CEO3187 21CEO3207 21CEO3207 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO327</td> <td>Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Total Credits Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial Information System Spatial Information System Building Materials Introduction to Environmental Studies Integrated Waste Management Principles of Sustainable Development Road Safety and Audit Traffic Management System Principles of Sustainable Development</td> <td>Hou D D D D D D D D D D D D D D D D D D D</td> <td>urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>Veek P 2 6 0 30 30 Veek P 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>46 C 1 3 15 19 C C 3 3 3 3 3 3 3 3 3 3 3 3 3</td>	Course Code 21GNP301L 21CEP302L 21CEP302L 21CEP401L 21CEP402L 21CEP402L 21CEO317J 21CEO317J 21CEO3187 21CEO3207 21CEO3207 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO327	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Total Credits Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial Information System Spatial Information System Building Materials Introduction to Environmental Studies Integrated Waste Management Principles of Sustainable Development Road Safety and Audit Traffic Management System Principles of Sustainable Development	Hou D D D D D D D D D D D D D D D D D D D	urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Veek P 2 6 0 30 30 Veek P 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	46 C 1 3 15 19 C C 3 3 3 3 3 3 3 3 3 3 3 3 3
21LEM010 21LEM202 21LEM302 21LEM302 21GNM102 21G	Terrofessional Ethics Terrofessional Ethics Universal Human Values Indian Art Form Indian Traditional Knowledge Indian Traditional Knowledge Indian Traditional Knowledge NSS NSC NSC NSC Total Cre Copen Elective Courses (O) Any 3 Courses Course Title Maintenance and Rehabilitation of Structures Disaster Resistant Structures Smart City and Infrastructure Real Estate Management Project Management Disaster Mitigation and Management Disaster Mitigation and Management Disaster Mitigation and Management Municipal Solid Waste Management Mater Pollution and its Management Ideor and Ambient Air Quality Management Intelligent Transportation Systems Traffic flow Modeling and Simulation Techniques Viscoelasticity Soil Sciences	I 1	Image: Control of the second	Image: line with the second	0 0 0 <td>Course Code 21GNP301L 21CEP302L 21CEP302L 21CEP401L 21CEP402L 21CEP402L 21CEO317J 21CEO317J 21CEO3187 21CEO3207 21CEO3207 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO327</td> <td>Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial technology in Engineering GIS and Spatial Analysis Web GIS Building Materials Introduction to Environmental Studies Integrated Waste Management Principles of Sustainable Development Road Safety and Audit Traffic Management System Rheology of Complex materials</td> <td>Hou 0 3 0 Hou L 2 3 3 3 3 3 3 3 3 3 3 3 3 3</td> <td>urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>Veek P 2 6 0 30 30 2 8 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>46 C 1 3 15 19 C C 3 3 3 3 3 3 3 3 3 3 3 3 3</td>	Course Code 21GNP301L 21CEP302L 21CEP302L 21CEP401L 21CEP402L 21CEP402L 21CEO317J 21CEO317J 21CEO3187 21CEO3207 21CEO3207 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO3227 21CEO327	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Title Rural Development and Technology Floods and Flood Management Climate Change and Water Resources Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial technology in Engineering GIS and Spatial Analysis Web GIS Building Materials Introduction to Environmental Studies Integrated Waste Management Principles of Sustainable Development Road Safety and Audit Traffic Management System Rheology of Complex materials	Hou 0 3 0 Hou L 2 3 3 3 3 3 3 3 3 3 3 3 3 3	urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Veek P 2 6 0 30 30 2 8 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	46 C 1 3 15 19 C C 3 3 3 3 3 3 3 3 3 3 3 3 3
21LEM201 21LEM202 21LEM302 21LEM302 21GNM102 21G	Terrofessional Ethics Terrofessional Ethics Universal Human Values Indian Art Form Indian Traditional Knowledge Indian Traditional Knowledge Physical and Mental Health using Yoga NSS NCC NSS NCC Indian Traditional Knowledge Total Cre Copen Elective Courses (O) Any 3 Courses Course Title Maintenance and Rehabilitation of Structures Disaster Resistant Structures Smart City and Infrastructure Real Estate Management Project Management Project Management Disaster Mitigation and Management Disaster Mitigation and Management Disaster Mitigation and Management Global Warming and Climate Change Indoor and Ambient Air Quality Management Intelligent Transportation Systems Traffic flow Modeling and Simulation Techniques Viscoelasticity Soil Sciences	Hou dits Hou dits 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	rs/W T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Image: line with the second	0 0 <t< td=""><td>Course Code 21GNP301L 21CEP302L 21CEP302L 21CEP401L 21CEP402L 21CEP402L 21CEO317J 21CEO317J 21CEO317J 21CEO321T 21CEO321T 21CEO322T 21CEO322T 21CEO322T 21CEO322T 21CEO323T 21CEO323T 21CEO324T 21CEO401T 21CEO401T 21CEO403T 21CEO404T 21CEO406T 21CEO408T</td><td>Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Course Title Rural Development and Technology Floods and Flood Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial Information System Remote sensing and GIS applications in Engineering Spatial Information System Building Materials Introduction to Environmental Studies Introduction to Environmental Studies Integrated Waste Management Principles of Sustainable Development Road Safety and Audit Traffic Management System Rheology of Complex materials Water Conservation and Management Water Conservation and Management</td><td>Hoi L 0 0 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3</td><td>urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td><td>Veek P2 6 0 30 30 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td><td>46 C 1 3 15 19 C C 3 3 3 3 3 3 3 3 3 3 3 3 3</td></t<>	Course Code 21GNP301L 21CEP302L 21CEP302L 21CEP401L 21CEP402L 21CEP402L 21CEO317J 21CEO317J 21CEO317J 21CEO321T 21CEO321T 21CEO322T 21CEO322T 21CEO322T 21CEO322T 21CEO323T 21CEO323T 21CEO324T 21CEO401T 21CEO401T 21CEO403T 21CEO404T 21CEO406T 21CEO408T	Total Credits Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P) Course Title Community Connect Project MOOC Major Project Internship Total Credits Open Elective Courses (O) Any 3 Courses Course Course Title Rural Development and Technology Floods and Flood Management Principles of Satellite Remote Sensing Spatial Information System Remote sensing and GIS applications in Engineering Spatial Information System Remote sensing and GIS applications in Engineering Spatial Information System Building Materials Introduction to Environmental Studies Introduction to Environmental Studies Integrated Waste Management Principles of Sustainable Development Road Safety and Audit Traffic Management System Rheology of Complex materials Water Conservation and Management Water Conservation and Management	Hoi L 0 0 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	urs/ V T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Veek P2 6 0 30 30 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	46 C 1 3 15 19 C C 3 3 3 3 3 3 3 3 3 3 3 3 3

							Open Elective Courses (O)				
							Any 3 Course				
							Course	Ηου	irs/ W	eek	_
						Code	Title	L	Т	Ρ	С
						21CEO409T	Water Quantity and Quality	3	0	0	3
						21CEO410T	Remote Sensing Surveying	3	0	0	3
						21CEO411T	Introduction to GIS and data	3	0	0	3
						21CEO412T	Web and Mobile GIS	3	0	0	3
						21CEO413T	Digital Mapping	3	0	0	3
							Total C	redi	its		09
	Professional Elective Courses (E)						Professional Elective Courses (E)				
	Any 7 Courses						Any 7 Courses				
		ŀ	lours	s/		-		H	lours	s/	
Course	Course		Weel	k		Course	Course		Nee	k	
Code	Title	L	Τ	Ρ	С	Code	Title	L	Τ	Ρ	С
	Professional Elective – 1						Professional Elective – 5				
21CEE301T	Foundation Engineering and Design	3	0	0	3	21CEE404T	Surface Hydrology	3	0	0	3
21CEE302T	Geotechnical Design	3	0	0	3	21CEE405T	Groundwater Engineering	3	0	0	3
21CEE303T	Ground Improvement Techniques	3	0	0	3	21CEE406T	Design of Hydraulic Structures and Irrigation	2	٥		3
21CEE304T	Foundation on Expansive Soil	3	0	0	3	210224001	Engineering	5	U	0	5
	Professional Elective – 2					21CEE407T	Advance Hydraulic Engineering and Design	3	0	0	3
21CEE305T	Solid and Hazardous Waste Management	3	0	0	3		Professional Elective – 6				
21CEE306T	Air and Noise Pollution Control	3	0	0	3	21CEE408T	Fundamentals of Remote Sensing and GIS	3	0	0	3
21000077	Environmental Impact Assessment and Life	3	0	0	2	21CEE409T	GIS and its Techniques	3	0	0	3
210223071	Cycle Analysis	5	U	0	5		Professional Elective – 7				
	Professional Elective – 3					21CEE410T	Construction Equipment and Automation	3	0	0	3
21CEE308T	Pavement analysis and design	3	0	0	3	21CEE411T	Contracts Management	3	0	0	3
21CEE309T	Railway, Airport and Harbour Engineering	3	0	0	3	21CEE412T	Repairs and Rehabilitation techniques	3	0	0	3
21CEE310T	Traffic Engineering	3	0	0	3	21CEE413T	Sustainable Construction Methods	3	0	0	3
21CEE311T	Pavement Construction Technology	3	0	0	3	21CEE414T	BIM in Construction Management	3	0	0	3
21CEE212T	Computer application in Transportation	2	0	0	2	21CEE415T	Modern Civil Engineering Economics	3	0	0	3
ZICEEJIZI	Engineering	5	0	0	5		Total Credits				21
	Professional Elective – 4										
21CEE401T	Advanced Pre-stressed Concrete	3	0	0	3						
21CEE402T	Earthquake Resistant Design of Structures	3	0	0	3						
21CEE403T	Design of Steel Concrete Composite	3	0	0	3						
	Structures	-		-							

13. (f) Implementation Plan: B.Tech. in Civil Engineering

	Semester – I						1	Semester – II				
Code	Course Title		Hou We	rs/ ek	C	Codo		Course Title		lour	5/ k	C
Coue				Code		Course Intie	- \	T	K P	C		
21LEH101	T Communicative English	2	1	0	3	21LEH102T	Chinese				•	
21MAB101	T Calculus and Linear Algebra	3	1	0	4	21LEH103T	French					
21PYB104 21MES103	J Physics : Mechanics	3	1	2	2	21LEH104T	German				~	2
21EES101	T Electrical and Electronics Engineering	3	1	0	4	21LEH105T	Japanese		2	1	0	3
21CYM101	T Environmental Science*	1	0	0	0	21LEH106T	Korean					
21PDM101	L Professional Skills and Practices	0	0	2	0	21LEH107T	Spanish					
21LEM101	T Constitution of India	1	0	0	0	21GNH101J	Philosophy	of Engineering	1	0	2	2
	l otal Credits	;			18	21MAB102T	Advanced	Calculus and Complex Analysis	3	1	0	4
						21CYB101J	Chemistry		3	1	2	5
						21CEC101T	Building Ma	aterials in the Built Environment	3	0	0	3
						21CSS101J	Programmi	ng for Problem Solving	3	0	2	4
						21BTB103T	Biology		2	0	0	2
						21MES101L	Basic Civil	and Mechanical Workshop	0	0	4	2
						21PDM1021	General Ar	titude*	0	0	2	0
						21GNM1011	Physical ar	nd Mental Health using Yoga	Ū	Ū	2	Ŭ
						21GNM107L	NSS	a mental health using roga		0	2	0
						21GNM102L	NCC		0	0	2	0
						21GNM104L	NSO					
								Total Credits	;			25
	Semester – III							Semester – IV				
Code	Course Title	Но	urs/ \	Veek	С	Code		Course Title	Hou	rs/ W	/eek	С
044400047		L	T	P		040500041	Analistos		L	T	Ρ	
210EC201T	Transforms and Boundary Value Problems	3	1	0	4	21CEB201J	Applied Ge	Diogy	3	0	2	4
21CEC2011	Fluid Mechanics and Machinery Lab	0	0	2	1	21CSC2007 21CEC204T	Structural E	ingence Ingineering Design-I	3	0	0	3
21CEC202T	Engineering Surveying	3	0	0	3	210502041	Concrete T	echnology and Strength of	0	0	2	1
21CEC202L	Surveying Lab	0	0	2	1	210E0204L	Materials La	aboratory	0	0	2	
21CEC203T	Environmental Engineering and Design	3	0	0	3	21CEC205T	Geomecha	nics	3	0	0	3
21CEC203L	Environmental Engineering Laboratory	0	0	2	1	21CEC205L	Geomechai	nics Laboratory	0	0	2	1
21DC3201F 21CFS201T	Mechanics of Structures	3	0	0	3	21CEC2001 21CEC207T	Concrete To	echnology and Special Concrete	3	0	0	3
21LEM201T	Professional Ethics	1	0	0	0	21PDH201T	Social Engi	neering	2	0	0	2
21PDM201L	Verbal Reasoning	0	0	2	0	21PDM202L	Critical and	Creative Thinking Skills	0	0	2	0
	Total Credits				22	21LEM2021	Universal H	uman Values Total Credits	1	0	0	0
								Total Oreans	,			25
	-							• · · · · ·				
	Semester – V	He	100/1	Nook		-		Semester – VI	Hou	ro/\\	look	1
Code	Course Title	HOL	T	P	С	Code		Course Title	Hou	rs/ w	P	С
21MAB301T	Probability and Statistics	3	1	0	4	21CSS303T	Data Scien	20	2	0	0	2
21CEC301T	Structural Analysis	3	0	0	3	21CEC304T	Constructio	n Engineering and Management	3	0	0	3
21CEC301L	Computer-Aided Civil Engineering Laboratory	0	0	2	1	E-2	Professiona	I Elective – II	3	0	0	3
21CEC302T	Structural Engineering Design-II	2	1	0	3	E-3	Professiona	I Elective – III	3	0	0	3
21CEC3031	Transportation Engineering	3	0	2	3	21CEP302L 21CEP303T	Project MOOC		0	0	0	3
E-1	Professional Elective – I	3	0	0	3	0	Open Elect	ive – II	3	0	0	3
0	Open Elective – I	3	0	0	3	21PDM302L	Employabili	ty Skills and Practices	0	0	2	0
21PDM301L	Analytical and Logical Thinking Skills	0	0	2	0	21LEM302T	Indian Trad	itional Knowledge	1	0	0	0
21LEM301T	Indian Art Form	1	0	0	0			Total Credits				17
ZIGNP301L	Total Credits	0	0	2	22							
L						1						
	Compation 1/11							Compation \//				
	Semester – VII	Но	urs/ \	Veek	-			Semester – VIII		Но	urs/	
Code	Course Title	L	T	P	С	Coo	de	Course Title		We	ek	C
21GNH401T	Behavioral Psychology	2	1	0	3	01055	04011	Major Project		L 1	P	
E-4	Protessional Elective – IV	3	0	0	3	210EP 210EP	4072	Internshin		0 0) 30) 15
E-0 F-6	Professional Elective – V	3	0	0	3			Total Cred	lits			15
E-7	Professional Elective – VII	3	0	0	3							
0	Open Elective – III	3	0	0	3							
<u> </u>	Total Credits				18							
						1						

ACADEMIC CURRICULA

UNDERGRADUATE/ INTEGRATED POST GRADUATE DEGREE PROGRAMMES (With exit option of Diploma)

(Choice Based Flexible Credit System)

Regulations 2021

Volume - 20 (Syllabi for Common Courses)



SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Chengalpattu District 603203, Tamil Nadu, India



Contents (Volume - 20)

Syllabi for Common Courses

No		Title	<u>Page No</u>
1	Core Course		7
	21CSC206T	Artificial Intelligence	8
2	Open Elective Co	urses	10
		Aerospace Engineering	
	21ASO301T	Elements of Aeronautics	11
	21ASO302T	Creativity, Innovation. & New Product Development	13
	21ASO303T	Aviation and Airline Maintenance Management	15
	21ASO304T	Aircraft General Engineering and Maintenance Practices	17
	21ASO305T	Flow Visualization Techniques	19
	21ASO306T	Airport Engineering	21
	21ASO307T	Molecular Gas Dynamics	23
		Artificial Intelligence	
	21AIO351T	Introduction to Artificial Intelligence	25
	21AIO352T	Machine Learning	27
	21AIO353T	Python for Data Analytics	29
	21AIO354T	Soft Computing	31
	Autom	nation and Robotics & Electronics and Instrumentation Engineering	
	21EIO131J	Virtual Instrumentation	33
	21EIO132T	Analytical Instrumentation	35
	21EIO133T	Industrial Automation Systems	37
	21EIO134T	Introduction to Sensors	39
	21 <mark>EIO135T</mark>	Introduction to MMEMS	41
	21EIO136J	PLC for Industrial Automation	43
	21EIO138T	Logical Foundation of Cyber Physical Systems	45
		Automobile Engineering	
	21AUO101T	Hybrid and Electric Vehicles	47
	21AUO102T	Renewable Sources of Energy	49
	21AUO103T	Special Type of Vehicles	51
	21AUO104T	Fuel Cells and Applications	53
	21AUO105T	Transport Management	55
	21AUO106T	Composite Materials for Automotive Applications	57
	21AUO107T	Non-Destructive Testing and Evaluation	59

21AUO108T	Advanced Engine Technology	61
21AUO109T	New Product Development	63
21AUO110T	Automotive Standards and Regulations	65
21AUO111T	Automotive Sciences	67
21AUO112T	Intelligent Vehicle Technology	69
	Biotechnology	
21BTO101T	Human Health and Diseases	71
21BTO105T	Animal Models for Biomedical Research	73
21BTO106T	Waste to Wealth to Wheels	75
21BTO107T	Fundamental Neurobiology	77
	Biomedical	
21BMO121T	Fundamentals of Biomedical Engineering	79
21BMO122T	Health Information Systems	81
21BMO123T	Basics of Medical Imaging	83
21BMO124T	Rehabilitation Engineering	85
21BMO125T	Quality Control for Biomedical Devices	87
21BMO126T	Biomechanics of Human Movements	<mark>8</mark> 9
21BMO127T	Digital Healthcare Technology	91
	Chemical Engineering	
21CHO101T	Sustainable Energy Engineering	93
21CHO102T	Petroleum Engineering	<mark>95</mark>
21CHO103T	Fundamentals of Chemical Engineering	97
21CHO104T	Process Plant Safety	99
21CHO105T	Pollution Abatement	101
	Civil Engineering	
21CEO301T	Maintenance and Rehabilitation of Structures	103
21CEO302T	Disaster Resistant Structures	105
21CEO303T	Smart City and Infrastructure	107
21CEO304T	Real Estate Management	109
21CEO305T	Project Management	111
21CEO306T	Environmental Impact Assessment	113
21CEO307T	Municipal Solid Waste Management	115
21CEO308T	Disaster Mitigation and Management	117
21CEO309T	Water Pollution and its Management	119
21CEO310T	Global Warming and Climate Change	121
21CEO311T	Indoor and Ambient Air Quality Management	123
21CEO312T	Intelligent Transportation Systems	125
21CEO313T	Traffic Management Systems	127

Traffic Flow Modeling and Simulation Techniques	129
Viscoelasticity	131
Soil Sciences	133
Rural Development and Technology	135
Floods and Flood Management	137
Climate Change and Water Resources Management	139
Principles of Satellite Remote Sensing	141
Spatial Information System	143
Remote Sensing and GIS Application in Engineering	145
Spatial Technology In Engineering	147
GIS and Spatial Analysis	149
Web GIS	151
Building Materials	153
Introduction to Environmental Studies	155
Integrated Waste Management	157
Principles of Sustainable Development	159
Road Safety and Audit	<mark>16</mark> 1
Transportation Systems	<mark>16</mark> 3
Rheology of Complex Materials	165
Water Conservation and Management	1 <mark>67</mark>
Water Quantity and Quality	1 <mark>6</mark> 9
Remote Sensing Surveying	<mark>17</mark> 1
Introduction to GIS and Data	<mark>17</mark> 3
Web and Mobile GIS	175
Digital Mapping	177
Computer Science and Engineering	
Cyber Security	179
Web Programming	181
Python Programming	183
Mobile Application Development	185
Data Analytics	187
Machine Learning for All	189
Convolutional Neural Networks Foundation	191
Data Visualization Basics	193
Network Security	195
Fundamentals of Information System Security	197
Security Policy Implementation	199
Deen Learning Foundation	201
	Traffic Flow Modeling and Simulation Techniques

Electronics and Communication Engineering

21ECO101 T	Short Range Wireless Communication	203
21ECO102J	Electronics Circuits and Systems	205
21ECO103 T	Modern Wireless Communication System	207
21ECO104J	PCB Design and Manufacturing	209
21ECO105T	Fiber Optics and Optoelectronics	211
21ECO106J	Embedded System Design Using Arduino	213
21ECO107J	Embedded System Design Using Raspberry PI	215
21ECO108J	3D Printing Hardware and Software	217
	Electrical and Electronics Engineering	
21EE <mark>O301T</mark>	E-Mobility	219
21EEO302T	Wearable Technology	221
21EEO303T	E-Waste Management	223
21EEO304T	Energy Efficient Practices	225
21EEO305T	Surveillance Technology	227
21EEO306T	Sustainable Development Practices	229
21EEO307T	Clean and Green Energy	<mark>23</mark> 1
21EEO308T	Smart Cities and Communities	<mark>23</mark> 3
21EEO309T	Electrical Trading	235
21EEO310T	Unmanned Aerial Vehicle	237
	Genetic Engineering	
21GE0101T	Behavioral Biology	<mark>23</mark> 9
21GEO102T	Microbes and Society	<mark>2</mark> 41
21GEO103T	Biofertilizers – An Entrepreneurial Perspective	243
21GEO104T	Computational Genomics	245
21GEO105T	Biology for Everyday Life	247
	Mechatronics Engineering	
21MHO301T	Smart Farming	249
	Mechanical Engineering	
21MEO101T	Fundamentals of Composite Materials	251
21MEO102T	Reverse Engineering and 3D Printing	253
21MEO103T	Fundamentals of Biomechanics	255
21MEO104T	TQM and Reliability Engineering	257
21MEO105T	Occupational Safety and Disaster Management	259
21MEO106T	Introduction to Robotics	261
21MEO107T	Fundamentals of Nano Engineering	263
21MEO108T	Computer Numerical Control Programming and Operation	265
21MEO109T	Resource Management Techniques	267

	21MEO110T	Energy Systems for Sustainable Buildings	269
	21MEO111T	Environmental Pollution and Abatement	271
	21MEO112T	Renewable Energy Sources and Applications	273
	21MEO113T	Electronics Thermal Management	275
	21MEO114T	Solar Energy for Societal Applications	277
	21MEO115T	Introduction to Drones	279
		Nanotechnology	
	21NTO301T	Applications of Nanotechnology	281
	21NTO303T	Micro and Nanoelectronics	283
	21NTO302T	Solid State Electronic Devices	285
	21NT <mark>O304T</mark>	Environmental Nanotechnology	287
	21NTO305T	Medical Nanotechnology	289
	21NTO306T	Nanoscale Surface Engineering	291
	21NT0307T	Nanocomputing	293
	21NTO308T	Smart Sensor Systems	295
	21NTO309T	2D Materials and Applications	297
	21NTO310T	Nano and Microeletromechanical Systems	299
	21NTO401T	Scientific Research Principles	301
	21NTO402T	Micro and Nanofluidic Technology	303
	21NTO403T	Thin film Photovoltaics	305
	21NTO404T	Nanotechnology in Societal Development	307
	21NTO405T	Polymer Engineering	<mark>30</mark> 9
	21NTO406T	Industrial Nanotechnology	311
	21NTO407T	Quantum Computing	313
3	Engineering Scier	nce Courses	315
	21DCS201P	Design Thinking and Methodology	316
	21CSS303T	Data Science	318
4	Non Credit Course	es	320
	21PDM201L	Verbal Reasoning	321
	21PDM202L	Critical and Creative Thinking Skills	320
	21PDM301L	Analytical and Logical Thinking Skills	322
	21PDM302L	Employability Skills and Practices	324
	21LEM201T	Professional Ethics	326
	21LEM202T	Universal Human Values – Understanding Harmony and Ethical Human Conduct	328
	21LEM301T	Indian Art Form	330
	21LEM302T	Indian Traditional Knowledge	332

5	Humanities Cours	es	333
	21PDH201T	Social Engineering	334
	21GNH401T	Behavioral Psychology	336
6	Project Work, Sem	ninar, Internship in Industry / Higher Technical Institutions	337
	21GNP301L	Community Connect	338
	21XXP302L	Project	340
	21XXP303T	MOOC	342
	21XXP401L	Major Project	344
	21XXP402L	Major Project	346
	21XXP403L	Internship	348
	21XX <mark>P501L</mark>	Specialization Project	350
	21XXP502L	Specialization Project	352
	21XXP503L	Domain Internship	354



ACADEMIC CURRICULA

Core Course

Regulations 2021



SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Chengalpattu District 603203, Tamil Nadu, India

Course Code	rse 21CSC206T Course Name ARTIFICIAL INTELLIGENCE						Cor Cate	urse gory	С		PROFESSIONAL CORE L T P 2 1 0									C 3		
Pre-requi Course	site s	Nil		Co- requisite Courses		Nil		Progressive Nil														
Course Offering Department School of Computing Data Book / Codes / Standards Nil																						
Course Learning Patienele (CLP) The purpose of learning this source is to Program																						
Course Le	arning Rationale	(CLR): T	he purpose of	learning this co	urse is to:					2		Progr	am Oi	utcome	es (PO)				- 5	rogra	m ic
CLR-1: Infer knowledge in problem formulation with Al. 1 2 3 4 5 6 7 8 9 10 11 12 0									00	tcom	es											
CLR-2:	Exemplify the uni	informed and	d info <mark>rmed sea</mark> r	<mark>rch technique pro</mark>	cedures for real	world problems	e e		of	•	s of	10	iety			rk		е				
CLR-3:	Understand the a	dversarial se	ea <mark>rch metho</mark> ds,	constraint satisfa	action problems	and intelligent agents.	vledo		ento		stion	ge	d soc			oW r		Jano	D			
CLR-4:	Demonstrate vari	ious knowled	d <mark>ge repres</mark> entat	tion techniques		See and	Vou V	lysis	, do	. :	stige	Usa	and	જ		ean	uo	& Fir	arnin			
CLR-5:	Infer knowledge a	about exp <mark>ert</mark>	t systems.	>/			eerina	em Ana	n/devel	SUC	uct inve ex prot	n Tool	ngineel	nment		lual & T	unicati	t Mgt.	ong Lea	_		~
Course Ou	tcomes (CO):	A	At the end of th	nis course, learn	ers will be able	e to:	nain	roble	esig	olutic	Sond	lode	he el	invirc	:thics	pivipu	Comm	rojec	ife Lo	OS	SO-S	Sos
CO-1:	Formulate a prob	lem as <mark>a sta</mark>	ate space searc	h method and its	solution using v	arious AI techniques	1	2			-	-	-	-	-	-	-	-		-	-	-
CO-2:	Apply appropriate	e search <mark>ing t</mark>	techniques to s	olve a real-world	problem	and the second second	1	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Develop various	game pl <mark>ayin</mark> g	ig strategies to a	sol <mark>ve</mark> real world a	dversarial searc	ch problems	-	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Represent variou	s knowl <mark>edge</mark>	<mark>e rep</mark> resentatior	n techniques to so	olve complex Al	problems	1	2			-	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Design an expert	system to in	<mark>mplem</mark> ent adva	nce techniques in	Artificial Intellig	gence	3	2	3	3	-	-	1		-	2	-	-	-	-	-	-
Instanting			1		and the second																	
Al techniqu	roauction to Al	a with ALA	U Models Data	acquisition and l	earning aspects	in AL Problem solving	Probler	n solvi	na nra		s forn	nulatir	na nrol	lome	Proble	m type	ha and	charac	toristic	s Prol	y hlom (HOUR
AI techniques, Problem solving with AI, AI Models, Data acquisition and learning aspects in AI, Problem solving- Problem solving process, formulating problems, Problem types and characteristics, Problem space																						
Unit-2- Basic Introduction to Data Structure and Search Algorithms 9 Hour 9 Hour																						
Basic introduction to stacks, queues, trees and graphs - General Search Algorithms – Searching for solutions – Problem-solving agents – Control Strategies – Uninformed Search Methods – Breadth First Search –																						
Uniform Cost Search - Depth First Search - Depth Limited Search - Informed search - Generate and test - Best First search - A* Algorithm																						
Unit-3 - Adversarial Search Problems and Intelligent Agent 9 Hour																						
Adversarial Search Methods (Game Theory) - Mini max algorithm - Alpha beta pruning - Constraint satisfactory problems – Constraints – Crypt Arithmetic Puzzles – Constraint Domain – CSP as a search problem																						
agents.																						
Unit-4- Knowledge Representation 9 Hour																						
Knowledge	Representation -K	Knowledge ba	ased agents –	The Wumpus wor	<mark>1d – P</mark> roposition	al Logic - syntax, semai	ntics and	l knowl	edge	base	e build	ling - i	nferen	ces – re	easoni	ng pat	terns ir	n propo	sitional	l logic	– prec	dicate
logic – representing facts in logic: Syntax and semantics – Unification – Unification Algorithm - Knowledge representation using rules - Knowledge representation using semantic nets - Knowledge representation																						
using frame	es inferences - Und	certain Know	vledge and reas	oning Methods.																		

Unit-5 – Planning and Expert System

Planning – planning problem – Simple planning agent – Blocks world problem – Mean Ends analysis Learning - Machine learning - Learning concepts, methods and models Introduction to expert system – architecture of expert systems.

	Learning Resources	1. 2.	Parag Kulkarni, Prachi Joshi, Artificial Intelligence –Building Intelligent Systems, 1st ed., PHI learning, 2015 Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition, Pearson Education, 2020.	3. 4.	Deepak Kemhani Data Structures S
--	-----------------------	----------	--	----------	-------------------------------------

Deepak Kemhani, First course in Artificial Intelligence, McGraw Hill Pvt Ltd, 2013
Data Structures Schaum's Outlines Series, Seymour, Lipschutz, 2014.
······································

Bloom's Level of Thinking Continuous Learning Assessment (CLA) Summative Final Examination (40% weightage) Level 1 Remember 20% - 20% - 20% - Level 2 Understand 15% - 15% - 15% - Level 4 Analyze 20% - 20% - 20% - Level 5 Evaluate 20% - 20% - 20% - Level 6 Create - 20% - 20% - 20% - Level 3 Apply 20% - 20% - 20% - Level 4 Analyze 25% - 25% - 25% - Level 5 Evaluate 20% - 20% - 20% - Level 6 Create - - - - - - -	Learning Assessme	ent		1								
Bloom's Level of ThinkingFormative CLA-1 Average of unit test (50%)Life-Long Learning CLA-2 (10%)Summative Final Examination (40% weightage)Level 1Remember20%-20%-20%-Level 2Understand15%-15%-15%-Level 3Apply20%-20%-20%-20%-Level 4Analyze25%-20%-20%-20%-Level 5Evaluate20%-20%-20%Level 6CreateTotal100 %100 %100 %100 %100 %100 %100 %100 %			Continuous Learning Assessment (CLA)									
Image:		Bloom's Level of <mark>Thinking</mark>	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Lon CL (1	g Learning "A-2 0%)	Final Examination (40% weightage)					
Level 1 Remember 20% - 20% - Level 2 Understand 15% - 15% - 15% - Level 3 Apply 20% - 20% - 20% - Level 4 Analyze 25% - 25% - 25% - Level 5 Evaluate 20% - 20% - 20% - Level 6 Create - - 20% - - - Total 100 % 100 % 100 % 100 % 100 % 100 %			Theory	Practice	Theory	Practice	Theory	Practice				
Level 2 Understand 15% - 15% - Level 3 Apply 20% - 20% - 20% - Level 4 Analyze 25% - 25% - 25% - Level 5 Evaluate 20% - 20% - 20% - Level 6 Create - - 20% - - - Image: 100 % 100 % 100 % 100 % 100 % 100 % 100 %	Level 1	Remember	20%		20%		20%	-				
Level 3 Apply 20% - 20% - Level 4 Analyze 25% - 25% - 25% - Level 5 Evaluate 20% - 20% - 20% - Level 6 Create - - 20% - - - Image: 100 % 100 % 100 % 100 % 100 % 100 % 100 %	Level 2	Understand	15%		15%		<mark>1</mark> 5%	-				
Level 4 Analyze 25% - 25% - Level 5 Evaluate 20% - 20% - 20% - Level 6 Create - - 20% - - - Image: Comparison of the system - - - - - - Image: Comparison of the system - - - - - - Image: Comparison of the system - - - - - -	Level 3	Apply	20%		20%	- 20%		-				
Level 5 Evaluate 20% - 20% - Level 6 Create -	Level 4	Analyze	25%	100 000500	25%		<mark>25</mark> %	-				
Level 6 Create - <t< td=""><td>Level 5</td><td>Evaluate</td><td>20%</td><td></td><td>20%</td><td></td><td>20%</td><td>-</td></t<>	Level 5	Evaluate	20%		20%		20%	-				
Total 100 % 100 % 100 %	Level 6	Create	C - C - C	E 68 19			- 18	-				
	Total 100 %				10	0 %	100 %					

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Tejas Gowda, Co-Founder & Chief Data Scientist, TenzA	I 1. Dr. T. Senthilkumar, Associate Professor, Amrita School of	1. Dr. A. Alic <mark>e Nithya,</mark> SRMIST
the second se	Engineering, Amrita Vishwa Vidyapeetham	
		2. Dr. K. Senthil Kumar, SRMIST



B.Tech / M.Tech(Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

9 Hour

ACADEMIC CURRICULA

Open Elective Courses

Regulations 2021



SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Chengalpattu District 603203, Tamil Nadu, India

Course Code	21ASO301T	SO301T Course ELEMENTS OF AERONAUTICS Course Category		ourse ategor	e ry	0				OPEN	ELEC	ΓIVE			;	- T 3 0	P 0	C 3			
Pre-requis Courses	site s	Nil	Co- re Cours	quisite se <mark>s</mark>	Nil		Pro	gres: ours	sive es						Nil	,					
Course C	Offering Departme	ent	Aerospace Engl	neering	Data Book / Codes / St	andards	1.7							Nil							
Course Learning Rationale (CLR): The purpose of learning this course is to:												-									
Course Lea	arning Rationale ((CLR): <i>1</i>	he purpose of learning	ng this col	irse is to:					-	Progr	am Ou	itcome	es (PO)	r –			- S	pecifi	ic
CLR-1: Describe the art of flying 1 2 3 4 5 6 7 8 9 10 11 12									12	outcomes											
CLR-2:	Discuss the vario	us types of a	aircr <mark>aft configura</mark> tion, (control syst	ems and instruments	-	ge		f	s of	10	iety			논		Ð			l.	
CLR-3:	Explain about the	atmosphere	e a <mark>nd variati</mark> on in prop	erties, aircr	aft flight and different speed regime	es	vled		ento	ation	ge	soc			M C		Jano	b		ļ	
CLR-4:	Explain the basic	s of aircraft	structures and the aer	ospace mai	erials	100	Von	lysis	mdo	stiga	Usa	and	∞ ठ		ean	uo	Ë	Inin		1	
CLR-5:	CLR-5: Describe about the various propulsion systems used in aerospace industry.						eering !	em Ana	n/devel	uct inve lex prob	m Tool	ngineer	onment inability		dual & J	nunicati	ot Mgt. 8	ong Lea	~	5	с С
Course Ou	tcomes (CO):	1	At the end of this co	ırse, learne	ers will be able to:		Engin	Proble	Desig solutio	Condu	Mode	The e	Enviro	Ethics	Individ	Comn	Projec	Life L	PSO-	PSO-	PSO-
CO-1:	Discuss the evolu	ition of <mark>aircra</mark>	aft and their types		A State Auge Vi	4.51	3	•		-	4-1	-	-	-	-	-	-	1	-	-	-
CO-2:	CO-2: Describe the various types of aircraft configuration, control systems and instruments 3									-	-										
CO-3:	Describe about th	ne atmo <mark>sphe</mark>	e <mark>re a</mark> nd variation in pro	perties, ain	craft flight and different speed regin	nes	3	1	1.2	-	-	- 10	-	-		-	-	-	-	-	-
CO-4:	Explain the basic	s of airc <mark>raft</mark> :	<mark>struc</mark> tures and the aer	ospace mai	erials	100	3		1	-	-		-	-	-	-	-	1	-	-	-
CO-5:	CO-5: Demonstrate about the various propulsion systems used in aerospace industry. 3 1 -									-	-										
Unit-1 - His	Unit-1 - History of Flight 9 Hour										Hour										
Balloon flight-ornithopter-Early Airplanes by Wright Brothers, biplanes and monoplanes, Developments in aerodynamics, materials, structures and propulsion over the years																					
9 Hour Different types of flight vehicles, Classifications-Components of an airplane and their functions - Conventional control, powered control- Basic instruments for Flying -Typical systems for control actuation																					
Unit-3 - Ba	sics of Aerodyna	mics												, . <i>,</i> , , , , , , , , , , , , , , , , , ,						9	Hour
Physical Pr	operties and struct	tures of the A	Atm <mark>osphe</mark> re, Tempera	ture, pressi	ure and altitude relationships, Newt	on's Law	of Mo	tions	applie	d to Ae	eronau	tics-Ev	v <mark>olut</mark> ion	<mark>of l</mark> ift,	drag a	and mo	ment. /	Aerofoi	ls, Ma	ch nui	mber,
Manoeuvre.	sice of Aircraft St	tructuros		- (-)	11.18.1.11	6.0	1			10	2									0	Hour
General types of construction, Monocoque, semi-monocoque and geodesic constructions, typical wing and fuselage structure. Metallic and non-metallic materials. Use of Aluminium alloy, titanium, stainless steel and																					
composite materials. Stresses and Strains-Hooke's law- stress-strain diagrams - elastic Constants-Factor of Safety.																					
Unit-5 - Ba	sics of Propulsio	n						. <i>i</i>									, ,	C.		9	Hour
Basic ideas	about piston, turb	oprop and j	et engines – use of <mark>p</mark>	ropeller and	jets for thrust Production – Comp	arative m	erits, I	Princ	iple of	operat	on of I	ocket,	types	ot rocl	ket and	typica	al appli	cations	, Explo	oratio	n into
Space				A CONTRACTOR OF THE OWNER OF THE																	

	5.	Anderson, J.D., Introduction to Flight, McGraw-Hill; 8th edition, 2015	8.	Sadhu Singh, "Internal Combustion Engines and Gas Turbine", SS Kataraia& Sons, 2015
Loarning	6.	E Rathakrishnan, "Introduction to Aerospace Engineering: Basic Principles of Flight", John	9.	Kermode, "Flight without Formulae", Pitman; 4th revised edition 1989.
Desources		Wiley, NJ, 2021	10.	McKinley, J.L., R.D. Bent, Aircraft Power Plants, McGraw Hill 1993
Resources	7.	Stephen.A. Brandt, Introduction to aeronautics: A design perspective, 2nd edition, AIAA	11.	. Clancy L.J., Aerodynamics, 2nd ed., Sterling book house 1975
		Education Series, 2004.		

Learning Assessme			Continuous Learning	Assessment (CLA)		Cum	motivo				
	Bloom's Level of Thin <mark>king</mark>	Form CLA-1 Avera (50	ative ge of unit test %)	Life-Long L CLA (109	_earning -2 6)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	50%		50%		50%	-				
Level 2	Understand	50%	the second second	50%		50%	-				
Level 3	Apply					-	-				
Level 4	Analyze			Contraction of the		-	-				
Level 5	Evaluate		A state	-7/C-4	7-2-6	-	-				
Level 6	Create					-	-				
	Total	100)%	100	%	100 %					

Co	urse Designers	10			And a second sec
Ex	perts from Industry	Ex	perts from Higher Technical Institutions	Inte	ernal Experts
2.	Wg.CdrK. Manoharan (Retd), Blue Dart Aviation Ltd.,	2.	Dr. A. P. Haran, Park College of Engineering & Technology,	1.	Dr. T. Selvakumar <mark>an, SRMI</mark> ST
	manoharank@bluedart.com		ap_haran@rediffmail.com		
3.	Wg.Cdr R.Annamalai, Chief training co-ordinating officer	3.	Dr.S. Nadaraja Pillai, Sastra university Thanjavur,	2.	Mr. G. Mahendra Perumal, SRMIST
	IAF,Tambaram.annamalai.ramasamy2@gmail.com		nadarajapillai@mech.sastra.edu		



Course Code	21ASO302T	Co Cat	ourse tegory	,	0			(OPEN I	ELECT	IVE			L	- T 3 0	P 0	C 3			
Pre-requis Courses	site s	Nil	Co- requisite Course <mark>s</mark>	Nil		Prog Co	ress urse	ive s						Nil						
Course C	Offering Departme	ent	Aerospace Engineering	Data Book / Codes / Standa	ards								Nil							
Course Lea	arning Rationale (CLR): T	he purpo <mark>se of learnin</mark> g this co	urse is to:	T	1	k			Progra	am Ou	tcome	s (PO)					Pr	ograr	n
CLR-1:	Explain the proce		1	2	3	4	5	6	7	8	9	10	11	12	outcomes					
CLR-2:	Discuss the ideas	and and services		Ð	134	÷	of	20	ety			¥								
CLR-3:	Identify the project	t evaluation	techniques and describe the fac	tors for product screening		ledg		ent o	tions	ge	soci		-	Wo		ance	5			
CLR-4:	Discuss the impo	rtance of pat	ent search and patent laws, as u	vell as the role and classifications of IPF	R	Nou ·	lysis	obme	stiga	Usaç	and	∞ ŏ		eam	uo	& Fin	Inin			
CLR-5:	Explain the steps	involved <mark>in l</mark>	new product development proce	SS The second			n Ana	/devel	ct inve x prob	I Tool	gineer	iment ability		al & T	unicati	Mgt. 8	ng Lea			
Course Ou	tcomes (CO):	4	At the end of this course, learn	ers will be able to:			robler	Design	Conduc	Moderr	The en	Enviror Sustair	Ethics	Individu	Commi	Project	Life Lo	PS0-1	PSO-2	PSO-3
CO-1:	Describe the tec enaineerina	hnologi <mark>cal</mark> i	nnovation process and identify	the need for creativity & innovation	in ;	3	1	-	-	54	1	-	-	-	-	-	1	-	-	-
CO-2:	Explain the project selection	ct selec <mark>tion</mark>	ideas as well as the various crit	eria and measures adopted during proj	ect	3	1		- 15	-	1	-	-		-	-	1	-	-	-
CO-3:	Describe the facto	ors for p <mark>rodu</mark>	<mark>ct s</mark> creening and identify the pro	ject evaluation techniques		3	2	12	-	-		-	-	-	-	-	1	-	-	-
CO-4:	Explain IPR & its	types a <mark>nd di</mark>	scuss the objective of patent law	is, WIPO, TRIPS, WTO, PCT		3	1		-	-	1	-	-	-	-	-	1	-	-	-
CO-5:	Describe the proc research	ess of n <mark>ew p</mark>	roduct development and discuss	the need, purpose & methods of market	ing	3	2	-	-	/	5.	-		-	-	-	1	-	-	-
Unit-1 - Inti	roduction			1/4					-		-								9	Hour
Introduction individual an Different teo	n-The process of te nd nation-The need chniques for creativ	chnologica <mark>l</mark> d for innovat ve intelligend	innovation-Factors contributing t io <mark>n for individual and nation-Crea</mark> ce-Detailed explanation with exa	o successful technological innovation-E ativity -Obstacles-Problem solving-Obsta mples-Case Study on technology innova	xample acles-C ation-E	es for t Creativ Xamp	the fa ity -k le	actors ceys a	-Techn nd que	ologica stions-	al mile: Proble	ston <mark>es-</mark> em solvi	Techn ing-ke	ologica /s and	al evolu questio	ition-Tl ons-Bra	he need ain Stol	d for ci rming-	reativi Exam	ty for ples-
Unit-2 - Pro	oject Selection	-files Dif	for an alternative state of the	Formation Tables different income Orachi				F		1	da a f O				4	- 01	_ //	41	91	Hour
- sking sear	rching questions - I	or ideas-Diri Increasing th	erent routes for collecting ideas-	Examples-Taking unerent views, Combi Is - Purpose and types. Indian National	ning in Techn	oloav i	suar- Miss	Exam ions-l	pies-Ad Detailed	iapi, a expla	nation	Proiec	re - Bre t selec	tion cr	iteria -	analvsi	allerige s meth	ods-C	sump ase S	uoris tudv-
on project s	election - Example)				eleg) i			, o taine e	enpro	ind to fi						0	040 0		
Unit-3 - Pro	oject Evaluation														<u> </u>				91	Hour
Introduction Research fa	to project evaluation to project evaluation to project evaluation to the second s	ation-Prelimi at factors-Po	nary Methods-Screening Metho sition factors- Production factors	ds-Examples-Product life cycle-Differe	nt org ineerin	anizati na-Cas	ions-	Produ	ict eva	luation t eval	profil	e- Stat - Exam	oility ta Inle	actors-	Growth	tacto	rs-Marl	ketabil	ty fac	tors-
Unit-4 - Ne	w Product Develo	pments				ig Ouo		udy of	r projet		uuton	Exam	pio						9 (Hour
Evaluation of	of IPR-4 traditional	forms-Defir	ition of IPR-Development of 7 ty	pes of IPR-Need for IPR in India-Pater	ntable I	Innova	tion-	Oblig	ations-	Enforc	ement	Measu	res-Pa	atent s	earch a	and its	advant	ages-l	P Col	uncil-
Internationa	al Treaties-Conven	tions-WIPO-	IRIPS-WIO-PCI-Case Study-	4 on IPR-Example																

 Unit-5 - New Product Planning
 9 Hour

 Design of product prototype-Factors of design-Requirement of design-Design process-Functional design-Functional margins-Test and Qualification-Types of tests and their significance-Test plan-Issues in concluding a test-Quality standards-Product Strategy-Six-sigma Practice Procedure-Implementation-Marketing- methods-Marketing- research-Case Study -5 on product development-Example

	1.	Keleen A.L., New Product Planning and Development, International Correspondence	4.	Abdul Kalam.A.P.J., Arun Tiwari, "Wings of Fire", Universities Press, Hyderabad, 1999, Edward
Learning		Schools Division, Scraton, Pennsyvania, 1969		de Bono, How to have a beautiful mind, Vermilon, London, 2004
Deseuress	2.	Paul Sloane, The Leader's Guide to Lateral Thinking Skills, 2nd ed., Kogan Page India,	5.	Khandwalla, R.N., Fourth Eye (Excellence through creativity), Wheeler Publishing, Allahabad, 1992.
Resources		New Delhi, 2008, Department of Space: IPR Manual, Bangalore, 2007	6.	Rajiv.V.Dharaskar, Innovation-Growth Engine for Nation. Nice Buzzword but often
	3.	Osho, Creativity – Unleashing the Forces Within, St Martin's Griffin, New York, March, 2007		Misunderstood, www.dharaskar.com Annamalai.N., www.creativitysphere

Learning Assessme	ent						
		A 1 /	Continuous Learning	Assessment (CLA)		Sum	mativo
	Bloom's Level of Thinking	Forma CLA-1 Averag (509	ative e of unit test %)	Life-Long CL (10	g Learning "A-2 0%)	Final Ex (40% w	amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	50%		50%		50%	-
Level 2	Understand	50%	100 m 100 m 100 m	50%		50%	-
Level 3	Apply		1		10 - A -	-	-
Level 4	Analyze			and the second	· · · · ·		-
Level 5	Evaluate		1		W		-
Level 6	Create	1 State 1 State 1			- Parent		-
	Total	100	%	10	0 %	10	0 %

Co	ourse Designers	1.1			
Ex	perts from Industry	Ex	perts from Higher Technical Institutions	lr	nternal Experts
1.	Dr. D. Saji, National Aerospace Laboratories, Bangalore,	1.	Dr. V. Arumugam, Madras Institute of Technology, Chennai,	1	1. Dr. S. Gurusideswar, SRMIST
	saji@nal.res.in		arumugam.mitaero@gmail.c <mark>om</mark>		
2.	Dr. Manoj Kumar Buragohain, Defen <mark>se Rese</mark> arch and	2.	Dr. K. Vadivuchezhian, National Institute of Technology	1	2. Dr. K. Sarava <mark>nakumar,</mark> SRMIST
	Development Organization, Hyderabad,ragohainm@yahoo.com		Karnataka, Surathkal, vadivuchezhian_k@yahoo.co.in		



Course Code	21ASO303T	Course Name	AVIATION	AND AIRLIN	E MAINTENANCE MANAGEMENT	Cou Categ	rse Jory	0				OPEN	ELECI	IVE			l	- T 3 0	P 0	C 3
Pre-requis Courses	site S	Nil	Co- Co	requisite ourses	Nil	P	rogres Cours	sive ses						Nil						
Course C	Offering Departm	ent	Aerospace E	Engineering	Data Book / Codes / Stan	dards							Nil							
Course Lea	arning Rationale	(CLR): T	he purpose of lea	arning this c	ourse is to:		1			Progr	am Ou	utcome	s (PO))				Pi	rograr	m
CLR-1:	Explain the cond	epts of Air tra	ansportation and A	irline manag	ement	1	2	3	4	5	6	7	8	9	10	11	12	S ou	pecifie tcom	c es
CLR-2:	Explain the cond	ept of Airline	fore <mark>casting and</mark> fle	eet planning	in the second se	e		of	s of	24	iety			¥		۵.				
CLR-3:	Discuss the sign	ificance of air	rlin <mark>e schedul</mark> ing an	nd equipment	maintenance	vledç		ento	ation	ge	soc		-	٥W ر		anci	D			1
CLR-4:	Describe the cor	ncepts of Airc	<mark>raft reliab</mark> ility and a	aging aircraft	maintenance	Knov	lysis	mdo	stiga	Usa	anc	ઝ્		[ean	uo	& Fir	arnin			1
CLR-5:	Discuss the avia	tion suppo <mark>rtin</mark>	ng organization and	d state regula	atory	leering	em Ana	jn/devel	uct inve lex prot	rn Tool	engineer	onment	6	dual & ⁻	nunicati	ct Mgt.	ong Lei	5	5	3
Course Ou	tcomes (CO):	A	At the end of this	course, lear	ners will be able to:	Engir	Probl	Desig	Cond	lode	The e	Envir	Ethic	ndivi	Comr	Proje	life L	-OSc	- SO	-OS
CO-1:	Describe the org	anization det	ails in air-transpor	tation	A State of the Sta	3	-	-	-	-	-	-	-	-	-	-	1	-	-	-
CO-2:	Describe the for	ecasting <mark>meth</mark>	nods in airline		States and the second	3		1	-	-		0-	-	-	-	-	1	-	-	-
CO-3:	Summarize the	schedulin <mark>g pro</mark>	ocess and mainter	nance of airc	raft	3		-	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Explain the agin	g aircraf <mark>t mai</mark> i	ntenance	-		3	-	-		-		-	-	-	-	-	-	-	-	-
CO-5:	Summarize the a	aviation suppo	orting organization	is and state r	egulatory	3	-	Li.	-	-	-	-	-	-	-	-	1	-	-	-
Unit-1 - Air Internationa of managen	Transportation In Aviation Association	ation - IATA - management	- General Aviation	Classificatio	n - Factors Affecting General Aviation I	ndustry - A	Nircraft	Uses -	Airport	classi	ficatio	n - Airlii	n <mark>e M</mark> ar	nagem	ent Le	vels of	Manag	emen	9 t Func	Hour tions
Unit-2 - Air	line Managerial	Aspect		1201					12	1									9	Hour
Airline Fore	casting - Fleet Pl Fleet Commonali	anning - Airci tv - Factors A	raf <mark>t Selectio</mark> n Proc ffecting Elect - Ch	ess - Passer	nger Capacity - Load Factor - Passenge n and Depreciation - Budgeting - Cost n	er Fare an	d Tarifi Aircrew	s - Infl Analy	uence c sis - Ro	of Geog ute An	graphi alvsis	cal, Eco	onomic off eval	and F	Politica	l Facto	rs on F	Routes	and F	Route
Unit-3 - Air	line Scheduling	y ruotoro n	neering ricer en		n and Doprodución (Dadgoung Coor p	nanning i	110101	Thuy	010 110		aryoro	7 11 01 0	int ovur	uuuon					9	Hour
Mission of A flow - Scheo - Hub and s	Airline scheduling dule salability - So poke scheduling	- Equipment chedule Adjus	mainte <mark>nance - Ma</mark> tment - Ch <mark>ain reac</mark>	aintenance sy ction effect - L	rstem of a jet aircraft - Objective of grou .oad factor leverage - Equipment's and t	und servic types of sc	e - Gro hedule	und op - Prep	eration aring fli	s and i ght pla	facility Ins - A	limitati ircraft s	ons - S chedul	Schedu ling in l	ıle plar line wit	nning a h aircra	nd coo aft mair	rdinati ntenan	on - T ice pra	raffic actice
Unit-4 - Air	craft Reliability																		9	Hour
Parameters depressuriz	to monitor Maint ation - Aging Airc	enance sche raft Maintena	dule - Maintenanc Ince in aging aircra	e program - aft - Operatin	Condition monitoring maintenance -ET(g cost associated with maintenance - H	OPS - Mai Ielicopter n	ntenar nainten	ice ver iance -	sus Col Mainte	nventio nance	onal M scheo	laintena lule	nce - I	ETOP	S for N	lon-ET	ops a	irplane	≥s - Ai	rcraft
Unit-5 - Av	iation Supportin	g Organizati	ons														_		9	Hour
organizatior maintenanc	n - State regulato e - Introduction a	ry - Respons nd Functions	ibilities and function of Technical Publi	ons of FAA - ications, Airlii	DGCA - functions of DGCA - Turbine ne Libraries, Control of Publications, Do	engine m ocument D	onitorin stributi	i <mark>g - O</mark> r ion	board	mainte	enance	e syster	n - Life	e usag	ie mon	itoring	- Tech	nology	γ in ai	rcraft

Learning	1.	John G Wensveen, Air Transportation – A Management Perspective, Ashgate Publications,	3.	Indian Aircraft Manual, DGCA, sterling book House, Mumbai, reprint 2014
Desources		8th ed., 2015	4.	Aviation maintenance management Harry.A.Kinnison, Second edition McGraw-Hill 2013
Resources	2.	Friend C.H.,Aircraft Maintenance Management,Longman aviation technology.2nd ed.,1992	5.	PS Senguttuvan, Fundamentals of air transport management, excel books, reprint 2010

Learning Assessm	lent			States and							
			Continuous Learnin	g Assessment (CLA)		0					
Bloom's Level of Thinking		Forma CLA-1 Averag (505	ative e of unit test %)	Life-Lon Cl (1	g Learni <mark>ng</mark> LA-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	50%		50%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	50%	-				
Level 2	Understand	50%		50%		50%	-				
Level 3	Apply	A		-		-	-				
Level 4	Analyze	~ ~	the second second			-	-				
Level 5	Evaluate					-	-				
Level 6	Create			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		-	-				
	Total	100	%	10	00 %	10	0 %				

Cοι	urse Designers			
Ex	perts from Industry Experts	from	Higher Technical Institutions	Internal Experts
1.	Wg.Cdr retd. Manoharan, Continuing Airworthiness Manager, Blue Dart	1.	Dr. V.Arumugam, Madras Institute Of Technology Campus,	1. Dr. S. Si <mark>vakumar,</mark> SRMIST
	Aviation. manoharank@bluedart.comS	-	Anna University, Chennai, arumugam.mitaero@gmail.com	Press
2.	Wg.cdr R.Annamalai, Chief training co-ordinating officer IAF, Tambaram	2.	Dr.S.Nadaraja pillai, Sastra university Thanjavur,	2. Mr. K. Iyenthezhuthon, SRMIST
	anamalai.ramasamv2@gmail.com	2010	adaraiapillai@mech.sastra.edu	



B.Tech / M.Tech(Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses –Syllabi-Control Copy

Course Code	21ASO304T	Course Name	A	AIRCRA	.FT GEN	ERAL E	NGINE	EERING AND TICES	MAINTENANC	E	Cour Categ	se ory	0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3
Pre-requ Course	isite es	Nil			Co- req Cours	uisite e <mark>s</mark>			Nil		P	rogres Cours	sive ses						Ni	1					
Course	Offering Departme	ent	A	Aerospa	ice Engir	neering		Data B	ook / Codes / S	Standard	ls						_	Nil							
Course Lo	earning Rationale	(CLR): T	The pur	rpose o	o <mark>f l</mark> earnii	ng this c	course	e is to:			-	1	1		Prog	am O	utcome	es (PC))				P	rogra	m
CLR-1:	Identify ground ha	andling tools	s and e	equipme	nt's to pe	ərform gi	round h	handling			1	2	3	4	5	6	7	8	9	10	11	12	- S 01	Specif utcom	ic Ies
CLR-2:	Maintain the aircr	aft ground s	servicin <mark>,</mark>	<mark>ig units</mark>	1.7	3	1		1000		ge		of	s of		iety			Ł		ø				
CLR-3:	Summarize the sa	afety aspect	ts a <mark>nd i</mark>	improve	the hur	nan relat	tions in	n working envir	ronment.		vledç		ento	tion	ge	soc			oW r		anci	0			
CLR-4:	Work in the plann	ning process	s <mark>env</mark> iro	onment o	of mainte	enance i	ndustry	y	1. 2 m 1.		Know	lysis	obm	stiga	Usa	and	ø		Team	N	& Fin	arnin			
CLR-5:	Maintain the tools	s, access <mark>orie</mark>	es and	compor	nents						sering	m Ana	l/deve	ict inve	n Tool	ginee	nment	5	ual & .	unicat	t Mgt.	ng Le:			
Course O	utcomes (CO):	4	At the e	end of a	this cou	rse, lea	rners v	will be able to	p:	2.7	Engine	Proble	Design	Condu	Moder	The er	Enviro Sustai	Ethics	Individ	Comm	Projec	Life Lc	PSO-1	PSO-2	PSO-3
CO-1:	Explain the opera	ntion of <mark>vario</mark>	ous grou	und har	ndlin <mark>g</mark> eq	uipment	's and i	its procedures	s	120	3	- 1	-		-	-	-	-	-	-	-	1	-	-	-
CO-2:	Restate the utility	[,] of aircr <mark>aft g</mark>	g <mark>roun</mark> d s	servicin	ng units a	and their	mainte	enance	1.00		3		1	-	-	- 10	-	-		-	-	-	-	-	-
CO-3:	Describe the vari	ous asp <mark>ects</mark>	s of hum	nan peri	formance	e factors	;		1000	1	3	- 1	-	-	-	-	-	-	-	-	-	1	-	-	-
CO-4:	Discuss about dif	ferent m <mark>aint</mark> e	tenance	e operat	tional pro	ocedures	s	10	and the state		3		12		-	200	-	-	-	-	-	-	-	-	-
CO-5:	Explain the variou	us preci <mark>sion</mark>	instrun	ments a	nd sp <mark>e</mark> ci	al tools	1	1.00	- m.	- 1	3		1.1	-	-		-	-	-	-	-	1	-	-	-
llnit-1 - A	ircraft Ground Har	ndling					C.e. Hill																	٥	Hour
Mooring, j	acking, levelling and	d towing ope	erations	s – Prep	aration -	- Equipn	nent – I	precautions -	Engine starting	procedu	res – F	Piston	engine	. turbo	props a	and tur	bojets -	- Engi	ne fire	exting	uishing.	- Gro	und Pc	wer L	Inits.
Unit-2 - M	aintenance and Ha	andling of G	Ground	d Equip	ments								0	,	1			U			0			9	Hour
Air Starter	Unit - Portable Hyd	Iraulic Test S	Stand -	- Electric	power :	supply e	quipme	ent - Air-condi	tioning Unit - O	il Pressu	re Unit	- Jack	ks, Cra	nes, <mark>La</mark>	dders,	Platfo	orms, Ti	restles	& Cho	ocks.					
Unit-3 - H	uman Performance	e and Limita	ations				-			_					1									9	Hour
The need physical a	to take human fact ccess.	ors into acco	count, li	ncidents	s attribut	able to I	human	n factors/huma	in error, Murph	iy's law. \	lision,	Heari	ng, Inf	ormatic	n proc	essing	, Atten	tion a	nd per	ceptior	n, Mem	ory, C	austro	phobi	a and
Unit-4 – lı	nspection					160				10.1			12											9	Hour
Inspection	Process, Purpose,	Types - Ins	spection	n interva	als – Tec	<mark>:hniques</mark>	s – Che	ecklist - Specia	al inspection –	Publication	ons, bi	ılletins	, vario	us mai	nuals –	FAR	Air wor	thines	s direc	tives	Туре	certific	ate Da	ta She	ets –
Unit-5 - A	ircraft Hardware a	nd Materials	s													-								9	Hour
Hand tools systems o	s – Precision instru f specifications – Th	ments – Spe nreads, gears	ecial too rs, bear	ols and rings –	equipme Drills, ta	ent in an pes & re	<mark>1 airpla:</mark> amers.	ane maintenan 3.	ice shop - Ider	ntification	termir	nology	– Spe	cificati	on and	corre	ct use o	of vari	ous air	craft h	ardwar	e - Am	ierican	and	3ritish

	1.	Airframe and Power plant Mechanics,	General	Hand	Book,	Federal	Aviation	3.	Michael J.Kroes, William A.Watkins ad Frank Delp, Aircraft Maintenance and Repair, 7 th ed., Tata
Learning		Administration, and AC65 - 9A.							McGraw Hill, New Delhi, 2013.
Resources	2.	Airframe and Power plant Mechanics,	Airframe	Hand	Book,	Federal	Aviation	4.	CAP 715 – An Introduction to Aircraft Maintenance Engineering Human Factors for JAR 66, Civil
		Administration, and AC65- 15A.							Aviation Authority, UK.

earning Assessin			Continuous Learning	Assessment (CLA)			
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (1)	g Learning .A-2 0%)	Sum Final Ex (40% w	mative amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	50%		50%		50%	-
Level 2	Understand	50%		50%		50%	-
Level 3	Apply	\sim \sim	A Carlot Same			-	-
Level 4	Analyze					-	-
Level 5	Evaluate	2.1/		Contraction of the local distance of the loc		-	-
Level 6	Create	- · ·	7.2	10/2/201			-
	Total	10	0%	10	0%	10	0 %

Coi	urse Designers				
Ex	perts from Industry	Ex	perts from Higher Technical Institutions	Int	ernal Experts
1.	Wg.Cdr retd. Manoharan, Continuing Airworthiness Manager,Blue	1.	Dr. V.Arumugam, Madras Institute Of Technology Campus, Anna	1.	Dr. S. Sivakumar, SRMIST
	Dart Aviation.manoharank@bluedart.com		University, Chennai, arumugam.mitaero@gmail.com		
2.	Wg.cdr R.Annamalai,Chief training co-ordinating officer	2.	Dr.S.Nadaraja Pillai, Sastra university Thanjavur,	2.	Mr. G. Mahendra Perumal, SRMIST
	IAF, Tambaram annamalai.ramasamy2@gmail.com		nadarajapillai@mech.sastra.edu		and the second se



Course Code	21ASO305T	Course Name	FLOW VISUALIZ	ZATION TECHNIQUES	Ca	ourse	e ry	0				OPEN	ELEC	ΓIVE			(L T 3 0	P 0	C 3
Pre-requ Cours	lisite es	Nil	Co- requisite Courses	Nil		Pro	gres: ours	sive es						Nil	1					
Course	Offering Departme	ent	Aerospace Engineering	Data Book / Codes / S	Standards								Nil							
Course L	earning Rationale	(CLR):	The purpose of learning this cou	irse is to:			4	1		Progra	am Ou	itcome	s (PO)				P	rograi	n
CLR-1:	Describe the flow	visualizati	on techniques in fluid flows			1	2	3	4	5	6	7	8	9	10	11	12	S OU	pecifi itcom	c es
CLR-2:	Select the approp	priate equip	oment required for performing flow v	visualization experiment	1	e		+	of	20	ety			¥						
CLR-3:	Identify the techn	niques for p	erforming flow visualization in air ai	nd water		ledg		ent o	tions	e	soci			Wor		ance				
CLR-4:	Visualize the den	sity gradie	nts and shocks in compressible flow	VS.		Non	lysis	opme	stiga	Usaç	and	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		eam	ч	Fin	uming			
CLR-5:	Examine the lase	ed based of	otical techniques for flow visualization	on applications.		eering h	em Anal	n/devel	uct inve	m Tool	ngineer	onment inability		dual & T	nunicati	ct Mgt. 8	ong Lea		2	с С
Course C	utcomes (CO):		At the end of this course, learne	ers will be able to:		Engin	Proble	Desig	Condi	Mode	The e	Envire Susta	Ethics	ndivi	Comn	Proje	-ife L	-OSc	-OSc	-OSc
CO-1:	Apply the princip	les of flu <mark>id</mark> :	flows for flow visualization application	on.	Same	3	2	-	-	-		-	-	-	-	-	-	-	-	-
CO-2:	List the equipmer	nt requir <mark>ed</mark>	for flow visualization experiments	The second second		3	2	100		-		-	-	-	-	-	1	-	-	-
CO-3:	Perform flow visu	ializatio <mark>n in</mark>	air and water	1.11.11.11.11.11	1	3	2		-	-	- 10	-	-		-	-	1	- 1	-	-
CO-4:	Illustrate the flow	field in <mark>su</mark>	personic flows		200	3	2	-	-	-		-	-	-	-	-	1	- 1	-	-
CO-5:	Apply advanced	flow visu <mark>ali</mark>	zation techniques to fluid flows	a Fine of Street		3	2	1.1	-	-	1	-	-	-	-	-	-	-	-	-
llnit-1 - E	luid Flows		1 - C - C	بالمتحدث وتصاف							-								0	How
Brief histo	ory of fluid mechani	ics. Proper	ties of fluids, fluid statics, flow kin	ematics, types of flows, Fluid Fl	low descrip	tion, (Cons	ervatic	on laws.	Conti	nuity a	and Na	vier-S	tokes	equatio	on, Ber	rnoullis	equa	tion ar	nd its
applicatio	ns, Boundary layer a	and separa	tion, Reynolds number and Mach n	number	· · · ·										'			, 		
Unit-2 - F	low Visualization	Set-Ups a	nd Equipments							-									9	Hour
Wind Tun	nels and their classif	fication - Si	ibso <mark>nic and Supersonic Wind Tunne</mark>	els, Smoke Tunnel, Hele-Shaw ap	oparatus, Re	eynold	ds ap	paratu	s, Wate	r Tunn	el, Ph	otograp	hic eq	uipmei	nt and i	echniq	ues, La	ab Der	nonstr	ation
Unit-3 - F	low Visualization i	n Incompr	essible Flows	1 1 1 1 1 1	The Lot	-	-	-	-	-	-								0	How
Flow visu	alization in air – Smo	oke aenera	tor, Smoke rake technique, Smoke-	wire technique. Surface oil flow vi	isualization.	Tufts	Visu	alizatio	on. Flov	Visua	alizatio	n in wa	ter – C	Conver	tional a	and Flu	ioresce	ent dve	es. Met	hods
of dye inje	ection, Hydrogen bu	bble techni	que, Lab Demonstration of visualiza	ations	oudin2 dition,	. anto		anzaa	,								0.0000	uj o	0,01	
Unit-4 - F	low Visualization i	n Compre	ssible Flows																9	Hour
Optical Te	echniques, Gladston	ne-Dale Rei	ation, Shadowgraph, Schlieren, La	b demonstration of Schlieren Tec	chnique, Ba	ckgroi	und (Driente	d Schlie	eren (E	30S)									
Unit-5 - A	dvanced Laser Ba	sed Optica	al Techniques			((D (01	D/L		-								9	Hour
Particle II	nage Velocimetry (I ns. Pressure Sensit	PIV) - PIV ive Paints	Setup components and procedure Temperature Sensitive Paints	- Image Correlation and Post p	processing of	ot PIV	Data	a, Ster	eo PIV	and T	omo	PIV, Pla	anar L	aser lı	nduced	Fluor	escenc	e tor o	combu	stion
apprivatio		a c i unito.																		

	1.	Rathakrishnan, Ethirajan. Instrumentation, measurements, and experiments in fluids. CRC press, 2007.	4.	Barlow, Jewel B., William H. Rae, and Alan Pope. Low-speed wind tunnel testing.
Learning	2.	Smits, Alexander J. Flow visualization: techniques and examples. World Scientific, 2012.		John wiley & sons, 1999.
Resources	3.	Tropea, C., Yarin, A. L., & Foss, J. F. (Eds.). (2007). Springer handbook of experimental fluid mechanics.	5.	Discetti, Stefano, and Andrea Ianiro, eds. Experimental aerodynamics. CRC
		Berlin: Springer.		Press, 2017.

			Continuous Learning A	Assessment (CLA)	and the second se	0	<i>(</i> '			
	Bloom's Level of Thinking	Forr CLA-1 Avera (5	native age of unit test 0%)	Life-Long CL (1)	l Learning A-2)%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%		20%		20%	-			
Level 2	Understand	20%		20%		20%	-			
Level 3	Apply	60%	and the second second	60%		60%	-			
Level 4	Analyze				-	-	-			
Level 5	Evaluate					-	-			
Level 6	Create		111 - 24 - 20	1	1. A.	-	-			
	Total	10	0%	10	0 %	10	0 %			

Course Designers	and the second sec	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
 Dr. Saurav Kumar Ghosh, CSIR-NAL, Bangalore skohosh@nal.res.in 	1. Dr. Lakshmana Dora C, IIT Hyderabad Ichandrala@mae.iith.ac.in	1. Dr. K K Bharadwaj, SRMIST
2. Dr. Raja S, CSIR-NAL, Bangalore, raja@nal.res.in	2. Dr. Arun Kumar Perumal, IIT Kanpurakp@iitk.ac.in	2. Dr. S Senthilkumar, SRMIST



Course Code	Code 21ASO306T Course AIRPORT ENGINEERING			C Ca	ourse itegor	e Ty	0				OPEN I	ELECI	ΓIVE			l	- T 3 0	P 0	C 3			
Pre-requi Course	site s	Nil		Co- requisite Courses		Nil		Prog	gres: ourse	sive es						Nil						
Course (Offering Departme	ent	Aerospa	ce En <mark>gineering</mark>	Da	ta Book / Codes / Star	ndards								Nil							
Course Le	arning Rationale (CLR): T	The purpo <mark>se o</mark>	<mark>f learnin</mark> g this co	ourse is to:	1.11.1			1			Progra	am Ou	<mark>itco</mark> me	s (PO))			Prog			m
CLR-1:	Explain about airp	oorts and su	urveys		\mathbf{v}			1	2	3	4	5	6	7	8	9	10	11	12	ou	itcom	es
CLR-2:	Describe about ai	rport plannii	ing a <mark>nd forecas</mark>	ting	1.00	and the second		е		Ļ	s of	3	ety			¥		0				
CLR-3:	Contrast and desi	ign runway a	an <mark>d taxiways</mark>	-	1	1.11.11.11.11		vledç		ento	tions	ge	soc		-	oW I		ance	6			
CLR-4:	Explain air traffic control tower and terminal areas and Air cargo				Vov	lysis	mdo	stiga	Usa	and	∞ .		earr	ы	& Fin	arnin						
CLR-5:	Discuss about he	liports, STO	OL ports and ve	rtiports	1212			ing	Ana	evel	inve	Tool	neer	hent bility		L & 1	licati	Agt. 8) Lea			
L								ineel	olem	ign/d tions	duct	ern .	engi	ironn taina	cs	vidua	mur	ect N	Lonç)-2	-3
Course Ou	itcomes (CO):	-	<mark>At the</mark> end of t	his course, learr	ners will be al	ole to:	47.0	Eng	Prot	Des solu	Con	Mod	The	Envi	Ethi	Indiv	Con	Proj	Life	PSC	PSC	PSC
CO-1:	Describe airports	and su <mark>rveys</mark>	<mark>vs invo</mark> lved	PS-1		a curches	1.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Explain airport pla	anning <mark>and f</mark>	forecasting	1 44	97 - S.			2	-	100	- 1	-		-	-	-	-	-	1	-	-	-
CO-3:	Differentiate interp	pret an <mark>d des</mark>	<mark>sign r</mark> unway an	d ta <mark>xi</mark> ways	1.1.2.2		1	2			-	-	-	-	-	-	-	-	1	-	-	-
CO-4:	Describe about ai	r traffic <mark>cont</mark>	ntrol tower and t	erminal areas	(Astronomy)		2	2	-	-		-	-	-	-	-	-	-	-	-	-	-
CO-5:	Differentiate interp	pret abo <mark>ut h</mark>	<mark>helipor</mark> ts, STOL	ports and vertipo	orts		-	2	-	1.1	-	-	2	-	-	-	-	-	1	-	-	-
Unit-1 - Ai National an	rport Survey ad International Org	anizations -	- Aircraft Chara	cteristics - Civil a	and military airc	crafts - Airport Definition	os- Cate	gories	and	Codes	of airp	orts - I	Flying	Activitie	əs - So	chedule	ed and	non-so	chedule	əd fligł	9 hts - A	Hour irport
Unit-2 - Ai	rport Planning	OI SUIVEy -	- Drawings to be	e Flepaleu - Type	es or pian	100					1	27									9	Hour
Improveme	ent of existing Airpo	ort - Airport	site selection -	Factors affecting	size of airpor	t - Aviation Forecasting	- Airpor	t obst	ructic	ons - Ir	naginal	y surf	ace - (Obj <mark>ects</mark>	with a	ictual I	height	- Airpo	rt zone	s - Zo	ning l	aws-
Environme	ntal considerations	- Factors in	nfluenced by air	port activity - Poll	lution, Social fa	actor		-	-	-			-	-							0	Hour
Runwav or	ientation - Change	in direction of	of runway - Bas	sic runway length	- Runwav patt	erns - Comparison of ru	inwav pa	atterns	s - Ta	xiwav	desian	- Lavo	ut of t	axiwavs	s - Geo	ometric	stand	ards fo	r taxiw	av - Ex	yit taxi	iwavs
- Location of	of exit taxiway - Des	sign of exit t	taxiways - Apro	n Types - Fillets	- Separation C	learance - Bypass or tu	rnaroun	d taxiv	way											<u> </u>		- , -
Unit-4 - Te	rminal Area and A	TC and Air	ir Cargo	Turnical airport la	wout Air Troff	in Control Elight Dulog	ATC	Notwo	vela l	ATC A	do Ar	tomot	ion in		ootoro	offect	ina tha	0170 0	foorac	tormi	9	Hour
cargo hand	lling - Passenger	riow- Apro	uii - Hariyars -			ic Control - Flight Rules	- AICI	Netwo	01K - A	ATC AI	us - Al	lomal		ATC- F	actors	anecu	ing the	SIZE 0	r cargo	lennii	11di - 7	чргоп
Unit-5 - Vis	sual Aids, Heliport	t and STOL	L Ports, Vertipe	orts																	9	Hour
Requireme - Character	nts of pilot for visua ristics of STOL - Air	al aids - Airp craft Planni	port Marking - (ing of STOL Po	Guidance to pilots rt - Runway and t	s during landing taxiway of STC	<mark>g - ele</mark> ments of airport lig DL port - Lighting of STC	ghting- H <mark>DL Port</mark> ·	Helipor Mark	rt - Pi ting o	lanning <mark>f ST</mark> OI	of hel Port -	port - Planni	Elevat ng and	ed helip I desigr	oort - N 1 of Ve	/arking ertiport	g and l s	ighting	of heli	oort - S	STOL	ports

Loarning	1.	Rangwala. Airport Engineering, Charotar Publishing House Pvt. Ltd.; 17th Edition	1 3	Norman J. Ashford, Saleh A. Mumayiz, Paul H. Wright. Airport Engineering: Planning, Design and
Desourcos		January 2018)		Development of 21St - Century Airports", 4th ed., CBS Publishers & Distributors. April 2011
Resources	2.	FAA Advisory Circular - Airport Design 150/5300-13B - March 2022	4	Airport Engineering - planning and design- Saxena S.C.CBS Publishers & Distributors

Learning Assessmer	nt									
			Cum	mativa						
	Bloom's Level of Thinking	Form CLA-1 Avera (50	ative ge of unit test %)	Life-Lon Ci (1	g Learning LA-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	50%	and the second second	50%		50%	-			
Level 2	Understand	50%		50%		50%	-			
Level 3	Apply	-					-			
Level 4	Analyze		and the second second			-	-			
Level 5	Evaluate	Str. 1					-			
Level 6	Create			Sector Sector			-			
	Total	100)%	10	00 %	10	0 %			

Co	Course Designers										
Ex	perts from Industry	Ex	perts from Higher Technical Institutions	Int	ernal Experts						
1.	Wg.Cdr retd. Manoharan, Continuing Airworthiness Manager,Blue	1.	Dr. V.Arumugam, Madras Institute Of Technology Campus, Anna	1.	Dr. S. Sivakuma <mark>r, SRMIS</mark> T						
	Dart Aviation.manoharank@bluedart.com		University, Chennai, arumugam.mitaero@gmail.com								
2.	Wg.cdr R.Annamalai,Chief training co-ordinating officer	2.	Dr.S.Nadaraja pillai, Sastra university Thanjavur,	2.	Mr. K. Iyenthezhuthon, SRMIST						
	IAF, Tambaram annamalai.ramasamy2@gmail.com		nadarajapillai@mech.sastra.edu								



Course Code	Course Code 21ASO307T Course Name MOLECULAR GAS DYNAMICS				Cour Categ	se ory	0				OPEN I	ELECI	ΓIVE			1	- T 3 0	P 0	C 3		
Pre-requis Courses	site s	Nil	C	o- requisite Course <mark>s</mark>		Nil	P	rogres Cours	sive es						Nil	1					
Course C	Offering Departme	nt	Aerospace	Engineering	Data Bo	ok / Codes / Standa	ds							Nil							
								1.0	1.00					_							
Course Learning Rationale (CLR): The purpose of learning this course is to: Program Outcomes (I							s (PO))				P	ograr	m io							
CLR-1:	Discuss need for i	molecular de	lescription of fluid	<mark>flow, binary c</mark>	ollision and th <mark>e</mark> Boltzr	mann equation	1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	es
CLR-2:	Explain the signifi	cance of ela	astic <mark>and inelas</mark> tic	c collision	1		ge		of	s of	10	iety			ork		е				
CLR-3:	Interpret the chem	nical reaction	ons <mark>and therm</mark> al ra	adiation with re	espect to engineering	problem	vled		ent o	ation	ge	l soc		-	M No		Janc	Ð			
CLR-4:	Describe importar	nce of collisi	i <mark>onless flo</mark> w	~			Kno	lysis	opm	stig	Usa	and	∞		ear	ы	& Fii	arnir			
CLR-5:	Explain the nume	rical tech <mark>niq</mark>	<mark>que for m</mark> icroscop	oic and mesoso	copic method		ering	n Ana	/devel	t inve x prot	Tool	gineer	iment		lal & T	Inicati	Mgt. a	ng Lea			ĺ
				<u> </u>			gine	bler	sign		derr	e en	/iror stain	<u>ics</u>	ividu	JMIL	ject	e Lor	<u>-</u> 1	0-2	0-3
Course Ou	tcomes (CO):	4	At the end of thi	s course, lear	mers will be able to:	and the second	ц	Pro	De	CO CO	Mo	The	Sus Sus	뮲	Ind	Ō	Pro	Life	PS	PS	PS
CO-1:	Define the import equation.	tance of m	olecular perspec	tive fluid flow	, binary collision an	d need for Boltzman	ⁿ 1			-	5-5	-	-	-	-	-	-	-	-	-	-
CO-2:	Explain the differe	ence be <mark>twee</mark>	<mark>en in</mark> elastic and e	lastic collision	and its significance		2	-	-		-	- 10	-	-		-	-	-	-	-	-
CO-3:	Examine the role	of bimo <mark>lecul</mark>	<mark>ılar re</mark> actions and	termolecular r	reactions in chemical	reaction	2	-	- 1	-	-	-	-	-	-	-	-	2	-	-	-
CO-4:	Describe the signi	ificance <mark> of c</mark>	collisionless flow.		1. I.		2	-	1	1.25	-	1	-	-	-	-	-	-	-	-	-
CO-5:	Demonstrate the I	need fo <mark>r me</mark>	esoscopic and mi	croscopic num	erical technique for fl	uid flow	3	-	-	-	-		-	-	-	-	-	2	-	-	-
Unit-1 - Inti	roduction to Kine	tic Theory									1		~							9	Hour
Gaskinetic	theory, Molecular n	nodel, the <mark>si</mark>	<mark>imple dilu</mark> te gas, i	real gas effects	s, macroscopic prope	rties in a simple gas.	Equilibi	ium Ki	netic tl	heory: L	Distribu	tion fu	nction,	phase	space	distrib	utions,	macro	scopi	c avera	ages,
the Maxwell	I-Boltzmann distrib	ution									-9									0	Hour
The Boltzm	ann Equation: The	evaluation	of the phase spa	ce distribution	function, the Boltzma	ann collision integral,	The H-t	heorer	n, BGK	(appro	ximatio	n. Ela	astic col	llision	dynam	nics, co	llision i	models	, Max	well m	nodel.
Inelastic co	llision models: Lars	en-Borgnak	kke m <mark>odel, The</mark> g	eneral Lasren-	Borgnakke distributio	on, vibrational and ele	ctronic	energy	, gas-s	surface	interac	tion.			-						
Unit-3 - Ch	emical Reaction a	nd Therma	al Radi <mark>ation</mark>		11		<u>.</u>													9	Hour
Collision the	eory for bimolecula	ar reactions,	s, reaction cross-	sections for gi	ven reaction rates.	Extension to termoled	ular rea	rodiot	, cherr	nical eq	uilibriu	m, The	e equili	brium	collisio	on theo	ory. It	ne diss	ociatio	n rea	ction,
Unit-4 - Co	llisionless Flows	change and		UIS. Classical			liieiiiai	Taulat	1011												Hour
Bimodal dis	tributions, molecul	ar effusion	and transpiration	n, one-dimensi	onal flows, Transfer	of normal, tangential	momer	tum, t	ransfer	r of trar	slation	al ene	ergy, fre	e mol	ecular	heat t	ransfer	; recov	ery te	mpera	ature,
Stanton nur	mber and thermal r	ecovery faci	ctor. Thermophor	esis, flows witl	<mark>h multi</mark> ple reflection, t	est-particle Monte Ca	rlo metl	nod, va	riance	reduct	on								-	· .	
Unit-5 - Co	mputational Tech	niques for	Mesoscopic and	d Microscopio	Methods														,	9	Hour
Direct Simu	lation Monte Carlo), Lattice Bo	oitzmann Method	: Lattice gas a	automata (LGA), LGA	to lattice Boltzmann	equatio	on, alg	orithm,	bound	ary an	d initia	l condi	tions. I	Molecu	ular Dy	namics	s: the	force	calcula	ation,
integrating	ะนุนสแบกร บาท10แบก	1, 301000181	1110005.																		

	1.	Gombosi, Tamas I., and Atmo Gombosi. Gaskinetic theory. No. 9. Cambridge University	4.	Frenkel, Daan, et al. "Understanding molecular simulation." Computers in Physics 11.4
		Press, 1994.		(1997): 351-354.
Learning	2.	Bird, Graeme A., and J. M. Brady. Molecular gas dynamics and the direct simulation of gas	5.	Anderson, John David. Modern compressible flow: with historical perspective. Vol. 12. New
Resources		flows. Vol. 5. Oxford: Clarendon press, 1994		York: McGraw-Hill, 1990.
	З.	Kruger, Ch H., and W. G. Vincenti. "Introduction to physical gas dynamics." John Wlley &		
		Sons (1965).	1	

		Continuous Learning Assessment (CLA)										
	Bloom's Level of Th <mark>inking</mark>	Form CLA-1 Avera (5)	native ige of unit test 0%)	Life-Long L CLA- (10%	earning 2 .)	Final Ex (40% w	rative amination eightage)					
		Theory	Practice	Theory	Practice	Theory	Practice					
Level 1	Remember	20%	States - Sales	20%	1.1	20%	-					
Level 2	Understand	20%		20%		20%	-					
Level 3	Apply 📃	60%		60%		60%	-					
Level 4	Analyze		12 1 1	1.7		-	-					
Level 5	Evaluate	-				-	-					
Level 6	Create		Sec. 29.15.19	the first of the second		-	-					
	Total	10	0%	100 %	%	10	0%					

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mrs. Smrutisudha Sahoo, DRDO s.sahoo.pxe@gov.in	 Dr. Rakesh Kumar, Indian Institute of Technology Kanpur rkm@iitk.ac.in 	1. Dr. Malaikannan G, SRMIST
2. Mr. Dhanabal K, S & I Engineering Solutions Pv.t. Ltd.	2. Dr. Arun Kumar P, Indian Institute of Technology Kanpur	2. Dr. Aravindh Kumar S M, SRMIST
dhanabal@sandi.co.in	akp@iitk.ac.in	

Course Code	21AIO351T	Course Name	INTRODUCTIC	INTRODUCTION TO ARTIFICIAL INTELLIGENCE								OPEN	ELEC	TIVE				- T 2 1	P 0	C 3
Pre-requ Course	isite es	Nil	Co- requis Cour <mark>ses</mark>	te Nil	×	Pr	ogres Cours	sive ses						Nil						
Course	Offering Departme	ent	Computational Intellige	ence Data Book / Code	s / Standard	s	-		-				Nil							
Course L	arning Pationale		he nurnose of learning t	his course is to:		-	-			Progr	am Oi	Itcome	e (DO)	<u>،</u>				Р	rogra	m
Course L									100	FIOGI			S (FU	,	10		40	S	pecifi	ic
CLR-1:	Analyze the vario	us character	istics of Intelligent agents			1	2	3	4	5	6	1	8	9	10	11	12	ou	tcom	es
CLR-2:	Organize differen	t search stra	tegi <mark>es in Al</mark>	Viel Investor	-	ge		of	Is of	15	ciety			Ł		g			l	
CLR-3:	Incorporate know	ledge in solv	rin <mark>g AI proble</mark> ms		24.6	vled		lent	ation	ge	so			МЙ		Jano	þ		l	
CLR-4:	P-4: Construct in different ways of designing software agents				1.1	Kno	lysis	opm	stiga	Usa	ranc	~× _		Tear	UO	چە تا	arnir		l	
CLR-5:	CLR-5: Plan various applications of Al.					ing	Ana	level	inve	Tool	neel	hent		8	licati	Agt. 8) Le		l	
					-	nee	lem	gn/c	duct	em .	engi	ronr aina	s	idue	mur	ect N	Lonç	-	$\tilde{\gamma}$	က္
Course O	utcomes (CO):	A	t the end of this course,	learners will be able to:		Engi	Prob	Desi	Conc	Mod	The	Envi	Ethic	Indiv	Com	Proje	Life	PSO	PSO	PSO
CO-1:	Use appropriate s	search a <mark>lgori</mark>	thms for any AI problem	and the starts	129-	3		-	-	5-	-	-	-	-	-	-	-	-	-	-
CO-2:	Represent a prob	lem usi <mark>ng fir</mark>	<mark>st o</mark> rder and predicate logi	с		3	3	3	-	2	3	-	-	-	-	-	-	-	-	-
CO-3:	Provide the apt a	gent strategy	to solve a given problem	1 W. 192 W.	2.4	3	3	2	- 1	2		-	-	-	-	-	-	-	-	-
CO-4:	Design software a	agents to sol	ve a problem	10 25 17 10 12 T	100	3	1	3	-	2	3	-	-	-	-	-	-	-	-	-
CO-5:	Develop applicati	on that uses	Artificial Intelligence.	State State Street		3	1	3	-	-	2	- 10	-	-	-	-	-	-	-	-
			1	Martin and I																·
Unit-1 - In	troduction																		9	Hour
Introductio	n, Definition, Futur on problems, Constr	e of Artificial	Intelligence, Characterist	ics, Typical Intelligent agents, Prob propagation, Back tracking search, (lem solving a Game plaving	approa n Ontii	nch, Se mal de	earch s	strategi	es, Un	iforme	ed and i	nform	ed, He	uristic	s, Loca	l searc	sh, Alg	orithn	n and
Unit-2 – P	redicate Logic and	d Knowledg	e Representation	Stopagation, Back tracking scarch, v	Sume playing	, opui	nui uc	0131011	10	1									9	Hour
Alpha beta	a pruning, First orde	er predicate l	lo <mark>gic, Porlog</mark> programming	, Unification, Forward Chaining, ba	ckward chim	ing Re	solutio	on, Kno	owledge	e Repr	resenta	ation, E	vents,	Menta	al Even	ts, Me	ntal Ob	jects,	Reas	oning
Systems,	Reasoning with defa	ault informati	on, Typical Al Problems	Sherry Way				-		125	-									
Unit-3 – II Arobitootu	re for intelligent agents	nto Agont or	mmunication Negotiation	Paragining Argumentation Agents	Truct Don	itation	Multi	agont	nuctom	Ala	nligat	iono Lo	nguoo	n Mod	lolo Ini	formati	on Dotr	ioval	9 Inforn	Hour
extraction	Natural language r	processina. N	Machine translation	h recognition Robot Hardware Per	cention	itation,	wuu	ayem	systems	s, AI ар	piical	iuns, La	nyuay	le MOU		Umali	JII Keli	ievai,	mom	lation
Unit-4 – II	ference Engine											-							9	Hour
Planning,	Moving, Frames, So	cripts, Goals,	Plans, Inheritance in Tax	onomies, Description logics, Forma	l concept ana	alysis,	Conce	ptual g	graphs,	Hierar	chies	in doma	ain, Kn	owled	ge bas	ed rea	soning,	Agen	ts, Fa	cts of
knowledge	e, Logic and inference	ce, Formal lo	ogic, Propositional lo <mark>gic</mark>																	Hour
Resolution	method first order	Indic secon	d order logic Genetic alg	orithms Travelling salesman problem	m Neural net	works	Anto	olony	ontimiza	ation (Gener	ate and	searc	h Den	th firet	search	– Brea	dth F	irst Sc	arch
Quality of	Solution, Depth bou	Inded DFS. H	Hill climbing, Beam search			WUINS	, Ant C		punizo			ne anu	300101	, Бер	ur mət	350101	- 0160		131 00	ui ui ,
	, ,	-)	U/ 111																	

	1.	S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approachll, Prentice Hall, Third	5.	William F. Clocksin and Christopher S. Mellish, Programming in Prolog: Using the ISO
		Edition, 2009.		Standard ^{II} , Fifth Edition, Springer, 2003.
Loarning	2.	Bratko, – Prolog: Programming for Artificial Intelligencell, Fourth edition, Addison- Wesley	6.	Gerhard Weiss, – Multi Agent SystemsII, Second Edition, MIT Press, 2013.
Posourcos		Educational Publishers Inc., 2011	7.	David L. Poole and Alan K. Mackworth, —Artificial Intelligence: Foundations of
Resources	3.	M. Tim Jones, — Artificial Intelligence: A Systems Approach (Computer Science) II, Jones and		Computational AgentsII, Cambridge University Press, 2010.
		Bartlett Publishers, Inc.; First Edition, 2008	8.	"A First Course in Artificial Intelligence", Deepak Khemani, McGraw Hill Education, 2013.
	4.	Nils J. Nilsson, — The Quest for Artificial Intelligencell, Cambridge University Press, 2009.		

-			Continuous Learning	g Assessment (CLA)	1	Sum	motivo				
	Bloom's Level of Th <mark>inking</mark>	Forn CLA-1 Avera (50	native ge of unit test 1%)	Life-Long CL (1)	g Learning "A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%		20%		20%	-				
Level 2	Understand	20%		20%		20%	-				
Level 3	Apply	30%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	30%		30%	-				
Level 4	Analyze	30%	0.000	30%		30%	-				
Level 5	Evaluate		And the second second			-	-				
Level 6	Create					-	-				
	Total	10	0%	10	0%	10	0 %				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Marriappan Vaithilingam, Senior Director of Engineering, Fresh works	1. Dr. Udendran, Dept. of CSE., Bharathidasan University, Tiruchirappalli	1. Dr. A. Alice Nithya, SRMIST
		2 Mr. Joseph James SRMIST



Course Code	Code 21AIO352T Course Name MACHINE LEARNING							C Ca	ours itego	e ry	0				OPEN	ELEC	TIVE				L T 2 1	P 0	C 3
Pre-requis Courses	site s	Nil		Co- requisite Courses		Nil			Pro	gres ours	sive es						Nil	1					
Course C	Offering Departme	ent	Com	outation <mark>al Intelligen</mark>	ce	Data Book / Cod	es / Stand	dards								Nil							
Course Lea	arning Rationale	(CLR):	The purpo	se <mark>of learnin</mark> g this	cours	e is to:			-				Progr	am Ou	utcome	s (PO)				Р	rogra	m
CI R-1:	Explore the funda	, , amentals (of machine l	earning along with i	ts math	ematical concepts			1	2	3	4	5	6	7	8	9	10	11	12	S	pecifi	ic
CLR-2:	Provide deeper u outputs	understan	ding of varia	ous tools and tech	niques	for Machine learning Alg	orithms a	nd	e		of ,	s of		iety		•	÷	10			οι	tcom	es
CLR-3:	Apply linear learn	ning mode	ls to perform	classification in m	achine	learning	100		/ledc		ent o	tions	e	soci			Wo		ance	5			
CLR-4:	CLR-4: Understand the various Clustering Methods							Know	lysis	opme	stiga	Usaç	r and	8		Team	ion	& Fin	arninç				
CLR-5: Learn and Understand the Tree based machine Learning Algorithms								eering	em Ana	n/deve	Lict inve	n Tool	nginee	nment		lual & ⁻	nnicat	t Mgt.	ong Le:	_	0	~	
Course Outcomes (CO): At the end of this course, learners will be able to:								Engine	Proble	Design	Condu	Moder	The e	Enviro Sustai	Ethics	Individ	Comr	Projec	Life Lo	PSO-`	PSO-2	PSO-3	
CO-1:	Understand the c	oncepts <mark>c</mark>	<mark>f mach</mark> ine le	arning	-	1.	1994	100	3	-	-			-	-	-	-	-	-	-	-	-	-
CO-2:	Learn and unders	stand to <mark>ol</mark>	<mark>s and li</mark> brarie	es of ma <mark>ch</mark> ine learn	ing	- CC	Mad	1	3	3	3	-	3	-	-	-	Ξ-	-	-	-	-	-	-
CO-3:	Implement machi	ine learn <mark>ir</mark>	<mark>g mod</mark> els us	sing supe <mark>rv</mark> ised lea	rning al	gorithms	112		3	3	-	-	3	-	-	-	-	-	-	-	-	-	-
CO-4:	Implement machi	ine learn <mark>ir</mark>	<mark>g mod</mark> els us	ing unsupervised l	earning	algorithms	1	-	3	3		10.2	3	-	-	-	-	-	-	-	-	-	-
CO-5:	Implement the tre	e-based i	<mark>nachine</mark> lea	rning techniques ar	nd to ap	preciate their capability	1		3	3	-	3	3		-		-	-	-	-	-	-	-
Unit-1 - Ma	chine Learning			100									-		-	-	-					9	Hour
Introduction	n - Types of Machi	ine Learni	n <mark>g, Superv</mark> is	ed Learning, Unsu	pervise	d Learning, Reinforceme	nt le <mark>a</mark> rning	g, The	Curs	e of c	dimen	sionalit	, Ove	r fitting	and ur	nder fi	tting, L	inear l	Regres	sion, B	lias ar	nd Var	riance
tradeoff, Te	sting – cross valid	ation, Re <u>(</u> Is	ularization,	Learning Curve, Cl	assifica	tion - Error and noise, Pa	rametric v	s. non	-para	metri	с тоа	els	-7				-					Q	Hour
Platform for	r machine learning	n, Machine	e learning p	thon libraries, train	ning dat	a – testing data – valida	tion data,	k-fold	cross	valic	lation	Featur	es, Pe	rforma	nce me	trics, I	MSE, á	accura	cy, con	fusion	matrix	, prec	cision,
recall, F- sc	core, Linear Regre	ssion with	multiple var	<mark>iables</mark> , Logistic Reg	gressio	1	TO DE		-	_	_												
Unit-3 – Cla	assification	likeliheed	a atima tian (ainalaa	manant analysis, Dayso	ion closeif	For Cu	nnort			hine C	unnort	un ata	r maaabii		11.000	10 Mul	4: 01000	alaaaii	Geotio	9	Hour
neighbour d	assification, K ne	arest neig	hbour classi	fication	сіраї со	mponent analysis, bayes	ian ciassii	ier, Su	pport	vecio	or mac	mme, S	upport	vector	machii	ne and	i kerne	is, iviui	u ciass	ciassii	icalioi	<i>I, K II</i> E	aresi
Unit-4 – Cl	ustering	J																				9	Hour
Measuring	(dis)similarity, Eva s. Bi clustoring, M	luating ou	tput of clust	ering methods, Spe Moons clustering	ectral cl	ustering, Hierarchical clu	stering, Ag	gglome	erativ	e clus	stering	, Divisi	ve clus	stering,	Choos	ing th	e numi	ber of o	clusters	s - Clus	stering	ı datar	ooints
Unit-5 - De	cision Trees		iusterniy, N-	ineans clustering, i	-medu																	9	Hour
Decision tree representation, Basic decision tree learning algorithm, Inductive bias in decision tree, Decision Multivariate adaptive regression trees (MART).								e cons	tructi	on, Is	sues	in decis	sion tre	e, Cla	ssificati	on an	d regre	ession	trees (CART)	, Ranc	lom Fr	orest,

Learning Resources	 Kevin P. Murphy, —Machine learning: A Probabilistic Perspectivell, MIT Press, 2012. Ethem Alpaydin, —Introduction to Machine Learningl, Prentice Hall of India, 2005 Tom Mitchell, "Machine Learning", McGraw-Hill, 1997. Sebastian Raschka, Vahid Mirjilili, NPython Machine Learning and deep learningl, 2nd edition, kindle book, 2018 	5. 6.	Carol Quadros, IlMachine Learning wit Publishing, 2018. Gavin Hackeling, Il Machine Learning with
			The second se

5.	Carol Quadros,	Machine	Learning	with	python,	scikit-learn	and	Tensorflowll,	Packet
	Publishing, 2018.								

n scikit-learn∥, Packet publishing, OʻReily, 2018.

arning Assessme	ent			A Contractor							
			Continuous Learning	Assessment (CLA)		Sum	motivo				
	Bloom's Level of Thin <mark>king</mark>	Forn CLA-1 Avera (50	native ge of unit test 1%)	Life-Lon Cl (1	g Learning LA-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%	0.021	20%		20%	-				
Level 2	Understand	20%	And the Second Second	20%		20%	-				
Level 3	Apply	30%		30%		30%	-				
Level 4	Analyze	30%		30%		30%	-				
Level 5	Evaluate	- 14		10000		-	-				
Level 6	Create	-		- 19 F		-	-				
	Total	10	0%	1(0 %	10	00 %				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Marriappan Vaithilingam, Senior Director of Engineering	1. Dr. Udendran, Dept. of CSE., Bharathidasan University, Tiruchirappalli	1. Mr. C. Arun, SRMI <mark>ST</mark>
Fresh works		
		2. Mr. Joseph James, SRMIST



Pre-requisite Courses Nil Co-requisite Courses Nil Progressive Course Nil Course Offering Department Computational Intelligence Data Book / Codes / Standards Nil Nil Course Offering Department Computational Intelligence Data Book / Codes / Standards Nil Nil Course Offering Repartment Computational Intelligence Data Book / Codes / Standards Nil Nil Clark 1: Introduce a range of topics and concepts related to data and data analysis process. 1 2 3 4 5 6 7 8 9 10 11 12 0 9	Course Code	21AIO353T	Course Name	PYTHON FO	C Ca	ourse	y	0				OPEN	ELEC	TIVE				- T 2 1	P 0	C 3	
Course Offering Department Computational Intelligence Data Book / Codes / Standards NI Course Learning Rationale (CLR): The purpose of learning this course is to: Program Program Program Specific outcomes CLR-1: Introduce a range of topics and concepts related to data and data analysis process. Interview of the purpose of learning this course is to: Program Specific outcomes CLR-2: Understand the basic data structures involved in python to perform exploratory data analysis Interview of the purpose of learning techniques to solve real world problems Interview of the purpose of learning techniques to solve real world problems Interview of the purpose of learning techniques to solve real world problems Interview of the purpose of learning techniques to solve real world problems Interview of the purpose of learning techniques to solve real world problems Course Outcomes (CO): At the end of this course, learners will be able to: Interview of the purpose of data and stats working in python and perform exploratory data analysis 3 3 2 -	Pre-requi Course	site s	Nil	Co- requisite Courses	Nil	-	Prog	gress ourse	sive es				_		Nil	1					
Course Learning Rationale (LLR): The purpose of learning this course is to: Program Outcomes (PO) Program Specific outcomes Program Specific outcomes CLR-1: Introduce a range of topics and concepts related to data and data analysis process. 1 2 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 2 3 4 5 6 7 8 9 10 11 2 3 4 5 6 7 8 9 10 11 2 3 4 5 6 7 8 9 10 11 2 3 4 5 6 7 8 9 10 11 2 3 4 5 6 7 8 9 10 11 12 3 3 2 - - - - - - - - - - -	Course	Offering Departme	ent	Computational Intelligence	Data Book / Codes / S	tandards								Nil							
Course Learning Rationale (CLR): The purpose of learning this course is to: Program Outcomes (PO) Program Outcomes (PO) CLR-1: Introduce a range of topics and concepts related to data and data analysis process. 1 2 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 2 1 1 1 1 10					1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		-		1.00												
CLR-1: Introduce a range of topics and concepts related to data and data analysis process. 1 2 3 4 5 6 7 8 9 10 11 12 outcomes CLR-1: Understand the basic data structures involved in python to perform exploratory data analysis analysis analysis bit outcomes bit outcom	Course Le	arning Rationale ((CLR): 7	The purpo <mark>se of learnin</mark> g this co	urse is to:						Progra	am Oı	utcome	s (PO)	1	1		- 5	rogra	m ic
CLR-2: Understand the basic data structures involved in python to perform exploratory data analysis B <t< td=""><td>CLR-1:</td><td>Introduce a range</td><td>of topics a</td><td>nd con<mark>cepts related</mark> to data and c</td><td>lata analysis process.</td><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>ou</td><td>itcom</td><td>es</td></t<>	CLR-1:	Introduce a range	of topics a	nd con <mark>cepts related</mark> to data and c	lata analysis process.		1	2	3	4	5	6	7	8	9	10	11	12	ou	itcom	es
CLR-3: Apply EDA for different file formats.	CLR-2:	Understand the b	asic data st	ruct <mark>ures involve</mark> d in python to per	form exploratory data analysis		je		of	s of	1	iety			rk		a)				
CLR4: Understands data visualization using python Visualization	CLR-3:	Apply EDA for diff	ferent file fo	rm <mark>ats.</mark>	- 11 H H H H H	100	vledç		ento	tions	ge	soc			oW r		ance	D		1	
CLR-5: Provides an exposure to basic machine learning techniques to solve real world problems Different solution Different solution <thdifferent solution<="" th=""> <thdifferent solution<="" th=""></thdifferent></thdifferent>	CLR-4:	CLR-4: Understands data visualization using python						lysis	opm	stiga	Usa	r and	8		Tear	UO	& Fin	arnin			
Course Outcomes (CO): At the end of this course, learners will be able to: Image: Course Outcomes Image: Course Outcomes <thimage: cour<="" td=""><td>CLR-5:</td><td>Provides an expo</td><td>sure to b<mark>as</mark></td><td><mark>ic machi</mark>ne learning techniques to</td><td>solve real world problems</td><td></td><td>eering</td><td>em Ana</td><td>ns devel</td><td>ict inve ex prot</td><td>n Tool</td><td>ginee</td><td>nment</td><td></td><td>ual & ⁻</td><td>unicati</td><td>t Mgt.</td><td>ong Lea</td><td></td><td></td><td>~</td></thimage:>	CLR-5:	Provides an expo	sure to b <mark>as</mark>	<mark>ic machi</mark> ne learning techniques to	solve real world problems		eering	em Ana	ns devel	ict inve ex prot	n Tool	ginee	nment		ual & ⁻	unicati	t Mgt.	ong Lea			~
C0-1: Understand different types of data and starts working in python environment 3 3 2 - <td< td=""><td>Course Ou</td><td colspan="7">Course Outcomes (CO): At the end of this course, learners will be able to:</td><td>Design solutio</td><td>Condu</td><td>Moder</td><td>The er</td><td>Enviro Sustai</td><td>Ethics</td><td><mark>Individ</mark></td><td>Comm</td><td>Projec</td><td>Life Lo</td><td>PSO-1</td><td>PSO-2</td><td>PSO-3</td></td<>	Course Ou	Course Outcomes (CO): At the end of this course, learners will be able to:							Design solutio	Condu	Moder	The er	Enviro Sustai	Ethics	<mark>Individ</mark>	Comm	Projec	Life Lo	PSO-1	PSO-2	PSO-3
CO-2: Understand various data structures involved in python and perform exploratory data analysis 3 3 2 - 2 -	CO-1:	Understand differ	ent typ <mark>es o</mark>	^f data and starts working in pytho	n environment	191-1	3	3	2	-	5-1	1	-	-	-	-	-	-	-	-	-
CO-3: Apply the concepts of EDA in various datasets. - 3 -	CO-2:	Understand vario	us data <mark>stru</mark>	<mark>cture</mark> s involved in python and pe	form exploratory data analysis		3	3	2	-	-	2	_	-		-	-	-	-	-	-
CO-4: Formulate and use appropriate visualization techniques for their data 2 3 2 - 2 - <td>CO-3:</td> <td>Apply the concept</td> <td>ts of ED<mark>A ir</mark></td> <td><mark>i vari</mark>ous datasets.</td> <td></td> <td></td> <td>2.4</td> <td>3</td> <td></td> <td>-</td> <td></td> <td></td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td>	CO-3:	Apply the concept	ts of ED <mark>A ir</mark>	<mark>i vari</mark> ous datasets.			2.4	3		-			-	-	-	-	-	-	-	-	-
CO-5: Formulate and use appropriate models of data analysis to solve hidden solutions to business-related challenges 3 2 - <t< td=""><td>CO-4:</td><td>Formulate and us</td><td>e appro<mark>pria</mark></td><td>te visualization techniques for the</td><td>eir data</td><td>100</td><td>2</td><td>3</td><td>2</td><td>-</td><td>-</td><td>2</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>- </td><td>-</td><td>-</td></t<>	CO-4:	Formulate and us	e appro <mark>pria</mark>	te visualization techniques for the	eir data	100	2	3	2	-	-	2	-	-	-	-	-	-	-	-	-
Unit-1 - Introduction to Python 9 Hour Python Data Structures and Functions, Basic Python Programs, Introduction to Data Analysis, Understanding the nature of Data, Types of Data, Data – Information; Information - Knowledge, Types of Data, Application using Python Data structures and libraries, Quantitative Data Analysis, Qualitative Data Analysis, Scipy: Numpy, Pandas, Matplotlib, Applications using Python libraries 9 Hour Vanip 2 - Numpy Library 9 Hour Numpy Installation, Ndarray, Create an array and Types of data, Basic Operations: Arithmetic Operators, Matrix Product, Increment and Decrement Operators, Operations on Numpy array, Application using Numpy and its functions, Shape and array manipulation, Vectorization, structured arrays, Pandas library: Installation, Introduction to Pandas data structures, Application using Python Panda library, Function application and mapping, Sorting and ranking, Correlation and covariance, Hierarchical Indexing and leveling, Applications using Panda library functions 9 Hour Reading data from csv, xml, text and html files, Writing data in CSV, Html, Excel, files, Json data, Data preparation - Concatenating, Application using Panda, Ibrary, Data Aggregation- Group by, Hierarchical grouping, Advanced data aggregation, Application illustrating data aggregation function using Panda 9 Hour Matri 4 - Data Visualization with Matplotlib Library 9 Hour Matplotlib – Installation and architecture, Pyplot, plotting window, Using Kwargs and adding elements to the chart, Application using different ploting techniques, Line charts, Bar charts- Pie charts, Application using Panda Matplotlib – Installation and architecture, Pyplot, plottin	CO-5:	Formulate and us challenges	se appr <mark>opri</mark>	ate models of data analysis to s	olve hidden solutions to business	-related		1	U.S	3	2	1	-	-	-	-	-	-	-	-	-
Python Data Structures and Functions, Basic Python Programs, Introduction to Data Analysis, Understanding the nature of Data, Types of Data, Data – Information; Information - Knowledge, Types of Data, Application using Python Data structures and libraries. Unit-2 - Numpy Library Numpy Installation, Ndarray, Create an array and Types of data, Basic Operations: Arithmetic Operators, Matrix Product, Increment and Decrement Operators, Operations on Numpy array, Application using Numpy and its functions, Shape and array manipulation, Vectorization, structured arrays, Pandas library: Installation, Introduction to Pandas data structures, Application using Python Panda library, Function application and mapping, Sorting and ranking, Correlation and covariance, Hierarchical Indexing and leveling, Applications using Panda library functions 9 Hour Reading data from csv, xml, text and html files, Writing data in CSV, Html, Excel, files, Json data, Data preparation - Concatenating, Application using Panda library, Data Aggregation- Group by, Hierarchical grouping, Advanced data aggregation, Application illustrating data aggregation function using Panda 9 Hour Matplotlib Library 9 Hour	Unit-1 - Int	troduction to Pyth	on	100		2				_	-		-		-					9	Hour
using Python Data structures and libraries, Quantitative Data Analysis, Qualitative Data Analysis, Scipy: Numpy, Pandas, Matplotlib, Applications using Python libraries Unit-2 - Numpy Library Numpy Installation, Ndarray, Create an array and Types of data, Basic Operations: Arithmetic Operators, Matrix Product, Increment and Decrement Operators, Operations on Numpy array, Application using Numpy and its functions, Shape and array manipulation, Vectorization, structured arrays, Pandas library: Installation, Introduction to Pandas data structures, Application using Python Panda library, Function application and mapping, Sorting and ranking, Correlation and covariance, Hierarchical Indexing and leveling, Applications using Panda library functions Unit-3 - Pandas Pan	Python Dat	a Structures and Fi	unctions, Ba	n <mark>sic Pytho</mark> n Programs, Introduction	n to Data Analysis, Understanding t	he nature	of Data	a, Typ	pes of	Data, D	ata – I	nform	ation; Ir	n <mark>forma</mark>	tion - k	Knowle	dge, Ty	/pes of	Data,	Applic	cation
Wint-2 - Numpy Library 9 Hour Numpy Installation, Ndarray, Create an array and Types of data, Basic Operations: Arithmetic Operators, Matrix Product, Increment and Decrement Operators, Operations on Numpy array, Application using Numpy and its functions, Shape and array manipulation, Vectorization, structured arrays, Pandas library: Installation, Introduction to Pandas data structures, Application using Python Panda library, Function application and mapping, Sorting and ranking, Correlation and covariance, Hierarchical Indexing and Ieveling, Applications using Panda library functions 9 Hour Unit-3 - Pandas 9 Hour Reading data from csv, xml, text and html files, Writing data in CSV, Html, Excel, files, Json data, Data preparation - Concatenating, Applications illustration of loading external data using Panda, Data transformation-Removing duplicates, Mapping Discretization and binning: Detecting and filtering outliers, Permutation – random sampling - String manipulation, Application using Panda library, Data Aggregation- Group by, Hierarchical grouping, Advanced data aggregation, Application gata aggregation function using Panda Unit-4 - Data Visualization with Matplotlib Library 9 Hour Watplotlib – Installation and architecture, Pyplot, plotting window, Using Kwargs and adding elements to the chart, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different plotting up using different ploting techniques, Line charts, Bar charts- Pie charts, Application	using Pythe	on Data structures a	and librarie	s <mark>, Quantita</mark> tive Data Analysis, Qu	alitative Data Analysis, Scipy: Num	ipy, Panda	is, Mat	plotli	ib, App	olication	s usin	g Pyth	ion libra	aries							
Numpy installation, Ndarray, Create an array and Types of data, Basic Operations: Antimieric Operators, Matrix Product, increment and Decrement Operators, Operators on Numpy array, Application using Numpy and its functions, Shape and array manipulation, Vectorization, structured arrays, Pandas library: Installation, Introduction to Pandas data structures, Application using Python Panda library, Function application and mapping, Sorting and ranking, Correlation and covariance, Hierarchical Indexing and leveling, Applications using Panda library functions Unit-3 - Pandas Reading data from csv, xml, text and html files, Writing data in CSV, Html, Excel, files, Json data, Data preparation - Concatenating, Applications illustration of loading external data using Panda, Data transformation- Removing duplicates, Mapping Discretization and binning: Detecting and filtering outliers, Permutation – random sampling - String manipulation, Application using Panda library, Data Aggregation- Group by, Hierarchical grouping, Advanced data aggregation, Application alustrating data aggregation function using Panda Unit-4 - Data Visualization with Matplotlib Library Matplotlib – Installation and architecture, Pyplot, plotting window, Using Kwargs and adding elements to the chart, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using With and architecture, Puplot, plotting window, Using Kwargs and adding elements to the chart, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using Water of the structure operatory of the structure	Unit-2 - Nu	Impy Library	Create an a	may and Times of data Dasis On	anational Arithmatic Operators Mat	trive Dreadered	t In our		at and	Deeren	ant O			ration	0 0 0 M			Innling	tion	<u>9</u>	Hour
Marketons, Shape and and ynamplataton, vectorization, structure analys, Fandas inder, Installation, introduction of Fandas data structures, Application using Fython Fandas inder ynamplataton, and inprint and inder yn fanda inder yn fanda inder yn fandation and inder yn fandation application and inder yn fandation application and inder yn fandation application and binner, Fandas inder yn fandas Removing dufficates, Advanced data aggregation, Application aggregation function using Panda Unit-4 - Data Visualization with Matplotlib Library 9 Hour 9 Hou	and its fund	tallallon, Nuarray, C	Jieale all al prev manin	ulation Vectorization structured	erations. Antiminetic Operators, Mat arrays. Pandas library: Installation	Introductiv	n to P	anda	n anu as dat	Decreri		perato	ation us	ing Pv	S 011 N thon P	unipy a anda li	allay, F brany l	Applica Eunctic	แบบ นร งก อกก	ing N licatio	unipy n and
Property of the process of the constant of the constant of the process of the process of the property of the process of the proces of the proces of the process of the process of the proces of the	manning S	Sorting and ranking	Correlation	and covariance Hierarchical Inc	dexing and leveling Applications us	ina Panda	library	fund	ctions	3 30 000	1103, F	ppilo	111011 43	ing i y	unonn	anua n	biaiy, i	unciic	ii appi	icatio	in anu
Reading data from csv, xml, text and html files, Writing data in CSV, Html, Excel, files, Json data, Data preparation - Concatenating, Applications illustration of loading external data using Panda, Data transformation- Removing duplicates, Mapping Discretization and binning: Detecting and filtering outliers, Permutation – random sampling - String manipulation, Application using Panda library, Data Aggregation- Group by, Hierarchical grouping, Advanced data aggregation, Application illustrating data aggregation function using Panda Unit-4 - Data Visualization with Matplotlib Library 9 Hour Matplotlib – Installation and architecture, Pyplot, plotting window, Using Kwargs and adding elements to the chart, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different alchiting techniques, Line charts, Bar charts- Pie charts, Application using different alchiting techniques, Line charts, Bar charts- Pie charts, Application using	Unit-3 - Pa	nit-3 - Pandas 9 Hour																			
Removing duplicates, Mapping Discretization and binning: Detecting and filtering outliers, Permutation – random sampling - String manipulation, Application using Panda library, Data Aggregation- Group by, Hierarchical grouping, Advanced data aggregation, Application illustrating data aggregation function using Panda Unit-4 - Data Visualization with Matplotlib Library Matplotlib – Installation and architecture, Pyplot, plotting window, Using Kwargs and adding elements to the chart, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different eleting techniques, Line charts, Bar charts- Pie charts, Application using different eleting techniques, Line charts, Bar charts- Pie charts, Application using	Reading da	ata from csv, xml, te	ext and html	files, Writing data in CSV, Html, I	Excel, files, Json data, Data prepara	ation - Cor	ncatena	ating	, Appl	ications	illustra	ation c	of loadir	ng exte	ernal da	ata usir	ng Pan	da, Dai	ta tran	sform	ation-
Hierarchical grouping, Advanced data aggregation, Application illustrating data aggregation function using Panda Unit-4 - Data Visualization with Matplotlib Library Matplotlib – Installation and architecture, Pyplot, plotting window, Using Kwargs and adding elements to the chart, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different eletting techniques, Line charts, Bar charts- Pie charts, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different eletting techniques, Line charts, Bar charts- Pie charts, Application using different eletting techniques, Line charts, Bar charts- Pie charts, Application using different eletting techniques, Line charts, Bar charts- Pie charts, Application using different eletting techniques, Line charts, Bar charts- Pie charts, Application using different eletting techniques, Line charts, Bar charts- Pie charts, Application using different eletting techniques, Line charts, Bar charts- Pie charts, Application using different eletting techniques, Line charts, Bar charts- Pie charts, Application using different eletting techniques, Line charts, Bar charts- Pie charts, Application using different eletting techniques, Line charts, Bar charts- Pie charts, Application using different eletting techniques, Line charts, Bar charts- Pie charts, Application using different eletting techniques, Line charts, Bar charts- Pie charts, Application using different eletting techniques, Line charts, Bar charts- Pie	Removing	duplicates, Mappin	ng Discretiz	ation and binning: Detecting and	l filtering outliers, Permutation – r	random sa	mpling	- Š	tring r	nanipul	ation, .	Applic	ation u	sing F	Panda	library,	Data	Aggreg	jation-	Grou	ıp by,
9 Hour Matplotlib – Installation and architecture, Pyplot, plotting window, Using Kwargs and adding elements to the chart, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using	Hierarchica	al grouping, Advanc	ed data ag	gregation, Application illustrating	data aggregation function using Pa	nda															
Matpion – Installation and architecture, Pyplot, plotting window, Using Kwargs and adding elements to the chart, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different plotting techniques, Line charts, Bar charts- Pie charts, Application using different plotting techniques, Line charts- Pie charts, Application using different plotting techniques, Line charts- Pie charts- Pie charts, Application using different plotting techniques, Line charts- Pie	Unit-4 - Da	ta Visualization w	vith Matplo	tlib Library								, .	,.			, ,	<i></i>		A	<u> </u>	Hour
DIVERENT DIOUTIO FECTIVIOUES, FISIODIAUS - FOTAL CUAUS, MOTOL SU TOOLKIE SU SULACES, NCAUELDIOIS AND DAL CUAUS IN SUL MUUL-DADELDIOL, ADDITICAUOD LISTID DIVERDIT DIOTINIA TOCOMIANOS	Matpiotlib - different pli	imatplotub – Installation and architecture, Pyplot, plotting window, Using Kwargs and adding elements to the chart, i different plotting techniques. Histograms - Polar charts. Molot 3D toolkit: 3D surfaces. Scatter plots and bar charts.							g aiffe	Annlic	ation .	ecnniq Isina d	ues, LII Hifferen	ne cha t nIotti	πs, Ba na tech	n chart Chart	s- Pie (cnarts,	Αρρίις	ation	using

Unit-5 - Machi	ine Learning with Sci-kit Learn	9 Hour
Sci-kit learn lib	prary, Machine Learning - Supervised learning with sci-kit learn, Application of Supervised lea	rning, Linear Regression, Logistic Regression, Application using regression techniques, Support Vector
Machines, Sup	pport Vector Classification, Support Vector Regression, Application using Support Vector mach	ine
	1. Fabio Nelli, Python Data Analytics with Pandas, Numpy and matplotlib (Second	3. Jake vaderplas, Python Data Science Handbook: Essential tools for Working with Data, O'Reily
Learning	edition), Apress	Media, 2016
Resources	2. Wes McKinney, Python for Data Analysis, 2nd Edition, O'Reilly Media, Inc.	4. Charles R. Severance, "Python for Everybody Exploring Data Using Python", Charles Severance,

2016.

(https://learning.oreilly.com/library/view/python-for-data/9781491957653/)

1

			Continuous Learning	Assessment (CLA)		Summative Final Examination (40% weightage)					
	Bloom' <mark>s</mark> Level of <mark>Thinking</mark>	Form CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (1)	g Learning A-2 0%)						
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%		20%		20%	-				
Level 2	Understand	20%	21.00	20%		20%	-				
Level 3	Apply	30%	0.000	30%		30%	-				
Level 4	Analyze	30%	the second second	30%		30%	-				
Level 5	Evaluate	Contraction of the second			· · · · · ·	-	-				
Level 6	Create		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	N			-				
	Total	10	0%	10	0%	10	0 %				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Senthilnathan, Co-founder, Tenzai, Bangalore	1. Dr. E. Sivasankar, Assistant Professor, Department of CSE, NIT, Trichy	1. Mr.C.Arun, SRMIST
		2. Mr. Joseph Jam <mark>es, SRMI</mark> ST



Course Code	se 21AIO354T Course SOFT COMPUTING							Cou Cate	rse J <mark>ory</mark>	0				OPEN	ELEC	TIVE				L T 2 1	P 0	C 3	
Pre-requi Course	site s	Nil		Co- requ Cour <mark>se</mark>	uisite s		Nil		F	rogre Cours	ssive ses						Ni	1					
Course (Offering Departme	ent	Comp	utation <mark>al Intel</mark>	ligence	Da	ata Book / C	odes / Standa	ards							Nil							
						100				1.1	1												
Course Le	arning Rationale (CLR): T	he purpos	se of learning	y this cour	rse is to:			Program Outcomes (PO)											P	rogra	m	
CLR-1:	Understand the id	leas of fuzzy	y sets, fuzz	<mark>zy logic a</mark> nd u	se of heuris	stics based	on human ex	<i>«perience</i>	1	2	3	4	5	6	7	8	9	10	11	12	01 01	itcom	ic ies
CLR-2:	Gain knowledge o	on neural ne	etwor <mark>ks wit</mark> t	<mark>h exa</mark> mples									1		>								
CLR-3:	CLR-3: Gain knowledge on the mathematical background for carrying out the optimization associated w neural network learning						issociated wit	h B		of	is of	2	ciety	inabilit	T,	ark		e					
CLR-4: Gain knowledge on genetic algorithms and other random search procedures useful while seeking glob						seeking globa	al powled	/sis	pment	tigation	Jsage	and so	k Susta		eam W	L.	Finano	ning					
CLR-5:	Introduce case st soft computing	udies utilizir	ng the abo	ve and illustr	ate the inte	illigent beha	avior of progi	rams based o	leering K	em Analy	in/develo	uct inves	m Tool L	ingineer :	onment 8		dual & Te	nunicatio	ct Mgt. &	ong Lear	-	2	3
Course Ou	itcomes (CO):	4	At the end	of this cour	se, learner	rs will be al	ble to:	2.16.2	Engin	Probl	Desig	Cond	Mode	The e	Envire	Ethics	Indivi	Comr	Proje	Life L	PSO-	PSO-	PSO-
CO-1:	Analyze a given o	computa <mark>tiona</mark>	<mark>al tas</mark> k to r	ecognize the	appropriate	eness throu	gh fuzzy sets	;	3			-	-		-	-		-	-	-	-	-	-
CO-2:	Design a fuzzy ba	ased so <mark>ft co</mark> i	<mark>mpu</mark> ting sy	stem to addr	ess the con	nputational	task	10	3	-	3	-	2-	-	-	-	-	-	-	-	-	-	-
CO-3:	Analyze a given o	computa <mark>tiona</mark>	<mark>al tas</mark> k to s	olve it throug	h neural ne	etwork	1.1		3	3	2		-	-	-	-	-	-	-	-	-	-	-
CO-4:	Apply Genetic Alg	gorithm <mark>oper</mark>	rations for a	solving a com	putational t	task		A	3	2	2	-	-	2	-	-	-	-	-	-	-	-	-
CO-5:	Design and imple	ment a soft	<mark>compu</mark> ting	system to ac	hieve a cor	mputational	l solution	1722	3	2	2	3	-		2	-	-	-	-	2	-	-	-
Unit-1 - Int	troduction to Soft	Computing	1	-																		9	Hour
Evolution fi	rom Conventional /	AI to Compu Rules Euzzy	utational in v Reasonir	telligence, El	Olutionary	Search Str	ategies Fuzz	y Sets, Fuzzy	Membe	ership i	Functio	ons, O	peratio	ns, Rel	ations,	Fuzzy	(Exter	ision F	rinciple	+ Basic	s of F	uzzy	Logic,
Unit-2 - Fu	zzv Inference Svs	tems	y neasonii	ig, manuani s	s nepresen	itation.	-	and the second division of the second divisio	-				15			-						9	Hour
Fuzzificatio	on, Application of Fi	uzzy Operat	tors on Ant	ecedent part	of Rules, E	Evaluation o	of Fuzzy Rule	s, Defuzzifica	tion, and	Probl	ems as	ssocia	ed to F	uzzy c	ontrolle	er, Cru	ise Co	ntroller	and A	r Conc	litione	r Cont	roller,
Convergen	nvergence of efficiency parameter, Boltzmann's Machine Learning Algorithm, Back Propagation Algorithm.																						
Unit-3 - Ne	eural Networks				200				_	1.1												9	Hour
Neural Net	works in Computer	r Science, E	Biological r	nodel, McCul	loch-Pitts N	Model, The	Perceptron I	Model, Widrow	v-Hoff's	Delta I	Rule,)	KOR F	roblem	, Curse	e of Di	mensic	onality,	Dimer	nsionali	ty Red	luction	, Acti	vation
Functions,	Learning by Neural	Nets.			_																	0	Hour
Natural Eve	olution Chromoson	nes System	atic approx	ach of Elitism	(Selection-	Crossover	- Mutation) F)evelopment c	f Geneti	Alaor	ithm F	itness	Functi	on Por	ulation	GAO	nerato	rs Par	ameter	s Con	veraer	nce P	attern
Classifiers, (Hopfield n	Layered Feed For ets),Back Propagai	ward Neural	Networks, ks, Genera	Solution for X	(OR Proble	e, desever m, Hebb's i	Rule, Compe	titive Learning	Method	s (Koh	onen's	Self (rganiz	ing Maj	os and	Learni	ing Vec	ctor Qu	antizat	ion), Pa	attern	Assoc	iators
Unit-5 - Hybrid	l Sys	tems		9 Hour																			
-----------------	--------	---	----	---																			
Neuro-Fuzzy M	lodell	Free Optimization (GA operators), Gain Scheduling , Case study: Color Recipe Prediction,																					
	1.	Sandhya Bansal & Rajiv Goel "Fundamentals of Soft Computing", 1st Edition, Notion Press	5.	D.E.GoldBerg, "Genetic Algorithms in Search, Optimization, and Machine Learning", Pearson																			
		Publication, 2020		Education, 2013.																			
	2.	Saroj koushik & Sunita Tiwari "Soft Computing, Fundamentals, Techniques and Applications"	6.	S.N.Sivanandam, S.N.Deepa, "Priciples of Soft Computing", 2nd Edition, John-Wiley India,																			
Learning		1st Edition, McGraw Hill Publication, 2018		2011.																			
Resources	З.	Samir Roy and Udit Chakraborthy, "Introduction to Soft Computing: Neuro-Fuzzy and Genetic	7.	G.J.Klir and B.Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", Second Reprint,																			
		Algorithms" Pearson Education, 2013.		PHI, 2000.																			
	4.	J.S.R. Jang, C.T.sun and E. Mizutani, "Neuro-fuzzy and Soft Computing: A computational	8.	J.A.Freeman and D.M.Skapura, "Neural Networks: Algorithms, Applications and																			
		Approach to Learning and Machine Intelligence, Pearson Education, 2004.		Programming Techniques", Pearson Education, 2011																			

earning Assessme	ent								
	Bloom's Level of Thinking	Form CLA-1 Avera (50	Continuous Learning native ge of unit test 0%)	<u>Assessment (CLA)</u> Life-Long CL (10	g Learning .A-2 0%)	Summative Final Examination (40% weightage)			
		Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	20%	the state of the state	20%	10 A.	20%	-		
Level 2	Understand	20%		20%	1	20%	-		
Level 3	Apply	30%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	30%	W	<u>30%</u>	-		
Level 4	Analyze	30%		30%	- Annual	30%	-		
Level 5	Evaluate	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		10 10 10 10 10 10 10 10 10 10 10 10 10 1		-	-		
Level 6	Create						-		
	Total		0%	10	0%	100 %			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Senthilnathan, Co-founder, Tenzai, Bangalore	1. Dr. E. Sivasankar, Assistant Professor, Department of CSE, NIT, Trichy	1. Dr. C.Lakshmi, SRMIST



Course Code	Course 21EIO131J Course VIRTUAL INSTRUMENTATION Name				JMENTATION	Cou Categ	se ory	0				OPEN	ELEC	ΓIVE				- T 2 0	P 2	C 3
Pre-requi Course	site s	Nil	(Courses	Nil	P	rogres Cours	sive ses						Nil						
Course (Offering Departme	ent Elec	ctronics and Instr	umentation Engineerin	g Data Book / Codes / Stand	ards							Nil							
Course Le	arning Rationale	(CLR): 7	The purpo <mark>se of</mark>	learning this course i	s to:		1			Progr	am Ou	utcome	s (PO))				Pr	rograi	n
CLR-1:	Understand vario	us building e	elements of virtu	al instrumentation.		1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	c es
CLR-2:	Know the basics	of creating V	VI pr <mark>ograms.</mark>		- understand	e		f	s of	20	iety			¥		0				
CLR-3:	Impart knowledge	e on usage o	of a <mark>rrays and</mark> clu	isters.		/ledo		ento	tions	ge	soc		-	Wo		ance	0			
CLR-4:	Introduce various	graphs and	d <mark>structure</mark> s used	d in developing VI progr	ram.	- Non	lysis	obme	stiga	Usa	and	∞ .		eam	и	& Fin	arnin			
CLR-5:	R-5: Understand the concepts of data acquisition by interfacing modules.					ering I	n Ana	devel	t inve	Tool	gineer	ment		al & T	nicati	Mgt. 8	ig Lea			
				have been a second as		jine6	blen	sign/	uduc (algr	dern	enç	viron	S	vidu	nmu	ject	Lon	5	0-2	0-3
Course Outcomes (CO): At the end of this course, learners will be able to:						ЦÜ	Pro	Des	S S	Moc	The	Sus	뛾	Indi	Š	Pro	Life	PS(PS(PS(
CO-1:	Explain the proce	dure fo <mark>r cre</mark>	<mark>eating</mark> virtual inst	rumentation program	ALC: CURNER	2	-		-	I.	-	-	-	-	-	-	-	-	-	-
CO-2:	Select the approp	oriate co <mark>nditi</mark>	<mark>tion lo</mark> ops for the	given application		2		1	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Examine the usa	ge of ar <mark>rays</mark>	s and clusters.	57 5 5 5 7		2		1	-	-	- 30	-	-		-	-	-	-	-	-
CO-4:	Compare the data	a from g <mark>raph</mark>	<mark>hs an</mark> d charts.	1000		2	-	1		-		-	-	-	-	-	-	-	-	-
CO-5:	Use different DA	ຊ for da <mark>ta ac</mark>	cquisition.			2	1	2	-	-	2	-	-	-	-	-	-	-	-	-
Unit-1 - IN	TRODUCTION TO	VIRTUAL II	INSTRUMENTA	TION							-			_					12	Hour
Introduction of graphica program. Practice: 1. Creating 2 Program	n to graphical syste Il programming with Virtual Instrument ming exercises for	em design <mark>(C</mark> h textual pro ation for sim	GSD) model - Vi ogramming - Cre nple applications	rtual instrument and tra eating and saving a VI	aditional instrument - Hardware ar - Front panel toolbar, palettes, co	nd softwa entrols, ai	re in vi nd indi	irtual in cators	strume - Block	ntatior diagra	n - Des m, ter	sign and minals,	d virtua nodes	al instru s, funci	umenta tions, v	ation ac vires, d	lvantag lata typ	ies - C ies ani	compa d data	rison flow
Unit-2 - MC	DULAR PROGRA	AMMING AN	ND LOOPS	1.11	L'ARCHITER OF	177		1.1	1.1	1									12	Hour
Creating ar Practice: 1. Program 2. Program	n Icon - Building a o ming exercises for ming exercises on	connector pa clusters and case and se	ane - Displaying ad graphs equence structu	SUBVIs - Creating SU	BVIs - Editing SUBVIs - Repetitio	n and Lo	ops - S	hift Re	gisters	- Feea	back i	nodes -	Local	and gl	obal va	ariables).			
Unit-3 - AF	RRAYS AND CLUS	STER																	12	Hour
Creating or - Conversic Practice:	Creating one-dimensional array – Deleting - Inserting and replacing into arrays - Array functions - Auto indexing - Creating clusters control and constant - Cluster operations - Assembling and disassembling clusters - Conversion between arrays and clusters Practice:																			

1. Data acquisition through Virtual Instrumentation.
2. Developing voltmeter using DAQ cards.
3. Developing signal generator using DAQ cards.
Unit-4 - PLOTTING DATA AND STRUCTURES 12 Hou
Types of graphs and charts - Customizing graphs and charts - Types of structures sequence, flat sequence, stacked sequence, event, timed, diagram disable - Basic of file I/O format
Practice:
1. Simulating reactor control using Virtual Instrumentation.
2. Real time temperature control using Virtual Instrumentation
3. Real time sequential control of any batch process.
Unit-5 - DATA ACQUISITION 12 Hou
Introduction to analog and digital signals - DAQ hardware - Analog and digital inputs and outputs - DAQ software architecture - DAQ assistant - Selecting and configuring a data acquisition device - Case study.
Practice:
1. Data Acquisition using DAQs.
2. Data Acquisition using NIELVIS
3. Mini project
 Jerome, Jovitha, "Virtual Instrumentation and LABVIEW", PHI Learning, New Delhi, 1st ed., 2010. Lisa K. Wells and Jeffrey Travis, "LABVIEW for Everyone", PHI, 1997.

 Learning Resources
 2. Sanjay Gupta and Joseph John, " Virtual Instrumentation using LabVIEW", Tata Mc Graw – Hill Publishing Company Limited, New Delhi, 1st ed., 2005.
 6. 6. S. Gupta, "PC Interfacing for Data Acquisition and Process Control", ISA, 2nd ed., 1994.

 3. Kevin James, "PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control", Newnes, 2000.
 7. Mark Profile and Some y Hulls, Distribution Control, " Instrumentation and Process Control", ISA, 2nd ed., 1994.

Learning Assessme	ent internet	and the second	All the second second		15 Mar				
			Continuous Learning	g Assessment (CLA)	100 March 100 Ma	Sum	mativa		
	Bloom's Level of Thinking	Forr CLA-1 Avera (4	native ige of unit test 5%)	Life-Long L CLA (15%	Learning -2 %)	Final Examination (40% weightage)			
		Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	20%	- 1.00	-	20%	20%	-		
Level 2	Understand	20%			20%	20%	-		
Level 3	Apply	30%	170-		30%	30%	-		
Level 4	Analyze	30%	MILL STATE	Margaret - Control	30%	30%	-		
Level 5	Evaluate	1.1.1.1.1		1 - 1 - NY AV		-	-		
Level 6	Create			Contraction of the second			-		
Total		10	0%	100	%	100 %			

Co	Course Designers										
Ex	perts from Industry	Ex	perts from Higher Technical Institutions	Int	ernal Experts						
1.	Mr. Manoj Gupta, Mitsubishi Electric India,	1.	Dr.K.Srinivasan, NIT, Trichy, srinikkn@nitt.edu	1.	Dr. C. Likith Kumar, SRMIST						
	Manoj.Gupta@asia.meap.com										
2.	Mr. Gautham, Schneider Electric, gautham.r@se.com	2.	Dr. J. Prakash, MIT, Chennai, prakaiit@rediffmail.com								

Course Code	Course Code 21EIO132T Course Name		AN	ALYTICAL INS	TRUMENT	ATION	(Cours Catego	se ory	0				OPEN	ELEC	TIVE			l	- T 3 0	P 0	C 3	
Pre-requis	site s	Nil		Co- re Cours	quisite se <mark>s</mark>		Nil		Pr	ogres Cours	sive es						Nil						
Course C	Offering Departme	ent Ele	ectronics ar	nd Instru <mark>men</mark>	tation Engineeri	ing Data	a Book / Codes /	/ Standard	S							Nil							
Course Lea	arning Rationale (CLR):	The purpo	o <mark>se of learni</mark>	ng this course	is to:	<u></u>		6	1			Progr	am Oı	utcome	s (PO)	-			P	rogra	m
CLR-1:	Understand the pl	rinciple an	d theory of	<mark>f analytica</mark> l in	struments.	100			1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	es
CLR-2:	Know the quantita	ative analy	rsis o <mark>f disso</mark>	olved compor	nents.	1			je		of	s of	10	lety			논		ⁿ				
CLR-3:	Provide the conce	ept of sepa	arati <mark>on scie</mark>	ence and its a	pplications.		1000	2016	vledç		ent c	tions	ge	soc			Wo		ance	D			
CLR-4:	Impart the knowle	dge on va	rio <mark>us</mark> spec	troscopic tec	hniques and its	instrument	tation			lysis	mdo	stiga	Usa	and	∞.		earr	ы	Z Fin	arning			
CLR-5:	Identify the engine	eering pro	blems asso	ociated with F	Radiation Techn	iques.	1.200		ing l	Ana	evel	inve	8	neer	bility		8	icati	1gt. 8) Lea			
						1000	1.19	1	neer	lem	gn/d	duct	ern	engi	ronn	s	vidua	mur	ect N	Lonç	-1	-2	ကို
Course Ou	tcomes (CO):		At the en	d of this cou	ırse, learners v	will be able	e to:	10. SY	Engi	Prob	Desi	Con	Mod	The	Envi	Ethio	Indiv	Corr	Proj	Life	PSC	PSC	PSC
CO-1:	D-1: Summarize the principles and theory of instrumental analysis					t.	3	1	-	-	5	1	-	-	-	-	-	-	-	-	-		
CO-2:	Apply the principle	es of va <mark>rio</mark>	ous chemica	al analysi <mark>s i</mark> n	struments in ind	lustries			3	2	-	-		-	-	-		-	-	-	-	-	-
CO-3:	Analyze and unde	erstand <mark>the</mark>	e operation	n of variou <mark>s</mark> ra	dio chemical m	ethods of a	analysis		3	-		-	_	-	-	-		-	-	-	-	-	-
CO-4:	Illustrate the oper	ation of ins	struments l	based on opt	ical properties	5.570		010	3	1	ίđ.		-		-	-	-	-	-	-	-	-	-
CO-5:	Outline the engine	eering p <mark>rol</mark>	blems asso	ociated with F	Radiation Techn	iques	2.000		3		11	-	-		-	-	-	-	-	-	-	-	-
Г				1	1.11	100															I		
Unit-1 - Int	roduction to Cher	nical Inst	rumental A	Analysis		romont D	oforonoo olootrou	dag and ga	ondor		tradad	and tu	noo /	adiaat	ar alaat	radaa	nH m	otoro	Direct	roodin	a tuno	9 n4 m	Hour
Null detecto	or type pH meter - I	on selecti	ve in chem	nical industrie	s - Types of cor	nductivity n	elerence electroc neters - Air polluti	tion monitor	ing ins	y elec trume	nts	and ty	ues - n	luical	or electi	oues	· pri III	elers -	Direct	reaumę	y type	рпш	elei -
Unit-2 - Ga	s Analyser								J -			1										9	Hour
Dissolved o	xygen analyzer - S	ilica analy	zer <mark>- Moist</mark>	t <mark>ure</mark> measure	ment - Oxygen a	analyzer - I	Methods of oxyge	en analyzer	s - Par	amag	netic c	xygen	analyz	ər - Ele	ectro an	alytica	l meth	od – C	0 mon	itor, typ	es of	CO m	onitor
- NO2 anal	yzer, H2S analyzer	- Dust and	d smo <mark>ke m</mark>	neasurement	- Thermal analy	/zer, impor	tance of thermal	analyzers			-		10				-						Haur
Chromaton	ranhy, hasic workir	a of chrou	mətoarənhi	v - Gas chrou	matography - C	hromatoar	anhic column - D	ataction sv	stom	record	ina sv	stom -	Liquid	chrom	atoarar	by - F	liah na	accura	liquid	hromo	toarar	y hy_l	iquid
chromatogr	aphic column work	ing -Types	s of recordi	ling system - I	Detector types,	factors infl	uencing the selec	ction of det	ectors	ecoru	ing sy	310111 -	Liquiu	CIIIOIII	alograp	///y = //	iyii pit	533010	iiquiu (<i></i> 0111a	logiap	///y - L	.iquiu
Unit-4 - Sp	ectrophotometer	0 71																				9	Hour
Spectral me	ethods of analysis -	Electrom	agnetic spe	ectrum – UV	visible spectrop	hotometer	s - Beer's law - D	Derivations of	of beel	's law	- Sing	le bear	n and	double	beam	instrur	nents ·	- IR sp	ectroph	otome	ters - I	IR rad	iation
sources – N	Aonochromators - F Agnetic Resonanci	- IIR speci e Technia	trometers -	- atomic abso	rption spectrop	hotometer																9	Hour
NMR spect	rometers - Mass s	pectromet	ers - Doub	ole focusing s	pectrometers -	Time of flig	<mark>ght analyzers - C</mark>	Quadrupole	mass	analy	zers -	Nuclea	r radia	tion de	etectors	- GM	count	er - Pr	oportio	nal cou	nter -	Solid	state
detectors- S	Scintillation counter																						

Learning Resources	1. 2. 3.	Khandpur. R.S, "Handbook of Analytical Instruments", Tata McGraw Hill publishing Co. Ltd., 2006 Bella. G, Liptak, "Process Measurement and analysis", CRC press LLC. 2003. Francis Rousseau and Annick Rouesac, "Chemical analysis Modern Instrumentation Methods and Techniques", John wiley & sons Ltd.2007.	4. 5.	James W.Robinso Dwayne Heard, Publishing, 2006.	n, "Undergra "Analytical	aduate li Techni
			1			

ŧ.	James W	.Robinsc	on, "Undergra	aduate Instrun	nenta	l Analysis", M	arcel Dekker, 200	5
5.	Dwayne	Heard,	"Analytical	Techniques	for	atmospheric	measurement",	Blackwel
	Publishin	g, 2006.						

			Continuous Learning A	ssessment (CLA)		Sum	motivo		
	Bloom's Level of Thin <mark>king</mark>	Form CLA-1 Avera (50	native ge of unit test %)	Life-Long CL (1)	g Learning "A-2 0%)	Final Examination (40% weightage)			
		Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	20%		20%		20%	-		
Level 2	Understand	20%	the second second	20%		20%	-		
Level 3	Apply	30%		30%		30%	-		
Level 4	Analyze	30%		30%		30%	-		
Level 5	Evaluate		12 C 14 C 10 C	0.010		-	-		
Level 6	Create		10 C	- 19 F		-	-		
	Total 100 %		0%	10	0%	100 %			

Course Designers											
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts									
1. Mr. Manoj Gupta, Mitsubishi Electric India, Manoj.Gupta@asia.meap.com	1. Dr.K.Srinivasan, NIT, Trichy, srinikkn@nitt.edu	1. Dr. Vibha.K, SRMIST									
2. Mr. Gautham, Schneider Electric, gautham.r@se.com	2. Dr. J. Prakash, MIT, Chennai, prakaiit@rediffmail.com										



Course Code	21EIO133T	Course Name	e	INDUSTRIAL	AUTOMAT	ION SYSTEMS	C	Cours atego	se ory	0				OPEN	ELEC	ΓIVE			1	- T 3 0	P 0	C 3
Pre-requi	isite es	Nil		Co- requisite Courses		Nil		Pro (ogres Cours	sive es						Nil	1					
Course	Offering Departme	ent El	ectronics and	d Instrumentation En	gineering	Data Book / Codes / S	Standards		_						Nil							
Course Le	arning Rationale	(CLR):	The purpos	s <mark>e of learnin</mark> g this o	course is to	p:		-	1			Progr	am Ou	itcome	s (PO))				Pi	rograr	n
CLR-1:	Introduce the har	dware cor	mponents of	programmable logic	controller	100		1	2	3	4	5	6	7	8	9	10	11	12	S	pecifi	0
CLR-2:	Provide knowledg	ge on PLC	C progr <mark>ammir</mark>	ng using various fund	tion blocks			e		of	s of	24	iety			¥		0		00		
CLR-3:	Understand distri	buted con	ntrol s <mark>ystem il</mark>	n process automatio	n	1.	1.16	vledo		ento	ations	ge	soc			oW r		ance	b			
CLR-4:	Impart basic infor	mation or	n o <mark>perator in</mark> t	erface in distributed	control sys	tem		Non	lysis	mdo	stige	Usa	and	∞.		ean	и	& Fir	arnin			
CLR-5:	Understand the h	ardware o	components a	and communication	n SCADA			eering I	em Ana	n/devel	uct inve ex prob	'n Tool	ngineer	onment inability		lual & T	nunicati	t Mgt. 8	ong Lea	-		8
Course O	utcomes (CO):		At the end	of this course, lea	rners will b	e able to:	1.17	Engin	Proble	Desig	Condu	Mode	The e	Envirc Susta	Ethics	Individ	Comn	Projec	Life L(PSO-	PSO-3	PSO-:
CO-1:	Summarize the w	orking of	programmab	le logic controller		Les Carel	54	2		-	-	4		-	-	-	-	-	-	-	-	-
CO-2:	Write basic ladde	r logic p <mark>ro</mark>	o <mark>gram f</mark> or cor	ntrol application				2	1.	2	-	-		-	-	-	-	-	-	-	-	-
CO-3:	Outline the variou	ıs local <mark>co</mark>	ontrol unit arc	hitectur <mark>e</mark> in distribute	ed control s	ystem		2	1	- 2-	-	-	-	-	-		-	-	-	-	-	-
CO-4:	Analyze the vario	us oper <mark>at</mark>	or displays u	sed in distributed co	ntrol system	n	100	2	-		2		-	-	-	-	-	-	-	-	-	-
CO-5:	Describe the varie	ous ele <mark>me</mark>	ents of SCAD	A system		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1	2		14	-	-	1	-	-	-	-	-	-	-	-	-
Unit-1 - Pl Parts of a	-C Hardware Com PLC - PLCs versus witches - Mechani	ponents compute	rs - PLC size	e and application - Fi	ixed and mu	odular I/O - Discrete I/O, avices - Seal-In circuits -	analog I/C), spe Linterl	cial I/C	O modi a circui	ules - E ts	lectro	magne	etic con	trol rel	ays - C	Contact	tors - N	Notor si	tarters	9 - Mar	Hour nually
Unit-2 - Pl	c Programming									,	1	-7									9 (Hour
PLC progr	amming language -	Wiring di	iagra <mark>m - Lado</mark>	der logic program -C	n-delay tim	er instruction - Off-delay	timer instr	ruction	n - Ret	tentive	timer -	Casca	ading t	imer - L	Jp-cou	nter -	Down-o	counter	r - Cas	cading	coun	ters -
Unit-3 - Di	stributed Control	Svstem	- Main opera	llion - Dala compare	Instruction	S.	12.4.4		-	-			-								9	Hour
Evolution of	of DCS - DCS archi	itecture - I	Local control	unit architecture - C	Comparison	of different LCU archite	ctures – LO	CU lai	nguag	e requ	irement	s - LC	U pro	cess int	terfacii	ng issu	ies - Se	ecurity	require	ements	s - Sei	curity
design app	proach - Redundant	controlle	r design.					_	1.11							-						
Unit-4 - O	perator Interface	monto I	ow lovel one	rator interface High	h loval ana	rator intorfaco Hardwar	ro alamante	n in th	0.000	rator ir	torfoor	00	rator	dianlow	- End	ninoori	na into	rfaaa r	oquiro	nonto	91	Hour
engineerin	g interface, high lev	/el engine	ering interfac	ces			e elementa	5 11 11	e ope		lienace	- Ope		uispiays	5 - LII	Jineen	ny inte	nacen	equilei	nenio	- LOW	IEVEI
Unit-5 - So	ada Elements					_															9	Hour
SCADA ba	sics introduction - l components - Comn	Elements nunication	of SCADA - protocols.	Functionality of SCA	DA - Key fe	e <mark>atures - R</mark> emote termina	al unit - An	alog a	and dis	screte d	control	- Moni	toring	signals	- Mas	ter teri	minal u	init - R	TU/MT	U com	munic	ation

	Frank D. Petruzella, "Programmable Logic Controller", Tata McGraw Hill Sthed., 2017. Bolton, W. "Programmable Logic Controllers", 6th ed., Elsevier Newnes, 2016	5.	Stuart Boyer A, "SCADA : Supervisory control and data Acquisition", ISA-The Instrumentation Systems and Automation Society 4th ed 2016
Learning Resources	 Krishna Kant, "Computer-based Industrial Control", Prentice Hall, NewDelhi, 2nd ed., 2011. Lukcas M.P, "Distributed Control Systems", Van Nostrand Reinhold Co., New York, 1986 	6.	NPTEL Video Lecture series on "Industrial Automation and Control "by Prof. S. Mukhapadhyay, IIT Kharagpur.

Sec.

100 C 100 C 100 C

			Continuous Learning A	ssessment (CLA)		Sum	motivo			
	Bloom's Level of Thin <mark>king</mark>	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (1)	g Learning .A-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%		20%		20%	-			
Level 2	Understand	20%	A State State	20%		20%	-			
Level 3	Apply	30%		30%		30%	-			
Level 4	Analyze	30%		30%		30%	-			
Level 5	Evaluate		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1977 States			-			
Level 6	Create	-		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		-	-			
	Total	10	0%	10	0%	10	0%			

Course Designers	えた パント・ション アンマンス主義	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Manoj Gupta, Mitsubishi Electric India, Manoj.Gupta@asia.meap.com	1. Dr.K.Srinivasan, NIT, Trichy, srinikkn@nitt.edu	1. Dr. J. Sam Jeba K <mark>um</mark> ar, SRMIST
2. Mr. Gautham, Schneider Electric,gautham.r@se.com	2. Dr. J. Prakash, MIT, Chennai, prakaiit@rediffmail.com	



Course Code 21EIO134T Course Name INTRODUCTION TO SENSORS			SENSORS	Cou Cate	Course Category			OPEN ELECTIVE								L T 3 0	C 3			
Pre-requi Course	site s	Nil	Co- requisite Courses		Nil		Progres Cours	ssive ses						Nil						
Course (Offering Departme	ent Elec	tronics and Instrumentation E	ngineering	Data Book / Codes / Standa	rds							Nil							
Course Le	arning Rationale (he nurnose of learning this	s course is f		1	1			Progr	am Qı	Itcome	s (PO)				P	roara	m
CLR-1: Introduce different types of Sensing physical quantity and their basic principle and characteristics							2	3	4	5	6	7	8	9	10	11	12	S OU	pecifi Itcom	ic es
CLR-2:	Gain knowledge o	on the const	ruct <mark>ion and prin</mark> ciple of motic	on, <mark>proximity</mark>	and ranging sensors	е		of	s of	100	ety			논		0				
CLR-3:	Impart the knowle	edge of basi	c p <mark>rinciples</mark> of force, magneti	c and headir	g sensors	ledo		ento	tions	e	soc			Wo		ance	D			
CLR-4:	Understand the co	oncepts of c	ptical, pressure and tempera	ature sensors	Martin Children	Know	Ilysis	lopme	stiga	Usa	r and	8		Team	ion	& Fin	arning			
CLR-5:	Provide the different	ent types <mark>of</mark>	sensors employed in various	applications		eering	em Ana	n/deve	uct inve	rn Tool	nginee	onment	(0	dual &	nunicat	ct Mgt.	ong Le	-	2	е
Course Ou	itcomes (CO):	/	At the end of this course, le	arners will	be able to:	Engir	Probl	Desig	Cond	Mode	The e	Envir	Ethics	ndivi	Comr	Proje	_ife L	-OSc	-OSc	-OSc
CO-1:	Familiarize the tra	ansduct <mark>ion p</mark>	<mark>rinci</mark> ples and label their char	acteristics of	the measurement system	2	2	-	-	5		-	-	-	-	-	-	-	-	-
CO-2:	Describe the prine	ciple of <mark>moti</mark>	on, proximity and ranging se	nsors		2	2	1	-		- 16		-		-	-	-	-	-	-
CO-3:	Recall the perform	nance o <mark>f for</mark>	<mark>ce, m</mark> agnetic and heading se	ensors		2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Outline the workir	ng princ <mark>iples</mark>	optical, pressure and tempe	erature sense	rs	2	-	2		-	- 24		-	-	-	-	-	-	-	-
CO-5:	Select the type of	sensor <mark>s us</mark>	<mark>ed in</mark> various real time applic	ations		2		10.50	-	-	-	-	-	-	-	-	-	-	-	-
llnit-1 - Eu	indomontals and S	Sonsor Cha	ractoristics	1211															0	Hour
Introduction	n on Sensor - Gene	ral concepts	and terminology of measurir	ng systems, t	ransducer classification, genera	input-o	output c	onfiqui	ation, s	tatic ar	nd dyn	amic ch	naracte	eristics	of a m	easurir	iq syste	əm, an	id stati	istical
analysis of	measurement data	, classificati	on of sensors			'	'	Ũ		10							0,	<u> </u>		
Unit-2 - Mo	otion, Proximity ar	nd Ranging	Sensors	1.1					1000	1									9	Hour
Motion Ser	isors – Potentiomei Iofloctivo boacons	ters – Resol	ver - Encoders – Optical, ma no Sonsor (LIDAP)	ignetic, induc	tive, capacitive, LVDI – RVDI	- Sync	hro – M	licrosyl	n, accel	erome	ter – G	iPS - B	luetoo	th, ran	ge sen	sors –	RF bea	icons ·	- Ultra	sonic
Unit-3 - Fo	rce. Magnetic and	Heading S	ensors	1.1	10 000	1.			1.1	1	-								9	Hour
Strain Gag	e - Load Cell - Mag	netic Senso	rs - Types, principle, require	ment and ad	vantages - Magneto resistive – I	Hall effe	ect – Cu	urrent s	ensor	neadin	a sens	ors – C	ompa	ss. gyr	oscope	, incli	nomete	ers		
Unit-4 - Op	otical, Pressure an	d Tempera	ture Sensors											- / 0/		,			9	Hour
Photo cond	luctive cell, photo v	oltaic, photo	resistive - LDR – Fiber optic	sensors – F	ressure – Diaphragm – Bellows	- Piezo	electric	: – Tac	tile sen	sors, T	emper	ature –	IC, TI	nermisi	tor - R	2TD – 1	Thermo	couple	ə - Acc	oustic
sensors – l	low and level mea	surement -	Radiation sensors - Smart se	ensors - Film	sensor - MEMS & Nano Sensor	s - LAS	SER ser	isors	-										0	Hour
Moisture h	umidity, wind chill ir	ndicator, rad	ioactive count rate, smoke se	ensor infrare	d microwave, air purity, fire dete	ctor - li	naging	senso	s - Nor	-destri	ictive r	nonitor	ina - P	ressur	e sensi	tive pa	int (PS	P) me:	asurer	nents
for aerodyr	namic applications	10.00101,100			a, molenavo, an panty, me dete		naging	0011001	0 1101	40000					5 501101	avo pu		,	.001011	

	1.	Patranabis D, "Sensors and Transducers" 2nd ed., PHI Publications, 2021	4.	Murthy DVS, "Transducers & Instrumentation", 2nd ed., Prentice Hall of India, 2008
Learning	2.	Ian Slinchar, "Sensors and Transducers", 3rd ed., Newnes (an imprint of Butterworth-	5.	Ernest O. Doebelin , Dhanesh N. Manik,Doebelin's Measurement Systems: 7th ed., Tata
Resources		Heinemann Ltd), 2000		McGraw Hill, 2019
	3.	S. J. Prosser, E. Lewis, "Sensors and Their Applications XII", 1st ed., CRC Press, 2014.	6.	NPTEL Lecture notes on "Sensors and Actuators" by Prof Hardick J Pandiya, IISc Bangalore

			Continuous Learning	Assessment (CLA)		Sum	mativo			
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (10	y Learning A-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%		20%		20%	-			
Level 2	Understand	20%	1. 1. 1. 1. C. C.	20%		20%	-			
Level 3	Apply	30%	States Land	30%		30%	-			
Level 4	Analyze	30%	1.1.2.2.2.1	30%		30%	-			
Level 5	Evaluate	SV/		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1		-	-			
Level 6	Create	- · ·	1	10/2010		-	-			
	Total	10	0%	10	0%	10	0 %			

Course Designers			
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
1. Mr. Manoj Gupta, Mitsubishi Electric India, Manoj.Gupta@asia.meap.com	1. Dr.K.Srinivasan, NIT, Trichy, srinikkn@nitt.edu	1. Dr.A.Vimala Juliet, SRMIST	
2. Mr. Gautham. Schneider Electric. gautham.r@se.com	2. Dr. J. Prakash, MIT. Chennai, prakajit@rediffmail.com		



Course Code 21EIO135T Course Name INTRODUCTION TO MEMS					Cour Categ	se ory	0		OPEN ELECTIVE								- T 3 0	P 0	C 3			
Pre-requ Course	isite es	Nil	Co- Co	requisite urse <mark>s</mark>		Nil	-	Pr	rogres Cours	sive ses						Nil						
Course	Offering Departme	ent Electro	onics and Instru <mark>m</mark>	entation En	gineering	Data Book / Co	odes / Standar	ds							Nil							
Course Le	earning Rationale	(CLR): The	e purpo <mark>se of lea</mark>	rning this c	ourse is a	to:		-	71	1		Progr	am Ou	Itcome	s (PO)				P	rograi	m
CLR-1:	Know the importa and actuators	ance of micros	system <mark>technolog</mark>	y and the o	perating p	rinciple of various	micro sensors	1	2	3	4	5	6	7	8	9	10	11	12	S ou	pecifi tcom	c es
CLR-2:	Impart knowledge	e of MEMS ma	ate <mark>rials and th</mark> eir	properties	1	11-12-1	COMP	ge		of	s of	15	iety			ork		е				
CLR-3:	Introduce differen	nt MEMS fa <mark>bric</mark>	c <mark>ations ste</mark> ps and	procedures		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	S Call	vled		ent	ation	ge	soc			M No		Janc	6			ı
CLR-4:	Explore packagin	ig process and	<mark>d solutio</mark> ns	~ ~		1125	1	Kno	Ilysis	mdo	stige	Usa	r and	৵		Tear	U	& Fir	arnir			I
CLR-5:	Gain knowledge	on the imp <mark>leme</mark>	entation of MEM	S and micro	system <mark>s</mark> ir	า various industries	S.	leering	em Ana	jn/devel	uct inve lex prot	ern Tool	enginee	onment ainability	S	dual & ⁻	nunicat	ct Mgt.	ong Le	.	Ņ	က်
Course O	utcomes (CO):	At	the end of this	course, lear	rners will	be able to:	0.922	Engir	Probl	Desig	Cond	Mode	The	Envir Susta	Ethic	ndivi	Com	Proje	_ife L	-OS	-SO	SO.
CO-1:	Summarize the fu	Indame <mark>ntal co</mark>	oncepts in MEMS	technology		Store Car	31091	3	3	-	-	5-		-	-	-	-	-	-	-	-	
CO-2:	Familiarize the va	arious M <mark>EMS r</mark>	<mark>ma</mark> terial and their	properties			Sec 5	2	3	1	-	-	- 10	-	-		-	-	-	-	-	-
CO-3:	Understand the fa	abricatio <mark>n and</mark>	machining tools	needed for l	MEMS stru	ucture developmer.	nt	3	3	-	-	_	-	-	-	-	-	-	-	-	-	-
CO-4:	Explain the variou	us proce <mark>ss inv</mark>	<mark>olv</mark> ed in packagii	ng				3	3	192	1.	-		-	-	-	-	-	-	-	-	-
CO-5:	Apply MEMS and	l micros <mark>ystem</mark>	concepts to real-	time challen	iges		S	3	3	U.S.	-	_		-	-	-	-	-	-	-	-	-
Unit-1 - 0	verview of Mems a	and Microsyst	tems				1					1									9	Hour
Evolution	of MEMS - Microsy	stems Vs <mark>MEN</mark>	<mark>MS –</mark> Microsystei	n and minia	turization	 Scaling laws in I 	ME <mark>MS –</mark> Engine	ering s	science	es for l	Microsy	stem L	Design	and Fa	abricat	tion - N	<i>IEMS</i>	produc	ts - Wo	orking	princip	ole of
Unit-2 - M	a microsystems. aterials for Mems			1000	-						1	-7									9	Hour
Substrate	and Wafers- Active	e substrate Ma	a <mark>terials-Silico</mark> n a	s a substrat	te – Silico	n Compounds : S	Silicon dioxide, S	Silicon	carbid	le , Sili	con nit	ride po	olycrys	talline :	silicon	, Silico	on Piez	o resis	stors, C	Gallium	1 Arse	nide,
Piezoelect	ric crystals, Polyme	ers		- 7	time 1	- 1. T	1.1.1.1		-	_		1	-									Hour
Introductio	n. basic tools. phot	tolithographv –	- Light sources, r	hotoresist o	levelopme	ent. ion implantatio	n. diffusion. oxi	dation -	- CVD	- PVD) - Spu	tterina	– Dep	osition	bv epi	taxv –	Etchin	a - Bu	k micro	o man	ufactu	rina -
Surface m	icromachining LIGA	process.	J				,,.	_				5				,		0				5
Unit-4 - Pa	ackaging in Mems	naidarationa	Dia attach proce	an Wiring	and interes		of nookoging oo	utiona	Qual	ity oon	rol roli	obility	and fo	iluro or	olugia						9	Hour
Unit-5 - A	n and packaging co polications of Men	nsiderations - ns and Micros	svstems	ss – wining	and interc	connects – Types d	DI packaging sol	ulions ·	- Quali	ity com	roi, reii	adiiity,	and la	illure ar	lalysis						9	Hour
In automo applicatior Applicatior	tive Industry - Aerc - Projection displa ns Resonator, swite	ospace industr by with the digination of the second s	ry - Biomedical II ital Micro mirror	ndustry - Co device - Fibr	nsumer p re-optic c	roducts - Telecom ommunication dev	nmunication ind vices - In life sci	ustry - ences -	Press –Micro	ure sei ofluidics	isors – s lap-or	Acce 1–chip	eleratic compo	n sens onents ·	or an - Micro	d gyro o- need	scopes dles, m	s – Ga nicro –e	s Sens electroc	or - Ir de arra	ı phote ay - Ir	onics า RF-

Loorning	1. H. Tai-ran," Designs, Manufacture and Nanoscale engineering" John Wiely Publications, 2008	3.	V. Choudary, K Iniewskwi," MEMS – Fundamental Technology and Application", ISBN
Desources	2. Williams. K, Maluf.N "An Introduction to Microelectromechanical Systems Engineering",		<mark>97811380</mark> 72305,2013
Resources	second edition Artech House Publishers; 2nd ed., 2004.	4.	Stephen D. Senturia, "Microsystem Designs" Kulwer academic publisher , 2001

Learning Assessmen	nt			and the second se							
			Continuous Learning	g Assessment (CLA)		Cum	motivo				
	Bloom's Level of Thinking	Form CLA-1 Avera (50	ative ge of unit test %)	Life-Lon Cl (1	g Learning LA-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%	and the second second	20%		20%	-				
Level 2	Understand	20%		20%	1.2	20%	-				
Level 3	Apply	30%		30%		30%	-				
Level 4	Analyze	30%	and the second second	30%		30%	-				
Level 5	Evaluate	Str. 11			1. 1 A. /		-				
Level 6	Create						-				
	Total	100)%	10	00 %	10	00 %				

Co	Course Designers												
Ex	perts from Industry	Ex	perts from Higher Technical Institutions	Ir	iternal Experts								
1.	Mr. Manoj Gupta, Mitsubishi Ele <mark>ctric Indi</mark> a, Manoj.Gupta@asia.meap.com	1.	Dr.K.Srinivasan, NIT, Trichy, srinikkn@nitt.edu	1	. Dr.A.Vimala Juliet, SRMIST								
2	Mr. Gautham, Schneider Flectric, gautham r@se.com	2	Dr. J. Prakash, MIT, Chennai, prakajit@rediffmail.com										



Course Code	21EIO136J	Course Name	IRSE PLC FOR INDUSTRIAL AUTOMATION				Course Category O OPEN ELECTIVE L T P 2 0 2 0 2 0 2									C 3						
Pre-requis Courses	site s	Nil		Co- requisite Course <mark>s</mark>		Nil		Pr	ogres Cours	sive es						Nil	1					
Course C	Offering Departme	nt Elec	ctronics and In	strumentation Eng	gineering	Data Book / Co	odes / Standa	irds							Nil							
Course Lea	arning Rationale (CLR): 7	The purpose	of learning this c	ourse is to):	-	Program Outcomes (PO)									Pi	rograi	m			
CLR-1:	Introduce the nee	, d for proces	ess automation	technologies.	00	2		1	2	3	4 5 6 7				8	9	10	11	12	Specific		c es
CLR-2:	Provide the fundamental knowledge for ladder logic programming					ge		of	s of	20	iety			ĸ		Φ						
CLR-3:	: Identify applications of timers and counters in process automation				SCALE	vledç	S	hent	ation	ge S	l soc		-	NC NC		Jano	Ð					
CLR-4:	: Understand the various math and data manipulation instructions used in PLC					Knov	Ilysis	mdo	stiga	Usa	anc	৵		[ean	u	Se Fi	arnin					
CLR-5:	P-5: Provide the knowledge of commissioning, maintenance and their importance in industries					S	ering	n Anal	/devel	st inve	Tool	gineer	ment		al &	nicati	Mgt.	ig Lea				
				and the second second	_			- ginee	blen	sign/	und Dubr	dern	e euc	/iron stain	ics	ividu	Juur	ject	e Lor	<u>-</u> 1	0-2	0-33
Course Ou	tcomes (CO):		At the end of	this course, lear	rners will b	e able to:	3. Stor 7	ц	Pro	De	S S S	Ъ	μ	ы Su;	뛾	pul	Ŝ	Pro	Life	PS	PS	R
CO-1:	Summarize the ne	ed for <mark>proc</mark>	cess automatic	on technologies		and they	5.3634	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Apply logical princ	ciple in <mark>lado</mark>	<mark>der lo</mark> gic progr	am for control app	olications		100.00	2	3	1	-	-	-	-	-		-	-	-	-	-	-
CO-3:	Use timer and cou	inter fu <mark>nctio</mark>	<mark>ion bl</mark> ocks in P	LC programming	for process	automation	8.4	3	3	-	-	-	- 100	-	-		-	-	-	-	-	-
CO-4:	Use data manipul	ation in <mark>stru</mark>	<mark>iction</mark> s in PLC	programming	1		100	3	3		-			-	-	-	-	-	-	-	-	-
CO-5:	Summarize the tro	oublesh <mark>ooti</mark>	<mark>ing tec</mark> hniques	s of PLC		1. 2.		3	3	1-1	-	-	2	-	-	-	-	-	-	-	-	-
Unit-1 - Int	roduction to PLC	-			CORES.	iel	1000						-								12	Hour
Evolution of Practice: 1. Basics of	f PLCs - Architectu f PLC ladder logic p	re of PLC – programmin	<mark>- PLC v</mark> s PC - ng	PLC size and ap	plications -	PLC wiring - Disc	crete and ana	og I/O, F	ield I/(O devi	ices - S	inking	and so	ourcing	- Eleci	trical ir	nterlock	ĸs				
2. Implement	ntation of code con	verters			-	-	-	-			_	de la	_			-					12	Hour
PLC progra – Proximity Practice: 1. Implement 2. Water Inv	rogramming mming languages - / sensor, magnetic ntation of MUX and	- Ladder log reed switch I DEMUX A	gic, function bl h, light sensor Automatic cont	ock diagram, instr s, velocity and pos rol of bottle filling	ruction list - sition senso system usir	Instruction addre ors ng PLC	ssing - Branci	n instructi	ons –	Relay	rs – Con	tactors	: - Man	ually op	perate	d switc	hes - N	<i>l</i> echar	nically c	perate	<u>- 12 1</u> ?d swit	tches
Unit-3 - Tin	ners and Counters	s																			12	Hour
Timer instru Practice: 1. Traffic lig 2. Sequenti	uctions - On-delay, iht control system ial operation of step	off-delay tir oper motor	mer instruction	- Retentiv <mark>e time</mark> r	s - Cascadii	ng timers - Count	er instructions	s - Up and	l dowr	n coun	iters - C	ascadi	ng cou	inters -	Comb	ining ti	mers a	nd cou	nters -	Simple) exer	cises

Unit-4 - Data Manipulation and Math Instructions 12 Hou
Data manipulation - Data transfer operations - Data compare instructions - Data manipulation programs - Numerical data I/O interfaces - Math Instructions - Addition, subtraction, multiplication and division instruction
- Other word-level math instructions
Practice:
1. Bottle filling system
2. Material handling system
Unit-5 - Troubleshooting of PLC 12 Hou
Electrical noise - Leaky inputs and outputs – Grounding - Voltage variations and surges - Program editing and commissioning - Preventive maintenance – Troubleshooting - Input and output malfunctions - Comparativ
study of industrial PLCs - Case studies
Practice:
1. Program for lighting sequence (using timers and counters)
2. Design of smart room
1. Frank D. Petruzella, "Programmable Logic Controller", Tata McGraw Hill, 5th ed., 2017 3. Bolton, W. "Programmable Logic Controllers", Elsevier Newnes, 6th ed., 2016

Learning	1.	Frank D. Petru	<mark>zella, "Pro</mark> gram	mable Logic C	Controller", 1	Tata M	cGraw Hill,5	th ed., 2017	3.	Bolton. W, "Programmable L	.ogic Controllers", Elsev	vier Newnes, 6th ed., 201	16
Decourses	2.	M.P.Groover,	"Automation,	Production	Systems	and	Computer	Integrated	4.	NPTEL Video Lecture Notes	on "Industrial Automatic	on and Control "by Prof. S	S. Mukhapadhyay,
Resources		Manufacturing'	<mark>", Pears</mark> on Educ	cation, 5th ed.	, 2009	-				IIT	1		

curring Accessing			Continuous Learnin	g Assessment (CLA)	10 A -	Cum	motivo			
	Bloom's Level of Thinking	Forn CLA-1 Avera (4)	native oge of unit test 5%)	Life-Long CL (15	Learning A-2 %)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%	a la serie de la s		20%	20%	-			
Level 2	Understand	20%		and the second	20%	<mark>2</mark> 0%	-			
Level 3	Apply	30%			30%	<mark>3</mark> 0%	-			
Level 4	Analyze	30%	-	<u>e</u> -	30%	30%	-			
Level 5	Evaluate			-		-	-			
Level 6	Create			-		-	-			
	Total	10	0%	100)%	10	0 %			

Course Designers												
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts										
1. Mr. Manoj Gupta, Mitsubishi Electric India, Manoj.Gupta@asia.	meap.com 1. Dr.K.Srinivasan, NIT, Trichy, srinikkn@nitt.edu	1. Dr. R. Bakiya Lakshmi, SRMIST										
2. Mr. Gautham, Schneider Electric, gautham.r@se.com	Dr. J. Prakash, MIT. Chennai, prakaiit@rediffmail.co	m										

Course Code	21EIO138T	Course Name	LOGICAL FOUNDAT	Cour Categ	se ory	0	OPEN ELECTIVE								L T 3 0	P 0	C 3		
Pre-requ Course	isite es	Nil	Co- requisit Courses	e Nil	P	rogres Cours	ssive ses						Ni	1					
Course	Offering Departme	ent Elect	tronics and Instru <mark>mentation</mark>	Engineering Data Book / Codes / Stan	ndards	-						Nil							
Course Le	earning Rationale	(CLR): T	he purpos <mark>e of learning</mark> th	s course is to:		1	1		Progr	am Ou	utcome	s (PO)				Р	rogra	m
CLR-1: Provide the basic concepts of cyber-physical system and modeling of a continuous system					1	2	3	4	5	6	7	8	9	10	11	12	ິ 0 ເ	pecif itcom	ic Ies
CLR-2:	CLR-2: Understand the basic concepts of discrete modeling of a system						f	s of	20	lety			ž		0				
CLR-3:	Impart the adequ	ate informati	io <mark>n about hyb</mark> rid system and	I state machines	vledç		ento	itions	ge	soc			oW r		ance	ວ			
CLR-4:	CLR-4: Know the sensor networks in CPS						mdo	stige	Usa	and	৵		earr	u	& Fir	arnin			
CLR-5: Explore the knowledge about security issues in CPS				eering I	em Ana	n/devel	ict inve ex prot	n Tool	ngineer	nment		lual & T	unicati	t Mgt.	ong Lea	_		~	
Course O	utcomes (CO):	A	At the end of this course, I	earners will be able to:	Engin	Proble	Design	Condu	Mode	The el	Enviro	Ethics	ndivic	Comm	Projec	_ife Lo	-OSc	-OSc	0Sc
CO-1:	Summarize the b	asic con <mark>cep</mark> i	ts of cyber physical systems	and modeling in continuous domain	3		3	-	-	1	-	-	-	-	-	-	-	-	-
CO-2:	Illustrate the disc	rete mo <mark>del o</mark>	f continuous system		3		3	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Analyze the hybri	d syste <mark>m an</mark>	d its interactions	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	3		3	-	-	- 30	-	-		-	-	-	-	-	-
CO-4:	Select the sensor	⁻ networ <mark>ks fo</mark>	r CPS	A CART IN CART	3	-	3	-	-		-	-	-	-	-	-	-	-	-
CO-5:	Examine the CPS	S design <mark> for s</mark>	specific applications		3	13	3	-	-	-	-	-	-	-	-	-	-	-	-
Unit-1 - C	ontinuous Dynami	cs Modeling	g	Colorado Ho						-								9	Hour
Structure of Stability -	of cyber-physical sy Feedback control -	rstems - D <mark>es</mark> Proportiona	ign process - Modeling des I control systems - Tracking	ign – Analysis - Newtonian mechanics - A error - Transformation to equivalent mod	ctor model	s - Pro L dvna	opertie:	s of sys Modelir	tems,	causai simula	syster	ns - M ols - M	emory Aultiple	less sy	rstems Is - I In	- Linea certain	ar-time	invar	iant – ation -
Problems	stabilization using p	roportional o	control – Problems - BIBO	stability analysis		ruyna	11103, 1	vioucin	y and	Simul		013 1	Tunipic	mouch	13 - 011	contain	ty quu	minoc	luon
Unit-2 - D	iscrete Dynamics	Modeling							1									9	Hour
Discrete sy for FSM, of specification	ystems - Discrete si determinacy - Rece ons	gnals - Even ptiveness, e	nt triggered - Modeling actor extend <mark>ed state</mark> machines, n	s as function - Notion of state - Finite-state noore and mealy machines - Traffic light o	machines, controller -	transii Non-d	tions, r letermi	eaction nism -	– Hyst Formal	eresis mode	e - Time el - Use	scale s of n	varian on-dei	ce - Up terminis	odate fi sm, - E	unction Environ	s - So menta	tware I moc	tools leling,

Unit-3 - Hybrid Systems and State Machines

Modal models combining discrete and continuous dynamics - Actor model for state machines - Actor representation of FSM - Continuous inputs- Thermostat example - State refinements, Notations of hybrid systems, - Classes of hybrid systems - Timed automata - Higher order dynamics - Timed automation variant of traffic light controller - Hybrid system model for mass system - Supervisory control - Automated guided vehicle, Composition of state machines, Concurrent composition - Side-by-side synchronous composition - Side-by-side asynchronous composition - Shared variables - Cascade composition, General composition -Hierarchical state machines

9 Hour

9 Hour

Traditional sensor networks vs WSNs - Sensors employed by CPS - Types of sensors - Smart sensors - Wireless sensor networks(WSNs) - Distributed WSNs - Sensor networks for Internet of Things (IoT) -Architecture of WSNs for CPS applications - Sensor network as Service-Oriented Architecture (SOA) - Semantic modeling of sensor network and sensor attributes, sensing resource management and task scheduling - Design of WSNs for CPS applications, sensing capacity of sensor networks - Optimum deployment of wireless sensor nodes for CPS applications - Routing techniques, WSNs for CPS applications, transforming WSNs to cyber-physical systems - emerging cyber-physical systems - Intelligent health care cyber system - Heath care monitoring and tracking - Intelligent rescue cyber system - Position–navigation–timing monitoring and tracking - Intelligent transportation cyber system- Transportation - Monitoring and tracking

Unit-5 - Security Issues in CPS

Workflow of CPS - Monitoring, networking - Computing, actuation - Case studies on CPS security breaches - Stuxnet, maroochy water breach - Slammer worm, automobile attacks -health care, manufacturing sector, smart grid - Security objective for CPS - Challenges in CPS security - Real-time requirements - Intrusion detection techniques - Requirement for security in CPS - Sensing security, storage security, communication security, actuation security - Feedback security - Prominent attacks on security for CPS - Denial-of-service attack - Man-in-the-middle attack - Defensive mechanism against attack in CPS

	1. AncaMolnos, "Model Implementation Fidelity in Cyber-Physical System Design", Springer, 2017	4. E.A.Lee, S.A.Sashia, "Introduction to Embedded Sytems : A Cyber-Physical Systems
Learning	2. Gaddadevara Matt Siddesh et.al, "Cyber-Physical Systems – A Computational Perspective", CRC	Appproach", 2011
Resources	Press, 2016.	5. NPTEL Video Lecture series on "Foundations of cyber-physical systems" by Prof.
	3. Rajeev Alur, "Principles of Cyber-Physical Systems", MIT Press, 2015	Soumyajit Dey, IIT Kharagpur

earning Assessme	ent		Continuous Learning	Assessment (CLA)						
	Bloom's Level of Thinking	Form CLA-1 Avera (50	ative ge of unit test 0%)	Life-Long CL (10	g Learning A-2 0%)	Summative Final Examination (40% weightage)				
	and the second	Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	20%		20%	-			
Level 2	Understand	20%		20%		20%	-			
Level 3	Apply	30%	1	30%		<mark>3</mark> 0%	-			
Level 4	Analyze	30%	-	30%		<mark>- 3</mark> 0%	-			
Level 5	Evaluate						-			
Level 6	Create					-	-			
	Total	10	0%	10	0%	100 %				

Course Designers											
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts									
1. T.A.Balaji, Robert Bosch, Coimbatore, Balaji.TAnanthanpillai@in.bosch.com	1. Dr.K.Srinivasan, NIT, Trichy, srinikkn@nitt.edu	1. Dr.G.Y. Rajaa Vikhram, SRMIST									
2. Mr. Vijayarajeswaran, MD, Vi micro Pvt.Ltd, vijay@vimicrosystems.com	2. Dr.S.Latha, TCE, Madurai, sleee@tce.edu										

Course Code	21AUO101T	Course Name	9	HYBRID AND ELECTRIC VEHICLES			ourse O ategory		OPEN ELECTIVE									L T 3 0	P 0	C 3
Pre-requi Course	site s	Nil		Co- requisite Course <mark>s</mark>	Nil	P	rogres Cours	sive es						Nil	1					
Course	Offering Departme	ent	Auto	omobile Engineering	Data Book / Codes / S	tandards	-						Nil							
Course Le	arning Rationale (CLR):	The purpo	ese of learning this course	is to:		71		1.1	Progr	am Ou	itcome	s (PO)				P	rogra	m
CLR-1:	Provide an insigh	t into how	^r electric vel	hicle operate		1	2	3	4	4 5		7	8	9	10	11	12	0L	itcom	c es
CLR-2:	.R-2: Demonstrate the functional requirements of Battery management system in detail.			e		of	s of	10	iety			rk		e						
CLR-3:	R-3: Demonstrate how Electric and Hybrid Vehicle vary as per design requirements			vledç		ento	stigation	uct myesugation lex problems rn Tool Usage	ngineer and soc		-	oW r		Janc	D					
CLR-4:	R-4: Perform the detailed analysis on the drives and driveline.				Knov	lysis				mdo	∞		Tean	u	& Fir	arnin				
CLR-5:	R-5: Selection of the appropriate drive and driveline system for the different cases		Bering	m Ana	n/deve	ict inve	nment				ual & -	unicati	t Mgt.	ng Lei		~				
Course Ou	itcomes (CO):		At the end	d of this course, learners	will be able to:	Engine	Proble	Design	Condu	Moder	The er	Enviro Sustai	Ethics	Individ	Comm	Projec	Life Lo	PSO-1	Z-OSd	PSO-3
CO-1:	Learn the basic c	oncepts <mark>o</mark>	<mark>f electri</mark> c vel	hicle technology and electri	c vehicles.	3	-	-	-	5		2	-	-	-	-	-	-	-	-
CO-2:	Develop and anal	lyze hy <mark>bric</mark>	<mark>d and </mark> electri	ic drive trains.		3	-	3	-	-		-	-	-	-	-	-	-	1	-
CO-3:	Interpret various	vehicle <mark>po</mark>	wer sources	s in hybr <mark>id</mark> vehicle technolo	gy	3	3	-	-	-	- 30	-	-		-	-	-	-	-	-
CO-4:	Analyze data to d	letermin <mark>e</mark>	<mark>appro</mark> priate	design calculation for hybr	id system under study.	3		-	3	-	-	1	-	-	-	-	-	-	-	-
CO-5:	Apply the concep	ts in siz <mark>in</mark>	<mark>g the el</mark> ectri	ic motors	- and -	3	1	3	-	-	1	-	-	-	-	-	-	-	-	-
Unit-1 - Ele Basic conc System De Discharge- Battery Cel	ectric Vehicle Prop epts and problems sign - Force Veloc Calculation of Spe Il Balancing- Tractic	oulsion ar concerni city Chara ecific Ener on Batterie	nd Energy S ing the elect cteristics, C rgy and Spe es - Nickel M	Sources trification in Mobility- Functi Calculation Of Tractive Pow ecific Power & Ragone Plot fetal Hydride Battery, Li-Ion,	ional components in an electri ver And Energy Required- Ele Relationship- Battery Modelin Li-Polymer Battery.	ic and hybrid cctric Vehicle I ng - Run Time	vehicle Power Batte	- Vehio Source ry Mod	cle Mec e - Batte lel, Firs	hanics ery Ca t Princ	s – Kir pacity iple M	netics - - Batte Iodel- E	Dynai ery Co Battery	mics & onstruct Mana	Roadu tion an gemen	way Fu d Type t Syste	indame es- Sta em- SC	entals- te of (DC Me	9 Propi Charge asure	Hour Ilsion 9 and ment,
Unit-2 - El	ectric Vehicle Pov	verplant a	and Drives	or and Torque plot. Constru	uction of Induction Machines C	porating cyclo	anda	nnlicat	ion in tr	action	Cons	truction	of Po	rmano	nt Maa	inot Mr	chinos	Cor	9	Hour

Switch Reluctance Machines- Role of Power Electronic Converters-DC/DC Converters- Description of Buck Boost Converter- Isolated DC/DC Converter- Functional Requirements and Operating limits- Two Quadrant Chopper – Switching Modes- AC Drives- PWM- Current Control Method - Role of Switch Reluctance Machine Drives- Voltage Control- Current Control. 9 Hour

Unit-3 - Hybrid and Electric Drivetrains

Functional requirements of Hybrid Vehicle- Operational difference between the Fully Electric, Hybrid, and Mild Hybrid- Topological Phenomena and Social Importance of e-mobility Role of modern drivetrain and the conversion efficiency and power consumption- Description of Hybrid Traction- Description of Electric Traction.- Topological Optimization for Hybrid Traction- Topological Optimization for Electric Traction- Power Flow Control & Energy Efficiency Analysis- Configuration and Control of DC Motor Drives- Induction Motor Drive.- Permanent Magnet Motor Drives, Switch Reluctance Motor Drives, Drive System Efficiency

Unit-4 - Electric and Hybrid Vehicle Design

Design requirement for electric vehicles- Range, maximum velocity, acceleration, power requirement, mass of the vehicle. Various Resistance- Transmissionefficiency- Electric vehicle chassis and Body Design, Electric Vehicle Recharging and Refueling Systems, Power Split devices for Hybrid Vehicles - Operation modes - Control Strategies for Hybrid Vehicle - Economy of hybrid Vehicles. Steering and Suspension system. Choice of Tires. 9 Hour

Unit-5 - Electric and Hybrid Vehicles –Case Studies

Parallel Hybrid, Series Hybrid -Charge Sustaining- Parallel Hybrid, Series Hybrid –Charge Depleting- Hybrid Vehicle Case Study –Toyota Prius, Hondalnsight, Chevrolet Volt- 42 V System for Traction Applications-Lightly Hybridized Vehicles and Low Voltage System- Electric Vehicle Case Study - GM EV1, Nissan Leaf, Mitsubishi Miev- Hybrid Electric Heavy-Duty Vehicles, Fuel Cell Heavy Duty Vehicles

Learning	1.	Igbal Husain, "Eclectic and Hybrid vehicles Design Fundamentals,"	3. James Larminie, John Lowry, "Electric vehicle technology Explained"Second Edition, Wiley 2012,
Resources	2.	CRC Press, second edition 2013, ISBN 9781439811757	ISBN-13: 978-1119942733

annig / loocooni							
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Sum Final Ex (40% w	mative amination eightage)		
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	100 C 100 C 100 C 100 C	15%		15%	-
Level 2	Understand	25%	the second second	25%		25%	-
Level 3	Apply	30%		30%		<u>30%</u>	-
Level 4	Analyze	30%	5 7 The Part 1	30%	W	<u>30</u> %	-
Level 5	Evaluate	1000	20 C 10 C 10 C 10		- Press	- T	-
Level 6	Create					-	-
	Total	-10	0%	10	0%	10	0%

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.G.Giri, Managing Director, Atalon ,giri@atalon.co.in	1. Dr.S.Jeevananthan, Professor, Electrical and Electronics	1. Mr S. Madhan Kumar, SRMIST
	Engineering, PTU, drsj_eee@pec.edu.in	
	2. Mr. Sam Jebakumar, SRM IST, iebakumi@srmist.edu	2. Dr. Carunaiselvane, SRMIST



Course Code	21AUO102T	Course Name	SOURCES OF ENERGY	C Ca	ourse	e Ty	0				OPEN I	ELECT	TIVE			1	- T 3 0	P 0	C 3	
Pre-requis Courses	site	Nil	Co- requisite Course <mark>s</mark>	Nil		Prog	gres: ourse	sive es						Nil	1					
Course O	offering Departme	nt	Automobile Engineering	Data Book / Codes /	Standards								Nil							
Course Lea	arning Rationale (CLR).	The purpose of learning this c	ourse is to:				1		Progr	am Qu	itcome	s (PO))				P	roara	m
	Explain the conce	ont of win				1	2	3	1	5	6	7	8	, 	10	11	12	S	pecifi	ic
		-pt 01 will				-	2	5	of 4	5	y o	'	0	9	10	11	12	ou	tcom	es
CLR-2:	Create insight on	solar ene	ergy and its application	1.		dge		tof	ns c		ociet			/ork		g				
CLR-3:	Evaluate the use	of geoth	ermal and hydro power for power	generation	201 B	owle	s	nen	gatio ns	age	os pu			2 E		inar	bu			
CLR-4:	Analyze the biom	ass energ	gy and ocean energy	10.1- 0		Kne	alys	Idole	estic	I Us	er ar	r &		Tea	tion	~× ⊥	arni			
CLR-5:	Develop knowled	ge on va <mark>l</mark>	r <mark>ious ener</mark> gy conversion devices	F - 2323		ering	۱An	deve	t inv x pro	Toc	gine(men abili		al &	nica	Mgt.	ig Le			
F					100	ginee	blen	sign/	uduc (alqr	dern	enç	viron	cs	vidu	nmu	ject	Lor	<u>-</u> 1	0-2	0-3
Course Out	tcomes (CO):		At the end of this course, lear	ners will be able to:		Ě	Pro	Des	Cor	Mo	The	Sus Sus	击	Ind	õ	Pro	Life	PS	PSd	PS(
CO-1:	Apply the knowled	dge of <mark>us</mark>	<mark>ing win</mark> d energy for power product	ion	221-1	3	3	-		5-	-	2	-	-	-	-	-	-	-	-
CO-2:	Analyze the econ	omy of <mark>us</mark>	<mark>sing so</mark> lar power			3	3	1.	-	-	-	-	-		-	-	-	-	-	-
CO-3:	Rationalize geo th	hermal <mark>ar</mark>	nd hydro power plants		1	3	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Perceive the cond	cept of bio	omass and ocean energy for powe	r production	100	3	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Demonstrate the	working o	of various energy conversion devic	es		3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
			1	College States II M																
Unit-1 - Wir	nd Energy		a statistics and tashnalagian Win	d Energy Introduction Applicati	on of wind o	norau	Tro	noform	otion	fuind	onora	v Mine	Turbi	inco (Inorati	na cho	rootori	otion 1	9 Mindr	Hour
plant- Utiliz	- Renewable energ	ly source. er- Trends	s-statistics and technologies- win s in wind energy utilization	a Energy – Introduction - Applicati	on or wind ei	nergy-	- ITa	nsioni	alion o	r wina	energ	y - vviric		nes - C	Jperali	ng cha	racteri	sucs- v	wina p	Jower
Unit-2 - Sol	ar Energy		in the oriorgy damzador	-2 - 2 N					1.1	17									9	Hour
Basic prope	erties of solar ene	rgy- App	licati <mark>on of solar energy- Transfo</mark> l	mation of solar energy - Solar I	heat collecto	ors- So	olar j	photov	oltaic d	collecto	ors- Ap	oplicatic	on of s	olar co	llectors	s- Sola	r powe	r plant	- Ecor	nomic
study- Trend	ds in solar energy (utilization		the state of the state						1	-									
Coothormal		ro powe	r Ms. Mothod of harnossing power	and its notantial in India. Hydron	owor Pror	ortios	and	availa	bility -	Transf	ormati	on of w	ator o	norav	Hydro	nowo	r nlante	Ann	y licatio	nour
hydro powe	r plants- Special h	vdropowe	er plants- Economic study- Trends	s in hydro power utilization	ower – Frop	Jerues	anu	availa	Dility-	ransio	Jinau			nergy-	Tiyuro	power	piants	- App	licalio	115 01
Unit-4 - Oc	ean energy and l	Biomass	based energy																9	Hour
Ocean Ener	rgy – Principle, Util	ization- S	Setting of power plants- Thermody	namic cycles- Tidal and wave ene	ergy- Biomas	ss - Pr	rincip	le of bi	iomass	conve	ersion-	Anaero	bic/ae	erobic (digestic	on- Bio	gas dig	gestor	s, gas	yield
and combus	stion characteristic	s- Utilizat	tion for cooking and economic as	ects- Utilization in IC engine															٥	Hour
Need for dir	ect energy conversions	, sion (DEC	C), carnot cycle- Limitations and p	rinciple of DEC- Thermo electric g	enerators- S	Seebec	ck, pe	eltier a	nd joule	Thon	npson	effect a	and ap	plicatio	on- Ma	gneto l	hydrod	/nami	c gene	erator
(MHD) – Wo	orking principle- M	HD accele	erator, MHD engine- Electron gas	lynamic conversion- Fuel cell – ba	asic principle	- Hybr	rid ve	hicle -	Basic	princip	le.			-		-			-	

 Learning
 1.
 Boyle, Godfrey. 2004. Renewable Energy (2nd edition). OxfordUniversity Press.
 3.
 Systems at the sy

 Systems and Sustainability: Power for a Sustainable Future. OxfordUniversity Press, 619 pages (ISBN: 0-19-926179-2)

			Continuous Learning	Assessment (CLA)		– Summative Final Examination (40% weightage)				
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (1)	g Learning .A-2 0%)					
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	15%	· · · · ·	15%	1	15%	-			
Level 2	Understand	25%	and the second sec	25%		25%	-			
Level 3	Apply	30%	1	30%		30%	-			
Level 4	Analyze	30%	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	30%	100	30%	-			
Level 5	Evaluate		and the second second	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		-	-			
Level 6	Create	N / / E	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1				-			
	Total	10	0%	10	0%	10	0 %			

Course Designers			
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
	ALL	CARL CONTRACTOR	



Course Code	21AUO103T	Cours Name	e SPECIAL TYPE	OF VEHICLES	C	Cours atego	e ory	0				OPEN	ELEC	ΓIVE			l	- T 3 0	P 0	C 3
Pre-requis	site s	Nil	Co- requisite Courses	Nil	-	Pro	ogres Cours	sive es						Nil	1					
Course C	Offering Departme	ent	Automobile Engineering	Data Book / Codes / S	Standards								Nil							
Course Lea	arning Rationale (CLR):	The purpose of learning this course	is to:			1	1		Progr	am Ou	Itcome	s (PO)				Pr	ogra	m
CLR-1:	Define and Class	ify earth	moving equipment	2		1	2	3	4	5	6	7	8	9	10	11	12	S	pecifi tcom	C es
CLR-2:	Identify the specia	al vehicle	es used in construction site	C. undered		Ð		-	of	1	ety			¥						
CLR-3:	Identify the specia	al type of	vehicles, their applications			rledg		ent o	tions	e	soci			No		ance	5			
CLR-4:	Define the princip	les and	design considerations of farm equipmer	nt		Non	lysis	opme	stiga lems	Usaç	and	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		eam	ы	Ë	urninç			
CLR-5:	Understand the c	oncept o	of designing Combat Vehicles			ring h	Anal	levelo	inve: prob		ineer	nent a abilitv		al & T	nicati	Agt. 8	g Lea			
			~ ~ /		1000	inee	olem	ign/c	iduct iplex	lern	eng	ironr taina	cs	vidua	Inmu	ect	Long	-	0-2	-3
Course Ou	tcomes (CO):		At the end of this course, learners w	will be able to:	1.20	Eng	Prot	Des	Con	Moc	The	Env	Ethi	Indi	Con	Proj	Life	PSC	PSC	PSC
CO-1:	Acquire the know	ledge o <mark>f</mark>	earth moving machines their construction	on and application	54-1	3	1	3		-	1	-	-	-	-	-	-	-	-	-
CO-2:	Suggest Suitable	equipm <mark>e</mark>	ant appropriate for material handling in C	Construction site.		3	3	12	-	-	-	-	-		-	-	-	-	-	-
CO-3:	Acquire the know	ledge o <mark>f</mark>	construction and operation of special ty	pe vehicle.		3		3	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Classify Farm Ma	chineri <mark>es</mark>	<mark>s and re</mark> cognize the concept of tractor de	esign	100	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Demonstrate the	concep <mark>t</mark>	<mark>of desig</mark> n for Military vehicles and its co	ommunication system		3	1	3	-	-	1		-	-	-	-	-	-	-	-
			6- 60																	
Unit-1 - Ea	rth Moving Mach	ines	nt consoity and applications of corthms	wara Paoia considerations fo	or oquipm	ont co	lactio	n Dull	lazora	Cono	truction	nal data	ile on	danar	otiona	and an	oliootio	no Tu	9	Hour
dozers- Cal	he and Hydraulic [)ozers- R	rit- capacity and applications of earthing	tion-Introduction types Rigin	n equipine Dump Tr	ent se ucks i	Const	ruction	al Deta	ils- Ar	ticulat		ns and n Tru	cks Co	alions a Instruc	tional l	Details.	iis - i y . Load	pes c ers: S	i Dull Sinale
Bucket Con	structionalDetails.	Applicat	ions- Multi Bucket Constructional Detail	s. Applications- Skid steer lo	aders con	structi	ional	details	and ap	plicati	ons- T	renche	rs- Inti	oducti	on- Pri	nciples	and of	peratio	ns- c	riteria
for selection	n of prime mover fr	om dump	pers- <mark>criteria for</mark> selection of prime mover	for front end loaders	100					1						'	,			
Unit-2 - Co	nstruction Equip	ment		1. 1. 1. 1.						1	-								9	Hour
Scrapers –	Introduction-, Cons	structione	الا Details, <mark>Applications</mark> and their types- G	raders- Introduction- Motor gr	raders Con	struct	ional	Details,	Applic	ations	-Class	ificatior	<mark>ns o</mark> f N	lotor g	raders	- Bush	Cutters	s – Intr	oduc	tions-
Bush Cutte	ers- Constructional	Details,	, Applications- Stumpers –Introduction-	- Constructional Details, App	plications	Doz	er- In	troduct	ion, C	onstru	ctional	Detail	s, App	olicatio	ns- Ri	ppers	-Const	ruction	al De	etails,
Application:	s- DraglineExcavat	or –Intro	Juction Constructional Details, Applicat	tions- Vibratory roller – introdu	iction-, Coi	nstruc	tional	details	and ap	plicati	ons-C	oncrete	e mixei	- Con	structio	onal de	tails an	d appl		<u>n.</u>
Unit-3 - Sp	ecial Purpose ve	nicies	hines Dever Shavel Introduction and t	unas Constructional dataile a	nd annling	tione	Drag	lines 1	Davahu	na oha		aamatu	unting	al data	ile end	lonnlio	otiono	Otaina	9	Hour
	i io special applicational details and an	uun maci nlications	IIIIes- Fower Shoves - Introduction and ty	ypes, constructional details a	nu appilCa and annlica	uoris- tions-	Drag Artic	intes-t ilatod <mark>v</mark>	hicles		ruction	CUIISII eteb ler	ucuon ils ano	ai uela annlic	uis ano ations-	appilC . Δmhi	allONS- Ilance-	SIIPP	er SN tinavi	overs
vehicle- Ho	ver craft- oil tanker	s- Introdu	uction to tankers- Special features and c	onstructional details of tanke	rs- qun ca	rriers	– Intr	oductic	n- con	structi	onal de	etails	13 010	appilo	0110113-	AIIIDU	101108-	C CX	unyui	siniy

Unit-4 - Farm Equipments

Classification of farm equipment- Introduction to tractors- lay out of wheeled tractor- Classification of tractors- Wheeled Tractor - Constructional Details, Applications- Crawler Tractor - Constructional Details, Applications- Recent Trends In Tractor Design- Power transmission system In Caterpillar Tractor. – Mechanism- Steering system- Accessories of wheeled tractors- Hydraulic control system- Power take off unit.-Motor Grader: Recent Trends- Control Mechanism Of A Caterpillar Motor Grader- Ride and stability characteristics- Safety features in tractors- Human factors in tractor design- Procedure of testing and standard code for testing of tractor performances

Unit-5 - Defence Vehicles

Selection and design for military vehicles - combat systems Design Vehicle Configuration detection, tracking, and identification systems- commercialmarine vehicles- passenger ship, cargo ships, oil and chemical tankers, Manned and Un Manned Submersible - Introduction of naval combat systemsCommunication Systems, Surveillance and Tracking Radar, Radar Designs. Free space optical communication, Fiber optics communication, Wireless/cellular communications...

		1.	Wong J, "Terramechanics and Off-Road Vehicle Engineering", Butterworth-	4.	Rodhiev and Rodhiev, "Tractors and Automobiles", MIR Publishers, Moscow, 1984
			Heinemann, 2009	5.	Abrosimov. K. Bran berg.A. and Katayer.K,"Road makingMachinery", MIR Publishers, Moscow,
Learning	g	2.	"Off the Road Wheeled and Combined Traction Devices"., -Ashgate Publishing Co.		1971.
Resourc	es		Ltd. 1998	6.	RoviraMás, Francisco, Zhang, Qin, Hansen, Alan C, "Mechatronics and Intelligent Systems for
		3.	Construction Equipment Management for Engineers, Estimators, and Owners, 1st		Off-road Vehicles", Springer, 2011
			Edition, CRC Press, 2006		

Learning Assessme	ent									
		24 - A - A - A - A - A - A - A - A - A -	Continuous Learning	g Assessment (CLA)	27 S -	Sum	motivo			
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test %)	Life-Long CLA (109	Learning A-2 %)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	15%		15%	-	<mark>15</mark> %	-			
Level 2	Understand	25%		25%	-	<mark>2</mark> 5%	-			
Level 3	Apply	30%		30%	-	<mark>3</mark> 0%	-			
Level 4	Analyze	30%	- 101	30%	-	<mark>3</mark> 0%	-			
Level 5	Evaluate	Sec. 1 -	-	-	-	-	-			
Level 6	Create		-	-	-	-	-			
	Total	100	0%	100	%	10	0 %			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. R. Siva GM GMMCO – Caterpiller	1. Dr. Ganesh P, Professor SVCE vinaganesh@svce.ac.in	1. Mr.S. Yokeshwaran, , SRMIST
2. Mr. Ravindran R Senior Manager GMMCO	2. Mr. S. Sunil Assistant Professor Dept of Automobile MIT ssunil@mitinida.edu	2. Dr.K.Ka <mark>malakkanna</mark> n , SRMIST

9 Hour

Course Code	Course Code 21AUO104T Course Name FUEL CELLS AND APPLICATIONS									0				OPEN I	ELEC	ΓIVE				- T 3 0	P 0	C 3
Pre-requi Course	site s	Nil		Co- requisite Cours <mark>es</mark>		Nil		P	rogres Cours	sive es						Nil						
Course (Offering Departme	ent	Autom	obile <mark>Engineering</mark>		Data Book / (Codes / Stand	lards							Nil							
			-			-	-	11	-	1	_	-	-		(00)					D	oara	_
Course Le	arning Rationale ((CLR): <i>1</i>	i ne purpose	e of learning this	course is	to:				1	-	Progr	am Ol	itcome	s (PO)	1			S	pecifi	c
CLR-1:	Impart knowledge	e on fuel cell	ll technology	and applications	1	a series and		1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	es
CLR-2:	Know the concep	t of electroc	chem <mark>istry in</mark>	fuel cells				e		ef	s of	10	iety			논		a				
CLR-3:	Distinguish differe	ent types of	^r fu <mark>el cells a</mark> r	nd operations	1	12.2%	1907	ledç		ento	tion	ge	soc			No No		anci	0			
CLR-4:	CLR-4: Inferring different hydrogen production techniques								Ilysis	lopm	stiga	Usa	r and	~× _		Tearr	ion	& Fin	arnin			
CLR-5:	Identify the applic	ation of f <mark>uel</mark>	<mark>el cells in</mark> pov	wer generation			Sec. 3	ering	Ane	deve	t inve	Tool	jinee	ment ability		al &	nicat	Mgt.	g Le			
						10 C 22	2	inee	blem	ign/	uduc npley	dem	enç	iron	cs	vidu	nmu	ect	Lon	÷)-2	-33
Course Ou	tcomes (CO):		<mark>At the</mark> end c	of this course, lea	arners will	be able to:	Children's	Eng	Pro	Des	Cor	Moc	The	Env Sus	Ethi	Indi	Cor	Proj	Life	PS(PS(PS(
CO-1:	Understand the b	asics o <mark>f fuel</mark>	e <mark>l cell</mark> techno	logy				3	1.	-1	-	5-1	-	-	-	-	-	-	-	-	-	-
CO-2:	Infer the concepts	s of fue <mark>l cell</mark>	l <mark>l ele</mark> ctrocher	mistry	1999	S	165.1	3	1.5	1	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Classify the majo	r types <mark>of fu</mark>	<mark>uel c</mark> ells and	their modes of op	eration	22.2	1.8.4	3		-	1	-	- 10	-	-	-	-	-	-	-	-	-
CO-4:	Categorize the m	ethods <mark>of p</mark> i	p <mark>rodu</mark> ction, si	torage and utilizat	ion of hydr	rogen as a fuel	1.1	3		-		-	-	-	-	-	-	-	-	-	-	-
CO-5:	Gain knowledge o	on appli <mark>catio</mark>	<mark>on of f</mark> uel ce	lls in power coger	neration	1000		3	E.	1.1	-	-	1	-	-	-	-	-	-	-	-	-
Unit-1 - Int	roduction to Fuel	Cells and F	Fuel Cell Th	ermodynamics	Contra	the state		-				-	-			_					9	Hour
Introduction Electrolyte. of first and Basic Para	and overview of - Difference betwee second law to fuelo meters of Fuel Cell	fuel cell tec en fuel cell a cells- Heat l ls- Fuel cell e	chnology- A and batteries Potential of efficiency (simple fuel cell, f s, fuel choice- Ove a fuel- Enthalpy Comparison with C	uel cell ad rview of typ of reaction Carnot effici	vantages and dis pes of fuel cells (n,- Work potentia iency	sadvantages- with emphasis al of a fuel: G	Basic fue on PEMF libbs free	cell o C and energ	peratic DMFC y- Pre	on- Lay techno dicting	out of ology- i revers	a Rea Fuel ce ible vo	IFuel C ell thern oltage c	cell- Ti nodyn of a fu	he Hyc amics: Iel cell	lrogen- Therm under	-Oxyge odynai nonsta	en Fue nics re andard	l Cell view- -state	with L Applic condi	iquid ation tions-
Unit-2 - Fu	el Cell Electroche	emistry										1									9	Hour
Introduction	n to electrode kineti	ics - Fuel ce	ell reaction ki	netics- Conversion	ו of chemic	al energy to elect	tricity in a fuel	cell- Read	tion ra	te of fu	el cell-	Butler	-Volm	er equa	tionF	uel cel	ll charg	e trans	fer- Ma	iss trai	nsfer i	n fuel
Linit-3 - Tv	allons and use of it nes of Fuel Cells	uei celi polar	rization curve	e-Activation polari	zauon, onn	nic Polarization-	Concentration	Polarizali	ori, poi	arizalio	on iosse	es.									9	Hour
Classificati	on of fuel cells- Poly	mer electrol	lyte membrar	ne fuel cell (PEMFO	C)- Electroc	les and Electrode	Structurein PE	MFC-Wa	ter Ma	nagem	ent in tl	ne PEN	IFC-P	EMFuel	I Cell (Cooling	and A	ir Sup	oly- Dir	ect me	ethanc	ol fuel
cells (DMF	C)- Anode, cathode	e Reaction a	and Catalyst	s in DMFC- Metha	nol Produc	tion, Storage, an	nd Safety- Alka	line fuel c	ell (PA	FČ)- T	ypes o	f Alkali	ne Ele	ctrolyte	Fuel	Cell- E	lectroa	les for l	Álkalin	e Elec	trolyte	Fuel
Cells- Molte	en Carbonate fuel o	cell (MCFC)-	- Solid Oxide	e fuel cell (SOFC)	- Compari:	son of fuel cell, F	Performance be	ehavior.		_	-											
Unit-4 - Hy	drogen Productio	n, Storage	and Utiliza	tion	octrolucio t	bormal docompo	sition photost	nomical n	hotoco	talutio	Hudro	non str	vrage i	nothod	o. Ont	oard h	vdroa	n stor	200	homio	9 al stor	Hour
physical sto	prage of hydrogen-	Storage in I	metal and al	lloy hydrides- Carl	bon nanotu	bes- Glass capill	lary arrays- pip	beline stor	age- h	ydroge	n utiliza	ation	naye I	neurous	sUni	ioaru II	iyuroge	511 51016	iye- Ci	iennica	ai StOI	aye -

Unit-5 - Application of Fuel Cells in Power Cogeneration

Balance of fuel cell power plant, - Fuel cell power plant structure- Cogeneration- Fuel cell electric vehicles- Fuel cell in Motor cycles and bicycles, airplanes- Case study: fuel cell vehicles with electric vehicles- Case study: different fuel cell powered Indian vehicles- Fueling stations- Fuel processor and fuel cell stack- Water, Thermal managements- Safety issues and cost expectation.

	1.	O'Hayre, R. P., S. Cha, W. Colella, F. B. Prinz, "Fuel CellFundamentals", Wiley, 3rd	3.	Bagotsky .V.S, "Fuel Cells",Wiley, 2009.
Learning		edition 2016	4.	DetlefStolten, "Hydrogen and Fuel Cells: Fundamentals, Technologiesand Applications", 2011.
Resources	2.	Viswanathan. B, AuliceScibioh, M, "Fuel Cells – Principles and Applications",		
		Universities Press (India) Pvt., Lt <mark>d., 2009.</mark>		2244 24 U.A.

Learning Assessme	nt									
			Continuous Learning	g Assessment (CLA)		Sum	motivo			
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Lon CL (1	g Learning _A-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	15%		15%		15%	-			
Level 2	Understand	25%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	20%		25%	-			
Level 3	Apply	30%	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	25%		30%	-			
Level 4	Analyze	30%	the course with	25%		30%	-			
Level 5	Evaluate	and the second second	10 10 10 10 10 10 10 10 10 10 10 10 10 1	10%		- 11	-			
Level 6	Create		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	5%			-			
	Total	- 10	0%	10	0%	10	0%			

Course Designers				
Experts from Industry		Experts from Higher Technical Institutions	Internal Experts	
	0	and the second s		



B.Tech / M.Tech (Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses - Syllabi-Control Copy

Course Code	21AUO105T	T MANAGEMENT	(Cours Catego	se ory	0				OPEN I	ELECT	IVE			Ĺ	- T 3 0	P 0	C 3			
Pre-requ Course	isite es	Nil		Co- requisite Course <mark>s</mark>	Nil		Pr	ogres Cours	sive es						Nil						
Course	Offering Departme	ent	Automo	bile Engineering	Data Book / Code	es / Standard	S							Nil							
Course Le	arning Rationale (The nurnose	of learning this cou	urse is to:			1	18		Progr	am Or	itcome	s (PO)					P	roara	m
CLR-1:	Acquire knowledg	ae about	Motor Vehicle A	ct and Laws Govern	ing Transport system												12	S	C		
CI R-2:	Familiarize with T	ransport	system and Ta	Structure	<u> </u>		0			of		ety .							ou	ICOM	35
CL R-3	Know the various	method	s of f <mark>are charging</mark>	and fleet manager	ment		edge		nt of	ions	e	socie			Wor		ance				I
CLR-4:	CIR-4: Acquire knowledge in Intelligent Transport System							/sis	bme	tigat ems	Jsag	and :	~*		eam	Ę	Fina	rning			1
CLR-5	Familiarize with in	surance	nolicies and veh	icle maintenance	100 100 100 100 100 100 100 100 100 100	1.25	ng K	Analy	evelo	nves probl	ool (leer	ent 8 oility		s N T S	catio	gt. &	Lea			I
OEN-0.	r anninanze with in	isurunce				_	leeri	em /	jn/de	uct i lex p	ern T	angir	onm ainab	S	dual	nuni	ct M	ong	<u> </u>	Ņ	က္
Course O	utcomes (CO):		At the end of	this course, learne	rs will be able to:	1000 27	Engir	Probl	Desig	Cond	Mode	The e	Envir Susta	Ethic	ndivi	Comr	^o roje	life	-OSC	-OSc	-SO
CO-1:	Describe the Mot	or vehi <mark>cl</mark>	le Act	P	The cas	1.54.	1.		-	-	-	-	3	3	-	-	-	-	-	_	-
CO-2:	Demonstrate the F	-unctions	s of Transport Sy	stem and Tax Structu	re		-		12	-	-	-	3	3	-	-	-	-	-	-	-
CO-3:	Analyze the cost o	of operat <mark>ic</mark>	on			8.4	2	-	-	-	-	- 30	3	-	-	-	3	-	-		-
CO-4:	Provide conceptu	al desig <mark>r</mark>	<mark>n for Int</mark> elligent 1	ransport System		100		-	-	-	-	- 34	-	-	-	3	3	-	-		-
CO-5:	Recognize the im	portance	<mark>e of vehi</mark> cle mair	tenance.	a financia de la companya de la comp		3	-	11.0	-	-	-	-	-	-	-	-	-	-		-
				6	المحكم والمحاد	1.0								_							
Unit-1 - M	otor Vehicle Act	A . 4 . T 4		The second section	anta Danistratian af unhistr	Dame 14 June 14		0			1-1		hists a	0		4				9	Hour
Authorities	. Responsibilities of	f Driver, p	nic rules and sig public – offences	- Accidents – causes	s and analysis – preventive	measures- Sta	ance- ate an	d inter	state p	ar regu bermits-	Test	for col	mpeten	ce to	drive- l	Licensi	ing of L	on stru Drivers	ciure - and c	- pers condu	ctors-
Rules rega	arding construction	of motor	ve <mark>hicles L</mark> aws	Governing to use of	Motor vehicle.					14			F · · · ·				5				
Unit-2 - Tı	ansport systems a	and Taxa	ation	1.11							1									9	Hour
Transport	systems - Modes of	transpor	rt systems. Road	Network Architectur	e in India- Advantages of Me	otor Transport-	Area	s of im	proven	nent in l	Motor	Trans	portatio	<mark>n-</mark> Prin	cipal fu	unction	of Adn	ninistra	ition- F	unctio	ons of
Traffic and	Engineering divisio	ns- Chaii	n of responsibilit	/- Forms of ownershi	by stateGovernment- Publ	ic body undert	akings	s- Forn	ns of o	wnersh	ip by I	nunici	pality, p	private	under	takings	s- Taxa	tion –	objecti	ves- I	Notor
Venicie Ta	x Structure in India	- Impact	tion	motive sector - Trend	is in revenue generated by F	Road Transpol	τ.													0	How
Introductio	n – Passenger Transpor	n opera	eration Structur	e of passenger trans	nort organization- Requirer	ent on fleet m	anana	mont_	Proble	me on	floot n	nanan	omont_l	Eloot n	naintar	1anco-	Public	rolatio	<u>ne _ n</u>	9	anda
Publicity a	nd passenger amen	ities- Par	cel traffic- Theor	v of Fares- Basic prir	ciple of fare charging- Meth	od ofdrawing	un of	a fare	table-	Variou	s type	s of fa	are colle	ectina	metho	idnee- ids- Fs	timatin	a the i	cost fc	opage or trar	isnorf
vehicles- L	Different rates for di	fferent ty	pe of service- P	rincipal features of op	erating cost- Operation cost	– revenues- Ed	conom	ics – re	ecords.		, cype	0 01 10		Joung				g allo s			0,001
Unit-4 - In	telligent Transpor	t Systen	n																	9	Hour
Introductio	n – Computerized	Vehicle r	routing and Sche	duling System - Adv	r <mark>ance technique in Traffic m</mark>	nanagement- T	<i>raffic</i>	demar	nd Fore	ecast -	ITS DI	raft Po	licy - Co	oncept	ual De	sign of	f Intellig	jent Tr	anspo	rt Sys	tem -
ITS for Tra	ffic Control - ITS for	^r Public T	Fransport - ITS fo	or Highways Traffic na	avigation- Global positioning	g system															

Unit-5 - Vehicle Maintenance and insurance

Introduction – vehicle Maintenance and insurance- Preventive maintenance system in Transport industry- Tyre maintenance procedure Causes for uneven tyre wear- Remedies for tyre wear Maintenance procedure for better fuel economy- Design of Bus depot layout- Insurance types – significance- Comprehensive insurance- Third party insurance- Furnishing of particulars of vehicle involved in accident- MACT – hit and run case- Solatium fund- Duty of Driver in case of accident- Surveyor and loss assessor- Surveyor's report.

Learning Resources	1. 2. 3	"Motor vehicle Act" – Govt of India publications. Shrivastava s k, "Transport Development in India", S Chand &co Pvt Ltd., New Delhi John Duke, "Elect Management" Mc Graw Hill USA - 1984	4. 5.	Government Motor vehicle Act – Eastern Book Company, Lucknow –1989 Kitchin. L. D – Bus operation – ILLiffee and sons Co., London, 3rd edition -1992 Ministry of Road Transport & Hickways, Government of India (moth nic in)
	υ.	John Duke, Theel Management, Mc Olaw Thin, OSA - 1304	υ.	winistry of Road Transport & Highways, Obvernment of India (mortif.me.in)
			_	

Learning Assessment										
			Continuous Learning	Assessment (CLA)		Cum	mativa			
	Bloom's Level of <mark>Thinking</mark>	Form CLA-1 Avera (50	native ge of unit test %)	Life-Lon CL (1	g Learning LA-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	15%		15%		15%	-			
Level 2	Understand	25%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	25%		25%	-			
Level 3	Apply	30%		30%		<u>30%</u>	-			
Level 4	Analyze	30%	the second second	30%		30%	-			
Level 5	Evaluate			1000		-	-			
Level 6	Create		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	N		-	-			
	Total		%	100	0 %	100)%			

Course Designers	HI CONTRACTOR OF A CONTRACTOR OFTA	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. G.Thanigai Arasu Deputy General ManagerTechnical Leader	r 1. Dr.R.Elansezhian, Pondicherry Engineering College,	1. Mr.S. Yokeshwaran, SRMIST
Transversal RNTBCI thanigai.arasu@rntbci.com	elansezhianr@gmail.com	
	2. Mr. S. Sunil Assistant Professor Dept of Automobile MIT	2. Dr.R.Rajendran, SRMIST
	ssunil@mitinida.edu	



B.Tech / M.Tech (Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

Course 21AUO106T Course Name COMPOSITE MATERIALS FOR AUTOMOTIVE APPLICA									Cour Categ	se ory	0				OPEN	ELEC	TIVE			1	- T 3 0	P 0	C 3
Pre-requi Course	site s		Nil		Co- requisit Courses	e	Nil	-	P	ogres Cours	sive es						Nil	1					
Course (Offering D	epartme	nt	Autom	obile Engineerir	ng	Data Book / Co	des / Standard	s	_						Nil							
Course Le	arning Ra	tionale (CLR):	The purpose	of learning thi	is course	is to:			1			Progr	am Ou	Itcome	s (PO)				Pr	ogra	m
CLR-1:	Study ma composit	atrix mate tes	rial, reinfo	forcements of p	polymer matrix	composite	s, metal and ceramic r	matrix	1	2	3	4	5	6	7	8	9	10	11	12	S ou	pecifi tcom	c es
CLR-2: Understand the fundamentals of composite material strength and its mechanical behavior									e		of	s of		iety			¥		a)				
CLR-3: Develop knowledge on processing, interfacial properties and application of composites								5.200	/ledo		ent o	tion	e	soc			Wo		ance	5			
CLR-4:							Sec. 1	Non	ysis	bm	stiga	Usa	and	<u>مح</u>		earr	5	Fin	шi.				
CLR-5:					27				eering h	em Anal	n/develo	uct inve	rn Tool	ngineer	onment inability		dual & T	nunicatio	ct Mgt. 8	ong Lea	~	2	e
Course Ou	itcomes (CO):		At the end o	f this course, I	learners v	vill be able to:	NR. T	Engin	Proble	Desig	Cond	Mode	Lhe e	Envire	Ethics	ndivid	Comr	^o roje	life L	-OSc	-OSC	-SQ-
CO-1:	Understa	and the ba	asics o <mark>f re</mark>	einforcements	and matrix mat	terial	Charles State	5.NP.2212	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Use of m	nathemati	cal tec <mark>hni</mark>	<mark>iques</mark> to predi	ct the macrosco	opic prope	erties of different lamin	ates	3	3	1	-	-	- 16	-	-		-	-	-	-	-	-
CO-3:	Choose s	suitable n	nateria <mark>l to</mark>	o design comp	osites		2,40,6,60	11 T	3	-	3	-	_	-	_	-	11-11	-	-	-	-	-	-
CO-4:	Select su	uitable ma	anufact <mark>uri</mark>	ing process fo	r different types	of compo	osites	100	3	-	1.1	3	-	-		-	-	-	-	-	-	-	-
CO-5:	Compare importan	e/evaluate t enginee	e the r <mark>ela</mark> ering and o	<mark>ative m</mark> erits c other applicat	of using variou ions.	s conven	tional and composite	materials For	3	1	шý	3	-	-	-	-	-	-	-	-	-	-	-
Unit-1 - Int	roduction	to Com	posites		marker 1			11-15-					-	-								9	Hour
Fundament Problems of Strength- D	tals of com on Elastic E Discontinuo	nposites- I Behavior u Dus Fiber	Need for a Inder Long Reinforce	composites- C ngitudinal Load ed Composites	lassification, Ad ing- Elastic Beh s- Applications	lvantages, avior unde of compo	Disadvantages, Prope er TransverseLoading- site	erties and Part Problems on L	ticulate Elastic	of col Behav	mpositi vior un	es-Fibi der Tra	e reinfo ansvers	orcedC se Loa	Compos Iding- L	ite- El ongitu	astic E Idinal	Behavic Tensile	or unde Streng	er Long gth- Tr	iitudina ansvei	al Loa rse Te	ding- ensile
Unit-2 - Po	lymer Ma	trix Com	posites										175									9	Hour
Reinforcem Thermosett Autoclave	nent mater ting resins moldina- F	ial-Fibres , thermop Resin tran	- Glass fi lastic resi Isfer mold	ibre, Carbon f ins- Fillers-Ad dina- Pultrusion	ibre-Processing ditives- Pre-Pro 1. Filament wind	- Aramid cessed Ma ling- Prope	fibre and Boron fibre-F aterial- Molding compo erties of PMCs- Automo	Processing- Pro ound- Prepegs- otive Applicatio	pertie PMC n of Pl	s and proces MCs.	Applic ses- F	ation- I land la	Particle yup, S	e reinfo Spray u	prceme up proc	nt- Na cesses	no reir - Com	nforcen pressio	nent- P on mole	olymei ding, li	r matri njectio	x mat n mol	erial- ding-
Unit-3 - Me	etal Matrix	Compo	sites		,						-											9	Hour
Metallic Ma technique- - Automotiv	trix Matrix- Hot Press /e Applicat	Selectior ing- Diffu tion of MI	n of reinfor sion Bond MCs.	rcement-Proce ding- Gaseous	essing of MMC- state processe	Liquid stat s- Deposi	te processes- Stir Castii tion techniques- Machi	ng, Squeeze Ca ining and joinin	asting- g of M	Slurry MCs- I	Castin Proper	g, Melt ties of	Infiltrat MMCs-	ion- Sµ - Parai	oraydep neters	ositioi affecti	n- Solic ng proj	d state perties	proces of MM	ses- P C- Inte	owder rfacial	Metal Probl	lurgy lems-
Unit-4 - Ce	ramic Ma	trix Com	posites																			9	Hour
Ceramic Ma Processes-	atrix Mater In Situ Ce	rial- Failui eramic Co	re Behavi omposite l	ior of CMCs- 1 Processing- N	oughening of C Ielt Processing-	MCs- Pro Polymer	cessing of CMCs- Cen Infiltration and Pyrolys	amic Particle B is- Properties o	ased I f CMC	Proces s- Auto	ses- C	old Co e Appli	mpacti cation	on- Sli of CM	urry Imp Cs	oregna	tion- S	Sol-gel	Proces	sing- F	Reactio	on Boi	าding

Unit-5 - Carbon /Carbon composites

Carbon /Carbon composites- Carbon Fiber Reinforcements- Matrix Systems-Thermosetting- Thermoplastic and Gaseous precursor- Processing of C/C Composites- Thermosetting Resin Based Processing-Thermoplastic Pitch Based Processing- Chemical Vapor Infiltration- Properties of C/C Composites- Oxidation Protection of C/C composites- Application of C/C Composites- Nanocomposites- Polymer Nanocomposites- Metal Nanocomposites- Ceramic Nanocomposites- Nanocomposites- Properties and Applications

	1.	Krishnan K Chawla, Composite Materials: Science and Engineering, International Edition,	4.	. Sanjay K Mazumdar, "Composites Manufacturing: Materials, Product and Proce:
Loorning		Springer, 2012.		Engineering", CRC Press, New York, 2010.
Deseurees	2.	Mallick, P.K. and Newman.S, Composite Materials Technology, Hanser Publishers, 2003.	5.	ASM Handbook – Composites, Vol-21, 2001
Resources	З.	M. Balasubramanian, "Composite Materials and Processing", CRCpress, Taylor and		
		Francis Group, 2014.		

Learning Assessme	nt	~ ~ ~									
			Continuous Learnin	g Assessment (CLA)		Summativo					
	Bloo <mark>m's</mark> Level of Thinking	Form CLA-1 Avera (50	native ge of unit test %)	Life-Lon Cl	g Learning LA-2 10%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	<u>Th</u> eory	Practice				
Level 1	Remember	15%	1.00 - 2.00	15%		<mark>1</mark> 5%	-				
Level 2	Understand	25%	the Case of	25%		<mark>25</mark> %	-				
Level 3	Apply	30%		30%	-	<mark>30</mark> %	-				
Level 4	Analyze	30%		30%		<u>30</u> %	-				
Level 5	Evaluate					-	-				
Level 6	Create	and the second	a literative states in		10 - XM	-	-				
	Total	100	0%	10	00 %	100)%				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr S. Srinivasan, Ashok Leyland, srinchand@gmail.com	1. Dr.R.Elansezhian, Pondicherry Engineering College, elansezhianr@gmail.com	1. Dr.R.Rajendran, SRMIST,
2. Mr.A.Venugopal, WABCO, venugopal.a@wabco-auo.com	 Dr.T.R.Tamilarasan, Crescent Institute of Science and Technology tamilarasanr@crescent.education 	2. Dr.J.Chandradass, SRMIST,

B.Tech / M.Tech (Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

Course Code	21AUO107T	Course Name	NON DESTRUCTIVE TES	TING AND EVALUATION	Ca	Course Category						OPEN I	ELECT	ΓIVE			L 3	- T 3 0	P 0	C 3
Pre-requi Course	site s	Nil	Co- requisite Courses	Nil		Prog Co	ressi urses	ive s						Nil						
Course (Offering Departme	ent	Automobile Engineering	Data Book / Codes / Stan	dards	121							Nil							
Course Lo	arning Pationala		a purpose of learning this course	a ia ta		-				Drogr		toomo	~ (PO)					Pr	ograr	n
Course Le		(CLK). 11	le purpose of learning this cours		_		_						5 (FU)		4.0			S	pecific	
CLR-1:	Understand the t	asic principle	e, importance and applications of	various NDT techniques		1	2	3	4	5	6	1	8	9	10	11	12	ou	tcome	es
CLR-2:	Acquire proper s products.	kills and equ	uip with proper competencies to I	ocate flaws in various Materials a	and	ge		of	is of	5	ciety			y.		e				
CLR-3: Equip themselves familiar with industrial applications						wled		lent	atior	ge	d so			МИ		nan	b			
CLR-4:						Yuo	IJSI	ndo	estig: olem	Use	r and	৵		Tear	o	& Fi	arnir			
CLR-5:						reering	em Ana	gn/devel ions	luct inve olex prot	ern Tool	engineer	onment	s	idual & -	municat	ct Mgt.	-ong Le:	-	-2	ۍ ا
Course Ou	tcomes (CO):	A	t the end of this course, learners	will be able to:		- ugi	rob	Desig	Conc	Aode	he	Envir Sust	Ethic	ndiv	Com	roje	-ife L	SOS	Ś	SO
CO-1:	Understand vario	us Non- <mark>Destru</mark>	uctive Techniques to detect defects	The Children		3	-	-	-	-	- 11	-	-	-	-	-	-	-	-	-
CO-2:	Apply scientific a	nd tech <mark>nical l</mark>	knowledge to the field of non-destr	uctive testing		3			-	-	. 1	-	-	-	-	-	-	-	-	-
CO-3:	Use the relevant	non-de <mark>struct</mark>	ive testing methods for various en	gineering practice		3	-		-	-	- 1	-	-	-	-	-	-	-	-	-
CO-4:	Recognize and a	chieve high le	evels of professionalism in their wo	^k		3	-		et.25	-		-	-	-	-	-	-	- 1	-	-
CO-5:	Engage in lifelon	g learnin <mark>g, th</mark>	ought process and development		A 1	3	-	÷	-	-	-	-	-	-	-	-	-	-	-	-
				1.1						1	× .							<u> </u>		
Unit-1 - Ov	erview of NDT										-								9	Hour
Introduction for Visual II	n to NDT- Compari nspectionMicrosc	son of Destru ope, Rigid Bo	ictive and Non Destructive Methods prescope Mini and Hybrid Borescop	e- Overview of Non Destructive Tes be- Optical Aid used for Visual Insp	ting Me ection-E	ethods- Extenda	Cast able l	ting D bores	efects- cope, E	Weldii ndosc	ngDefe ope, T	ects- Vi ele <mark>sco</mark> j	isual T pe and	esting- Holog	Princiµ graphy-	ole and • Merits	Tools- and D	Optica emerit	al Aid ts of V	used ′isual
Testing	rface NDE Metho	de	1			-				1										Hour
Liquid Pene Penetrant F Demagneti	etrate Testing-Princ Removal Process, A zation-Method of L	iple, Characte Advantage an Demagnetizat	eris <mark>tics and typ</mark> es of penetrants- Dev nd Limitation of Liquid penetrate Tes tion	elopers-Function, Properties and ty t- MagneticParticle Testing-Introdu	pes-Cle uction,	eaning Metho	Meth d of	nods a Magn	nd Emu netizatic	ulsifiers on- Pro	s-Liqui ocedu	d penet re for l	trant Te Magne	esting p etic Pa	orocedi rticle	ure and Testing	Interpr - Resi	etatior dual N	n of res Aagne	sults- tism-
Unit-3 - Th	ermography and l	Eddy Current	t Testing		-	_		_	-										9 [Hour
Principle of	Thermography- IR-	radiation-Prop	perties, Factors affecting Thermal m	easurements- Contact and non-cont	act tem	peratur	e ser	nsors-	Non C	ontact	Thermo	ography	Syster	n-Adva	antages	, Disad	vantage	es and a	applica	ations
of Thermogi	rapny-Eddy Current trasonic Testing (lesting-introd	uction and principle-Factors affecting	eddy current- Instrumentation of edd	iy currei	nt testi	ng- I	ypes o	ot probe	es- Aa	<i>lantag</i>	es, Limi	itations	s and a	ppiicat	ion ot e	eaay cu	rrent te	esting 9	Hour
Ultrasonic	Testing-Introductio	n, Basic Prop	perties of sound beam, Acoustic In	pedance- Ultrasonic Transducers	- Inspec	ction N	letho	ds-Tra	ansmis	sion ai	nd pul	se-echo	o meth	od- In	spectio	n Meth	ods- A	ngle t	beam (oulse
echo metho Technique-	od- Ultrasonic Flav Instrumentation o	w Detection I f Acoustic El	Equipment, Mode of Display-A-Score mission Testing- Applications.	an, B-scan, C-scan- Advantages,	limitatio	ons and	d app	plicatio	on of L	Iltraso	nic te	sting n	nethod	I- Acou	ustic E	missio	n Test	ing-Pri	nciple	and
			*																	

Unit-5 - Radiography

Radiography- Principle- Electromagnetic radiation sources- Radiation Attenuation and Effect of radiation on film- Radiographic Imaging- Inspection Techniques- Single wall and double wall penetration techniques-Inspection Techniques-Multiwall penetration technique- Advantages, disadvantages and applications of radiography- Real time Radiography-Microfocal Radiography- Advantages and limitations of Microfocal Radiography- Xero Radiography.

	1.	Baldev Rai, T.Javakumar, M.Thavasimuthu "Practical Non-Destructive Testino".	4.	Paul E Mix. "Introduction to Non-destructive testing: a training guide". Wiley. 2nd Edition New
		Narosa Publishing, 3rd Edition, 2014	11	Jersey, 2005
Learning	2.	Ravi Prakash, "Non-Destructive Testing Techniques", 1st revisededition, New Age	5.	Charles, J. Hellier, "Handbook of Nondestructive evaluation", McGraw Hill, New York, 2nd Edition,
Resources		International Publishers, 2010		2013.
	З.	ASM Metals Handbook, "Non-Destructive Evaluation and Quality Control", American		
		Society of Metals, Park, Ohio, USA, 200, Volume- 1, 2018.		

Learning Assessme	nt										
		~ ~	Continuous Learning	g Assessment (CLA)	-	Summativo					
	Bloom's Level of Thinking	Form CLA-1 Avera (50	ative ge of unit test %)	Life-Long CL (10	g Learning A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	<u>Th</u> eory	Practice				
Level 1	Remember	15%	the state of the	15%	1 A .	15%	-				
Level 2	Understand	25%		25%		<mark>25</mark> %	-				
Level 3	Apply	30%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	30%		<u>30</u> %	-				
Level 4	Analyze	30%		30%		<mark>- 30</mark> %	-				
Level 5	Evaluate					-	-				
Level 6	Create				- C -	-	-				
	Total	100)%	10	0 %	1(00 %				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.C.Subash, Mahindra and Mahindra,	1. Dr.P.Jawahar, Assistant Professor, NIT Agartala,	1. Dr.J.Chandradass,SRMIST
SUBASH.C@mahindra.com	drjawahar.me@nita.ac.in	
2. Mr. R. Silambarasan, RNTBCI,	2. Dr. D. Muruganandham, SVC of Tech,svctvp@gmail.com	2. Dr.P.BaskaraSethupathi, SRMIST,
silambarasan.ramadoss@rntbci.com		

Course Code	Course Code 21AUO108T Course Name ADVANCED ENGINE TECHNOLOGY						0	OPEN ELECTIVE									P 0	C 3	
Pre-requis Courses	site S	Nil	Co- requisite Courses	Nil	P	rogres Cours	ssive ses						Nil						
Course C	Offering Departmo	ent	Automobile Engineering	Data Book / Codes / Standar	ds	-						Nil							
Course Lea	arning Rationale	(CLR):	The purpo <mark>se of learnin</mark> g this course	is to:	1	1	1		Progra	am Ou	itcome	s (PO))				P	rogra	m
CLR-1:	Explore the susta	ainable c	levelopmen <mark>t, energy co</mark> nservation, efficie	ncy and environmental Preservation.	1	2	3	4	5	6	7	8	9	10	11	12	01 01	pecit	ic ies
CLR-2:	CLR-2: Provide a comprehensive reference to understand the current trends in Advanced engines						÷	of	10	ety			¥						
CLR-3:							ent o	tions	ge	soci			Wo		ance	D			
CLR-4:						lysis	mdo	stiga	Usa	and	<u>مح</u>		Team	uo	Z Fic	arnin			
CLR-5:						n Ana	/devel	ct inve ex prob	n Tool	gineer	nent		lal & T	unicati	Mgt. 8	ng Lea			
Course Outcomes (CO): At the end of this course, learners will be able to:						Proble	Design	Condu	Moder	The en	Envirol Sustair	Ethics	Individ	Comm	Project	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Acquire knowled	ge abou	t the Thermodynamic Analysis of SI Engi	ine Combustion process.	3	-	-	-	5-1	-6	-	-	-	-	-	-	-	-	-
CO-2:	Acquire knowled	ge abou	<mark>t the Th</mark> ermodynamic Analysis of CI Eng	ine Combustion process.	3	-	-	-	-	- 1	-	-		-	-	-	-	-	-
CO-3:	Understand the \	/arious <mark> </mark>	Fuel injection system for SI & CI engine	22 - C - C - C - C - C - C - C - C - C -	3	1	-	-	-	- 35	-	-		-	-	-	-	-	-
CO-4:	Gain knowledge	about th	<mark>e engine</mark> modification required for alterna	ative fuels.	3	-	-	-	-	- 34	-	-	-	-	-	-	-	-	-
CO-5:	Acquire knowled	ge abou	t recent trends in IC engines.	The state of the	3	-	1.1-1	-	-	- 74	-	-	-	-	-	-	-	-	-
Unit-1 - Spa Introduction Knock- Con SI Engines.	ark Ignition Engi to Spark ignition nbustion Chamber	i nes engines: rs- Introd	- Air-Fuel Ratio Requirements- Design of Juction To Thermodynamic Analysis of SI	Carburetor- Carburetor –Fuel Jet Siz Engine- Thermodynam <mark>ic Anal</mark> ysis Of	e and SI Eng	/enture ine- Th	e Size- nermoo	- Stages lynamic	of Cor Analys	nbust sis Of	ion- No. SI Engi	rmal a ne Col	nd Abr mbusti	normal ion Pro	Combi cess- F	ustion- Recent	Facto Devel	9 rs Affe lopme	Hour ecting ents In
Unit-2 - Co	mpression Igniti	on Engi	nes						11									9	Hour
Introduction	to Compression	Ignition	Engines- Stages of Combustion in Cl	Engine- Normal and Abnormal Con	bustion	1 - Fa	actors	Affecting	Knoc	k-Dire	ect and	Indirec	t Inject	tion Sys	stems-	Combi	ıstion	Charr	ibers-
Unit-3 - Fu	el systems		iodynamic Analysis Of Cr Engine- memo	uynaniic Analysis Of Ci Engine- Con	ibustioi	TFICE	535 111	CI LIIYIII	63- NC	Cent I	Develop	Jinenta		Ligine	73			9	Hour
Introduction Line, Rotary Dispersion	to Fuel Injection S Pumps- Testing- Of Diesel- Electro	System- Governin onic Eng	Fuel Injection <mark>System Func</mark> tions And Com ng- Injection Lag- Fuel Injector - Types Of ine Management system- Common Rail	ponents- Petrol Injection - Open Loo Injection Nozzle-Fuel Spray Charac Direct Injection Diesel Engine	o Syste teristics	ms- M s- Fue	ono Po I Injec	oint And tion Tim	Multi P ing- F	oint li actor	njection s Influe	Syster encing	m- Dire Fuel	ect Injeo Spray	ction Sy Atomiz	/stems- ation,	- Fuel Pene	Injecti tration	on In- 1 And
Unit-4 - Alt	ernate Fuels	ootis		reportion Quitability AlL-L	ual f	10	ain	Vacati				loost		AL. (! !	unf-	9	Hour
Introduction Gas- Hydro fuels used i	to Engine Modifi gen as a fuel in IC in CI engines.	cations I Cengine	For Alternative Fuels, Alternative fuels Plesses P Plesses Plesses Ple	operues, Suitability- Alconols as a F nission and combustion characteristi	uel for s of SI	engine	gines- es, Per	vegetat formanc	e, emi:	s And ssion	BIO- DI and coi	nbusti	BIO-Ga on cha	as- Nat aracteri	urai Ga istics o	as- Liq f CI enț	uetied gines-	Alteri	native

Unit-5 - Recent Trends

Recent Trends- Homogeneous Charge Compression Ignition Engine- Lean Burn Engine- Stratified Charge Engine- Surface Ignition Engine- Four Valve and Overhead Cam Engines- Alternative Power Sources: Wankel Rotary Engine- Sterling Engine, Gas Turbine Engine.

	1.	Heinz Heisler, "Advanced Engine Technology"., SAE International Publications,	4.	Patterson D.J. and Henein N.A, "Emissions from combustion engines andtheir control".,
Learning		USA,1998	1	Ann Arbor Science publishers Inc, USA,
	2.	Ganesan V. "Internal Combustion Engines"., Third Edition, Tata Mcgraw-Hill	5.	Gupta H.N, "Fundamentals of Internal Combustion Engines"., PrenticeHall of India, 2006
Resources		,2007	6.	Ultrich Adler, "Automotive Electric / Electronic Systems"., Published by Robert Bosh
	3.	John B Heywood. "Internal Combustion Engine Fundamentals"., Tata McGraw-Hill 1988		GmbH,1995

			Summotivo						
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (1)	g Learning "A-2 0%)	Final Examination (40% weightage)			
		Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	15%	2	15%		15%	-		
Level 2	Understand	25%	100 million - 100 million	25%		25%	-		
Level 3	Apply	30%	the state of the	30%		<mark>30</mark> %	-		
Level 4	Analyze	30%	-	30%	-	<u>30%</u>	-		
Level 5	Evaluate	1000	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	A. 9724-2	< · · · ·		-		
Level 6	Create	A State States	2 - C - C - C - C - C - C - C - C - C -	-			-		
	Total	10	0%	100 %					

Co	urse Designers								
Experts from Industry		Ex	perts from Higher Technical Institutions	Internal Experts					
1.	Dr. N. Saravanan, Mahindra Research Valley,	1.	Dr.S. Premnath, Sri Venkateswara College of Engineering,	1.	Dr. C. Prabhu S <mark>RMIST</mark>				
	n.saravanan@mahindra.com		prem@svce.ac.in						
2.	Mr.P.MohamedAzarudeen,Renault Nissan Technology and	2.	Dr.S.RamKumar, Vel Tech RangarajanDr.Sagunthala R&D Institute of	2.	Dr. T.Prakash <mark>, SRM IST</mark>				
	Business Centre,		Science and Technology , drsramkumar@veltech.edu.in						
	mohamedazarudeen.pakkirmohideen@rntbci.com								

Course Code 21AUO109T Course Name NEW PRODUCT DEVELOPMENT			C	Cours atego	se ory	0				OPEN	ELEC [.]	ΓIVE			ļ	- T 3 0	P 0	C 3				
Pre-requi Course	isite es	Nil		Co- requisite Course <mark>s</mark>		Nil		Pr (ogres Cours	sive es						Nil	I					
Course	Offering Departme	ent	Autom	obile Engineering		Data Book / Codes / St	andards								Nil							
Course Le	earning Rationale	(CLR):	The purpo <mark>se</mark>	<mark>of learnin</mark> g this c	course is to				1			Progr	am Ou	itcome	s (PO)				P	rogra	m
CLR-1:	understand the ne	ew product	t process		195			1	2	3	4	5	6	7	8	9	10	11	12	01	itcom	ies
CLR-2:	CLR-2: learn and apply the concepts and tools necessary through case examples and assignments										f	10	λ							1		
CLR-3:	CLR-3: actually use the new product development process by conceiving your own new product or server and introductory launch plan						ervice	vledge		ient of	ations o s	ge	l societ	4	1	n Work		Jance	ŋ			
CLR-4:	CLR-4:						1.10	Kno	lysis	opm	stig	Use	ranc	~ ຮ		Tear	u	ξ. Έ	arnir			
CLR-5:						eering	em Ana	n/devel	uct inve lex prot	rn Tool	nginee	onment inability		dual & -	nunicati	ct Mgt.	ong Lei	-	2			
Course O	utcomes (CO):		At the end o	f this course, lear	rners will b	e able to:		ingin	nobl)esig		lode	hee	invire	thic	ivibr	Comr	noje	ife L	-os	- S O-	-OS
CO-1:	Familiarize with	the Conc	cept of Design	thinking		L CHARLES		3	-	3	3	-	-	ш <i>0</i>) -	 _	-	-	3		3	-	-
CO-2:	Understand the i	importan <mark>ce</mark>	e of new pr	oduct developmen	nt to firm per	formance		3				-	_ 14	1			-	3	-	3	-	-
CO-3:	Learn methods of	of gener <mark>ati</mark>	ting, evaluating	and testing produ	luctideas			3		121	3	-	-	-	-	-	-	3	-	3	-	-
CO-4:	Identify relevant,	componen	nts,and,plan,a	oroduct launch	1	The second se		3		12	1.3	_	-		-	_	-	3	-	3	-	-
CO-5:	Learn methods of	of evalu <mark>ati</mark>	ing and monit	oring the success c	of a launch			3	1	1.0	-	-	-	-	-	-	-	3	-	3	-	-
												11	1					1			_	
Concont of	esign Ininking	Polo wit	ithin NPD and	Innovation Princ	ciplos and t	ho "Mindsot" of Dosign T	Thinking	Doci	an Th	inkina	Tools	Nino (ritoria	of an	Inspir	ational	Dosia	n Dore	onae:	Powo	9 ful To	Hour
Designers	i Design thinking	- Role Wil	uiiii NFD allu		ipies and u	ie minusel of Design r	minking-	Desi	yn m	iiikiiig	10013-	wine c	JILEIIA		inspire	101181	Desigi	I- Feis	,011dS. 1	rower	iui io	101 101
Unit-2 - Ne	ew Product Reso	urces		1000	1.1	1. S.						1									9	Hour
Technolog Need for c customer i New Produ	ical Research Basi leveloping product needs –voice of cu ucts - Creative desir	ic concepts is – the im istomer –c an Model E	s and need for nportance of e customer popul Preparation Te	Intellectual Proper ngineering design lations- hierarchy sting Cost evaluati	erty Patents 1 – types of of human ne tion Patent a	Patent Search Patent Law design –the design proc eeds-need gathering meth	ws Interna cess – rel nods – affi	ationa levan inity c	al Cod ce of diagrai	le For produi ms - C	Patents ct lifecy ollectio	s Intell cle iss n Of Ic	ectual sues ir leas Pl	Propert desigi urpose	ty Righ n –de: Of Pro	its(IPR signing oject - (? Copyr y to cou Selecti	rights (des an on Crite	Geogra d stand eria Sc	phical dards- reenin	Indica Ident g Idea	ations tifying as For
Unit-3 - Ne	ew Product Plann	ing and D	Development	sting Cost evaluation	ion r atoni a				-	-		-			-						9	Hour
Design Of	Prototype Testing	of prototy	pe Quality Sta	ndards Marketing	Research I	ntroducing New Products	Integrate	, proc	cess d	lesign	Manag	ing co	sts Ro	bust de	sign I	ntegrat	ting C/	AE, CA	D, CA	M tool	s Jou	irneys
In Product	Development Proc	duct Devel	lopment Proce	ss Tools Scoping	Product De	velopments Technical And	d Busines	ss Co	ncern	is Und	erstand	ling Ci	ustome	r Need	's Esta	ıblishir	ng Proc	luct Fu	inction	involv	e cus	tomer
in develop	ment and managin	ng requiren	ments process	management and	l improveme	ent Plan and establish proc	duct spec	iticati	ons													Hour
Why Asse	ss the Market Dem	and? Meth	hods for Asses	sing the Initial Der	mand- Expe	ert Evaluation Technique-	Jury of F	xecu	tive O	ninion-	Delph	i Meth	od- Sa	les For	ce Coi	mposit	e-Sunr	lv Cha	ain Par	tner F	oreca	astina-
Decision 1	Free Diagram- Man	ket Potenti	tial–Sales Reg	uirement Method-	Graphical	Displays of Data- Consta	nt Mean	Mode	el-Line	ear Mo	del-Qu	adratic	: Mode	I-Expo	nentia	I Mode	9 0 0pp 	., 0.10			0.000	cung

Unit-5 - Product Architecture

Establishing the Product architecture creation clustering geometric layout development fundamental and incidental interactions related system level design issues secondary systems architecture of the chunks creating detailed interface specifications

Learning Resources	1. 2.	Paul trott "Innovation Management and New Product Development"5th Edition Sep 2011 Barclay, Z. Dann, P. Holroyd, "New Product development" I, Published by BH Butterworth-Heinemann a division of Reed Educational and professional publishing	3.	Marc Annacchino "New Product Development " 1st Edition Sep 2003	
		limited.2000			
				AV VA	

Learning Assessment					1					
			Continuous Learnin	Summativo						
	Bloom's Level of <mark>Thinking</mark>	Forn CLA-1 Avera (50	native ige of unit test 0%)	Life-Lon Ci (1	g Learning LA-2 10%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	15%		15%	-	15%	-			
Level 2	Understand	25%		25%		<mark>2</mark> 5%	-			
Level 3	Apply	30%	0.000	30%		<mark>3</mark> 0%	-			
Level 4	Analyze	30%	10000	30%		<mark>30</mark> %	-			
Level 5	Evaluate					-	-			
Level 6	Create		- 185 B.C.	N	-		-			
	Total	10	0%	10	00 %	10	0 %			

Course Designers								
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts						
1. Mr. P. Poongukamaran, MD TICEL	1. Mr. S. Sunil Assistant Professor Dept of Automobile MIT	1. Mr. S. MadhanKumar. SRMIST						
	ssunil@mitinida.edu							
2. Mr. G. Thanigai Arasu Deputy General ManagerTechnical	2. Mr. Muthuvel Assistant Professor Sairam EngineeringCollege	2. Mr. S. Yokeshwaran, SRM IST						
Leader Transversal RNTBCI thanigai.arasu@rntbci.com	muthuvel.rd@sairam.edu.in							



Course Code	21AUO110T	Course Name	AUTOMOTIVE STANDARD	S AND REGULATIONS	Cours atego	se ory	0		OPEN ELECTIV			ΓIVE	VE		1	- T 3 0	P 0	C 3	
Pre-requis Course Course C	site s Offering Departme	Nil Co- requisite Courses Nil Progressive Courses Nil ing Department Automobile Engineering Data Book / Codes / Standards Nil																	
Course Le	arning Rationale	(CLR):	The purpos <mark>e of learnin</mark> g this course i	is to:	9	1	1		Progra	am Ou	tcomes	s (PO))				P	rogra	m
CLR-1:	Impart knowledge	wledge on basics of automobile standards and regulations 1 2 3 4 5 6 7 8 9 10 11							12	S OU	pecifi itcom	es							
CLR-2:	Know the various	s safety st	anda <mark>rds on collisio</mark> n.	Contraction of the	ge		of	s of	Pc.	iety			¥		ø				
CLR-3:	Gain knowledge about various safety standards in automotive electrical systems.						ient o	ation	ge	l soc			n Wo		Jano	Ð			
CLR-4:	Understand the re	egulations	; u <mark>sed in hy</mark> brid and electric vehicles.	and the states	Knov	Ilysis	lopm	stiga	Usa	r anc	~~		Tean	ion	& Fir	arnin			
CLR-5:	Impart knowledge	e on regul	ations used in gaseous fuel vehicles.		sering	m Ana	ns ns	ict inv∈ ex prol	n Tool	ginee	nment		ual & .	unicat	t Mgt.	ng Le			
Course Ou	itcomes (CO):		At the end of this course, learners w	ill be able to:	Engine	Proble	Design	Condu	Moder	The er	Enviro Sustai	Ethics	Individ	Comm	Projec	Life Lo	PSO-1	-OS	PSO-3
CO-1:	Gain knowledge	about b <mark>as</mark>	ic automobile standards and regulations	ALC: CARS AND	3	-	-	-	-	-6	-	-	-	-	-	-	-	-	-
CO-2:	Gain knowledge a	about s <mark>tar</mark>	ndards for safety during collision		3	(•)	12	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	: Understand the various standards used for automotive electrical systems							-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	CO-4: Gain knowledge about the regulations used for hybrid and electric vehicles					-	-	-	-	1	-	-	-	-	-	-	-	-	-
CO-5: Gain knowledge about the regulations used for gaseous fuel vehicles					3	-	1.1	-	-	-	-	-	-	-	-	-	-	-	-
Unit-1 - Ge	eneral Automotive	Standar	ds and Regulations	ALC: NOT THE REAL PROPERTY OF										•				9	Hour

Unit-1 - General Automotive Standards and Regulations

Procedure for Type Approval and Certification of Vehicles for Compliance to Central Motor Vehicles Rules- Speed Limitation Devices and Its Specifications- Arrangement of Foot Controls of Vehicles- Starting Grade-Ability - Method of Measurement and Requirements- Protective Helmets for Motor Cycle Riders- Protective Helmets and Visors for Motorcycle Riders – Specification-Two Wheeled Vehicles – Location, Identification and Operationof Controls, Tell-Tales and Indicators- Procedure for Type Approval and Establishing Conformity of Production for Safety Critical Components- NCAP And BNVSAP Ratings, Requirements for School Buses

Unit-2 - Collision Safety Standards

Bumper Fitment on Vehicles – Test Methods- Safety Belt Assemblies, Safety Belt Anchorages – Specifications- Seats, their Anchorages and Head Restraints Specifications, Survival Space for the Protection of the Occupants- Requirements for Behaviour of Steering Mechanism of a Vehicle in a Head-On Collision- Procedure for Determining the "H" Point and The Torso Angle in Seating Positions of Motor Vehicles. Requirements for the Protection of the Occupants in the Event of an Offset Frontal Collision

Unit-3 - Automotive electrical Standards

Testing Procedure and Requirements for Headlamp Beam- Approval of Front Position Lamps, Rear Position Lamps, Stop Lamps, Direction Indicators, Rear Registration Plate Illuminating Devices and Reversing Lamp- Provisions Concerning the Approval of Headlamps Equipped with Gas Discharge Light Sources-Provisions Concerning the Approval of Light Emitting Diode(LED) Light Sources For use in Approved Lamp Units- Lighting, Signalling & Indicating Systems on Motor Vehicles- Performance Requirements of Lighting and Light-Signalling Devices

9 Hour

Unit-4 - Electric and Hybrid Vehicle Standards

Battery Operated Vehicles – Requirements for Construction and Functional Safety-Measurement of Electrical Energy Consumption.- Method of Measuring the Range Measurement of Net Power and the Maximum 30 Minute Power and Speed- Electric Power Train - Requirements for Construction and Functional Safety-Measurement of Electrical Energy Consumption- Method of Measuring the Range-Measurement of Net Power and The Maximum 30 Minute Power and Speed- CMVR Type Approval for Hybrid Electric Vehicles, CMVR Type Approval of Vehicles Retrofitted with Hybrid Electric System. Hour

Unit-5 - CNG, LPG Vehicles and Engine Emission Standards

Safety and Procedural Requirements for Type Approval of CNG Operated Vehicles- Safety and Procedural Requirements for Type Approval of CNG Operated Vehicles- Safety and Procedural Requirements for Type Approval of LPG Operated Vehicles- Code of Practice for use of LPG Fuel in InternalCombustion Engine to Power 4 Wheeled Vehicles- Code of Practice for use Of LPG Fuel in Internal Combustion Engine to Power 2 & 3 Wheeled Vehicles. Bharath and Euro Emission Norms.

Learning Resources	1. ARAI publications "\Automotive industry standards", April 30,2016.

Learning Assessme	ent										
		~	- 10-	Summetive							
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test %)	Life-Long CL (10	g Learning A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	<u>Th</u> eory	Practice				
Level 1	Remember	15%	the second second	15%		<mark>15</mark> %	-				
Level 2	Understand	25%		25%		25%	-				
Level 3	Apply	30%	5 7 See 19 /	30%	W	30%	-				
Level 4	Analyze	30%		30%		<u> </u>	-				
Level 5	Evaluate	and the second		and the second second		-	-				
Level 6	Create	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1					-				
	Total	100	0%	10	0 %	1(0 %				

Course Designers									
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts							
1. Mr.K.V. Simmom, Royal Enfield,	1. DrA.Samuel Raja, Thiyagarajar college of EngineeringMadurai,	1. Dr. T. Praveenkumar, SRMIST							
kvsimmon1@royalenfield.com	samuel1973@tce.edu								
2. Mr.R.Srikanth, Altair, srikanth.r@altair.com	2. Mr. N.Ravikumar, Crescent Institute of Science and Technology,	2. Dr. K. Kamalakkannan, SRMIST							
	ravikumar@crescent.education								

Course Code	21AUO111T	Course Name	AUTC	AUTOMOTIVE SCIENCES Course Category					OPEN ELECTIVE									L T P C 3 0 0 3				
Pre-requisite Nil Co- requisite Nil Courses Nil						Pr	ogres Cours	sive es	Nil													
Course Offering Department Automobile Engineering Data Book / Codes / Standard						\$							Nil									
				and the second sec			1.0	1										1				
Course Le	arning Rationale	(CLR):	The purpo <mark>se of learnin</mark> g this	s course is to:			1	10	1.4	Progr	am Ou	utcome	s (PO))				P	ogra	m		
CLR-1:	Understand the ability and infor engine technology		informatio <mark>n to follow</mark> recent o	rmation to follow recent developments about the internal combustion		1	2	3	4	5	6	7	8	9	10	11	12	Specific outcomes				
CLR-2:	-2: Describe methods for reduction of exhaust emissions, and their relations to fuel quality and engine performance					e		of	s of	6	tiety			Ł		ę						
CLR-3:	Demonstrate cor	npetency in	skills related to automotive t	technology.		vled		ent	tion %	ge	soc			M		anc	b					
CLR-4:		· ·		(1.1	Nov	ysis	dd	stiga	Usa	and	~		earr	ч	Fin	ці.					
CLR-5:			1.50			ering k	n Anal	/develo	ot inves x prob	Tool	gineer	iment a		lal & T	unicatio	Mgt. 8	ng Lea					
Course Ou	itcomes (CO):	- 1	At the end of this course, le	earners will be able to:	2.4	Engine	Probler	Design	Conduc	Moderr	The en	Enviror Sustair	Ethics	Individu	Commi	Project	Life Lo	PSO-1	PSO-2	PSO-3		
CO-1:	Understand the Insights in Internal Combustion Engine				1.1	3	1.0	24		-	-	-	-	-	-	-	-	-	-	-		
CO-2:	Summarize the Knowledge in Engine Cycles							5.4	-	-	-	-	-	-	-	-	-	-	-	-		
CO-3:	Compare the technology in emissions					3	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-		
CO-4:	Demonstrate the Relationship in Velocity, Acceleration and Speed					3		1	100	-		-	-	-	-	-	-	-	-	-		
CO-5:	Explain the technology of Vehicle Characteristics					3		-	-	-	-	-	-	-	-	-	-	-	-	-		
		ielegy el re		and the second second		-				1										L		
Unit-1 - Int	ernal combustion	n engines	120								-								9	Нои		
Internal con crank angle torque and	mbustion engines- e- Mechanical effic SFC compared- T	Engine pov ciency of an hermal effic	ver and Brake power- Engine engine- Morse test- Characte iency- Indicated thermal efficie	power and Brake power- Mean ef eristic curves of engine performanc ency- Brake thermal efficiency peti	ffective pressu ce- Volumetric rol vs. diesel-	ure- H : effici Heat	orsepo ency- energy	ower P Torque ⁄ balan	S – the vs. en ce	DIN- gine sj	Indica beed-	ted pow Specific	er Me fuel c	an effe onsum	ective p option v	oressur s. engi	e- Cylii ine spe	nder p ed- Br	ressu ake p	re vs ower		
Unit-2 - Th	eoretical engine	cycles			100					1									9	Hou		
Theoretical Relative efi double-acti	l engine cycles- Th ficiency- Diesel or ng Stirling engine-	e constant v constant pr The gas tur	volume <mark>cycle (Otto</mark> cycle)- The essure cy <mark>cle- The dual</mark> combu bine- Summary of formulae- S	ermal efficiency of the theoretical C ustion cycle-Operation of dual com Simple Problems	Otto cycle- The bustion cycle	ermal Com	efficier pariso	ncy in t n betwo	erms o een the	f comp oretica	oressic al and	on ratio i practica	- Effec al engii	ct of co ne cycl	mpres les- Th	sion rat e Stirlin	tio on ti ng engi	herma ne reg	effici enera	ency tor- A		
Unit-3 - Fu	els and combust	tion & emis	sions					_	-										9	Hou		
Fuels and c chambers- Catalysts- I	ombustion & emiss Diesel fuel-Flash Diesel particulate f	sions- Produ point- Pour filters- Lique	icts of combustion <mark>- Relevant co point-Cloud point- Exhaust e</mark> fied petroleum gas (LPG)- <mark>Ze</mark>	ombustion equations- Air–fuel ratio missions-Factors affecting exhaus ero emissions vehicles (ZEVs).	Petrol engine st emissions- l	comb Emiss	ustion- ions ar	Deton	ation, l cause	Pre-ign s- Meti	<mark>ition-</mark> hods o	Octane f contro	rating Iling ex	- Com khaust	pressio emissi	on ignii ons-E	tion en xhaust	igine (gas re	circul	ıstior ation		
Unit-4 - Ve	locity and accele	eration, spe	eed								_					<u> </u>			9	Hou		
Speed and weight- Ine	velocity Acceleration rtia- Motion under	on- Velocity- r gravity- Ar	-time graph Uniform velocity- L Igular (circular) motion- Equa	Jnitorm acceleration- Equations of n tions of angular motion- Relation	notion and the between angl	ir app <mark>ular</mark> ai	lication nd line	<mark>n to ve</mark> ł ar velo	nicle teo city- Ce	chnolo entripe	gy- Fo tal acc	rce, ma celeratio	ss and n- Acc	d acce celerati	leratioi ing torq	n- Rela jue- Mo	tion be odel pro	etweer oblem	mas Land	s and 11.		
						-														6		
Unit-5 - Vehicle Characteristics

Load transfer under acceleration- Static reactions- Vehicle under acceleration- Vehicle acceleration – effect of load transfer- Front wheel drive- Maximum acceleration – rear wheel drive- Four wheel drive – fixed-Four wheel drive – with third differential- Accelerating force – tractive effort-Tractive resistance- Power required to propel vehicle- Gradeabilityspeed- Skidding speed

	1.	Allan Bonnick "Automotive Science and Mathematics "Published by Elsevier Ltd First	3.	N. K. Giri "Automobile Technology" Khanna Publishers; 2nd edition (2002)	
Learning		edition 2008			
Resources	2.	Willard W. Pulkrabek "Engineering Fundamentals of the InternalCombustion Engine"			
		Pearson; 2 edition (10 June 2003)			

Learning Assessme	ent	1									
		N	Continuous Learning	Assessment (CLA)		Sum	mativa				
	Bloom's Level of Thinking	Forma CLA-1 Average (50%	tive e of unit test 6)	Life-Long CL (10	g Learning .A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	15%	1.1.1	15%		<mark>1</mark> 5%	-				
Level 2	Understand	25%	0.000	25%		<mark>25</mark> %	-				
Level 3	Apply	30%	11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	30%		<mark>30</mark> %	-				
Level 4	Analyze	30%		30%		<u>30%</u>	-				
Level 5	Evaluate		A COLORED AND	N. 9724-A	· · ·		-				
Level 6	Create	7	1 S - 0 C - 0		- Passa	-	-				
	Total	100	%	10	0 %	10	0 %				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.Amarnath, Rampal india,amar@rambalindia.net	1. Dr.Arulselvan, MIT Chennai, arul@annauniv.edu.	1. Dr.K.Kamalakkanan,SRMIST,



B.Tech / M.Tech (Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses - Syllabi-Control Copy

Course Code	21AUO112T		Cours Catego	e ory	0				OPEN	ELECT	IVE			l	- T 3 0	P 0	C 3					
Pre-requi Course	site	Nil	Co- requ Course	iisite s	Nil		Pr	ogres	sive es						Nil							
Course	Offering Departm	ent	Automobile Engine	eering	Data Book / Code	s / Standard	s							Nil								
						-			1.00													
Course Le	arning Rationale	(CLR): T	he purpo <mark>se of learnin</mark> g	g this course	is to:				1		Progr	am Ou	itcome	s (PO)					Pr S	Specific		
CLR-1:	Acquire knowled	ge of about li	ntellig <mark>ent vision sy</mark> stem		1000		1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	es	
CLR-2:	Know the archite	ecture of Inte	ellige <mark>nt transport</mark> ation sy	/stem	1 marcine	-	ge		of	s of	10	iety			rk		Ð					
CLR-3:	CLR-3: Impart the techniques of adaptive control								ento	tions	ge	soc		-	Wo		ance	D				
CLR-4:	Know the archited	cture for autor	nomous vehicles		Mag-	1	Anow	lysis	obme	stiga	Usaç	and	৵		Team	ио	& Fin	arning				
CLR-5:	Study the autono	omous vehicle	e cases	1			ing l	Ana	evel	inve prob	00	neer	bility		8	icati	1gt. 8) Lea				
				6	100 Carton	100	neer	lem	gn/d	duct	en	engi	ronn aina	s	idua	mur	ect N	Lonç	-	Ņ	က္	
Course Ou	itcomes (CO):	A	At the end of this cour	se, learners i	will be able to:	Gro WY	Engi	Prob	Desi	Conc	Mod	The	Envil	Ethic	Indiv	Com	Proje	Life I	PSO	PSO	PSO	
CO-1:	Understand the	intelligen <mark>t vis</mark> i	<mark>ion s</mark> ystem used in auto	omobiles	Steel Cars	124-	3	1		-	5-	-	-	-	-	-	-	-	-	-	-	
CO-2:	Understand the	architec <mark>ture</mark> d	<mark>of in</mark> telligent transportat	tion system		5. E.	3	1.	12		-	-		-	-	-	-	-	-	-	-	
CO-3:	Understand ada	otive co <mark>ntrol a</mark>	techniques of an auton	omous vehic	le	1	3		12	-	-	- 100	-	-		-	-	-	-	-	-	
CO-4:	Understand abo	ut the succes	ssful autonomous vehic	le projects		1.10	3	-	-	-	1	- 100	-	-	-	-	-	-	-	-	-	
CO-5:	Know the case s	studies o <mark>f Au</mark> t	tonomous vehicle		- Tel - Daniel	1	3	-	1.1	-	-		-	-	-	-	-	-	-	-	-	
Unit 1 Int	raduation to Into	lligont Visio	n Suctom	1000	and and the second second															0	Hour	
Vision Bas	ed Driver Assistan	ingent vision ice System –	Vehicle optical Sensor-	Vision Based	l Driver Assistance Syste	m –I aser Ra	dar- N	on Co	ntact o	round v	elocit	v dete	ctina Se	ensor-	Road	Surfac	e Reco	anitior	1 Sens	or-Ve	hicle	
Sensors fo	r Electronic Toll C	ollection Sys	tem- Vehicle Sensors for	or Electronic	Toll Collection System- C	omponents o	of a Vis	on Se	nsor S	ystem-	Driver	Assist	tance o	n High	ways -	-Lane	Recogi	nition-1	Driver	Assist	ance	
on Highwa	ys –Lane Recogn	nition- Driver	Assistance on Highwa	ys –Traffic S	Sign Recognition- Driver	Assistance of	on Higi	hways	-Traf	fic Sign	Reco	ognitio	n-Drive	r Assis	stance	in Urb	an Trai	fic-Ste	reo Vis	sion- E)river	
Assistance	in Urban Traffic-S	hape base ar	nalysis-Driver Assistant	ce in Urban Tr	affic-Pedestrian Recognit	tion			-	-	4										Hour	
Intelligent	Transportation Svs	tem (ITS) – \	Vision for ITS Communi	cations- Multi	imedia communication in	a car- Currer	nt ITS (Comm	unicati	on Svst	ems a	nd Se	rvices-	Vehicl	e to Ve	hicle C	Commu	nicatio	n Svst	ems-	Road	
to Vehicle	o Vehicle Communication- Systems- Inter Vehicle Communication- Intra Vehicle Communication- VANETS-Devices- Optical Technologies- Millimeter Wave technologies																					
Unit-3 - Ac	laptive Control Te	chniques for	r Intellige <mark>nt Vehicle</mark>	100		_	_	2.21												9	Hour	
Automatic	Control Of Highwa	ay Traffic And	d Moving Vehicles- Ada	aptive Control	Overview- Gain Schedu	ling- Model I	Referer	ice Ac	laptive	Contro	I- Self	-Tunin	g Adap	tive C	ontrol	Systen	n Mode	əl- Sys	tem Id	entific	ation	
Basics- Re	cursive Paramete	r Estimation-	Estimator Initialization-	- Design Of S	Selt-Tuning Controllers- G	Seneralized N	linimui	n Vari	ance (GMV) (contro	I- Pole	Placer	nent C	Control	- Mode	el Pred	ictive	Contro	I Over	view	
Unit-4 - De	cisional Architec	tures for Au	Itonomous Vehicles																	9	Hour	
Control Ar	chitectures- Motio	n Autonomv-	- Deliberative Architect	ures - Reacti	ive Architectures- Hvbrid	Architecture	Oven	view-	Overvi	ew of S	Sharp	Archit	ecture-	Mode	ls Of V	/ehicle	s- Con	cepts	Of Ser	isor B	ased	
Maneuver-	Reactive Trajecto	ry Following	Parallel Parking- Platoc	oning- <mark>Main A</mark>	pproaches To Trajectory	Planning - N	on-Hol	onomi	c Path	Plannin	g											

Unit-5 - Autonomous Vehicle and Case Studies

DARPA Challenge Case Study- ARGO Prototype Vehicle- The Gold System- The inverse Perspective Mapping- Lane Detection- Obstacle Detection-Vehicle Detection- Pedestrian Detection- Software systems architecture- Computational Performances- ARGO Prototype vehicle Hardware- Functionalities- ARGO Prototype vehicle- Data acquisition System- Processing System- Control System Overview

	1.	LiuboVlacic. Michel Parent and Fumio Harashima. "IntelligentVehicle Technologies".	3.	NicuBizon.Lucian D Ascalescu And NaserMahdavitAbatabaei"Autonomous Vehicles
Learning		Butterworth- Heinemann publications, Oxford, 2001-ISBN 0 7506 5093 1		
Resources	2.	Ronald K Jurgen. "Automotive Electronics Handbook ". Automotive Electronics		
		Series, SAE, USA, 1998		

Learning Assessme	ent	1	100								
			Continuous Learning	g Assessment (CLA)		Cum	motivo				
	Bloom's Level of <mark>Thinking</mark>	Forn CLA-1 Avera (50	native ge of unit test %)	Life-Lon CL (1	g Learning _A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	15%		15%		15%	-				
Level 2	Understand	25%	21.00	25%		25%	-				
Level 3	Apply	30%	100 Car 100	30%		<mark>3</mark> 0%	-				
Level 4	Analyze	30%	the street in	30%		<mark>30</mark> %	-				
Level 5	Evaluate	10122-3	TO MAN			-	-				
Level 6	Create		1 / 1 · 1 · 1	No. 224-2			-				
	Total	- 10	0 %	- 10	0 %	10	0 %				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.G.Giri, Managing Director, Atalon ,giri@atalon.co.in	1. Dr. SathishKumar. P, Assistant Professor, sathish.p@nitpy.ac.in, NIT, Karaikal	1. Dr. Carunai <mark>selvane,</mark> SRMIST
		2. Dr.T.Praveenkumar, SRMIST



B.Tech / M.Tech (Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses - Syllabi-Control Copy

Course Code	e 21BTO101T Course HUMAN HEALTH AND DISEASES								e ry	0				OPEN	ELECI	IVE			l	<u> </u>	P 0	C 3
Pre-requi Course	site s		Nil		Co- requisite Course <mark>s</mark>	Nil		Pro	ogres Cours	sive es						Nil						
Course (Offering	Departme	nt		Biotechnology	Data Book / Codes /	Standards		_						Nil							
Course Le	arning R	ationale (CLR):	The purpos	s <mark>e of learnin</mark> g this cou	rse is to:		-	1			Progra	am Ou	itcome	s (PO)					Pr	ograi	m
CLR-1:	Explain	the basic	structura	al organizatio	<mark>n of hum</mark> an health syste	em		1	2	3	4	5	6	7	8	9	10	11	12	Sl	pecifi tcom	c es
CLR-2:	Summa	rize the et	iology of	^f human infect	ious diseases	1 million	1	e	-	4	of	20	ety			¥						
CLR-3:	CLR-3: Describe immune system and nervous system of human body and diseases related ot it							ledg		ent o	tions	ge	soci			Wo		ance	D			
CLR-4:	CLR-4: Impart knowledge on genetic diseases							Vou	lysis	bmdo	stiga	Usa	and	æ		eam	ы	ß Fin	Inin			
CLR-5:	Indicate	e the high i	risk disea	as <mark>es assoc</mark> iate	ed with modern society			ring l	Ana	devel	t inve	Tool	ineer	ment ability		al & T	nicati	Mgt. 8	g Lea			
					Provide State	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1	inee	blem	ign/c	Induct	dern	eng	ironi taina	S	vidua	nmu	ect I	Lon	-	0-2	0-3
Course Ou	utcomes	(CO):		At the end	of this course, learne	ers will be able to:	10.27	Еnç	Pro	Des	Cor	Mod	The	Env Sus	Ē	Indi	S	Pro.	Life	PS(PS(PS(
CO-1:	Explain	the struct	ural org <mark>a</mark>	nization of hu	man system and conce	pts in human diseases	1341	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Differer	ntiate the d	lisease- <mark>c</mark>	<mark>ausing</mark> agents	s and explain the life sty	le related diseases		-	2	20		-	-	0	-	-	-	-	-	-	-	-
CO-3:	Describ	e the imm	une an <mark>d</mark>	neural system	n and related diseases.			2	2		-	3	-	-	-		-	-	-	-	-	-
CO-4:	Integrat	te the gene	etical m <mark>al</mark>	<mark>keup w</mark> ith ger	netical disorders		010	1	2		-	3		-	-	-	-	-	-	-	-	-
CO-5:	Apply tl	he knowled	lge of d <mark>is</mark>	<mark>sease an</mark> d the	ir symptoms in develop	ing monitors and diagnostic de	vice	25	2	1.1	-	3	1	-	-	-	-	-	-	-	-	-
Unit-1 - Hu	iman Svi	stom and	Coll Stri	ucture and E	unction	da al	- 51		80												0	Hour
Introduction	n to huma	an health.	Anatomy	v and Physiol	pav. Respiratory system	n. Circulatory System. Digestiv	e Svstem. E	Excret	orv sv	stem. I	Reprod	uctive	svster	n. Ferti	lizatior	n and (Cell str	ucture.	Embr	voaene	əsis T	issue
types, How	/ body ge	ts energy,	ATP Syr	nth <mark>esis, Cell</mark> n	netabolism, Cell cycle,	Checkpoints in cell division, Cel	I <mark>l division -</mark> M	litosis	and N	<i>leiosis</i>	, Growt	h facto	ors- ov	erview,	Types	and f	unctior	1 1	,	- 3		
Unit-2 - Inf	fections	and Life S	Style Dis	eases	1 2 3 4						14	-2									9	Hour
Infectious L	Diseases,	, Bacterial	toxins, v	virulen <mark>ce of ba</mark>	cterial infection, Antibio	otic resistance strains, An overv	iew of replic	cation	cycle	of viru	s, Effec	t of vi	rus inf	ection i	n the h	iost ce	II, Epic	lemiolo	ogy, Ro	ots of	sprea	ding,
Emerging a	ana reem futuro Lif	erging viru o stylo and	S. LITE STJ I cancor	yle alseases: l risk	High risk disease of mo	aern society, Obesity, Hyperten	sion and dia	Detics	, iveo	olasm,	Uncog	enes a	ina tun	nor sup	presso	or gene	es, Typ	es of ca	ancer,	Stages	; or ca	ncer,
Unit-3 - Im	Unit-3 - Immune Disorders									2.3		-									9	Hour
Immune sy	vstem, Ph	iysical che	emical an	nd cellular bai	rrier, Types of Immune	cell, Humoral and cell mediate	ed immunity	, Cells	s Invo	lved in	inflam	matior	n, Infla	mmato	ry Pro	cess, I	mmun	e disor	ders, A	bsces	ses, I	ulcer,
cellulitis An	nd Allergy	, Autoimm	unity, Im	nmunodeficien	c <mark>y. Nervous s</mark> ystem, P	arkinson's, Alzheimer's disease	e															
Unit-4 - Ge	enetical l	Diseases																			9	Hour
Mendelian	delian genetics, Genetics of simple and complex traits, Hereditary disease, Karyotype preparation and anal mia. Indian genetic disease database. Human gene mutation database. Principle class of metabolic disc						I analysis Cl	nromo Inhori	some	abnori	nality,	halas	semia Motab	, Cystic	tibros	is, Duo	chene l	Muscul	ar dyst	rophy,	Sickl	e cell
Molecular I	emia, indian genetic disease database, Human gene mutation database, Principle class of metabolic disor lecular basis, List of proteins involved in LSD, Balanced nutrition and Malnutrition, Deficiency disease							minell		elaboli		Jei 5, 1	vielabl	SIIC SYL	uiuiile	, risk	1001	s, Lyst	лгунне	SUIDY		7ase.

 Unit-5 - Diseases Diagnosis and Treatment
 9 Hour

 Disease Diagnosis, Treatment strategy, Biomedical Instruments, Biosensors, Sources of drug- plants and microbes, Drug Designing, Computer aided drug designing, Vaccines, Route of administration, Vaccines types, Recommendation by age, Vaccines – Recent advancement, Immunotherapy, Immunotherapeutic approaches currently in use, Stem cell therapy, Gene therapy

Learning	1.	Goodenough and McGuire, Biology of Humans: Concepts, Applications and	2.	Marianne Neighbors, Ruth Tannehil, Human Diseases, 4th ed., Jones Cengage learning, 2015
Resources		issues, 4th ed., Benjamin Cummins/Pearson Publisher, 2011	3.	Marianne Neighbors, and Ruth Tannehill-Jones Human Diseases, 5th ed Delmar Cengage Learning 2018

earning Assessme	ent			CC 14 / 1 / 1							
		1.11	Continuous Learning	Assessment (CLA)	A	Sum	mativa				
	Bloom's Level of Th <mark>inking</mark>	Form CLA-1 Avera (50	native ge of unit test 0%)	Life-Lon Cl (1	g Learning LA-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	15%	States in	15%		15%	-				
Level 2	Understand	25%		20%		25%	-				
Level 3	Apply 📃	30%		25%		30%	-				
Level 4	Analyze	30%	The second	25%		30%	-				
Level 5	Evaluate		A	10%	and the second	-	-				
Level 6	Create		1 S 1 S 1 S 1 S	5%	·	-	-				
	Total	10	0%	10	0 %	10	0%				

Co	ourse Designers			
Ex	perts from Industry	Experts from Higher Technical Institutions	Int	ernal Experts
1.	Dr. C. N. Ramchand, Saksin Life sciences Pvt Ltd, Chennai,	1. Prof. K Subramaniam, IITM, Chennai, subbu@iitm.ac.in	1.	Dr. Lilly M saleen <mark>a, SRMIS</mark> T
	ramchand@saksinlife.com			
2.	Dr. Karthik Periyasamy, Scientist, Biocon,	2. Prof. R. B. Narayanan, Anna University, Chennai	2.	Dr. Rpriya Swa <mark>minathan ,</mark> SRMIST
	karthik.periyasamy@biocon.com	arbeen09@gmail.com		



Course Code	Course Code 21BTO105T Course Name ANIMAL MODELS FOR BIOMEDICAL RESEARCH								C	Cours atego	e ry	0				OPEN E	ELECI	ΓIVE				- T 3 0	P 0	C 3
Pre-requi Course	site s	Nil		Co- ro Cou	equisite rse <mark>s</mark>			Nil		Pro	ogres Cours	sive es						Nil						
Course	Offering Departmo	ent		Biotechno	logy		Data Boo	ok / Codes / Sta	Indards	1	_						Nil							
Course Le	arning Rationale	(CLR):	The purpe	ose of learr	ning this d	course i	is to:		T	-	4			Progr	am Ou	itcome:	s (PO))				P	rogra	m
CLR-1:	Understand the b	asics anim	mal Biolog <mark>y.</mark>	T	-	0	2			1	2	3	4	5	6	7	8	9	10	11	12	00	pecifi itcom	IC Ies
CLR-2:	Describe the vari	ous animai	al mod <mark>els a</mark>	<mark>nd their</mark> req	uirement i	in biome	dical research		-				of	1	ty									
CLR-3:	Learn the models	s available	e for v <mark>arious</mark>	<mark>hum</mark> an dise	eases	1		1000	16	edge		nt of	suo	0	socie		-	Nork		nce				
CLR-4:	LR-4: Learn to do pilot experiments to evaluate their working/living environment							INO	SIS.	Inmel	igati	sage	s pu			am	_	Fina	ing					
CLR-5:	CLR-4: Learn to do pilot experiments to evaluate their working/living environment CLR-5: Learn different ethical and regulatory issues with animal models and design an alternative model to replace animal models							0	eering Kr	em Analy	n/develop	uct invest lex proble	m Tool U	ngineer a	onment & inability		dual & Te	nunicatior	ct Mgt. &	ong Learr	-	2	3	
Course Or	utcomes (CO):		At the en	d of this co	ourse, lea	irners w	vill be able to:			Engin	Proble	Desig	Cond	Mode	The e	Envire Susta	Ethics	Individ	Comr	Proje	Life L	-OSC	-OSC-	-OS-
CO-1:	Define the fundar	mentals of	<mark>f anima</mark> l exp	periments			1000	242.00	11-1	-	2	1	2	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Outline the variou	us anim <mark>al n</mark>	<mark>model</mark> s ava	ilable for <mark>b</mark> i	omedical r	research	1	Sec. 24.			2	2	2	-	-	<i>.</i>	-	=-	-	-	-	-	-	-
CO-3:	Explain the simila	arities b <mark>etw</mark>	<mark>ween a</mark> nima	l models an	d humans	5	-100.21	1.00		-	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Design and evalu	ıate pilo <mark>t e</mark> z	experiments	to study the	eir enviror	nment		1 mar -			-	3	3	2		-	-	-	-	-	-	-	-	-
CO-5:	Prepare alternati	ve mode <mark>ls</mark>	<mark>s to repl</mark> ace	animal mod	els and co	omply wi	ith ethical issue	es a la companya de la	1	-	3	3	3	2		-	-	-	-	-	-	-	-	-
Unit-1 - Ba Introductio	asics of Animal Bi n to biology of anin	i ology nals, Class	sification of	Animals (In	vertebrate	es and V	/ertebrates), Str	ructure and orga	ans, Hur	nan e	volutio	on, Dai	winism	theor	y, Hist	ory of a	nimals	and re	esearc	h			9	Hour
Unit-2 - Aı	nimal Models in B	iomedical	l Research						Í.			,		19		1							9	Hour
Animal mo	dels, Need for Anin	nal models	s, Liv <mark>ing and</mark>	d Non-living	animal m	odels for	r research, Sele	ection of animal	models,	Non-	Invert	ebrate	anima	mode	ls (Dro	osophila	and C	C.elaga	ans), V	ertebra	te anin	nal mo	odels ((Rats,
Unit-3 - A	ales, Cow, Dog an nimal Models for F	u Sneep), (Human Dis	Genetically iseases	engineered	animais	_	1 1 1 T	-		-	-	-		-	-			-					9	Hour
Animal mo	dels for cataracts a	and retinitis	is pigmento	sa, Atheros	clerosis a	and myo	cardial infarctio	on, cardiac and (cardiova	ascula	r dise	ase, n	netabol	ic sync	lrome,	diabete	es and	l obesi	ity, live	r disea	ises, sl	kin dis	sorder	's and
regeneratio	on, Neurodegenera	tive disord	ders, Cance	er	14	200					1.1		1											
Unit-4 - Ai	nimal Models in Pl	istration n	Studies	nimal mode	s to test	now coi	mnounds prior	clinical study (Oral adı	ninist	ration	Nasa		no Inl	alatio	n Inva	siva a	dminis	tration	, (intra	Nonou	s intra	9 anoriti	Hour oneal
intraocular	, intramuscular, su	bcutaneou	us), non-inv	asive drug	administra	<mark>ation, S</mark> k	tin adsorption, s	selecting approp	oriate dr	ug ad	Iminis	tration	route,	unders	standir	g the r	oute o	f expo	sure in	toxicit	y case	s, mile s, Hur	man-a	animal
equivalent	dose calculations,						<u></u>																	
Unit-5 - Re	gulatory and Eth	ical Issues	s in Anima	and Huma	an Resear	rch	Disk served a			-l' - t'	0.6	4 . D.			-!1		-l	7- 6	I				9	Hour
animals in animal mo animal mo	dels (cell and tissu	nd animal n	yulauons ar s, organoids I models), Limitatior	s and eth	ical issu	Jonazards, Bi Jes on human r	research, Ethica	aliu Ra al issues	in us	ing h	uman s	sample	and al s and	anima anima	model	s, App	lication	n of co	e anin mputai	tional n	arcn, nodels	s to re	place

Learning Resources	1. 2.	Hau J, Van Hoosier GL Jr, Handbook of Laboratory Animal Science, Volume I: Essential Principles and Practices" 2nd ed., CRC Press: Boca Raton, FL, 2003 Micheal Conn P, Animal Models for the Study of Human Disease,2nd ed., Academic Press, 2017	3. 4.	The Guide for Care and Use of Animals in Research, Eight Edition, 2011 Jerome Y Yager, Animal Models of Neuro-developmental Disorders, Human Press, 2015							

			Continuous Learning	g Assessment (CLA)		Cummetive					
	Bloom's Level of Thin <mark>king</mark>	Form CLA-1 Avera (50	native ge of unit test 0%)	Life-Lon Cl (1	g Learning _A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	15%		15%		15%	-				
Level 2	Understand	25%	And the later	20%		25%	-				
Level 3	Apply	30%		25%		30%	-				
Level 4	Analyze	30%		25%		30%	-				
Level 5	Evaluate		and the second second	10%		-	-				
Level 6	Create		10 C 10 C 10 C 10 C	5%		-	-				
	Total	10	0%	10	0 %	10	0%				

Co	urse Designers		And a second sec					
Ex	perts from Industry	Experts from Higher Technical Institutions	Internal Experts					
1.	Dr. C. N. Ramchand, Saksin Life sciences Pvt Ltd, Chennai, ramchand@saksinlife.com	1. Prof. K Subramaniam, IITM, Chennai, subbu@iitm.ac.in	1. Dr.R.A. Nazeer, SRMIST					
2.	Dr. Karthik Periyasamy, Scientist, <mark>Biocon,</mark> karthik.periyasamy@biocon.com	2. Prof. R. B. Narayanan, Anna University, Chennai arbeen09@gmail.com	2. Dr. Harinarayana Ankamreddy, SRMIST					



Pre-requisite NII Co-requisite NII Progressive Courses NII Course Offering Department Biotechnology Data Book/ Codes / Standards NII Course Offering Department Biotechnology Data Book/ Codes / Standards NII Course Offering Department Biotechnology Data Book/ Codes / Standards NII ClrR-1: Identify the application of engineering concepts for sustainable waste management 1 2 3 4 5 6 7 8 9 10 11 12 2 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 2 4	Course Code	21BTO106T	T Course WASTE TO WEALTH TO WHEELS Cour Categ			se ory	0				OPEN E	ELECT	ΓIVE			;	L T 3 0	P 0	C 3	
Course Offering Department Biotechnology Data Book / Codes / Standards Nil Course Learning Rationale (CLR): The purpose of learning this course is to: Program P	Pre-requi Course	site s	Nil	Co- requisite Course <mark>s</mark>	Nil	P	ogres Cours	sive es						Nil						
Course Learning Rationale (CLR): The purpose of learning this course is to: Program Outcomes (PO) Program Specific outcomes CLR-1: Identify the applications of engineering concepts for sustainable waste management 1 2 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 <td< td=""><td>Course (</td><td>Offering Departme</td><td>ent</td><td>Biotechnology</td><td>Data Book / Codes / Standard</td><td>s</td><td></td><td></td><td></td><td></td><td></td><td></td><td>Nil</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	Course (Offering Departme	ent	Biotechnology	Data Book / Codes / Standard	s							Nil							
CLR-1: Identify the applications of engineering concepts for sustainable waste management 1 2 3 4 5 6 7 8 9 10 11 12 Outcomes CLR-2: Demonstrate of energy conversion technology for fuel application 9 9 10 11 12 0	Course Le	arning Rationale (CLR): 7	The purpo <mark>se of learnin</mark> g this c	ourse is to:	4	1	1		Progr	am Ou	<mark>itco</mark> me:	s (PO))	<u> </u>			P	rograi	n
CLR-2: Demonstrate of energy conversion technology for fuel application Age Age Age Age	CLR-1:	Identify the applic	ations of er	ngineerin <mark>g concepts</mark> for sustaina	able waste management	1	2	3	4	5	6	7	8	9	10	11	12	00	itcom/	es
CLR-3: Examine the significance of eco-friendly process in waste management Image: Click of the concepts of zero-waste process in industrial waste disposal methods CLR-4: Prescribe the concepts of zero-waste process in industrial waste disposal methods Image: Click of the concepts of zero-waste process in industrial waste disposal methods CLR-5: Analyze the important wastes to energy conversion Image: Click of the concepts of zero-waste process in industrial waste disposal methods Image: Click of the concepts of zero-waste process in industrial waste disposal methods Course Outcomes (CO): At the end of this course, learners will be able to: Image: Click of the concepts of zero-waste process for waste segregation Image: Click of the concepts of zero-waste process for waste to energy conversion Image: Click of the concepts of zero-waste process for waste to energy conversion Image: Click of the concepts of zero-waste process for waste to energy conversion Image: Click of the concepts of zero-waste process for waste to energy conversion Image: Click of the concepts of zero-waste process for waste to energy conversion Image: Click of the concepts of zero-waste process for waste to energy conversion Image: Click of the concepts of zero-waste process for waste to energy conversion Image: Click of the concepts of zero-waste process for waste to energy conversion Image: Click of the concepts of the conce	CLR-2:	Demonstrate of e	nergy conve	ersio <mark>n technolog</mark> y for fuel applic	ation	ge		of	s of	24	iety			rk		е				
CLR-4: Prescribe the concepts of zero-waste process in industrial waste disposal methods Image: Construction of the concepts of zero-waste process in industrial waste disposal methods Image: Construction of the concepts of zero-waste process in industrial waste disposal methods Image: Construction of the concepts of zero-waste process in industrial waste disposal methods Image: Construction of the concepts of zero-waste process in industrial waste disposal methods Image: Construction of the concepts of zero-waste process in industrial waste disposal methods Image: Construction of the concepts of zero-waste process in industrial waste disposal methods Image: Construction of the concepts of zero-waste process in industrial waste disposal methods Image: Construction of the concepts of zero-waste process in industrial waste disposal methods Image: Construction of the concepts of zero-waste process in industrial waste disposal methods Image: Construction of the concepts of zero-waste process in industrial waste disposal methods Image: Construction of the concepts of zero-waste process in industrial waste disposal methods Image: Construction of zero-waste process in industrial waste disposal methods Image: Construction of zero-waste process in industrial waste disposal methods Image: Construction of zero-waste process in industrial waste disposal methods Image: Construction of zero-waste process in industrial waste disposal methods Image: Construction of zero-waste process in industrial waste disposal methods Image: Construction of zero-waste process in industrial waste management to meet the mandates of Global and india and zero-zero zero. Image: Construction of zero-zero-zero zero-zero-zero. <t< td=""><td>CLR-3:</td><td>Examine the sign</td><td>ificance of e</td><td>eco<mark>-friendly p</mark>rocess in waste m</td><td>anagement</td><td>vled</td><td></td><td>ent</td><td>ation</td><td>ge</td><td>soc</td><td></td><td></td><td>No.</td><td></td><td>anc</td><td>5</td><td></td><td> </td><td></td></t<>	CLR-3:	Examine the sign	ificance of e	eco <mark>-friendly p</mark> rocess in waste m	anagement	vled		ent	ation	ge	soc			No.		anc	5			
CLR-S: Analyze the important wastes to energy conversion Image: State of the important wastes to energy conversion Image: State of the important wastes to energy conversion Image: State of the important wastes to energy conversion Image: State of the important wastes of the important waste of the important waste of the important waste of the important wastes of the important waste of the	CLR-4:	Prescribe the con	cepts of ze	r <mark>o-waste p</mark> rocess in industrial w	aste disposal methods	Knov	alysis	lopm	estige	Usa	r and	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		Tear	noi	& Fir	arnin			
Course Outcomes (CO): At the end of this course, learners will be able to: Image: Course outcomes (Co): At the end of this course, learners will be able to: Image: Course outcomes (Co): Image: Course outcomes (Co): At the end of this course, learners will be able to: Image: Course outcomes (Co): Image: Course	CLR-5:	Analyze the impo	rtant waste	s to energy conversion	1 - 1 - 1	sering	em Ana	n/deve	ict inve ex pro	n Tool	nginee	nment		ual & .	iunicat	t Mgt.	ong Le			~
CO-1: Understand the waste and formulate methodology for waste segregation 3 2 - 2 -	Course Ou	tcomes (CO):	T.	At the end of this course, lear	ners will be able to:	Engine	Proble	Design	Condu	Moder	The er	Enviro Sustai	Ethics	Individ	Comm	Projec	Life Lo	PSO-1	PSO-2	PSO-3
CO-2: Evaluate the National policy towards novel biofuel production and energy security 3 - 3 2 -	CO-1:	Understand the w	vaste an <mark>d fo</mark>	rmulate methodology for waste	segregation	1	3		2		-	2	-	-	-	-	-	-	-	-
CO-3: Compare and plan thermo-chemical conversion process for waste to energy conversion 3 2 2 2 -	CO-2:	Evaluate the Nation	onal po <mark>licy i</mark>	towards novel biofuel production	n and energy security	3		3	2	-	-		-	-	-	-	-	-	-	-
CO-4: Demonstrate bioprocessing techniques to convert waste to biofuel and value-added chemicals - 3 2 2 -	CO-3:	Compare and pla	n therm <mark>o-cl</mark>	hemical conversion process for	waste to energy conversion	3	2	2	-	2	-36	-	-		-	-	-	-	-	-
CO-5: Utilize novel recent technologies for efficient waste management to meet the mandates of Global and hational policy - 2 2 2 2 -	CO-4:	Demonstrate biop	processi <mark>ng t</mark>	echniques to convert waste to b	iofuel and value-added chemicals		-	3	2	2		2	-	-	-	-	-	-	-	-
Unit-1 - Wastes: A Boon or Bane? 9 Hour Waste generation sources - Classification of wastes - Waste Management pyramid - Characterization of wastes - 4R principle - Modern Waste collection tools -Environmental and climatic change issues - Rapid urbanization, depletion of fossil reserves, need for energy security - Impact of wastes on biodiversity 9 Hour Unit-2 - Waste Bioeconomy 9 Hour Transforming from fossil-based economy to a sustainable circular bio-economy - Global and Indian perspective - waste as the core element for the future economic models - drivers for the bioeconomy - futuristic needs, scope and opportunities envisaged in the business and economic realm 9 Hour Unit-3 - Technologies/Processes that can be Applied for Biogenic Wastes Valorization 9 Hour Circular economy in a waste biorefinery model for the production of biobased products including bioenergy - Thermal processing of wastes: Combustion, Co-generation/co-firing - Pyrolysis and torrefaction - Hydrolysis and plasma treatment for waste to energy conversion - Catalytic conversion process - Syngas production- Bioenergy-Biochar energy cycle - Land fill and flue gas recovery for its commercial application Unit-4 - Insights into Bioenergy 9 Hour Classification of Biofuels - Liquid, Gaseous and Solid - Bioethanol Hexose and Pentose sugar conversion to ethanol- Bioethanol plant design and its components- Bio refinery demonstration projects of Bioethanol-Biodiesel - Biodiesel form butanol production - Pyrolysis bio-oil/bio-char -Bio-alkanes and alkenes from waste biomely either (DME-LBiohydrogen-Biolakanes and alkenes from waste bioregines for biofuel and value added chemical preparation - Biobuta	CO-5:	Utilize novel rece National policy	ent tech <mark>nolo</mark>	gies for efficient waste manag	ement to meet the mandates of Global and	6	-	620	2	-	2	2	-	-	-	-	-	-	-	-
Waste generation sources - Classification of wastes - Waste Management pyramid - Characterization of wastes - 4R principle - Modern Waste collection tools -Environmental and climatic change issues - Rapid urbanization, depletion of fossil reserves, need for energy security - Impact of wastes on biodiversity Unit-2 - Waste Bioeconomy Transforming from fossil-based economy to a sustainable circular bio-economy - Global and Indian perspective - waste as the core element for the future economic models - drivers for the bioeconomy - futuristic needs, scope and opportunities envisaged in the business and economic realm Unit-3 - Technologies/Processes that can be Applied for Biogenic Wastes Valorization 9 Hour Circular economy in a waste biorefinery model for the production of biobased products including bioenergy - Thermal processing of wastes: Combustion, Co-generation/co-firing - Pyrolysis and torrefaction - Hydrolysis and plasma treatment for waste to energy conversion - Catalytic conversion process - Syngas production- Bioenergy-Biochar energy cycle - Land fill and flue gas recovery for its commercial application Unit-4 - Insights into Bioenergy Classification of Biofuels - Liquid, Gaseous and Solid - Bioethanol Hexose and Pentose sugar conversion to ethanol- Bioethanol plant design and its components- Bio refinery demonstration projects of Bioethanol Biodiesel - Biodiesel from vegetable oils/ non-edible oils - Transesterification process-Oleaginous microorganisms-Algal Biofuel - Algal based technologies for biofuel and value added chemical preparation - Biobutanol - ABE Fermentation for Butanol production - Pyrolysis bio-oil/bio-char - Bio-alkanes and alkenes from waste biomes - Gaseous Biofuel - Bio-synthetic natural gas (SNG)- Biomethanation process- Microbiology of anaerobic direction- Dimethyl ether (DME)-Biobydrogen- Biological Processes for Hydrogen Production Part formation and algal based technologies	Unit-1 - Wa	astes: A Boon or I	Bane?		122					<i>.</i>	1	-		_					9	Hour
urbanization, depletion of fossil reserves, need for energy security - Impact of wastes on biodiversity 9 Hour Unit-2 - Waste Bioeconomy 9 Hour Transforming from fossil-based economy to a sustainable circular bio-economy - Global and Indian perspective - waste as the core element for the future economic models - drivers for the bioeconomy - futuristic needs, scope and opportunities envisaged in the business and economic realm Unit-3 - Technologies/Processes that can be Applied for Biogenic Wastes Valorization 9 Hour Circular economy in a waste biorefinery model for the production of biobased products including bioenergy - Thermal processing of wastes: Combustion, Co-generation/co-firing - Pyrolysis and torrefaction - Hydrolysis and plasma treatment for waste to energy conversion - Catalytic conversion process - Syngas production - Bioenergy-Biochar energy cycle - Land fill and flue gas recovery for its commercial application Unit-4 - Insights into Bioenergy 9 Hours Classification of Biofuels - Liquid, Gaseous and Solid - Bioethanol Hexose and Pentose sugar conversion to ethanol- Bioethanol plant design and its components- Bio refinery demonstration projects of Bioethanol-Biodiseel rom vegetable oils / non-edible oils - Transesterification process-Oleaginous microorganisms-Algal Biofuel - Algal based technologies for biofuel and value added chemical preparation - Bioethanol-Bioethanol production - Pyrolysis bio-oil/bio-char - Bio-alkanes and alkenes from waste biomass - Gaseous Biofuel - Bio-synthetic natural gas (SNG)- Biomethanation process- Microbiology of anaerbic direction- Dark fermentation process	Waste gen	eration sources - C	Classification	n of wastes - Waste Managem	ent pyramid - Characterization of wastes - 4	R prin	ciple -	Mode	n Wast	e colle	ection	tools -E	nviror	menta	al and (climatio	chang	ge issi	Jes - F	Rapid
Unit-2 - Waste Bioeconomy 9 Hour Transforming from fossil-based economy to a sustainable circular bio-economy - Global and Indian perspective - waste as the core element for the future economic models - drivers for the bioeconomy - futuristic needs, scope and opportunities envisaged in the business and economic realm Unit-3 - Technologies/Processes that can be Applied for Biogenic Wastes Valorization 9 Hour Circular economy in a waste biorefinery model for the production of biobased products including bioenergy - Thermal processing of wastes: Combustion, Co-generation/co-firing - Pyrolysis and torrefaction - Hydrolysis and plasma treatment for waste to energy conversion - Catalytic conversion process - Syngas production- Bioenergy-Biochar energy cycle - Land fill and flue gas recovery for its commercial application Unit-4 - Insights into Bioenergy 9 Hours Classification of Biofuels - Liquid, Gaseous and Solid - Bioethanol Hexose and Pentose sugar conversion to ethanol- Bioethanol plated technologies for biofuel and value added chemical preparation - Biobutanol Biodiesel from vegetable oils/ non-edible oils - Transesterification process-Oleaginous microorganisms-Algal Biofuel - Algal based technologies for biofuel and value added chemical preparation - Biobutanol - ABE Fermentation for Butanol production - Pyrolysis bio-oil/bio-char -Bio-alkanes and alkenes from waste biomass - Gaseous Biofuel - Bio-synthetic natural gas (SNG)- Biomethanation process- Microbiology of anaerobic digestion- Dimethyl ether (DME)-Biohydrogen- Biological Processes for Hydrogen- Broduction- Dark fermentation and algal based technologies	urbanizatio	n, depletion of foss	il reserves,	need for energy security - Impa	ect of wastes on biodiversity		•			18										
Iransforming from tossil-based economy to a sustainable circular bio-economy - Global and Indian perspective - waste as the core element for the future economic models - drivers for the bioeconomy - futuristic needs, scope and opportunities envisaged in the business and economic realm Unit-3 - Technologies/Processes that can be Applied for Biogenic Wastes Valorization 9 Hour Circular economy in a waste biorefinery model for the production of biobased products including bioenergy - Thermal processing of wastes: Combustion, Co-generation/co-firing - Pyrolysis and torrefaction - Hydrolysis and plasma treatment for waste to energy conversion - Catalytic conversion process - Syngas production- Bioenergy-Biochar energy cycle - Land fill and flue gas recovery for its commercial application 9 Hour Classification of Biofuels - Liquid, Gaseous and Solid - Bioethanol Hexose and Pentose sugar conversion to ethanol- Bioethanol plant design and its components- Bio refinery demonstration projects of Bioethanol- Biodiesel - Biodiesel from vegetable oils/ non-edible oils - Transesterification process-Oleaginous microorganisms-Algal Biofuel - Algal based technologies for biofuel and value added chemical preparation - Biobutanol - ABE Fermentation for Butanol production - Pyrolysis bio-oil/bio-char -Bio-alkanes and alkenes from waste biomas - Gaseous Biofuel - Bio-synthetic natural gas (SNG)- Biomethanation process- Microbiology of anagraphic digestion- Dimethyl ether (DME)-Biohydrogen-Biologia Processes for Hydrogen-Broduction- Dark fermentation and algal based technologies	Unit-2 - Wa	aste Bioeconomy																	9	Hour
Interests, scope and opportunities envisaged in the business and economic realing Unit-3 - Technologies/Processes that can be Applied for Biogenic Wastes Valorization Gircular economy in a waste biorefinery model for the production of biobased products including bioenergy - Thermal processing of wastes: Combustion, Co-generation/co-firing - Pyrolysis and torrefaction - Hydrolysis and plasma treatment for waste to energy conversion - Catalytic conversion process - Syngas production- Bioenergy-Biochar energy cycle - Land fill and flue gas recovery for its commercial application Unit-4 - Insights into Bioenergy Classification of Biofuels - Liquid, Gaseous and Solid - Bioethanol Hexose and Pentose sugar conversion to ethanol- Bioethanol plant design and its components- Bio refinery demonstration projects of Bioethanol- Biodiesel - Biodiesel from vegetable oils/ non-edible oils - Transesterification process-Oleaginous microorganisms-Algal Biofuel - Algal based technologies for biofuel and value added chemical preparation - Biobutanol - ABE Fermentation for Butanol production - Pyrolysis bio-oil/bio-char -Bio-alkanes and alkenes from waste biomass - Gaseous Biofuel - Bio-synthetic natural gas (SNG)- Biomethanation process- Microbiology of anagrobic direction- Dimethyl ether (DME)-Biohydrogen-Biologia Processes for Hydrogen Production- Dark fermentation and algal based technologies	I ransformi	ng from fossil-base	d economy	to a sustainable circular bio-ed	conomy - Global and Indian perspective - wa	iste as	the c	ore ele	ment fo	or the f	uture	econom	ic mo	dels - d	drivers	for the	bioec	onomy	/ - tutu	iristic
Circular economy in a waste biorefinery model for the production of biobased products including bioenergy - Thermal processing of wastes: Combustion, Co-generation/co-firing - Pyrolysis and torrefaction - Hydrolysis and plasma treatment for waste to energy conversion - Catalytic conversion process - Syngas production- Bioenergy-Biochar energy cycle - Land fill and flue gas recovery for its commercial application Unit-4 - Insights into Bioenergy Classification of Biofuels - Liquid, Gaseous and Solid - Bioethanol Hexose and Pentose sugar conversion to ethanol- Bioethanol plant design and its components- Bio refinery demonstration projects of Bioethanol- Biodiesel - Biodiesel from vegetable oils/ non-edible oils - Transesterification process-Oleaginous microorganisms-Algal Biofuel - Algal based technologies for biofuel and value added chemical preparation - Biobutanol - ABE Fermentation for Butanol production - Pyrolysis bio-oil/bio-char -Bio-alkanes and alkenes from waste biomass - Gaseous Biofuel - Bio-synthetic natural gas (SNG)- Biomethanation process- Microbiology of anaerobic direction- Dimethyl ether (DME)-Biohydrogen, Biological Processes for Hydrogen Production, Dark fermentation and algal based technologies	Ileeus, sco	chnologios/Proco	esos that c	a in the business and economic	lastos Valorization		-	-		-	-								0	Hour
and plasma treatment for waste to energy conversion - Catalytic conversion process - Syngas production- Bioenergy-Biochar energy cycle - Land fill and file gas recovery for its commercial application Unit-4 - Insights into Bioenergy Classification of Biofuels - Liquid, Gaseous and Solid - Bioethanol Hexose and Pentose sugar conversion to ethanol- Bioethanol plant design and its components- Bio refinery demonstration projects of Bioethanol- Biodiesel - Biodiesel from vegetable oils/ non-edible oils - Transesterification process-Oleaginous microorganisms-Algal Biofuel - Algal based technologies for biofuel and value added chemical preparation - Biobutanol - ABE Fermentation for Butanol production - Pyrolysis bio-oil/bio-char -Bio-alkanes and alkenes from waste biomass - Gaseous Biofuel - Bio-synthetic natural gas (SNG)- Biomethanation process- Microbiology of anagraphic digesting- Dimethyl ether (DME)-Biobydrogen- Biological Processes for Hydrogen Production- Dark fermentation and algal based technologies	Circular ec	onomy in a waste b	iorefinerv m	odel for the production of bioba	sed products including bioenergy - Thermal p	rocess	ina of	wastes	: Comb	ustion	Co-a	eneratic	n/co-i	firina -	Pvrolv	sis and	torrefa	action	Hvdra	olvsis
9 Hour Classification of Biofuels - Liquid, Gaseous and Solid - Bioethanol Hexose and Pentose sugar conversion to ethanol- Bioethanol plant design and its components- Bio refinery demonstration projects of Bioethanol- Biodiesel - Biodiesel from vegetable oils/ non-edible oils - Transesterification process-Oleaginous microorganisms-Algal Biofuel - Algal based technologies for biofuel and value added chemical preparation - Biobutanol - ABE Fermentation for Butanol production - Pyrolysis bio-oil/bio-char -Bio-alkanes and alkenes from waste biomass - Gaseous Biofuel - Bio-synthetic natural gas (SNG)- Biomethanation process- Microbiology of anaerobic direction- Dimethyl ether (DME)-Biobydrogen-Biological Processes for Hydrogen Production- Dark fermentation and algal based technologies	and plasma	treatment for was	te to energy	conversion - Catalytic convers	ion process - Syngas production- Bioenergy	Bioch	ar ene	rgy cyc	le - Lar	nd fill a	and flue	e gas re	cover	y for its	s comn	nercial	applica	ation	/ iyun	nyolo
Classification of Biofuels - Liquid, Gaseous and Solid - Bioethanol Hexose and Pentose sugar conversion to ethanol- Bioethanol plant design and its components- Bio refinery demonstration projects of Bioethanol- Biodiesel - Biodiesel from vegetable oils/ non-edible oils - Transesterification process-Oleaginous microorganisms-Algal Biofuel - Algal based technologies for biofuel and value added chemical preparation - Biobutanol - ABE Fermentation for Butanol production - Pyrolysis bio-oil/bio-char -Bio-alkanes and alkenes from waste biomass - Gaseous Biofuel - Bio-synthetic natural gas (SNG)- Biomethanation process- Microbiology of anaerobic digestion- Dimethyl ether (DME)-Biobydrogen- Biological Processes for Hydrogen Production- Dark fermentation and algal based technologies	Unit-4 - Ins	sights into Bioene	rgy		, , , , , , , , , , , , , , , , , , , ,							Ŭ		<u>.</u>					9	Hour
Biodiesel - Biodiesel from vegetable oils/ non-edible oils - Transesterification process-Oleaginous microorganisms-Algal Biofuel - Algal based technologies for biofuel and value added chemical preparation - Biobutanol - ABE Fermentation for Butanol production - Pyrolysis bio-oil/bio-char -Bio-alkanes and alkenes from waste biomass - Gaseous Biofuel - Bio-synthetic natural gas (SNG)- Biomethanation process- Microbiology of anaerobic digestion- Dimethyl ether (DME)-Biobydrogen- Biological Processes for Hydrogen Production- Dark fermentation and algal based technologies	Classificati	on of Biofuels - Liq	uid, Gaseou	us and Solid - Bioethanol Hexos	e and Pentose sugar conversion to ethanol-	Bioet	hanol	plant d	esign a	nd its	compo	onents-	Bio re	finery o	demon	stratior	n proje	cts of	Bioeth	anol-
- ABE Fermentation for Butanoi production - Pyrolysis bio-oil/bio-char -Bio-alkanes and alkenes from waste biomass - Gaseous Biofuel - Bio-synthetic natural gas (SNG)- Biomethanation process- Microbiology of anaerobic digestion- Dimethyl ether (DME)-Biobydrogen- Biological Processes for Hydrogen Production- Dark fermentation and algal based technologies	Biodiesel -	Biodiesel from vege	etable oils/ r	non-edible oils - Transesterificati	on process-Oleaginous microorganisms-Alga	al Biofu	iel - Al	gal bas	ed tech	nologi	es for	biofuel a	and va	lue add	ded che	emical	prepar	ation -	Biobu	tanol
	- ABE Fern	nentation for Butan digestion- Dimethyl	oi productio ether (DMF	on - Pyrolysis bio-oil/bio-char -E =)-Biohydrogen- Biological Proc	No-aikanes and alkenes from waste biomass esses for Hydrogen Production- Dark fermel	s - Gas ntation	and a	BIOTUEI Igal ba	- BIO-S sed tec	yntnet hnoloc	iic natu nies	irai gas	(SNG)- Bion	netnan	ation p	process	3- MICI	ODIOIO	gy of

Unit-5 - Technologies for Waste Management and Government Policies

Smart Bins - Robotic hand for waste segregation using image acquisition and analysis - Unmanned Arial Vehicle (UAV) for landfill waste forecasting - AI and Sensor Technology for waste segregation - Robotic ocean waste collection and reutilization - Activities of Ministry of Energy, Government of India and International Energy Agency - Potential Benefits of Replacing Fossil Fuels with Biofuel, Biomass and Biogas

 Learning
 1.
 Peter Lacy, Jakob Rutqvist, Waste to Wealth, The Circular Economy Advantage, Springer, 2015
 3.
 Reeta
 Rani
 Singhania,
 Rashmi
 Avinash
 Agarwal,
 R.
 Praveen
 Kumar,
 Rajeev
 K

 Resources
 2.
 Online resources: https://onlinecourses.nptel.ac.in/noc21_ch09/preview]
 3.
 Reeta
 Rani
 Singhania,
 Rashmi
 Avinash
 Agarwal,
 R.
 Praveen
 Kumar,
 Rajeev
 K

			Continuous Learning	Assessment (CLA)		Summotivo					
	Bloom's Level of Thin <mark>king</mark>	Forr CLA-1 Avera (5	native age of unit test 0%)	Life-Lon Cl (1	g Learning _A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	15%	Martin Same	15%		15%	-				
Level 2	Understand	25%	10000	20%	122/201	25%	-				
Level 3	Apply 📃	30%		25%		30%	-				
Level 4	Analyze	30%	Carl Stranger	25%		<mark>30</mark> %	-				
Level 5	Evaluate	- A.		10%		-	-				
Level 6	Create		CONSTRUCTION OF	5%	·	-	-				
	Total	10	0 %	10	0 %	10	0%				

Course Designers	And States Contractions and the second	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.Kirti Singh, Camlin Fine Sciences Ltd., New Delhi	1. Dr. Rintu BanerjeeIIT Kharagpur, rb@agfe.iitkgp.ernet.in	1. Dr.B.Samuel Jacob, SRMIST
2. Dr.D.Gunaseelan, Alvotech Pvt., Ltd., Iceland	2. Dr. Vinod Kumar, Cranfield University, UK,	2. Dr.K.Ramani, SRMIST
	vinod.kumar@cranfield.ac.uk	



B.Tech / M.Tech (Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

Course Code	Ise 21BTO107T Course FUNDAMENTAL NEUROBIOLOGY Name		Cours Catego	e ry	0				OPEN I	ELEC	TIVE				L T 3 0	P 0	C 3		
Pre-requ Course	isite es	Nil	Co- requisite Courses	Nil	Pro C	Progressive Courses Nil													
Course	Offering Departmen	t	Biotechnology	Data Book / Codes /	Standards							Nil							
Course Le	earning Rationale (C	LR): Th	ne purpos <mark>e of learning</mark> this course	e is to:				1.1	Progra	am Ou	utcome	s (PO)				P	rogra	m
CLR-1:	CLR-1: Recall the brain function from its organization						3	4	5	6	7	8	9	10	11	12	່ S 0ເ	pecifi	ic Ies
CLR-2:	Discuss the synapt	ic structure	an <mark>d function</mark>	- u-man	e		of	s of	2	iety			rk		e				
CLR-3:	Understand differe	nt types of l	e <mark>arning and</mark> memory, influence of sl	leep and ageing	vled		ent o	ation	ge	soc			NC NC		Jano	Ð			
CLR-4:	Analyze genetic va	riations in b	p <mark>rain dev</mark> elopment and behavior	16 - C	Knov	Ilysis	lopm	estig: olem	Usa	r and	৵		Tean	ion	& Fir	arnin			
CLR-5:	Study the brain pat	hology	1. 5. 1.		ering	n Ana	devel	t inve	Tool	ginee	ment		al & -	nicat	Mgt.	ng Le;			
Course O	utcomes (CO):	A	t the end of this course, learners	will be able to:	Enginee	Problen	Design/	Conduc complex	Modern	The enç	Environ	Ethics	Individu	Commu	Project	Life Lor	PSO-1	PSO-2	PSO-3
CO-1:	Describe the funda	menta <mark>l orga</mark>	anization of brain and its functions	Steel Curst	2	2	-	-	-		-	-	-	-	-	-	2	-	2
CO-2:	Explain the synapti	ic com <mark>positi</mark>	i <mark>on</mark> and neurotransmitter release cyc	cle	2	2	-	- (-		-	-	-	-	-	-	2	-	2
CO-3:	Analyze different d	omain <mark>s of le</mark>	earning and synaptic protein mainter	nance	2	2		-	3		-	-		-	-	-	2	-	3
CO-4:	Summarize the role	e of ge <mark>nes i</mark>	<mark>n br</mark> ain development and functions		3	2	-	-	3		-	-	-	-	-	-	3	-	3
CO-5:	Understand the ne	uropat <mark>holog</mark>	<mark>lical</mark> conditions across the age group	DS	3	2	1	-	3	1	-	-	-	-	-	-	3	-	3
Unit-1 - In Basics of I	troduction to Brain Neurobiology- Unders	and Neuro	nal Types ain function- Orientation of Central n	nervous system- Peripheral no	ervous system- L	evels	of Net	ıral org	anizati	ion- Ci	oncept	of fund	ctional	units-	Cellula	r basis	s of Ne	9 urobic	Hour blogy-
Clinical iss	ues in neurobiology-	Neuron terr	ninology- Cell biology of neurons and	d glia- Differentiation of axon	and dendrite- Syr	naptic	organ	ization-	Sensc	orimoto	or, autor	nomic	and er	nteric d	ivisions	s- Syna	ipses a	and sp	oines-
Unit-2 - Ti	memeurons and clas	silication- II re Impulse	Inibilory projection neurons- Excitation	ory neurons- neurogila and g	jiiai sneatns	_		-					-					9	Hour
Membrane	potential- Action pot	ential- Rest	tin <mark>g potential-</mark> Electrochemical basis	of nerve function- Electrical	and Thermodyna	mic F	orces	in Pass	ive Dis	tributi	on of lo	ns- Hy	/perpo	larizatio	on or D	Depolar	izatior	1- Che	mical

basis for neuronal communication- Ion pumps and lon gradients- Ion channels and transporters- Hyperpolarization- Activated Ionic Currents- Membrane excitability- Neurotransmitters- Receptors of neurotransmitters-Synthesis of neurotransmitters and neuropeptides- Synaptic vesicle cycle- Release and metabolism of neurotransmitters- Molecular mechanisms nerve terminal- Molecular signaling in neurons

Unit-3 - Functions of Brain-Learning and Memory

Brain energy metabolism at the cellular level- Sensory systems- Receptors to perceptions- Chemical and somatic senses- Molecular and neural basis of visual perception- Organization of autonomic nervous system and functions- Nature of motor system and its functions- Reflexes and fixed motor responses- Locomotion- Epigenetics of the brain- Epigenetics in brain disorders- Sleep, dreaming and wakefulness- Reward and motivation- Emotion and addiction- Aging and synaptic degradative pathways- Cognitive impairment- Learning and memory- Language, communication and consciousness

Unit-4 - Circuits of Neuroendocrinology, Neuroimmunology and Role of Neurogenetics

Nature of central systems- Survey methods- Neuroendocrine circuits- Functions of neuroendocrine system- Neuroendocrine tumors- Global epidemiology of neuroendocrine tumors- Neuroimmune functions- Neuroendocrine-immune interactions in neurological disorders- Neuroendocrine-immune interactions in autoimmune diseases- Developmental genetics of the brain- Genes for human brain development- Genes in neurological disorders- Genes and behavior- Drugs and the brain- Role of Environmental factors in neurodevelopment- Exposure of lead and methyl mercury in neurodevelopmental disorders-Neurotoxins-

Unit-5 - Diseases of Brain

Disorders of the nervous system- Developmental disorder- Autism, Intellectual disability, Dyslexia, ADHD- Mental Disorder- Schizophrenia- Degenerative disorders- Alzheimer's disease- Parkinson's disease-Psychiatric disorder- Depression and anxiety- Stroke- Epilepsy- Implications of neuropharmacology- Novel therapeutic targets- Neural Plasticity, Goat Brain Dissection- Understanding brain by Artificial Intelligence-Neural network for analyzing brains network

Learning	1. Larry Squire, Darwin Berg, Floyd E. Bloom, Sascha du Lac, Anirvan Ghosh, Nicholas C.	2. Michael Aschner,Lucio G. Costa,Environmental factors in Neurodevelopmental	and
Resources	Spitzer, Fundamental Neuroscience, 4th ed., Academic Press, 2012	neurodegenerative disorders, Academic Press, 2015	

Learning Assessme	ent										
			Continuous Learning	Summetive							
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ige of unit test 0%)	Life-Long CL (1)	g Learning "A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	<u>The</u> ory	Practice				
Level 1	Remember	15%		15%	100	15%	-				
Level 2	Understand	25%		20%		<mark>25</mark> %	-				
Level 3	Apply	30%	10 S H S 10 C 1	25%		30%	-				
Level 4	Analyze	30%		25%		30%	-				
Level 5	Evaluate			10%	-	-	-				
Level 6	Create	- 10 - 10 - 10 - 10 - 10 - 10 - 10 - 10		5%			-				
	Total	10	0%	10	0 %	10	0 %				

Co	Course Designers										
Ex	perts from Industry	Experts from Higher Technical Institutions	Internal Experts								
1.	Dr. C. N. Ramchand, Saksin Life sciences Pvt Ltd, Chennai, ramchand@saksinlife.com	1. Prof. K Subramaniam, IITM, Chennai, subbu@iitm.ac.in	1. Dr. Anil Annamneedi, SRMIST								
2.	Dr. Karthik Periyasamy, Scientist, Biocon, karthik.periyasamy@biocon.com	2. Prof. R. B. Narayanan, Anna University, Chennai arbeen09@gmail.com	2. Dr. R. Vasantharekha, SRMIST								

9 Hour

Course Code	21BMO121T	Course Name	FUNDAMENTALS OF BIO	MEDICAL ENGINEERING	Cour Categ	Course Category					OPEN I	ELEC	ΓIVE				L T 3 0	P 0	C 3
Pre-requis Courses	site S	Nil	Co- requisite Courses	Nil	P	rogres Cours	sive ses						Nil						
Course C	Offering Departme	nt	Biomedical Engineering	Data Book / Codes / Standar	ds							Nil							
Course Lea	arning Rationale (e purpose of learning this course	is to:	-	1	1.0		Progr	am Oi	Itcome	s (PO))				Pi	roara	m
CLB 1: Pagell the basiss of abusislagy							3	1	5	6	7	8	, 0	10	11	Speci			с
						2	5	4	5	0	· ·	0	3	10	11	12	ou	tcom	es
CLR-2:	Recognise basic a	aspects of bio	medical recorders		e		de la	sof		iety			£		۵.				
CLR-3:	Tabulate the varie	ous patient m	onitoring systems used in health ca	re	rledo		ent o	tion	e	soc			Wo		ance	6			
CLR-4:	Interpret the phy imaging	vsics behind	x-ray imaging, computed tomogra	phy (CT) and magnetic resonance	Know	alysis	lopme	estigat	I Usaç	er and	t & V		Team	tion	& Fin	arninç			
CLR-5:	Describe the prop	erties an <mark>d tec</mark>	hniques involved in Therapeutic Eq	uipment's	sering	m An	n/deve	ict inv ex pro	n Too	nginee	nmeni nabilit		ual &	unicat	t Mgt.	ong Le		0	~
Course Ou	tcomes (CO):	At	the end of this course, learners	vill be able to:	Engine	Proble	Design	Condu	Moder	The e	Enviro Sustai	Ethics	Indivic	Comm	Projec	Life Lo	-OS	PSO-2	-SO-S
CO-1:	Recall the basics	of phy <mark>siology</mark>			1	-	1	۰.,			-	-	-	-	-	-	-	-	-
CO-2:	Recognise basic a	aspects of bio	medical recorders	and the second	1	-	1	- 5	-	-	1	-		-	-	-	-	-	-
CO-3:	Tabulate the varie	ous pat <mark>ient m</mark>	<mark>on</mark> itoring systems used in health ca	re	1	-	1	1	-		-	-	-	-	-	-	-	-	-
CO-4:	Interpret the phys	ics beh <mark>ind x-ı</mark>	ray imaging, computed tomography	(CT) and magnetic resonance imaging	3	-	1	4.25	-		-	-	-	-	-	-	-	-	-
CO-5:	Describe the prop	erties a <mark>nd tec</mark>	<mark>chniq</mark> ues involved in Therapeutic Eq	uipment's	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Unit 1 Eur	ndomontalo of Dia	modical Inc	trumontation						1									0	Ham
Anotomy or	Damentals of Bio		tom of the body Sources of Biomon	ical signals, Basic Block diagram of r	nodica	Linetru	monta	tion eve	tom G	onora	constr	ainte ir	dosia	in of m	odical	inctrun	ontati	9 On SV	nour ctom
Origin of -	bioelectrical signal	ls-Electrocard	liogram-Electroencephalogram-E	stromyogram-Recording electrodes-S	Silver-si	ilver c	hloride	electro	odes-E	lectro	des for	ECG	Electr	odes i	for EE	G-Elec	trodes	for E	EMG-
Microelectro	odes				-			1	1										
Unit-2 - Bio	medical Recorde	rs					_		1									9	Hour
Electrocard	iograph-Block diag	ram of an E	CG machine- The ECG leads-Effe ram description of Electrophoneopholo	cts of Artifacts on ECG recording-Bl	OCK diá Instru	agram montai	of -mid	croproc	essor	based	ECG n	nachin	e-Pho	nocard	iograpi	h (PCC	3)-Orig	in of	heart
Unit-3 - Pat	tient Monitorina S	vstems	and description of Electroencephaic	gram-Electromyography-bioleeuback	Insuu	nental	.1011		-									9	Hour
Introduction	to cardiac monitor	r-Basic Block	diagram of Bedside patient monito	ring systems-Basic block diagram of	Centra	l monit	tors-Me	easuren	nent of	^r heart	rate-Av	/erage	heart	rate m	eters-l	nstanta	aneous	s hear	t rate
meters Mea	surement of pulse	rate-Blood p	ressure measurement-Direct metho	ds of monitoring blood pressure-bloc	d pres	sure-Ir	ndirect	method	ls of m	nonitor	ing bloc	od pre	ssure	Autom	atic blo	ood pre	essure	meas	uring
apparatus u	sing korotkoffs me	thod-Ultrasor	nic method-Measurement of Respire	tion rate-Displacement method-Apne	a dete	ctors												•	
Basics of d	ignostic imaging	Naturo of V	rave-Production of X rave Stationar	v anode tube-Rotating anode tube P	lock di	aaram	of an	Y-ray n	achin	o_Intro	duction	to co	mnutor	tomo	aranhu	Racio	nrinci	y nlos o	f CT
Introduction	to Nuclear imaair	na-Sinale pha	ton emission computed tomograph	v-Positron emission tomography-Pri	nciple of	of NM	R imao	ing, sp	n pola	rizatio	n-Reso	nance	. relax	ation.	spin ea	-basic choes.	aradie	nt eci	hoes-
Introduction	to ultrasound-Mod	les of ultraso	und	,				3, 50								,			
				and the second se															

Unit-5 - Therapeutic Equipments

Need for cardiac pacemaker-External and Implantable pacemaker-Need for Defibrillators-DC defibrillator-Implantable defibrillator-Principle of surgical diathermy-Surgical diathermy machine-Short wave diathermy-Microwave diathermy and Ultrasonic unit-Working of hemodialysis machine-Principle of peritoneal dialysis-Need for anesthesia-Working principle of anesthesia machine-Mechanics of respiration-Ventilators and types of ventilators-Automated Drug delivery system-Infusion pumps-Implantable Infusion system

	1. Leslie Cromwell, Fred J.Weibell, Erich A. Pfeiffer, "Bio-Medical Instrumentationand	4. Jerrold T. Bushberg, John M. Boone, "The essential physics of medical imaging", Lippincott
	measurements", Pearson Education, PHI Learning Private limited, India, 2ndedition,	Williams & Wilkins, 3rdedition, 2011.
	2007.	5. Rongguang Liang, "Biomedical optical imaging technologies: Design and applications", Springer
Learning	2. John G.Webster, "Medical Instrumentation application and design", Wiley India PvtLtd,	Science & Business Media, 1st edition, 2012
Resources	India,4thedition, 2015	6. Nadine Barrie Smith, Andrew Webb, "Introduction to medical imaging: Physics, Engineering and
	3R.S.Khandpur., 'Handbook of Biomedical instrumentation', Tata McGraw Hill	clinical applications", Cambridge University Press, 1st edition, 2010.
	Publishing Co Ltd., 3rd edition, 2014.	7. M. A. Flower (Editor), "Webb's Physics of medical imaging, Second Edition", CRC Press, Taylor &
		Francis Group, ISBN:978-0-7503-0573-0, 2nd edition, 2016.

Learning Assessn	nent		A CONTRACTOR								
		Summativa									
	Bloo <mark>m's</mark> Level of <mark>Thinking</mark>	Format CLA-1 Average (50%	ive of unit test)	Life-Long CL (10	Learning A-2 %)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%		10%	× ×	<u>10</u> %	-				
Level 2	Understand	20%	20 C 10 C 10 C	10%		<u> </u>	-				
Level 3	Apply	30%		30%	1.00	<mark>30</mark> %	-				
Level 4	Analyze	30%		30%	-	<mark>3</mark> 0%	-				
Level 5	Evaluate			10%		<mark>1</mark> 0%	-				
Level 6	Create	· · ·	- 1 P.	10%		<mark>1</mark> 0%	-				
	Total	100 %	6	100) %	100	%				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Anbuselvan T, General Manager – Sales, Wipro GE	1. Dr. S. Poonguzhali, Professor, Centre for Medical Electronics, Anna University	1. Dr.P.Vinupritha, SRMIST
Healthcare Pvt. Ltd., Tamil Nadu, Srilanka & Maldives	The Star And And Distance	

Course Code	21BMO122T	Course Name	HEALTH INFOR	RMATION SYSTEMS	Cours Catego	se ory	0	O OPEN ELECTIVE L T 3 0									P 0	C 3	
Pre-requ Course	isite es	Nil	Co- requisite Courses	Nil	Pr	ogres Cours	sive es						Nil	1					
Course	Offering Departme	Data Book / Codes / Standard	S							Nil									
Course Le	earning Rationale	rse is to:	-	1	1	2.1	Progr	am Ou	itcome	s (PO))				Program				
CLR-1:	Write about the b	No. 20	1	2	3	4	5	6	7	8	9	10	11	12	S	pecifi tcom	c es		
CLR-2:	Express the use	new method	s in <mark>health inform</mark> ation acquisition a	and medical records	ge		of	s of	10	iety			Ł		e				
CLR-3:	Identifying differe	10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	vled		lent o	ation	ge	l soc			n Wo		Jano	þ					
CLR-4:	Demonstrate stra	tegies in HI <mark>S</mark>	<mark>S data ma</mark> nagement regulations		Kno	alysis	lopr	estig: blem	Usa	r and	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		Tear	U	& Fii	arnir			
CLR-5:	Incorporate Heal	h informatio	<mark>n system</mark> for the hospital benefit a	nd apply HIS usage in Indian context	ering	m Ana	/deve	ct inve	n Tool	Iginee	nment		ual & .	unicat	t Mgt.	ng Le			
Course O	utcomes (CO):		At the end of this course, learned	rs will be able to:	Engine	Proble	Design	Condu	Moder	The er	Enviro Sustai	Ethics	Individ	Comm	Projec	Life Lo	PS0-1	PS0-2	PSO-3
CO-1:	Define role of infe	Define role of information technologies in potentially revolutionizing healthcare delivery, administration education, and research						-	-		-	-	-	-	-	-	-	-	
CO-2:	Describe the Integration of existing & emerging technology in healthcare							-	-	-	-	2	-	-	-	-	-	-	-
CO-3:	Practice the architecture standards in HIS						2	-	2		-	-	-	-	-	-	-	-	-
CO-4:	Interpret the acceptance testing & issues on standards in HIS						1	1.1.2	2		-	-	-	-	-	-	-	-	-
CO-5:	Implement health information for computer aided diagnostic purposes and apply Health Information hospitalcontext						1	-	-	-	-	-	-	-	-	2	-	-	-

Unit-1 - Foundations of Health Information Management

Health Care Systems-Evolution Health Care-Health Informatics-Information Management Profession in Hospitals- Importance of confidentiality-Personal and Impersonal data-Health Information Infrastructure-Health Information Systems-Standalone Information System-Clinical Decision Support System(CDSS)-Hospital Information System(HI-Related Parties in HIS-Profit & Nonprofit healthcare stakeholders ; Provider (Hospital)-Payers(Insurance Companies) ; Employers ; Practitioners ;-Public Health Officials; Educator

Unit-2 - Medical Records and Other Documents

A Brief Introduction to Medical record history-Physical Record - Data expected in record-Health Insurance Portability and Accountability Act (HIPAA)-Problems-advantages of Physical Records-Modules in Hospital – Information System(HIS)-Admission/Discharge/Transfer (ADT) system-Scheduling & Registration-Pharmacy System-Embedded CDSS-Connecting Teleradiology- Laboratory Information System(LIS)-Electronic Health Record Data- Dangers of Large Databases-Internal Data – Clinical, Administrative-Use of internal data-External Data – Comparative, Expert Data,-External Data- Knowledge Base

Unit-3 - Architecture and Interfacing for Healthcare Technology

Complexity of systems in healthcare-Wireless networks-LAN security-overcoming LAN security vulnerabilities-Middleware-Different products in Middleware-Network Interoperability-Platform interoperability-Database Interoperability-GUI/MUI Interoperability-Multi-Location Enterprise-Inter-enterprise health care solution-Timely Admissions, Discharges, and Transfers-Connectivity to Another Health Plan-Information Systems Life Cycle- Information Systems Life Cycle-Health Care Informatics-Project management in health Informatics

9 Hour

9 Hour

Unit-4 - Regulations and Computer Aided Detection

Computer-Aided Diagnostics-Computer-Aided detection-Electronic Health Record Data-Database Presentation and Statistics-Health Record Data-Representing data-Public Health Informatics-Patient EHR Databases -in public health-Clinical decision support systems-Clinical decision support systems-Privacy and patient protection concerns-Privacy and patient protection concerns-Implementing Computerized Physician Order Entry-Issues and Ethics in HIS-Privacy and health Law-Predicting Uncertainty-Risk management in HIS-Risk management in HIS

Unit-5 - Future of His and Technology

9 Hour

9 Hour

eHealth, mHealth-Equipment used in eHealth, mHealth data-Social Media, and Telemedicine-Improved use of Telemedicine-Parts of telemedicine-Connecting rural India through telemedicine-Voice enabledrecordings in health-disease progression modeling-Handheld Technologies in Healthcare at home-Handheld Technologies in Healthcare at hospital-Integrating Handheld Technologies at hospital-Technology for personalized medicine- Automated Patient Identification-Automated Patient Identification in medicine-Bar Coding, and Smart Cards-Applying Bar Coding, and Smart Cards in research in Hospital-Impact of HIS on – Research-Impact of Technology on Policy, and Public Health

	1.	Winter, A., Haux, R., Ammenwerth, E., Brigl, B., Hellrung, N., Jahn, F., "Health	3.	Karen A. Wager, Frances W. Lee, John P. Glaser, "Health Care Information Systems: APractical
Looming		Information Systems-Architectures and Strategies", 2nd Edition Number, Springer-		Approach for Health Care Management", John Wiley & Sons, 4th edition, 2017
Learning		Verlag London, 2011	4.	Jean A Balgrosky, "Essentials of Health Information Systems and Technology", Jones & Bartlett
Resources	2.	Mervat Abdelhak Mary Alice Hanken, "Health Information: Management of a Strategic		Publishers, 2014
		Resource", 5th Edition, Saunders, 2015		

Learning Assessm	ent			Contraction of the second				
			Summetive					
	Bloom's Level o <mark>f Thinkin</mark> g	Forma CLA-1 Averag (509	ntive e of unit test %)	Life-Long Le CLA-: (10%	earning 2)	Final Exa (40% wei	anve mination ghtage)	
		Theory	Practice	Theory	Practice	Theory	Practice	
Level 1	Remember	20%		10%		10%	-	
Level 2	Understand	20%		10%		10%	-	
Level 3	Apply	30%		30%		<mark>3</mark> 0%	-	
Level 4	Analyze	30%		30%	-	<mark>3</mark> 0%	-	
Level 5	Evaluate		-	10%		10%	-	
Level 6	Create		-	10%	-	10%	-	
	Total	100	%	100 %	6	100	%	

Course Designers												
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts										
1. Mr. Anbuselvan T, General Manager – Sales, Wipro GE	1. Dr. S. Poonguzhali, Professor, Centre for Medical Electronics, Anna	1. Dr. A. Bhargavi Haripriya, SRMIST										
Healthcare Pvt. Ltd., Tamil Nadu, Srilanka& Maldives	University											

Course Code	Irse 21BMO123T Course BASICS OF MEDICAL IMAGING Name							Cour Categ	se ory	0				OPEN I	ELECI	IVE			l	- T 3 0	P 0	C 3
Pre-requ Course	isite es	Nil		Co- requisi Courses	te	Nil		P	rogres Cours	sive						Nil						
Course	Offering Departme	ent	Biome	dical <mark>Engineeri</mark>	ing	Data Book /	Codes / Standar	ds							Nil							
							1	14	1	1.00												
Course Le	earning Rationale	(CLR): 7	The purpose	<mark>of learnin</mark> g th	nis cou	irse is to:			1	1		Progr	am Ou	utcome	s (PO)	1				Pr	rogran	n
CLR-1:	Describe the wor	king principl	le of X-ra <mark>y</mark> in	laging	- \			1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	es
CLR-2: Demonstrate the working principle of Computed tomography							ge		f	s of	20	iety		۰.	¥		a					
CLR-3:	Narrate the physi	ics behind n	nucl <mark>ear radia</mark> t	ion and the ima	nging m	odalities in nuclear med	licine	vled	S	lent o	ation	ge	d soc		-	n Wo		Jano	b			
CLR-4:	Illustrate the work	king principle	le <mark>of ultras</mark> oul	nd and its differ	rent ima	aging modalities		Kno	IJsis	opm	stig	Usa	r and	৵		Tear	O	& Fii	arnir			
CLR-5:	CLR-5: Explain the working principle of magnetic resonance imaging and its application in diagnosis							neering	lem Ana	gn/devel	duct inve	ern Tool	engineer	ronment ainability	S.	idual &	municat	ect Mgt.	Long Lei	<u>-</u>	-2	-3
Course O	utcomes (CO):		At the end o	of this course,	learne	ers will be able to:	A Growth	Engi	Prob	Desi	Conc	Mode	The	Envi	Etic	ndiv	Com	Proje	Life	SO	SO	PSO
CO-1:	Describe the prin	ciple be <mark>hina</mark>	<mark>d the w</mark> orking	of X-ray imagi	ng	A States As	S 1.54.	1	-	-	-	4	1	-	-	-	-	-	-	-	-	-
CO-2:	Explain the worki	ing princ <mark>iple</mark>	e of tomograp	hic imaging an	d recor	struction procedures.	이는 프	1	1	12	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Compare the diffe	erence i <mark>n wo</mark>	<mark>orkin</mark> g princip	ole of different r	nuclear	imaging modalities	1.8.4	1			1	-	- 10	-	-		-	-	-	-	-	-
CO-4:	Analyze the diffe	rent mo <mark>des</mark> (of ultrasound	l imaging techn	niques		100	1	2	-	-	-		-	-	-	-	-	-	-	-	-
CO-5:	Illustrate the phys in MR imaging	sical prin <mark>cipl</mark>	<mark>le of m</mark> agneti	c resonance im	aging a	and the instrumental con	nponents involved	1	-	Ú.	1	-		-		-	-	-	-	-	-	-
Unit-1 - X-	Rav Imaging	_		100			1 2					1				-					9	Hour
Principles screen- El	of Imaging with X-ra	ays-Producti X-ray Film-II	tion of X- ray- Image charac	Interaction of X steristics-Digita	(-ray wii I radiog	th Tissue-Coherent, Col graphy-Flat panel detect	mpton-and photo ors-Mammograpl	electric 1y – Ba	effect- sic blo	Attenu ck diag	ation c gram-X	oefficie -ray tul	ents of be des	X-rays i ign	in tissu	<mark>le -</mark> coll	imator	s-Anti-s	scatter	grids-l	Intensi	fying
Unit-2 - C	omputed Tomogra	phy			1.1		1.2.1	-				1									9	Hour
Computed	Tomography-Histo	orical develo	opm <mark>ent-Instru</mark>	Imentation-Hou	unsfiela	unit-Detectors and De	tector arrays-Tor	nograp	ohic re	constru	iction-E	Back pi	rojectio	on algoi	rithm-E	Digital	image	display	/-Radia	ation d	lose-Ir	nage
quality- Ar	tifacts-Helical CT-N	lulti slice spi	oral CT-Multi	slice CT - Dete	ector co	onfigurations -CT Applica	ations	1	-	-	-	-	-									Uaur
General n	rinciples of Nuclea	r Medicine-F	Radioactivity	basics-Produc	tion of	radionuclides-Types of	f radioactivity-Ins	trumen	tation-	Gamm	a came	ra-Col	llimato	rs scin	tillatior	1 cryst	al-Pho	tomulti	nlier tu	ihes-P	y i Ulse h	eiaht
analyzer-	Single photon emi	ssion comp	outed tomogi	raphy-Instrume	ntation	Clinical Application-F	Photon Emission	Tomo	graphy	-Gene	ral Prin	nciples-	Radio	nuclide	s used	d for F	PET-In	strume	ntation	for P	'ET-Cl	inical
application	ns of PET		0																			
Unit-4 - U	Itrasound Scanner	rs																			9/	Hour
General P	rinciples -Wave Pr	opagation-U	Jitrasound Ci	haracteristics-V	Vave re	eflection and refraction-	Absorption, Scat	tering,	Attenu	ation-I	nstrum	entatio	n-Trar	sducer.	s-Tran	sducer	r array	s-Scan	ning m	iodes-	A-Mod	le-B-
linit-5 - M	agnetic Resonanc	e Imanina	Jaliai resoluli	un, contrast -ic	J-HOISE	Tallo-Doppier eriect, Co	nunuous wave L	oppier	-0001	Doppie	er innag	ing -Ci	inicar	applicati	10115-01	JSIEITIC	is anu	gyneco	лоду		9	Hour
Nuclear M	lagnetism-Quantum	mechanica	al description	n-Radiofrequen	cy puls	se and rotating frame-S	pin-Spin and Sp	in-Latti	ce rela	xation	-Meası	iremen	t of T	1 and 7	2-Inve	ersion	recove	ry-Spir	n echo	seque	ences-	Slice
Selection-	Phase and frequen	cy encoding	g-MRI Instrun	nentation-Block	k Diagr	am-Magnets-Magnetic	field gradient coil	Radio	frequer	ncy coil	l-Image	chara	cterist	ics-MRI	contra	ist age	ents-Cli	inical a	pplicat	ion-Bra	ain	
																						83

	1.	R.S.Khandpur., 'Handbook of Biomedical instrumentation', Tata McGrawHill Publishing	19 3. M. A. Flower (Editor), "Webb's Physics of medical imaging, Second Edition", CRC Press, Taylo
		Co Ltd., 3rd edition, 2014.	Francis Group, ISBN: 978-0-7503- 0573-0, 2nd edition, 2016. Nadine Barrie Smith, Andrew Wel
Learning	2.	Jerrold T. Bushberg, John M. Boone., "The essential physics of medical imaging",	j", <u>"Introduction to medical imaging</u> : Physics, Engineering and clinical applications", Cambric
Resources		Lippincott Williams & Wilkins, 3rd edition, 2011.	UniversityPress, 1st edition, 2010.
			4. K. Kirk Shung, Michael Smith, Benjamin M.W. Tsui., "Principles of medical imaging", Acader
			Press, 1stedition, 2012.

Learning Assessment

			(A.)	Summetive							
	Bloom's Level of Thinking	Forma CLA-1 Averag (50	ative le of unit test %)	Life-Long CL (10	Learning A-2 1%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	10%		10%	-				
Level 2	Understand	20%		10%		10%	-				
Level 3	Apply	30%		30%		30%	-				
Level 4	Analyze	30%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	30%		30%	-				
Level 5	Evaluate			10%		10%	-				
Level 6	Create	Create 10% -					-				
	Total	100	%	100)%	100 %					

Course Designers		Press.
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Anbuselvan T, General Manager – Sales, Wipro GE	1. Dr. S. Poonguzhali, Professor, Centre for Medical Electronics, Anna	1Dr.S.P.Angeline kirubha SRMIST
Healthcare Pvt. Ltd., Tamil Nadu. Srilanka & Maldives	University	



Course Code	21BMO124T Course REHABILITATION ENGINEERING								Cour Categ	se ory	0				OPEN	ELEC	TIVE			:	L T P C 3 0 0 3				
Pre-requi	isite es	Nil			Co- requi	isite s		Nil		Pi	ogres Cours	sive es						Nil	1						
Course	Offering Departm	ent	I	Biomedi	cal Engine	ering	Dat	ta Book / Codes	s / Standard	ls							Nil								
Course Le	arning Pationale		The pu	Irnosa o	floarning	this cours	so is to:		-	-	1			Progr	am Oi	Itcome	e (DO	<u>۱</u>				P	rogra	m	
		hiomoch	nice of m			ol docian	se is to.	-												Specific					
CLR-1.		uomecna									2	5	4	5	0	/	0	9	10	11	12	ou	tcom	es	
CLR-2:	Learn about per	sonal trai	isportation	n, manua	l and pow	rered wheel	Ichairs	and the second second		dge		of	US O	15	ciet			/ork		e			l		
CLR-3:	Appreciate the w	orking o	prosthetic	ics, ortho	tics	1			2216	wlee	s	nent	atio	age	d so			≥ E		nan	бu		l		
CLR-4:	Understand sense	sorial pro	sthe <mark>ses</mark>		~			Rei-		Knc	alysi	lopr	estic	IUs	ir an	v &		Tea	tion	ъ К	ami		l		
CLR-5:	CLR-5: Apprehend the advanced technologies in rehabilitation engineering						leering	em Ana	jn/deve	uct inve lex pro	rn Too	ingineer	onment	6	dual &	nunicat	ct Mgt.	ong Le	5	2	ę				
Course O	utcomes (CO):		At the	end of t	his cours	se, learners	s will be ab	le to:	a	Engir	Probl	Desig		Mode	The e	Envir Susta	Ethic	ndivi	Comr	Proje	-ife L	-OSc	-OSc	-OSc	
CO-1:	Explain gait cycl	e and ba	s <mark>ic rehab</mark> il	litation te	rminologie	es	1 () () ()	a cure	S.S.4	1	-	2	-			-	-	-	-	-	-	-	-	-	
CO-2:	Differentiate the	types an	<mark>d techno</mark> lc	ogies with	n wheelcha	airs	1-5-	 If the set of the se		-	-	2	2	-		-	-	-	-	-	-	-	-	-	
CO-3:	Design basic ort	hotics an	<mark>d prosth</mark> et	tics	27.6		1.000			-		3	3	-	-	-	-	-	-	-	-	-	-	-	
CO-4:	Summarize the s	sensorial	<mark>prosthet</mark> ic	cs		100	1000		100	1	2		1	1	1	1	-	-	-	-	-	-	-	-	
CO-5:	Appraise the var	ious adv	a <mark>nced to</mark> pi	ics and c	hallenges	in rehabilita	ation engine	eering		2		1	1	1	2	-	-	-	-	-	-	-	-	-	
Unit 4 D	habilitation Engl	nooring	In tro du ot	lion		- Her	1.1.1								-	1								How	
Introductio	n to rehabilitation	Fnaineer	ing-Scone	e-Assistiv	ve Techno	logy-Termi	inologies in	volved-Design cr	onsideration	s-Scor	e of th	his fieli	d-Reha	hilitatic	n ann	roache	s-Con	ents i	n reha	hilitatio	n enai	neerin	a-Univ	/ersa	
design- Co	ncept of universal	design-E	Barrier free	e design-	Disability	assessmen	nt-Legal asp	ects-Provision a	vailable-Mol	bility-B	iomecl	hanics	of mob	ility-Int	roduct	tion to C	Gait cy	cle-lts	applica	ations	n ongi	loonn	<i>y</i> 0111	oroui	
Unit-2 - W	heelchair Techno	logies												1									9	Hour	
Personal	transportation-As	sociated	disabilitie	es-Lift	<i>Nechanism</i>	ns-Applicati	ion areas-	Wheelchairs-Typ	bes-Wheelcl	nair s	tandar	ds-Sa	fety te	sting-N	Nanua	whee	elchair	-Comp	onents	-Powe	red w	heelcl	hair-D	esign	
considerat	ions- Wheels and	casters-N	lotor selec	ction-Bai	teries and	microproce	essors used	3-Smart wheelch	air-Other wi	neeicna	air tech	nnologi	es-Hur	nan tao	ctor, Fa	ault tole	rance						0	How	
Unner and	I ower extremity-	anatomv	overview	-Amnuta	tion Class	ification-Pr	osthesis nr	escription-Comp	onents of u	ner lii	nh nr	osthetii	-s-Fahr	ication	techn	iaues-(Compo	nents	of low	er limh	nrostl	hetics-	Fabric	ration	
techniques	-Latest technolog	ies-Lates	t trends ir	n prosthe	tics-Ortho	otics-Needs	and types-	-Lower extremity	orthotics-T	pes a	nd cor	nsidera	ation-Up	per ex	tremit	y ortho	tics-Ty	pes al	nd con	siderat	ion-Lat	est te	chnolo	gies-	
Latest tren	ds in Orthotics- Im	proveme	nt in orien	ntation ar	i <mark>d mobility</mark>	1																			
Unit-4 - Se	ensorial Prosthet	ics																		_			9	Hour	
Sensorial and naviga –Latest teo	Prostnetics- introd tion aids-Intelligei chnologies-Tactile	uction-Ty nt mobilit prostheti	pes of sei y aids-Hei cs Tongue	ensorial p earing fur e prosthe	rostnetics- ictional as tics-Olfact	-Categories ssessments tory prosthe	s of visual ii s <mark>-Surgical h</mark> etics-Future	mpairment-Cortic earing aids-Non of sensorial reha	cai impiants surgical he abilitation	-Retina aring	ai impli aids- (ants-M Compu	iopility iter aide	aids fo ad lip	r biind readin	-Alas fo g -Tele	or read comm	ung ar unicati	ia writi ion, co	ng-Gra mputer	ipnic a s and	ccess- web a	Crien	tation sibility	

Unit-5 - Rehabilitation Applications

Functional electrical stimulation-FES application-Robots in rehabilitation-Therapeutic robots-Rehabilitation in sports-Areas of sports application-Daily living aids-Assistive technology for dyslexia-Assistive t

	1.	Rory.A.Cooper, "Rehabilitation Engineering Applied to Mobility and Manipulation", First	4.	Glenn Hedman, "Rehabilitation Technology", First Edition, Haworth Press Inc, 1990.
Learning		Edition, CRC Press, 2010	5.	Michael P. Barnes, Anthony B. Ward, "Oxford Handbook of Rehabilitation Medicine", FirstEdition,
Resources	2.	Horia-Nicolai.L.Teodorescu, Lakhmi C. Jain, "Intelligent Systems and Technologies in		Oxford University Press, 2005
	З.	Rehabilitation Engineering", First Edition, CRC press, 2010.		

Learning Assessme	ent									
		~ ~ ~	Continuous Learning A	ssessment (CLA)		Summ	ativo			
	Bloom's Level of Th <mark>inking</mark>	Forma CLA-1 Average (50%	tive e of unit test 6)	Life-Long CL4 (10	Learning A-2 %)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	10%		<mark>1</mark> 0%	-			
Level 2	Understand	20%	0.000	10%		<mark>1</mark> 0%	-			
Level 3	Apply	30%	the state of the	30%		<mark>30</mark> %	-			
Level 4	Analyze	30%		30%		<u>30</u> %	-			
Level 5	Evaluate		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	10%		10%	-			
Level 6	Create	State of the second second		10%	- Promo	10%	-			
	T <mark>otal</mark>	100	%	100	%	100	%			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Anbuselvan T, General Manag <mark>er – Sale</mark> s, Wipro GE	1. Dr. S. Poonguzhali, Professor, Centre for Medical Electronics, Anna	1. Dr. Varshini Karthik, SRMIST
Healthcare Pvt. Ltd., Tamil Nadu, Srilanka &Maldives	University	



Course Code 21BMO125T Course Name QUALITY CONTROL FOR BIOMEDICAL DEVICES						DEVICES	Cor Cate	urse gory	0				OPEN	ELEC	TIVE			Ĺ	- T 3 0	P 0	C 3	
Pre-requ Cours	iisite es	Nil		Co- requi Course <mark>s</mark>	site		Nil		Progre Cour	ssive ses						Nii	1					
Course	Offering Departme	ent	Biom	edical Enginee	ering	Data Boo	k / Codes / Stan	ndards							Nil							
Course L	earning Rationale (CLR): 7	The purpos	e <mark>of learning</mark>	this cours	e is to:			1			Progr	am Ou	utcome	s (PO)				P	rogra	m
CLR-1: Ensure various quality measures in an organization				1	2	3	4	4 5		7	8	9	10	11	12	S OU	pecifi tcom	ic Ies				
CLR-2:	Introduce manag	gement pri	incipl <mark>es</mark> ar	<mark>nd m</mark> anagem	ent practio	ces to enhance	the performa	ince g		of	s of	15	tiety			ĸ		e				
CLR-3:	Implement variou	s quality cor	ntr <mark>ol strate</mark> g	gies to ensure	quality		100 E 20	vled		ent	ation	ge	soc			M C		anc	D			
CLR-4:	Apply innovative i	ideas at all <mark>l</mark>	l <mark>evels of m</mark> a	anagement			State State	Nor	lysis	mdo	stige	Usa	and	∞ .		ean	Б	& Fir	arnin			
CLR-5:	Comply with proto	ocols app <mark>lica</mark>	able to heal	Ithcare globally	y and nation	nally			m Ana	n/devel	ct inve	n Tool	ngineer	nment		ual & T	unicati	t Mgt. 8	ng Lea			
Course C	utcomes (CO):		At the end	of this cours	e, learners	will be able to:	10000	Enaine	Proble	Design	Condu	Moder	The er	Enviro Sustai	Ethics	Individ	Comm	Projec	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Describe Quality,	Quality con	ntrol measu	res essential fo	or an organi	ization		224	1	-	÷ -	2-1	-	-	-	-	-	1	-	-	-	-
CO-2:	Implement the qu	uality m <mark>anag</mark>	<mark>geme</mark> nt prin	ciples and goo	od manager	ment practices	1. 1. 1. 1		2		-	-	- 10	1	-	-	-	3	-	-	-	-
CO-3:	Apply the various	s quality <mark> con</mark>	ntrol tools		1	-10-21	1.00	-	1 -		2	-	-	-	-	-	-	2	-	-	-	-
CO-4:	Adopt the various	s qualit <mark>y ma</mark>	anagement i	tools	1.25	1	a state of the		1	1	10.2	-		-	-	-	-	3	-	-	-	-
CO-5:	Accomplish globa	l and n <mark>ation</mark>	nal protocol	s applicable to	healthcare			1	1	11.00	1	-		-	-	-	-	-	-	-	-	-
Unit-1 - lı	ntroduction to Qual	ity		-		Contract of the second	17-1	-				1	č		f	-					9	Hour
Quality: T Statemen	Ferminologies-Dimer ts- Strategic Plannin	nsions of Q g-Barrierst	Quality-Qual to TQM Imp	lity Planning- plementation	Total Qual	lity Management-	-Basic concepts	-Principle	es of T	¯QM-Le	eadersh	ip – C	Concep	ots-Role	of S	enior I	Manag	ement-	-Quality	/ Cou	ncil-Q	uality
Unit-2 - T	QM Principles				12		1000	-													9	Hour
Customer	satisfaction – Custo	omer Percep	ption of Qua	ality-Customer	Complaints	s-Service Quality-	Customer Reten	tion-Empl	oyee In	volvem	ent-Mo	tivatior	n-Emp	owerme	ent-Tea	ams- T	eam V	Nork-R	ecogni	tion ar	id Rei	ward-
Unit-3 - S	tatistical Process (Control			7.83	THE	A COLUMN	112		1	1.1	1	-								9	Hour
The sever	n tools of quality-Cau	ise-and-effe	ect diagram	-Check sheet-	Control cha	art-Histogram -Pai	reto chart-Scatte	r diagram	-Strati	fication	- Six sig	ma										
Unit-4 – 1	QM Tools							-			_										9	Hour
Benchma	rking-Reasons to Be	nchmark-Be	enchmarkin	ng Process-Qu	ality Functio	on Deployment (C	QFD-House of Qu	uality- QF	D Proce	ess – To	otal Pro	ductive	e Main	tenance	e (TPN	1)FN	NEA-S	tages c	of FME	4		
Unit-5 - S	tandards for Medic	al Devices						000 0000	0 "	0 (01	50			071			05	1	-0.0	9	Hour
Standards	s-iveea i ypes-Medic	ai device sa	arety-medic	ai device q <mark>uali</mark>	ty managen	nent systems requ	uirements-ISO 90	000:2000	Quality	Systen	n-Claus	es-FDI	4-Fun	cuons-A	SIM	Interna	ational-	UE mai	rкing-IĿ	20-Sp	ecitica	ations

Learning Resources	 Rose J.E, Total Quality Management, Kogan Page Ltd., 1993 Cesar A. Cacere, Albert Zana, The Practise of clinical Engineering, Academic Press, 1997 Greg Bounds, Beyond Total Quality Management-Toward the emerging paradigm, McGraw Hill, 2013 	 Joseph J.Carr, Elements of Electronics Instrumentation and Measurement, 2nd ed., Pearson Education, 2003 Jerrold T. Bushberg, John M. Boone, The essential physics of medical imaging, 3rd ed., Lippincott Williams & Wilkins, 2011

			Summ	otivo						
	Bloom's Level of Thinking	Forma CLA-1 Averag (505	ative e of unit test %)	Life-Long CL/ (10	Learning A-2 %)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%		10%		10%	-			
Level 2	Understand	20%	10.2- 14	10%		10%	-			
Level 3	Apply	30%		30%		30%	-			
Level 4	Analyze	30%		30%		30%	-			
Level 5	Evaluate			10%		10%	-			
Level 6	Create		100 C C C C C C C C C C C C C C C C C C	10%		10%	-			
	Total	100	%	100	%	100 %				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Anbuselvan T, General Manager – Sales, Wipro GE Healthcare	1. Dr. S. Poonguzhali, Professor, Centre for Medical Electronics, Anna	1. Dr.D.Kathirvelu SRMIST
Pvt. Ltd., TamilNadu, Srilanka & Maldives	University	



Course Code	21BMO126T	Cours Name	BIOMECHANI	IAN MOVEMENTS	C Ca	ourse itegory	y	0				OPEN I	ELECI	ΓIVE			l	- T 3 0	P 0	C 3	
Pre-requi Course	site s	Nil	Co- requisite Courses		Nil		Prog	gress ourse	sive es						Nil						
Course C	Offering Departme	ent	Biomedical Engineering	g	Data Book / Codes / Sta	andards	1.00							Nil							
Course Le	arning Rationale	(CLR):	The purpos <mark>e of learnin</mark> g this	s course is	to:		-	1			Progra	am Ou	itcome	s (PO))				Pr	ogram	
CLR-1:	Identify essential	anatomic	al components of the musculos	keletal syste	m.		1	2	3	4	5	6	7	8	9	10	11	12	S	pecific	
CLR-2:	Illustrate about th	e movem	ents using standard anatomical	terminology			e		of	s of	2	iety			¥		۵		00	icomes	
CLR-3:	Explain the key c	ontributor	rs to t <mark>he various</mark> events in a gait	cycle.		16	/led		ent o	tion	ge	soc		-	Wo		anci	0			
CLR-4:	Describe measur	ements u	sed in analysis of human mover	ment.	W-2		Non	ysis	udc	stiga Iems	Usa	and	ళ		earr	ы	k Fin	nin			
CLR-5:	Discuss the caus	es and co	mpensation mechanisms for pa	thological g	ait		ering k	n Anal	/develo	ct inves x prob	I Tool I	gineer	ment a		al & T	unicatio	Mgt. 8	ng Lea			
Course Ou	itcomes (CO):	_	At the end of this course, le	arners will	be able to:	-	ingine	roblei	lesign olution	condu	loden	he en	inviror	thics	Ipivipu	omm	roject	ife Lo	SO-1	S0-2	50.5
CO-1:	Apply the commo	n concep	t of movement and study the for	rce balan <mark>ce</mark>	of change in motion		2	-	-		-	-	ш <i>о</i> -	-	- 1	-	-		-	-	<u>-</u>
CO-2.	Analyze the muse	cle force a	and its velocity relationship	1000	C. 2002	-	2	-	1	-	-	_	-	_	-	-	-	-	-	-	-
CO-2:	Identify the joint of	constraint	s in an intact systems	111		-		2						_		_	_	-	-		
CO-3.	Outline the impor	tance of l	vinematics in human movement					2	3									2			
CO-4:	Describe the met	or functio	n and balance theory	-	the state of the s	-	2	-	5		_			-	-	-	-	2			
CO-5:	Describe life mol				10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	100	2	-	1.10	-	-			-	1	-	-	2	-	-	-
Unit-1 - Int	roduction to Bion	nechanic	s	Carlow and	a free free	-							-							9 Hc	our
Understand	ling movement for	rehabilita	tion-Force measurement-Vector	r, scalar gei	neral introduction-Dra <mark>wing</mark> ve	ectors, po	oint of a	applic	cation-	The for	ce of r	nuscle	s worki	in <mark>g p</mark> rii	nciple-	Magnit	ude an	d direc	tion of	momer	its-
Gravity- Mo	oments and posture	e-Momen	ts and posture-Standing balance	e-Force ma	gnitude and change in motion	n-Local a	nd ger	neral	stabil	ity											
Unit-2 - Bio	omechanics of Hu	iman Mo	vements										0 1						<u> </u>	<u>9 Hc</u>	our
Structure of	f Protein filaments	-The sarc	omer <mark>e anatom</mark> ical details-The c	lifference be	etween muscle force and mu	uscle stre	ngth-N	lusci	e worl	K- MUSO	cle fibe	er type	s-Grada	ation o	t musc	le forc	e-Leng	th-Ien tion Inc	SION re	ationsh d	iip-
Increased e	passive tension i endurance	neasuren	ient technique-Force -velocity	reialionsni	o-Angle of pull -Stability an	iu sequei	nung-i	weat	sunny	muscie	e Suer	iyin, e	nuuran		lease	I Vasci	lidiiZal	1011-1110	lease	1 Streng	u1-
Unit-3 - Jo	int Mobility			3112	- HALFING						-									9 Hc	bur
Introduction	n to joint mobility-	Factors in	nvolved in assisting and restric	cting range	of movements-Normal rang	qe definiti	ion-No	rmal	range	-Abnor	mal li	mitatio	ns-Effe	cts of	decre	ased r	ange o	of mov	ement	s-Types	of
therapeutic	- movement of join	ts-Types	of therapeutic movement of joir	nts-Passive	movements-Active movemer	nts-Norma	al joint	con	straint	in an ir	ntact s	ystem	S				0				
Unit-4 - Me	easurement of Hu	man Mov	rement																	9 Hc	our
Linear Kine	ematics-Angular K	inematics	-Forces and movements-Newt	on's First I	aw of motion-Newton's sec	cond law	of mo	tion-	Newto	on's thi	rd law	of m	otion-Fi	Ill thre	e dim	ension	al mot	ion caj	oture-	Movem	ənt
assessmen	nt systems-Visual n	novement	evaluation-Linear Displacement	nt-Angular L	isplacement-Body functions	and struc	ctures-	Case	e stud	y 1:trea	dmill ti	raining	-Promo	oting pi	hysica	l activit	y to im	prove I	nealth	<u></u>	
Basic Princ	sioning and Optin	ning_The	nnan wovements	theory m	del-The task environment T	he task d	Asian	Gait	of the	child w	ith cor	ohral r	alev ho	fore	nd off	reuro	ny_Th	sit to	stand	9 110	nt.
Upper limb	impairment after s	troke-Me	dical history and evaluation-Mot	or impairme	nt-Functional limitations	no lask u	USIGH-	Jail			001	unai p	uisy De			n surye	<i>y-111</i>	311103	stanu i	novenile	111-

	1.	Basic Biomechanics of the Musculoskeletal System, Margareta Nordin and Victor	3. Biomechanics and Motor Control of Human Movement, David Winter 17 September 2009, 2009
Learning		Frankel LippincottWilliams & Wilkins, 2001	JohnWiley & Sons, Inc.
Resources	2.	Biomechanical Analysis of Fundamental Human Movements, Arthur Chapman First	
		Edition 2013	

Learning Assessm	nent		111111	1 200							
			Continuous Learning A	ssessment (CLA)		Summative Final Examination (40% weightage)					
	Bloom's Level of Thinking	Forma CLA-1 Average (50%	tive e of unit test 6)	Life-Long CL/ (10	Learning A-2 %)						
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%		10%		10%	-				
Level 2	Understand	20%		10%		10%	-				
Level 3	Apply	30%	A Date of the second	30%		30%	-				
Level 4	Analyze	30%	1.12.20	30%		30%	-				
Level 5	Evaluate		-	10%		10%	-				
Level 6	Create			10%		10%	-				
Total 100 %				100)%	100 %					

Course Designers	A CONTRACT OF A		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
1. Mr. Anbuselvan T, General Manager – Sales, Wipro GE	1. Dr. S. Poonguzhali, Professor, Centre for Medical Electronics,	1. Dr. G.Anitha, SRM <mark>IST</mark>	
Healthcare Pvt. Ltd., TamilNadu <mark>, Srilanka</mark> & Maldives	AnnaUniversity	The second se	



Course Code	21BMO127T	Course Name	e Di	GITAL HEALT	HEALTHCARE TECHNOLOGY								OPEN I	ELECT	ΓIVE			l	- T 3 0	P 0	C 3
Pre-requis Courses	site	Nil	Co- Co	requisite urse <mark>s</mark>	Nil		Pro	gress	sive es						Nil	1					
Course C	offering Departm	ent	Biomedical E	ngineering	Data Book / Codes / S	Standards								Nil							
Course Lea	Course Learning Rationale (CLR): The purpose of learning this course is to:						Program Outcomes (PO)									Pr	ogra	n			
CLR-1: Illustrate the need and challenges of personalized healthcare						1	1 2 3 4 5 6 7 8 9 10 11						12	S	pecifi tcom	C es					
CLR-2:	Explore the basic	c aspects c	of teleh <mark>ealth and te</mark> ler	nedicine	- Contractor		θ		÷	of	3.	ety			¥				00		ò
CLR-3:	Enumerate mHe	alth evolut	tion, <mark>regulation</mark> and a	oplications	/ 1988 S		vledg		ent o	tions	ge	soci			I Wol		ance	D			
CLR-4:	Demonstrate the	e use of vir	rtu <mark>al reality a</mark> nd game	s in healthcare	9	22.	Know	lysis	udo	stiga olems	Usa	and	৵		Fear	on	& Fin	arnin			
CLR-5:	Explain the impo	rtance of lo	o <mark>T in heal</mark> thcare throu	igh its applicat	tions		ering	i Ana	devel	t inve t prot	Tool	inee	ment		al & T	nicati	Mgt.	g Le			
				11		1	ginee	blem	sign/	nduct	dern	eng	/iron	ics	ividu	nmu	ject I	, Lon	<u>-</u> 1	0-2	0-3
Course Out	tcomes (CO):		At the end of this	course, learne	ers will be able to:		Ē	Pro	Des	Col	Ъ	μ	Sus Sus	뮲	pul	Ō	Pro	Life	PS	PS	PS
CO-1:	Explain the need	l and ch <mark>alle</mark>	enges of personalized	d healthcare	and the state of the	14.00	1		-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Recognize basic	aspects o	<mark>of teleh</mark> ealth and telen	nedicine			3	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Demonstrate mH	lealth ev <mark>ol</mark> i	<mark>lution, r</mark> egulation and	applications			-	-	1		-	- 34	-	-	-	-	-	-	-	-	-
CO-4:	Interpret the use	of virtua <mark>l r</mark>	<mark>reality a</mark> nd games in h	ealthcare		1.0	-		1	- 1	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Discuss the impo	ortance o <mark>f l</mark>	<mark>IoT in h</mark> ealthcare thro	ugh its app <mark>lic</mark> a	ations		3		1	-	-	1	-	-	ł	-	1	-	-	-	-
Unit-1 - Per Personaliza	rsonalised Health tion of healthcare	hcare	ionship between data,	Digital techno	plogies and advanced analytics – I	Digital hea	Ith me	asure	es – Ex	amples	in dig	ital he	alth tec	hnolog	<mark>gies in</mark>	clinica	l resea	rch - E	xample	9 es in c	Hour ligital
Unit-2 - Tel	ehealth and Tele	medicine	iway – Challenges In I	oringing digital	neaith technologies to market – C	nallenges i	n adoj	plion	oi aigit	arneail	ntech	lologi	95							9	Hour
Telemedicine versus telehealth – Definitions - Technology vs services – Telemedicine technological requirements – Telehealth technological requirements – Distant health examples – Smart medical shirts – Haptic platform – Overgrown cities – Rural health – Satellite telehealth – Telemedicine critical technologies – Present challenges and benefits – Groundwork for a good telehealth application – Enabling telehealth for existing medical application – Case study – Panic disorder – Case study – Diabetes telehealth framework – Case study – telehealth support for unit care – Medicolegal, ethical and regulatory guidelines pertaining to telehealth																					
Evolution fro	neaith Iom telemedicine to	m-Health	- Initial and recent an	plications – Mo	obile apps for mHealth - Overview	of mHealth	apps	– Rec	nulation	n of mH	ealth a	nns -	Cloud (сотри	tina de	efinitior	and se	elected	applic	y ations	HOUR
closed loop solutions for personalized health interventions - Challenges in sensor design and fabrication - Challenges in mining and managing Big health data - Common mHealth and ICT applications - Evidence for																					
mHealth imp	bact – New frontie tual Reality and	rs in mHea Games foi	alth - Case study – Sle r Healthcare	ep problems a	nd their implications				-											9	Hour
Augmenting	mental healthca	re – Mobili	izing services with vir	tual reality – F	Pain – Anxiety and phobias – Stre	ess manage	ement	– Re	habilit	ation –	Game	s for ii	nprovir	ng hea	Ithcare	ə – Hoi	no Lua	lens –	Learni	ng thi	ough
challenges	and fun – Physica	l and functi	ional fidelity – Games	for health – Re	ehabilitation – Crowdsourcing scier	nce – Gami	ing do	ctor –	Game	<mark>s in o</mark> ffi	cial Me	edical	orogran	ns – G	ames	in skills	trainin	g outin	g oper	ating	room
– Financial	and Ethical aspec	sts																			

Unit-5 - IoT for Healthcare

Concept of IoT-Based Healthcare Technology – Ambient intelligence in Healthcare Technologies – Benefits – Challenges – Data handling and resource management – Security and Privacy – Interoperability – Stake holder collaboration and implementation – Technologies that enable IoT – Healthcare – Internet of Medical things – Applications of IoT in Healthcare – Benefits - Challenges

	1.	Halit Eren and John G Webster, "Telemedicine and Electronic Medicine", CRC Press, Taylor	4.	Homero Rivas and Katarzyna Wac, "Digital Health: Scaling Healthcare to the World", Health
		and Francis Group, New York, 2nd edition, 2016.		Informatics, Springer, Switzerland, 2018.
Learning	2.	Shabbir Syed-Abdul, Xinxin Zhu, Luis Fernandez-Luque, "Digital Health: Mobile and	5.	Nishu Gupta and Sara Paiva, "IoT and ICT for Healthcare Applications", Springer Innovations
Resources		Wearable Devices for participatory Health Applications", Elsevier, Cambridge, USA, 2021.		inCommunication and Computing, Switzerland, 2020.
	3.	Shashi Gogia, "Fundamentals of Telemedicine and Telehealth", Elsevier, Cambridge, USA,		
		1 st Edition, 2020		

Learning Assessm	ient									
		100 M	Continuous Learning	Summativo						
	Bloom's Level of T <mark>hinking</mark>	oom's Formative f Thinking CLA-1 Average of unit test (50%)			Learning A-2 %)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	<u>Th</u> eory	Practice			
Level 1	Remember	20%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	10%		10%	-			
Level 2	Understand	20%	A COLOR NO	10%		<u>10%</u>	-			
Level 3	Apply	30%		30%		30%	-			
Level 4	Analyze 🚽 🚽	30%		30%		<mark>30</mark> %	-			
Level 5	Evaluate		10 S H 0 10 C 1	10%	-	<u>10</u> %	-			
Level 6	Create	Provide States		10%	COLUMN TO A	<u>10%</u>	-			
	Total	100	%	100	%	100	%			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Anbuselvan T, General Manager – Sales, Wipro GE Healthcare	1. Dr. S. Poonguzhali, Professor, Centre for Medical Electronics, Anna	1. Dr.Vani Damodaran, SRMIST
Pvt. Ltd., Tamil Nadu,Srilanka & Maldives	University	



B.Tech / M.Tech (Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

Course	210401017	Course		Course	0		L	Т	Ρ	С
Code	210001011	Name	SUSTAINABLE ENERGT ENGINEERING	Category	0	OPEN ELECTIVE	3	0	0	3

Pre-requisite Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Chemical Engineering	Data Book / Codes / Standards	10110	Nil

Course L	earning Rationale (CLR)	: The purpo <mark>se of learn</mark> ing this course is to:				1	Progr	am Ou	utcome	s (PO)				P	rogra	m
CLR-1:	Familiarize various way	rs of collec <mark>ting solar en</mark> ergy and its applications	1	1 2 3 4 5 6 7 8 9 10 11 12								outcomes		ic ies			
CLR-2:	Familiarize various ways of utili <mark>zing wind</mark> energy				of	s of		iety			¥		Φ				
CLR-3:	LR-3: Familiarize various aspects of Biomass energy and utilization				lent o	ation	ge	soc			n Wo		Jano	þ			
CLR-4:	CLR-4: Understand the current status and future trends in energy				lopr	estig	Usa	r and	ø		Tear	ion	& Fi	arnir			
CLR-5:	CLR-5: Appreciate the need for efficient energy storage			em Ane	n/deve	uct inve ex pro	n Tool	nginee	nment		lual &	nnicat	t Mgt.	ong Le	_	~	~
Course C	outcomes (CO):	At the end of this course, learners will be able to:	Engin	Proble	Desig	Condu	Mode	The e	Enviro Susta	Ethics	Individ	Comn	Projec	Life Lo	-OS4	PSO-3	PSO-:
CO-1:	Learn the different indu	st <mark>rial solar</mark> equipments for heat and electricity	3	2	1	-	-	-	2	-	-	-	-	-	-	-	-
CO-2:	Know the types of wind	m <mark>ills and</mark> their design	2	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	CO-3: Comprehend the uses of energy from biomass and reactor design				2	•	-	1	2	-	-	-	-	-	-	-	-
CO-4:	CO-4: Apply the concept of energy transfer to modern processes			2	1/	-	2	1	-	-	-	-	-	-	-	-	-
CO-5:	0-5: Comprehend the various means of energy storage				2	-	-	-	1	-	-	-	-	-	-	-	-

Unit-1 -	 Solar 	energy
----------	---------------------------	--------

9 Hour

9 Hour

9 Hour

9 Hour

9 Hour

Solar angles, solar collectors, types of collectors, flat type and dish type, solar concentrators, types of concentrators, solar pumping, solar refrigerators, solar air cooling, solar furnaces, solar power generation, solar drying, solar stills, solar cooking, Photovolatic cells.

Unit-2 - Wind energy

Availability of wind, Special features of wind energy, Types of wind mills, Power from the wind, Performance of wind mills, Modern wind energy generators, Horizontal wind mills, Vertical wind mills, Wind turbines, Design parameters, Design principles of wind turbine, Wind power farms, and Modern wind farms.

Unit-3 - Biomass energy

Biomass resources, Composition, fuel properties, Biomass conversion technologies, Anaerobic digestion, Direction combustion, Pyrolysis, Gasification, Biogas technology, Bioethanol and Biodiesel production, Community and institutional biogas plants, Family biogas plants, Recent developments in biomass technology, Energy farming, Design consideration, Digestors and reactors.

Unit-4 - Energy calculations and modern energy transfer processes

Basic thermodynamic functions and applications, Calculation of heat of reaction, Application of Hess law, Other chemical processes for energy transfer, Microwave-assisted reactions, Sonochemistry, Electrochemistry, Photochemistry.

Unit-5 - Energy storage

Introduction, Energy storage systems, Mechanical energy storage, Electrical storage, Electrical storage: the lead acid battery, Chemical storage, Electromagnetic energy storage, Thermal energy storage (Sensible heat), Thermal energy storage (Latent heat), Biological storage.

	1	Rai G.D., "Non-Conventional Energy Sources", Khanna Publishers, New Delhi, 1999.	3	Bansal N.K, Manfred Kleen Man and Michael Meliss, "Renewable energy sources of conversion
Learning	2	Anne E. Marteel-Parrish and Martin A. Abraham, "Green Chemistry and Engineering - A		technology" TMH Publication.
Resources		pathway to sustainability", John Wiley & Sons, 2014.	4	Kothari. P., Singal, K. C. and Rakesh, "Renewable Energy Sources and Emerging
				Technologies" Ranian PHI Pyt 1 td New Delhi 2008

		Continuous Learning Assessment (CLA) Formative Life-Long Learning CLA 1 Augusto of writheat										
	Bloom's Level of Thin <mark>king</mark>	Forn CLA-1 Avera (50	native ge of unit test)%)	Life-Lon CL (1	g Learning _A-2 0%)	Final Examination (40% weightage)						
		Theory	Practice	Theory	Practice	Theory	Practice					
Level 1	Remember	15%		15%		15%	-					
Level 2	Understand	25%	And the second	20%		25%	-					
Level 3	Apply	30%		25%		30%	-					
Level 4	Analyze	30%		25%		30%	-					
Level 5	Evaluate	L.	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	10%			-					
Level 6	Create	-		5%	1. 1. 1	-	-					
	Total	10	0%	10	0 %	1(0 %					

Course Designers		The second s
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. A. Subramaniam, PESCO Beam Environmental Solutions Pvt. Ltd	1. Dr. Lima Rose Miranda, Anna University	1. Dr. K. Deep <mark>a, SRMI</mark> ST
2. Mr. S. Stalin, Course Director, Chem Skill Development Centre	2. Dr. N. Anantharaman, Former Professor, NIT Trichy	2. Dr. K. Selvam, SRMIST



Course Code	21CHO102T Course Name PETROLEUM ENGINEERING				Cou Cate	irse gory	0				OPEN	ELEC	ΓIVE				<u> </u>	P 0	C 3
Pre-requi	isite es	Nil	Co- requisite Courses	Nil		Progree Cours	ssive ses						Nil	1					
Course	Offering Departme	nt	Chemical Engineering	Data Book / Codes / Sta	andards							Nil							
Course Le	earning Rationale (CLR): The	e purpose of learning this cours	e is to:		1	1		Progr	am Ou	itcome	s (PO)				Ρ	rogra	m
CLR-1:	Describe the forn Technology	nation of crud	e oil, o <mark>verview o</mark> f petroleum expl	pration and Oil and Gas Well D	rilling 1	2	3	4	5	6	7	8	9	10	11	12	S ou	pecifi Itcom	c es
CLR-2:	Explain the Reser	voir Engineer	in <mark>g and Pet</mark> roleum Production Ope	erations				of	15	ť			2						
CLR-3:	Express the prope	erties and <mark>ana</mark>	l <mark>ysis of Cr</mark> ude Oil		edae	•	nt of	suo	a)	socie			Wor		ince				
CLR-4:	Define the Petrole	eum refinin <mark>g p</mark>	rocesses	a Marine Star	Iwor	Sis	pme	tigati	Isage	and s			am	_	Fina	ning			l
CLR-5:	Explain the Health and Safety Syster	n Safety and E m	nvironment in Petroleum Industry	, Enhanced Oil Recovery Techn	iques X puiue	n Analy	develo	t inves x proble	Tool L	gineer a	ment 8 ability		lal & Te	inicatio	Mgt. &	ng Lear			
Course O	utcomes (CO):	At	the end of this course, learners	will be able to:	Enaine	Probler	Design	Conduc	Moderr	The en	Enviror Sustain	Ethics	Individu	Commu	Project	Life Lor	PSO-1	PSO-2	PSO-3
CO-1:	Define formation of	of crud <mark>e oil, ov</mark>	verview of petroleum exploration		2	-	2	-	-		-	-	-	-	-	-	-	1	-
CO-2:	Define the Petrole	eum Pr <mark>oductio</mark>	n Operations	1.102 1.102 1.10	2	-	3	5	-		-	-	-	-	-	-	-	-	-
CO-3:	: Apply the properties and <mark>analysis</mark> of Crude Oil					-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	CO-4: Construct the Petroleum refining processes						2		-		-	-	-	-	-	-	-	-	-
CO-5:	0-5: Incorporate the flow sheets of important petrochemicals						-	-	-	-	2	-	-	-	-	-	-	-	-

Unit-1 - Petroleum Exploration

9 Hour Formation theories, Petroleum exploration, classification and description of some common rocks with special reference to reservoir rocks, origin, migration and accumulation of petroleum, petroleum exploration methods, oil and gas well drilling technology, drilling method, drilling rig operating systems, drilling fluids function and properties, drilling fluid maintenance equipment, oil gas well cementing operation, drill bit types and their applications, drill string casing string function, operations, selection design, drilling problems, their control remedies, directional drilling tools, directional survey, application of horizontal, multilateral, extended reach, slim wells.

Unit-2 - Reservoir Engineering

Physical properties of reservoir rocks, reservoir fluid properties, phase behavior of hydrocarbon system, flow of fluids through porous media, water and gas coning, reservoir pressure measurements, reservoir drives, drive mechanics and recovery factors, reserve estimation techniques, petroleum production operations: well equipment's, well completion techniques, well production problems and mitigation, well servicing work over operations, work over completion fluids, formation damage, well stimulation techniques, artificial lift techniques, field processing of oil gas, storage and transportation of petroleum and petroleum products, metering and measurements oil gas, production system analysis optimization, production testing, multiphase flow in tubing and flow-lines, nodal system analysis, pressure vessels, storage tanks, shell and tube heat exchangers, pumps and compressors.

Unit-3 - Properties of Crude Oil

Testing of petroleum products, physical properties, thermal properties, removal of sulphur compounds, coking and thermal process, catalytic thermal cracking, catalytically hydro cracking, hydro processing, reforming, isomerization, alkylation and polymerization, product blending processes, product testing.

9 Hour

Unit-4 - Petroleum Refining Processes

Petroleum refining processes, refining flow diagram, petroleum products, feedstock selection for petrochemical, application of C1 to C4 petrochemical, plastics and its classification, process flow for manufacture of synthetic rubber, feed stock for polyesters synthesis, process flow diagram for BTX.

Unit-5 - Health Safety and Environment

9 Hour

9 Hour

Health safety and environment in petroleum industry: health hazards in petroleum industry, toxicity, physiological, asphyxiation, respiratory and skin effect of petroleum hydrocarbons, sour gases. Safety system: manual automatic shutdown system, blow down systems, gas detection system, fire detection and suppression systems, personal protection system measures, disaster crisis management in petroleum industry. Environment: environment concepts, impact on eco-system, the impact of drilling production operations on environment, environmental transport of petroleum wastes, offshore environmental studies, offshore oil spill and oil spill control, waste treatment methods, enhanced oil recovery techniques, thermal recoveries. Latest trends in petroleum engineering: coal bed methane, shale gas, oil shale, gas hydrate, and heavy oil.

	1.	W. L. Nelson , Petroleum Refinery Engineering, , 4th Edition, McGraw Hill, New York, 1958	4.	J.H. Gary and G. E. Handwerk , Petroleum Refining: Technology and Economics, 4th Edition Marcel Dekker Inc. New York 2001
Loarning	2	B K Bhackara Dao, Modern Potroloum Pofining processor, 5th Edition, Oxford and IBH	5	John C. Pais, Environmental Control in Potroloum Engineering, Culf Publishing Company
Deseuress	Ζ.	D. K. Dilaskala Nau, Modelli Felioleulli Kellilling processes, Sui Euluuli, Oxiolu allu ibi i	J.	
Resources	~	Publishing Co. Pvi. Lia., 2008.		1990.
	3.	Gopala Rao M. and Marshall Sittig. "Dryden's Outlines of Chemical Technology", 3rd Edn,		
		East-West Press, <mark>New Delhi</mark> , 1997.	No.	

Learning Assessme	ent 💦 👘			Carlo Andrews						
			Continuous Learning	Summetive						
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test %)	Life-Long CL (10	n Learning A-2)%)	Final Examination (40% weightage)				
	and the second second	Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	15%		20%		15%	-			
Level 2	Understand	25%		20%		25%	-			
Level 3	Apply	30%		30%		30%	-			
Level 4	Analyze	30%		30%		<mark>3</mark> 0%	-			
Level 5	Evaluate						-			
Level 6	Create		·		-	-	-			
	Total	10	0%	10	0 %	10	0 %			

Course Designers	and the second sec	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. A. Subramaniam, PESCO Beam Environmental Solutions Pvt. Ltd	1. Dr. Lima Rose Miranda, Anna University	1. Dr.K.Anbalagan, SRMIST
2. Mr. S. Stalin, Course Director, Chem Skill Development Centre	2. Dr. N. Anantharaman, Former Professor, NIT Trichy	2. Dr. S. Kiruthika, SRMIST

Course	210001027	Course		Course	0		L	Т	Р	С
Code	21000031	Name	FUNDAMENTALS OF CHEMICAL ENGINEERING	Category	0	OPEN ELECTIVE	3	0	0	3

Pre-requisite Courses	Nil	Co- req <mark>uisite</mark> Courses	Nil	Progressive Courses	Nil
Course Offeri	ing Department	Chemical Engineering	Data Book / Codes / Standards		Nil

Course Lo	earning Rationale (CLR):	The purp <mark>ose of learni</mark> ng this course is to:				2	Progr	am Ou	utcome	es (PO)				P	rogra	m
CLR-1:	Understand the basics o	f stoichio <mark>metry.</mark>	1	2	3	4	5	6	7	8	9	10	11	12	01	itcom	es.
CLR-2:	Describe the fundament	als of si <mark>ze reductio</mark> n.	e e		of	s of		tiety			¥		е				
CLR-3:	Understand the fundame	ental <mark>s of fluid flo</mark> w phenomena.	vled		ient o	ation	ge	soc			N No		Janc	b			
CLR-4:	Understand the modes of	of h <mark>eat transfe</mark> r and rate of heat transfer.	Kno	alysis	lopm	estiga	Usa	r and	ø		Tear	ion	Se Fi	arnir			
CLR-5:	Acquire the knowledge of	on <mark>the basic</mark> s of mass transfer.	ering	n Ane	/deve	ct inve	Tool	ginee	ment		. s ler	unicat	Mgt.	ng Le			
Course O	utcomes (CO):	At the end of this course, learners will be able to:	Engine	Proble	Design	Condu	Moder	The en	Envirol Sustair	Ethics	Individ	Comm	Project	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Comprehend the basics	of stoichiometry and mass balance for processes.	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Analyze the mechanical	operations involved in material handling.	3	2	1	-	-	- 10	-	-	-	-	-	-	-	-	-
CO-3:	Analyze the concept of f	l <mark>uid and i</mark> ts flow characteristics.	3	2	1	-	-		-	-	-	-	-	-	-	-	-
CO-4:	Evaluate the rate of heat	t <mark>transfer f</mark> or different modes.	3	2	2	-	-	-		-	-	-	-	-	-	-	-
CO-5:	Comprehend the basics	o <mark>f mass transfer</mark>	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-

Unit-1 - Material Balance

9 Hour

9 Hour

9 Hour

9 Hour

Units and dimensions (mole unit), Analysis of a mixtures, (mole, mass and partial pressure fraction (or percent)), Concentrations, Basis of calculations, Predicting P-V-T properties of gases using ideal gas law & Van der Waals equation, Calculation of density, Basics of chemical equation and stoichiometry (limiting reactant, excess reactant, conversion, selectivity and yield), Basic concepts involved in material balance calculations, Problem solving on Material Balance - Mixing, Evaporation

Unit-2 - Particulate Technology

Size reduction, Size analysis, Screen efficiency, Filtration and its types – pressure and vacuum filtration, Filters and its classification, Basics of Settling and sedimentation, Principles of agitation, Types of agitators, Flow patterns: prevention of swirling- draft tubes, Blending and Mixing- Mixers: types

Unit-3 - Fluid Flow

Nature of fluids: Type of fluids and flow, Fluid flow and their characteristics (Incompressible and compressible, potential flow, Laminar and turbulent flow), Hydrostatic equilibrium and manometers, Newtonian and Non-Newtonian fluids: Newton's law of viscosity, Reynolds number and transition from laminar to turbulent flow, Boundary layer concept, Pipe flow and friction factors, Drag & Lift forces, Terminal settling velocity, Introduction to various types of flow metering devices

Unit-4 - Heat Transfer

Introduction to Heat Transfer, modes of Heat transfer, Fourier's law of heat conduction and Thermal conductivity, Steady-state conduction, resistances in series - slab and cylinder, Newton's law of cooling, Natural and forced convection, Heat transfer coefficient and Overall heat transfer coefficient, Heat transfer to fluids without phase change: Boiling and Condensation, Basic concepts of radiation, examples and application

Unit-5 - Mass Transfer

Introduction to Mass Transfer operations, Diffusion, Types, Fick's I law of Diffusion, Steady – state molecular diffusion in fluids at rest and in laminar flow: molecular diffusion in gases, Principles of drying - driers and freeze drying, Methods of distillation, Basic concept of extraction and leaching, Adsorption, Membrane separation processes,

Learning Resources	1. 2.	David M. Himmelblau, Basic Principles and Calculations in Chemical Engineering, 7 th ed., Prentice-Hall of India Warren L. McCabe, Julian C. Smith, Peter Harriott, Unit Operations of Chemical Engineering, 7 th ed., McGraw Hill Education, 2014	3.	S.K. Ghosal, S.K., Sar Company, 1998.	anyal and S. Datta,	Introduction to Cl	nemical	Engineering,	TMH Book

Learning Assessme	ent		and the second sec		- A.		
		N	Continuous Learning	Assessment (CLA)		Sum	mativa
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (10	g Learning _A-2 0%)	Final Ex (40% w	amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	10%		20%	-
Level 2	Understand	20%		10%		20%	-
Level 3	Apply	30%	Contraction of	20%		30%	-
Level 4	Analyze	30%		30%		30%	-
Level 5	Evaluate		10 A 10 A 10 A 10	30%			-
Level 6	Create	7 1 1 1 1 1 1 1 1			-	-	-
	Total	10	0 %	10	0 %	10	0 %

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. A. Subramaniam, PESCO Beam Environmental Solutions Pvt. Ltd	1. Dr. Lima Rose Miranda, Anna University	1. Mr. V. Ganesh, SRMIST
2. Mr. S. Stalin, Course Director, Chem Skill Development Centre	2. Dr. N. Anantharaman, Former Professor, NIT Trichy	2. Dr. S. Sam David, SRMIST



B.Tech / M.Tech(Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

Course	Cou	rse		Course	0		L	Т	Ρ	С
Code	Nar	ne	PROCESS PLANT SAFETT	Category	0	OPEN ELECTIVE	3	0	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering	g Department	Chemical Engineering	Data Book / Codes / Standards		Nil

Course Le	earning Rationale (CLR):	The purpose of learning this course is to:	-			1	Progr	am Ol	Itcome	s (PO)				P	rogra	m
CLR-1:	Familiarize the basics of I	ndustria <mark>l safety man</mark> agement	1	2	3	4	5	6	7	8	9	10	11	12	01	itcom	ic ies
CLR-2:	Acquire knowledge on che	emical plant safety	ge		of	s of	97	iety			Ł		Ð				
CLR-3:	Impart knowledge on Indu	stri <mark>al accident</mark> s, prevention and fire protection systems	vled		ient (ation	ge	soc			n Wo		Jano	Ð			
CLR-4:	Acquire knowledge on Ha	z <mark>ard identif</mark> ication techniques	Knov	alysis	lopm	estige	Usa	r and	~		Tean	ion	& Fir	arnin			
CLR-5:	Expose industrial hygiene	and Occupational health hazards, Safety legislation in chemical industries	ering	Ana	deve	t inve k pro	Tool	jinee	ment		al &	nicat	Mgt.	g Le			
	(00)		ginee	oblem	sign/	nduct	dern	e eng	viron	lics	lividu	nmm	oject I	e Lon	<u>-</u>	0-2	0-3
Course O	utcomes (CO):	At the end of this course, learners will be able to:	ш	Pre	De	888	ž	Ч Ц	ы Su	击	lnc	ပိ	Pre	Life	PS	PS	PS
CO-1:	Identify the importance a <mark>n</mark>	d basic principles of safety management	2	-	1.1	-	-	1	0-	-	-	-	-	3	-	-	-
CO-2:	Describe the safety aspe <mark>c</mark>	<mark>ts of ch</mark> emical process industries	1	2	3	-	-	- 100	-	-	-	-	-	-	-	-	-
CO-3:	Apply the methods of prev	rention of industrial accidents and learn the fire safety		1	1	-	-	2	-	-	-	-	-	3	-	-	-
CO-4:	Familiarize with various ty	pes of Hazard Identification techniques	2	3	1.1	-	-	1	-	-	-	-	-	-	-	-	-
CO-5:	Identify the components not the laws relating to industri	eeded to provide a safe and healthful work environment and to gain insight into ies	-	ė.	2	-		-	-	-	1	-	-	3	-	-	-

Unit-1 - Industrial Safety Management

Importance of process plant safety - Bhopal gas Tragedy, Piper Alpha Explosion – Case Studies- Development of Industrial Health and Safety - Safety Organization – Polices-Culture - Planning- Promotion - Inspection -Rules - Responsibility - Supervision - Effective Safety Education and Training - Safety policy. Safety Officer responsibilities, authority. Safety committee- needs, types, advantages, Communication- purpose and barrier to communication.

Unit-2 - Chemical Plant Safety

Siting and Layout of a Chemical plant, Chemical hazards, Toxic effects of chemicals, PEL, TLV, LC 50 and LD 50 & Toxicology; Dose Vs. Response Relationship- Chemical process in hazardous operations -Chemical reactors- reaction hazards and control -operational deviations -case studies - Hazardous chemicals - Classification and Transportation - Storage and Handling - Safe guarding of Machines - Ergonomics, Emergency preparation plan: On-site and Offsite.

Unit-3 - Accident Prevention and Fire Safety

Accident, Injury, Unsafe act, Unsafe Condition, Theories of accident causation. Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate, Safe T-Score. Cost of accidents - Plant safety inspection, types, inspection procedure. Safety sampling techniques. Job safety analysis (JSA), Safety surveys, and Safety audits. Fire triangle- Classification of fires. Common causes and impacts of industrial fires, Fire protection systems- prevention 9 Hour

Unit-4 - Hazard Identification Techniques

B.Tech / M.Tech (Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses - Syllabi-Control Copy

9 Hour

9 Hour

Hazard and risk, Types of hazards - fire, explosion and toxic gas release, Structure of hazard identification and risk assessment. Process Hazard Analysis Identification of hazards : Fire and explosion hazard rating of process plants - The Dow Fire and Explosion Hazard Index, Preliminary hazard analysis, Hazard and Operability study (HAZOP), Failure mode and Effect Analysis (FMEA), Fault Tree Analysis, Cause and Effect Analysis in process industries.

Unit-5 - Industrial Hygiene and Occupational Safety

9 Hour

Industrial and Occupational health hazards- Electrical, Mechanical safety- Industrial Housekeeping, Personal protective equipment – Head protection – Eye and face protection- Hand protection – Foot and leg protection - Body protection – Respirators – Safety unions, government and voluntary agencies – OSHA, ILO, NEPA in safety. Health and safety executive (HSE)- Safety legislation in India, Factories act, Trade Union act, Worker's compensation act -Indian boilers act, Indian explosives act and rules, Mines act, Environmental protection act

	1.	Sharma. A M., "Safety and Health in Industry" - A Hand book, BS Publications, 2019.	5.	William Handley, "Industrial safety hand book", McGraw- Hill, 1969.
	2.	Fulekar. M.H, "Industrial Hygiene and Chemical Safety", Dreamtech Press, 2020.	6.	Daniel. A, Crowl and Joseph. F. Louvar, "Chemical Process safety: fundamentals with applications",
Looming	З.	Fawcett .H.H, and Wood W.S, "Safety and Accident Prevention in Chemical		Prentice Hall international series, 2020.
Desources		Operations", John Wiley & sons, U.S.A., 1965.	7.	Geoff Wells, "Hazard Identification and Risk Assessment", 1997.
Resources	4.	Willie Hammer, Dennis Price, "Occupational safety management and Engineering",	8.	Francis, R.L. and White, J.A, "Facilities layout and Location", Prentice Hall of India, 2002.
		Prentice Hall, 2001.	9.	James A. Klein, Bruce K. Vaughen, "Process Safety Key Concepts and Practical approaches", CRC
				press, 2017.

Irning Assessme	ent		0							
	Bloom's Level of Thinking	Form CLA-1 Avera (50	Continuous Learning native ge of unit test %)	<u>Assessment (CLA)</u> Life-Long CL (10	g Learning A-2 0%)	- Summative Final Examination (40% weightage)				
	and the second se	Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	30%	An in the set of the	30%		30%	-			
Level 2	Understand	30%		30%	-	30%	-			
Level 3	Apply	20%		20%		20%	-			
Level 4	Analyze	20%		20%		<mark>2</mark> 0%	-			
Level 5	Evaluate						-			
Level 6	Create	2 3 L		-	-	-	-			
	Total	100)%	10	0%	10	0%			

Course Designers		A Martin Contraction of the Cont
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. A. Subramaniam, PESCO Beam Environmental Solutions Pvt. Ltd	1. Dr. Lima Rose Miranda, Anna University	1. Dr. D. Nanditha, SRMIST
2. Mr. S. Ravichandran, Assistant General Manager, SPIC	2. Dr. N. Anantharaman, Former Professor, NIT Trichy	2. Dr. K.Selvam, SRMIST

Pre-requisite Nil Co-requisite Nil Progressive Courses Nill Course Learning Rationale (CLR): The purpose of learning this course is to: Nill Nill Clares Learning Rationale (CLR): The purpose of learning this course is to: Nill Nill CLR-1: Familiarize the sustainability concepts, environmental regulations and global issues 1 2 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 2 3 4 5 6 7 8 9 10 11 12 3 4 5 6 7 8 9 10 11 12 3 1 1 1 1 1 1 1 1 </th <th colspan="3">Course 21CHO105T Course Name</th> <th>•</th> <th></th> <th>POLLUTI</th> <th>ON ABATE</th> <th>EMENT</th> <th></th> <th>Cou Categ</th> <th>se ory</th> <th>0</th> <th></th> <th colspan="6">OPEN ELECTIVE</th> <th></th> <th colspan="7">L T P 3 0 0</th>	Course 21CHO105T Course Name			•		POLLUTI	ON ABATE	EMENT		Cou Categ	se ory	0		OPEN ELECTIVE							L T P 3 0 0						
Course Offering Department Channel Engineering Data Book / Codes / Standards Nil Course Learning Rationale (CLR): The purpose of learning this course is to: Program	Pre-requisite Courses		Nil	Nil		Co- requisite Nil						Progressive Courses				Nil											
Course Learning Rationale (CLR): The purpose of learning this course is to: Program Outcomes (PO) Program Successes (PO) Program Su	Course	Course Offering Department Chemical Engineering Data Book / Codes / Standa						rds							Nil												
CLR:1: Familiarize the sustainability concepts, environmental regulations and global issues 1 2 3 4 5 6 7 8 9 10 11 12 Specific outcomes CLR:2: Understand the solid waste generation and disposal methods I 2 3 4 5 6 7 8 9 10 11 12 outcomes CLR:2: Understand the solid waste generation and disposal methods Image: provide the approximate the concepts of water treatment principles and methods Image: provide the approximate the concepts of water treatment principles and methods Image: provide the approximate the concepts of water treatment principles and methods CLR:5: Familiarize the government initiatives, application of software Image: provide the approximate the concepts of global environmental issues on earth - - - 3 2 - - 1 - - - - - 3 -	Course Le	arning Rationale	(CLR):	The purpo	ose of learn	ing this coເ	urse is to:	200	- 11	IT.	1	1	211	Progr	am O	utcome	s (PO)				P	rogra	m			
CLR-2: Understand the solid waste generation and disposal methods Big graph	CLR-1: Familiarize the sustainability concepts, environmental regulations and global issues						1	2	3	4	5	6	7	8	9	10	11	12	S OL	pecifi Itcom	iC Ies						
CLR-3: Demonstrate the concepts of water treatment principles and methods Image: Stream of the sources of air pollution and noise pollution control methods Image: Stream of the sources of air pollution and noise pollution control methods Image: Stream of the sources of air pollution and the way to control it Image: Stream of the sources of air pollution and the way to control it Image: Stream of the sources of air pollution prevention in the sources of air pollution prevention in the sources of air pollution and the way to control it Image: Stream of the sources of air pollution prevention in the sources in the sources of air pollution prevention in the sources in the sources of air pollution prevention in the sources in the sources of air pollution prevention in the sources in the sources of air pollution prevention in the sources in the source of air pollution prevention in the sources in the source of air pollution prevention in the source of air pollution prevention. Environment policies and regulations to encourage pollution prevention. Environment policies and regulations to encourage pollution prevention. Environment policies and regulations to encourage pollution prevention. Environment pollicies and regulations to encourage pollution prevention. Environment prevention water be adding and pape	CLR-2:	Understand the	solid waste	generation	n and dispos	al methods			and in the	e		of	s of	1	iety			¥		-							
CLR-4: Analyze the air pollution and noise pollution control methods Image: Clr and the second the second and the second the second and the seco	CLR-3:	Demonstrate the	e concepts	of w <mark>ater tre</mark>	atment prind	ciples and m	nethods		S. ANK	wledo		lent c	ations	ge	soc			oW n		Jance	ŋ						
CLR-5: Familiarize the government initiatives, application of software Image: Construction of software <td>CLR-4:</td> <td>Analyze the air p</td> <td>collution an</td> <td>d <mark>noise pol</mark></td> <td>lution contro</td> <td>I methods</td> <td></td> <td>WAS-</td> <td>122</td> <td>Kno</td> <td>lysis</td> <td>opu</td> <td>stig</td> <td>nsa</td> <td>and</td> <td>∞ .</td> <td></td> <td>Tear</td> <td>и</td> <td>& Fil</td> <td>amir</td> <td></td> <td> </td> <td></td>	CLR-4:	Analyze the air p	collution an	d <mark>noise pol</mark>	lution contro	I methods		WAS-	122	Kno	lysis	opu	stig	nsa	and	∞ .		Tear	и	& Fil	amir						
Course Outcomes (CO): At the end of this course, learners will be able to: Image: Course outcomes (CO): Image: Course outc	CLR-5:	Familiarize the g	government	i <mark>nitiative</mark> s,	ives, application of software		1.8	ering k	n Ana	/devel	ct inve	I Tool	gineer	nment		Jal & J	unicati	Mgt.	ng Lea								
CO-1: Identify the effects of global environmental issues on earth - - - - - - - 1 - - - 1 - - 1 - - - 1 - - 1 - - - 1 - <	Course Outcomes (CO): At the end of this course, learn				urse, learne	ers will be	able to:	a de la	Engine	Proble	Design	Condu	Modern	The en	Enviro	Ethics	ndivid	Comm	Project	_ife Lo	-SO-1	PSO-2	-SO-3				
CO-2: Discuss the sources and processing methods of solid wastes 1 2 - - 3 - <th< td=""><td>CO-1:</td><td colspan="4">Identify the effects of global environmental issues on earth</td><td>2334.</td><td>12</td><td>6</td><td></td><td>-</td><td>-</td><td>-</td><td>3</td><td>2</td><td>-</td><td>-</td><td>-</td><td>1</td><td>-</td><td>-</td><td>-</td></th<>	CO-1:	Identify the effects of global environmental issues on earth				2334.	12	6		-	-	-	3	2	-	-	-	1	-	-	-						
CO-3: Analyze the different water treatment methods and its implementation 2 3 - - 3 -	CO-2:	0-2: Discuss the sources and processing methods of solid wastes					1		2	-	-	-	3	-	-	-	-	-	-	-	-						
CO-4: Examine the sources of air pollution and the way to control it 1 2 - - 3 - 1 - - - - - 1 - - - - 1 1 - - - 1 1 1 - - 1 1 1 1 1 1 1 1 1 1 1 1	CO-3:	-3: Analyze the different water treatment methods and its implementation				2		3	-	-	- 1	3	-		-	-	-	-	-	-							
CO-5: Summarize the role of government and application of software in pollution prevention - - 2 3 - - 1 - - 1 - - 1 - - 1 - - 1 - - 1 - 1 - - 1 - 1 - - 1 - - 1 - - 1 - - 1 - - 1 - - 1 - - 1 - - 1 - - 1 - - 1 - - 1 - - 1 - - 1 - - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 0 1 0 1 0 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 <th1< th=""> <th1< th=""> <th1< th=""></th1<></th1<></th1<>	CO-4:	Examine the sou	urces of <mark>air</mark>	pollution ar	nd the wa <mark>y</mark> t	o control it	264	10.5	100	1	2	-	-		-	3	-	-	-	-	-	-	-	-			
Unit-1 - Sustainability and Pollution Prevention Methods 9 Hour Industrial activity and environment, indicators of sustainability-sustainability strategies. Barriers to sustainability, Global issues: Greenhouse effect, Ozone depletion, Global warning, Acid rain. Environment policies and regulations to encourage pollution prevention. Environment friendly chemical processes. Improved process methods to reduce pollution. 9 Hour Unit-2 - Solid Waste Management 9 Hour Sources, types and general disposal methods of solid waste, Waste disposal and management laws and guidelines, Value-extraction from the solid wastes, energy from solid waste. Processing methods: Municipal waste, Biomedical waste, E-waste, plastic waste and nuclear waste. 9 Hour Vinit-3 - Wastewater Treatment 9 Hour Wastewater characteristics, Need of water treatment, Principle, removal mechanism, processing methods of Primary, secondary and tertiary treatments, Need of advanced water treatment, recovery of valuables from effluent. Case studies on water pollution control: pharmaceutical, pulp and paper industries. 9 Hour Sources and types of air pollution, Classification of air pollutants. Air pollution control equipments: Gravity Settlers, Centrifugal Separators, Electrostatic Precipitators (ESP), Bag filters, wet Scrubbers. Dust management, Odor Control Systems. Control methods of emissions: SOx, NOx, Hydrocarbons, VOC, CO. Noise pollution: Sources, causes, effects and control methods 9 Hour Integrated Approach and Circular Economy 9 Hour Integrated waste management policies, Challenges and opportunities associated with waste managemen	CO-5:	Summarize the	role of go <mark>ve</mark>	<mark>ernmen</mark> t and	d application	of software	e in pollutio	n prevention			1	1.1	-	2	-	3	•	-	-	-	1	-	-	-			
Industrial activity and environment, indicators of sustainability-sustainability strategies. Barriers to sustainability, Global issues: Greenhouse effect, Ozone depletion, Global warming, Acid rain. Environment policies and regulations to encourage pollution prevention. Environment friendly chemical processes. Improved process methods to reduce pollution. Unit-2 - Solid Waste Management Sources, types and general disposal methods of solid waste, Waste disposal and management laws and guidelines, Value-extraction from the solid wastes, energy from solid waste, plastic waste and nuclear waste. Unit-3 - Wastewater Treatment Wastewater characteristics, Need of water treatment. Principle, removal mechanism, processing methods of Primary, secondary and tertiary treatments, Need of advanced water treatment, recovery of valuables from effluent. Case studies on water pollution control: pharmaceutical, pulp and paper industries. Unit-4 - Air Pollution and Noise Pollution Control Sources and types of air pollution, Classification of air pollutants. Air pollution control equipments: Gravity Settlers, Centrifugal Separators, Electrostatic Precipitators (ESP), Bag filters, wet Scrubbers. Dust management, Odor Control Systems. Control methods of emissions: SO _x , NO _x , Hydrocarbons, VOC, CO. Noise pollution: Sources, causes, effects and control methods 9 Hour Integrated Approach and Circular Economy Integrated waste management policies, Challenges and opportunities associated with waste management in India, Indian waste management market size, Government initiatives towards environmental protection, Application of artificial intelligence, machine learning in pollution prevention. Circular economy strategies in waste management. Case studies on Indore model, National mission for clean Ganga.	Unit-1 - Su	istainability and	Pollution F	Prevention	Methods		inter-		14-2-5					-	÷								9	Hour			
and regulations to encourage pollution prevention. Environment friendly chemical processes. Improved process methods to reduce pollution. Unit-2 - Solid Waste Management 9 Hour Sources, types and general disposal methods of solid waste, Waste disposal and management laws and guidelines, Value-extraction from the solid wastes, energy from solid waste. Processing methods: Municipal waste, Biomedical waste, E-waste, plastic waste and nuclear waste. 9 Hour Unit-3 - Wastewater Treatment 9 Hour Wastewater characteristics, Need of water treatment. Principle, removal mechanism, processing methods of Primary, secondary and tertiary treatments, Need of advanced water treatment, recovery of valuables from effluent. Case studies on water pollution control: pharmaceutical, pulp and paper industries. 9 Hour Sources and types of air pollution Control 9 Hour Sources and types of air pollution of air pollutants. Air pollution control equipments: Gravity Settlers, Centrifugal Separators, Electrostatic Precipitators (ESP), Bag filters, wet Scrubbers. Dust management, Odor Control Systems. Control methods of emissions: SO _x , NO _x , Hydrocarbons, VOC, CO. Noise pollution: Sources, causes, effects and control methods Unit-5 - Integrated Approach and Circular Economy 9 Hour Integrated waste management policies, Challenges and opportunities associated with waste management in India, Indian waste management market size, Government initiatives towards environmental protection, Application of artificial intelligence, machine learning in pollution prevention. Circular economy strategies in waste management. Case studies on Indore model, National mission for clean Ganga.	Industrial a	ctivity and enviror	nment, indi	cators of su	stainability-	sustainability	y strategie	s. Barriers to sug	stai <mark>n</mark> ability, Gl	obal iss	ues: G	reenho	ouse eff	ect, O	zone c	lepletio	n <mark>, G</mark> lo	bal wa	rming,	Acid ra	in. Env	/ironm	ent pc	licies			
Sources, types and general disposal methods of solid waste, Waste disposal and management laws and guidelines, Value-extraction from the solid wastes, energy from solid waste. Processing methods: Municipal waste, Biomedical waste, E-waste, plastic waste and nuclear waste. Unit-3 - Wastewater Treatment Wastewater Characteristics, Need of water treatment. Principle, removal mechanism, processing methods of Primary, secondary and tertiary treatments, Need of advanced water treatment, recovery of valuables from effluent. Case studies on water pollution control: pharmaceutical, pulp and paper industries. Unit-4 - Air Pollution and Noise Pollution Control 9 Hour Sources and types of air pollution, Classification of air pollutants. Air pollution control equipments: Gravity Settlers, Centrifugal Separators, Electrostatic Precipitators (ESP), Bag filters, wet Scrubbers. Dust management, Odor Control Systems. Control methods of emissions: SO _x , NO _x , Hydrocarbons, VOC, CO. Noise pollution: Sources, causes, effects and control methods 9 Hour Integrated Approach and Circular Economy Integrated waste management policies, Challenges and opportunities associated with waste management in India, Indian waste management market size, Government initiatives towards environmental protection, Application of artificial intelligence, machine learning in pollution prevention. Circular economy strategies in waste management. Case studies on Indore model, National mission for clean Ganga.	and regular	tions to encourage	e pollution p	prevention.	Environmen	t friendly ch	nemical pro	cesses. Improve	ed process me	thods to	reduc	e pollu	ution.		-									Hour			
waste, Biomedical waste, E-waste, plastic waste and nuclear waste. Unit-3 - Wastewater Treatment Wastewater characteristics, Need of water treatment, Principle, removal mechanism, processing methods of Primary, secondary and tertiary treatments, Need of advanced water treatment, recovery of valuables from effluent. Case studies on water pollution control: pharmaceutical, pulp and paper industries. Unit-4 - Air Pollution and Noise Pollution Control 9 Hour Sources and types of air pollution, Classification of air pollutants. Air pollution control equipments: Gravity Settlers, Centrifugal Separators, Electrostatic Precipitators (ESP), Bag filters, wet Scrubbers. Dust management, Odor Control Systems. Control methods of emissions: SO _x , NO _x Hydrocarbons, VOC, CO. Noise pollution: Sources, causes, effects and control methods 9 Hour Integrated waste management policies, Challenges and opportunities associated with waste management in India, Indian waste management market size, Government initiatives towards environmental protection, Application of artificial intelligence, machine learning in pollution prevention. Circular economy strategies in waste management. Case studies on Indore model, National mission for clean Ganga.	Sources, tv	/pes and general (disposal me	ethods of so	olid waste. V	Vaste dispos	sal and ma	anagement laws	and guideline	s. Value	-extrac	ction fr	om the	solid v	vastes	. en <mark>era</mark>	v from	solid v	vaste.	Proces	sina m	ethods	: Mur	nicipal			
Unit-3 - Wastewater Treatment 9 Hour Wastewater characteristics, Need of water treatment. Principle, removal mechanism, processing methods of Primary, secondary and tertiary treatments, Need of advanced water treatment, recovery of valuables from effluent. Case studies on water pollution control: pharmaceutical, pulp and paper industries. Unit-4 - Air Pollution and Noise Pollution Control 9 Hour Sources and types of air pollution, Classification of air pollutants. Air pollution control equipments: Gravity Settlers, Centrifugal Separators, Electrostatic Precipitators (ESP), Bag filters, wet Scrubbers. Dust management, Odor Control Systems. Control methods of emissions: SO _x , NO _x , Hydrocarbons, VOC, CO. Noise pollution: Sources, causes, effects and control methods Unit-5 - Integrated Approach and Circular Economy 9 Hour Integrated waste management policies, Challenges and opportunities associated with waste management in India, Indian waste management market size, Government initiatives towards environmental protection, Application of artificial intelligence, machine learning in pollution prevention. Circular economy strategies in waste management. Case studies on Indore model, National mission for clean Ganga.	waste, Bior	medical waste, E-	waste, plas	tic w <mark>aste a</mark>	<mark>nd nu</mark> clear w	laste.		3	J					15		,					- 0		-				
Wastewater characteristics, Need of water treatment. Principle, removal mechanism, processing methods of Primary, secondary and tertiary treatments, Need of advanced water treatment, recovery of valuables from effluent. Case studies on water pollution control: pharmaceutical, pulp and paper industries. Unit-4 - Air Pollution and Noise Pollution Control 9 Hour Sources and types of air pollution, Classification of air pollutants. Air pollution control equipments: Gravity Settlers, Centrifugal Separators, Electrostatic Precipitators (ESP), Bag filters, wet Scrubbers. Dust management, Odor Control Systems. Control methods of emissions: SO _x , NO _x , Hydrocarbons, VOC, CO. Noise pollution: Sources, causes, effects and control methods 9 Hour 9 Hour 1 Integrated Approach and Circular Economy 9 Hour 1 Integrated waste management policies, Challenges and opportunities associated with waste management in India, Indian waste management market size, Government initiatives towards environmental protection, Application of artificial intelligence, machine learning in pollution prevention. Circular economy strategies in waste management. Case studies on Indore model, National mission for clean Ganga.	Unit-3 - Wa	astewater Treatn	nent			711		216 1 3	S.I. 1971	10.00				1.1									9	Hour			
Integrated waste management policies, Challenges and opportunities associated with waste management in India, Indian waste management, Case studies on Indore model, National mission for clean Ganga.	Wastewate	er characteristics,	Need of wa	ater treatme	ent. Principle), removal m	nechanism	, processing me	thods of Prim	ary, seo	ondar	y and i	tertiary	treatm	ents, I	Need of	fadva	nced w	vater tr	eatmer	nt, reco	very o	f valu	ables			
Sources and types of air pollution, Classification of air pollutants. Air pollution control equipments: Gravity Settlers, Centrifugal Separators, Electrostatic Precipitators (ESP), Bag filters, wet Scrubbers. Dust management, Odor Control Systems. Control methods of emissions: SO _x , NO _x , Hydrocarbons, VOC, CO. Noise pollution: Sources, causes, effects and control methods Unit-5 - Integrated Approach and Circular Economy Integrated waste management policies, Challenges and opportunities associated with waste management in India, Indian waste management market size, Government initiatives towards environmental protection, Application of artificial intelligence, machine learning in pollution prevention. Circular economy strategies in waste management. Case studies on Indore model, National mission for clean Ganga.	from eπiue	nt. Case studies o r Pollution and N	n water pol loise Poll u	tion Contr	roi: pnarmac	eutical, pulp	o and pape	r industries.	_	-	_		-	-			_						0	Hour			
management, Odor Control Systems. Control methods of emissions: SO _x , NO _x Hydrocarbons, VOC, CO. Noise pollution: Sources, causes, effects and control methods Unit-5 - Integrated Approach and Circular Economy Integrated waste management policies, Challenges and opportunities associated with waste management in India, Indian waste management market size, Government initiatives towards environmental protection, Application of artificial intelligence, machine learning in pollution prevention. Circular economy strategies in waste management. Case studies on Indore model, National mission for clean Ganga.	Sources a	nd types of air po	ollution. Cla	assification	of air pollu	tants. Air po	ollution co	ntrol equipments	s: Gravitv Sei	tlers. C	entrifu	aal Se	parator	s. Ele	ctrosta	tic Pre	cipitate	ors (ES	SP). Ba	aa filtei	s. wet	Scrut	bers.	Dust			
9 Hour Integrated waste management policies, Challenges and opportunities associated with waste management in India, Indian waste management market size, Government initiatives towards environmental protection, Application of artificial intelligence, machine learning in pollution prevention. Circular economy strategies in waste management. Case studies on Indore model, National mission for clean Ganga.	manageme	ent, Odor Control S	Systems. C	ontrol meth	ods of emis	sions: SO _{x,} I	NO _X , Hydro	ocarbons, VOC,	CO. Noise po	llution: S	Source	s, cau	ses, eff	ects ar	nd con	trol met	hods	,		0	<i>.</i>						
Application of artificial intelligence, machine learning in pollution prevention. Circular economy strategies in waste management. Case studies on Indore model, National mission for clean Ganga.	Unit-5 - Int	tegrated Approac	ch and Circ	Chollon and	omy	tupition acco	aniated wit	h waata maraza	mont in India	Indian	woote	mone	nomor ¹	morte	toiza	Course	mort	initio!	ion to:	uarda a	nuiron	monto	9	Hour			
	Application	of artificial intellig	nii policies, jence, maci	hine learnin	s and opport ng in pollutio	n prevention	n. Circular	economy strateg	nient in india. <mark>Jies in was</mark> te r	nanagei	nent. (Case s	tudies of	narke	n size, p <u>re m</u> o	del, Na	tional	missio	n for cl	iarus e <u>ean G</u> a	invironi Inga.	nental	prote	cuon,			

Learning Resources	1. 2. 3.	Bishop.P, "Pollution Prevention: Fundamentals and Practice", McGraw Hill International Edn., McGraw Hill Book Co., Singapore, 2000 Pandey.G.N and Carney.G.C, "Environmental Engineering", Tata McGraw Hill, New Delhi, 2017. Rajaram, V., Siddiqui, F.Z., Agrawal, S.,Khan, M.E., "Solid And Liquid Waste Management Waste To Wealth", PHI Learning Pvt Ltd, 2016.	4. 5.	Rumana Riffat, "Fundamentals of Wastewater Treatment and Engineering", CRC Press, 2012. Noel de Nevers, "Air Pollution Control Engineering", 3 rd Edition, Kindle Edition, 2016.

			Continuous Learning A	Summativo							
	Bloom's Level of Thin <mark>king</mark>	Form CLA-1 Avera (50	ative ge of unit test %)	Life-Long CL (1	g Learning "A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	30%		30%		30%	-				
Level 2	Understand	40%	And the second	40%		40%	-				
Level 3	Apply	30%		30%	1	30%	-				
Level 4	Analyze	SW1 - 58		Contraction of the		-	-				
Level 5	Evaluate			7/00		-	-				
Level 6	Create	- A.			2 . J . /-	-	-				
	Total	100)%	10	0 %	100 %					

C	ourse Designers		Press.
E	xperts from Industry	Experts from Higher Technical Institutions	Internal Experts
1	. Mr. A. Subramaniam, PESCO Beam Environmental Solutions Pvt. Ltd	1. Dr. Lima Rose Miranda, Anna University	1. Dr. Paromita Chakraborty, SRMIST
2	. Mr. S. Stalin, Course Director, Chem Skill Development Centre	2. Dr. N. Anantharaman, Former Professor, NIT Trichy	2. Dr. S.Vishali, SRMIST



Course Code	e 21CEO301T Course MAINTENANCE AND REHABILITATION OF STRUCTURES				Cours Catego	se ory	0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3
Pre-requisite Nil Co- requisite Nil Nil				Progressive Nil															
Course	Course Offering Department Civil Engineering Data Book / Codes / Stand										_	Nil							
Course L	earning Rationale (CL	.R): <i>Th</i>	e purpo <mark>se of learning this</mark> cour	se is to:		1			Progr	am Ou	utcome	s (PO)				Р	rogra	m
CLR-1:	Assess the diagnosis	s of distres	SS	10 200	1	2	3	4	5	6	7	8	9	10	11	12	- S 01	pecifi utcom	C es
CLR-2:	Provide an overview	of perforn	nan <mark>ce of concre</mark> te	Constraints	e		+	of	30	ety			¥						
CLR-3:	Identify the sources	of dampne	s <mark>s and its p</mark> revention remedies		vledg		ent o	stigations lems	Usage	soci		-	Mo		ance	5			
CLR-4:	Choose the appropri	ate materi	al and its application for buildings	Martin and	Know	lysis	mdo			and	∞ ,		earr	ю	Ei Bi	arnin			
CLR-5:	Study strengthening	and d <mark>emo</mark>	demolition of structural component		eering	em Ana	n/devel	uct inve	m Tool	ngineer	onment		dual & J	nunicati	ot Mgt.	ong Lea	~	2	e
Course O	utcomes (CO):	At	the end of this course, learner	s will be able to:	Engin	Proble	Desig	Condu	Mode	The e	Enviro	Ethics	ndivid	Comn	Projec	Life L	-OSc	-OSc	-OSc
CO-1:	Diagnosis the distres	sses	100	The survey of the	3		-	-	-	3	-	-	-	-	-	-	-	-	-
CO-2:	Demonstrate the per	form <mark>ance</mark>	of the concrete		3		-	-	-	3	-	-	-	-	-	-	-	-	-
CO-3:	Identify the sources	of da <mark>mpne</mark>	ess and its remedies		3		-		-	3	-	-		-	-	-	-	-	-
CO-4:	Interpret various type	es of mate	rials and its selection for building		3	•		-	-	3	-	-	-	-	-	-	-	-	-
CO-5:	Strengthen and dem	olish <mark>the</mark> s	tructural components	- Tel Contraction	3		1.1	-	-	3	-	-	-	-	-	-		-	-
Unit-1 - G General c of building	General Aspects onsideration – distress gs- Influence of environ	es monito mental el	oring, causes of distresses - Defe ements on buildings- Design a	cts due to climate, wear anderosion- and construction errors-Corrosion me	- Quality as echanism-l	suran Effects	nce & li s of bio	nspectio logical	on- Stri agents	uctural s- Tern	l & eco nite cor	nomic ntrol a	apprai nd pre	sal- Life vention	e expe - Cher	ctancy nical a	of difi	9 ferent on bui	Hour types ilding-
Aspects of Unit-2 - D Sources of cement of pack- Che	f fire on buildings- Build amages and Their Re of dampness - Moisture verlay - Resin or polym emical coating- Flexible	ding cra <mark>ck</mark> medies movemen ner slurry i and rigid	s causes diagnosis-Remedial me nt from ground - DPC - Reasons njection - Thin polymer overlay- coatings	easures-Thermal cracks-shrinkage co for ineffective DPC - Roof leakage Thin epoxy overlay- Dampness in s	racks- Veg - pitched r olid walls-	etation oofs - Cond	n and t Madra ensatic	rees gr s terra n – hy	owth- I ce roo grosco	Founda fs - Le pic sa	ation m akage Its- Rei	oveme of con media	ents ocrete s I treatn	slabs P nents-	Protecti Dry pa	ve seai ick & e	l coati poxy	9 ings - bonde	Hour Ferro ed dry
Unit-3 - N Materials	laterials and Techniqu	ues of Rep	p air r materials - <u>Special mortar</u> and	concretes concrete chemicals - Spe	cial cemen	its - H	iah ara	ide con	crete-	Exnar	nsive ce	ement	-nolvn	ner cor	ncrete-	Enoxie	es reg	9	Hour Inface

Materials: types – Essential parameters for materials - Special mortar and concretes, concrete chemicals - Special cements - High grade concrete - Expansive cement – polymer concrete - Epoxies, resins-surface coatings- parameters and type of coatings- Sulphur infiltrated concrete(SIFCON) - Properties and application of SIFCON- Ferrocement- Application of ferrocement- Fiber reinforced concrete- Types and applications-Admixtures-chemical and mineral admixtures - Case Studies SIFCON, Fibre reinforced concrete
Unit-4 - Maintenance and Diagnosis of Failure

9 Hour

9 Hour

Distresses: concrete structures: Introduction, causes of deterioration Diagnosis of causes, flow charts fordiagnosis – Methods of repair – repairing, spalling and disintegration - Preparing of concrete floor and pavements - Steel Structures: types and causesfor deterioration – Types and causes for deterioration – preventive measures - Repair procedure - brittle fracture - Lamellar tearing – Defects in welded joints - Mechanism of corrosion - Design to protect against corrosion. – Design and fabrication errors - Distress during erection - Biotical treatments - Preservation – chemical preservatives- Brick masonry structures-Distresses and remedial measures

Unit-5 - Strengthening and Demolition Aspect

General principle for strengthening - Relieving loads plan – Strengthening super structures -Plating- Conservation of compositeconstruction - Post stressing - Jacketing –Bonded overlays- Reinforcement addition-Fiber wrap techniques- Pre placed aggregate concrete- Shotcrete- Strengthening concrete by surface impregnations- Vacuum methods- Strengthening the substructures: Shoring- Underpinning- Increasing the load capacity of footing- Design for rehabilitation - conservation of heritage structures

			_	
	1.	Handbook on "repair and rehabilitation of RCC buildings", CPWD, Government of	5.	Dodge Woodson.R," Concrete Structures – protection, repair and rehabilitation", Elsevier
		India, Government of India Press, India, 2011		Butterworth – Heinmann, UK, 2009.
	2.	Allen R.T and Edwards S.C, "Repair of Concrete Structures", Blakie and Sons, UK,	6.	Peter H.Emmons, "Concrete Repair and Maintenance Illustrated", Galgotia Publications Pvt. Ltd.,
Learning		1987		2001.
Resources	3.	Dayaratnam.P and Rao.R, "Maintenance and Durability of Concrete	7.	Raikar, R.N., "Learning from failures - Deficiencies in Design, Construction and Service" – Rand
		Structures",University Press, India, 1997		D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
	4.	Denison Campbell, Allen and Harold Roper, "Concrete Structures, Materials,	8.	https://onlinecourses-archive.nptel.ac.in/noc19_mm06/preview
		Maintenance and Repair" Longman Scientific and Technical LIK 1991		

Learning Assessme	nt 🛛	1		State States							
			Continuous Learning A	Assessment (CLA)	A STATE OF A STATE	Sum	mativa				
	Bloom's Level of Thinking	Form CLA-1 Averag (50	ative ge of unit test %)	Life-Long CL (10	g Learning .A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	<u>Th</u> eory	Practice				
Level 1	Remember	20%	- 11	20%		20%	-				
Level 2	Understand	20%	- 1/7	20%	-	20%	-				
Level 3	Apply	25%	- ////	25%	-	25%	-				
Level 4	Analyze	25%		25%		25%	-				
Level 5	Evaluate	10%		10%	2011	10%	-				
Level 6	Create					-	-				
	Total	100	%	10	0 %	10	0 %				

Course Designers	Contraction of the second seco	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Lavina D'souza, Head, RMC, Ultratech, lavina.dsouza@adityabirla.com	1. Dr. J. Karthikeyan, Associate Professor, NITT, jk@nitt.edu	1. Dr.K.S.Satyanarayanan, SRMIST
 Mr. R. Eswaran, Chief Engineering Manager, L&T, eswaran@Intecc.com 	2. Dr. Manu Santhanam, Professor, IITM, manus@iitm.ac.in	2. Dr.M.Prakash, SRMIST

Course Code	ode 21CEO302T Course DISASTER RESISTANT STRUCTURES							e ry	0				OPEN	ELEC	TIVE				- T 3 0	P 0	C 3
Pre-requi	isite es	Nil	Co- req Course	uisite es	Nil		Pro	gres	sive es						Nil	1					
Course	Offering Departmo	ent	Civil Engineer	ring	Data Book / Codes / S	Standards								Nil							
Course Le	earning Rationale	(CLR):	The purpos <mark>e of learnin</mark>	g this cour	se is to:		-	Č.			Progr	am Ou	itcome	s (PO)				P	rogra	m
CLR-1:	Know the basic c	oncepts an	d design <mark>philosophy</mark> for	disaster resi	istant structures		1	2	3	4	5	6	7	8	9	10	11	12	S OU	pecifi itcom	C es
CLR-2:	Learn the various	s materials u	used <mark>and design f</mark> or disa	aster resistar	nt structures		e		ч н	of	34	ety			¥		-				
CLR-3:	R-3: Get an exposure about damage assessment and retrofitting								ento	tions	Je	soci			Wor		ance	-			
CLR-4:	Learn the design	and detailir	ng for lifeline structures	1	West a		Non	lysis	opme	stiga	Usaç	and	οð		eam	ы	Ë	ming			
CLR-5:	Explore the mode	ern techniqu	ues of damage assessm	ent			eering h	em Anal	jn/devel	uct inve	ern Tool	engineer	onment	S	dual & T	nunicati	ct Mgt. 8	ong Lea	.	5	ņ
Course O	utcomes (CO):		At the end of this cou	rse, learner:	s will be able to:		Engir	Probl	Desig	Cond	Mode	The e	Envir Susta	Ethic	ndivi	Comr	Proje	_ife L	-OSC	-OSc	- SO
CO-1:	understand the d	esign p <mark>hilos</mark>	sophy for loads, earthqu	ake and win	d	Salah	3	3	3	-	-		-	-	-	-	-	-	-	-	
CO-2:	study the materia	als to be <mark>use</mark>	<mark>ed, an</mark> d design to be ma	de for disast	ter resistant structures		3	3	3	-	3		-	-	-	-	-	-	-	-	-
CO-3:	study damage as	sessme <mark>nt a</mark>	and retrofitting				3	3	3	-	_	- 10	-	-		-	-	-	-	-	-
CO-4:	understand mate	rials de <mark>sign</mark>	<mark>n and</mark> detailing for lifeline	structures		100	3	3	3	-	-		-	-	-	-	-	-	-	-	-
CO-5:	know techniques	of dam <mark>age</mark>	assessment		1-11-2		3	2	2	-	3	1	- 10	-	-	-	-	-	-	-	-
llnit-1 - B	ehaviour of Lifelin	o Structure	30			- 54		6.7										1		0	Hour
Design phi	losophy to resist flo	od, cyclone	e, and earthquake and fi	re disasters l	National and International Codes	s of practic	e - By	-laws	of urba	an and	semiu	rban a	reas – F	Past h	istory a	and les	sons fr	om disa	asters	- Appi	roach
to tradition	al and Modern Stru	ictures - Co	ncept of life period base	ed Design - d	case studies.	,				1											
Unit-2 - Co	ommunity Structu	res									- 1									9	Hour
Safety ana	lysis and rating - R	eliability as	ses <mark>sment re</mark> pairs and R	etrofitting te	chniques of Community Structur	res - Prote	ction o	of Nuc	clear S	tructur	es - Da	ms, b	ridges a	and bu	ildings	-					
Unit-3 - Re	ehabilitation and I	Retrofitting	1									-								9	Hour
lesting an	d evaluation - Clas	sification ac	ccording to safety level -	methods an	id materials for strengthening for	r different (disast	ers - (qualific	ation te	est.										Harrie
Modern Ma	aterials, Design al aterials for disaster	s reduction	- Detailing aspects of str	uctures subi	iect to probable disasters - Cons	truction to	hnia	105 - 1	Analysi	s moth	odoloc		chnique	as for	ontima	Inorfo	mance	- Prov	isions	for ar	tificial
disasters -	blast and impact		- Dotalling aspects of str				Jiniqu	03-7	anarysi	Sincli	ouolog	y - 10	unique	53 101 0	opuna	1 00100	manut	-1100	1310113		moral
Unit-5 - Te	echniques of Dam	age Asses	sment																	9	Hour
Damage s	urveys - Maintenan	ce and mod	dification to improve haz	ard resistan	ce - application GIS in disaster r	manageme	ent - fo	ounda	tion im	proven	nent te	chniqu	ies.								

Loorning	1. Raiker, R.N. "Learning from failures, Deficiencies in Design, Construction and Service",	3. Moskvin.V "Concrete and Reinforced Concrete" - Deterioration and protection - MIR Publishers -
Deseuress	R&D Center, Raiker Bhavan, 1987	Moscow 1983
Resources	Allen.R.T., and Edwards.S.C., "Repairs of Concrete Structure", U.K.1987	Lecture notes on the course "Disasters Management" - conducted by Anna University, 2000

Learning Assessme			Continuous Learning	Assessment (CLA)		<u>Cum</u>	no ti vo
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test)%)	Life-Lor C (*	ng Learn <mark>ing</mark> CLA-2 10%)	Final Ex (40% w	native amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	and the second	20%		20%	-
Level 2	Understand	20%		20%	100	20%	-
Level 3	Apply	30%	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	30%		30%	-
Level 4	Analyze	30%	and the second second	30%		30%	-
Level 5	Evaluate			14 C		-	-
Level 6	Create			1. Sec. 1. Sec. 1.		- 16 B	-
	Total	10	0%	1	00 %	10	0%
			1997 - C. 2010 V	ALC: NOT BE	122 1 1-		

Co	urse Designers		18	
Ex	perts from Industry	Experts from Higher Technical Institutions	Int	ernal Experts
1.	Er. G.Hariharanath, GA Consult <mark>ants, Ch</mark> ennai, gac1996z	1. Dr. G. Appa Rao, Professor, IIT Madras, garao@iitm.ac.in	1.	Dr. R. Ravi, SRMIST
	e@hotmail.com	and the second		
2.	Er. AGV. Desigan, Design Grou <mark>p Engine</mark> ering Consultancy	2. Dr. C. Uma Rani, Professor, Anna University, umarani@annauniv.edu	2.	Dr. C. Arunkumar, SRMIST
]	Pvt Ltd. Chennai, desigan.agv@gmail.com			



B.Tech / M.Tech(Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses –Syllabi-Control Copy

Course Code	21CEO303T	ICTURE	Cou Cate	irse gory	0		Course O Category O									P 0	C 3				
Pre-requis Course	site s	Nil	Co- Co	· requisite ourse <mark>s</mark>		Nil	1	Progres Cours	sive ses						Nil	1					
Course C	Offering Departme	ent	Civil En <mark>g</mark>	ineering	Data	Book / Codes / Stan	dards							Nil							
-					the second second	1.11 - T		1.0	1												
Course Le	arning Rationale	(CLR): <i>Th</i>	he purpo <mark>se of lea</mark>	arning this co	urse is to:				0.00		Progr	am Ou	utcome	s (PO)	1			Pr	ograr	n c
CLR-1:	Understand the f	undamental r	require <mark>ments for a</mark>	smart city			1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	es
CLR-2:	Recognize the ch	allenges exp	perie <mark>nced during</mark> tl	he transition to	smart cities		e e		f	s of	1	iety			Ł		Ð				
CLR-3:	Know the role of	renewable er	ne <mark>rgy in sm</mark> art ene	ergy systems.		10000	vled		ento	ation	ge	soc			J Wc		lanc	D			
CLR-4:	Comprehend the	different tech	hnologies used to	create smart c	tities	S- 123	Kno	lysis	opm	stige	Usa	r anc	×		Tean	.u	& Fir	arnin			
CLR-5:	Recognize the va	nrious technol	logies involved in	intelligent tran	sportation syste	ms	Jeering	em Ana	gn/deve	luct inve	ern Tool	enginee	onment	S	idual & ⁻	nunicat	ct Mgt.	-ong Le:	-	-2	ç
Course Ou	tcomes (CO):	A	At the end of this	course, learn	ers will be able	to:	Engir	Probl	Desig	Cond	Mode	The (Envir	Ethic	ndivi	Com	Proje	-ife L	SO	0Sc	OSc
CO-1:	Identify the core I	needs fo <mark>r a s</mark> i	mart city.		1000	Pres 634	3	2	-	2	-	3	3	-	-	-	-	-	-	-	-
CO-2:	Realize the difficu	ulties en <mark>coun</mark>	n <mark>tere</mark> d when movin	ng to smart citie	es	1000	3	2	0	2	-	3	3	-	-	-	-	-	-	-	-
CO-3:	Realize the functi	ion of re <mark>newa</mark>	<mark>able</mark> energy in mo	dern energy sy	vstems	141 8 4	3	2	2	2	-	3	3	-		-	-	-	-	-	-
CO-4:	Identify the variou	us techn <mark>ologi</mark>	<mark>ies e</mark> mployed to de	evelop smart c	ities		3	2	2	2	-	3	3	-	-	-	-	-	-	-	-
CO-5:	Learn about the v	/arious t <mark>echn</mark>	n <mark>ologi</mark> es used in in	telligent transp	ortation system	S	3	2	2	2	-	3	3	-	-	-	-	-	-	-	-
linit-1 - Eu	ndamentals of Sr	nart Cities			and the second							-								0	Hour
Introduction	to Smart cities. S	mart city indi	licators: Smart gov	ernance. Sma	art economy. Sm	art environment. Sma	art people.	Smart	livina.	Smart	mobilit	. Sma	rt Citv	Missio	n. 201	5. India	a "100 S	Smart (Cities"	Polic	/ and
Mission, Cr	iteria for selection	of 'Smart Citi	ties', Case study o	n smart city pro	ojects in India		- p p ,		J ,						,	-,				,	
Unit-2 - Tra	ansition Challeng	es		1201						1	17									9 /	Hour
Legacy to s	mart infrastructure	systems - C	Ch <mark>allenges fa</mark> ced ir	n infrastructure	layer, service la	ayer and digital/data la	yer, Decis	sion ma	king co	onstrair	s - Tec	hnolog	gical, Fi	nancia	al, Polit	tical, S	ocial, e	nvironr	nental,	Tran	sition
in Socio-Te	chnical systems –	role of feedba	ack loop and data	layer, Case st	udy on Citizen's	perspective on need	for smart	cities			1.25	-									
Unit-3 - Sn	9 Hour																				
SES CONCE	-S Conceptualization and its types, Applications of renewable energy in SES, Smart energy devices, SES in different sectors: buildings, water management, transport, waste management, Case study on SES																				
Unit-4 - Sn	nart Buildings						-		_	-										9	Hour
Smart Serv	ices in buildings, lo	oT and Sman	t Building, Techno	ologies involved	d in smart buildii	ng, Energy conservation	on concep	ots in bu	iilding,	Green	buildin	g cond	epts, G	RIHA,	LEED	and IC	GBC ra	ting sys	stem, (Case :	study
on a Platinu	um rated green bui	ilding in India	1						3 ,				1					.,			,
Unit-5 - Int	elligent Transpor	tation Syste	ems (ITS)																	9	Hour
Technologi	hnologies involved in ITS, Smart traffic monitoring systems, Sensors used in ITS, Floating car data, Methods to obtain Floating car data, Navigation systems, Applications of ITS																				

Learning	1.	Smart City on Future Life - Scientific Planning and Construction by Xianyi Li	3.	Smart city government of India. http://smartcities.gov.in
	2.	Jo Beall (1997); "A city for all: valuing differences and working with diversity"; Zed books	4.	Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; NatašaPichler-Milanovic; Evert
Resources		limited, London (ISBN: 1-85649-477-2)		Meijers (2007). "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science

Learning Assessme	ent		- 10 M M	1 7-2-			
		and the second	Continuous Learning		Sum	mativa	
	Bloom's Level of Thinking	Forma CLA-1 Averag (50	ative le of unit test %)	Life-Long CL (1)	g Learning _A-2 0%)	Final Ex (40% w	amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%		20%		20%	
Level 2	Understand	20%		20%		20%	
Level 3	Apply	30%	1.1	30%		30%	
Level 4	Analyze	30%	1000	30%		30%	
Level 5	Evaluate			Section 2			
Level 6	Create	· · · ·	in the second	1977 S. 148 .		-	
	Total	100	%	10	0 %	10	0%
	-	Tel market a	1 1 M 2 M 2	and the second	1		

Co	urse Designers		ATTACK BENGE FLUXURE	1						
Ex	perts from Industry	Ex	perts from Higher Technical Institutions	Internal Experts						
1.	Mr.V.Boobalan, Assistant Engineering Manager Larsen &	1.	Dr.K.Yogeswari, Professor, BSACIST	1.	Dr.B.Indhu, SRMI <mark>ST</mark>					
	Toubro, Chennai									
2.	.Mr.K.Prithviraj Kannan, Manage <mark>r at Larse</mark> n & Toubro, Bangalore	2.	Dr.Vennila.G, Director, K.S.Rangasamy College of Technology,	2.	Mr.M.B.Sridhar, SRMIST					
		4	Tiruchengode							



Course Code	se 21CEO304T Course REAL ESTATE MANAGEMENT Name								C Ca	ours atego	e ry	0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3
Pre-requi Course	isite es	Nil		Co- requi Courses	isite s		Nil			Pro	gress	sive es						Nil	1					
Course	Offering Departm	nent	С	ivil Engineerin	<u>ıg</u>		Data Book / (Codes / Stand	dards		_						Nil							
Course Le	arning Rationale	(CLR):	The purpos	e <mark>of learnin</mark> g	this cour	rse is to:		-			Č.	1		Progr	am Ou	utcome	s (PO)				P	rogra	m
CLR-1:	Understand the	scenario of	different sec	<mark>tors of r</mark> eal es	state	3.5	1			1	2	3	4	5	6	7	8	9	10	11	12	- S 01	pecifi itcom	ic ies
CLR-2:	Understand the	relationship) betw <mark>een ec</mark>	onomy and re	al estate	. /				ge		of	s of	2	iety			rk		a)				
CLR-3:	CLR-3: Interpret the norms and regulation of real estate sector							é.	vledç		ento	ations	ge	soc		-	oW r		ance	D				
CLR-4:	CLR-4: Develop the layout of the land for approval							6. ₁₀	Knov	lysis	mdo	stige	Usa	and	8		[ean	u	& Fir	arnin				
CLR-5:	Know the housir	ng situation a	and measure	es taken in Inc	dia	12.2	1.0	1.00		ring	I Ana	devel	t inve	Tool	ineel	ment		al &	nicati	Mgt.	g Le			
										inee	olem	ign/c	iduct	lern	eng	ironi taina	S	vidua	nmu	ect I	Lo	-	0-2	-3
Course Or	utcomes (CO):		At the end	of this cours	e, learner	rs will be	able to:	Courses!	27	Eng	Prol	Des solu	Con	Moc	The	Env Sus	Ethi	Indi	Con	Proj	Life	PSC	PS(PSC
CO-1:	Understand the	status of <mark>rea</mark>	<mark>al estat</mark> e sec	tor in India			100 000	-R \$ \$4	101	-	1		-	5	3	-	-	-	-	2	-	-	-	-
CO-2:	Apply the real es	state inv <mark>estr</mark>	<mark>ment d</mark> ecisio	n making con	cepts	1.0	E	1925 I I		2	2		-	•	2		-	-	-	3	-	-	-	-
CO-3:	Understand the	norms a <mark>nd r</mark>	<mark>regula</mark> tion of	real estate pr	roject appr	raisal	S. 2 19	1.8.4		2	-	-	-	1	3	2	-		-	-	-	-	-	-
CO-4:	Create a layout	of land fo <mark>r a</mark>	<mark>approv</mark> al proc	ess	1943	25.47		1.1.1	-24	-	2	3	2	-		1	-	-	-	-	-	-	-	-
CO-5:	Recognize the h	ousing s <mark>itua</mark>	<mark>ation an</mark> d ref	orms taken fo	r housing i	in India	0.00		1	-	1	5	-	-	3	-	-	-	-	-	-	-	-	-
linit 1 in	traduction to Day	al Estata		1	10	dia i									-									Hour
Introductio	n to real estate R	al estate s	ector in India	- land Hous	ing office	202002	waro housina	Characteristi	cs of la	and T	Vnos	of pro	norty (Junor	hin ri	nhte Ec	rme o	fowno	rshin I	Poolos	tato cr	ontract	9	пош
Unit-2 - Re	eal Estate Econol	mics and In	nvestment		ing, once	spaces,	ware nousing.		03 01 10	inu, i	урез		Jerty, C	JWIIEI.	siip ng	<i>jno,</i> r c	1113 01	OWIE	1311ip. 1	1001 03		miaci	<u>s.</u> 9	Hour
Real estate	e and economy -	Relationship	ip b <mark>etween</mark> F	Real estate an	nd macroe	economy,	Real estate in	nvestment cy	cle, Re	eal es	tate p	oroject	develo	pment	cons	der <mark>atio</mark>	ns, Re	al esta	ate fina	ancing,	Real e	estate	inves	tment
decision m	aking, Tax implica	ations, Risk I	managemen	t, and Propert	ty valuation	on.		1						11										
Unit-3 - Re	eal Estate Laws a	nd Regulat	tions		_			-			_											<u> </u>	9	Hour
Survey of RERA 201	rvey of land, Recording, Land divisions and subdivisions, land documents and registration process, Power agent, Land use and development control regulation – Master plan, zoning, Special economic zone,																							
Unit-4 - Re	eal Estate Develo	pment			1002, 1110							100											9	Hour
Land deve	lopment approval	authorities,	DTCP's app	proval proced	ure, NOC	certificate	es, Criteria for	r layout develo	opmen	t, buil	ding l	byelaw	s, Buil	ding p	ermiss	ions, F	SI/FAI	r, TDF	r, osf	Calcu	lation,	Marke	et pric	e and
guideline v	alue, Case study	of land layo	ut approval p	process				•			Ũ			01				-	-				•	
Unit-5 - Re	eal Estate Housin	ig																					9	Hour
Introduction to housing, Housing classification, Calculation of UDS, Housing situation in India – urban and rural, Hou Housing finance, PMAY 2015 – Types and features, Property tax calculation.									ousing	policy	/ sche	emes -	Role of	f govei	rnmen	t in hou	sing de	elivery,	reforn	ns to im	prove	housin	ıg situ	ation,

	1.	Steve Berges (2015), The Complete Guide to Real Estate Finance for Investment	4.	Charles Jacobus (2010), Real Estate Principles, Dearborn Real Estate Education
Looming		Properties, John Wiley & Sons	5.	N.G. Miller and D.M. Geltner (2010), Real Estate Principles for the New Economy, Cengage
Learning	2.	Arlyne Geschwender (2010), Real Estate Principles and Practices, Real Estate		Learning
Resources		Education Company (REECO)	6.	https://nptel.ac.in/courses/124/107/124107001/
	З.	Michael Weir (2001), Concepts of Property, Blackwell Publishers		

earning Assessme	ent		Continuous Learning	g Assessment (CLA)						
	Bloom's Level of Thin <mark>king</mark>	Form CLA-1 Avera (50	native ge of unit test 0%)	Life-Lon Cl (1	g Learning LA-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%		20%		20%				
Level 2	Understand	20%	the second second	20%		20%				
Level 3	Apply	30%	1.1.2.2.2.2.1	30%		30%				
Level 4	Analyze	30%		30%		30%				
Level 5	Evaluate		and the second			-				
Level 6	Create		10.00000000	1	25 1 1-	-				
	Total	10	0%	10	0 %	10	0%			

Co	urse Designers				Press.
Ex	perts from Industry	Ex	perts from Higher Technical Institutions	Inte	ernal Experts
1.	Mr. G. Murali, Manager, Srivari Foundation,	1.	Dr. K.Yogeswari, Associate Professor, B.S. Abdur Rahman Crescent	1.	Mr. M.B. Sri <mark>dhar, SR</mark> MIST
	gmuralioffice@gmail.com		Institute of Science and technology, yogeswari@crescent.education		
2.	Mr. K. M. Nanthan, Planning Manager south Factories, L&T,	2.	Dr. M. Harikrishna, Associate Professor, National Institute of	2.	Dr. B. Indh <mark>u, SRMIS</mark> T
	rkmnnn@Intecc.com		Technology, Calicut, harikrishna@nit.ac.in		



Course Code	Code 21CEO305T Course PROJECT MANAGEMENT						C Ca	ourse	e ry	0				OPEN I	ELECT	IVE			l	- T 3 0	P 0	C 3
Pre-requi Course	isite es	Nil		Co- requisite Course <mark>s</mark>		Nil		Pro	gres: ourse	sive es						Nil						
Course	Offering Departme	ent	Ċi	vil Engi <mark>neering</mark>		Data Book / Codes / Sta	ndards	1							Nil							
Course Le	arning Rationale	(CLR):	The purpose	e of learning this (course is	to:						Progr	am Ou	itcome	s (PO))				Pr	rograi	m
CLR-1:	Appreciate the pr	roject objec	ctives and pre	pare a project sche	edule for ti	me, cost and resources		1	2	3	4	5	6	7	8	9	10	11	12	S ou	pecifi tcom	c es
CLR-2:	Prepare an estim	nate of the p	projec <mark>t cost a</mark>	<mark>nd m</mark> anaging proje	cts.	Contract of the local division of the local		je		f	s of	10	iety			rk		0				
CLR-3:	Update Project P	Progress an	nd pr <mark>epare re</mark> p	orts for review and	<mark>l to</mark> contro	I the project		vledo		ento	tions	ge	soc		-	oW I		ance	0			1
CLR-4: Plan for the project organisation and directing						Vou	lysis	udo	stiga	Usa	and	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		earr	и	k Fin	L					
CLR-5:	CLR-5: Prepare a final project closure report and international projects							ring h	Anal	devel	inve	Tool	ineer	nent ability		al & T	nicati	۸gt. 8	g Lea			1
								inee	olem	ign/c	duct	lern	eng	ironr taina	S	vidua	Inm	ect	Lon	-	-7)-3
Course Ou	utcomes (CO):		At the end o	of this course, lea	rners will	be able to:	27	Eng	Prot	Des	Con	Moc	The	Env Sus	EH.	Indiv	Con	Proj	Life	PSC	PSC	PSC
CO-1:	Comprehend and	d identif <mark>y th</mark>	<mark>he elem</mark> ents o	f project managem	ent	it has been	91.1	3	-	-	-	-	-	-	-	3	-	3	-	-	-	-
CO-2:	Ability to select a	lternativ <mark>e c</mark>	<mark>course</mark> s of act	ion to attain projec	t objective	S		3		5	-	ł	2		-	-	-	-	-	-	-	-
CO-3:	Manage the phas	ses of pr <mark>oje</mark>	ects		10.00			3	-	-	-	-	2	-	-		-	-	-	-	-	-
CO-4:	Ability to Estimate	e, plan, <mark>cal</mark>	<mark>liculate</mark> , and a	djust project variab	le		102	3	-			-	-	-	-	-	-	3	-	-	-	-
CO-5:	Can manage proj	ject risk <mark>, in</mark>	<mark>ncluding</mark> identi	fying, analyzing an	d respond	ing to risk	1	3	-	1.1	3	-	2	-	-	-	-	-	-	-	-	-
Unit-1 - Pr Project Life	roject Perspective e Cycle - Types of actors	s Projects-	Selection of F	Professional Servic	es - Stak	e-holders in Project - Structu	re of Pro	oject (Orgar	nizatio	n - Rol	e of Pi	roject i	Manage	ers - F	inancii	ng of C	Constru	cted F	acilitie	9 s – Pi	Hour roject
Unit-2 - Pr Project scc Value Engi methods -	oject Estimation & ope- Work breakdo ineering - Developir Case study in Risk	& Manager wn structur ng project r managem	ement ire and its pro- network- CPM nent and resou	cess - Multidisciplir 1 & PERT - Risk Ma urces allocation	nary team nagemen	and its role - Factors of Proje t process - Contingency plann	ect estim ning - Op	nates, oportui	types nity N	s of co Ianage	sts, me ement a	thods, and Ch	refinir ange o	ng estin control r	nates- nanag	Case : ement	study i - Resc	n WBS ources	and pi allocati	roject i ion cla	9 estima ssifica	Hour ates - ations
Unit-3 - Co	onstruction Plann	ing, Monit	toring and Co	ontrol	1112	- 11/2 A 11 1 1 1	TP-			23				1.10							9	Hour
Types of F	Project Plans - Wor	rk Breakdou	wn Structure	- Resource Levellin	ng - Reso	urce Allocation -Project Sche	eduling -	Type	s of F	Project	Schea	uling -	Proje	<mark>ct P</mark> rog	ress C	Control	- Mea	suring	and Up	dating) of Pi	roject
Progress u	ising Bar Chart, Pro roject Organising	ogress Rep and Direct	ports to aid Pr	ogress Review - St	age-wise	Completion Cost - Earned Va	alue Ana	lysis.													0	Hour
Introduction	n, Organizational D	Design, Hiel	erarchical Syst	tems, Organization	Structure	Types of Organization Struc	ture. For	rmal a	and In	forma	l Organ	ization	, Facto	ors Dete	ərminii	ng Spa	n of M	anager	nent. C	Central	lizatio	n and
Decentraliz	zation, Span of con	trol, Under	rstanding auth	ority and responsil	oility.		·				U					0 1		0				
Unit-5 - Pr	oject Closure and	Internatio	ional Projects	; Drojost Manari	aral Class	ro Loopono Loornt from the	Droject	Dref	it/l.oc	a at C	omplet	on D	ionuto	o and O	loima	S.44	omort	of Diar	utoo o	nd Cla	<u>9</u>	Hour
Project Clo	sure - Financial Cl sure Reports -Inter	rnational pr	projects – envi	e - Project Manage ronmental factors a	and cross-	culture - Agile Traditional Vs.	agile me	ethods	s - Ca	s al Clase stu	dies in	projec	t audit	s anu C S.	ains	- Settle	ement	u Disp	ules a	nu Ula	IIIIS -	rınal

ſ		1.	Clifford Gray, Erik Larson and Gautam V Desai, Project Management, Tata McGraw	4.	Choudhury, S, Project Management, Tata McGraw-Hill Publishing Company, New Delhi, 1988.
	Loorning		Hill Edition, 7th Edition, 2018.	5.	George J. Ritz, Total Construction Project Management - McGraw-Hill Inc, 1994.
	Learning	2.	A Guide to the Project Management Body of knowledge PMBOK Guide PMBOK®	6.	Kumar Neeraj ha, Construction Project Management - Theory and Practice, Pearson Publications
	Resources		Guide – Sixth Edition, 2017.		- Dorling Kindersley (India) Pvt. Ltd., 2012.
		З.	Adrienne Watt, Project Management, BC Campus Victoria, 2 nd edition, 2014.		

			Continuous Learning	Assessment (CLA)		Summative Final Examination (40% weightage)				
	Bloom's Level of Thin <mark>king</mark>	Form CLA-1 Averag (50	ative ge of unit test %)	Life-Long CL (10	g Learning A-2 0%)					
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%		20%		20%				
Level 2	Understand	20%	ALLEN GAR	20%	1.1	20%				
Level 3	Apply	30%	1.1.2.2.2.1	30%		30%				
Level 4	Analyze	30%		30%		30%				
Level 5	Evaluate	-	A State of the second	19// Carlos 1		-				
Level 6	Create					-				
-	Total	100)%	10	0%	10	0%			

Co	urse Designers	÷.,			And a second sec
Ex	perts from Industry	Exp	erts from Higher Technical Institutions	In	ternal Experts
1.	Dr. G. Muneeswaran, Senior En <mark>gineering</mark> Manager, Larsen	1.	Dr. S. Shanmugapriya, Assosciate Professor, CIT, Coimbatore	1	. Dr. K. S. Anandh, SRMIST
	& Toubro, Chennai				
2.	Er. P. Jahanathan, CRO & VP - Contracts, Utracon Private	2.	Dr. S. Kamal, Associate Professor, Annamalai University,	2	Dr. A. Celina, SRMIST
	Limited, Chennai		Chidambaram		



Course Code	Course Code 21CEO306T Course Name ENVIRONMENTAL IMPACT ASSESSMENT						0				OPEN	ELEC	TIVE			ļ	L T 3 0	P 0	C 3
Pre-requi Course	site s	Nil	Co- requisite Courses	Nil		Progres Cours	sive ses						Nil	1					
Course (Offering Departm	ent	Civil Engin <mark>eering</mark>	Data Book / Codes / Star	ndards							Nil							
Course Le	arning Rationale	(CLR): 7	he purpos <mark>e of learning</mark> this course	is to:		1			Progr	am Oi	utcome	es (PO)				P	rogra	m
CLR-1:	Understand Impo	ortance of El	A and its evolution	1	1	2	3	4	5	6	7	8	9	10	11	12	- S 01	pecifi utcom	C es
CLR-2:	Learn principles	and method	s of environmental analysis	Contract 1	- D		-	of	30	ety			¥						
CLR-3:	CLR-3: Know the interrelationship between various activities and their impact on environment						ent o	tions	e	soci			Wor		ance	5			
CLR-4:	Understand the A	Application o	f EIA in various sectors	West- Sale	- Anov	Ilysis	opme	stiga	Usaç	r and	ø		Team	on	& Fin	arninę			
CLR-5:	Explain the conc	ept of enviro	nmental management		Lina I	Ana	level	prot	Tool	inee	ment		<u>م</u>	nicat	Mgt.	g Le			
					nee	lem	ign/c	duct	ern	eng	taina	S	/idua	Inmu	ect	Long	÷	-2	
Course Ou	itcomes (CO):		<mark>At the</mark> end of this course, learners v	vill be able to:	End	Prot	Des	Con	Mod	The	Envi	Ethi	Indiv	Con	Proj	Life	PSC	PSC	PSC
CO-1:	Understand the i	importan <mark>ce c</mark>	<mark>f vari</mark> ous rules & regulation in EIA and	I role of stake holders in EIA	3	-	-	-	1	2	3	-	-	-	-	-	-	-	-
CO-2:	Apply various teo	chniques <mark> in l</mark>	mpact Assessment studies		3		1	-	-	2	3	-	-	-	-	-	-	-	-
CO-3:	Identify the Impa	ict on W <mark>ater,</mark>	land and soil environments		3	-	- 21	-	-	2	3	-	-	-	-	-	-	-	-
CO-4:	Identify the Impa	ict on Air <mark>, No</mark>	i <mark>se,</mark> Biota and Socio-Economic enviro	nments	3	-	-		-	2	3	-	-	-	-	-	-	-	-
CO-5:	Evaluate the Imp	oact usin <mark>g m</mark> a	anagement plan and make suggestior	S	3	-	1.1	-	-	2	3	-	-	-	-	-	-	-	-
	,		<u> </u>																
Unit-1 - Int	troduction	w of Environ	mental Laws- EPA 1986 Water Act. For	est Act- Evolution: EIA Notification	1004.200	S and E	A Draft	2020- 1	Types (of FIA.	Screen	ina: Sc	onina-	Role of	Gover	nmonta	aland	9 NGOs	Hour
Unit-2 - El	A Methodologies				11004, 200		A Dian	2020- 1	ypcs c	л <u>сіл</u> ,	Ocreen	ing, oc	oping-		Ouven	monta	i unu i	<u>1003.</u> 9	Hour
Baseline D	escription- Enviror	nmental Exa	mination- Screening; Scoping- Method	ls: Checklist; Matrix; Network; O	verlay; Co	st Bene	fit Anal	ysis-P	ublic pa	articip	ation <mark>- A</mark>	nalysi	s of Ali	ternativ	/es- Ex	pert sy	vstems	;	
Unit-3 - Co	omponents of the	Environme	nt <mark>– Water, L</mark> and, Soil						11									9	Hour
Setting Bas	seline- Impact Pred	diction and A	ssessment of- Water: Surface Water,	groundwater; Land; Soil- Case	Studies.				125	-									
Unit-4 - Co	omponents of the	Environme	nt – Ai <mark>r, Noise, Bi</mark> ota, Socio-Econol	nic			0		100									9	Hour
Setting Bas	seiine- impact Prec	aiction and A	Assessment of- Noise, Air Environmen	t; Biota; Socio-Economic; Cultur	ai and Aes	thetics-	Case S	stuales										0	Hour
Environme	ntal Management	Strategies- F	en Environmental Management Systems-	ISO14001: Environmental Mitig	ation: Risk	Δnalvs	is: Envi	ronmei	ntal Au	dit_ T(naratio	n- Doc	ument	ation a	nd Ron	ort Pr	9 Penara	tion

Learning	 L. W. Canter, Environmental Impact Assessment, 2nd Ed., McGraw-Hill, 1997. G. Burke, B. R. Singh and L. Theodore, Handbook of Environmental Management and 	 R. Therivel, John Glasson, Andrew Chadwick, Introduction to Environmental Impact Assessment (Natural and Built Environment), Routledge, 2005.
Resources	Technology, 2ndEd., John Wiley & Sons, 2000	K. Whitelaw and Butterworth, ISO 14001: Environmental System Handbook, 1997

			Continuous Learning	Assessment (CLA)		Summative					
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Lon Cl (1	g Learn <mark>ing</mark> _A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%	and the second	20%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	20%					
Level 2	Understand	20%		20%	1.2	20%					
Level 3	Apply	30%	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	30%		30%					
Level 4	Analyze	30%	A REAL PROPERTY AND	30%		30%					
Level 5	Evaluate	C	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	10 C 10 C		-					
Level 6	Create			and the second							
	Total	10	0%	10	0 %	10	0%				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. SuyashMisra, Arcadis Consulting India Private Limited, Bangalore.	1. Dr. Vivekanand, Assistant Professor, MNIT, Jaipur	1. Dr. P. Purushothaman. SRMIST
2. Dr.Rajkumar, Director, Hubert Enviro care Systems, Chennai.	2. Dr. Harish Gupta, Assistant Professor, Osmania University, Hyderabad	2. Mr. S. Ramesh, SRMIST



Course Code 21CEO307T Course Name MUNICIPAL SOLID WASTE MANAGEMENT						course atego	e ry	0				OPEN I	ELEC	ΓIVE			:	L T 3 0	P 0	C 3
Pre-requis Courses	site s	Nil	Co- requisit Courses	e Nil	-	Pro	gres	sive es						Nil						
Course C	Offering Departme	ent	Civil Engineering	Data Book / Codes / S	tandards		_						Nil							
Course Los	arning Pationalo (o purpose of learning th	is course is to:						Drogr	am Ou	itcomo	e (DO)	\				P	rogra	m
			e purpose of rearining un		_												S	Specific		
CLR-1:	Study the various	sources and	classification of solid and	nazardous waste		1	2	3	4	5	6	/	8	9	10	11	12	ou	tcom	es
CLR-2:	CLR-2: Know the concepts related to waste characteristics and source reduction							of	Is of	10	ciety			Ч,		g			'	
CLR-3: Realize insights to the storage, collection and transport of waste						vled		lent	atior	ge	soc			Ň		Janc	Ð			
CLR-4:	Explore the conce	epts related to	waste processing techno	logies	24.7	Von	lysis	mqo	stige	Usa	and	∞ŏ .		ean	u	Ē	arnin			
CLR-5:	Understand conce	epts related to	o waste disposal			neering I	em Ana	jn/devel	uct inve elex prob	ern Tool	angineer	onment ainability	s	dual & J	nunicati	ct Mgt. 8	ong Lea	.	-2	ç
Course Ou	tcomes (CO):	A	the end of this course, I	learners will be able to:		Engir	Probl	Desig	Cond	Mode	The e	Envir Susta	Ethic	ndivi	Com	Proje	-ife L	-SO	OSc	-OS
CO-1:	Apply the acquire	d knowl <mark>edge</mark>	on building materials and	products for construction.	Sec. 1	3	-	-	-	-		3	-	-	-	-	-	-	-	-
CO-2:	Identify various b	uilding f <mark>inishir</mark>	ng materials and ferro cem	ent applications for the building constru	ction.	3	-	2	-	-	2		-	-	-	-	-	-	-	-
CO-3:	Apply the knowled	dge on <mark>the ma</mark>	asonry, building transport a	and the termite treatment.	100	3	-	1.1	-	2	- 10	-	-	-	-	-	-	-	-	-
CO-4:	Disseminate the k	nowled <mark>ge on</mark>	various eco-friendly build	ing materials	100	3	-		1	-	3	-	-	-	-	-	-	-	-	-
CO-5:	Recognize the en	ergy eff <mark>icient</mark>	buildings and cost-effectiv	e construction techniques		3	-	1.1	-	-	26	3	-	-	-	-	-	-	-	-
				Teda -									-						_	
Unit-1 - So	urces and Types	of Municipal Solid worto r	Solid Waste	polid waston Classification of Solid Wa	oton Sour	200 8	Tuno	a haaa	d quar	tity	factor	offoot	ina ao	noratic	n of o	olid wo	otoo S	Coliont	9 footu	Hour
Indian Leais	slations on manage	ement and ha	ndling of municipal solid w	astes. Public health effect - Environme	ntal effect.	Case	studi	ies in ł	azards	due to	solid	waste i	manac	nen auc nemeni	n 01 30 t	Jiu wa	3103, 0	anent	ieatui	63 01
Unit-2 - Ch	aracteristics of S	olid Waste a	nd Source Reduction																9	Hour
Characteris	tics – Physical, ch	emical and b	i <mark>ological me</mark> thods of samp	oling and characterization, Waste Stread	m Assess	ment	(WSA	I), Sou	rce red	uction	(Basi	cs) <mark>, Mo</mark> l	nitorin	g and	Evalua	ition, S	torage	and c	:ollecti	ion of
recyclables			<u> </u>		192.	_	-		-	2	_									
Unit-3 - Wa	aste Collection, St	orage and T	ransportation	other collection methods times of ush	violee eell	ontina	route		motor	totion	4.000	andre		na o into		lion of	laastis		9	Hour
maintenanc		a container,	Stationary container and	other collection methods, types of veh	licies, coll	ection	route	es, ma	insier s	tation,	types		equire	ments,	seleci	lon oi	localic	т, оре	Hallor	i and
Unit-4 - Wa	ste Processing T	echniques	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1				_				1								g	Hour
Mechanical	Volume and Size	Reduction a	and Equipment's, Volume	reduction or compaction, Size reducti	ion or shr	edding	g, Pro	ocessir	ng techi	niques	- Con	posting	g, Incii	neratio	n, Pyr	olysis,	Gasifi	cation,	Anae	robic
degradatior	<u> </u>																			
Unit-5 - Dis	sposal Foolid wooto Math	ada of durani	a of colid woote I andfill	times essential companyante manifesia	a of londfi	11 1 00	ohoto	oolles	tion 8 t	no tre a	nt Fr	viron	ontal	nonita	ring c.:	otom			9	Hour
	SUIU WASLE, MELII	วนอ บเ นนเปนุป	iy or solid waste, Landini-	iypes, essential components, monitoring	y ur iariulli	I, LEd	unale	COLLEC		cault	πii, ⊑h		crital I	ποπιτΟί	my sy	SIGHI				

Learning Resources	 George Tchobanoglous, Hilary Theisen, Samuel Vigil, Integrated Solid Waste Management, McGraw Hill, 1993 Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and Environmental Resources Management, Hazardous waste Management, Mc-Graw Hill International edition, New York, 2001. 	 CPHEEO, "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000. NPTEL Course-Municipal solid waste management. https://nptel.ac.in/courses/120108005/

			Cummetica					
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test %)	Life-Lon Cl (1	g Learning LA-2 0%)	Final Examination (40% weightage)		
		Theory	Practice	Theory	Practice	Theory	Practice	
Level 1	Remember	20%	0.53	20%		20%	-	
Level 2	Understand	20%	A State State	20%		_ 20%	-	
Level 3	Apply	30%	1.1.2.5.5	30%		30%	-	
Level 4	Analyze	30%		30%		30%	-	
Level 5	Evaluate		A State of the second	6//		-	-	
Level 6	Create			A	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	-	-	
	Total	100)%	10	0 %	10	0%	

Course Designers		Design of the second se
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Rajkumar Samuel, Hubert Enviro-Care Systems, Chennai,	1. Dr. E. S. M Suresh, NITTT Taramani, Chennai	1. Dr. K. Prasanna, ,SRMIST
rajkumar@hecs.in	esmsuresh@gmail.com	
2. Mr. A. Abdul Rasheed, CMWSS Board,	2. Dr. G. Dhinagaran, Asst. Professor, CES, Anna University,	2. Mr. S. Dhanasekar, SRMIST
juruterarasheed@gmail.com	twinsdina@gmail.com	



Course Code 21CEO308T Course Name DISASTER MITIGATION AND MANAGEMENT					Cou Cate	irse gory	0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3		
Pre-requ Course	isite es	Nil		Co- requisite Courses		Nil	F	Progree Cours	ssive ses						Nil	1					
Course	Offering Departmo	ent	Ċ	vil Engin <mark>eering</mark>		Data Book / Codes / Sta	ndards							Nil							
Course Lo	earning Rationale	(CLR):	The purpos	e <mark>of learnin</mark> g this (course is	to:			1	2.1	Progr	am Ou	utcome	s (PO)				P	rogra	m
CLR-1:	Introduce various	s types of di	lisasters and	<mark>role of v</mark> arious stak	ceholders	in disaster management	1	2	3	4	5	6	7	8	9	10	11	12	01	pecifi itcom	es
CLR-2:	Understand vario	ous hazards	s, and <mark>health</mark>	issues on disaster	managen	nent	•		4	of	30	ety			¥						
CLR-3:	Understand vario	ous phases (of disaster n	nanagement and ris	sk reductio	on measures	ledg)	ent o	tions	e	soci			Mol		ance	-			
CLR-4:	Acquire knowled	qe on hazar	rd managem	ent systems			Mon	ysis	amdc	stiga	Usaç	and	ంచ		eam	ч	Fin	minç			
CLR-5:	Manage the pre a	and post dis	saster scena	rio			leering h	em Anal	in/devel	uct inve	m Tool	engineer	onment		dual & T	nunicati	ct Mgt. 8	ong Lea	<u>.</u>	5	ę
Course O	utcomes (CO):		At the end	of this course, lea	rners will	be able to:	Engir	Probl	Desig	Cond	Mode	The e	Envir	Ethic	ndivi	Comr	Proje	-ife L	-OSc	-OSc	-OSc
CO-1:	Understand the r	ole of variou	us stakeholo	ers in risk reduction	n measure	es	3	-	-	-	-	2	3	-	-	-	-	-	-	-	-
CO-2:	Acquire knowled	ge on va <mark>rio</mark> u	<mark>us mo</mark> des of	hazards and their o	occurrenc	e	3	1.1	1.2	-	-	2	3	-	-	-	-	-	-	-	-
CO-3:	Illustrate key con	cepts of vul	Inerability an	d risk assessment	technique	S	3	-	1.2	1.	-	2	3	-		-	-	-	-	-	-
CO-4:	Evaluate various	processes	employed in	pre-disaster scene	arios for ris	sk preparedness	3	-	1		-	2	3	-	-	-	-	-	-	-	-
CO-5:	Integrate the mar	nageme <mark>nt p</mark>	orinciples in a	lisaster manageme	nt during	post disaster scenario	3	-	1.1	-	-	2	3	-	-	-	-	-	-	-	-
Unit-1 - In	troduction			2	No. ala	in the second second	9.00			J		-					1			9	Hour
Disaster N	lanagement- Histor	y; Global i <mark>s</mark> :	sues- Strate	gies- Phases- Glob	al & India	n scenario- Major Disa <mark>sters</mark> in	n India- Disa	aster M	anager	nent in	India-	NDRF,	; Disast	e <mark>r M</mark> ai	nagem	ent Ac	t (2005); Disa	ster M	anage	ement
Policy (20	09) azarda			100	-	111				-	10										Hour
Natural- G	eological: Hvdrolog	ical: Meteo	orological: Bio	ological- Man Made	- Industria	al: Health related: Infrastructu	ral: Intentio	nal	-	-	-/-				-					9	nour
Unit-3 - V	ulnerability and Ri	isk Assess	ment								18	-								9	Hour
Risk Evalu	ation- Quantitative	& Qualitativ	ve; Risk Pere	<mark>eption;</mark> Vulnerabilit	ty- Mitigati	ion Measures- Need; Agencie	es involved;	Types	; Obsta	cles inv	olved-	Role	of Insur	ance							
Unit-4 - P	re-Disaster Manag	ement	Disastar Ma	nagamenti Dala a	f Causern	ment according and NCO's in	Mitiantian	0 Ma		ant 1/1	Inoroh		una in	Diago	toro M	100000	mont	Faaant	ial Cu	9	Hour
Managem	ent- Role of Techno	anning ior bloav in Disi	aster Manao	magement; Role of ement: Emergency	/ Governr / Manager	nent agencies and NGOS in nent Systems: Role of Remot	r wiiugauon te sensing	GIS an	nagem d GPS	in Disa	ster M	anage	ment	DISAS	iers M	anage	meni; i	Essent	iai SU	pplies	, SILE
Unit-5 - P	ost Disaster Mana	gement	actor manag	emenų Emergeney	managon		ie sonoing,		, .	2.00	0.01 101	anago								9	Hour
Medical Tr	auma and Stress N	Nanagemen	nt- Physical a	nd Socio-economic	c Impacts	of Disasters; Emotional Impac	cts of Disas	ters- R	ehabilit	ation a	nd Rec	onstru	ction; E	ducat	ion and	d Publi	c awar	eness;	Capa	city bu	iilding

Looming	1. D. Alexander, Natural Disasters, ULC Press, 1999	3. Damon P. Coppola, Introduction to International Disaster Management, 3rd edition, Elsevier, 2015
Deseuress	2. W.N. Carter, Disaster Management: A Disaster Management Handbook, Asian	4. C.J. Barrow, Developing the Environment: Problems and Management, Harlow: Longman, 1995
Resources	Development Bank, 2008	5. Disaster Management Act "2005", Ministry of Home Affairs, Govt. of India, 2005

Learning Assessmen	t									
		Cum	Summotivo							
	Bloom's Level of Thinking	Forr CLA-1 Avera (5	native age of unit test 0%)	Life-Loi C (ng Learning CLA-2 10%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%	Concernance of the second	20%	1	20%				
Level 2	Understand	20%		20%		20%				
Level 3	Apply	30%		30%		30%				
Level 4	Analyze	30%	and the second second	30%		30%				
Level 5	Evaluate		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	1000		-				
Level 6	Create	- V/ - 51		1		-				
	Total	10	0 %	1	100 %	10	0%			
				1	tor a for					

Co	urse Designers		
Exp	perts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.	Mr. Suyash Misra, Arcadis Consulting India Private Limited,	1. Dr. Vivekanand, Assistant Professor, MNIT, Jaipur	1. Dr. R. Sivakumar, SRMIST
	Bangalore.		
2.	Dr.Rajkumar, Director, Hubert Envirocare Systems,	2. Dr. Harish Gupta, Assistant Professor, Osmania University,	2. Dr. P. Purushothaman, SRMIST
	Chennai.	Hyderabad	



Course Code 21CEO309T Course Name WATER POLLUTION AND ITS MANAGEMENT Course Category O OPEN ELEC						ELEC	TIVE				L T 3 0	P 0	C 3							
Pre-requ Course	isite es	Nil		Co- requisite Courses	Nil	P	rogres Cours	sive es						Nil	1					
Course	Offering Departme	ent	Ċi	/il Engineering	Data Book / Codes / Sta	andards	-						Nil							
Course Le	earning Rationale (CLR): 7	The nurnose	of learning this co	ourse is to:		1	1.		Progr	am Qı	Itcome	s (PO)				P	rogra	m
CLR-1:	Create insights to	the source	e and type of	water pollution		1	2	3	4	5	6	7	8	9	10	11	12	S	pecifi	C
CLR-2:	Analvze the chara	acteristics of	of domestic a	nd industrial water p	ollution	Φ		-	of	30	ety			×					leoni	53
CLR-3:	Utilize resource re	ecovered fro	rom the waste	e water	1	ledg		ent of	tions	e	soci			Wor		ance	-			
CLR-4:	Identify the variou	is methods	to control the	e water pollution and	I regulatory bodies	Anow	lysis	opme	stiga	Usaç	and	æ		eam	uo	& Fin	Irninç			
CLR-5:	Sustainable pract	ice for eff <mark>ec</mark>	<mark>ctive wat</mark> er m	anagement.		Sering 1	m Ana	level	ict inve ex prob	n Tool	ngineer	nment		ual & T	iunicati	t Mgt. 8	ong Lea			~
Course O	utcomes (CO):	/	At the end o	of this course, learn	ners will be able to:	Engine	Proble	Design	Condu	Voder	The el	Enviro Sustai	Ethics	ndivic	Comm	Projec	life Lo	,-0Sc	-OSc	S-OS
CO-1:	Understand the v	arious s <mark>ourc</mark>	rces of water	pollution	States Proved in	3	-	-	-	-	2	3	-	-	-	-	-	-	-	-
CO-2:	Knowledge of var	ious ch <mark>arac</mark>	cteristics pres	sented in polluted wa	ater	3		12	-	-	2	3	-	-	-	-	-	-	-	-
CO-3:	Apply the concep	t of res <mark>ource</mark>	ce recovered	from the polluted wa	iter	3	-	1.		-	2	3	-	-	-	-	-	-	-	-
CO-4:	Knowledge of Wa	ter Act <mark>197</mark> 4	7 <mark>4 an</mark> d regula	tory bodies to contro	ol of Water Pollution	3	-	1.00	-	-	2	3	-	-	-	-	-	-	-	-
CO-5:	Analyze the envir	onment <mark>al in</mark>	<mark>mpact</mark> of wate	er pollution	A Fire And	3	1.0	11.1	-	-	2	3	-	-	-	-	-	-	-	-
l Init-1 - In	troduction to Wate	r Pollution	n	4	and the second	9					-								0	Hour
Sources a wastewate process -	and types of water µ er - Transport of pol Public awareness a	ollution - P lutants - Ca nd practices	Point source auses of Wa s in water po	pollution and Non-p ter pollution - Hydra Ilution.	point source pollution - Types of pol ulic flow of water pollution - Samplir	llutants - Adu ng procedure	verse e - Metl	effects hods o	of pollu f sampl	tants ing an	- Princ d stora	tiples of age - Ei	f pollu ffects	tion as of wate	ssessm er pollu	ent - 1 Ition - I	erms Eutrop	and de hicatio	əfinitio n and	ns in their
Unit-2 - C	haracteristics and	Effects of I	Polluted Wa	nter Provoturo Sposifio o	anduativity Chamical abaractoristic	o Organia a	nd Inor	aonio	Piolog	ioal ob	oracto	rictico	and its	o ia	nifioon	oo Ar		of woi	9 tor no	Hour
and their t in ground Water use	testing procedures - water quality - Effect d in different industri	Water Qual ts of groun ies.	ality standard nd water poll	s-BIS - Discharge of ution - Sampling me	Effluent and their standards - Water thods of ground water pollution - Le	s- Organic a borne disea egal regulato	ses - li ry aspe	mpact of	оf water ground	relate vater	ed issu contar	es on a nination	nimals n - Indi	s - Gro ustrial	und wa Particij	te - An ater qua pation	ality - I with re	mpact gulato	on Efi ry boa	fluent ards -
Unit-3 - M	litigation and Cont	rol Measure	res																9	Hour
Mitigation industries stakeholde representa	Measures for Wate - Thermal pollution ers - Water quality n ation of water quality	r pollution (and its adve nonitoring ar /.	Contamination rerse effects - and its purpos	on du <mark>e to industries</mark> · Role of <mark>regulatory b</mark> se - Monitoring activi	- Treatment of Industrial wastewate podies in Protection of Water bodies- ties and its strategy - Types of monit	r guidelines Control Mea toring - Steps	and pr sures - s involv	otocol Disch red in v	for trea arge Sta vater qu	ting In andard ality n	dustria Is for F nonitor	al waste Rivers a ing - Pa	ewater and Str aramet	r - Poll reams ters an	ution c - Self-µ d frequ	haracte ourificati iency c	eristics tion of of moni	of cer strean itoring	tain ty ns - Re - Graj	/pical ole of ohical

9 Hour

Administrative regulation under recent legislations in water pollution control - Water (Prevention & control of pollution) Act 1974 - Water (Prevention & control of pollution) Rules 1975 - Water (Prevention & control of pollution) Cess Act 1977 - Role of pollution control board - Powers given to boards - Irrigational approach in waste conservation - Legal action against defaulters - Management strategy used for water conservation - Industrial approach in water conservation - Legal action against defaulters - Management strategy used for water conservation - Industrial approach in water conservation - Awareness of domestic usage for conservation of water - Groundwater management - Public participation in water management - Environmental indices and its types - Water quality index.

Unit-5 - Effective Water Management

9 Hour

Rain water Harvesting - Classification of rainwater harvesting - Micro level harvesting, macro level harvesting and other methods - Roof top harvesting and their benefits - Role of Regulatory bodies - Role of local bodies- TWAD Board – CMWSSB - Case Studies related to Effective Water Management - Water crisis and their effects - Water crisis and their effects - Problems faced in water crisis - Zero water day – Awareness programme for water management and its sustainable development - Importance of World water day and World Environment day - Vulnerability of improper water management - Case study on adverse effects of water crisis - Sustainable development.

1

	1.	Fair.G.M, "Water and Waste water engineering Vol. I& II". John Wiley and sons,	4.	P. K. Goel, W	Vater Pollu	tion: Cause	s, effects a	nd Contro	ol. New	Age Interna	ational, 2006.
		Newyork. 2010.	5.	NPTEL C	Course:	Water,	Society	and	Susta	ainability.	-https://onlinecourses-
Learning	2.	Metcalf & Eddy, "Wastewater engineering, Treatment and Reuse", Tata McGraw hill		archive.nptel.	.ac.in/noc1	18_hs36					
Resources		publications, 2008.	6.	NPTEL C	Course:	Wastewat	er Trea	tment	& F	Recycling.	https://onlinecourses-
	З.	CPHEEO, ""Manual on Sewerage & Sewage Treatment", Ministry of Housing and		archive.nptel.	.ac.in/noc1	18_ce26					
		Urban Affairs, Government of India, New Delhi, 2009.		1. S.			100				

Learning Assessme	ent									
-	3	and the second	Continuous Learning	Cum	n officio					
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (10	r Learning A-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	<u>The</u> ory	Practice			
Level 1	Remember	20%		20%		20%	-			
Level 2	Understand	20%	- 1 L .	20%		<mark>2</mark> 0%	-			
Level 3	Apply	30%		30%		30%	-			
Level 4	Analyze	30%	· 10	30%	-	30%	-			
Level 5	Evaluate		- 111	-	1		-			
Level 6	Create	1.1.7.7	- C.S.S.	-		- 1	-			
	Total	10	0 %	10	0 %	10	0%			

Course Designers	A MARKAGE MADE DIAL	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Rajkumar Samuel, Hubert Enviro-Care Systems, Chennai	1. Dr. E. S. M Suresh, NITTTR, Taramani, Chennai.	1. Dr. K. Prasanna, SRMIST
2. Mr. A. Abdul Rasheed, CMWSS Board	2. Dr. G. Dhinagaran, Asst. Professor, CES, Anna University	2. Mr. S. Ramesh, SRMIST

Course Code	Course 21CEO310T Course GLOBAL WARMING AND CLIMATE CHANGE Code Name GLOBAL WARMING AND CLIMATE CHANGE			Cours Catego	se ory	0				OPEN E	ELECI	ΓIVE			Ĺ	- T 3 0	P 0	C 3				
Pre-requi Course	site s	Nil		Co- requisite Courses		Nil		Pr	ogres Cours	sive es						Nil						
Course	Offering Departme	ent	Ċivil I	Engineering		Data Book / Codes / S	Standard	s							Nil							
Course Le	arning Rationale	(CLR): Th	he purpo <mark>se o</mark>	f learning this co	ourse is to:	21.11		ł.	1			Progra	am Ou	itcome:	s (PO))				Pr	rograr	n
CLR-1:	Gain knowledge	about the ear	th syste <mark>m</mark>	1	100	1		1	2	3	4	5	6	7	8	9	10	11	12	S ou	pecifie tcom	c es
CLR-2:	Study the basics	of climate pai	ram <mark>eters and</mark>	climate change ca	ausing elem	ents		Ð		Ŧ	of	10	ety			'k						
CLR-3:	Understand impo	rtance of glot	ba <mark>l warming</mark>		1	125300		vledg		ent o	ations	ge	soci		-	IOW L		lance	D			
CLR-4:	Understand differ	rent mitigation	<mark>n measur</mark> es ag	ainst global warn	ning and the	ir protocol		Nor	lysis	mdo	stige	Usa	anc	∞ŏ		ean	и	č Fir	E			
CLR-5:	Explore renewab	le resourc <mark>e u</mark>	sage to reduc	e global warming				ering h	n Anal	devel	t inve k prob	Tool	gineer	ment		al & T	nicati	Mgt. 8	ig Lea			
			_	100 C	_		1.00	line	blen	sign/	nduc	dern	euć	iron	S	vidu	ามม	ject	۲ ۲	-1	0-2	D- 3
Course Ou	itcomes (CO):	A	<mark>t the</mark> end of t	his course, learn	ners will be	able to:	120	Enç	Pro	Des	Cor	Mod	The	Env Sus	Ethi	Indi	Cor	Pro.	Life	PS(PS(PS(
CO-1:	Apply the acquire	ed know <mark>ledge</mark>	on earth syst	em			44	3	1		-	5-1	2	3	-	-	-	-	-	-	-	-
CO-2:	Identify the clima	te parameters	<mark>s an</mark> d their imp	pa <mark>ct due to huma</mark> i	n activates			3	1		-		2	3	-	-	-	-	-	-	-	-
CO-3:	Identify the clima	te chan <mark>ge im</mark>	pact in various	s s <mark>ect</mark> or	1.1.2		5	3		-	-	1	2	3			-	-	-	-	-	-
CO-4:	Interpret different	t protoco <mark>ls rel</mark>	l <mark>ate</mark> d to climat	e ch <mark>a</mark> nge	245	100	10	3	•	6	-	-	2	3	-	-	-	-	-	-	-	-
CO-5:	Implement and a	nalyze r <mark>easor</mark>	<mark>n beh</mark> ind globa	al warming, mitiga	ntion measur	es of climate change		3	1	1.1	-	-	2	3	-	I	-	-	-	-	-	-
Unit 1 Ea	orth's Climata Sug	tom			to a later		- 91		60				-		-						0	Hour
Introduction	n to earth system-	hvdrosphere	lithosphere c	rvosphere atmos	sphere and l	oiosphere Hydrologica	al cycle a	nd Ca	thon c	vcle A	tmosph	ere ar	d its o	compos	ition A	Atmosi	oheric :	stahilitv	, and la	anse r	ate O	zone
layer and it	s functions, Ozone	e depletion an	d ozone hole,	Global warming a	and its impa	cts, Greenhouse gase	s and gre	enhou	se effe	ect, El	Nino an	d La N	lina	ompoo	laon, r	anoop		stability	anan	xp00 / (10, 0	Lono
Unit-2 - Cl	imate Indices and	Extreme Ev	rents	1.2.1							12	12									9 /	Hour
Climatolog	y, Paleoclimatology	y, Indian clima	at <mark>e system</mark> and	d their classificatio	on, Role of la	nd and ocean to regula	ate climat	e, Rol	e of ice	e and v	vind to r	egulat	e clima	ate, cau	ses of	climat	e chan	ge Mila	ankovit	ch theo	ory (na	atural
cause), Hu	man induced clima	te variations,	Climate Extre	emes-Cyclones, th	hunderstorm	s, Tornadoes, Heat wa	aves, Sea	level	rising-	lce me	lting, te	mpera	ture ri	sing, Fl	oods a	and dro	oughts.	Energ	y balar	ice of i	the ea	<u>rth</u>
Unit-3 - Ph	ysical Evidences	of Climate C	Change		0 /		F				-			,		1.17					91	Hour
Climate ch	ange impact in diff Polar ico, Isotopos	erent sectors- lco molting a	- Agriculture, I nd Ico coro an	orestry, Fishery,	Socio econo	omic impact – tourism, upply: Polo of operav	Evidenci	es of V	armin of hun	g ana nan civ	cnange vilization	IN atri Emis	ospre	from or	an ciro	culatio	ns. Sea tion D	a ievei olo of c	cnange	es ana	Snore ront cli	∋ IINe imato
changes. r	ulai ice, isolopes,	ice menny ai			ss. Literyy s	upply. Note of energy i	n uevelo	Jinein	or nun	nan un	mizatio	I, LIIII3	310113		iergy g	jenera	<i>uon.</i> N		nergy	III Cull		male
Unit-4 - Int	ternational Respo	nses to Clim	ate Change	Internet Contraction																	9 /	Hour
Climate ch	ange organization	and programs	s, History of IF	PCC and UNFCC	<mark>C, IPC</mark> C- As	sessment report highli	ghts, UNI	EP, Ne	ed for	intern	ational	protoc	ols of (climate	chang	e, Kyo	to prot	ocol, N	lontrea	I proto	col, U	NDP
- United na	tions development	program, Ca	rbon credit an	d Clea <mark>n developn</mark>	nent mechai	nism.																
Unit-5 - Cl	imate Change Ad	aptation and	Mitigation M	easures			la ma h'							0	- 4 - 5						91	Hour
sequestrati	e and alternative en ion Adaptation me	ergy technolo asures- Gree	ogies- Biomas en huilding tec	s, Solar, Hyaro, G hnology Public av	eotnermal a wareness - N	na wind. Clean techno Aethods and ecology	economic	s and	comp ethics	ost, Dio • the m	oaegraa nissina l	able pl inks_l	astics ife.cvr	. Conce	ept of S Vsis F	sustain 201e en	able de vironm	entalis	nent, C t	,oncep	N OF Ca	irdon
2094000100								- unu						analj	, 5, 5, 7,			uno	••			

	1.	Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University	3. Atmospheric Science, J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
Learning		Press India Private limited 2007.	4. Jan C. van Dam, Impacts of "Climate Change and Climate Variability on hydrological Regimes",
Resources	2.	Adaptation and mitigation of climate change-Scientific Technical Analysis. Cambridge	Cambridge university press, 2003.
		University Press, Cambridge, 2006.	

Learning Assessme	ent			1 24							
			Continuous Learning	Assessment (CLA)		Summativa					
	Bloom's Level of Thinking	Form CLA-1 Avera (50	ative ge of unit test %)	Life-Long CL (10	g Learning .A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%		20%		20%	-				
Level 2	Understand	20%		20%		20%	-				
Level 3	Apply	30%	The Inter Control	30%		30%	-				
Level 4	Analyze	30%		30%		30%	-				
Level 5	Evaluate	SM/ - ES		Contract of the second		- 199	-				
Level 6	Create			10 0 12 0 m		- 11	-				
	Total	100)%	10	0%	10	0 %				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Rajkumar Samuel, Hubert Enviro-Care Systems, Chennai	1. Dr. E. S. M Suresh, NITTTR, Taramani, Chennai.	1. Mr. K.C.Vinu Prakash, SRMIST
2. Mr. A. Abdul Rasheed, CMWSS Board	2. Dr. G. Dhinagaran, Asst. Professor, CES, Anna University	2. Dr. K.Prasanna, SRMIST



Course Code	21CEO311T	Course Name	, INDO(OR AND AMBIENT	AIR QUALITY MANAGEMENT	Ca	ourse tegory	y	0			1	OPEN F	ELECT	ίνε			Ĺ	- T 3 0	P 0	C 3
Pre-requ Course	lisite es	Nil		Co- requisite Courses	Nil		Prog Co	gress ourse	sive es						Nil						
Course	Offering Departm	ent	Civil I	Engineering	Data Book / Codes / Stan	Idards								Nil							
Course Le	earning Rationale	(CLR):	The purpose o	<mark>f learnin</mark> g this cou	rse is to:				1		Progra	am Ou	utcome:	s (PO))				Pr	rogra	m
CLR-1:	take up the basic	c concepts (of air pollution.	-	Nº 24		1	2	3	4	5	6	7	8	9	10	11	12	OU	pecifi itcom	ic ies
CLR-2:	introduce the kno	owledge of I	health related to	air pollution	and and and b		Ð	- 34		of	30	ety			¥					1	
CLR-3:	Acquire knowled	lge on vario	ous c <mark>auses, eff</mark> ec	cts and control meas	sures of environmental air pollution		ledg		ent o	tions	e	soci			Woi		ance	5		1	
CLR-4:	Acquire knowled	_ lge about de	es <mark>ign criter</mark> ia rela	ated to IAQ			Mon	ysis	9mdc	stiga lems	Usaç	and	ి		eam	ч	Fin	nin		1	
CLR-5:	Identifv better ve	entilation svs	stem to improve	good IAQ			bui	Anal	evelo	inve; prob	8	neer	bility		L & L	icatio	lgt. 8	Lea		1	
				<u>.</u>			neer	em	gn/d	duct	em 1	engi	ronmaina	s	idua	unu	ect N	ong	5	5	က္
Course O	utcomes (CO):		At the end of t	this course, learne	rs will be able to:		Engi	Prob	Desi	Conc	Mod	The	Envi	Ethic	lndiv	Com	Proje	Life	PSO	PSO	PSO
CO-1:	Analyze the sour	rces, effe <mark>cts</mark>	<mark>s and c</mark> ontrol me	asures of environm	ental air pollution	1.11	3	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO-2:	Analyze air quali	ity param <mark>ete</mark>	<mark>ers an</mark> d its impac	ct			3	-	-		-	2	<u> </u>	-	-	-	-	-	-	[-	-
CO-3:	Recognize air pc	ollution m <mark>ea</mark>	<mark>asurem</mark> ent methc	odology			3	-			2	- 200	-	-		-	-	-	- 1	-	-
CO-4:	Apply the concer	pt of Exh <mark>au</mark> s	i <mark>st sys</mark> tem for bei	tter IAQ		- P 1	3	-	-	-	-	3	-		-	-	-	-	-	-	-
CO-5:	Identify the Cont	rol devic <mark>es</mark>	related to air po	llution	a frank to the second		3	-		-		- 56	3	-	-	-	-	-	-	-	-
			-	201												L					
Unit-1 - In	troduction	ns of air po	ollutante: Eundan	montals of contamin	ant mixture the respiratory system: (Inatomy	of the	lunc	75 70	doling	125 OX	chang	n diso:		Rody h	urdon	1st orde	or evet		9	Hour
Unit-2 - D	esign Criteria				ani mixture the respiratory system. A	linalonny	or the	rung	<u>1</u> 5, 11100	Jenny g	103 EX	Jilany	e, uisea	1363, L	JOUY DI	uluen, i		a syste	711	9	Hour
Contamina	ant concentration lir	mits; Fire an	nd <mark>explosio</mark> n; He	aring and sound; He	eat stress; Odor Pollutant emission ra	ates: Ph	ysical	mea	surem	ents, flu	ux cha	mbers	:, mass	balanc	ces, en	nission	factors	s. Diffu	sion E	vapor	ation:
Evaporatio	on from liquid surfac	ces, evapor	ration in confined	d spaces, thermody	namics of evaporation					-	40		_								How
General ve	entilation: Dilution v	vs. displacer	ment ventilation	The well-mixed mc	del: sources, wall losses, recirculatio	on, air c	leaners	s, inf	filtratio	n and e	exfiltrat	ion, ve	arious re	oom ca	onfigur	ations:	Clean	rooms	: Effec	tiven.	ess of
ventilation	systems; Heating a	and cooling	j costs; <mark>Ventilatic</mark>	<mark>on in tun</mark> nels Local v	entilation: Hood design, bulk materia	als, prop	oer sel	lectio	n and	design	of hoc	ods, bu	loyant p	olumes	s, cano	py hoo	ods, air	curtair	ns. Air	clean	ers in
series and	l parallel Sybaust Duct Syste	om Dosian		200		_	-			-	_		_								How
Energy eq	uation, major and i	minor losse	es, fan performar	nce curves, fan sele	ction (matching fan to duct system r	requiren	nents)	13 P	articul	ate air	pollutic	on: Pa	rticle si	zes/cla	assifica	ations/t	ermino	logy: A	lerody	namic	c drag
and drag of	coefficient, particles	s settling in	ı quiescent air (g	gravi <mark>metric settling</mark> -	terminal settling speed); Equations	of partic	cle mo	otion	and pa	article t	rajectc	ory cal	culation	ıs in aı	n air fle	ow, usi	ing Rur	nge-Ku	itta to	predic	:t 2-D
particle tra	ijectories; Non-sphe	erical partici	les - equivalent	diameters; Gravime	tric settling in rooms and ducts; Iner	tial sepa	aration	in cu	urved o	Jucts			<u> </u>								How
(APCSs):	Lapple cyclones au	nd other AP	PCSs: Performar	nce and efficiency o	f APCSs: Series and parallel APCS	s for pa	rticle n	emo	val: Fil	ters Co	ontrol c	of narti	iculates	Cvcl	ones. (Scrubb	ers. Fl	ectrost	tatic pr	recipit	ators
Baghouse	filters. Control of a	ases. Abso	protion. Wet scru	ibbers and packed s	crubbers. Flue gas desulfurization.	Adsorpti	ion. Inc	cinera	ation. (Carbon	seaue	estratic	on.	,							

Learning	1.	Mukherjee, "Environmental Pollution and Health Hazards", causes and effects, 1986	3.	Noel De Nevers, "Air pollution control Engineering", McGraw Hill International Edition
	2.	Kenneth wark, Cecil F.Warner, "Air Pollution its Origin and Control", Harper and Row	4.	M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt Ltd, New Delhi, 1993
Resources		Publishers		

Learning Assessmen	t										
			Continuous Learning	Assessment (CLA)		Summativo					
	Bloom's Level of Thinking	Forma CLA-1 Averag (505	ative le of unit test %)	Life-Lon CL (1	g Learning LA-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%	and the second second	20%		20%	-				
Level 2	Understand	20%		20%		20%	-				
Level 3	Apply	30%	10.000	30%		30%	-				
Level 4	Analyze	30%	The International	30%		30%	-				
Level 5	Evaluate					-	-				
Level 6	Create			100 Million 100		-	-				
	Total	100	%	10	0 %	10	0 %				

Course Designers												
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts										
1. Dr. Rajkumar Samuel, Hubert Enviro-Care Systems, Chennai	1. Dr. E. S. M Suresh, NITTTR, Taramani, Chennai.	1. Mr. S. Ramesh, SRMIST										
2. Mr. A. Abdul Rasheed, CMWSS Board	2. Dr. G. Dhinagaran, Asst. Professor, CES, Anna University	2. Mr. S. Dhanasekar, SRMIST										



Course Code	Course Code 21CEO312T Course Name INTELLIGENT TRANSPORTATION SYSTEMS			Cou Cate	rse gory	0	OPEN ELECTIVE								C 3				
Pre-requis Courses	site s	Nil	Co- requisite Courses	Nil	1	Progres Cours	sive ses						Nil						
Course C	Offering Departm	ent	Civil Engin <mark>eering</mark>	Data Book / Codes / Star	ndards							Nil							
Course Lea	arning Rationale	ourse is to:		1			Progra	m Ou	itcome:	s (PO)					Program		n		
CLR-1:	Know the fundan	mentals of road	l traffic and its features	100 200	1	2	3	4	5	6	7	8	9	10	11	12	ou	tcome	; es
CLR-2:	Understand the i	importance of	tele <mark>communica</mark> tion and data c	ollection of ITS	de la		of	Is of	10	ciety			ork		à				
CLR-3:	Learn the various	s functional ar	e <mark>as of ITS</mark>	1 1 1 1 1 1 1 1 1 1	wled		lent	atior	ge	d soc		-	л W		nanc	b			
CLR-4:	Know the user sp	pecific ITS i <mark>mp</mark>	lementation	Wei- Mil	Kno	Ilysis	lopr	estig	Use	r and	৵		Tear	ion	& Fi	arnir			
CLR-5:	Explore the ITS a	application <mark>s gl</mark>	obally		eering	em Ana	In/deve	uct inve lex prot	rn Tool	Ingineer	onment	(0	dual & ⁻	nunicat	ct Mgt.	ong Le:	-	5	3
Course Ou	tcomes (CO):	A	the end of this course, lear	ners will be able to:	ingir	robl)esiç	cond omp	lode	hee	invir	thic	ivibr	omr	roje	ife L	- So	Ś	-OS
CO-1:	Define the funda	mentals of roa	d traffic and features	and the second second	3	3	-	-	-	2	-	-	-	-	-		-	-	- 6
CO-2:	Assess the telec	ommuni <mark>cation</mark>	requirements and data collec	tion of ITS	3	3	1	-	3			-	-	-	-	-	-	-	-
CO-3:	Demonstrate the	function <mark>al are</mark>	as of ITS	1. S. 199	3	3	-	-	3	-	-	-		-	-	-	-	-	-
CO-4:	Disseminate the	impleme <mark>ntatic</mark>	<mark>ns</mark> of ITS for various user nee	ds and services	3	3	1	-	-	3	-	-	1	-	-	-	-	-	-
CO-5:	Interpret the glob	oal applic <mark>ation</mark>	s of ITS		3	2	1.4	-	-	3	-	-	-	-	-	-	-	-	-
Unit-1 - Fu	ndamentals of R	oad Traffi <mark>c Fl</mark>	ow	Coloring The second	-				1	-	-							9 ł	Hour
Road user	and vehicle chara	cteristics, Bas	ic road geometric elements, F	undamental parameters and relations,	Measuren	nent at	a Point	(Volun	ne data	colle	ction an	n <mark>d a</mark> nal	lysis, I	PCU, P	PHF etc	:.), Mea	asuren	nent ov	ver a
Short Section	on (Speed data co	ollection and a	analysis), Measurement along	a Length of Road (Density and trave	l time mea	sureme	ent and	analys	is), Mo	ving (Observe	e <mark>r</mark> Meth	nod, T	raffic fo	orecast	ing and	d grow	rth stud	dies,
Unit-2 - ITS	S Basics and Tele	ecommunicat	s ion and Data Requirements		-			-	-									91	Hour
Introduction	to Intelligent Tran	nsportation Sys	ste <mark>ms (ITS) –</mark> Definition of ITS	and Identification of ITS Objectives, Hi	storical Ba	ckgrour	nd, Ben	efits of	TS - In	nporta	nce of t	elecon	nmuni	cations	in the	ITS sy:	stem, I	Informa	ation
Manageme	nt, Traffic Manage Vehicle Identificatio	ement Centres	t (TMC). Application of sense graphic Information Systems (ors to Traffic management; Traffic flow GIS) video data collection Vehicle – F	sensor te Road side i	chnolog commu	nication	S Data 1 – Vehi	collecti cle Pos	on teo sitionii	nnique	s – De em	etector	s, Auto	omatic	Vehicle) Loca	tion (A	(VL),
Unit-3 - ITS	S Functional Area	as			1000 0100 1	Johnina	noution	Von	010 1 00		ig Oyou	om						9 F	Hour
Advanced	Traffic Manageme	ent Systems	(ATMS), Advanced Traveller	Information Systems(ATIS) - Comm	ercial Veh	icle Op	eration	is (CVC)), Adv	ranced	d Vehic	le Co	ntrol S	System	s (AV	CS) - ,	Advan	ced P	ublic
Transportat	Transportation Systems (APTS) - Advanced Rural Transportation Systems (ARTS)																		
Travel and	Traffic manageme	ent - Public Tra	nsportation Management - Ele	ectronic Payment - Commercial Vehicle	e Operatior	ns - Em	ergenc	y mana	gement	t - Adı	/anced	Vehicl	e Safe	ty syst	ems, Ir	nformal	tion ma	anager	ment
Unit-5 - ITS	S Applications		, ,				Ĭ											9 F	lour
Automated	Highway Systems	s, vehicles in p	latoons - Integration of Auton	nated Highway Systems, a case study	- ITS prog	rams g	lobally	- Overv	iew of	ITS in	nplemei	ntation	is in de	evelope	ed cou	ntries,	ITS in	develo	oped
countines -	Case sinnies																		

Learning Resources	1. 2. 3.	Kadiyali, L. R. (1987), "Traffic Engineering and Transportation Planning", Khanna Publishers, India. Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US, 2001 Choudury M A and Sadek A, "Fundamentals of Intelligent Transportation Systems Planning" Artech House	4. 5. 6.	Sussman, J. M., "Perspective on ITS", Artech House Publishers, 2005. US Department of Transportation, "National IT'S Architecture Documentation", 2007 (CDROM). Cycle W.Halsapple and Andrew B.Winston, "Decision Support Systems – Theory and Application", Springer Verlog, New York, 1987
				(The second sec

			Continuous Learning		Summativo				
	Bloom's Level of Thin <mark>king</mark>	Forn CLA-1 Avera (50	native ge of unit test)%)	Life-Long CL (10	g Learning "A-2 0%)	Final Examination (40% weightage)			
		Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	20%		20%		20%	-		
Level 2	Understand	20%	A Real Provide States	20%		20%	-		
Level 3	Apply	30%		30%		30%	-		
Level 4	Analyze	30%		30%		30%	-		
Level 5	Evaluate	- · ·	1	1977			-		
Level 6	Create			- 12 P	/	-	-		
	Total	10	0%	10	0%	10	0 %		

Co	urse Designers	12.1							
Ex	perts from Industry	Ex	perts from Higher Technical Institutions	Internal Experts					
1.	Dr. Asif Ahmed, Business manager, Ingevity, ahmed.asif@ingevity.co	om 1.	Dr. Venkaiah Chowdary, Professor, NITW, vc@nitw.ac.in	1.	Dr. A. Padma Rek <mark>ha, SRM</mark> IST				
2.	Mr. Ankit Pachouri, Transport Planner, IUT, New Delhi,	2.	Dr. V Sunitha, Associate Professor, NITT, sunitha@nitt.edu	2.	Mr. G. Sivaprakas <mark>h, SRM I</mark> ST				
	ankit.pachouri@iutundia.org		and the second se		The second se				



Course Code	21CEO313T	Course Name	e	TRAFFIC MA	NAGEMENT SYSTEM	ЛS	Cou Categ	rse Jory	0				OPEN	ELEC	ΓIVE				L T 3 0	P 0	C 3
Pre-requi Course	site s	Nil		Co- requisite Courses		Nil	P	rogres Cours	sive es						Nil						
Course (Offering Departme	ent	Ċivi	l Engineering	Data Boo	ok / Codes / Standar	ds							Nil							
		(.		-	11-11	1	1.0	1.0		_			(7.6)					D		
Course Le	arning Rationale	(CLR):	The purpose	of learning this co	ourse is to:					1.1	Progr	am Ou	Itcome	s (PO)	r			- Pi	rograi necifi	n c
CLR-1:	Study the traffic f	low parame	neters				1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	es
CLR-2:	Explore the traffic	c flow mana	agem <mark>ent techn</mark>	iques	1 A 14		ge		of	s of	10	iety			rk		е				
CLR-3:	Know the interse	ction contro	rol m <mark>easures</mark>	-	1 2	No. ON IS	vled		ent o	ation	ge	soc			n Wo		Janc	Ð			
CLR-4:	Learn the parking	g systems a	an <mark>d manag</mark> eme	ent	1.1		Kno	Ilysis	lopm	estiga	Usa	r and	৵		Tean	ion	& Fir	arnin			
CLR-5:	Understand the p	oublic trans	sportation syste	ms	-	250	eering	em Ane	n/deve	ict inve ex prol	n Tool	nginee	nment		lual & ⁻	unicat	t Mgt.	ong Lei	_	0	~
Course Ou	tcomes (CO):		At the end of	this course, learn	ners will be able to:	Asonth	Engine	Proble	Design	Condu	Moder	The er	Enviro Sustai	Ethics	Individ	Comm	Projec	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Determine the tra	affic flow <mark>pa</mark>	aramet <mark>ers for t</mark>	affic management	States /	1. S. C. S. A.	3	2	2	2			-	-	-	-	-	-	-	-	-
CO-2:	Apply the various	s measu <mark>res</mark>	<mark>s of m</mark> anaging t	he traffic			3	3	3	3	-	-	_	-	-	-	-	-	-	-	-
CO-3:	Adopt the control	' measu <mark>re a</mark>	at the intersect	ions	1.1.2.2.2.2.0		3	3	3	3	-		-	-		-	-	-	-	-	-
CO-4:	Determine the pa	arking ch <mark>ara</mark>	racteristics and	apply the manager	ment techniques		3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Design the public	: transpo <mark>rta</mark>	<mark>ation m</mark> anagem	ent system	a First of		3	2	3	3	-	2	-	-	-	-	-	-	-	-	-
Unit-1 - Tra	affic Flow Studies	;			College P						1	-			-					9	Hour
Urban Roa Fundament Highway Se	d Systems - Highw tal Diagram of Trai egments.	vay System ffic Flow, N	n Classification Ma <mark>thematic</mark> al R	, Types of Transpo elationships Descr	ortation Facilities - Tra ibing Traffic Flow - Vo	iffic Flow Theory - Ti. olume Studies, Traffi	me Spa c Court	ace dia nts, trav	gram, ⁄el Tim	Variable e and E	es of Ir Delay S	nterest Studies	- Prima s, Spot	ary Ele Speed	ements Studi	of Tra es, Ca	ffic Flo pacity a	w, Flo and Le	w Spe vel of	ed De Servia	nsity, ce for
Unit-2 - Tra	affic Flow Manage	ement		1000			-				1									9	Hour
Introduction	n, Travel demand i	manageme	ent - T <mark>raffic ma</mark>	<mark>na</mark> gement measur	es, Restrictions to tur	ning movements, on	e way :	streets,	tidal fl	low ope	rations	s, Traf	fi <mark>c s</mark> egr	regatio	n, Trai	ffic call	ming, c	onflict	point (diagra	m for
various typ	es of streets			70		A STATE	1.	-	-	-	1										
Unit-3 - Int	ersection Control	l and Mana	agement	the start is a first		de la la contra Dela			Ohan			un de la	auta T			0			D	9	Hour
Traffic Sign	Demana manage Is	ment, Engi	gineering meas	ures, Junction type	es(Uncontrolled non-p	priority junctions, Pric	ority jur	ictions,	Cnanr	nelizatio	on, Ro	undab	outs, Ti	ramic s	signais	, Grad	e sepa	ration)	, Road	i mark	angs,
Unit-4 - Pa	rking Systems an	nd Manage	ement																	9	Hour
Traffic and	parking problems	, Types of	f Parking Facili	ties, III <mark>effects of</mark> p	parking, Definitions of	Parking Terms, Me	thodolo	ogy of I	Parking	g Studie	es, Ana	alysis	of Park	ing Da	ata, Zo	oning a	nd par	king s _l	bace r	equire	ment
standards,	Design standards i	IUI ON STREE	ei parking, Off	street parking facili	ues, Peripheral parkir	ig system, Parking Co	DITITION S	ysterns	j.											O	Hour
Design obje	ectives, Bus priorit	y measures	ns, Bus lanes ar	nd busways, and pa	arking management m	neasures, Bus stop in	nprove	ments,	Exclus	ive bus	lanes	syster	ms, Bus	s Pree	mption	at sigi	nals, e	ncoura	ging c	ar poc	oling

	1.	Dr. Kadiyali L. R., Traffic Engineering and Transport Planning, Khanna Publishers	5.	IRC-SP -12 2015 Parking facilities in Urban Roads
Learning	2.	Khanna S.K., Justo C.E.G., Highway Engineering, Nem Chand & Bros., Roorkee.	6.	IRC 65 - 1976 Traffic Rotaries
Resources	З.	Bindra S.P., A course in Highway Engineering, Dhanpat Rai Publications	7.	IRC 93 - 1985 Design & Installation of Road Traffic Signals
	4.	Martin Whol, Brian V Martin, Traffic system Analysis for Engineers and Planners, McGraw Hill, NY, 1967		

Learning Assessmen	t			1.20			
			Continuous Learning	Assessment (CLA)		C	motivo
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test %)	Life-Long CL (10	g Learning "A-2 0%)	Final Ex (40% w	amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%		20%		20%	-
Level 2	Understand	20%		20%		20%	-
Level 3	Apply	30%	A Real Production of the local sector	30%		30%	-
Level 4	Analyze	30%		30%		30%	-
Level 5	Evaluate	511 - 59		1.		-	-
Level 6	Create	- 1		10/2020			-
	Total	10	0%	10	0 %	10	0 %

Co	ourse Designers	THE REPORT OF A CONSTRUCTION OF A	
Ex	operts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.	. Dr. Asif Ahmed, Business manager, Ingevity, ahmed.asif@ingevity.com	1. Dr. Venkaiah Chowdary, Professor, NITW, vc@nitw.ac.in	1. Dr. A. Padma Rekha, SRM IST
2.	. Mr. Ankit Pachouri, Transport Pl <mark>anner, IU</mark> T, New Delhi,	2. Dr. V Sunitha, Associate Professor, NITT, sunitha@nitt.edu	2. Mr. G. Sivaprakash, SRM IST
	ankit pachouri@iutundia.org		



Course Code	21CEO314T	Course Name	TRAFFIC FLOW MODELING	AND SIMULATION TECHNIQUES	Cour Categ	se ory	0				OPEN I	ELECT	IVE			1	L T 3 0	P 0	C 3
Pre-requis Courses	site s	Nil	Co- requisite Courses	Nil	P	ogres Cours	sive ses						Nil						
Course C	Offering Departme	ent	Civil Engineering	Data Book / Codes / Stand	lards							Nil							
Course Lea	arning Rationale	(CLR): T	he purpos <mark>e of learning</mark> this cour	se is to:		71			Progra	am Ou	tcome	s (PO)					Pi	ogra	m
CLR-1:	Understand vario	ous traffic stre	eam para <mark>meters an</mark> d data collectio.	n methods	1	2	3	4	5	6	7	8	9	10	11	12	S OU	pecifi tcom	c es
CLR-2:	Study the traffic o	control meas	ures and LOS analysis		e		of	s of	20	iety			¥		a)				
CLR-3:	Explore the traffic	c stream moo	del <mark>ing</mark>	1.145.001	vledç		ent c	ations	ge	soc		-	٥W ۲		Jance	g			1
CLR-4:	Know the various	s methods a <mark>n</mark>	nd techniques of simulation		Kno	lysis	mdo	stiga	Usa	and	৵		[ean	on	Se Fi	arnin			
CLR-5:	Learn the validati	ion of sim <mark>ula</mark>	tion models with case studies		ering	n Ana	/devel	ct inve	n Tool	gineer	nment nability		lal & J	unicati	Mgt.	ng Lea			
Course Ou	itcomes (CO):	4	At the end of this course, learner	s will be able to:	Engine	Proble	Design	Condu	Modern	The en	Enviror Sustair	Ethics	ndividu	Comm	Project	-ife Lo	-SO-1	SO-2	SO-3
CO-1:	Evaluate the traff	fic strea <mark>m ch</mark>	aracteristics	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	3	3	2	2	-	1	-	-	-	-	-	-	-	-	-
CO-2:	Analyse the traffi	ic contro <mark>l me</mark> a	asures	The second second	3	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Develop the traffi	ic stream mo	dels	1.222	3	2	3	3	-	- 10	-	-	-	-	-	-	-	-	-
CO-4:	Simulate traffic a	t mid blo <mark>cks</mark>	and intersections		3	2	3	3		-	-	-	-	-	-	-	-	-	-
CO-5:	Apply the techniq	ques of c <mark>alibr</mark>	ration and validation of models	Carlos and I	3	2	3	3	-	-		-	-	-	-	-	-	-	-
Unit-1 - Tra Road user collection a	affic Stream Char and vehicle chara nd analvsis). Meas	racteristics	undamental parameters and relation	ons, Measurement at a Point (Volun travel time measurement and analys	ne data co is). Movin	ollectic	on and erver N	analysi lethod.	s, PCI Traffic	J, PHI foreca	= etc.),	Measi nd aro	ureme	nt over udies.	r a Sho	ort Sec	tion (S	9 Speed	Hour data
Unit-2 - Tra	affic Analysis and	d Manageme	ent		,	9 0		rourou,			ioung u	na gro						9	Hour
Basics of tra Rotaries an Signalized.	affic management, nd Grade Separate Coordinated Traff	, Principles o ed Intersectio fic Signal, Ve	of <mark>Traffic Co</mark> ntrol and Traffic Signs, on. C <mark>apacity a</mark> nd Level of Service of hicle Actuated Signals and Area T	Road Markings and Channelization, concepts, Queuing models and applic raffic Control.	Uncontrol cations. Tr	led Int affic S	ersecti Signal, I	on: Gap Evaluati	o acception of a	otance a Traff	and ca ic Signa	pacity al: Dela	conce ay Mo	epts, Ui dels, C	ncontro Sapacity	olled In / and L	tersec .OS Ai	tion, T nalysi	raffic s of a
Unit-3 - Tra	affic Stream Mode	elling	, , , , , , , , , , , , , , , , , , ,		11.													9	Hour
Traffic Strea Models: Lin	am Models, Model lear models, Car F s)	lling vehicle a Following Mod	arrivals: Con <mark>tinuous di</mark> stributions to dels: Non-line <mark>ar models,</mark> Lane Cha	model Headways and speed, Modell nging Models, Microscopic Traffic Sir	ling vehicle mulation (e arriva /ehicle	als: Dis e genei	crete di ration, n	stribut nodel f	ions to irame i	model vork, ca	flow a alibrati	nd eva on and	aluation d valida	n of dis ations,	tributio statisti	ns, Ca cal erro	r Follo or ana	wing lysis,
Unit-4 - Sir	nulation Methodo	ologies	and the second se															9	Hour
Monte Carle - Componer Time based	o method, Genera nts of traffic simula d and Even-based	tion of Pseuc ations models methods - E	dorandom Numbers, Discrete Rand s, vehicle arrival and movement mo xamples of Macro, Meso, and Micr	lom deviates - Simulation methods, F dels, mixed traffic flow simulation, Sin oscopic based simulation models.	Fundamen nulation m	tals of odel de	simula evelopi	tion, Int ment str	roduct ategie	ion to s - Stu	factoria dy of la	l expe rge sca	riment ale sin	al desi nulatior	igns, Fi 1 mode	raction Is; Sca	al facto nning	orial d Techr	esign lique;

Unit-5 - Calibration and Validation of Simulation of Models 9 Hour Simulation scenario evaluation, Number of runs and factors influencing simulation output, Calibration and validation definitions, methodology for calibrating and validating a microscopic traffic simulation model. Calibration and validation guidelines, data requirements, Goodness-of-fit measures - Case studies of application of simulation for various transportation engineering problems.

	1.	Kadiyali, L. R. (1987), "Traffic Engineering and Transportation Planning", Khanna	4.	Fred L. Mannering, Scott S. Washburn, Kilareski Walter P., Principles Of Highway Engineering And
Loorning		Publishers, India.		Traffic Analysis, Wiley India Pvt Ltd., 4th edition, 2011.
Desources	2.	Banks, J; Carson, JS; Nelson, B.L. Discrete-event system simulation. 5th ed. Upper	5.	Highway Capacity Manual, Transportation Research Board, Washington, D.C., 2010.
Resources		Saddle Drew, DR., Traffic flow theory and control, McGraw Hill Book Company, 1976.	6.	Kadiyali, L.R, "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi, 2006
	3.	May, A.D. Traffic Flow Fundamentals, Prentice Hall, 1st Edition, 1990.		

Learning Assessmer	nt						
			Continuous Learning	Assessment (CLA)		Cum	mativa
	Bloom's Level o <mark>f Thinking</mark>	Form CLA-1 Avera (50	ative ge of unit test %)	Life-Long CL (10	l Learning A-2)%)	Final Ex (40% w	native amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%		20%		20%	-
Level 2	Understand	20%		20%		20%	-
Level 3	Apply	30%		30%		<u>30%</u>	-
Level 4	Analyze	30%		30%		30%	-
Level 5	Evaluate			1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	- "Her"		-
Level 6	Create	7			· · · · · · · · · · · · · · · · · · ·		-
	Total	100)%	10	0 %	10	0 %

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Asif Ahmed, Business manage <mark>r, Ingevity</mark> ,	1. Dr. Venkaiah Chowdary, Professor, NITW, vc@nitw.ac.in	1. Dr. A. Padma Rekha, SRM IST
ahmed.asif@ingevity.com		
2. Mr. Ankit Pachouri, Transport Planner, IUT, New Delhi,	2. Dr. V Sunitha, Associate Professor, NITT, sunitha@nitt.edu	2. Mr. G. Sivaprakash, SRM IST
ankit.pachouri@iutundia.org		

Course Code	21CEO315T	Course Name	e VISCO		Cou Categ	rse Jory	0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3
Pre-requis Course	site s	Nil	Co- requisite Courses	Nil	P	rogres Cours	sive ses						Nil	1					
Course C	Offering Departme	ent	Civil Engineering	Data Book / Codes / Standa	ards							Nil							
Course Le	arning Rationale	(CLR):	The purpose of learning this cour	rse is to:	1	1	1		Progr	am Oi	utcome	s (PO)				P	rogra	m
CLR-1:	Understand the c	oncepts o	f linear viscoelasticity	No sec	1	2	3	4	5	6	7	8	9	10	11	12	0L	pecifi	c es
CLR-2:	Explore different	models to	model the behavior of linear viscoela	astic materials				of	10	Ŀ.									
CLR-3:	Comprehend the	relation b	etwe <mark>en linear v</mark> iscoelastic material fu	nctions	edge		nt of	ons (ocie		-	Vork		nce				
CLR-4:	Explore different	experime	nt <mark>al approac</mark> hes to characterize the b	ehavior of viscoelastic material	alwor	SIS.	omer	igati	sage	s pue			am \	E	Fina	ning			1
CLR-5:	Know the corres material	pondence	principle and it application towards	s studying the behavior of viscoelast	ieering Kr	em Analy	In/develo	uct invest lex proble	m Tool U	ngineer a	onment & inability	0	dual & Te	nunicatio	ct Mgt. &	ong Lear	-	2	3
Course Ou	tcomes (CO):	-	At the end of this course, learner	s will be able to:	Engin	Probl	Desig	Cond	Mode	The e	Envire	Ethics	ndivi	Comr	Proje	-ife L	-OSc	-OSc	-OSc
CO-1:	Discriminate the	viscoela <mark>st</mark>	<mark>ic mate</mark> rial based on it response to di	fferent loading conditions	3	3	-	3	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Apply different m	odels to <mark>t</mark>	<mark>ne mat</mark> erial that exhibits linear viscoe	lastic behavior	3	3		3	-	-	- N	-		-	-	-	-	-	-
CO-3:	Analyze the relati	ion betw <mark>e</mark>	en viscoelastic characteristic function	S	3	3	171	3	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Characterize the	mechan <mark>ic</mark>	<mark>al prop</mark> erties of the viscoelastic mate	rial	3	3	1	3	-		-	-	-	-	-	-	-	-	-
CO-5:	Apply basic princ	iples to <mark>m</mark>	<mark>odels th</mark> e behavior of viscoelastic ma	terial	3	3	11 A.	3	-		-	-	-	-	-	-	-	-	-
Unit-1 - Lir Introductior	near Viscoelastic to Viscoelasticity	Behavior - Review	of the structure of viscoelastic materi	als - Linear viscoelastic behavior, Cre	ep, reco	/ery, re	laxatio	n and c	oscillate	ory sh	earing							9	Hour
Unit-2 - Co	onstitutive Equation	ons							- 17									9	Hour
Constitutive	e equations using r lation Retween V	nechanica iscoelast	al an <mark>alogs - M</mark> axwell model, Kelvin m i c Functions	odel, standard linear solid and Burgers	s' model,	gener	alized i	nodels	, Integi	ral mo	dels,							9	Hour
Boltzmann	Superposition Prin	ciple - Cre	eep compliance, relaxation modulus,	complex modulus, phase lag – Relation	on betwe	en diffe	erent fu	nctions	s.	-		-							Tour
Unit-4 - Me	chanical Charact	erization	of Viscoelastic Material	<u> i l'ucitatione</u>														9	Hour
Unit-5 - Co	erature superpositi prespondence Pr	on, WLF a incinle	and Arrheniu <mark>s equation - Mechanical</mark>	characterization of viscoelastic materi	als and	experin	nental I	nvestig	ation		-							Q	Hour
Viscoelasti	c beam problems -	elastic-vi	scoelastic correspondence principle -	Effect of pressure and temperature														5	

	1.	A.S. Wineman and K. R. Rajagopal, Mechanical Response of Polymers: An	4. W. N. Findley, J. S. Lai and K. Onaran, Creep and Relaxation of Nonlinear Viscoelastic Materials,
		Introduction, Cambridge University Press, 2000.	Dover, 1989.
Learning	2.	M. T. Shaw and W. J. MacKnight, Introduction to Polymer Viscoelasticity, 3rd Ed.,	5. A.C. Pipkin, Lectures on Viscoelasticity Theory, 2nd Ed., Springer, 1986
Resources		Wiley-Interscience, 2005.	6. R. M. Christensen, Theory of Viscoelasticity, Dover, 2nd Ed., 1982
	З.	E. Riande, R. Diaz-Calleja, M. G. Prolongo, R. M. Masegosa, C. Salom, Polymer	J. D. Ferry, Viscoelastic Properties of Polymers, 3rd Ed., Wiley, 1980.
		viscoelasticity, CRC Press, 1999	1.20

Learning	Assessment

		11.1	Continuous Learning	Assessment (CLA)		Summative Final Examination (40% weightage)			
	Bloom's Level of Thi <mark>nking</mark>	Form CLA-1 Avera (50	native ige of unit test 0%)	Life-Lon Cl (1	g Learning LA-2 0%)				
		Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	20%	the second states	20%		20%	-		
Level 2	Understand	20%		20%		20%	-		
Level 3	Apply 📄	30%		30%		30%	-		
Level 4	Analyze	30%	71.00	30%		<u>30%</u>	-		
Level 5	Evaluate	-	0.000	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		-	-		
Level 6	Create		to care as	4		-	-		
	Total	10	0%	10	0 %	10	0 %		

Course Designers										
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts								
 Dr. Asif Ahmed, Business manager, Ingevity, ahmed.asif@ingevity.com 	1. Dr. Venkaiah Chowdary, Professor, NITW, vc@nitw.ac.in	1. Dr. A. Padma Rek <mark>ha, SRM</mark> IST,								
 Mr. Ankit Pachouri, Transport Planner, IUT, New Delhi, ankit.pachouri@iutundia.org 	2. Dr. V Sunitha, Associate Professor, NITT, sunitha@nitt.edu	2. Mr. G. Sivaprakash, SRM IST								



Course Code	21CEO316T	21CEO316T Course Name SOIL SCIENCES			C	Cours atego	e ory	0				OPEN	ELEC	TIVE				- T 3 0	P 0	C 3				
Pre-requi Course	site s	Nil		Co- requisi Courses	te		Nil	1		Pro (ogres Course	sive es						Nil						
Course	Offering Departme	ent	Civ	il Engineering]	Data Book /	/ Codes / Sta	Indards								Nil							
Course Le	arning Rationale (CLR): T	The purpose	of learning th	his cours	se is to:	-			Program Outcomes (PO)											P	rogra	m	
CLR-1:	Understand the c	onsistency d	dispersion ar	nd workability c	of soils	1.	2			1	2	3	4	5	6	7	8	9	10	11	12	S	pecif itcom	ic Ies
CLR-2:	CLR-2: Know the chemical composition of soils					Ð		Ŧ	s of	3.	ety			¥										
CLR-3:	Realize the conce	ptual and pr	oractical unde	erstanding of se	oil minera	alogy	18.5	Sec. 26.		ledg		ent o	tions	e	soci		-	No		ance	D			
CLR-4:	Familiarize with s	oil conserva	ation and wat	ershed manag	gement		112-2	- 100		Von	lysis	opme	stiga Iems	Usaç	and	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		eam	uo	š Fin	Irning			
CLR-5:	CLR-5: Explore the mechanism and concept related to soil microbial interactions and genetic landforms					eering h	em Ana	jn/devel	uct inve lex prob	ern Tool	engineer	onment 8 ainability	S	dual & T	nunicati	ct Mgt. 8	ong Lea	.	Ş	ę				
Course Ou	Course Outcomes (CO): At the end of this course, learners will be able to:				127	Engir	Probl	Desig	Cond	Mode	The e	Envir Susta	Ethic	ndivi	Comr	^o roje	_ife L	-OSC	-OSc	-OSc				
CO-1:	CO-1: Gain a thorough knowledge on the characterization and management of soil structure					3	-	-	-	-		-	-	-	-	-	-	-	-	-				
CO-2:	Recommend the	concep <mark>t of ic</mark>	<mark>ion e</mark> xchange	process in the	e soil che	mistry		100		3		1	-	-	-	_	-	-	-	-	-	-	-	-
CO-3:	Apply the soil clas	ssificati <mark>on, m</mark>	<mark>miner</mark> alogy a	nd soil maps fo	or the Ind	lian scena	ario	1 A	1	3			-	-	- 10	-	-		-	-	-	-	-	-
CO-4:	Demonstrate effic	cient soi <mark>l con</mark>	nservation te	chniques	1.1	100	100	1.1	122	3	-	-	-	-		3	-	-	-	-	-	-	-	-
CO-5:	Illustrate the geor	norphol <mark>ogy (</mark>	<mark>of so</mark> il condi	tion in India		197	1-2-			3		1.1	-	-	1	3	-	-	-	-	-	-	-	-
Unit-1 - So	oil Physics				100	1.4					60				-								9	Hour
Scope of se	oil physics and its re	elation with o	other branch	es of soil scien	ce; soil a	s a three	phase syste	em - S <mark>oil tex</mark> tu	ure, tex	tural c	lasses	, mech	anical	analys	sis, spe	cific su	rface -	Soil c	onsiste	ence; di	spersio	on and	work	ability
of soils; soi	is; soil compaction and consolidation; soil strength; swelling and shrinkage - Basic concepts - Soil structure - Genesis, types, characterization and management soil structure; Soil aggregation, aggregate stability																							
Chemical (9 Hour nical (elemental) composition of the earth's crust and soils - Soil colloids: inorganic and organic colloids - Origin of charge, concent of point of zero-charge (PZC) and its dependence on variable - Charge soil																							
component	ts, surface charge (characteristi	tics of soils; of	liffuse double i	layer the	ories of s	soil colloids,	, zeta potentia	al, stab	lity, co	bagula	tion/flo	cculati	on of s	soil co	lloids -	lon ex	chang	e proce	esses i	n soil;	cation	exch	ange-
theories ba	nsed on law of mass	s action - Cl	Chemistry of a	<mark>acid</mark> soils - Che	mistry of	f salt-affe	cted soils .	ALC: N	111					1										•
Unit-3 - So	oil Mineralogy, Gei	nesis, Class	sification		EM	1.00	Contraction of	11 L L L				1											9	Hour
Classificati	on, structure, chem	ical compos	sition and pro	operties of clay	/ minerals	s; genesi	is and transf	formation of c	crystalli	ne and	non-	crystall	ine cla	y mine	erals; i	dentific	ation t	echniq	ues; ai	norpho	us soil	const	ituent	s and
other non-o	crystalline silicate n	ninerals and	a their identifi	cation; clay mil	nerais in	Indian sc	DIIS - SOII CIA	assification, so	oii mine	ralogy	and s	soii ma	os - Us	setuine	ess.								0	Hour
Soil conser	vation planning lar	nd canability	vclassificatio	n: soil conserv	ation in s	necial pr	ohlem areas	s such as hilly	arid a	nd sen	ni-arid	reaion	s wate	rload	d and	wet lan	ds - M	latersh	ed ma	nadem	ont - co	ncent	9 ohio	ctives
and approa	ach; water harvestir	ng and recyc	cling; flood conning of wate	ontrol in waters	shed man	nagemen	it; socio- ecc	onomic aspec	ts of wa	atersh	ed ma	nagem	ent; ca	ise stu	idies ir	respe	ct to m	onitori	ng and	l evalua	ation of	' water	shed:	3; USE

9 Hour Soil biota, soil microbial ecology, types of organisms in different soils; soil microbial biomass; microbial interactions; unculturable soil biota - General introduction to geology and geochemistry, major and minor morphogenic and genetic landforms, study of schematic landforms and their elements with special reference to India.

	1.	Baver LD, Gardner WH & Gardner WR. 1972. Soil Physics. John Wiley & Sons.	5.	Hudson N. 1995. Soil Conservation. Iowa State Univ. Press.
Learning	2.	Bolt GH & Bruggenwert MGM. 1978. Soil Chemistry. Elsevier.	6.	Alexander M. 1977. Introduction to Soil Microbiology. John Wiley & Sons.
Resources	3.	McBride MB. 1994. Environmental Chemistry of Soils. Oxford Univ. Press.	7.	Brikland PW. 1999. Soils and Geomorophology. 3rd edition. Oxford Univ. Press
	4.	Indian Society of Soil Science 2002. Fundamentals of Soil Science. ISSS, New Delhi.		

Learning Assessme	ent			and the second sec			
			Continuous Learning	Assessment (CLA)		Sum	motivo
	Bloom's Level of <mark>Thinking</mark>	Form CLA-1 Avera (5)	g Learning _A-2 0%)	Final Ex (40% w	amination eightage)		
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%		20%		20%	-
Level 2	Understand	20%		20%		20%	-
Level 3	Apply	30%	100 C 10 C 10 C 10 C	30%		<mark>30</mark> %	-
Level 4	Analyze	30%	the course with	30%		30%	-
Level 5	Evaluate			100000		-	-
Level 6	Create		S 133 34	N			-
	Total	10	0 %	10	0%	10	0 %

Co	urse Designers	100									
Experts from Industry		Ex	operts from Higher Technical Institutions	Internal Experts							
1.	Dr. P.Selvanambi, Divisional Engi <mark>neer (Hig</mark> hways),	1.	. Dr.M.Muttharam, Anna University, muttharam@annauniv.edu	1	I. Dr. P.T.Ravichan <mark>dran, S</mark> RMIST						
	sundariselvam@yahoo.com										
2.	Mr.Lenin K.R., Head – GEOTECH, SECON Private Limited,	2.	Dr.V.Murugaiyan, Pondichery Engineering College,	2	2. Ms. S. Mary Re <mark>bekah Sh</mark> armila, SRMIST						
	Bangalore, lenin.kr@secon.in		vmurugaiyan@pec.edu								



Course Code	21CEO317J	Course Name	RURAL DEVELOPM	ENT AND TECHNOLOGY	Cor Cate	ategory 0 OPEN ELECTIVE							L T P 3 0 0			C 3			
Pre-requis Courses	site S	Nil	Co- requisite Course <mark>s</mark>	Nil		Progre Cour	ssive ses						Nil						
Course O	offering Departm	ent	Civil Engin <mark>eering</mark>	Data Book / Codes / Stand	lards							Nil							
Course Lea	arning Rationale	(CLR): Th	ne purpo <mark>se of learnin</mark> g this cou	rse is to:	T	1	1	51	Progr	am Ou	utcome	s (PO))				Pr	ogra	n
CLR-1:	Gain knowledge	about Indian	rural development concepts.	N. 200	1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	c es
CLR-2:	R-2: Explore the fundamental energy sources available in rural areas, and the biogas production technolog				IY. a		f	of	3	ety			¥						
CLR-3:	CLR-3: Provide familiarity about developments in rural water supply and sanitation				ledo		ento	tions	e	soci			Wo		ance	0			
CLR-4:	CLR-4: Enhance the knowledge of India's rural development policies and programs				Mou	ysis	bmdo	stiga	Usaç	and	ø		eam	ы	k Fin	min			
CLR-5:	CLR-5: Understand the evolution of entrepreneurship in Rural India				erina	n Ana	/devel	ct inve st prob	Tool	gineer	nment ability		lal & T	unicati	Mgt. 8	ng Lea			
Course Out	tcomes (CO):	A	t the end of this course, learned	rs will be able to:	Indine	Probler	Design	conduction Conduction Comple	Aoderr	The en	Enviror	Ethics	ndividu	Commi	Project	-ife Lo	SO-1	2-0-2	SO-3
CO-1:	Describe the var	ious dim <mark>ensio</mark>	ns of rural developments	The course with	2	-	-	1	-	1	-	-	-	-	-	-	-	-	-
CO-2:	Develop a solutio	ons for r <mark>educii</mark>	ng waste and make waste produc	t into useful resources	- 1	10.0	13	-	-		3	-	-	-	-	-	-	-	-
CO-3:	Apply multidiscip	olinary ap <mark>proa</mark>	ches in Public Health practice		1	-	-	-	-	2	2	-		-	-	-	-	-	-
CO-4:	Acquire knowled	lge on p <mark>olicies</mark>	<mark>s, sc</mark> hemes and programs for the o	development of rural community				-	-	3	1	-	-	-	-	-	-	-	-
CO-5:	Implement practi	ical solut <mark>ions l</mark>	for managing unemployment issue	es through entrepreneurship		1	-	-	-	1	3	-	-	-	-	-	-	-	-
Unit-1 - Intr Basic introd significance in Lab	roduction luction about rura - Land use patter	I developm <mark>en</mark> n Analysis of	t- History of Rural development- UBA Villages (Practically in the fit	Rural Settlement of UBA Villages An Id) *- The function and pattern of rura	alysis (F al settler	Practica nents -	lly in t Rural	he field) Settleme	* - cor ent ana	ncept f alysis-	or Rura Techno	I Settle	ements I Interv	s- Type rention	es of R in Rura	ural Se al Settl	ettleme ement	9 ents ai Praci	Hour nd its fically
Unit-2 - Rui	ral Energy and T	echnology	1000						1									9	Hour
Different en its types - F wastes - Va	ergy sources in ru Pyrolysis technolo rious Digesters a	ural areas- Bio gy and waste nd Its Materia	omass based energy systems - A management technique- Biomas Is (Practically in the field) *	ssessment of Waste in the University s methodologies (Practically in the fie	Campu ld) *- Bio	s (Prac) gas a	tically nd its ι	in the fie ıses- Bic	eld) * - Igas pr	conce oducti	pts of p ion usin	yrolysi g vario	is and ous sul	its type ostrate	es - co s incluc	oncept ding M	s of py SW an	rolysis d indu	s and Istrial
Unit-3 - Rui	ral Water supply	and Sanitati	on															9	Hour
Rural Water supply and s	Supply and Sani sanitation - sewag sanitation practice	tation current ge collection a es - Campaig	status - National and State level p ind treatment - Hygiene practices a and Concept of 3 R (Practically	rogramme of RWS- Sanitation practic at Workplace (Practically in the field) in the field) *	es and * - Iden	strategi tificatio	es of l n of sh	Rural UE ortcomir	A Villangs for	ges (F poten	ractica tial impi	lly in th roveme	e field ent - Ti) *- The he Late	e Basic est dev	elopme	oles of ents in	rural v rural v	vater water
Unit-4 - Rui	ral Development	policies																9	Hour
Rural Devel National Ru Managemer	lopment Legislatio Iral Livelihood Mi nt (INRM), PMGS	ons and Polic ission - Analy Y, PMAY - Im	ies in India - CSR Policy - Policy sis of various Govt. Schemes a plementing Rural Employment So	r Framework for rural community and nd Policies (Practically in the field) chemes in UBA Villages (Practically in	l develo * - Com the fiel	oment munity d) *	(Practi Based	cally in t I Natura	he fiel I Reso	d) * - urces	Implem Manag	entatic ement	n prog (CBN	gram o RM) -	r plan Integra	in Rui ated N	al dev atural	elopm Resoi	ient - urces

Unit-5 - Rural Entrepreneurship	9 Hour
Entrepreneurship Evolution of Entrepreneurship in Rural India - Types of Rural Entrepreneurship - Practicing Business environment in the rural villages (Practically in the field) * - Challenges for Rural Entrepreneurship - Practicing Business environment in the rural villages (Practically in the field) * - Challenges for Rural Entrepreneurship - Practicing Business environment in the rural villages (Practically in the field) * - Challenges for Rural Entrepreneurship - Practicing Business environment in the rural villages (Practically in the field) * - Challenges for Rural Entrepreneurship - Practicing Business environment in the rural villages (Practically in the field) * - Challenges for Rural Entrepreneurship - Practicing Business environment in the rural villages (Practically in the field) * - Challenges for Rural Entrepreneurship - Practicing Business environment in the rural villages (Practically in the field) * - Challenges for Rural Entrepreneurship - Practicing Business environment in the rural villages (Practically in the field) * - Challenges for Rural Entrepreneurship - Practicing Business environment in the rural villages (Practically in the field) * - Challenges for Rural Entrepreneurship - Practicing Business environment in the rural villages (Practically in the field) * - Challenges for Rural Entrepreneurship - Practicing Business environment in the rural villages (Practically in the field) * - Challenges for Rural Entrepreneurship - Practicing Business environment in the rural villages (Practically in the field) * - Challenges for Rural Entrepreneurship - Practicing Business environment in the rural villages (Practically in the field) * - Challenges for Rural Entrepreneurship - Practicing Business environment in the rural villages (Practically in the field) * - Challenges for Rural Entrepreneurship - Practicing Business environment in the rural villages (Practically in the field) * - Challenges for Rural Entrepreneurship - Practicing Business environment in the rural villages (Practically in the	repreneurs
- Social and Political Aspects of Rural Development - Networking with all Rural Support Systems(Practically in the field) * - Entrepreneurial Opportunities-Potential and Limitations Active - Rural in	rastructure
development - Development of Cultural Integrity in Rural Entrepreneurship (Practically in the field) *	

*Practical exposure will be given to the students on the specified topics

Fiactical expo			- 2 -
Learning Resources	 U. C. Sharma, Non-Conventional Sources of Energy, Studium Press LLC, USA, 2014. S. Gupta, Rural Water Supply and Sanitation, Vayu Education of India, New Delhi, 2013. M.C. Dash, Concepts of Environmental Management for Sustainable Development Publisher: I K International Publishing House Pvt. Ltd., 2013. 	4. 5.	G.Shivakoti, U. Pradhan, H. Helmi (editors), Redefining Diversity and Dynamics of Natural Resources Management in Asia, Volume 1st Edition, Sustainable Natural Resources Management in Dynamic Asia, Editors: ISBN: 9780128054543, Elsevier, 2016. P.Rogers, K. F. Jalal, J. A. Boyd, an Introduction to Sustainable Development. Publisher:
			Roulledge, 1 eulion, 13DN-10. 1644013200, 2001

			Continuous Learning	Assessment (CLA)	-	Cum	mativa		
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ige of unit test 0%)	Life-Long CL (10	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	<u>Th</u> eory	Practice		
Level 1	Remember	20%	Los Articles	20%		20%	-		
Level 2	Understand	20%		20%	· · · · · · · · · · · · · · · · · · ·	20%	-		
Level 3	Apply	30%	the start was	30%		<u>30%</u>	-		
Level 4	Analyze	30%	10 C 10 C 10 C 10	30%	- Annual Contraction	30%	-		
Level 5	Evaluate					-	-		
Level 6	Create					-	-		
	Total	10	0%	10	0%	10	0%		

C	ourse Designers				
E	xperts from Industry	Ex	perts from Higher Technical Institutions	Int	ernal Experts
1	Dr.Chetan Chittalkar, MGNCRE, Govt. of India chetanmgncre@gmail.com	1.	Dr. Ramesh, Professor, NIRD, Hyderabad, rramesh.nird@gmail.com	1.	Dr. Vignesh K.S, SRM IST
2	Mr. Suresh Mariaselvam, Independent Consultant, suresh.masel@gmail.com	2.	Dr. Samuel Inbadurai, Director, SIRD, Tamil Nadu, sird@tn.nic.in	2.	Dr. Deepa, SRM IST



B.Tech / M.Tech(Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

Course Code	21CEO318T	Course Name	F	LOODS AND	FLOOD MANAGEMENT	C	Cours atego	se ory	0				OPEN E	ELEC	TIVE			Ĺ	- T 3 0	P 0	C 3
Pre-requ Cours	iisite es	Nil	Co Co	· requisite ourse <mark>s</mark>	Nil		Pro	ogres Cours	sive es						Nil						
Course	Offering Departm	ent	Civil Eng	ineering	Data Book / Codes	/ Standards								Nil							
0							-	-	1		Dura			- (DO					D	roara	m
Course L	earning Rationale		ne purpose of lea	arning this co	jurse is to:						Progra		tcome	S (PU)	L		<u> </u>	s	pecifi	ic
CLR-1:	Learn floods and	flood estimat	tion				1	2	3	4	5	6	7	8	9	10	11	12	ou	itcom	es
CLR-2:	Know flood forec	asting and flo	ood <mark>routing tech</mark> nic	ques			ge		of	s of		iety			¥		a	1		'	
CLR-3:	CLR-3: Understand about flood control structures				2.16	/led		ento	tion	ge	soc			Wo		anci	5				
CLR-4:	CLR-4: Study earthen embankments and their design				194.1	Nov	ysis	udo	stiga Iems	Usa	and	<u>مم</u>		earr	ч	Ë	min				
CLR-5:	Understand stab	ility analys <mark>is c</mark>	of slopes and four	dation			ring k	Anal	levelo	inve: prob	Tool	neer	nent a		al & T	nicatio	Agt. 8	g Lea			
				2.11			neel	lem	gn/c	duct	E	engi	ronr aina	s	idua	mur	ect N	Long	-	-2	က္
Course O	utcomes (CO):	A	t the end of this	course, learn	ers will be able to:	and Y	Engi	Prob	Desi	Con	Mod	The	Envi	Ethic	ndiv	Com	Proj	Life	PSO	PSO	PSO
CO-1:	Estimate design	floods a <mark>nd flo</mark>	od flows		A Store Print	0.50	3	3	-	-	-	-		-	-	-	-	-	-	-	-
CO-2:	Appraise flood ro	outing an <mark>d floc</mark>	od control				3	3		-	-	-	-	-	-	-	-	-	_	-	-
CO-3:	Design various fl	ood con <mark>trol st</mark>	tructures	1 2 1 - 1			3	3	3	3	-	- 30	-	-		-	-	-	-	-	-
CO-4:	Analyze and des	ign earth <mark>en e</mark> i	mbankments	1		100	3	3	3	3	1	-	-	-	-	-	-	-	-	-	-
CO-5:	Analyze stability	of slope <mark>s and</mark>	<mark>l foun</mark> dation		A Press of the		3	3	Ú.	-	-	1	-	-	-	-	-	-	-	-	-
llnit-1 - E	loods and Elood E	etimation	1		Section - and the second	1.5		20												0	How
Definition	and causes of flood	sumation s. desian floo	d. SPF. PMF and	its importance	e - Estimating design flood and f	flood flows - E	Invelo	p curv	es - Me	ethods	of floo	d freau	iencv -	Flood	freaue	ncv sti	ıdies -	Unit hv	droara	aph m	ethod
- DAD and	alysis	e, eee.g			g																
Unit-2 - F	lood Forecasting a	and Flood Ro	outing	12.2						1	1									9	Hour
Flood fore	casting, need, prob	lems and limi	ita <mark>tions - Riv</mark> er for	ecasting proc	edure - Flood forecasting metho	ods - Flood ro	outing	- Res	ervoir r	outing	- Char	nel ro	uting, M	luskin	gham	method	d - Floc	d contr	ol, str	ucture	al and
IInit-3 - E	ural measures for in				1 1 1 3 1 X 1			-	-	-		-								0	Hour
Gully cont	rol structures, temp	orarv check o	dams - Permanen	structures for	r aully control - Desian of chute	spillway, des	ian of	drop i	nlets -	Ravine	reclar	nation	- Contro	ol and	trainir	a of riv	ers - C	biectiv	es. cla	assific	ation.
methods of	of river training - Ma	rginal emban	kments - Guide b	anks - Groyne	S	op	g o.	al op i			100rail	- action	001111	or arra	ci ci i i i i	9 0	0.0 0		00, 0.0		<i>uu</i> ,
Unit-4 - E	arthen Embankme	ents																		9	Hour
Types and	d methods of const	ruction - Four	ndation design – (Grouting - See	Page through embankments- F	lownet and i	ts pro	pertie	s - See	epage l	ine in	compo	site ear	rth em	ibankn	nents -	Draina	ige filte	rs, pip	oing a	nd its
causes - L	Jesign of earth dam tability ∆nalveis	S																			Hour
Stability a	nalysis of slopes. st	ability of foun	ndation against sh	ear - Small ea	arthen embankments - Subsurfa	ce dams, site	e seled	ction a	nd con	structio	onal fe	atures	- Plann	ning of	flood	control	projec	ts and	their e	conor	nics

Learning	 Mutreja K. N. 1986, Applied Hydrology, Tata McGraw-Hill Publishing Co, Delhi. Subramanya K., 2008, Engineering Hydrology, 3rdEdi., Tata McGraw-HillPublishing 	 Garg S.K., 2009, Irrigation Engineering and Hydraulic Structures, KhannaPublishers Pvt. Ltd, New Delhi.
Resources	Co., Delhi	 Murthy, V.V.N. 2002, Land and Water Management Engineering, 4thEdi.,Kalyani Publishers, New Delhi

Learning Assessmen	nt		1.11.11.11.11	1.7.						
			Continuous Learning	Current in a						
	Bloom's Level of Thinking	Form CLA-1 Avera (50	ative ge of unit test %)	Life-Long CL (1)	g Learning A-2 0%)	Final Examination (40% weightage)				
		Theory Practice		Theory	Practice	Theory	Practice			
Level 1	Remember	20%		20%		20%	-			
Level 2	Understand	20%		20%		20%	-			
Level 3	Apply	30%	And the second second	30%		30%	-			
Level 4	Analyze	30%		30%		30%	-			
Level 5	Evaluate	SW/ - ES		1000		-	-			
Level 6	Create			19/2/2010		-	-			
	Total	100)%	10	0%	100 %				

Co	urse Designers		
Experts from Industry		Experts from Higher Technical Institutions	Internal Experts
1.	Mr. Abdul Hakeem, National Remote Sensing Center, Hyderabad, abdulhakeem_k@nrsc.gov.in	1. Dr. Rehana Shaik, IIIT, Hyderabad, rehana.s@iiit.ac.in	1. Dr. Shaik Niyazuddin Guntakal, SRMIST
2.	Dr. Sat Kumar Tomer, Satyukt Analytics Pvt Ltd., Bengaluru, sat@satyukt.com	2. Dr. S. Saravanan, NIT Trichy, saravanans@nitt.edu	2. Dr. R. Sathyanathan, SRMIST



Course Code	21CEO319T	Co Cat	ourse itegory		OPEN ELECTIVE											C 3				
Pre-requisite Nil Co- requisite Nil Courses Nil Courses Nil							Progre Cour	ssive ses	re Nil											
Course (Offering Departme	nt	Civil E	Engineering	Data Book / Codes / Stand	lards							Nil							
Course Le	arning Rationale (CLR): TI	he purpos <mark>e of</mark>	learning this cour	se is to:		- 7			Progr	am Ou	utcome	s (PO))				Pr	rograi	m
CLR-1: Understand climate and climate system					1	1 2 3 4 5 6 7 8				9	10	11	Specific outcomes							
CLR-2:	Know the impacts	of climate c	chan <mark>ge on wate</mark>	er resources					of	20	ety							Uu	com	53
CLR-3:	Explore the tools available for vulnerability assessment							ent of	stigations lems	Usage	soci	e ð	-	eam Wor	ц	Finance	ſ			
CLR-4:	Learn to adapt to climate change and bio diversity							bmqc			and						rninç			
CLR-5:	Study case studies on water resources management								inves	Tool	neer	nent a		II & T	iicatio	Agt. 8	j Lea			
			olem	ign/d	duct	em	engi	ironn taina	S	/idue	Jmur	ect N	Long	-	-2	-3				
Course Ou	Irse Outcomes (CO): At the end of this course, learners will be able to:					сч Ц	Prot	Des	Con	Mod	The	Env	Ethi	Indiv	Con	Proj	Life	PSC	PSC	PSC
CO-1:	Identify the components of climate system ad greenhouse effect						3 -	-	-	-	-	3	-	-	-	-	-	-	-	-
CO-2:	2: Disseminate the impacts of climate change in Indian and Global scenarios								-	-	-	3	-	-	-	-	-	-	-	-
CO-3:	CO-3: Recognize the usage of tools to prepare different models						3 -	-		-	- 100	3	-		-	-	-	-	-	-
CO-4:	Illustrate bio energy crop <mark>s, hydro</mark> power and crop land management						3 -	-	-	1		3	-	-	-	-	-	-	-	-
CO-5:	CO-5: Solve the real time issues by adapting different strategies						3 -	tus!	-	-	1	3	-	-	-	-	-	-	-	-
Unit-1 - Th Definitions-	e Climate System Climate, climate sy	ystem, clima	ate change - Dri	ivers of climate chai	nge - Characteristics of climate system	m – Gre	enhous	e effect	- Carbo	n cycl	le - Wil	nd syste	ə <mark>ms –</mark>	Ozone	hole ii	n the a	tmosph	iere –	9 El Nin	Hour 10, La
Unit-2 - Im	pacts of Climate C	S Change		1					1	1									9	Hour
Global scer (SRES) - D	nario - Indian scena ifferent scenarios	ario - Observ	ve <mark>d change</mark> s an	nd projected change	s of IPCC - Impacts on water resourd	ces – N.	ATCOM	report	- Impact	s on s	sectora	al vulner	abilitie	es – Sp	oecial F	Report	on Emi	ssions	Scen	arios
Unit-3 - To	ols for Vulnerabili	ity Assessn	nent	700	UT MILASTIN	1.1.4			-	1									9	Hour
Need for vu	ilnerability assessm mate models – Red	ient – Steps ional modeli	s for assessmer	nt - Approaches – M	odels – Quantitative and Economic n	nodels -	Impact	matrix a	approac	h - Bo	x mod	els - Ze	ro dim	ension	nal mod	lels - H	igher a	imens	ion m	odels
Unit-4 - Ad	laptation and Mitig	nonal models gation				-	-	-	-										9	Hour
Water relat sustainable Implications	ed adaptation to cl development – Ca s for policy and sus	limate chang arbon dioxid tainable dev	ge in the fields le capture and velopment	s of Eco systems an storage (CCS), Bio	nd biodiversity – Agriculture and foo energy crops, Biomass electricity, H	d secur lydropol	ity, land wer – Ei	use, h nergy u	uman h se in bu	ealth, ildings	water s, Land	supply d use cl	and s hange	anitatio and m	on - Ao nanage	daptatio ment, o	on and croplar	vulnei 1d mar	rability nagerr	√ and nent -
Unit-5 - Ca	se Studies		0 D	dan analast O	Here we is a function of the in-		_				11	1	-l ! -				-+- F		9	Hour
strategies -	urces assessment (Drought managem	case studies ient strategie	s - Ganga Damo ies - Temporal a	oaar project – Ganga and spatial assessn	valley project – Adaptation strategies	s in ass	essmen	t of wate	er resou	rces –	Hyarc	ological	aesign	i practi	ces-D	am safe	ety - Fl	ooa ma	anage	ment
Looming	1.	Shukla P.R , Subobh K Sarma Climate change and India: Vulnerability assessment and	3.	UNFCC Technologies for adaptation to climate change , 2006																
-----------	----	--	----	---																
Deseuress		adaptation , University press (India)Pvt ., Ltd., Hyderabad	4.	Preliminary consolidated report on effect of climate change on water resources, GOI, CWC, MOWR,																
Resources	2.	IPCC Report technical paper IV – Climate change and water, 2008		2008																

Learning Assessmen	t									
			Continuous Learning	Assessment (CLA)		Cum	mativa			
	Bloom's Level of Thinking	Forma CLA-1 Averag (505	ative e of unit test %)	Life-Lor C (1	ng Learni <mark>ng</mark> CLA-2 10%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%	and the second	20%		20%	-			
Level 2	Understand	20%		20%		20%	-			
Level 3	Apply	30%	1. A. C. C.	30%		30%	-			
Level 4	Analyze	30%	States Low	30%		30%	-			
Level 5	Evaluate	EI	1.2.2.2.1			-	-			
Level 6	Create	SW/		Contract of the		-	-			
	Total	100	%	1	00 %	10	0%			

Co	urse Designers		A state of the state of the state of the state		
Ex	perts from Industry	Ex	perts from Higher Technical Institutions	Inte	ernal Experts
1.	Mr. Abdul Hakeem, National Remote Sensing Center,	1.	Dr. Rehana Shaik, IIIT, Hyderabad, rehana.s@iiit.ac.in	1.	Dr. Shaik Niyazudd <mark>in Gunta</mark> kal, SRMIST
	Hyderabad, abdulhakeem_k@nrsc.gov.in		The second s		
2.	Dr. Sat Kumar Tomer, Satyukt Analytics Pvt Ltd., Bengaluru,	2.	Dr. S. Saravanan, NIT Trichy, saravanans@nitt.edu	2.	Dr. R. Sathyanathan, SRMIST
1	sat@satyukt.com				



Course	21CE0220T	Course		Course	0		L	Т	Ρ	С
Code	210E03201	Name	PRINCIPLES OF SATELLITE REMOTE SENSING	Category	0	OPEN ELECTIVE	3	0	0	3

Pre-requisite Courses	Ni	Co- rec Cours	quisite Nil	Progressive Courses		Nil
Course Offeri	ing Department	Civil Enginee	ring Data Book / C	odes / Standards	Nil	

Course L	_earning Rationale (CLR): The purpose of learning this course is to:		1	340	2.1.1	Progr	am O	utcome	es (PO))				Ρ	rogra	m
CLR-1:	Disseminate basic con Balance	cepts and applications of Electromagnetic Spectrum in Remote Sensing, Energy	1	2	3	4	5	6	7	8	9	10	11	12	S ou	pecifi Itcom	c es
CLR-2:	Enlighten the metho characteristics	ds and methodologies for Data acquisition, platforms, sensors and their				of	0	ty	ability		~						
CLR-3:	Introduce the digital im	edge		nt of	Suc		ocie	taine		Vork		nce					
CLR-4: Upskill the knowledge about optical, thermal and microwave Remote Sensing for solving real life						estigatio	Usage	r and s	& Sust		Team V	ion	& Final	arning			
CLR-5: Instill the importance of satellite remote sensing in various real-world applications						ict inve ex pro	n Tool	nginee	nment		lual &	unicat	t Mgt.	ng Le			~
Course (Outcomes (CO):	At the end of this course, learners will be able to:	Engine	Proble	Design	Condu	Moder	The er	Enviro	Ethics	Individ	Comm	Projec	Life Lc	PSO-1	PSO-2	PSO-3
CO-1:	Understand the physic	al principles and sensing process in remote sensing	3	1.5	1	-	-	-	-		-	3	-	3	-	-	-
CO-2:	Study different type of	se <mark>nsors an</mark> d their characteristics	3		-		3	- 10	-	-	-	-	-	3	-	-	-
CO-3:	Analyze preprocessing	techniques and discuss various Digital Image Processing techniques	3	-	-	-	3	-	-	-	-	-	-	3	-	-	-
CO-4:	Explain statistical out diverse applications	loo <mark>k of sate</mark> llite images and different classification approaches with respect to	3	-	3	-	-	2	-	-	-	-	-	3	-	-	-
CO-5:	Apply the knowledge of	f sa <mark>tellite rem</mark> ote sensing in various thematic studies	3	-	-	3	-	1	-	-	-	-	-	3	-	- 1	-
Unit-1 - I Remote S and Earth Unit-2 - I Platform – Scannin Unit-3 - T Imaging a	Introduction to Remote S Sensing: History, Developi n's Surface: Absorption - R Data Acquisition Method and their Specifications: B ng mechanisms – Optical Types of Satellite Remot and Non-Imaging - Active a	Sensing ment, Definition, Concept & Principles - Electromagnetic Radiation (EMR) and Its eflectance and Scattering - Atmospheric Windows - Energy Balance Equation - Sp alloon, Rocket, Helicopter, Aircraft and Spacecraft - Sensors and their Specificatio and thermal scanners - Satellites and their Specifications: IRS, SPOT, LANDSAT e Sensing and Passive - Multispectral and Hyperspectral Sensors - Electro-Optical Systems -	Charac bectral F ons: MS , SEN1 Microw	teristic Respor SS, TM FINEL,	s - Wa ise and LISS RADA emote	velengt d Specti (I, II,III, NRSAT. sensinc	h Reg ral Sig IV), P/	ions ar nature AN, Wi	nd their - Spec FS, AV	Signifi tral, Sp ViFS, N	icance batial, i MODIS	- Intera Tempol , Weati ge and	action c ral and her & C Azimu	of EMR Radion Commun	with A netric i nicatio	9 \tmosp resolu 9 in Sate 9 Polaria	Hour ohere tions. Hour ellites Hour zation
- Dielectr	ic Properties - Surface Ro	ughness and Interpretation - Applications of optical, thermal and microwave remo	ote sen	sing.	Smolo	sonsing	Conce	рю. D	achoca	litering	nun	ye ana	Azimu	un Direc	<i>J</i> uon, 1	oiuiiz	ulion
Unit-4 - I	mage Processing Techn	iques														9	Hour

Unit-4 - Image Processing Techniques

Concepts about digital image and its characteristics - Radiometric and Geometric correction technique - Types of image displays and FCC - Radiometric enhancement techniques - Spatial enhancement techniques - Contrast stretching: Linear and non-linear methods - Low Pass Filtering: Image smoothing - High Pass Filtering: Edge enhancement and Edge detection - Gradient filters, Directional and non-directional filtering -Unsupervised and Supervised classification techniques.

Unit-5 - Satellite Remote Sensing – Applications

Applications of Artificial Intelligence and Remote Sensing – Environmental studies – Smart city planning – Disaster management – Smart Transport planning – Health applications – Water resource management – Agricultural studies – Forest mapping – Soil studies.

Loorning	 Joseph, George and Jeganathan, C, Fundamentals of Remote Sensing, 3rd Edition, Universities press (India) Pvt. Ltd., Hyderabad, 2017 John A, Bisharda, Remote Sensing Digital Image Applyoin Seringer Vedeo Regin and 	 Lillesand, Thomas M. and Kiefer, Ralph, W, Remote Sensing and Image Interpretation, 4th Edition, John Wiley and Sons, New York, 2007 D. Iudo Hamanth Artificial Intelligence Techniques for Satellite Image Analysis, Springer Nature
Learning	2. John A. Richards, Remote Sensing Digital Image Analysis, Springer-venag Benin and Holdoborg CmbH & Co. KC. ISBN: 0783642441011, 2022	5. D. Jude Hernandri, Aruncial Intelligence rechniques for Satellite Image Analysis, Springer Nature Switzerland Indian Edition, https://doi.org/10.1007/078.3.030.24178.0.2020
Resources	3 Jensen J.R. Introductory Digital Image Processing: A remote sensing perspective	Switzenand, Indian Edulon, https://doi.org/10.1007/970-3-030-24170-0, 2020
	Prentice Hall Series in GIS, USA, 1996	

			Continuous Learning	0						
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (10	Learning A-2)%)	Final Examination (40% weightage)				
		Theory		Theory	Practice	Theory	Practice			
Level 1	Remember	20%		20%		20%	-			
Level 2	Understand	20%	the second second second	20%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	20%	-			
Level 3	Apply	30%		30%	· · · · ·	30%	-			
Level 4	Analyze	30%	1	30%	- · V	30%	-			
Level 5	Evaluate	7	10 C 10 C 10 C 10			-	-			
Level 6	Create			and the second second		-	-			
	Total	10	0%	10	0%	10	0%			

Course Designers	Contraction of the second s	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sainarayanan Gopalakrishnan, HCL Technologies,	1. Dr. R. Kumar, NIT Nagaland,	1. Dr. R. Annadurai, SRMIST
sai.jgk@gmail.com	rajagopal.kumar@nitnagaland.ac.in	
2. Dr. Sricharan Srinivasan, Wipro Technologies,	2. Dr. B. Surendiran, NIT Puducherry, surendiran@nitpy.ac.in	2. Dr. M. Kamalanandhini, SRMIST
sricharanms@gmail.com		

B.Tech / M.Tech(Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses - Syllabi-Control Copy

Course Code	21CEO321T Course SPATIAL INFORMATION SYSTEM					Cours atego	se ory	0				OPEN	ELECT	IVE			l	- T 3 0	P 0	C 3	
Pre-requi Course	site s	Nil		Co- requisite Courses	Nil		Pro	ogres Cours	sive es						Nil						
Course (Offering Departm	ent	Civil	Engineering	Data Book /	Codes / Standards								Nil							
Course Lo	orning Dationals			f loarning this oou			-	1	1.0		Drogr		toomo	o (DO)					Pr	ogra	m
COUISE LE					13e is to.		1	0		4	FIOGI		7	S (FU)	0	10	44	10	S	pecifi	c
CLR-1: Learn the basic concepts of GIS								2	3	4	Э	0	1	0	9	10	11	IZ	ou	tcom	es
CLR-2:	Understand the	data models	s and structures	in GIS	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	di se subiser	lge		of	O SL	18	ciety			ork		e				
CLR-3:	Learn the vector	and raster a	ana <mark>lysis in G</mark> IS			100	wled	S	nent	atior	age	d so			μ		nan	бL			
CLR-4:	Study the geosp	atial analysi	sis in GIS			_	Kno	alysi	lopn	estig	Us	r an	8		Tear	ion	& Fi	arnir			
CLR-5:	Understand mod	leling techni	i <mark>ques in</mark> GIS	>/-	F - - - - - - - - - -		eering	em Ane	n/deve	uct inve ex pro	m Tool	nginee	onment		ual & .	nunicat	st Mgt.	ong Le	-	~	3
Course Ou	tcomes (CO):		At the end of t	this course, learne	rs will be able to:	Sam 27	Engin	roble	Desig	Condu	lode	he e	Enviro	Ethics	ndivic	Comn	rojec	ife Lo	-OS	SO-S	SO-S
CO-1:	Understand cond	cepts an <mark>d da</mark>	lata representati	on of geospatial dat	ta	- C.S.4	3	-	-	3	-	7	-	-	-	-	-	-	-	-	-
CO-2:	Learn how geos	patial da <mark>ta a</mark>	<mark>are sto</mark> res in GIS	3	1 - S		3	1.	12	-	2	-0	-	-	-	-	-	-	-	-	-
CO-3:	Understand the	operatio <mark>n wi</mark>	<mark>vith ve</mark> ctor and ra	aste <mark>r d</mark> ata	1.11		3	- 1	-	-	2	-10	-	-	-	-	-	-	-	-	-
CO-4:	Analyze the vari	ous inter <mark>pola</mark>	lation techniques	s in GIS	200		3	-		3		-	-	-	•	-	-	-	-	-	-
CO-5:	Evaluate the fun	ctions of <mark>var</mark>	<mark>arious G</mark> IS mode	ling	Sec. 2		3	1	14	-	3	25	-	-	I	-	-	-	-	-	-
linit-1 - Eu	ndamontals of C	artography		<u>e 1 e</u>	and the second second	14.5		62				-	×							0	Hour
Definition o	f Map – Mapping	Organisatio	n in India- Class	sification based on F	Function Scale Charac	teristics – Ellipsoid	and G	eoid –	- Co-or	dinate	Syster	ns – R	ectana	ular an	d Geo	aranhi	c Coor	dinates		V and	UPS
– Projection	n – Function – Typ	es of Map P	P <mark>rojections</mark> – Tra	ansformations – Fun	ction - Affine transform	ation – Choice of M	ap Pro	ojectio	n – Evo	olution of	of carto	ograph	y – Ge	o-Spat	ial, Sp	atial ar	nd Non-	spatia	l data -	– Defi	nition
of GIS – Ev	rolution GIS – Cor	nponents of	f GIS	122		1.11				1	-7										
Unit-2 - Gl	S Data Models al	nd Data Inp	out	collations Attribut	and Lovela of Maan	uramant Data Sa	Irooo	Cro	und on	d Dom	to So	noina	ouniou	Coll	atoral	data ar	llootio	n Inn	ut: Mo	9	Hour
and digitisa	oint, Line Polygon / Area, elevation and surface – Tessellations – Attributes and Levels of Measurement – Data Sources – Ground and Remote Sensing survey – Collateral data collection – Input: Map scanning and digitication, Registration and Remote Sensing survey – Collateral data collection – Input: Map scanning and digitication, Registration and Remote Sensing survey – Collateral data collection – Input: Map scanning and digitication, Registration and Remote Sensing survey – Collateral data collection – Input: Map scanning and digitication, Registration and Remote Sensing survey – Collateral data collection – Input: Map scanning and digitication, Registration and Remote Sensing survey – Collateral data collection – Input: Map scanning and digitication, Registration and Remote Sensing survey – Collateral data collection – Input: Map scanning and digitication, Registration,																				
– Raster Vs	- Raster Vs. Vector Comparison – File Formats for Raster and Vector – Data conversion between Raster and vector.																				
Unit-3 - Ra	Unit-3 - Raster and Vector Data Analysis 9 Hour																				
Raster Data	Laster Data analysis: Local, Neighborhood and Regional Operations – Map Algebra – Vector Data Analysis: Topological Analysis, point-in-polygon, Line-in-polygon, Polygon-in-Polygon – Proximity Analysis: buffering,																				
Init-4 - Ne	Intessen Folygon – Non-topological analysis. Altitolue data Analysis- concepts of SQL- ODBC Init-4 - Network Analysis and Surface Analysis																				
Network –	Creating Network	Data - Origi	n, Destination,	Stops, Barriers – Cl	losest Facility Analysis,	Service Area Anal	/sis, C	D Co	st matr	ix analy	vsis, S	hortes	t Path /	Analys	is – Ad	ddress	Geoco	ding –	Surfac	ce Ana	alysis
– DEM, DT	M - Point data to	Surface inte	erpolation – DEN	/ Representation – /	Applications.													-			-

Unit-5 - Data Output and Web Based GIS

Map Compilation – Cartographic functionalities for Map Design – Symbolization – Conventional signs and symbols – Spatial Data Quality – Lineage, Positional Accuracy, Attribute Accuracy, Completeness, Logical Consistency – Meta Data – Web based GIS: Definition, Merits – Architecture – Map Server – Spatial Data Infrastructure – Spatial Data Standards.

Learning Assessme	nt		1.							
		N 1	Continuous Learn	Sum	Summativo					
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test)%)	Life-Long CL (1)	g Learning A-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%	Server Brits and Ma	20%	10 10 1 Mar	20%	-			
Level 2	Understand	20%		20%		20%	-			
Level 3	Apply	30%	1	30%	1	<u> </u>	-			
Level 4	Analyze	30%		30%		30%	-			
Level 5	Evaluate	1000		and the second second		-	-			
Level 6	Create						-			
	Total	10	0%	10	0%	10	0 %			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Tune Usha, Scientist, NCCR, Ch <mark>ennai, us</mark> ha@nccr.gov.in	1. Dr. S. Sanjeevi, Professor, Anna University, Chennai ssanjeevi@annauniv.edu	1. Dr. R. Sivakumar, SRMIST
 Dr. Sarunjith K J, Scientist, NCSCM, Chennai, sarunjith@gmail.com 	2. Dr. C. Lakshumanan, Bharathidasan University, drlaks@gmail.com	2. Dr. Karuppasamy Sudalaimuthu, SRMIST

Course Code	21CEO322T	Cours Name	REMOTE SENSING AND GIS A	PPLICATION IN ENGINEERING	Cour	se ory	0				OPEN	ELEC	TIVE			;	L I 3 0	P 0	3
Pre-requ Cours Course	iisite es Offering Departme	<i>Nil</i>	Co- requisite Courses Civil Engineering	Nil Data Book / Codes / Standard	P	rogres Cours	sive ses					Nil	Nil	·					
Course L	earning Rationale (CLR):	The purpose of learning this course	is to:	r.	1		2.1	Progr	am Ou	itcome	s (PO))				P	rogra	im
CLR-1:	Study the forest a	nd water	applications mapping used in engineeri	ng techniques.	1	2	3	4	5	6	7	8	9	10	11	12	S οι	itcom	ic 1es
CLR-2:	Understand the ap	plicatior	is mapp <mark>ing potentia</mark> lities of remote sensi	ng data for Rock and Soil engineering					1		llity								
CLR-3:	Understand the co mapping in engine	ncepts c ering.	f urba <mark>n regional</mark> planning and Environme	ental Impact Assessment applications	edge		nt of	ons of		ociety	tainab		Nork		nce				
CLR-4:	Understand the co	oncepts o	of <mark>GIS data a</mark> nalysis tools and software's		INOL	SIS	omer	igati	sage	s put	Sus		am /	_	Fina	jing			
CLR-5:	Apply the Knowle spatial analysis ar	dge of (nd mode	GIS in identification of the data and inte l <mark>ling.</mark>	erpretation and perform various GIS	ering Kr	n Analy	/develop	ct invest	Tool U	gineer a	nment &		ual & Te	unicatio	: Mgt. &	ng Lean			
Course O	utcomes (CO):	-	At the end of this course, learners	vill be able to:	Engine	Problei	Design	Condu	Modern	The en	Enviror	Ethics	Individ	Comm	Project	Life Lo	PSO-1	PS0-2	PSO-3
CO-1:	Apply the acquire GIS techniques fo	d know <mark>le</mark> r fores <mark>t a</mark>	edge on remote sensing application dat and Water potentialities.	a separately and in combination with	3		2	3				-	-	-	-	3	-	-	-
CO-2:	Identify various ty and GIS application	pes of <mark>ro</mark> In tech <mark>ni</mark>	ock minerals and soil moisture estimatio ques.	n in combination with remote sensing	3			3	-	1	-	-	-	-	-	3	-	-	-
CO-3:	Apply the acquire techniques	d know	edge on urban and environmental ma	pping with remote sensing and GIS	3		Ŭ.	3	-			-	-	-	-	3	-	-	-
CO-4:	Disseminate the k	nowledg	<mark>e on vari</mark> ous data analysis tools in GIS s	software's	3	0.1	-	3	-	-	. -	-	-	-	-	3	-	-	-
CO-5:	Recognize the GI	S technic	g <mark>ues for va</mark> rious GIS earth sciences app	lications	3	-	-	3	-	-	-	-	-	-	-	3	-	-	-

Unit-1 - Remote Sensing in Forest and Water Applications

Forests – Forest type classification using multispectral data and density mapping. Forest stock mapping. Forest change detection. Forest fire detection and burned area mapping and fire vulnerability assessment. Applications of Laser in vegetation studies – Aerial and terrestrial.Water –Surface water resources assessment and management, Reservoir sedimentation. Performance evaluation of command areas. Integrated watershed development, water quality monitoring and mapping. Wetland mapping. Snow and Glaciers: Snow Cover Mapping, Glacier Mapping, Forecasting snow melt runoff.

Unit-2 - Remote Sensing in Rock and Soil Applications

Significance of Geological structures – Role of satellite Image interpretation characters – structural mapping – Fold, fault, Lineaments, Direction circular features. Intrusive rocks, rock exposure, Fractures and Joints – Rose diagram – Significance of landform – Geomorphological guide – Tectonic landforms – Fluvial landforms – Denudational landforms – Volcanic landforms – Importance of ground truth and geological field data collection – Geophysical survey – surface investigation – subsurface investigation. Soils– Soil mapping including generation of derivative maps like land capability, land irrigation and suitability for specific purpose. Land degradation mapping and monitoring. Soil erosion assessment and modeling, Soil moisture estimation using thermal and microwave data.

9 Hour

Unit-3 - Urban and Environmental Studies Applications

Concepts of Urban infrastructure demand analysis – regional planning and its applications – urban renewal land suitability analysis and services, and network planning – Urban landuse plan formulation – Urban growth /Sprawl modeling; Slum detection, monitoring and updating – Expert systems in mapping – Transportation interaction models – Intelligent transportation systems. Remote Sensing satellites for environmental Studies- an Overview; Environmental Policy- Legislation on water, air, noise, environmental protection act with special reference to legislation in India. Environmental Impact Assessment- an overview concepts, strategies, & methodologies – Web GIS.

Unit-4 - GIS Data Analysis Tools and Software

GIS – Data Input – Storage – Retrieval – Suitability of GIS software for Remote Sensing application in Engineering – Modeling with GIS – Decision support systems – Spatial interpolation, measurement and analysis methods, reclassification techniques, Buffer analysis, overlay analysis, Vector over lay analysis, Topological overlay, raster over lay analysis – measurement of length, perimeter and area – queries –2D to 3 D conversion- DTM and DEM, advantages and disadvantages, Network modeling – The Spatial Analyst Extension and Model Builder – Metadata – Georeferencing – Geocoding – Network Analyst – Interpolation and Surface Modeling – Interpolation Methods – Geodatabase – Building a Geodatabase – Cartographic Design. Overview of Application Software

Unit-5 - GIS Spatial Analysis and Modelling

GIS modeling, basic elements – classification, model processing, integration, Binary models, index model, regression models – linear regression model, logistic regression model, process model, applications – problem identification– designing data model, project management and evaluation – implementation. Remote sensing Applications in Engineering automated mapping (AM)/ Facility management (FM) Multi criteria evaluation using GIS Techniques – case studies - use of knowledge based tools with GIS - Expert system and DSS. Object oriented GIS, WEB based GIS Applications.

Learning Resources	 Anji Reddy .M, "Remote sensing and Geographical information system", B.S. Publications, 2011. Chestern, "Geo Informational Systems - Application of GIS and Related Spatial Information Technologies » ASTER Publication Co. 1992 	 Burrough. P.A. "Principles of GIS for Land Resources Assessment", Oxford Publication, 1980 SatheeshGopi, "Global Positioning System - Principles and Applications," Tata McGrawHill Publishing Company Limited, New Delhi (India), 2005 NPTEL: Course - GIS in Civil Engineering: https://nptel.ac.in/courses/105102015/8
	3. Jeffrey Star and John Estes, "Geographical Information System - An Introduction", Prentice Hall, 1990.	

Learning Assessme	ent 📃 👘						
			Continuous Learning	Assessment (CLA)	14 Mar 14	Sum	motivo
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (10	Learning A-2)%)	Final Ex (40% w	amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	- // //	20%	-	20%	-
Level 2	Understand	20%		20%		20%	-
Level 3	Apply	20%		20%	- /-	20%	-
Level 4	Analyze	20%		20%		20%	-
Level 5	Evaluate	10%	All Same	10%		10%	-
Level 6	Create	10%	PROPERTY OF THE OWNER.	10%		10%	-
	Total	10	0%	10	0%	10	0%

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
 Dr. T. Mayamanikandan, Project Scientist, NCCR, Chennai, maya@nccr.gov.in 	1. Dr. R. Kanmani Shanmuga Priya, Assistant Professor, Anna University, Chennai.	1. Dr. A. Manimaran, SRMIST
2. Dr. Tune Usha, Scientist, NCCR, Chennai	2. Dr. K. Nagamani Scientist-D/ Head, Centre for Remote Sensing and	2. Dr. S. Durgadevagi, SRMIST
	Geoinformatics, Sathyabama Institute of Science and Technology, Chennai	

B.Tech / M.Tech(Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

9 Hour

9 Hour

Course Code	21CEO323T Co	ourse ame	SPATIAL TECHNOLC	OGY IN ENGINEERING	C Ca	ourse tegory	y	0				OPEN	ELEC	TIVE			;	- T 3 0	P 0	C 3
Pre-requ Cours	isite N	il	Co- requisite Courses	Nil		Prog	gress ourse	sive es						Nil	1					
Course	Offering Department		Civil Engin <mark>eering</mark>	Data Book / Codes / S	Standards								Nil							
Course L	earning Rationale (CLR): The p	urpose of learning this cours	e is to:						Progra	am Ou	itcome	s (PO)				Pr	rogra	m
CLR-1:	Study GNSS satellites			10 200		1	2	3	4	5	6	7	8	9	10	11	12	OU SI	pecifi	c es
CLR-2:	Understand various da	ata sources	acquiring technologies	1 marine		e		f	s of	20	iety			¥		0				
CLR-3:	Learn advance techno	logies da <mark>ta</mark>	and processing	14 1 Sec. 5		ledg		ent o	tions	ge	soci			Mol		ance	D			
CLR-4:	Explore data processi	ng and analy	ysis	WCC- N	24	Mon	ysis	opme	stiga	Usaç	and	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		eam	ы	k Fin	rninç			
CLR-5:	Learn applications of s	spatial techn	ology in various specialization	start Starting		ering h	n Anal	/devel	ct inve	T Tool	gineer	nment ability		ual & T	unicati	Mgt. 8	ng Lea			
Course O	utcomes (CO):	At the	e end of this course, learners	will be able to:		Engine	Probler	Design	Conduc	Moderr	lhe en	Enviror Sustair	Ethics	ndividu	Commi	Project	life Lo	-SO-1	SO-2	-SO-3
CO-1:	Study and understand	the basics of	of spatial data acquisition satelli	ites	141.00	3		-	-	2	1	-	-	-	-	-	-	-		-
CO-2:	Learn various data ac	qui <mark>sition te</mark> cl	hnology for spatial data general	ion		3	-	3		-	-	-	-	-	-	-	-	-	-	-
CO-3:	Explore the current tee	chn <mark>ology an</mark>	d its importance in spatial data	acquisition	1	3				3	-	-	-	-	-	-	-	-	-	-
CO-4:	Apply the obtained know	ow <mark>ledge in</mark> d	lata processing and analysis		100	3	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Evaluate the role of sp	ati <mark>al techno</mark>	logy and its applications in vario	ous industries		3		14	3	3	25		-	-	-	-	-	-	-	-
			and the	بالألاحية وتحمله																
Unit-1 - G	NSS and Positioning				1 0'			(0.0		0.0		0 1	0			<u> </u>				Hour
Introductio	n to Global Navigation S	atellite Syst	em - GNSS Satellites – GPS Sa	ateilites – GPS System segmer	nts – Signa	I Struc	ture	of GPS	S – GP	5 6001	rainate	e Syster	m – G	PS Eri	ors – L	Jata pr	ocessii	1g - Ap	piicat	ions Hour
Introductio	on to spatial data _ Data	acquisition t	echniques - Satellite systems a	nd Sensors - Remote Sensing	Satellites	_ India	n Sa	tollitos	_ Aori	al nhot	ns - 4	orial P	hoto ti		Data n	rocass	ina Ter	hniau	9	noui
Unit-3 - D	rone Technology and I	aser Scanr	nina	na ochsors - remote ochsing	Outomico	mula	11 00	tomtos	Ach	ui priot	03 7			pes	Duiu pi	100033	ng roo	miyu	<u>,,,</u>	Hour
Introductio	n to Drone and Laser sc	anning - Dro	one data acquisition - Drone Dat	e processing software and harc	dware – Dro	one ap	plica	tion in	Engine	ering I	Indust	ries – T	errest	rial and	d Aeria	l Laser	Scann	er – C	ompo	nents
of Laser s	canning – Laser scannin	g data acqu	isition approaches – Data proce	essing					5											
Unit-4 - D	ata Processing and An	alysis		and the second line of the				100											9	Hour
Introductio	n to data processing – P	rocessing S	oftwa <mark>re – Types -</mark> Data Format	(Satellite, Aerial, Drone, Laser	Scanning) -	– Data	Тур	es – Da	ata Ana	alysis –	- Vect	or & Ra	ster –	Netwo	rk Ana	lysis –	Digital	Elevat	ion M	odels
- Surface	Analysis.	dan ladundu						_												Harrie
Introductio	phications in Engineer	ing industr al technolog	y av – Construction Engineering –	Transportation Engineering _	l Irhan Plar	nina _	. Voł	nicle Tr	acking		stor N	lanana	mont_	- Heali	h indu	strv			9	nour

Learning Resources	1. 2.	Alfred Leick, GPS Satellite Surveying, Wiley, Fourt Edition, ISBN 978-1-118-67557-1. David Wheatley and Mark Gillings, Spatial Technology and Archaeology, Taylor and Fancis, ISBN 0-203-30239-7	4. 5.	Otto Huisman and Rolf A. de By, Principles of Geographic Information Systems, The International Institute for Geo-Information Science and Earth Observation (ITC) Netherlands. Kang – Tsung Chang, Introduction to Geographic Information Systems, McGraw Hill Publishing, 2 nd
Resources	З.	Michael D., Introducing Geographic Information System with ArcGIS: A workbook		Edition, 2011
		Approach to Learning GIS, Jhon Wiley & Sons. Canada, ISBN 987-1-118-15980-4;		

			Continuous Learning	Assessment (CLA)		Sum	motivo			
	Bloom's Level of Thin <mark>king</mark>	Form CLA-1 Avera (50	native ge of unit test %)	Life-Long CL (1)	g Learning _A-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%		20%		20%	-			
Level 2	Understand	20%	Martin South	20%		20%	-			
Level 3	Apply	30%		30%		30%	-			
Level 4	Analyze	30%		30%		30%	-			
Level 5	Evaluate			10/2121			-			
Level 6	Create			- 19 F		-	-			
	Total	100 %			0 %	100 %				

Course Designers	经济保险 化化化化化 建金属法生产法	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. D. Vinu, Associate Vice President, DSM Soft Pvt, Ltd, Trichy	1. Dr. S. Kaliappan, Chair Professor, Anna University, Chennai	1. Dr. R. Sivakum <mark>ar, SRMI</mark> ST
2. Mr. Venkatraman Thennarasu, Director at TetraRays Limited,	2. Dr. J. Rajesh banu, Associate Professor, Central University	2. Dr. Karuppasamy Sudalaimuthu, SRMIST
Krishnagiri.	Tamilnadu	



B.Tech / M.Tech(Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses –Syllabi-Control Copy

Course Code	21CEO324T	Course Name	GIS AND S	SPATIAL ANALYSIS	Cou Cate	irse gory	0				OPEN	ELEC ⁻	TIVE			;	- T 3 0	P 0	C 3
Pre-requi Course	isite es	Nil	Co- requisite Courses	Nil		Progres Cours	ssive ses						Nil	1					
Course	Offering Departme	ent	Civil Engineering	Data Book / Codes /	Standards							Nil							
Course Lo	orning Potionalo		The nurness of learning this of	uree is to:			1.0		Drogra		itoomo	~ /DO	<u>،</u>				P	rogra	m
				Jurse 13 to.			T ₂		riogra			S (FU	,	40	44	40	S	pecifi	ic
CLR-1:	Study the princip	les of GIS			1	2	3	4	5	6	1	8	9	10	11	12	ou	Itcom	es
CLR-2:	Understand abou	ıt different d	ata used and formats	Section and and	e		of	Is of	10	ciety			ч		g				
CLR-3:	Learn the differen	nt models us	sed in GIS data	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	vled		ent	atior	ge	soc		_	Ň		Janc	Ð			
CLR-4:	Know the various	s spatial ana	lysis	WG- G	Knov	lysis	opru	stig: olem	Usa	and	ઝ્		Fear	u	& Fi	arnir			
CLR-5:	Aware on more a	dvanced sp	atial data analysis		, in the second s	Ana	evel	inve prot	00	neel	bility		∞ ŏ	icat	1gt.) Le			
		,	and the second second	1.5.2.2.2.2.2	leer	em	b/ug	duct	L L	engi	onn	ş	idua	unu	sct IV	-onc	5	-2	က္
Course Ou	utcomes (CO):		<mark>At the</mark> end of this course, learr	ers will be able to:	Ena:	Prob	Desi	Conc	Mode	The	Envi	Et i	ndiv	Com	Proje	Life	SO	DSG	DSO
CO-1:	Awareness on G	IS conce <mark>pts</mark>	and principles	Steel Fars	3	-		-	2	1	3	-	-	-	-	-	-	-	-
CO-2:	Knowledge on da	ata used in (GIS and its standards and accura	су	3	1.1	1.00	-	2	-	3	-	-	-	-	-	-	-	-
CO-3:	Apply the knowle	dge on <mark>GIS</mark>	models and data base manager	nent	3			-	2	- 10	3	-		-	-	-	-	-	-
CO-4:	Analyze the diffe	rent use <mark>s of</mark>	spatial data analysis	1000	3	-	-	-	2	-	3	-	-	-	-	-	-	-	-
CO-5:	Evaluate the adv	anced a <mark>ppli</mark>	<mark>cation</mark> of spatial data analysis for	decision making	3		1.30	-	2	2	3	-	-	-	-	-	-	-	-
Unit-1 - Ba	asics of GIS		2.0		- 2					e								9	Hour
Introduction	n to GIS, Compone	ents, GIS So	<mark>ftware,</mark> GIS Data types – Spatial	– Non-spatial, Data Representat	<mark>ions</mark> , Coordina	te Syste	em, Ge	ographi	c coord	linate	system	1 <mark>– Pro</mark>	<mark>ject</mark> ed	coordi	inate sy	/stem l	Project	tion,	
Unit-2 - Gl	S Data																	9	Hour
Sources of	^r GIS data, Maps –	Types, Data	a Input methods, Output products	s and methods, Data Conversion	- Vectorization	- Raste	risation	Meta d	lata, D	ata Ei	rrors, D	ata Sta	andard	Is					Hour
Topology	Data Accuracy. Ve	ctor data m	odel – Georelational Data model	- Coverage data structure - Rast	er data models	– Elen	nents - I	Raster	lata str	uctur	e DEM	– Tvn	es					9	nour
Unit-4 - Sp	patial Data Analys	is				LION		100107 1	ata oti	uotur	0, 0210	- yp						9	Hour
Terrain ma	pping and Analysis	s, Viewshed	analysi <mark>s, Least cost</mark> path analys	is, Query - Types, Buffering, Vect	tor Overlay Op	erations	s, Raste	r Overla	ay, Mea	asure	ments								
Unit-5 - Ac	dvanced Data Ana	lysis			11 0 "1													9	Hour
Reclassific	ation. Interpolation	– Local – G	ilopai. Spatial Models – Cartodra	pric models – Spatio-temporal m	iodels - Cell ba	sea Mo	aeis. M	uiti-Crit	eria an	alvsis	5								

Learning Resources	 Paul Bolstad," GIS Fundamentals: A First Te. 5th Edition, Eider Press, Minnesota 2016. Burrogh. P.A, "Principles of Geographical In Assessment", Oxford Publications, ISBN-13: Kang Tsung Chang, "Introduction to Geograp. Hill, 9th edition, 2019. 	xt on Geographic Information Systems" formation System for Land Resources 978-0198545927, 1986. hical Information System", Tata McGraw	 Paul A. Science Chandr 2000. Michae 	Longley, Michael F. Goodchild, David J. Maguire, David W. Rhind, "Geographic Information <mark>e & Systems</mark> ", Fourth Edition, John Wiley & Sons, Inc.,2015. a. A. M. and Ghosh S. K. "Remote Sensing and GIS", Narosa Publishing House, New Delhi, I N. DeMers, "Fundamentals of Geographic Information Systems", 2008.
			1	

			Continuous Learning	Assessment (CLA)	1 A	Summativo				
	Bloom's Level of Th <mark>inking</mark>	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Lon CL (1	g Learning _A-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%	and the state	20%		20%	-			
Level 2	Understand	20%		20%		20%	-			
Level 3	Apply 📃	30%		30%		30%	-			
Level 4	Analyze	30%	7 / L P 24	30%		30%	-			
Level 5	Evaluate		100 Car 30 Car	- 19 F		-	-			
Level 6	Create	- 18 N	Los Crase W	1		-	-			
	Total	10	0%	10	0 %	100 %				

Course Designers		2 Press
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sarunjith K J, Scientist, NCSCM	1. Dr. Rajesh Reghunath, Professor, University of Kerala	1. Dr. Aparna S Bhaskar, SRMIST
2Dr. Anoop V. Mohandas, GSI, Hvderabad	2. Dr. C. Lakshumanan, Professor, Bharathidasan University	2. Dr Sachikanta Nanda <mark>, SRM</mark> IST



Course Code	21CEO325T	Course Name	9		WEB GIS		(Cours Catego	se ory	0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3
Pre-requ Cours	isite es	Nil		Co- requisit Courses	e	Nil	-	Pr	ogres Cours	sive es						Nil	1					
Course	Offering Departme	ent	Ċiv	il Engin <mark>eering</mark>		Data Book / Cod	es / Standard	s							Nil							
Course L	oarning Pationalo			of loarning th	is courso is t		-	Program Outcomes (PO)										Program				
CLR-1	Learn the concern	ots of Open	n Web mannin		3 COUISE IS 10).		1 2 3 4				5		7	8	, α	10	11	12	S	pecif	ic
	Learn the concep	to of Open	n Web mappin	9 ~					2	J	J.	J	ر ک	, '	0		10		12	ou	itcom	les
CLR-2:	Learn the concep		n web mappin	<u>y.</u>		1.1		adge		it of	o suo		ociet			Vork		g				
CLR-S: Onderstand the very GIS rectifical basics						S. 6. 11	owle	SI.	mer	gatic ms	sage	s pu			am V	_	-inal	ing				
CLR-4: Obtain the concepts of MashUp						Local State	JКп	alys	elop	/esti	ol Uŝ	er a	it &		Te	ation	8 S	earn				
CLR-5: Gain the knowledge about Geo Portals and Implementation							erinç	m Ar	/dev	et in ex pr	n To	gine	nmel		ual 8	unica	t Mg	ng L				
Course O	utcomes (CO):		At the end o	of this course, I	earners will b	e able to:	uniter 27	Engine	Proble	Design	Condu	Moder	The er	Enviro	Ethics	ndivid	Comm	Projec	Life Lo	-SO-1	-SO-2	-SO-3
CO-1:	Understand conc	epts of <mark>Op</mark>	oen Web Mapp	ving		Pro Carlo		3	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO-2:	Remember the co	oncepts of	Web GIS	2.10		and states	15 (F)	3		12	3	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Gain the Technic	al Basic <mark>s o</mark>	of Web GIS			10 C	100	3			-	2	-	-	-	-	-	-	-	-	-	-
CO-4:	Apply the mashu	o conce <mark>pts</mark>	S	_	1.25	The second	100	3	-	-		3	-	-	-	-	-	-	-	-	-	-
CO-5:	Obtain the knowle	edge of <mark>Ge</mark>	eo portals and	Open Source w	eb concepts	11 1 T		3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
				200	Cardina .		14.4															
Unit-1 - In	troduction to Ope	n Web Ma	apping		framework of a		immortonoo a	fanar	wah		na inte	motio	nalan	an wah	atom	darda (lahad	hutha	0.000	9	Hour
Consortiu	e Basics, web Map m. explain the impoi	ping, Geos rtance of in	nternational or	ervices, OGC-II	developers. I	pen web mapping, isers and business	, importance o es	i oper	i web	таррі	ng, me	malio	паг ор	en web	stand	larus a	as pubi	isried i	by the	Open	Geos	spalial
Unit-2 - In	ternet Concepts &	Web GIS		<u>en etanadi de te</u>							12	17			1.1						9	Hour
Overview	of Internet concepts	s & features	es: In <mark>ternet pro</mark>	tocol, Domain N	lame System, I	Internet services, w	ww, Web serve	ers, We	eb cliei	nts. CC	al, The	web a	nd GIS	S, <mark>Web</mark>	GIS oi	igin an	d Evol	ution-c	oncept	t-Applic	cation	S.
Unit-3 - W	/eb GIS Technical	Basics					100 million (100 million)					125				_					9	Hour
Fundamer	ntals-principles-arch	nitecture-co	omponents-Th	<mark>in VS.</mark> thick Cl	lient architecti	ure- design develo	opment. Geos	patial	web s	service	s- We	bsite t	o web	o servi	ce-geo	spatial	l webs	ervice	functio	on-ser	vice t	types-
Unit-4 - G	eospatial Mashup	ce stanuari s	IU	9	100									-							9	Hour
Evolution-	Impact-web content	- t-function a	and interfaces	–Mashup desig	n and impleme	entation - challenge	s and prospec	ts-use	s and	benefit	s-supp	orting	technc	ology- s	olutior	and p	roducti	on.				
Unit-5 – 6	Geoportals																		·		9	Hour
Concept-u	ises-functions-archi	tectures-ge	eoportal appli	cations-challeng	es and prospe	ects. Web page de	sign principles	s, HTN	1L, XN	1L, dat	a forma	ats, he	lperap	plicatio	ons, Ja	ıva, da	tabase	s and	the W	'eb. Ap	plicat	ion of
Unternet se	ervices to GIS Intern	net GIS sof	ttware_interon	erability issues	& Onen GIS-C	SDI and NSDL Ani	plications-e-bu	siness	e-ao	vernme	ent											

Learning Resources	1. 2. 3.	Burrogh P.A., Principles of Geographical Information System for Land Resources Assessment, Oxford Publications, 1980 Pinde Fu and Jiulin Sun,Web GIS: Principles and applications, ISBN:9781589482456, ESRI, 2010 Randy Connolly & Ricardo Hoar, Fundamentals of Web Development, Pearson	4. 5. 6. 7.	Kang-tsung Chang, Introduction to Geographical Information System, Fourth Edition, Tata McGraw Hill,2008 AM Chandra SK GOSH "REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM, Narosa Publishing House Pvt LTD., India https://swayam.gov.in/nd1_noc20_de04/preview https://nptel.ac.in/courses/105/107/105107155
-----------------------	----------------	---	----------------------	--

		1111	Continuous Learning	Assessment (CLA)		Summotivo						
	Bloom's Level of Thi <mark>nking</mark>	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (1)	g Learning A-2 0%)	Final Examination (40% weightage)						
		Theory	Practice	Theory	Practice	Theory	Practice					
Level 1	Remember	20%	And the second second	20%		20%	-					
Level 2	Understand	20%		20%		20%	-					
Level 3	Apply	30%		30%		30%	-					
Level 4	Analyze	30%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	30%		<u>30%</u>	-					
Level 5	Evaluate		100 C	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		-	-					
Level 6	Create	- 14	Section of the section of the	1		-	-					
	Total	10	0%	10	0%	100 %						

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Er. Praves hlyer, Hexagon, Chennai, Prevish.lyer@intergragh.com	1. Dr. R. Srinivasa Raju, IRS, Anna University, Chennai	1. Dr. R. Sivakumar, SRMIST
	raju_irs@yahoo.com	
2. Dr. Tune Usha, Scientist, NCCR, Chennai, usha@nccr.gov.in	2. Dr. S. Ramesh, NIOT, sramesh@niot.res.in	2. Dr. Karuppasamy Sudalaimuthu, SRMIST



Course	21CE0401T	Course		Course	0		L	Т	Ρ	С
Code	210E04011	Name	BUILDING WATERIALS	Category	0	OFENELEGTIVE	3	0	0	3

Courses Courses Courses	
Course Offering Department Civil Engineering Data Book / Codes / Standards	Nil

Course L	earning Rationale (CLR):	The purpose of learning this course is to:		1	1	2.1	Prog	am Ou	utcome	s (PO)				P	Program Specific		
CLR-1:	Explore the concepts of Lo	pad bearing materials, testing procedure and properties of reinforced concrete	1	1 2 3 4 5 6 7 8 9 10 11 12							outcomes							
CLR-2:	CLR-2: Learn the non-load bearing materials of construction and its types and application				of	s of	1.	tiety			rk		e					
CLR-3:	CLR-3: Know the suitable floors and requirement of good truss system in buildings				lent (ation	ge	d soc		-	N No		Janc	Ð				
CLR-4: Get insight into suitable damp proofing, painting and identify the defects in plastering.			Kno	alysis	lopr	estig	Use	r and	~		Tear	ion	S F	arnir				
CLR-5: Get insight into building services like water supply, electricity and sewage disposal				n Ana	deve	t inve	Too	ginee	meni abilit		al &	nica	Mgt.	ig Le				
			ginee	blen	sign/	uduc aldr	dern	enç	viron	ics	vidu	nmu	ject	Lor	5	0-2	<u>-</u> 3	
Course O	outcomes (CO):	At the end of this course, learners will be able to:	ц	PG	De	Cor	Ň	The	Sus	E	pu	Col	Pc	Life	PS	PS	PS	
CO-1:	To gain knowledge of buil for better construction	ding materials such as stones, bricks, aggregates, cements and its properties	3		-	-	53		3	-	-	-	-	-	-	-	-	
CO-2:	To gain knowledge on no <mark>r</mark>	n-Load bearing materials, innovative materials	3	-		-	-	2	- 1	-		-	-	-	-	-	-	
CO-3: Identify the suitable floors, roofs in buildings		3	-	-	-	2	-	-	-	-	-	-	-	-	-	-		
CO-4: To gain knowledge about doors, windows, plastering, painting, damp proofing, scaffolding, shoring, underpinning and to take suitable engineering measures		3		S		-	2	-	-	-	-	-	-	-	-	-		
CO-5:	CO-5: Identify the suitable services in building at various aspects		3	6-	-	-	-	-	3	-	-	-	-	-	-	-	-	

Unit-1 - Load Bearing Materials of Construction

Introduction to conventional materials used in construction - stones, bricks, cement, mortar, concrete, steel and timber - manufacturing process, types, applications, properties, testing procedures and availability methods of improving ductility and fire resistance of concrete (principles only) - reinforced concrete, fibre reinforced concrete, prestressing principles, ferrocement - high strength concrete and high performance concrete - admixtures.

Unit-2 - Non-Load Bearing Materials of Construction

Wood based products – varnishes – distempers – asbestos – glass – tiles –terracotta – porcelain – stoneware –earthenware – geosynthetics - polymer products -fibre reinforced plastics - types, process of manufacture and application- innovative sustainable green building materials – translucent wood, other planet urbanizing materials etc:

Unit-3 - Lintel Floor and Roof

Definition - Function and classification of lintels - Balconies - Chajja and canopy – Arches - Elements and Stability of an Arch – Floors - Requirement of good floor - Components of ground floor - Selection of flooring material -Laying of Concrete - Mosaic, Marble – Granite - Tile flooring - Cladding of tiles – Roof - Requirement of good roof - Types of roof - Elements of a pitched roof - Trussed roof, King post Truss, Queen Post Truss, Steel Truss, Different roofing materials, R.C.C. Roof – Introduction to façade materials

Unit-4 - Plastering, Damp Proofing and Painting

Plastering and Pointing - purpose, materials and methods of plastering and pointing - defects in plastering - Stucco plastering - lathe plastering. Damp proofing- causes, effects and methods - Paints- Purpose – types - ingredients and defects - Preparation and applications of paints to new and old plastered surfaces - wooden and steel surfaces.

9 Hour

9 Hour

9 Hour

9 Hour Integration of services in buildings - water supply & plumbing layout for a residential building - elevators & escalators - planning & installation - basic components of the electrical system for a residence - typical electrical layout diagram. Lay out of external services -water supply- sewage disposal-electrical cabling

	1.	Punmia. B.C., Ashok Kumar Jain, Arun Kumar Jain, Building Construction, Laxmi	3.	Rangwala .S.C," Engineering Material"s, Charotar Publishing House, Anand, 2012.
Loorning		Publishing (P).Ltd. New Delhi-2, 2012.	4.	K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and
Deseuress	2.	Bhavikatti.S.S, Building Materials, Vikas Publishing House.Pvt. Ltd., New Delhi,		Technologies. New Age International, 2007.
Resources		2012.	5.	https://www.scientific.net/book/binders-materials-and-technologies-in-modern-construction-iii/978-3-
				0357-3157-6

Learning Assessme	nt										
-		N	Continuous Learning	g Assessment (CLA)		Cum	mativa				
	Bloom's Level of Thinking	Forma CLA-1 Averag (509	ative e of unit test %)	Life-Long CL (10	g Learning A-2 0%)	Final Examination (40% weightage)					
	2	Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%	The Part of the	20%		20%	-				
Level 2	Understand	20%	100 Car 100	20%		20%	-				
Level 3	Apply Television	30%	100 C 100 C 100	30%		30%	-				
Level 4	Analyze	30%		30%		30%	-				
Level 5	Evaluate		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	N. 1724-2	~		-				
Level 6	Create	7 No. 1 No. 1	2 S 4 S 1 S 3				-				
	Total	100	%	10	0 %	10	0 %				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Er. K. Jayasankar, Senior Vice President, Ultra Tech Cement Limited, Mumbai	1. Dr. R. Senthil, Professor, Anna University, Chennai	1. Dr. K.S.Satyana <mark>rayanan,</mark> SRMIST
 Dr. P. Manoharan, Regional Executive Engineer, Madurai, Municipal Administration. 	2. Dr. R. Baskar, Professor, Annamalai University, Chidambaram	2. Dr. N.Partha <mark>sarathi, SRMI</mark> ST

Course Code	21CEO402T Course INTRODUCTION TO ENVIRONMENTAL STUDIES				ITAL STUDIES	Cour Categ	se ory	0	OPEN ELECTIVE									L T P 3 0 0			
Pre-requi Course	site s	Nil		Co- requisite Courses		Nil	Pi	rogres Cours	sive es						Nil	1					
Course	Offering Departm	ent	Civil E	ingin <mark>eering</mark>	Dat	a Book / Codes / Stand	dards	-						Nil							
Course Le	arning Rationale	(CLR): The	e purpose of	learning this co	urse is to:	Prese and		1	1		Progra	am Ou	itcome	s (PO)				Pi	rogra	m
CLR-1:	gain knowledge o	of the physical,	chemical and	d biological aspec	t of the enviror	nment	1	2	3	4	5	6	7	8	9	10	11	12	S	pecifi Itcom	c es
CLR-2:	an overview of th	ne natural world	l w <mark>orks</mark>		1 - A		e		f	s of	1	ety			ž		0				
CLR-3:	CLR-3: understand issues facing the environment from a scientific and social perspective								ent o	ations	ge	soci		-	o Vo		Jance	ŋ		l	
CLR-4: explore how environment issues affect humans from multiple perspective						Kno	lysis	mqo	stig: olem	Usa	anc	৵		[ean	u	& Fir	arnin		ł		
CLR-5: explore solutions to environmental degradation through law, policy and human behaviour						heering	em Ana	gn/devel	uct inve lex prot	ern Tool	engineer	onment ainability	s	dual & ⁷	nunicati	ct Mgt.	ong Lea	.	5	ę	
Course Or	utcomes (CO):	At	the end of th	nis course, learn	ers will be abl	le to:	Engir	Probl	Desig	Cond	Mode	The e	Envir Susta	Ethic	Indivi	Comr	Proje	Life L	-OS	- DSC	- OS
CO-1:	Apply the acquire	ed knowl <mark>edge o</mark>	on environme	ntal protection.	1000	1 A	3	-	-	-	-		3	-	-	-	-	-	-	-	-
CO-2:	Identify natural re	esource <mark>s and it</mark>	<mark>'s c</mark> onservatio	on	12-2-		3		1	-	-	2	-	-	-	-	-	-	-	-	-
CO-3:	Identify variety of	f environ <mark>mental</mark>	<mark>l p</mark> roblems, a	nd solutions, in a	scientific conte	ext	3			-	2	- 10	-	-		-	-	-	-	-	-
CO-4:	Gain the knowled	dge on v <mark>arious</mark> .	<mark>so</mark> cial issues		A STATE	100 m	3	-	-	-	-	3	-	-	-	-	-	-	-	-	-
CO-5:	Know the enviror	nmental <mark>laws ar</mark>	nd ethics		1.5.50		3		1.1	-		1	3	1	-	-	-	1	-	-	-
llnit-1 - Fr	vironment and F	cosvstem			a selection of			-00				-	N		_					0	Hour
Introductio	n to Environmenta	I studies - Defi	inition, scope	and importance,	Ecology-Ecos	ystem, Types, Structure	and Fund	ction o	f Ecosy	/stem -	Fores	t ecos	ystem,	grass	land e	cosyst	em, de	sert ec	cosyste	em, a	quatic
ecosystem	s- Food chains, for	od webs an <mark>d ec</mark>	cological pyra	mids -Biodiversity	y and its Conse	ervation, Threa <mark>ts to b</mark> iod	liversity -N	eed fo	r Public	Aware	eness.										Haur
Forest res	atural Resources	ource Mineral I	resources	Food resources :	World food pr	oblems changes cause	d by agric	ulture	and o	/eraraz	ina Fi	nerav	resourc		Frowin	a eneri	nv nee	ds ren	ewahl	e anc	non-
renewable	energy sources, L	and Resources	s soil erosion	and causes for s	soil erosion, car	uses and effects of dese	ertification.	Role	of an in	dividua	al in co	nserva	ation of	natur	al resc	ources	-Equita	ble use	e of re	sourc	es for
sustainable	e development			- 74	6 N 17 3	W. A. ash I. W.					1						'				
Unit-3 - Po	ollution Control T	echnologies a	nd G <mark>lobal E</mark> l	<mark>nviro</mark> nmental Pro	oblem	Alter Street Life	1000				1									9	Hour
Environme	ntal Pollution: Defi	nition, causes,	effects and c	ontrol measures o	of air pollution,	water pollution, soil poll	ution, mari	ne pol	lution, I	noise p	ollution	n, therr	nal pol	lution a	and nu	clear h	azards	, Role	of an i	ndivid	ual in
prevention	of pollution. Case	studies.: Flood	ls, earthquake	<u>e, cyclone and lan</u>	idslides, Climat	te change, global warmi	ng														Harris
Erom Uno	ocial Issues and the	ne Environmei	mont Poccu	roo for a Crowing	, Population or	d Dolitical Implications	Solid was	to Mar	agam	nt: Ca	1000	footo	and co	ntrol		roo of .	urban a	nd ind	lustrial	9 Wast	nour
waste and	plastic waste: recv	cling and reuse	e Water cons	ervation: Rain wa	ter harvesting	watershed managemen	sonu was t. Resettle	e iviai ment a	and reh	abilitat	ion of r	people	its pro	oblems	and c	concern	iinaii a IS	inu inu	usuiai	Waste	;5. E-

Unit-5 - Environmental Ethics and Environmental Impact Assessment

Environment Ethics, Environmental Laws, Environmental Impact Assessment, RS and GIS in EIA, Environment Management Plan, Disaster management, Green Politics, Earth Hour, Green Option Technologies, ISO standards: ISO 9000 and 14000. Environmental communication and public awareness, Role of National Green Tribunal; EIA Formulations, stages, Merits and demerits: case studies (e.g., CNG vehicles, Bharat IV stage) Role of NGOs in the protection of environment

Learning Resources	1.	Erach Bharucha, ed., UGC	Textbook of Environmental Studies for Undergraduate Courses, 2nd 2.	. Kamaraj. P, Arthanareeswari. M, Environmental Science–Challenges and Changes, 6th Sudhandhira Publications, 2013	ed.,

Learning Assessme	ent	1.11					
			Continuous Learnin	g Assessment (CLA)	1.1	Gum	mativa
	Bloom's Level of <mark>Thinking</mark>	Form CLA-1 Avera (50	native ge of unit test 0%)	Life-Lon Cl (1	g Learning LA-2 0%)	Final Ex (40% w	amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%		20%		20%	-
Level 2	Understand	20%		20%		20%	-
Level 3	Apply	30%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	30%		30%	-
Level 4	Analyze	30%	1	30%		30%	-
Level 5	Evaluate		Los Crase Vo			-	-
Level 6	Create		10 10 10 10 10 10 10 10 10 10 10 10 10 1			-	-
	Total	10	0%	10	00 %	10	0 %
			and the second se				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Rajkumar Samuel, Hubert Enviro-Care Systems,	1. Dr. E. S. M Suresh, NITTTR, Taramani, Chennai.	1. Mr. K.C.Vinu Prakash, SRMIST
Chennai		
2. Mr. A. Abdul Rasheed, CMWSS Board	2. Dr. G. Dhinagaran, Asst. Professor, CES, Anna University	2. Mr. D. Justus Reymond, SRMIST



B.Tech / M.Tech (Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

Pre-requisite Courses Nil Co-requisite Courses Nil Progressive Courses Nil Course Offering Department Civil Engineering Data Book// Codes / Standards Nil Course Offering Department Civil Engineering Data Book// Codes / Standards Nil Course Learning Rationale (CLR): The purpose of learning this course is to: Program Outcomes (PO) Pro	Course Code	se 21CEO403T Course INTEGRATED WASTE MANAGEMENT									Cour Categ	Course O ategory O								L T 3 0	P 0	C 3			
Course Offering Department Civil Engineering Data Book / Codes / Standards Nil Course Learning Rationale (CLR): The purpose of learning this course is to: Program Outcomes (PO) Program Specific CLR-1: Study the various sources and classification of solid and hazardous waste 1 2 3 4 5 6 7 8 9 10 11 12 0 9 9 9 10 11 12 0 9 9 9 10 11 12 0 9 9 9 10 11 12 0 9 9 9 10 11 12 0 9 9 9 10 11 12 0 9 9 10 11 12 0 9 9 9 10 11 12 0 9 9 9 10 11 12 0 9 9 9 10 11 12 0 0 9 9 10 11 12 0 0 0 0 0 0 0 0 0	Pre-requi Course	site s	Nil			Co- requisi Courses	ite		Nil	-	P	rogres Cours	sive ses						Nil	1					
Course Learning Rationale (CLR): The purpose of learning this course is to: Program Outcomes (PO) Program Specific Specific Outcomes Specific CLR-3: Realize insights to the storage, collection and transport of waste I 2 3 4 5 6 7 8 9 10 11 12 0 90	Course (Offering Departn	nent		Civil E	Ingineering			Data Book / C	odes / Standa	rds							Nil							
CLF-1: Study the various sources and classification of solid and hazardous waste 1 2 3 4 5 6 7 8 9 10 11 12 outcomes CLF-2: Know the concepts related to waste characteristics and source reduction 9 9 9 10 11 12 outcomes CLR-3: Realize insights to the storage, collection and transport of waste 9 9 9 9 9 9 9 9 9 9 9 9 9 9 10 11 12 outcomes CLR-3: Realize insights to the storage, collection and transport of waste 9 10 11 12 outcomes 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10	Course Le	arning Rationale	e (CLR):	The pu	urpo <mark>se of</mark>	learning ti	his cou	ırse is to:	1			1			Progr	am Ou	utcome	s (PO)				P	rogra	m
CLR-2: Know the concepts related to waste characteristics and source reduction B<	CLR-1:	Study the variou	is source	s and clas	ssification	<mark>of s</mark> olid and	l hazarc	dous wast	e		1	2	3	4	5	6	7	8	9	10	11	12	0	itcom	ies
CLR.3: Realize insights to the storage, collection and transport of waste Image: Clr.4: Explore the concepts related to waste processing technologies CLR.4: Explore the concepts related to waste processing technologies Image: Clr.4: Explore the concepts related to waste disposal Course Outcomes (CO): At the end of this course, learners will be able to: Image: Clr.4:	CLR-2:	Know the conce	epts relate	d to wa <mark>ste</mark>	<mark>e charact</mark> e	eristics and	source	reduction		-	ge		of	s of	10	iety			ĸ		Ð				
CLR.4: Explore the concepts related to waste processing technologies Out Display Display <td>CLR-3:</td> <td>Realize insights</td> <td>to the st</td> <td>orage, <mark>coll</mark></td> <td>lection an</td> <td>d transport</td> <td>of waste</td> <td>е</td> <td>1.255</td> <td>Sec. Soft</td> <td>vledç</td> <td></td> <td>ento</td> <td>ution:</td> <td>ge</td> <td>soc</td> <td></td> <td></td> <td>No No</td> <td></td> <td>anci</td> <td>D</td> <td></td> <td></td> <td></td>	CLR-3:	Realize insights	to the st	orage, <mark>coll</mark>	lection an	d transport	of waste	е	1.255	Sec. Soft	vledç		ento	ution:	ge	soc			No No		anci	D			
CLR-5: Understand concepts related to waste disposal Image: State of the state of this course, learners will be able to: Image: State of the state of this course, learners will be able to: Image: State of the state of this course, learners will be able to: Image: State of the state of the state of this course, learners will be able to: Image: State of the state o	CLR-4:	LR-4: Explore the concepts related to waste processing technologies							Von	lysis	mdo	stige	Usa	and	∞ŏ		ean	и	& Fir	arnin					
Course Outcomes (CO): At the end of this course, learners will be able to: Image: Course of this course, learners will be able to: Image: Course of this course, learners will be able to: CO-1: Apply the acquired knowledge on building materials and products for construction. 3 - <td< td=""><td>CLR-5:</td><td colspan="7">LR-4: Explore the concepts related to waste processing technologies LR-5: Understand concepts related to waste disposal</td><td>50.3</td><td>leering h</td><td>em Ana</td><td>jn/devel</td><td>uct inve</td><td>ern Tool</td><td>angineer</td><td>onment ainability</td><td>S</td><td>dual & T</td><td>nunicati</td><td>ct Mgt. 8</td><td>ong Lea</td><td>.</td><td>ç</td><td>ę</td></td<>	CLR-5:	LR-4: Explore the concepts related to waste processing technologies LR-5: Understand concepts related to waste disposal							50.3	leering h	em Ana	jn/devel	uct inve	ern Tool	angineer	onment ainability	S	dual & T	nunicati	ct Mgt. 8	ong Lea	.	ç	ę	
C0-1: Apply the acquired knowledge on building materials and products for construction. 3 - - 3 - - - 3 -	Course Ou	tcomes (CO):		At the	end of t	his course,	learne	rs will be	able to:	Sugar.	Engir	Probl	Desig	Cond	Mode	The e	Envir Susta	Ethic	Indivi	Comr	Proje	LifeL	-OS-	-OS-	-OS
CO-2: Identify various building finishing materials and ferro cement applications for the building construction. 3 - - 2 -<	CO-1:	Apply the acqui	red know	l <mark>edge on</mark> b	building m	aterials and	l produc	cts f <mark>or co</mark> n	struction.	- Kisa.	3	-	-	-		-	3	-	-	-	-	-	-	-	-
CO-3: Apply the knowledge on the masonry, building transport and the termite treatment. 3 - - 2 -	CO-2:	Identify various	building f	i <mark>nishing</mark> m	naterials a	nd ferro cei	ment ap	oplications	for the building	g construction.	3	1	1	-	-	2	-	-	-	-	-	-	-	-	-
CO-4: Disseminate the knowledge on various eco-friendly building materials 3 -	CO-3:	Apply the knowl	edge on i	t <mark>he maso</mark> n	n <mark>ry</mark> , buildir	ng transport	and the	e termite t	reatment.	12.0	3	1	-	-	2	- 10	-	-		-	-	-	-	-	-
CO-5: Recognize the energy efficient buildings and cost-effective construction techniques 3 - - 3 -	CO-4:	Disseminate the	e knowlea	l <mark>ge on va</mark> ri	ious eco-t	riendly build	ding ma	aterials		100	3	-	-	-	-	3	-	-	-	-	-	-	-	-	-
Unit-1 - Sources and Types of Integrated Waste 9 Hd Introduction and Objective of Solid waste, Sources of solid wastes, Classification of Solid Wastes-Sources & Types based, quantity – factors affecting generation of solid wastes Hazardous waste and its typ Salient features of Indian Legislations on management and handling of Integrated wastes, Public health effect - Environmental effect, Case studies in hazards due to solid waste management Unit-2 - Characteristics of Solid Waste and Source Reduction 9 Hd Functional elements of integrated waste management, Characteristics – Physical, chemical and biological methods of sampling and characterization, Waste Stream Assessment (WSA), Source reduction (Basic Monitoring and Evaluation, Storage and collection of recyclables Unit-3 - Waste Collection, Storage and Transportation 9 Hd Methods of Collection - Hauled container, Stationary container and other collection methods, types of vehicles, collection routes, Transfer station, types and requirements, selection of location, operation a maintenance. 9 Hd Unit-4 - Waste Processing Techniques 9 Hd	CO-5:	Recognize the e	energy efi	f <mark>icient bu</mark> ild	dings and	cost-effect	ive cons	struction to	echniques		3	1.5	1.3	-	-	-	3	-	-	-	-	-	-	-	-
Introduction and Objective of Solid waste, Sources of solid wastes, Classification of Solid Wastes-Sources & Types based, quantity – factors affecting generation of solid wastes Hazardous waste and its typ Salient features of Indian Legislations on management and handling of Integrated wastes, Public health effect - Environmental effect, Case studies in hazards due to solid waste management Unit-2 - Characteristics of Solid Waste and Source Reduction Functional elements of integrated waste management, Characteristics – Physical, chemical and biological methods of sampling and characterization, Waste Stream Assessment (WSA), Source reduction (Basic Monitoring and Evaluation, Storage and Transportation Methods of Collection- Hauled container, Stationary container and other collection methods, types of vehicles, collection routes, Transfer station, types and requirements, selection of location, operation a maintenance. Unit-4 - Waste Processing Techniques Mechanical Volume and Size Reduction and Evaluation and Evaluation or compaction Size reduction or stredding. Processing techniques, Composting Incineration Purplysis, Casification Anagement Mechanical Volume and Size Reduction and Evaluation purply Volume reduction or compaction or stredding. Processing techniques, Composting Incineration Purplysis, Casification Anagem	Unit 1 Sa	urees and Turns	o of Inton	wated Wa	a a fa		10	al air		A Martin						5									Hour
Salient features of Indian Legislations on management and handling of Integrated wastes, Public health effect - Environmental effect, Case studies in haards due to solid waste management Unit-2 - Characteristics of Solid Waste and Source Reduction Functional elements of integrated waste management, Characteristics – Physical, chemical and biological methods of sampling and characterization, Waste Stream Assessment (WSA), Source reduction (Basic Monitoring and Evaluation, Storage and Transportation Unit-3 - Waste Collection- Hauled container, Stationary container and other collection methods, types of vehicles, collection routes, Transfer station, types and requirements, selection of location, operation a maintenance. Unit-4 - Waste Processing Techniques Hechanical Volume and Size Reduction and Equipment's Volume reduction or compaction. Size reduction or stredding. Processing techniques, Composting Incineration, Purplysis, Casification, Anagem	Introduction	n and Objective of	of Solid w	aste Sou	irces of su	olid wastes	Classif	fication of	Solid Wastes-	Sources & Typ	es base	d qua	ntitv –	factor	affect	tina ae	eneratio	n of s	olid wa	astes F	lazardo	us wa	ste an	nd its t	types
Unit-2 - Characteristics of Solid Waste and Source Reduction 9 Ho Functional elements of integrated waste management, Characteristics – Physical, chemical and biological methods of sampling and characterization, Waste Stream Assessment (WSA), Source reduction (Basic Monitoring and Evaluation, Storage and collection of recyclables Unit-3 - Waste Collection, Storage and Transportation 9 Ho Methods of Collection- Hauled container, Stationary container and other collection methods, types of vehicles, collection routes, Transfer station, types and requirements, selection of location, operation a maintenance. 9 Ho Unit-4 - Waste Processing Techniques 9 Ho	Salient feat	tures of Indian Le	gislations	: on manag	i <mark>gem</mark> ent a	nd handling	of Integ	grated wa	stes, Public he	alth effect - En	/ironme	ntal eff	ect, Ca	ase stu	dies in	hazar	ds due	to soli	d wast	e mana	agemer	nt na	oto un	<i>a no i</i>	<i>.,,,,,,,,,,,,,</i>
Functional elements of integrated waste management, Characteristics – Physical, chemical and biological methods of sampling and characterization, Waste Stream Assessment (WSA), Source reduction (Basic Monitoring and Evaluation, Storage and collection of recyclables Unit-3 - Waste Collection, Storage and Transportation Methods of Collection- Hauled container, Stationary container and other collection methods, types of vehicles, collection routes, Transfer station, types and requirements, selection of location, operation a maintenance. Unit-4 - Waste Processing Techniques Mechanical Volume and Size Reduction and Equipment's Volume reduction or compaction. Size reduction or shredding. Processing techniques, Composting Incineration, Purclusis, Casification, Anaero	Unit-2 - Ch	naracteristics of	Solid Wa	iste and S	Source Re	eduction				1000				1										9	Hour
Monitoring and Evaluation, Storage and Collection of recyclables Unit-3 - Waste Collection, Storage and Transportation 9 Hc Methods of Collection- Hauled container, Stationary container and other collection methods, types of vehicles, collection routes, Transfer station, types and requirements, selection of location, operation a maintenance. 9 Hc Mechanical Volume and Size Reduction and Equipment's Volume reduction or compaction. Size reduction or shredding. Processing techniques, Composting Incineration, Purplusis, Casification, Anaero 9 Hc Mechanical Volume and Size Reduction and Equipment's Volume reduction or compaction. Size reduction or shredding. Processing techniques, Composting Incineration, Purplusis, Casification, Anaero 9 Hc	Functional	elements of integ	rated wa	ste ma <mark>nag</mark>	gement, C	haracteristi	cs – Ph	iysical, ch	emical and biol	logical method	s of san	pling a	and ch	aracter	ization,	Wast	e Strea	m Ass	essme	ent (WS	SA), So	urce re	eductic	on (Ba	isics),
Unit-3 - Waste Collection, Storage and Transportation 9 Hi Methods of Collection- Hauled container, Stationary container and other collection methods, types of vehicles, collection routes, Transfer station, types and requirements, selection of location, operation a maintenance. Unit-4 - Waste Processing Techniques 9 Hi Mechanical Volume and Size Reduction and Equipment's Volume reduction or compaction. Size reduction or shredding. Processing techniques, Composting, Incineration, Purplusis, Casification, Anaero	Monitoring	and Evaluation, S	storage a	nd collection	ion of recy	<i>(clables</i>		_	1.11		-	-	_			-									
methods of contention induced container, stationary container and other contention methods, types of vehicles, contection routes, relation, types and requirements, selection of rotation, operation and the contention of the station	Methods of	f Collection, Hau	Storage a	and Trans	sportation	1 ntainer and	l other	collection	methods type	as of vehicles	collectiv	n rout	los Tr	ansfor	station	type	s and r	oquiro	monte	soloc	tion of	locatic	<u></u>	9 oratio	n and
9 Hc Mechanical Volume and Size Reduction and Equipment's Volume reduction or compaction. Size reduction or shredding. Processing techniques, Compacting, Incineration, Purolusis, Casification, Anaero	maintenand	CONECTION- 1180 Ce.			Tonary Co		ouner (conection	memous, type		conectio	in rout	cs, 11	ansier	31211011	, types	s and n	equile	mento,	30100		1004110	ni, ope	51 81101	i anu
Mechanical Volume and Size Reduction and Equipment's Volume reduction or compaction. Size reduction or shredding, Processing techniques, Composting, Incineration, Purolusis, Casification, Anapor	Unit-4 - Wa	aste Processing	Techniq	ues		1.							_											9	Hour
presentation volume and orze reduction and Equipments, volume reduction or compaction, orze reduction or sineduling, rideesing techniques- composing, including, including, rideesing, reduction, rigers, cashication, Anaelo	Mechanica	I Volume and Si	ze Reduc	tion and l	Equipmer	nt's, Volume	<mark>e reduc</mark>	tion or cc	mpaction, Size	e reduction or	shreddi	ng, Pr	ocessi	ng tecl	niques	s- Con	nposting	g, Inci	neratic	n, Pyr	olysis,	Gasifi	cation,	Anae	ərobic
degradation.,	degradation	n.,										_		-											
Unit-2 - Disposal 9HC Dumping of solid waste. Landfill, types, essential components, monitoring of landfill, Leachate collection & treatment. Environmental monitoring system	Dumping o	sposai f solid waste Met	hods of a	lumning of	of solid wa	ste Landfill	- types	essential	components r	nonitoring of la	ndfill I d	achat		tion &	treatm	ont Fr	wironm	ontal	monito	rina su	stom			9	nour

	1.	George Tchobanoglous, Hilary Theisen, Samuel Vigil, Municipal Solid Waste	4. CPHEEO, "Manual on Integrated waste management, Central Public Health and Environmental
Loarning		Management, McGraw Hill,1993	Engineering Organisation , Government of India, New Delhi, 2000.
Decourooc	2.	Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and Environmental	NPTEL Course-Integrated waste management. https://nptel.ac.in/courses/120108005/
Resources	З.	Resources Management, Hazardous waste Management, Mc-Graw Hill International	
		edition, New York, 2001.	Constant and Constant
			1.2

			Continuous Learning	Assessment (CLA)		Summative						
	Bloom's Level of Thin <mark>king</mark>	Form CLA-1 Avera (50	native ge of unit test %)	Life-Lon CL (1	g Learning _A-2 0%)	Final Ex (40% w	rative camination reightage)					
		Theory	Practice	Theory	Practice	Theory	Practice					
Level 1	Remember	20%		20%		20%	-					
Level 2	Understand	20%	Martin Line	20%	1.1.1.1	20%	-					
Level 3	Apply	30%		30%		30%	-					
Level 4	Analyze	30%		30%		30%	-					
Level 5	Evaluate		1.	10/2010			-					
Level 6	Create			- 19 F		-	-					
	Total	100)%	10	0 %	10	0 %					

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Rajkumar Samuel, Hubert Enviro-Care Systems, Chennai, rajkumar@hecs.in	1. Dr. E. S. M Suresh, NITTT TaramaniChennai esmsuresh@gmail.com	1. Dr. K. Prasanna, SRMIST
2. Mr. A. Abdul Rasheed, CMWSS Board, juruterarasheed@gmail.com	2. Dr. G. Dhinagaran, Asst. Professor, CES, Anna University, twinsdina@gmail.com	2. Mr. S. Dhanasekar, SRMIST



Course Code	21CEO404T	Cours Name	e e	LE DEVELOPMENT	Cat	ourse tegory	y	0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3		
Pre-requ Course	isite es	Nil		Co- requisite Cour <mark>ses</mark>		Nil		Prog	gress ourse	sive es						Nil	1					
Course	Offering Departme	nt	(Sivil Engin <mark>eering</mark>		Data Book / Codes / Sta	andards								Nil							
Course Le	earning Rationale (CLR):	The purpo	se of learning this	course is to	and the second				1		Progr	am Ou	utcome	s (PO)				P	rogra	im
CLR-1:	Study the importa	nce of Er	nvironment, l	Ecosystem and susi	tainability	200		1	2	3	4	5	6	7	8	9	10	11	12	- S	peciti utcom	ic 1es
CLR-2:	Know the current	issues re	elated t <mark>o envi</mark>	ronment				Ð		Ŧ	of	30	ety			ž						
CLR-3:	Realize the meas	urement	tool f <mark>or impa</mark>	cts on environment	- 1			ledg		ent o	tions	ge	soci			Moi		ance	-			
CLR-4:	-4: Explore the concepts about sustainability in material resources							Non	lysis	obme	stiga	Usaç	and	~~~		eam	ы	& Fin	ruin			
CLR-5:	Explore the concepts about sustainability in material resources Understand the sustainable strategies and policies							leering h	em Ana	jn/devel	uct inve lex prob	ern Tool	engineer	onment ainability	s	dual & T	nunicati	ct Mgt. 8	ong Lea	.	5	က္
Course O	utcomes (CO):		At the end	l of this course, le	arners will b	e able to:	197	=ngir	Probl	Desig	Cond	Mode	The e	Envir Susta	Ethic	ndivi	Com	Proje	_ife L	-SO	-OSc	-OSc
CO-1:	Apply the acquire	d knowl <mark>e</mark>	dge on value	s of Environment, E	Ecosystem a	nd sustainability theory.		3	-	-	-		1	3	-	-	-	-	-	-	-	-
CO-2:	Understand the va	arious e <mark>n</mark>	nvironmental .	ssues and current t	treatment/ dis	posal methods		3	-	1	-	_	2	-	-	-	-	-	-	-	-	-
CO-3:	Learn the impacts	cause <mark>d</mark>	<mark>by hum</mark> ans o	n environment and	their measu	ement tools		3		-		2	-	-	-		-	-	-	-	-	-
CO-4:	Know the change	s in ma <mark>te</mark>	erial resource	s and sustainable tr	raps	The second second	12	3	-			-	3	-	-	-	-	-	-	-	-	-
CO-5:	Explore the susta	inable str	<mark>rategies</mark> and	policies for practica	al applications		1	3	-		-	-	-	3	-	-	-	-	-	-	-	-
Unit-1 - So	ustainability and D	evelopm	n <mark>ent Cha</mark> llen	ges		ainability Sustainable Da	volonmon	ot Mod	lala	Stron	a ond l	Nook	Sustair	achility	Dofi	ning D	avalan	mont	Aillonn		9	Hour
Goals – M	indsets for Sustaina	bility, Glo	obal, Regiona	al and Local environ	nmental issue	s – Social insecurity - Reso	ource Deg	gradat	ion –	- Clima	ate Cha	nge –	Deser	tificatio	n n		evelopi	nent- i		ium De	sveiop	JIIIGIII
Unit-2 - El Climate Cl methods, I	nvironmental Conc hange – Air Issues E-waste – Human he	e rns – P (Ozone a ealth – Di	Present and depletion, sm liversity of life	Future og, other air polluta on the plant (popu	ants) – Wate lation stresse	r issues (Eutrophication, w s and ecology, Failure at la	vater qual arge scale	lity/acc e.	cess,	Pollut	tion) –	Land u	ise ch	anges -	- Was	te (qua	antity g	generat	ted, Tr	eatmei	9 nt/ dis	Hour sposal
Unit-3 - A	ssessing Progress	and Wa	y Forward	7		$\Lambda R \Lambda \sim 1.1$	1.1.1.			2.0		1				_					9	Hour
Sustainabi organizatio software–	ility in global, regiona ons - ISO and other certification potentia	al and na standaro I Handpr	ational cont <mark>ex</mark> ds - Systems rints - Trade-	t - Change in mater engineering – mate offs in Impacts and	rials used (his erial flow ana Decision-Ma	tory) & critical materials - E Iysis; lean/6S (certification king from Data	Energy an potential,	d foss) - Env	il fue viron	el cons imenta	umptio I Produ	n -Buil Ict Deo	dings - claratic	- Food s ons - Ca	systen arbon	ns - Tra Foot p	ansport rinting	tation - - Life (Busine Cycle A	esses a Ssess	and se ment	ervice using
Unit-4 - C	ross – Discipline C	onsidera	ations			*															9	Hour
Issues in c Sustainabi	leveloping countries ility traps: failed poli	: sanitatio cies to ao	ion and public ddress consu	: health, changes in mption (one-child, f	n material res forced steriliz	ources without correspondi ation, etc.)	ing chang	jes in t	treat	ment o	options	- Ethic	al issu	ues: link	ks betw	veen e	nvironi	mental	emissi	ons an	id pov	/erty -

Unit-5 - Sustainable Socio-Economic Systems

Corporate / Organizational responsibility (Sustainability strategy development, Management tools, Sustainable/ethical investment accounts, Silos and open access, Product development and design) - Policies for Sustainability (COP commitments, UK and other national directives, US approaches to sustainability policies) - Sustainability in Individual Lives (Behavioral changes, Activism and group networking) - Future of the planet - Careers in sustainability - Course recap

Learning Resources	1. 2.	F. Douglas Muschett, Principles of Sustainable Development, CRC Press, 2019 Bhavik R. Bakshi, Sustainable Engineering Principles and Practice, Cambridge University Press, 2019.	3. 4.	Catherine Mulligan, Sustainable Engineering: Principles and Implementation, CRC Press, 2019 Kauffman, Joanne, LEE, Kun Mo, Handbook of Sustainable Engineering, Springer 2013.
				av Va

Learning Assessment			100	1							
			Continuous Learnin	g Assessment (CLA)		Cum	mativa				
	Bloom's Level of Thinking Remember Understand Apply	Form CLA-1 Avera (50	ative ge of unit test %)	Life-Long CL (1)	g Learning .A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%		20%		20%	-				
Level 2	Understand	20%		20%		20%	-				
Level 3	Apply	30%		30%		<mark>30</mark> %	-				
Level 4	Analyze	30%	the trace of	30%		30%	-				
Level 5	Evaluate					- 11	-				
Level 6	Create		1 1 1 1 N 1	No. 2022			-				
	Total	100)%	10	0 %	10	0 %				

Course Designers	the second s		
Experts from Industry	Experts from Higher Te	echnical Institutions Int	ternal Experts
1. Dr. Rajkumar Samuel, Hubert Enviro-Car	e Systems, 1. Dr. E. S. M Suresh,	NITTTR Taramani Chennai, 1.	Mr. D. Justus Reymond, SRMIST
Chennai, rajkumar@hecs.in	esmsuresh@gmail.c	com 🔰	
2. Mr. A. Abdul Rasheed, CMWSS Board,	2. Dr. G. Dhinagaran, J	Assistant Professor, CES, Anna University, 2.	Mr. C. Vinuprak <mark>ash, SRM</mark> IST
juruterarasheed@gmail.com.	twinsdina@gmail.co	om	



Course Code	e 21CEO405T Course Name ROAD SAFETY AND AUDIT							se ory	0				OPEN E	ELEC	ΓIVE			l	- T 3 0	P 0	C 3
Pre-requis Course	site s	Nil	Co- requ Courses	isite	Nil		Pr	ogres Cours	sive es						Nil						
Course (Offering Departm	ent	Civil Engineerir	ng	Data Book / Code	es / Standard	S							Nil							
Course Lea	arning Rationale	(CLR): 7	The purpose of learning	this course i	is to:		-	1			Progr	am Ou	Itcome:	s (PO)				Pr	ograr	n
CLR-1:	Learn the safe de	esign of road	l geometri <mark>c feature</mark> s	- 10	1		1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	: es
CLR-2:	Study the data a	nalysis of ro	ad ac <mark>cidents</mark>	N		and have	e		of	s of	24	iety			rk		a)				
CLR-3:	Explore the safet	ty measures	in <mark>design of n</mark> ew roads a	nd in traffic op	perations	1000	vledo		ento	ations	ge	soc			oW r		ance	D			
CLR-4:	CLR-4: Know the safety aspects while reconstructing							lysis	mdo	stiga	Usa	and	৵		earr	ю	& Fir	arnin			
CLR-5:	CLR-5: Understand the concept of auditing the safety issues							lem Ana	jn/devel ons	uct inve lex prot	m Tool	engineer	onment	(0	dual & ⁻	nunicati	ct Mgt.	ong Lei	5	5	e.
Course Ou	tcomes (CO):		At the end of this cours	e, learners w	ill be able to:	Sec. 27.	Engir	Probl	Desig	Cond	Mode	The e	Envir Susta	Ethics	ndivi	Comr	Proje	-ife L	-OSc	-OSc	-OSc
CO-1:	Design the road	geometr <mark>ics i</mark>	for safety measures		Star Curs	N. 54	3	3	-	-	-	3		-	-	-	-	-	-	-	-
CO-2:	Analyze the acci	dent spo <mark>ts fo</mark>	or safety measures				3	3			-	3		-	-	-	-	-	-	-	-
CO-3:	Apply the safety	features <mark> in c</mark>	lesign of new roads and o	operations	1995 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -	2.00	3	3		-	-	3	-	2		-	-	-	-	-	-
CO-4:	Demonstrate the	safety a <mark>spe</mark>	cts in road reconstruction	1	1000	100	3	3	-	-	-	3	-	-	-	-	-	-	-	-	-
CO-5:	Organize the aud	dit for ro <mark>ad s</mark>	afety measures		1000		3	3	1.1	-	-	3	-	3	-	-	-	-	-	-	-
Unit-1 - Ro	ad Geometric Fle	ements and	Its Safety Measures	- Carl	A COLORADO	1000						5	<u> </u>							9	Hour
Cross-secti	ional elements, Su	ırface char <mark>a</mark>	cteristics, unevenness, ca	amber, kerb, r	oad margins and width,	light reflecting	g chara	acteris	tics - S	Sight dis	stance	requir	ements	, stop	<mark>oing</mark> , o	vertaki	ing sigl	nt dista	nces -	Horiz	ontal
curve - Ven	tical curve - safety	and control	measures at intersection	is - access col	ntrol measures - Level o	of service anal	ysis - I	On-roa	ad featu	ires, pa	arking,	lightin	g, mark	ing, b	usbays	s, Ianin	g				Hour
Analysis of	Individual Acciden	nts to Arrive	at Real Causes - Statisti	cal Methods o	f Analysis of Accident D	Data Applicatio	on of (Compu	ter Ana	alvsis o	f Accie	lent D	ata -Tra	ffic Fr	nainee	rina Si	tudies -	Statis	tical N	Jethor	ds In
Traffic Safe	ty Analysis, Regre	ession Meth	ods, Poisson Distribution	, Chi- Square	d Distribution, Statistical	I Comparisons	S- Traf	fic Mar	nagem	ent Me	asure	s And	Their Ir	nfluen	ce On	Accid	ent Pr	eventic	on .		
Unit-3 - Tra	Unit-3 - Traffic Safety in Design of New Roads and Operations										1									9	Hour
Ways of Ensuring Traffic Safety in Road Design considering the Features of Vehicle Fleet, Psychological Feat							of Driv	ers, N	atural a	and Me	teorol	ogical	Conditio	ons, S	tructur	e of Tr	raffic S	treams	, Orier	ntation	ı of a
Driver on th	Driver on the Direction of a Road beyond the Limits of Actual Visibility and Roadway Cross Section & Objects on							f-Way.	Ensur	ing Tra	ffic Sa	fety di	iring Re	epair a	nd Ma	intenar	nce, Pr	eventic	on of S	lipperi	ness
and Influen	ce of Pavement S	moothness,	Restriction speeds on Re	oads, Safety o	f Pedestrians, Cycle Pa	aths, Informing	Drive	rs on l	Road C	conditio	ns wit	h Aid c	of Signs	, Traff	ic Con	trol Lin	es & G	uidepo	sts, G	uardra	ails &
Barriers and	a Road Lighting	oonotruotio							_												Hour
Road Reco	inc Salely III Re	affic Safety	Reconstruction Principle	s Plotting of	Speed Diagram for Wo	rking out Per	onstru	ction	Project	s 1100	of Ac	rident	Data in	Plan	nina P	oroneti	ruction	of Ros	ade F	yamnl	as of
Reconstruc	tion of Selected R	Road Section	s for Improving Traffic Sa	afety. Improvin	a Traffic Conditions on	Grades, Shar	p Curv	es. Re	edesia	of Inte	ersecti	ons. C	hanneli	zed A	t-Grad	e Inters	section	s. Bus	Stops	. Park	ina &
Rest Areas and Effectiveness of Minor Road Improvements.								,				, e						.,			3 ~

Unit-5 - Road Safety Audit

Key elements of a road safety audit, Road Safety Audits & Investigations, Work zone safety audit; Crash investigation and analysis, Methods for identifying hazardous road locations, Case Studies - Procedures and Practice, Code of Good Practice and Checklists. Road Safety Issues and Various Measures through Engineering, education and enforcement measures for improving road safety.

1.0					
		1.	Athelstan Popkess, Traffic Control and Road Accident Prevention, Chapman and Hall, 1997	4.	J. Stannard Baker, Traffic Collision Investigation, Northwestern University Center for Public
			(Digitized 2008)		Safety, 2002.
	Learning	2.	Ezra Hauer, Observational Before-After Studies in Road Safety, Pergamon Press, 1997	5.	BABKOV, V.F. Road conditions and Traffic Safety, MIR, publications, Mascow - 1975.
	Resources		(reprinted 2002)	6.	K.W. Ogden, Safer Roads - A Guide to Road Safety Engg. Averbury Technical, Ashgate
		3.	Kadiyali, L.R., Traffic Engineering and Transport Planning, Khanna Publications, New Delhi,		Publishing Ltd., Aldershot, England, 1996.
			2009.		

Learning Assessmen	t	~ ~ /									
			Continuous Learnin	g Assessment (CLA)		Summative Final Examination (40% weightage)					
	Bloom's Level of Thinking	Form CLA-1 Avera (50	ative ge of unit test %)	Life-Lon CL (1	g Learning LA-2 0%)						
		Theory	Practice	Theory	Practice	<u>Th</u> eory	Practice				
Level 1	Remember	20%		20%		20%	-				
Level 2	Understand	20%	and the second second	20%		20%	-				
Level 3	Apply	30%		30%		30%	-				
Level 4	Analyze	30%		30%	< - V	<u>30%</u>	-				
Level 5	Evaluate	7 B (- Permit		-				
Level 6	Create			and the second second		-	-				
	Total	100)%	10	0 %	10	0 %				

Course Designers	Testa and the second second	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
 Dr. Asif Ahmed, Business manager, Ingevity, ahmed.asif@ingevity.com 	1. Dr. Venkaiah Chowdary, Professor, NITW, vc@nitw.ac.in	1. Dr. A. Padma Rekha, SRM IST
 Mr. Ankit Pachouri, Transport Planner, IUT, New Delhi, ankit.pachouri@iutundia.org 	2. Dr. V Sunitha, Associate Professor, NITT, sunitha@nitt.edu	2. Mr. G. Sivaprakash, SRM IST

B.Tech / M.Tech(Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses –Syllabi-Control Copy

Course Code	e 21CEO406T Course TRANSPORTATION SYSTEMS							(Cours Catego	se ory	0				OPEN	ELEC	ΓIVE			l	- T 3 0	P 0	C 3		
Pre-requi	isite es		Nil		Co- requis Courses	site		Ni	lil		Pr	ogres Cours	sive es						Nil						
Course	Offeri	ng Departme	ent	Ċi	vil Engi <mark>neerin</mark> g	J		Data Book	(/ Codes / S	standard	s							Nil							
Course Le	earnin	g Rationale	(CLR): 7	The purpos	e <mark>of learnin</mark> g	this cou	rse is to:				ł.	đ	π		Progr	am Ou	Itcome	s (PO))				Pi	rogra	m
CLR-1:	Stua	y the charact	teristics of ro	road tran <mark>spo</mark>	rt system	- \		20			1	2	3	4	5	6	7	8	9	10	11	12	S ou	pecifi tcom	c es
CLR-2:	Expl	lore the comp	onents and	d cont <mark>rol mea</mark>	<mark>asure</mark> s of railw	ay tra <mark>nsp</mark>	port syster	ms	and strength	-	ge		of	s of	10	iety			ork		е				
CLR-3: Know the facilities in the airway transport systems							vled		ent o	ation	ge	l soc		-	n Wo		Janc	Ð							
CLR-4: Learn the facilities of ports and harbour							Kno	Ilysis	opm	stig: olem	Usa	r and	৵		Tear	io	& Fii	arnir							
CLR-5: Understand the special modes of transportation systems							leering	em Ana	jn/devel	uct inve lex prot	rn Tool	enginee	onment	0	dual & ⁻	nunicat	ct Mgt.	ong Le:	5	2	3				
Course O	utcom	es (CO):		At the end	of this course	e, learnei	rs will be	able to:	Anos	. 27	Engir	Probl	Desig	Cond	Mode	The e	Envir Susta	Ethic	ivibu	Comr	Proje	_ife L	-OSc	-OSc	-OSc
CO-1:	Dete	ermine the fea	atures o <mark>f the</mark>	e road trans	portation syste	m		1-1 × 15	1.00	54	3	3	-	-	-	3	-	-	-	-	-	-	-	-	-
CO-2:	Deri	ve the compo	onents o <mark>f rai</mark>	<mark>ailway</mark> transp	ortation syster	ns and its	s control r	measures	10.2		3	3	10	-	-	3	-	-	-	-	-	-	-	-	-
CO-3:	Obta	ain the facilitie	es in air <mark>way</mark>	<mark>y tran</mark> sportati	ion system	1.00	3.65	1.0	8. 8		3	3	-	-	-	3	-	-		-	-	-	-	-	-
CO-4:	Cha	racterize the	facilitie <mark>s of v</mark>	waterway tra	ansportation sy	ystems	25.5	10.2	1	1	3	3-	10		-	3	-	-	-	-	-	-	-	-	-
CO-5:	Dem	nonstrate the	special <mark>tran</mark>	<mark>nsport</mark> ation s	ystems global	ly	1.50	5-2			3	3	1	-	-	3	-	-	I	-	-	-	-	-	-
Unit-1 - R History of I curve, sup	oadwa Road L erelev	ay Transport Development ation, extra-w	ation plans - High videning, tra	ihway plannii ansition curv	ng and alignme e- Vertical cun	ənt, requi ve, sumn	irements, nit and val	factors cont lley curvey -	trolling the a	lignment ns, types	- Cros and c	s-sect	tional e s, cont	lement rol mea	s - Sig sures	ht dista - Pave	ance re ment, t	quiren ypes, I	ients, a nateria	all type al chara	s of sig acterist	ht dista ics, fac	ances- tors a	9 Horiz	Hour contal
pavement	design	n			1.52				100				_	14	-7										
History of I gradients,	aııway Railwa transit	y developme iy developme ion curve - Tu	tion nt - Perman urnouts, poii	nent way, Co iints and cros	mponents of p	ermanen ents, type	nt way - Ra es - Signa	ails, Sleepei Is, types - Ir	ers, Ballast, S Interlocking -	Subgrade railways	(funct statio	ions, t is and	ypes) I juncti	Conin	g of wh bes - Y	neels - 'ard <mark>s, f</mark>	Track I	aying is and	oroces types ·	s - Trai - Maint	ck Geo enance	metrics e opera	s, supe tions	9 erelev	Hour ation,
Unit-3 - Ai	irway	Transportati	on			12				4	1								,					9	Hour
History of configurati	Airwa ions - a	ys developm airport markin	ent - Maste a and lightir	er plan and ina	layout - Com	oonents o	of airport,	, runway, ta	axiway, hang	ger, apro	on, teri	ninal	buildin	gs - Ai	rcraft	parking	g syste	ms - (Control	meas	ures, N	/FR ar	nd IFR	- Ru	nway
Unit-4 - W	Init-4 - Waterway Transportation 9 Hour																								
History of unloading	-listory of Waterway transportation - Ports and Harbour - Classification - Natural Phenomena, waves, tides, littoral drift - ship characteristics - entrance facilities - approach facilities - protection facilities - loading and unloading facilities - dock facilities - mooring facilities - navigational facilities - turning basin - fendors - dredging facilities																								
Unit-5 - Sp	pecial	Transportat	ion System	n																				9	Hour
Urban tran public tran	ban transportation systems - Mass rapid transit system - Light rail transit - Personal rapid transit, guided way systems, cabin taxi, dual mode bus - Para transit systems - Demand responsive system - Intermediate blic transport.																								

				Summativa						
	Bloom's Level of Thin <mark>king</mark>	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (10	r Learning A-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	20%		20%	-			
Level 2	Understand	20%	States in	20%		20%	-			
Level 3	Apply	30%		30%		30%	-			
Level 4	Analyze	30%		30%		30%	-			
Level 5	Evaluate	· · ·		10/2/2010			-			
Level 6	Create		10 C - 30 C	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		-	-			
	Total	10	0%	10	0%	100 %				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
 Dr. Asif Ahmed, Business manager, Ingevity, ahmed.asif@ingevity.com 	1. Dr. Venkaiah Chowdary, Professor, NITW, vc@nitw.ac.in	1. Dr. A. Padma Rekha, SRM IST
 Mr. Ankit Pachouri, Transport Planner, IUT, New Delhi, ankit.pachouri@iutundia.org 	2. Dr. V Sunitha, Associate Professor, NITT, sunitha@nitt.edu	2. Mr. G. Sivaprakash, SRM IST



Course	21CEO407T Course RHEOLOGY OF COMPLEX MATERIALS				Cour Categ	Course O OPEN ELECTIVE								l	- T 3 0	P 0	C 3		
Pre-requis Courses	site S	Nil	Co- requisite Courses	Nil	P	rogres Cours	sive ses						Nil	1					
Course C	Offering Departme	nt	Civil Engin <mark>eering</mark>	Data Book / Codes / Star	ndards							Nil							
Course Lea	arning Rationale (CLR): 7/	he purpose <mark>of learning</mark> this c	course is to:		Program Outcomes (PO)											Pr	ogra	n
CLR-1:	Understand the ba	asics of cont	inuum mechanics		1	1 2 3		4 5		6	7	8	9	10	11	12	Specifi		c es
CLR-2:	CLR-2: Comprehend different linear viscoelastic functions						Ŧ	of	20	ety			¥						
CLR-3:	-3: Explore different models to model the behavior of linear viscoelastic materials							tions	Ge	soc	1		Wo		ance	D			
CLR-4:	Know various non	linear viscoe	elastic models	West- and	Vow	ysis	bmdo	stiga	Usa	and	ø		eam	ы	k Fin	rnin			
CLR-5:	CLR-5: Explore different experimental approaches to characterize the flow behavior of material						n/devel	uct inve lex prob	m Tool	ngineer	onment inability		dual & T	nunicati	ct Mgt. 8	ong Lea	~	2	3
Course Ou	tcomes (CO):	A	t the end of this course, lear	rners will be able to:	Engin	Proble	Desig	Condi	Mode	The e	Envire Susta	Ethics	Individ	Comn	Proje	Life L	PSO-	PSO-	-OS4
CO-1:	Apply the basics of	of conti <mark>nuum</mark>	mechanics to capture differen	t flow behavior of the material	3	3	-	2	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Characterize the r	mechan <mark>ical p</mark>	properties of the viscoelastic m	naterial	3	3	-	2	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Model the behavio	or of lin <mark>ear vi</mark>	iscoelastic material		3	3	-	2	-	- 10	-	-		-	-	-	-	-	-
CO-4:	Analyze the nonlir	near vis <mark>coela</mark>	astic flow behavior of the mate	rial	3	3	-	2	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Apply various exp	erimen <mark>tal te</mark> e	<mark>chniq</mark> ues to characterize the flo	ow behavior of the material	3	3	1.1	2	-	2	-	-	-	-	-	-	-	-	-
Unit-1 - Co Vectors and momentum.	ntinuum Mechani I tensors - Differen Conservation of e	cs tiation of ter nerav	nsors - Kinematics of Deforma	ation - Lagrangian and Eulerian derivati	ives - veloc	ity and	l accele	eration	- Balar	nce La	aws, co	nserva	ation of	f mass,	balan	ce of li	near a	9 nd an	Hour gular
Unit-2 - Lin	ear Viscoelastic I	Behavior			•			1	1									9	Hour
Elastic resp	onse, viscous resp	onse and vis	sc <mark>oelastic r</mark> esponse – Linear v	iscoelastic properties and its relation - E	Boltzman pr	inciple	e - time	temper	ature s	super	positior	1							
Unit-3 - Lin	ear Viscoelastic I	Models - May	well element Voiat kelvin eler	ment and generalized models - respons	e to creen	strass	relava	tion and	loscilla	atory	shearin	a _ Int	ogral r	nodels				9	Hour
Unit-4 - No	nlinear Viscoelas	tic Behavior	r			511000	ТСГАХА	uon une	10301110		Shcann	g m	cyrain	100013				9	Hour
Elementary	theories of non-line	ear viscoela:	stic beha <mark>vior – Fourier</mark> Transfo	ormations and nonlinearity - nonlinear n	nodels	A.4.													
Unit-5 - Rh	eometry and non-Newtonia	n fluide - cha	ar stress, shear strain and she	par rate – flow curve, zero shear viscosi	ity - Flow m	asur	monte	- canill	any visy	omet	er rota	tional	and co	no ano	nlate	iscom	otor	9	Hour

	1. A.S. Wineman and K. R. Rajagopal, Mechanical Response of Polymers: A	n 4. W. N. Findley, J. S. Lai and K. Onaran, Creep and Relaxation of Nonlinear Viscoelastic Materials,
Learning Resources	 M. T. Shaw and W. J. MacKnight, Introduction to Polymer Viscoelasticity, 3rd Ed Wiley-Interscience, 2005 	 5. A.C. Pipkin, Lectures on Viscoelasticity Theory, 2nd Ed., Springer, 1986 6. B. M. Christensen, Theory of Viscoelasticity, Dover, 2nd Ed., 1982
	 E. Riande, R. Diaz-Calleja, M. G. Prolongo, R. M. Masegosa, C. Salom, Polym viscoelasticity, CRC Press, 1999 	r 7. J. D. Ferry, Viscoelastic Properties of Polymers, 3rd Ed., Wiley, 1980.
	viscoelasticity, CRC Press, 1999	

		Sum	mativa							
	Bloom's Level of Th <mark>inking</mark>	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Lon Cl (1	g Learning LA-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%		20%		20%	-			
Level 2	Understand	20%		20%		20%	-			
Level 3	Apply	30%	2 1 1 1 1 A	30%		30%	-			
Level 4	Analyze	30%	100 C - 3 3 100	30%		30%	-			
Level 5	Evaluate		the second second	4		-	-			
Level 6	Create		200 E		-	-	-			
	Total	10	0%	10	0 %	100 %				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Asif Ahmed, Business manag <mark>er, Ingev</mark> ity,	1. Dr. Venkaiah Chowdary, Professor, NITW, vc@nitw.ac.in	1. Dr. A. Padma Rekha, SRM IST
ahmed.asif@ingevity.com	and the state of the second state of the secon	
2. Mr. Ankit Pachouri, Transport Planner, IUT, New Delhi,	2. Dr. V Sunitha, Associate Professor, NITT, sunitha@nitt.edu	2. Mr. G. Sivaprakash, SRM IST
ankit.pachouri@iutundia.org		



Course Code	21CEO408T Course Name WATER CONSERVATION AND MANAGEMENT						Cours atego	e ory	0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3
Pre-requi Course	site s	Nil	Co- requisit Course <mark>s</mark>	;	Nil		Pro	ogres Cours	sive es						Nil	1					
Course	Offering Departm	ent	Civil Engineering		Data Book / Codes / S	tandards	1.							Nil							
-				-			-	100	1				_								
Course Le	arning Rationale	(CLR): The	e purpo <mark>se of learnin</mark> g th	s course is	to:		Program Outcomes (PO)										Program Specific				
CLR-1:	Study managem	ent and monito	ring of <mark>water res</mark> ources	10	1		1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	es
CLR-2:	Understand aqui	ifer properties a	n <mark>d treatment</mark> techniques	1 . A	C. and the second	-	ge	-	of	s of	20	iety			rk		a)				
CLR-3: Know the methods to conserve water						100	vledç		ento	ation:	ge	soc			Mo No		anci	ß			l
CLR-4:	CLR-4: Learn the importance of community involvement in water conservation						Knov	lysis	mqo	stige	Usa	and	৵		Team	и	& Fir	arnin			
CLR-5:	CLR-5: Understand Acts and policies in water management						ering I	m Ana	ns ns	ct inve ex prot	n Tool	Igineer	nment		ual & J	unicati	t Mgt.	ng Lea			
Course Or	utcomes (CO):	At	the end of this course, i	earners will	be able to:		Engine	Proble	Design	Condu	Moder	The er	Enviro Sustai	Ethics	Individ	Comm	Projec	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Apply acquired k	nowledg <mark>e to m</mark> a	anage surface and groun	l water	and there is	Sec. 1	3	1			4-5	3	3	-	-	-	-	-	-		-
CO-2:	Identify different	types of polluta	nts and its effect	182	See and the		3		12	-	-	3	3	-	-	-	-	-	-	-	-
CO-3:	Disseminate the	knowled <mark>ge on t</mark>	various irrigation methods	to save wat	er	1	3	1	1.2	-	_	3	3	-		-	-	-	-	-	-
CO-4:	Recognize the ro	oles of P <mark>anchay</mark>	<mark>at</mark> raj, NGO's and Educa	ional instituti	ions	10	3	-		-	-	3	3	-	-	-	-	-	-	-	-
CO-5:	Apply the Acts a	nd polici <mark>es at S</mark>	tate and National level pr	ojects	and a state of the	1.1	3	1	1.1	-	-	3	3	-	-	-	-	-	-	-	-
Unit-1 - M	anagement and N	Ionitoring of V	Vater Resources	Contast.	in the second						-	÷		-						0	Hour
Water and	its importance – S	Sources. Geogra	aphical distribution. Quali	v and Water	cvcle – Influence of huma	n activity o	on the	wate	r cvcle	- Surfa	ace wa	ter res	sources	- Eler	nentar	v know	ledae (of arou	nd wa	ter – V	Nater
quality and	its impact on hum	nan beings							.,							-	- J	9		-	
Unit-2 - W	ater Pollution and	d Quality Asse	ssment							1	-7			-						9	Hour
Soil and a	quifer properties a	nd their effect o	on ground water - Differe	it types of p	ollutants - Effects of polluta	ants on w	ater q	quality	, organ	nisms a	nd hu	man h	ealth -	Water	borne	diseas	ses and	d its co	ontrol -	Treat	tment
techniques	of used water, us	e of recycle wa	ter - Water supply in urba	and rural a	reas		-		-		100	-									
Different r	onservation of wa	ater vo wotor in indu	ustrian Water requeling	Mothodo te	o conconio wator in ogriqu	Ituro Sou	rinklor	r drin	irrigot	ion roc	t irria	otion	uno of r	olum	oro dri	land	forming	aaro	forosí	9	HOUR abord
developme	Different methods to conserve water in industries - water recycling – Methods to conserve water in agriculture - Sprinkler, drip irrigation, root irrigation, use of polymers, dry land farming, agro forestry, orchard development, retational cron method. Water saving occurrence crops																				
Unit-4 - Co	ommunity Involve	ement and Wat	er Analysis	1.00		-														9	Hour
Communit	/ involvement in v	vater managem	ent - Roles of Panchaya	. Raj institut	ions, NGO's, Educational	institution	s, Me	dia, P	Political	l parties	s and	farmei	rs asso	ciatior	ns – El	ementa	ary ide	a of w	ater ar	nalysis	s and
Instrument	s used - Chemical	analysis with th	he help of portable <mark>instrum</mark>	ent					-												Hour
Acts / Polic	cies related to wate	er management	and conservation at cen	ral and state	levels- Administrative mac	hinery for	imple	ment	ation fr	om sta	te to P	ancha	vat leve	els						9	nour
. 1010 / 1 0/10			and concervation at Com	a. and otalo								anona	,								

Learning	1.	Ahuja, Satinder 2008, Arsenic Contamination of ground water	4.	Bennison, E.W. 1947, Ground water its development, uses and conservation
Desources	2.	Singhal, B.B.S and Gupta, R.P., 1999, Applied hydrogeology of fractures Rocks	5.	Ganoulis 2009, Risk analysis of water pollution, Wiley interscience
Resources	3.	Todd D.K , 1980, Ground water hydrology, John wiley and sons		

Learning Assessment	t			ALC: NO					
			Continuous Learni	Cum	mativa				
	Bloom's Level of Thinking	Forma CLA-1 Averag (50	ative je of unit test %)	Life-Loi C (ng Learn <mark>ing</mark> CLA-2 10%)	Final Examination (40% weightage)			
		Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	20%	and the second second	20%		20%	-		
Level 2	Understand	20%		20%	1.2	20%	-		
Level 3	Apply	30%	1.5.6	30%		30%	-		
Level 4	Analyze	30%	The second second	30%		30%	-		
Level 5	Evaluate		1.1.1.1.1.1			-	-		
Level 6	Create	SV/		A CONTRACTOR		-	-		
	Total	100	%	1	00 %	10	0 %		

Course Designers	A state of the						
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts					
 Mr. Abdul Hakeem, National Remote Sensing Center, Hyderabad, abdulhakeem_k@nrsc.gov.in 	1. Dr. Rehana Shaik, IIIT, Hyderabad, rehana.s@iiit.ac.in	1. Dr. Shaik Niyazuddin Guntakal, SRMIST					
 Dr. Sat Kumar Tomer, Satyukt Analytics Pvt Ltd., Bengalun sat@satyukt.com 	u, 2. Dr. S. Saravanan, NIT Trichy, saravanans@nitt.edu	2. Dr. R. Sathyanathan, SRMIST					



Course Code	21CEO409T	Course Name	WATE	R QUANTITY AND QUALITY	Ca Ca	ourse tegor	y y	0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3
Pre-requ Course	isite es	Nil	Co- requis Course <mark>s</mark>	site Nil		Prog	gres: ourse	sive es						Nil	1					
Course	Offering Departme	nt	Civil Engi <mark>neerin</mark> g	Data Book / Codes / S	Standards								Nil							
Course L	earning Rationale (CLR):	The purpose of learning	this course is to:		-	1	1	_	Progra	am Qu	Itcome	s (PO)				Р	rogra	m
CLR-1:	Study the physica	al and cher	nical prop <mark>erties of wa</mark> ter			1	2	3	4	5	6	7	8	9	10	11	12	S	pecif	ic 105
CLR-2:	Address the conc	epts on th	e stream flow measuremen	t		e		-	of	30	ety			¥				00		103
CLR-3:	Explore the basic	concepts	abo <mark>ut water po</mark> llution and it	s treatment		ledg		ent o	tions	ge	soci		-	Wor		ance	5			
CLR-4: Know about the recycling and reuse of waste water						Vou	lysis	opme	stiga	Usaç	and	৵		eam	uo	& Fin	arnin			
CLR-5:	Interpret the conc	epts of the	water quality and its stand	ards		eering	lem Ana		uct inve ex prob	rn Tool	ngineer	onment inability		dual & T	nunicati	st Mgt. 8	ong Lea	-	2	~
Course O	utcomes (CO):		At the end of this course	e, learners will be able to:	1.127	Engin	Proble	Desig	Condu	Mode	The e	Enviro Susta	Ethics	ndivid	Comn	Projec	Life L	-OSc	S-OSc	-OSc
CO-1:	Analyze physical	and ch <mark>em</mark> i	ical properties of water	A State of the second	341.1	3	3	-	-	-		3	-	-	-	-	2	-	-	-
CO-2:	Estimate discharç	ge and <mark>vel</mark> a	ocity in streams			3	2	1	-	-	-	3	-	-	-	-	-	-	-	-
CO-3:	Identify water poll	ution a <mark>nd</mark>	its treatment	1		3				-	- 10	3	-		-	-	2	-	-	-
CO-4:	Appraise recycling	g and r <mark>eus</mark>	e of waste water		262	3		-	-		1	3	-	-	-	-	-	-	-	-
CO-5:	Illustrate the wate	ər qualit <mark>y s</mark>	standards and models	A State of the Sta	1.0	3	-	1.1	-	-	1	3	-	-	-	-	2	-	-	-
Unit-1 - P	roperties of Water		~	Code and the	- 9-						-								9	Hour
Properties	of water (Physical	and Chem	i <mark>ical) – S</mark> uspended and diss	solved solids – Major ions –.Water qualit	ity investigati	ion – S	Sam	oling d	esign -	Samp	lers ai	nd auto	matic	sample	ers - D	ata col	lection	platfo	rms –	- Field
kits – Wate	<u>ər quality data storaş</u> troom Elow Moosu	ge, analys romont	is and inference - Water qu	ality for irrigation – Salinity and permeab	bility problem	n - Irrig	gatior	n pract	ices for	poor	quality	water		_					0	Hour
Measurerr	inent of stage and ve	locitv – Ar	ea-velocity method – Dilutic	on technique – Electromagnetic method -	– Ultrasonic	metho	od – 3	Stage-	Dischai	ae rel	ations	hips – I	Hvdror	netrv s	tations	:			9	пош
Unit-3 - W	ater Pollution and	Treatmen	its					g		<u>j</u>			.)						9	Hour
Sources a	nd Types of pollutio	n – Organ	ic and i <mark>nor</mark> ganic pollutants	 BOD-DO relationships – Impacts on v 	water resour	rces –	NPS	S pollut	tion and	l its co	ontrol -	- Eutro	phicat	ion col	ntrol -	Water t	treatme	ent tec	hnolo	gies -
Unit-4 - R	ecvcling and Reus	e of Wast	e Water		10.11							_							9	Hour
Multiple us	ses of water – Reus	e of water	r in agriculture – Low cost	waste water treatment technologies - Ec	conomic and	l socia	al din	nensio	ns - Pa	ckage	d treat	ment u	nits –	Rever	se osn	nosis a	nd des	alinati	on in	water
reclamatio	n.		d lite. Oten de ude						_											
Principles	of water quality manage	jement ar /ater qualit	to its Standards ty classification – Water due	ality standards - Water quality indices - 7	TMDL Conce	onts _	Wate	er qual	ity mod	els									9	nour

	1	George Tchobanoglous, Franklin Louis Burton, Metcalf & Eddy, H. David Stense, and	4	Mackenzie I. Davis, David A. Cornwell, Introduction to Environmental Engineering, McGraw Hill
		Wastewater Engineering: Treatment and Reuse, McGraw-Hill, 2002.		2006.
Learning	2.	2 Vladimir Novonty, Water Quality: Diffuse pollution and watershed Management, 2 and	5.	Stum, M and Morgan, A., Aquatic Chemistry, Plenum Publishing company, USA, 1985.
Resources		edition, John Wiley & Sons, , 2003	6.	5. Lloyd, J.W. and Heathcote, J.A., Natural inorganic chemistry in relation to groundwater
	3.	K. Subramanya; Engineering hydrology; McGraw Hill, fourth edition	-	resources, Oxford University Press, Oxford, 1988.

ing Assessme			Continuous Learning	Assessment (CLA)				
	Bloom's Level of Thin <mark>king</mark>	Form CLA-1 Avera (50	pative ge of unit test %)	Life-Long CL (1	g Learning _A-2 0%)	Summative Final Examination (40% weightage)		
		Theory	Practice	Theory	Practice	Theory	Practice	
Level 1	Remember	20%		20%		20%	-	
Level 2	Understand	20%	the second second	20%	1. 1. 1. 1.	20%	-	
Level 3	Apply	30%		30%		30%	-	
Level 4	Analyze	30%		30%		30%	-	
Level 5	Evaluate		1	1000			-	
Level 6	Create			- 14 F		-	-	
	Total	100)%	10	0 %	10	0 %	

Course Designers							
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts					
 Mr. Abdul Hakeem, National Remote Sensing Center, Hyderabad, abdulhakeem_k@nrsc.gov.in 	1. Dr. R. Saravanan, Anna University, rsaran@annauniv.edu	1. Dr. R. Sathyanathan, SRMIST					
 Dr. Sat Kumar Tomer, Satyukt Analytics Pvt Ltd., Bengaluru sat@satyukt.com 	, 2. Dr. S. Saravanan, NIT, Tiruchirappalli, ssaravanan@nitt.edu	2. Mrs. D. Jaishree, SRMIST					



Course Code	21CEO410T	Course Name	REMOTE SENSI	NG SURVEYING	Cour Categ	se ory	0				OPEN	ELECT	ΓIVE				- T 3 0	P 0	C 3
Pre-requisite Nil Co- requisite Nil Courses Nil Courses Nil						rogres Cours	sive es						Nil	1					
Course C	Offering Departme	ent	Civil Engineering	Data Book / Codes / Standa	ards							Nil							
Course Learning Rationale (CLR): The purpose of learning this course is to:						2			Progr	am Ou	utcome	s (PO))				P	rogra	m
CLR-1:	Study the basics	principles of ren	note sensing techniques.	1000	1	2	3	4	5	6	7	8	9	10	11	12	S OU	pecifi	c es
CLR-2:	Understand the v	arious platforms	and sensors used in remote sen	sing.	ge		of	s of	10	tiety			ork		е				
CLR-3:	Understand the c	tand the concepts and applications behind various remote sensing satellites data.					ent o	ation	ge	d soc			n Wo		nanc	b			
CLR-4:	Understand the c	oncepts of <mark>grou</mark> i	<mark>nd trut</mark> hing hyper spectral remote	sensing analysis.	Kno	alysis	lopr	estig	Use	r and	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		Tear	ion	i ⊒	arnir			
CLR-5:	Apply the Knowle	dge of G <mark>PS sur</mark>	veying techniques.	- Contraction of the	ering	n An	/deve		n Too	ginee	men		Jal &	unicat	Mgt.	ng Le			
Course Ou	itcomes (CO):	At th	e end of this course, learners v	will be able to:	Engine	Probler	Design	Conduc	Moderr	The en	Enviror Sustair	Ethics	Individu	Commi	Project	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Apply the acquire	d knowl <mark>edge on</mark>	remote sensing application with	its techniques.	3			-	3		-	-	-	-	-	3	-	1	-
CO-2:	Identify various types of platforms and sensors combination used with remote sensing application.				3			-	3		-	-	-	-	-	3	-	-	-
CO-3:	Apply the acquired know <mark>ledge on</mark> different satellite data on remote sensing applications.				3		-		3	-	-	-		-	-	3	-	-	-
CO-4:	Disseminate the knowledge on ground truthing analysis technique by hyper spectral remote sensing surveying.				3	1		13	3		-	-	-	-	-	3	-	-	-
CO-5:	Recognize the GI	PS surv <mark>eying teo</mark>	chniques for different field applica	tions.	3		10.00	-	3		-	-	-	-	-	3	-	-	-

Unit-1 - Remote Sensing

Physics of Remote Sensing: Electromagnetic Radiation (EMR), Characteristics – Electromagnetic Spectrum (EMS) – Interactions Between Matter and Electro-Magnetic Radiation – Energy Interaction in The Atmosphere – Energy Interactions with The Earth's Surface. Radiation Laws. Atmospheric Windows – Types of Remote Sensing with Respect to Wavelength Regions. Electro Magnetic Radiation (EMR): Velocity of EM radiation, Polarization, coherent radiation, Propagation of EM waves, from one medium to another, Attenuation, quantum nature of EM radiation, Thermal radiation, Source of EM radiation, for Remote sensing – Fundamentals of Radiometry: Measure Geometry – concept of the solid angle – radiometric quantities – Surface characteristic for Radiometric Measurements – Observation geometry in Remote sensing – Reflectance Measurement – Physical Basis of Signature – Signature in the Reflective OIR region – Thermal Infrared (TIR) and Microwave region.

Unit-2 - Remote Platforms and Sensor

Platforms: Principles of satellite Missions – Locating satellites in space – Types of Orbits, Airborne platforms – balloons, helicopters, aircrafts – Spaceborne platforms – Orbital Elements of Satellite – Sun synchronous and Geosynchronous satellites – Projectile geometry – Land coverage – Repetitively – On track and Across track stereovision capability. IRs, LANDSAT, SPOT, RUSSIAN, CANADA, JAPAN, EUROPEAN, CAHAINA SATELLITE series. Sensor Technology – Historical Development – Sensor Types Characteristics: Active and Passive Remote Sensing – Imaging Systems – Non–Imaging Sensors – Across Track and Along Track Scanners – Framing and Scanning Systems – Characteristics of Optical Sensors – Resolution. Classification of Remote sensor, selection of sensor parameters, spatial resolution, spectral resolution, Radiometric resolution, Temporal resolution, – Optical and Infrared sensors: Quality of Image in Optical system, Imaging mode, – Photographic camera, Television Push broom cameras, Whisk broom cameras. Microwave sensors.

9 Hour

Unit-3 - Remote Sensing Satellites and Data Products 9 H	our
Overview of Different Satellite and Sensors for Earth Observations- Coarse - Medium and High - Resolution Missions (IRS Series - LANDSAT Series - SPOT Series - High resolution satellites, character	and
applications, CARTOSAT Series – GEOSAT – IKONOS Series – QUICKBIRD Series, Weather/Meteorological satellites, INSAT series, NOAA, GOES, NIMBUS Applications – Marine observation satel	lites
OCEANSAT – ASTER – Sentinel – Aqua and Terra (MODIS) – SLAR / SAR and Future Missions.	
Unit-4 - Ground Truthing Hyper Spectral Remote Sensing and Image Analysis 9 -	our
Atmospheric correction – Analysis technique of hyper spectral remote sensing – Biophysical modelling – Image transmission & compression – Spectroscopy – Image cube, Hyperian /HYSI, – Spectral matchin	ıg –
Digital Spectral Data – Libraries – Application of Hyper spectral data – MODIS. Importance of Ground truth data collection – Ground Truth Radiometer (GTR), Radiometric Calibration – Digital and Analog Meth	iods
- use of radiometers, and spectrophotometers, etc., - Spectral Reflectance - Physical basis of spectral signatures of the objects and Spectral - Signature for Vegetation - Soil - Water and Snow - Thermal In	age
and Interpretation – Interpretation of SAR data (from Satellite) for Landuse studies.	-
Unit-5 - GPS Surveying Techniques	our

Unit-5 - GPS Surveying Lechniques Modern Surveying Equipment – Introduction to Concept of Global Positioning System and its architecture – Positioning Methods using Satellites – GPS Principles – GPS receivers – More on GPS principles – GPS in Different Engineering Application – Different types of GPS Errors and Accuracy in GPS observations – Satellite geometry and Accuracy measures – Other Satellite navigation Systems and GPS Modernization – GPS Applications in Various Fields – Concept of DGPS and WAAS – GNSS And Types (NAVSTAR – GLONASS – GALELIO) – IRNSS.

	1.	George Joseph and Jeganathan. C, Fundamentals of Remote Sensing, Universities	5.	Satheesh Gopi, Global Positioning System: Principles and Applications, Tata Mcgraw-Hill
		Press, 3rd edition, 2018		Publishing Company Limited, 2005
	2.	Anij Reddy, M. "Textbook of Remote Sensing and Geographical Information systems",	6.	NPTEL - NOC: Remote Sensing Essentials, IIT Roorkee, https://nptel.ac.in/courses/105107201
Learning		B S Publications, Hyderabad, 2008.	7.	NPTEL - NOC: Remote Sensing: Principles and Applications,
Resources	З.	Richards, Remote sensing digital Image Analysis-An Introduction Springer – Verlag		https://nptel.ac.in/courses/105101206
		1993.	8.	NPTEL - Remote Sensing, IISc Bangalore, https://nptel.ac.in/courses/105108077
	4.	Lillesand, T.M., Kiefer, R.W & Chipman, J.W. "Remote Sensing & Image Interpretation".	9.	. NPTEL - NOC: GPS SURVEYING, IIT Roorkee, https://nptel.ac.in/courses/105107157
		John Wiley and <mark>Sons, In</mark> dia, 2007.	10.	 NPTEL - NOC: Remote Sensing and GIS, IIT Guwahati, https://nptel.ac.in/courses/105103193

earning Assessme	ent <u> </u>	A Contract of the	Stands A.		A COLORADO			
		Sum	Summativo					
	Bloom's Level of Thinking	Forr CLA-1 Avera (5	native nge of unit test 0%)	Life-Long CL (10	g Learning A-2 0%)	Final Examination (40% weightage)		
		Theory	Practice	Theory	Practice	Theory	Practice	
Level 1	Remember	20%	- 100	20%		20%	-	
Level 2	Understand	20%	- 111	20%		20%	-	
Level 3	Apply	20%		20%		20%	-	
Level 4	Analyze	20%		20%		20%	-	
Level 5	Evaluate	10%	171 - 11	10%		10%	-	
Level 6	Create	10%	1151511	10%		10%	-	
	Total	10	0%	10	0%	10	0%	

Course Designers							
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts					
 Dr. T. Mayamanikandan, Project Scientist, NCCR, Chennai, maya@nccr.gov.in 	1. Dr. R. Kanmani Shanmuga Priya, Assistant Professor, Anna University, Chennai.	1. Dr. A. Manimaran, SRMIST					
2. Dr. Tune Usha, Scientist, NCCR, Chennai	 Dr. K. Nagamani Scientist-D/ Head, Centre for Remote Sensing and Geoinformatics, Sathyabama Institute of Science and Technology, Chennai 	2. Dr. S. Durgadevagi, SRMIST					

Course Code	21CEO411T	Course Name	Co Cat	egory	0	OPEN ELECTIVE										L T P 3 0 0			
Pre-requ Cours	isite es	Nil	Co- requisite Courses	Nil		Progre	ssive ses						Nil	1					
Course	Offering Departme	ent	Civil Engineering	Data Book / Codes / Sta	indards							Nil							
				and the second		1100	11.00												
Course Learning Rationale (CLR): The purpose of learning this course is to:						Program Outcomes (PO)													m
CLR-1: Study the basic concepts of GIS						2	3	4	5	6	7	8	9	10	11	12	01	itcom	es
CLR-2: Understand the real-world data types and representations						D D	of	s of	10	iety			ĸ		a				
CLR-3:	Know the differer	nt data source	e <mark>s and stan</mark> dards				ento	stigations dems	Usage	and soc	৵		oW r		ance	ß			
CLR-4:	Understand the o	lata models	~ ~ ~	W62- 12		lysis	mdo						ean	u	м Ц	arnin			
CLR-5:	CLR-5: Explore the vector and raste		<mark>er analysi</mark> s		ripo	n Ana	devel	t inve x prot	Tool	gineel	ment		al & J	inicati	Mgt.	ng Lea			
Course Outcomes (CO):				rs will be able to:		roblen	lesign/		lodern	he en	inviron	ithics	ndividu	Commu	roject	ife Lor	SO-1	SO-2	SO-3
CO-1:	Apply the concepts of GIS				3	3 -	-		3		3	-	-	-	-		-		-
CO-2:	2: Recognize the real word data and its representation in GIS						1.2	-	3	2	<u> </u>	-	-	-	-	-	-	-	-
CO-3:	Apply the knowle	dge of d <mark>ata s</mark>	tandards on GIS data	1. 192	3	3 -	1.	-	3	2	-	-	-	-	-	-	-	-	-
CO-4:	Create the data r	nodel to store	GIS data			3 -	-	-	3	-	3	-	-	-	-	-	-	-	-
CO-5:	Identify the spatia	al analys <mark>is for</mark>	real world problem	a the second second	3	3 -	1.1-1	-	3		3	-	-	-	-	-	-	-	-
11:44 0	IC Concento		1 1	م ال			•			-		-							Haur
GIS, Histo	ry of GIS, Elements	s of GIS, Cart	ography - Maps – based on purp	ose & Scale, Coordinate system –	Geograph	ic & pro	iected c	coordin	ate sys	tem -	UTM, E	D <mark>atum,</mark>	Projec	ctions -	Base	d on pr	reserv	ed Prc	perty
– Surface.			V																
Unit-2 - R Geospatia	eal World and Rep I data – Spatial data	oresentations	lata. Data Representations - Vec	tor format- Raster format -Types of	fattribute	tahla Gl	S Softy	vare Tr	noloa	v_ Ad	iacenci	(Con	tiquity_	Contai	nment	Frrors		9	Hour
Unit-3 - D	ata Sources & Sta	ndards	ala, Dala Representations – vec	tor tormat-reaster tormat-rypes of	aundute	abie, Oi	0 0011	vare, ro	spolog	y – Auj	acency	r, com	.iguity-	Contan	iment,	LIIUIS		9	Hour
Input Data	– Primary – Secon	dary, Data inp	out methods, Data output methods	s and products, Data Standard, Dat	ta Quality,	Data Er	rors – F	Position	al accu	iracy -	Attribu	te Acc	uracy -	- Logic	al Con	sistenc	y - Lin	eage,	Meta
Data, Layo	out.			11- mr. and the	11	1.1	12.1	11	1										
Unit-4 - G	IS Data Models									_		_		<u> </u>				9	Hour
DTM – DS	a model – Geo-rela M- Terrain Parame	itional - Snape ters – slope-	enie - TIN, Geogatabase, Raster i aspect – hill shade	Data Model - Elements of Raster d	ata, Raste	er data s	tructure	– cell	by cell	– Run	Length	i Enco	aing –	Quad	i ree, L	vata Co	onvers	ion, D	'EM –
Unit-5 - S	patial Data Analys	is														-		9	Hour
Data Retri	eval – Querv – Spa	tial and Non-	Spatial Query, Proximity Analysis	- Buffering, Overlay – Vector – Ra	ster. Netw	ork Ana	lvsis. Te	errain A	nalysis	s. Sna	tial Inte	rpolati	on Mc	dellino		-			

	1.	Paul Bolstad," GIS Fundamentals: A First Text on Geographic Information Systems" 5th	5.	Anji Reddy .M, "Textbook of Remote Sensing and Geographical Information Systems", BS
		Edition, Eider Press, Minnesota 2016.		Publications, Hyderabad. 2011. ISBN: 81-7800-112-8.
	2.	Burrogh. P.A, "Principles of Geographical Information System for Land Resources	6.	Rolf A. de "Principles of Geographic Information Systems An introductory textbook" The
Learning		Assessment", Oxford Publications, ISBN-13: 978-0198545927, 1986.		International Institute for Aerospace Survey and Earth Sciences (ITC), The Netherlands,
Resources	З.	Kang Tsung Chang, "Introduction to Geographical Information System", Tata McGraw Hill, 9th		2001.1
		edition, 2019.	7.	Michael N. DeMers, "Fundamentals of Geographic Information Systems", 2008.
	4.	Paul A. Longley, Michael F. Goodchild, David J. Maguire, David W. Rhind, "Geographic		
		Information Science & Systems", Fourth Edition, John Wiley & Sons, Inc., 2015.		· 21
			_	10/ Ka

Learning Assessme	ent										
			Continuous Learning	Summative							
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test	Life-Long CL (1)	g Learning "A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%		20%		20%	-				
Level 2	Understand	20%	2	20%		20%	-				
Level 3	Apply	30%	0.000	30%		30%	-				
Level 4	Analyze	30%	the state of the	30%	Contraction of the second	30%	-				
Level 5	Evaluate	A CONTRACT OF		10 C		-	-				
Level 6	Create	1 2 5 7 6	Sec. 1999 1944	N. 524.2			-				
	Total	10	0 %	10	0%	100 %					

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. V. S. Jeyakanthan, Scientist, NIH, Kakinada	1. Dr. R. B. Binoj Kumar, Professor, University of Kerala	1. Dr. Aparna S Bhaskar, SRMIST
2Dr. Sarunjith K. J., Scientist, NCSCM, Chennai	2. Dr. C. Lakshumanan, Professor, Bharathidasan University	2. Dr Satish Kumar J, SRMIST



Course Code	21CEO412T Course WEB AND MOBILE GIS Name						Cour Categ	Course Category O OPEN ELECTIVE L T 3 0<									L T 3 0	P 0	C 3		
Pre-requisite Nil Co- requisite Nil Nil							Progressive Nil														
Course Offering Department Civil Engineering Data Book / Codes / Star							lards							Nil							
					and have	11.		1.0	1												
Course Learning Rationale (CLR): The purpose of learning this course is to:								-		Progra	am Ou	Itcome	es (PO)			1	Specific			
CLR-1: Study basics of Geographical Information System						1	2	3	4	5	6	7	8	9	10	11	12	ou	itcom	es	
CLR-2:	Understand Web [,]	GIS architect	ture <mark>, services</mark> and cc:	omponents	1 11		e		of	s of	1	iety			rk		n.				
CLR-3:	Learn advanceme	ent and appli	ication of WebGIS	1		1.00	vledç		ento	stigations	Usage	and soc	∞ర	-	Wo		ance	5			
CLR-4:	Know basics of N	Iobile GIS		311			Non	ysis	bm						earr	ы	Ë	rnin			
CLR-5:	Explore opportunities and application		olication of Mobile GI	ation of Mobile GIS he end of this course, learners will be able to:		eering h	em Ana	n/devel	uct inve lex prob	rn Tool	ngineer	onment inability		dual & T	nunicati	ot Mgt. 8	ong Lee	1	5	33	
Course Or	urse Outcomes (CO): At th		At the end of this co			Engin	Proble	Desig	Condi	Mode	The e	Envire Susta	Ethics	Individ	Comn	Proje	Life L	-OS4	PSO-	PSO-	
CO-1:	Apply the obtained knowledge in spatial analysis and development.				San 194	3	-	2	-	-		-	-	-	-	-	-	-	-	-	
CO-2:	Know basics of V	VebGIS <mark>and v</mark>	various services	A DEC			3	-		-	3		_	-	-	-	-	-	-	-	-
CO-3:	Apply knowledge	on dev <mark>elopn</mark>	<mark>ment</mark> of application fc	or various dom	ain.	100	3	-	2	-	2	-	-	-	-	-	-	-	-	-	-
CO-4:	Disseminate the i	importa <mark>nce o</mark>	o <mark>f M</mark> obile GIS compo	nents and Sys	tems		3	-	-	-	-	1	-	-	-	-	-	3	-	-	-
CO-5:	Apply gain knowle	edge on <mark>Mob</mark>	b <mark>ile G</mark> IS for different a	applications	1200		3	-	1.1	- 1	3		-	-	-	-	-	-	-	-	-
			1	1	1.1							0					1				
Unit-1 - In	troduction to GIS	Information S	System (GIS) - Type	s of GIS - Com	popents of GIS -	- Data types and E	ormats _ (non S		and Pro	nriota	N GIS	Softwa	aros- B	asic M	lan alai	nonte i	in GIS	- Data	9 Analı	Hour vsis in
GIS – Arc(GIS API for Python	and JavaScr	ript.	301010 0011		Data types and r	ormato – C	pen o			prictur	y 010	Contwa	105 D		up cici	nonto i	11 010	Dulu	Anary	515 111
Unit-2 - Ba	asics of Web GIS			2.2		18/10/2				14	1									9	Hour
Introductio	n to WEB GIS – W	EB GIS Archi	itecture and Compor	nents – Web S	ervices (WFS, W	MS, WCS) – Web S	Server (Ap	ache,	томс	AT) - M	lap Sei	rver (V	Veb Se	rver, C	Geoser	ver, Ar	cGIS S	erver)			
<u>Unit-3 - Ac</u>	<u>Ivancement and A</u>	<u>pplications</u>	of WebGIS	1			14/ 1.0			0 1		-							14/ /	<u> </u>	Hour
Internet GI	S Application Fram	iework - Map of a WebGIS	oServer utilities – Pul application for variou	blisning intera	ctive map – Acce	essing Map through	webServ	ices- V	NEBGI	S and I	Locatic	on bas	ea serv	/ICes -	Mana	ging sp	atial di	ata on	Web L	ising	open-
Unit-4 - : I	Basics of Mobile G	SIS			se olddy)			1.1				-								9	Hour
Introductio Terminal 7	n to Mobile GIS – Fechnology – WebG	Technology f	for Mobile GI <mark>S (Corr</mark> GIS	nputer Network	k, OS, Systems a	and Softwares) – M	lobile GIS	comp	onents	– Mob	ile GIS	C Archi	itecture	– Dei	velopm	ent of	Mobile	e Positi	ioning	and N	<i>lobile</i>
Unit-5 - O	pportunities and A	Applications	s of Mobile GIS																	9	Hour
Opportunit	ies of Mobile GIS -	Market oppo	ortunities - Applicatio	ns of Mobile G	IS - Online servic	es and Navigation	for traffic i	nforma	ation –	Public	Informa	ation S	ervices	s – Urł	oan dis	aster n	nanade	ement		-	
	1.	Michael D., Introducing Geographic Information System with ArcGIS: A workbook	3.	Jane Drummond, Dynamic and Mobile GIS Investigating changes in Space and Time, CRC Press,																	
-----------	----	---	----	---																	
Looming		Approach to Learning GIS, Jhon Wiley & Sons. Canada, ISBN 987-1-118-15980-4;		2007																	
Deseuress	2.	Otto Huisman and Rolf A. de By, Principles of Geographic Information Systems, The	4.	Eric Pimpler, Mark Lewin, Building Web and Mobile ArcGIS Server Applications with Javascript,																	
Resources		International Institute for Geo-Information Science and Earth Observation (ITC)		Second Edition, Packt Publishing, Birmingham.																	
		Netherlands.	5.	Tyler Mitchell, Web Mapping Illustrated, First edition, June 2005, ISBN 978-0596-00865-9																	
				1.7.																	

			Continuous Learning	Assessment (CLA)		Cum	motivo		
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	ative ge of unit test)%)	Life-Long CL (1)	g Learning "A-2 0%)	Final Examination (40% weightage)			
		Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	20%		20%		20%	-		
Level 2	Understand	20%	All and the second	20%	1.1.1	20%	-		
Level 3	Apply	30%		30%		30%	-		
Level 4	Analyze 🛛 👘	30%		30%		30%	-		
Level 5	Evaluate			17/2 Part		-	-		
Level 6	Create			- 19 F		-	-		
	Total	10	0 %	10	0%	1(0 %		

Co	Irse Designers			15	
Exp	erts from Industry	Ex	perts from Higher Technical Institutions	Int	ernal Experts
1.	Mr. D. Vinu, Associate Vice President, DSM Soft Pvt, Ltd, Trichy	1.	Dr. S. Kaliappan, Chair Professor, Anna University, Chennai	1.	Dr. R. Sivakumar, SRMIST
2.	Mr. Venkatraman Thennarasu, Director at TetraRays Limited,	2.	Dr. J. Rajesh banu, Associate Professor, Central University	2.	Dr. Karuppasamy Sudalaimuthu, SRMIST
	Krishnagiri.	1.1	Tamilnadu		



Course Code	21CEO413T	Cours Name	e DIGITAL	MAPPING	Co Cat	egory	0				OPEN E	ELECI	ΓIVE			ļ	- T 3 0	P 0	C 3
Pre-requi Course	site s	Nil	Co- requisite Courses	Nil		Progre Cour	ssive ses						Nil						
Course (Offering Departme	ent	Civil Engineering	Data Book / Codes / Sta	ndards	100						Nil							
Course Le	arning Rationale ((CLR):	The purpose of learning this cours	se is to:		17	U.		Progra	am Ou	Itcome	s (PO))				P	rogra	m
CLR-1:	Study various pre	paration	of map making Process	12		2	3	4	5	6	7	8	9	10	11	12	S	pecifi	iC
CLR-2:	Learn the differen	nt data typ	es.	Constant .		D	-	of	3	ety			¥			<u> </u>	00		
CLR-3:	Understand data	represent	ation and Software.			ĥ	ent of	tions	e	soci			Wor		ance	_			
CLR-4:	Acquire various d	ligital data	analysis techniques.			ysis	bme	stigat	Jsag	and	e X		eam	E	Ë	rning			
CLR-5:	Intellect different	applicatio	n <mark>s of digital mapping</mark>			Anal	evelo	inves	00	leer	ent 8 oility		& T	catic	gt. &	Lea			
		appiroutio				em ,	p/de	luct j	ern T	engir	onm	s	idua	mun	sct M	-ong	5	42	ကု
Course Ou	itcomes (CO):		At the end of this course, learners	s will be able to:		Prob	Desi		Mode	The (Envir Susta	Ethic	ndiv	Com	Proje	Life	SOS	oSc	SOS
CO-1:	Disseminate the F	knowled <mark>g</mark>	e on cartography.	The start is	3	3 3		-	-	-	-	-	-	-	-	3	-	-	-
CO-2:	Identify different of	data sou <mark>r</mark> d	ces de la constant de	the second	3	3 -	12	-	3	-		-	-	-	-	3	-	-	-
CO-3:	Explore the different	ent data r	epresentation	1.22 0.02 0.0		3 -		-	3	-	-	-	-	-	-	3	-	-	-
CO-4:	Exhibit different d	ligital an <mark>a</mark>	lysis			3 -	-	3	-		-	-	-	-	-	3	-	-	-
CO-5:	Apply Knowledge	e of Digita	mapping	- and - and	3	3 -	11-1	-	-	25	-	-	-	3	-	3	-	-	-
L	1		and the second s	dial in the later															. <u> </u>
Unit-1 - Ca	rtography	rdinata au	stome Projection systems Mana	Characteristics types and uses	of Mono	Autor	noted m	opping	Toolo	and fu	notion	mon	lovout	oolor	and na	torn i	n diait	9 01 mor	Hour
Human per	ception of static, m	nultimedia	and animated maps.	Characteristics - types and uses	u waps -	- Autom	ialeu III	apping	10015 0	anu iu		map	ayout,	000	anu pa		i uiyite	л шар	jping,
Unit-2 - Dit	fferent Data Sourc	ces						11	17									9	Hour
GPS: Satel	lites, Sources and I	Errors of	GPS, Aerial photographs – Types - Co	rrection, Remote sensing: Types o	of Resolut	ion -Opt	ical and	nicrow	ave R	emote	sensing	g, IRS,	, Lands	sat, Se	ntinel,	RISAT	- Digita	al Elev	vation
Init-3 - Da	TM, PALSAR, CAP	n and Soi	- LIDAR – Types - LIDAR wave Ionn - itware	UAS – Dala Ionnals.			-		10	-								9	Hour
Spatial and	Non-Spatial data -	Data forr	nat – Data compression – Data Storag	e – Data Visualization 2D.3D – Gra	aphical re	oresenta	ation – I	mportar	t tools	in app	lication	softwa	are– Ll	IDAR -	Machi	ne Lea	rnina.	Super	rvised
and Unsup	ervised					1.1	III C	1									3,		
Unit-4 - Dig	gital Data Analysi	s																9	Hour
Map Gener	ralization - Spatial a	and nons	patial - Digital Elevation Model - Terra	in analysis - UAS - LIDAR – Filter loctor Machina, Spectral Angle Ma	ring – Cla	ssificatio	on — Hy Miorowy	perspec	stral - S	Superv	vised, M	laximu	m likel	lihood, tollitoo	Minim	um Dis	tance	class	ifier –
Unit-5 - Ap	plications of Digi	ital Mapp	perspectral – Advantages - Support v ing	ector Machine- Spectral Angle Ma	apper - Sa	lennes i	VIICIOWa	ave ren	IULE SE	IISIIIY	- JAR	- SLA	<u>r - 3a</u>	lennes				9	Hour
GPS applic	ations in Transport	t studies, i	Aerial photographs applications in urba	<mark>an studies- Remote sen</mark> sing applica	ation stud	ies in flo	od map	oping – S	Soil mo	oisture	studies	using	microv	wave r	emote	sensinę	g – Fo	rest st	tudies
using LIDA	R mapping - Agricu	Ilture stud	ies using Unmanned aerial vehicl <mark>e – R</mark> i	esource mapping using hyperspec	tral studie	s – Land	d use ar	nd Land	cover	studie	s using I	machii	ne lear	ning Te	echniqu	Jes – D	irone a	applica	ations
un se undi	ι παρμπų.																		

	1.	Robinson .A. H, Morrison .J. L, Muehrcke .A. C, Kimerling .A. J and Guptill .S. C,	4.	Kang Tsung Chang, "Introduction to Geographical Information System", Tata McGraw Hill, 9th
		"Elements of Cartography", 6th Edition, John Wiley and Sons, 1995.		edition, 2019.
Learning	2.	John R. Jenson "Introducing Digital Image Processing" - Prentice Hall, New Jersey	5.	Fahlstrom, P. and Gleason, T. 2012. Introduction to UAV Systems. 4th edition. United Kingdom.
Resources		1986		John Wiley & Sons Ltd
	3.	Anji Reddy .M, "Textbook of Remote Sensing and Geographical Information Systems",	6.	Borden D. Dent, Jeffrey Troguson, Thomas W. Hodler, "Cartography: Thematic map Design",
		BS Publications, Hyderabad. 2011. ISBN: 81-7800-112-8.	1	McGraw-Hill Higher Education, 2008

			Continuous Learning	g Assessment (CLA)		Gum	mativa
	Bloom's Level of Th <mark>inking</mark>	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Lon CL (1) Learning A-2 0%)	Final Ex (40% w	rative amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	Martin Sala	20%		20%	-
Level 2	Understand	20%		20%		20%	-
Level 3	Apply	30%		30%		30%	-
Level 4	Analyze	30%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	30%		30%	-
Level 5	Evaluate		100 C			-	-
Level 6	Create		Section of the section of the			-	-
	Total	10	0%	10	0%	10	0 %

Со	urse Designers				Press.
Ex	perts from Industry	Ex	perts from Higher Technical Institutions	Int	ernal Experts
1.	Dr. Sarunjith K J, Scientist, NCS <mark>CM, Che</mark> nnai,	1.	Dr. K. Palanivel, Professor, Bharathidasan University, Trichy.	1.	Dr. J. Satish Kumar, SRMIST
	sarunjith@gmail.com		kkpvlcers@bdu.ac.in		
2.	Dr. T. Mayamanikandan, Project Scientist, NCCR, Chennai,	2.	Dr. R. Kanmani Shanmuga Priya, Assistant Professor, Anna	2.	Dr. M. Kamalanandhini, SRMIST
	maya@nccr.gov.in		University, Chennai. kanmanirajkumar@gmail.com		and the second se



Course Code	Course 21CSO270T Course CYBER SECURITY Code Name Code Code							Cou Cate	urse gory	0					OPEN	ELEC	TIVE				<u> </u>	P 0	C 3	
Pre-requi Course	site s		Nil		Co- requisit Course <mark>s</mark>	e		Nil		Progre Cour	ssive ses	•		Nil										
Course (Offering Dep	partme	ent	Scho	ool of Computing		Data B	ook / Codes / Stand	lards								Nil							
Course Le	arning Rati	onale (CLR):	The purpose	e <mark>of learnin</mark> g thi	s course i	is to:			1	U,	6		Progra	am Ou	Itcome	s (PO)				Program		
CLR-1:	Understan	d the cy	yber secu	rity threat land	lscape	10	2.20		1	2	3	3	4	5	6	7	8	9	10	11	12	S	pecifi	C es
CLR-2:	Develop a	deeper	r understa	anding and fam	niliarity with vario	ous types o	of Cyber attac	cks			Sec. 1		f	20	Y									
CLR-3:	Analyze ar	nd evalu	uate exist	ting legal frame	work and laws	on cyber s	security	Sec. Sal	dae	5	t of		ons c		ociet			Vork		JCe				
CLR-4:	Analyze a payment fr	nd eva auds	luate the	e d <mark>igital pay</mark> m	ent system sec	urity and	remedial me	easures against digi	tal wouy	alysis		. :	estigatic blems	Usage	r and s	k &		Team V	tion	& Finar	arning			1
CLR-5:	Analyze ar	nd evalu	uate the ir	mportance of p	personal data its	privacy ar	nd security		leering	em Ani	an/deve	ons	uct inve olex pro	ern Too	enginee	onment	s	dual &	nunicat	ct Mgt.	ong Le	<u>.</u>	5	с,
Course Ou	itcomes (CO	D):		At the end o	of this course, I	earners w	vill be able to	o:	Enair	Prob	Desig	soluti	Conc	Mode	The (Envir Susta	Ethic	ndivi	Com	Proje	Life L	-OS-	0SC	-OS-
CO-1:	Able to ide	ntify se	ecurity i <mark>ssu</mark>	<mark>ues an</mark> d resolv	/e			242304	12/-					-	-	-	3	-	-	-	2	-	-	-
CO-2:	Able to wo	rk with	cybers <mark>ec</mark>	urity tools		1999	100	100 100 1	100	-				2	- 1	-	-		-	-	-	-	-	-
CO-3:	Analyze th	reats a	nd risks <mark>v</mark>	<mark>vithin c</mark> ontext c	of the cyber secu	rity archite	ecture	12 413	-	- 1			-	-	-	-	3	-	-	-	-	-	-	-
CO-4:	Appraise c	yber se	ecurity i <mark>nc</mark>	<mark>cidents</mark> to apply	/ appropriate res	sponse	1.1			-			13	-	2	- I	2	-	-	-	2	-	-	-
CO-5:	Evaluate d	lecision	n making <mark>c</mark>	<mark>outcome</mark> s of cy	/ber security sce	enarios			6.5	-			-	-	-	-	3	-	-	-	-	-	-	-
Unit-1 - Int	roduction t	o Cybe	er Securit	ty Computer and	Web-technolog	Architec	cture of cyber	space Communicati	on and u	woh tor	hnolo		Intern	at Wo	rld wi	de web	Advo	nt of ir	otornot	Intern	at infra	structu	9	Hour data
transfer and	d governanc	e, Inter	rnet socie	ety, Regulation	of cyberspace,	Concept of	of cyber secur	ity, Issues and challe	enges of	cyber :	secun	ity	mem	<i>, w</i>		<i>IC WCD</i> ,	Auve		iterriet,	mem		Sirucit	10101	uulu
Unit-2 - Cy	bercrime a	nd Cyb	per Law			1	<u> </u>				,			1							,		9	Hour
classification attacks, zer and offence	on of cyberc ro day and zo es, Organiza	crimes, ero clici ations d	Common k attacks, lealing wit	cybercrimes- , Cybercriminal th Cybercrime	cybercrime targ Is modus-operar and Cyber secu	eting com ndi , Repor rity in India	nputers and m rting of cyberc ia, Case studi	nobiles, cybercrime a crimes, Remedial and ies.	against v I mitigati	vomen on mea	and on Sures	childi s, Le	ren, fii gal pe	nancia rspect	l fraud tive of	is, soci cyberci	al eng rime, l	ineerii T Act 2	ng attai 1000 an	cks, ma id its ar	alware nendm	and ra ents, (ansom Cyber	ware crime
Unit-3 - So	cial Media	Overvie otwork	ew and S	Security of Social modi	a Social modia	platforms	Social modia	n monitoring Hashta	a Viral c	ontont	Soci	ol m	odia n	arkot	ing S	ocial m	odia n	rivacy	Challo	2000	nnorti	initios	9 and r	Hour
in online so	cial network	k, Secu	s. Types o irity issue:	s related to so	ocial media, Flag	iging and i	reporting of in	nappropriate content	, Laws r	egardir	ig pos	sting	of ina	ipprop	riate d	content,	Best	practic	es for	the use	e of Sc	cial m	edia,	Case
Unit-4 - E -	Commerce	and D	Digital Pag	yments																			9	Hour
Definition o payment ar related con	f E- Comme nd stake hole nmon frauds	rce, Ma ders, M and pr	ain compo lodes of d reventive l	onents of E-Co digital payment measures. RB	ommerce, Eleme ts- Banking Caro I guidelines on c	nts of E-Co Is, Unified ligital payr	Commerce sec I Payment Inte ments and cu	curity, E-Commerce i erface (UPI), e-Walle istomer protection in	hreats, E ets, Unst unautho	E-Comi ructure rized b	nerce d Sup ankin	e sec oplen g tra	<mark>urity</mark> k nentai insacti	est, p. y Serv ons. F	ractice vice D Releva	es, Intro ata (US nt provi	ductic SSD), / isions	n to di Aadhai of Pay	gital pa enable ment S	iyment: ed payl Settlem	s, Com ments, ent Aci	ponen Digita 2007	ts of c I payn	ligital nents

Unit-5 - Digital Devices Security, Tools and Technologies for Cyber Security	9 Hour
End Point device and Mobile phone security, Password policy, Security patch management, L	Data backup, Downloading, and management of third party software, Device security policy, Cyber Security best practices,
Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi	security, Configuration of basic security policy and permissions
Tutorial :	
1. Checklist for reporting cybercrime at Cybercrime Police Station.	9. Setting, configuring and managing three password policy in the computer (BIOS, Administrator and Standard User).
2. Checklist for reporting cybercrime online.	10. Setting and configuring two factor authentication in the Mobile phone.
3. Reporting phishing emails.	11. Security patch management and updates in Computer and Mobiles.
4. Demonstration of email phishing attack and preventive measures.	12. Managing Application permissions in Mobile phone.
5. Basic checklist, privacy and security settings for popular Social media platforms.	13. Installation and configuration of computer Anti-virus.
6. Reporting and redressal mechanism for violations and misuse of Social media Platforms.	14. Installation and configuration of Computer Host Firewall.
7. Configuring security settings in Mobile Wallets and UPIs.	15. Wi-Fi security management in computer and mobile.
8. Checklist for secure net banking.	

	1. Nina Godbole &SunitBelapure "Cyber Security", Wiley India, 2022 Reprint Evan Wheeler,	5. Security in the Digital Age: Social Media Security Treats and Vulnerabilities by Henry A.
	"Security Risk Management", Syngress ISBN: 97815, 2021	Oliver, Create Space Independent Publishing Platform. (Pearson, 13th November, 2001)
	Bruce Newsome, "A Practical Introduction to Security and Risk Management", 20203.	6. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
Learning	David L. Cannon, "CISA Certified Information Systems Auditor Study Guide", John Wiley &	Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant
Resources	Sons, ISBN: 978 <mark>-0-470-2</mark> 3152-4, 2019.	Publishers.
	3. Cyber Crime Impact in the New Millennium, by R. C Mishra ,Auther Press. Edition 2010.	8. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India
	4. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives	Pvt. Ltd.
	by SumitBelapu <mark>re and N</mark> ina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)	Fundamentals of Network Security by E. Maiwald, McGraw Hill.

Learning Assessme	ent 🛛 🚽 🚽									
		and the second	Continuous Learning	g Assessment (CLA)	N.	0				
	Bloom's Level of Thinking	Forr CLA-1 Avera (5	native age of unit test 0%)	Life-Lon CL (1	g Learning LA-2 0%)	Final Examination (40% weightage)				
	1.00	Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	15%	-	15%	- 10	15%	-			
Level 2	Understand	25%		20%	1	25%	-			
Level 3	Apply	30%		25%	E /	30%	-			
Level 4	Analyze	30%		25%		30%	-			
Level 5	Evaluate	- 7-9 V II		10%		-	-			
Level 6	Create	1200		5%		-	-			
	Total	10	0 %	10	0 %	10	0 %			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts

Course Code	Course Code 21CSO351T Course Name WEB PROGRAMMING						Co Cate	urse egory	0				OF	PEN EL	LECTI	VE			L 2	T 1	P 0	C 3		
Pre-requis Courses	Pre-requisite Nil Co- requisite Nil Courses Nil Courses Nil									Progr Cou	essiv	e						Nil						
Course C	Offering Depa	artme	ent	Scho	ool of Computing		Data Boo	ok / Codes / Standa	ards								Nil							
Course Lea	arning Ratio	nale ((CLR):	The purpos	e of learning th	is course	e is to:				1			Proar	am Oı	Itcome	es (PC))				P	rogra	m
CLR-1:	Understand	the co	oncepts of	f WEB Basics	and Design		1.1			1	2	3	4	5	6	7	8	9	10	11	12	S	pecifi	C
CLR-2:	Knowledge v	vith B	Basics of H	HTML and CSS	S Structure		1			0	34.		of		aty		-					ou	lcom	5
CLR-3:	Demonstrate	the o	client side	e scripting usin	g JavaScript	-	-			edge		nt of	ions	Φ	socie			Wor		ance				
CLR-4:	Execution of	Serv	er side Pr	roa <mark>rammina</mark> wi	ith PHP	1	112			now	ysis	pme	stigat	Jsag	and	~*		eam	Ľ	Fina	rning			
CLR-5:	Create Data	base	programm	nina with PHP	and MySQL and	Advance	d Web Program	nmina concepts		ng K	Anal	evelo	inves	00	leer	ent 8		S ⊥	icatic	gt. &	Lea			
•=•	ereate 2 ata	0400	programm		and mj e q= and		u mos mogram	initial g concepte	1.00	neer	em	gn/de	luct l	ern T	engir	onm ¹	ŝ	idual	mun	sct M	-ong	<u>-</u>	5	ကု
Course Ou	tcomes (CO)):		At the end	of this course, I	learners	will be able to	1000 C	100	Engi	Prob	Desi	Conc	Mode	The	Envii Sust	Ethio	Indiv	Com	Proje	Life I	PSO	PSO	PSO
CO-1:	Use the vari	ous H	ITML ta <mark>gs</mark>	s with appropria	ate styles to displ	lay the va	rious types of a	contents effectively	1	1	-	3	-		-	-	-	-	-	-	-	-	-	-
CO-2:	Develop the pages effect	dyna ive.	mic we <mark>b p</mark>	<mark>pages</mark> using H	ITML, CSS and J	lavaScrip	t applying web	design principles to	make	μ.	1	3	2	2			-	-	-	-	-	-	-	-
CO-3:	Design the c	lient s	side scr <mark>ipt</mark>	<mark>ts usin</mark> g variou	is features for cre	eating cus	tomized web s	ervices		1	- /	3	-	2	-	-	-	-	-	-	-	-	-	-
CO-4:	Develop the	serve	er side <mark>PH</mark>	<mark>-IP scrip</mark> ts using	g various feature	s for crea	ting customized	d web services.		1	2	3	1	2	-	-	-	-	-	-	-	-	-	-
CO-5:	Create the s web applicat	erver ion u	^r side s <mark>crij</mark> sing advai	<mark>ipts for d</mark> esign anced web prog	ing web based s gramming concep	e <mark>rvices</mark> w ots.	vith database c	onnectivity and dev	elop a	1 -6	1	3	-	2	1	-	-	-	-	-	-	-	-	-
Unit d Int	ve du etie e				and the second									-	-									Haum
Introduction	to WFB. Bas	sics o	f WWW. H	HTTP protocol	Client Server an	chitecture	. Introduction to	o web server installa	ation ai	nd con	figurat	ion W	eb De	sian C	oncen	ts of ef	ffective	web	desian	Web	desian	issue	s incl	udina
Browser, Ba	andwidth and	Cach	ne, Display	y resolution, L	ook and Feel of t	he Websi	ite, Page Layou	it and linking, User o	centric	desigi	n, Site	map, F	lannin	g and	publis	hin <mark>g w</mark>	ebsite	, Desig	ning e	ffectiv	e navię	gation	0	g
Unit-2 – HT	ML and CSS	5			1			- A															9	Hour
Basics of H	ITML and CS	S, St	ructure of	f HTML page,	HTML tags for d	ata forma	atting, tables, lii	nks, images, meta t	ags, fr	ames,	html f	form ta	gs, me	edia, A	APIs, H	ITML5	tags a	and va	lidatior	n. Nee	d for C	SS, S	Syntax	(and
structure, C	SS rules for I	Backg	grounds, C	Colors and pro	perties, manipula	ating texts	, Fonts, border	s and boxes, Margir	ns, Pac	dding L	lists, C	CSS Pa	ositioni	ng. Ar	nimatic	ons, To	ol-Tips	s, Style	e image	es, Vai	riables	, Medi	ia Que	əries,
Wildcard Se	electors (*, * a	and \$,) in CSS,	Working with	Gradients, Pseud	lo Class a	and Pseudo ele	ments		-		-												
Client Side	Scripting usir	n pun Ind lav	g /aScrint Si	Syntax of Javas	Script Execution	of JavaSc	rint Internal F	mbedded and Exter	nal la	/aScrii	nt lav	aScrin	t · varia	ahles	arravs	functi	ions c	onditio	ns loo	ns Pr	n un h	OVAS	9 lava!	Script
objects and	DOM, JavaS	Script	inbuilt fun	nctions, JavaS	cript validations a	and Regul	lar expressions	, Event handling with	h Java	Script.	<i></i>	uoonp	. vanc	10100,	unuyo	, ranou	0110, 0	onanio	110, 100	p0, r 0	p up o	0,000,	ouvac	Jonpt
Unit-4 – Se	rver Side Pr	ograr	mming																				9	Hour
Server Side	e Programmii	ng wit	th PHP Di	ifference betw	een Client side a	and Serve	er side scriptin	g, Structure of PHP	page,	PHP	Synta	x: vari	ables,	decisi	on an	d loopi	ing wit	h exar	nples,	PHP a	and H	rml, i	Arrays	s and
Functions, S	String, Form	oroce	ssing, File	e uploads, Dat	es and time zone	e, Working	g with Regular I	Expressions, Except	tion Ha	andling	1.													

Unit-5 – Database Connectivity

Database programming with PHP and MySQL Basic MySQL commands, PHP functions for database connectivity, Implementation of CRUD operations using PHP, Prepared Statement and stored procedure execution in PHP, Advanced Web Programming concepts, Asynchronous Web Programming, Difference between synchronous and asynchronous web programming.

	1.	Web Technology, Moseley and Savaliya, Wiley India 2016	5.	A Step-by-Step Guide to Creating Dynamic Websites By Robin Nixon Publisher: O'Reilly Media
Looming	2.	HTML 5 Black Book 2Ed, Kogent Learning Solutions Inc, dreamtech 2016		2021
Deseuress	3.	Web Design, Joel Sklar, Cengage Learning 2015	6.	Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel, Pearson, 5th edition, 2014
Resources	4.	Learning PHP, MySQL, JavaScript, CSS & HTML5, 3rd Edition, Robin Nixon, O'Reilly	7.	JavaScript for impatient programmers, Dr. Axel Rauschmayer 2022
		2014	8.	PHP: The Complete Reference By Steven Holzner, McGrawhill, 2017

Learning Assessme	nt										
		~~~	Continuous Learning	g Assessment (CLA)		Sum	mativa				
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test %)	Life-Long CL (1)	g Learning .A-2 0%)	Final Examination (40% weightage)					
	2	Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	15%		15%		15%	-				
Level 2	Understand	25%		30%		<mark>25</mark> %	-				
Level 3	Apply	30%	Section 2 and 2 and	30%		<mark>30</mark> %	-				
Level 4	Analyze	30%		25%		<mark>30</mark> %	-				
Level 5	Evaluate				-		-				
Level 6	Create	( D.C )			-	-	-				
	Total	100	)%	10	0 %	100	0 %				

Co	urse Designers				
Ex	perts from Industry	Exp	erts from Higher Technical Institutions	Inte	ernal Experts
1.	K.Sankar, Chief Data Scientist - AI, ML and Computer	1.	Dr. K. Veningston, Assistant Professor, Department of Computer	1.	Dr.S.Babu, SRMIST,
	Vision.Eagle Software India Pvt Ltd. Greams Road, Chenna	ai -	Science and Engineering, National Institute of Technology Srinagar,		
	600006. Mob : 7305926073		Hazratbal - 190006, Jammu and Kashmir. Contact: +91 9790278826	_	



Course Code	ROGRAMMING	C Ca	ourse itegory	,	0				OPEN	ELEC	ΓIVE				L T 2 1	P 0	C 3				
Pre-requisite         Nil         Co- requisite         Nil         Progre           Courses         Nil         Courses         Nil         Courses         Nil         Courses         Courses															Nil						
Course	Offering Departm	ent	Sch	ool of Computing	Data Book / Codes / Sta	Indards	1						_	Nil							
Course Le	earning Rationale	(CLR):	The purpos	e of learnin <mark>g this cours</mark>	se is to:		-	T	1		Pr <mark>ogr</mark>	am Ou	itcome	s (PO)	)				P	rogra	m
CLR-1:	Understand the	basic progi	ramming synta	ax of Python	10.22		1	2	3	4	5	6	7	8	9	10	11	12	S OI	peciti	C es
CLR-2:	Understand vario	ous Loopin	ng statements	and Functions	and and		Ð		÷	of	20	ety			¥						
CLR-3:	Acquire the Know	wledge of a	objec <mark>t oriente</mark>	d feature in Python	1.11	16.	vledg		ent o	ations	ge	soci			No I		ance	D			
CLR-4:	Comprehend the	significan	nce <mark>of Lists,</mark> Se	ets and Tuples in Progra	m Development	14 C 1	Yuov .	lysis	mdo	stige	Usa	and	৵		ean	u	ž.	arnin			
CLR-5:	Acquire the know	vledge of F	Fil <mark>es and h</mark> and	lling Exceptions	-		eering I	em Ana	n/devel	uct inve lex prot	m Tool	ngineer	onment inability		dual & J	nunicati	ot Mgt.	ong Lea	-	2	3
Course O	utcomes (CO):		At the end	of this course, learners	s will be able to:	127	Engin	robl	Desig	Cond	Mode	The e	Envire	Ethics	ndivi	Comr	Proje	-ife L	-OSc	-OSc	-OSc
CO-1:	Apply the basic µ	orogram <mark>mil</mark>	<mark>ing kno</mark> wledge	ofor Program Developm	ent	41.1	1	3	-	-	3		-	-	-	-	-	-	-	-	-
CO-2:	Apply the knowle	edge of L <mark>oc</mark>	<mark>ops an</mark> d Func	tions to build application	and the second second		1	2	3	- 4	-		-	-	-	-	-	-	-	-	-
CO-3:	Design of real w	orld appl <mark>ica</mark>	ation using Ol	bject oriented features		100	1	3	3	-	-	-10	-	-	-	-	-	-	-	-	-
CO-4:	Apply the conce	ots of Lis <mark>ts</mark>	<mark>s and T</mark> uples fo	or program optimization		12	1	3	3	-3			-	-	-	-	-	-	-	-	-
CO-5:	Design of Applic	ations fo <mark>r c</mark>	<mark>data exc</mark> hange	e using Files	Carlos and	-1	1	-	3	-	2	1	-	-	-	-	-	-	-	-	-
Unit-1 - In Introductio	troduction n - History of Pyth	on-Getting	g Started with	Python-Programming s	tyle and Documentation-Identifiers	s-Variable	es-Assi	ignm	nent st	atemer	ts-Exp	pressio	ons- Da	ta Typ	es-Op	erators	s-Prece	edence	-Comr	9 nents-	Hour Type
Unit-2 - Lo	pops and Function	n Function <b>ns</b>	IS-IIIIIOUUCIIOII	r to methous and Strings					_	12	1				-					9	Hour
Introductio	n-Scope-IF Statem	nents-Type	es of I <mark>F Statem</mark>	ents-Conditional Expres	sions-Loops -While Loops-For Loo	op-Neste	d Loop	s-Fu	inction	s-Defir	itions	Defau	lt A <mark>rgu</mark> r	nents-	Calling	g a Fun	ction- I	Functic	ns wit	h or wi	ithout
returning v	alues-Passings an	guments to ts	o a function-C	all by Value - Call by Re	terence-Recursion	-	-	-	-	-	-	-		-						9	Hour
Introductio	n to Object orient	ed Program	mming-Need	of class and objects-De	fining classes-Constructing Object	cts-Abstr	action a	and	Encap	sulatio	n-Ove	rriding	Metho	ds - Ir	nherita	nce ar	d Poly	morph	ism-M	odules	s and
Packages-	Introduction to Stri	ing Class-S	String Function	ns-Formatting Strings			_	1												•	
Unit-4 - Li	sts - Tuples-Sets	of List-Fur	nctions for List	ts-Passing List to Function	ons-Operation on Lists-Searching	and Sort	ina-Mul	tidin	nensio	nal List	s-Adv	anced	l ist Pro	ressi	na - Sa	mnle r	roaran	ns on l	ists-l r	9 otto nu	Hour mber
and Deck	of Cards-Introducti	on to Tuple	es-Sets - Crea	ation and Accessing Set	s-Dictionary Operations and Metho	ods	ng mai	uum	Torrolo		07107		LIOUTIC	/00000	ig Ou	inpic p	rogran			/110 /110	111001
Unit-5 - Fi	les and Exception	n Handling	g na and Matter	n Data Assassing Files	File Dielege Detrieving data forma	wah let-	oduot'-		Fuest	tions	-	and F	voont'-	no ()-		d line -		nto M-	od for	9	Hour
Introductio Handling E	n - Structure of Fil Exceptions-Raising	Exception	ng and writing ns-Exception C	g Data-Accessing Files- Dbjects-Custom Exception	File Dialogs-Retrieving data from	web-intro	Dductio	n to	Excep	Duons-E	rrors	and E	xceptiol	ns-Col	nmano	i line a	rgume	nts-Ne	ea tor	⊨xcel	jtion-

Learning	1. 2.	. Y.Daniel Liang, "Introduction to Programming using Python"1st edition, Pearson,2021, Karl Beecher, "Computational Thinking-A beginners guide to problem solving and	3.	Allen Downey, "Think Python - How to Think Like a Computer Scientist, Green Tea Press, 2021
Resources		programming, 2017		

Learning Assessmer	nt										
			Continuous Learning	Assessment (CLA)		Summative Final Examination (40% weightage)					
	Bloom's Level of Thinking	Form CLA-1 Averag (50	ative ge of unit test %)	Life-Lon C. (1	g Learning LA-2 10%)						
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	15%	and the second sec	15%		15%	-				
Level 2	Understand	25%		25%	1.3	25%	-				
Level 3	Apply	30%		30%		30%	-				
Level 4	Analyze	30%	and the second second	30%		30%	-				
Level 5	Evaluate	C	and the second sec		1		-				
Level 6	Create			1.00		-	-				
	Total	100	)%	1(	00 %	10	00 %				

Course Designers		and the second s
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. D. Surendran, CEO, SKS Skill Fasteners Private limited	1. Dr. Kannimuthu.S. Professor, Karpagam College of Engineering.Coimbatore	1. Dr. P. Madhavan. SRMIST



Course Code         21CSO353T         Course Name         MOBILE APPLICATION DEVELOPMENT							Cour Categ	se ory	0				OPEN I	ELECT	ΓIVE				_ T 2 1	P 0	C 3
Pre-requis Courses	site S	Nil	Co- Coi	requisite urse <mark>s</mark>		Nil	P	rogres Cours	sive ses						Nil						
Course C	Offering Departme	ent	School of Co	omputing	Data B	Book / Codes / Standa	rds	-						Nil							
Course Lea	arning Rationale		1	1			Progr	am Ou	Itcome	s (PO)	)				P	rograr	n				
CLR-1:	Understand the b	asics of And	Iroid devices and P	latform.			1	2	3	4	5	6	7	8	9	10	11	12	S ou	pecifie tcome	c es
CLR-2:	Acquire knowledg	ge on basic b	ouild <mark>ing blocks</mark> of G	UI Componen	nts in Android prog	gramming	e		f	s of	20	iety			rk		a)				
CLR-3:	Analyze Data sto	rage mechar	nis <mark>m in diffe</mark> rent An	droid App	1 1	1.1	vledç		ento	stions	ge	soc		-	oW r		ance	ດ			
CLR-4:	Appraise android	services for	different application	ns			Anov	lysis	mdo	stiga	Usa	and	৵		ean	и	& Fi	arnin			
CLR-5:	Design and apply	the knowled	dge to publish Andr	oid applicatior	ns		eering l	em Ana	n/devel	uct inve ex prob	rn Tool	ngineer	onment inability		dual & T	nunicati	st Mgt. 8	ong Lea	1	~	m
Course Ou	tcomes (CO):	A	At the end of this o	course. learne	ers will be able to	0:	ngin	roble	lesig		lode	he e	inviro	thics	divid	omn	rojec	ife L	-OS	- So-	Ś
CO-1:	Exhibit the knowl	edge on And	Iroid devices and P	latform		A	1	-	-		3		<u>ш</u> о	-	-	-	-	-	-	-	-
CO-2:	Demonstrate the	usage of GU	JI Components for A	App developm	nent.	1000	1	-	3	-	_	-	-	-	-	-	-	-	-	-	-
CO-3:	Decide on suitabl	le Data <mark>stora</mark>	ge mechanism for	Apps	11-352	1000		1.	3		-	-	-	-	-	-	-	-	-	-	-
CO-4:	Implement Andro	id servi <mark>ces u</mark>	ising threads		200	10.000	1	-	3	-	3	-	-	-	-	-	-	-	-	-	-
CO-5:	Develop and pub	lish And <mark>roid</mark> a	applications		1. 1. 1. 1. 1.		3	-	3	-	-	1	-	-	-	-	-	-	-	-	-
Unit-1 - Int	roduction to Mob	ile Applicati	ion Development		and the second	1445						-								9	Hour
Introduction	, Android platform	n: Features a	nd architecture, ve	ersions, ART (J	Android Runtime)	, ADB (Android Debug	Bridge)	. Deve	elopme	nt envi	ronmer	nt/IDE:	Androi	d stud	lio and	its wo	rking e	environ	ment,	Applic	ation
anatomy: A	pplication framew	ork basics: re	<mark>esource</mark> s layout, va	alues, asset XI	ML representation	n and generated R.Jav	afile, An	droid n	nanifes	t file. C	reating	a sim	ple app	licatio	n.						
Introduction	n to activities life-ci	vcle intent fi	ilters adding catego	ories linking a	activities user inte	erface design compon	ents Vie	ws and	d View	Group	s [.] Basi	ic view	s nicke	r view	is ada	nter vie	ews M	lenu A	nn Ba	r bas	Hour ics of
screen desi	gn; different layou	ts, App widge	ets. Lollipop Materi	ial design: new	w themes, new wid	dgets, Card layouts. F	ecycler	View, H	Fragme	ents: Int	roduct	ion to	Fragme	nts, lif	e-cycle	9. 9.	ono, m	ionia, ri	pp Du	, 5461	00 0/
Unit-3 - Me	mory Manageme	nt		7.1	11.3.70	Astilli				-	1									9	Hour
Introduction	to Different Data	persistence s	schemes <mark>, Shared</mark> p	references, Fi	ile Handling, Mana	aging data using SQLit	e databa	se. Co	ontent p	provide	rs: use	r conte	ent prov	ider, A	ndroia	in-buil	lt conte	ent prov	viders,	Integr	ation
Unit-4 - Th	reads and Androi	id Services			and the second s					-										9	Hour
introduction	to services – loca	al service, ren	note service and bi	nding the serv	vice, the communic	cation between service	and act	ivity, Ir	ntent S	ervice, l	Multi-T	hread	ng: Han	dlers,	Async	Task,	androi	d netwo	ork pro	grami	ning:
HTTP URL	Connection, Conn	ecting to RE	ST-based and SOA	AP based We	<mark>b services,</mark> Broad	lcast receivers: Local E	Broadcas	t Mana	ager, D	)ynamic	: broad	lcast re	eceiver,	Syste	m Bro	adcast.	. Pend	ing Inte	ent, N	otificat	tions,
l elephony	Manager: Sending	SMS and m	naking calls, Interac	ction with serv	ver side apps																Hour
Introduction	to Location base	d services. G	loogle maps V2 ser	rvices usina G	Google API. Anima	ations and Graphics: F	ropertv	Anima	tion, Vi	iew Anii	mation	s. Dra	wable A	nimati	ions, N	ledia a	nd Ca	mera A	PI: W	orkina	with
video and a	udio inputs, Came	era API, Sens	sor programming: N	Aotion sensors	s, Position sensor	s, Environmental sens	ors <mark>, Gui</mark> o	le line:	s, polic	ies and	proce	ss of L	ploadin	g App	s to G	oogle	play				

	1.	Dawn Griffiths, David Griffiths, "Head First: Android Development", OReilly 2015, ISBN:	3. PaulDeital, Harvey Deital, AlexanderWald, "Android6 for Programmers, App Driven approach"
Learning		9781449362188.	2015, Prentice Hall, ISBN: 9780134289366.
Resources	2.	Greg Milette, Adam Stroud, "PROFESSIONAL Android™ Sensor Programming", John	<ol><li>http://developer.android.com/training/index.html</li></ol>
		Wiley and Sons, Inc 2012,ISBN/978111265055	

		and the second	Continuous Learning	Assessment (CLA)		Summative			
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test 0%)	g Learning LA-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	15%		15%		15%	-		
Level 2	Understand	25%		20%		25%	-		
Level 3	Apply	30%	A State State	30%		30%	-		
Level 4	Analyze	30%	1. S.	30%		30%	-		
Level 5	Evaluate		-	and the second		-	-		
Level 6	Create	· · · ·	Sector Sector	1/100 - 100 - 1		-	-		
	Total	100	0%	10	0 %	10	0 %		

Course Designers	ALL STREET, ST	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mrs. C.Saranya, Engineering Manager, embedUR systems	1. Dr. Thiyagarajan, Asst Prof/Dept of IT, Sri Venkateswara College of	1. Dr. B. Prakash, SRMIST
Pvt. Ltd, Chennai.	Engineering, Sriperumbudur.	
		2. Ms. Revathi, SRMIST
		3. Ms. Vathana, SRMIST



Course Code	Course         21CSO354T         Course         DATA ANALYTICS           Code         Name         Course         Course				Co Cat	ourse egory		0				OPEN	ELEC	TIVE				L T 2 1	P 0	C 3
Pre-requ Course	isite es	Nil	Co- requisite Courses	Nil		Progr Cou	ress urse	ive s						Nil	1					
Course	Offering Departme	ent	School of Computing	Data Book / Codes /	Standards								Nil							
Course Lo	earning Rationale	(CLR):	The purpose of learning this cour	se is to:	1000	Program Outcomes (PO)								P	rogra	m				
CLR-1:	Understand the b	asic cond	epts of Data Analytics	1.	1		2	3	4	5	6	7	8	9	10	11	12	- S 01	pecifi	ic Ies
CLR-2:	Share knowledge	of Data	Analytic <mark>s technique</mark> s	1 and the second	9	D		÷	of	24	ety			¥						
CLR-3:	Explore the concept of visualization and its tools							ent o	tions	e	soci		-	Moi		ance	5			
CLR-4:	-4: Explore and apply the machine learning techniques						ysis	opme	stiga	Usaç	and	ø		eam	ы	Fin	rning			
CLR-5:	LR-5: Implement the applications of Data analytics in different domains						Alia	evel	inve: prob	0	neer	bilitv		R& T	icati	lgt. 8	Lea			
<u> </u>								gn/d	duct	en	engi	ronn aina	s	idua	unu	ect N	Long	5	2	က္
Course O	utcomes (CO):		At the end of this course, learner	s will be able to:				Desi solut	Conc	Mod	The	Envi	Ethic	Indiv	Com	Proje	Life	PSO	PSO	PSO
CO-1:	Exhibit knowledge	e on the <mark>f</mark>	undamental concepts of data analytic	S	1	1 2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Suggest suitable	data an <mark>a</mark>	ysis techniques to handle large data		1	1 2	2	3		-	-	-	-	-	-	-	-	-	-	-
CO-3:	Create an interac	tive das <mark>h</mark>	board to visualize data				1	2		3	-	-	-		-	-	-	-	-	-
CO-4:	Apply appropriate	e machi <mark>ne</mark>	learning algorithm to perform data a	alytics	1	1 2	2	1	3	1	-	-	-	-	-	-	-	-	-	-
CO-5:	Develop intelliger	nt decisio	n support systems	- Tak Section	115		1	2	-	3	26	-	-	-	-	-	-	-	-	-
Unit-1 - In	troduction to Data	Analytic	s s	dete analogia Analotia Davar		-											1		9	Hour
1 ypes – P Unit-2 - B	nases - Quality and ig Data and Cloud	Quantity Technol	o <mark>r data – measurement - Exploratory</mark> D <b>aies</b>	data analysis - Analytic Proces	ses and Tool	S				-	-	-		-					9	Hour
Streams C	Concepts – Stream L	Data Mod	el and Architecture - Introduction to H	ADOOP: Big Data, Apache Had	doop, MapRe	duce -	Dat	ta Ser	ializatio	on - Da	ata Ex	traction								
Unit-3 - D	ata Visualization		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1							1									9	Hour
Introductic Unit-4 - M Modeling	on to data visualizati I <b>achine Learning</b> Process – Training I	on – Data	a visualization options – Filters – Dasi	board development tools – Cre	eating an inte	ractive	das	shboa isod k	rd with	dc.js -	sumn	nary.							9	Hour
Unit-5 - C	ase Studies			ervalions – Superviseu learning	aiyontinns –	onsu	JEIVI	1350 18	anning	aiy011	111115								9	Hour
Case stud	ies and proiects. Ur	derstand	ing business scenarios- Scalable and	parallel computing with Hadoo	p and Map-R	educe	- Fei	ature	engine	erina a	and vis	sualizat	ion							

Learning	1.	Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Introducing Data Science, Manning	3.	Data Analytics Made Accessible: 2023, Kindle Edition
Desources		Publications Co., 1st edition, 2016.	4.	https://www.amazon.in/Data-Analytics-Made-Accessible-2018-ebook/dp/B00K2I2JL8
Resources	2.	Hadoop: The Definitive Guide, 4th Edition [Book] - O'Reilly		

Learning Assessme	ent									
			Continuous Learning	Assessment (CLA)		Summative Final Examination (40% weightage)				
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test )%)	Life-Lon Ci (1	g Learn <mark>ing</mark> LA-2 10%)					
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	15%	Constanting from the	15%	1.1	15%	-			
Level 2	Understand	25%		20%	1242.2	25%	-			
Level 3	Apply	30%	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	25%		30%	-			
Level 4	Analyze	30%	and the second second	25%		30%	-			
Level 5	Evaluate			10%	and the second second	-	-			
Level 6	Create	NY - 65		5%		-	-			
	Total	100	0%	10	0 %	10	0%			
				1 1 1 1 1 1 1 1	Company day					

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. C.Giridharan, M.Tech, Software engineer (Data science),	1. Dr. Bala Vinayaga sundaram, Anna University	1. G.Malarselvi, SRMIST
Quickplay media Pvt Ltd , Chennai	A STATE CONTRACTOR AND A MADE	
	the second state of the se	2 Dr. T. Pagunthar SPMIST



Course Code	21CSO355T	T Course MACHINE LEARNING FOR ALL				Cours Catego	se ory	0	OPEN ELECTIVE						<u> </u>	P 0	C 3					
Pre-requi Course	site s	Nil		Co- req Course	uisite es	Nil		Progressive Nil														
Course (	Offering Departme	ent	Sch	nool of <mark>Comp</mark>	uting	Data Book / C	odes / Standar	ds							Nil							
								-	-	1.0		_	-		(2.0)					D	roara	-
Course Le	arning Rationale (	CLR): 11	he purpos	se of learnin	g this coul	rse is to:					-	Progr	am Ou	utcome	s (PO	)				- FI	pecifi	C
CLR-1:	provide basic con	cepts of ma	chine learl	ning	-	10.00		1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	es
CLR-2:	provide deeper u outputs	nderstandin	ng of vario	us tools and	technique	s for Machine learning .	Algorithms and	ge		of	is of	20	ciety			ork		je				
CLR-3:	Understand and Implement the major classification techniques							vled	lysis	ent	ation	ge	soc			Ň		Janc	D			1
CLR-4:	Understand and Implement the various Clustering Methods						1.20	Kno		mdo	stig: olem	Usa	ranc	~~~		Tear	io	& Fii	arnir			I
CLR-5:	Learn and Understand the Tree based machine Learning Algorithms						eering	em Ana	in/deve ons	uct inve lex prot	m Tool	ngineel	onment		dual & ⁻	nunicat	ct Mgt.	ong Le:	~	2	3	
Course Ou	Dutcomes (CO): At the end of this course, learners will be able to:					Engin	Proble	Desig	Condi	Mode	The e	Enviro Susta	Ethics	Individ	Comn	Projec	Life L	PSO-	PSO-	PSO-		
CO-1:	Understand the co	oncepts <mark> of m</mark>	nachine lea	arning		1. 14 SM	22.11.22	1 - 1	2	-	• •	1	- 4	-	-	-	-	-	-	-	-	-
CO-2:	Learn and unders	tand m <mark>achin</mark>	<mark>ne to</mark> ols an	d librari <mark>es</mark> of	machin <mark>e</mark> le	earning	No. 1		2	-	-	1	-	-	2	1	-	-	-	-	-	-
CO-3:	Learn and unders	tand th <mark>e line</mark>	ear learnin	g model <mark>s</mark> and	d classificat	tion in machine learning	1	-	2		-	2	-	-	-	-	-	-	-	-	-	-
CO-4:	Understand the cl	lusterin <mark>g tec</mark>	<mark>hniq</mark> ues a	nd their utiliza	ation in ma	chine learning			2	1	4.2	1		-	-	-	-	-	-	-	-	-
CO-5:	Study the tree bas	sed ma <mark>chine</mark>	e learning i	techniques a	nd to appre	ciate their capability	1. 6	-	2	тic	-	2		-	-	-	-	-	-	-	-	-
Unit-1 - Int	troduction to Macl	hine Learnii	ng	and a	-		1 CF				_	1		-							9	Hour
Machine Le - Over fittin <b>Tutorial:</b> 1.	earning: What and g and under fitting- Implementation of I	Why?-Typ <mark>es</mark> linear regre Linear regre	s of Machin ession-Deri ession with	ne Learning, iving mathem real time dat	Supervised natical intuit ra, 2. 1	Learning- Unsupervised ion behind linear regress Implementation of Class	d Learning- Reir sion-Bias and V ification Algorith	forcem ariance- m	ent lea Testir	arning- ng and	Platfor Trainin	m for r g of d	nachin ata- R	ne learn egulariz	ing- M ation-	achine Classi	learnii ficatior	ng pyth 1-types	on libr - Error	aries- and n	Scikit- 10ise	learn
Unit-2 - To	ols and Techniqu	es for Mach	hine <mark>Learn</mark>	ing		1 1 1 3 A V							3-								9	Hour
Training da regression- <b>Tutorial:</b>	ata – Testing data – Naive Bayes with s	validation d scikit-learn-N	lata, P <mark>erfo</mark> Naïve Baye	rmance metro es application	ics- MSE, a is	accuracy, confusion matr	ix, precision, re	call, F- s	score-	Logist	ic Regr	ession	- Type	es of Log	gical re	egress	ion- Sp	oam filte	ering u	sing lo	gistic	
3. Unit-3 - Cl	Logistic Regression	n impiement <b>niques</b>	auon,	4. Nan	ie Bayes In	npiementation								-								Hour
Classificati Analysis-P Tutorial:	on in Machine learr CA Application	ning, Binary (	Classificat	ion-Multi labe	el classifica	tion- Imbalanced Classif	ication- Support	vector	machi	ne-Mul	ti class	<mark>clas</mark> sii	ficatior	n- K nea	arest n	eighbo	ur clas	sificatio	on-Prin	cipal (	Compo	onent
5.	Support Vector Ma	chine Impler	mentation,	6. PC	A Analysis																	

Unit-4 - C	Clustering Algorithms	9 Hour
Clustering	a algorithm Types of clustering algorithm Choosing the number of clusters- Spectral clustering - Hierarg	hical clustering - Agglomerative clustering -Clustering data points and features. K-Means clustering
DB Scan	Clustering algorithm- Application: image segmentation using K-means clustering	
Tutorial:		
6.	K Means Clustering, 7. DB Scan Clustering Implementation	
Unit-5 - T	ree based Machine Learning	9 Hour
Decision t	tree representation- Basic decision tree learning algorithm- Inductive bias in decision tree- Decision tree	construction- Issues in decision tree- Random Forest- Random forest with scikit learn- Multivariate
adaptive r	regression trees (MART)- Introduction to Artificial Neural Networks- Perceptron learning	
Tutorial:		A VA
7.	Decision Tree Construction, 8. Random Forest Implementation	
r		
	1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.	5. Carol Quadros,"Machine Learning with python, scikit-learn and Tensorflow", Packet
l earning	<ol><li>Ethem Alpaydin, "Introduction to Machine Learning", Prentice Hall of India, 2005</li></ol>	Publishing, 2018.
Resource	3. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.	6. Gavin Hackeling," Machine Learning with scikit-learn", Packet publishing, O'Reily, 2018.
	<ol> <li>Sebastian Raschka, Vahid Mirjilili, "Python Machine Learning and deep learning", 2nd edition,</li> </ol>	
	kindle book, 2018	

rning Assessme	ent 📃 🛌	V	the August	1974	1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -				
			Continuous Learning	Assessment (CLA)	and the	Summative Final Examination (40% weightage)			
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (10	l Learning A-2 )%)				
		Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	40%	a line a film of the	20%		40%	-		
Level 2	Understand	40%		20%	-	<u>40%</u>	-		
Level 3	Apply	10%		20%		10%	-		
Level 4	Analyze	10%	-	20%	and the second se	10%	-		
Level 5	Evaluate	- 11 M	- 1/7	10%	-	-	-		
Level 6	Create		-	10%	-	-	-		
Total		10	0%	10	0 %	100 %			

Course Designers	The second se	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Sibi Varthan, Senior Test Engineer, Tech Mahindra	1. Dr.Sundaravadivazhagan, Professor, University of Technology and Applied Sciences, Al Mussnah	1. Dr.M.Sangeetha , SRMIST
		2. Dr.G.Vadivu, SRMIST

Course Code	Course Code         21CSO356T         Course Name         CONVOLUTIONAL NEURAL NETWORKS FOUNDATION						Ca	ourse	e ry	0	OPEN ELECTIVE							P 0	C 3			
Pre-requi Course	site s	Nil	(	Co- requisite Course <mark>s</mark>		Nil		Pro C	gres: ourse	sive es						Nil						
Course	Offering Departme	ent	School o	of Computing		Data Book / Codes / Sta	andards							_	Nil							
Course Le	arning Rationale (	CLR): T	he purpose of	learning this c	ourse is t	o:		-	4	1		Progra	am Ou	itcome:	s (PO)					Pr	ograi	m
CLR-1: Learn the evolution of neural networks								1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	c es
CLR-2:	Utilize the knowle	dge for mod	del d <mark>evelopment</mark>		1.1			Ð		ł	of	1	ety			논		0				
CLR-3:	3: Fine tune the performance with optimization techniques							vledc		ent o	tions	ge	soc			Wo		ance	0			
CLR-4:	R-4: Utilize class and build domain model for real-time programs							Vou	lysis	mdo	stiga	Usa	and	<b>∞</b> ठ		earr	uo	ž Fin	Inin			
CLR-5:	CLR-5: Construct CNN model for image based applications							ering F	n Ana	devel	t inve k prob	Tool	jineer	ment ability		al & T	nicati	Mgt. 8	g Lea			
				- N/			-	ginee	blen	sign/	nduc	dern	enç	/iron	S	vidu	nmu	ject	Lon	<u>-</u>	0-2	ကို
Course Ou	utcomes (CO):	A	At the end of th	is course, lear	ners will	be able to:		ц Ц	Pro	Des	Cor	Mo	The	Sus	臣	Indi	Cor	Pro	Life	PS(	PS(	PS(
CO-1:	Understand funda	amental <mark>s of l</mark>	Neural Network	S		and the start of	4 - 1	-	3	-	-	3	-	-	-	-	-	-	-	-	-	-
CO-2:	Understand funda	amental <mark>s of (</mark>	CNN Architectu	re				-	3	-	-	3	-	-	-	-	-	-	-	-	-	-
CO-3:	Learn how to app	ly perfo <mark>rman</mark>	<mark>nce o</mark> ptimization	1	1.0		1		3	-	-	3	- 34	-	-		-	-	-	-	-	-
CO-4:	Understand differ	ent CN <mark>N Arc</mark>	chitectures		1200		100	-	3		-	3	1	-	-	-	-	-	-	-	-	-
CO-5:	Understand CNN	in imag <mark>e cla</mark>	assification	- 11 E	112		-	-	3	Y		3	2	-	-	-	-	-	-	-	-	-
Unit-1 - Int	troduction to AI &	ML			Central	and the second second	2					-	-								9	Hour
Types of N hyperparar T1: Implem	ML-Old versus new meters- Underfitting ment Simple Program	ML-Artificia versus over ns like vecto	al neural netwo rfitting Feature s or addition in Te	rks-Activation f scaling-Fully col ensorFlow.	functions nnected la	The XOR problem-Training yyers	g neural i	netwo	rks-B	ackpro	opagatic	n and	the c	hain ru	ıle-Bat	ches I	loss fu	Inction	s-The	optimiz	zer ar	nd its
Unit-2 - Fu	Indamental CNN A	rchitecture	ession model in e	neras.	-		100			-	-	1									9	Hour
Convolution Calculating T1: Implem T2: Implem	n Input padding-Ca the receptive field- nent a CNN based of nent a CNN based of nent a CNN based of	alculating the Building a C classifier of h classifier of h	ne numb <mark>e</mark> r of pa CNN model in Te handwritten digin handwritten digin bandwritten digin	arameters (weig ensorFlow. ts: The Convolu ts: The Max Poo ts: The Eully Co	ghts)- Cal ition Laye oling Laye	culating the number of ope , r avor	erations-C	Conve	rting	convol	lution la	yers ii	nto ful	lly conn	ected	layers	s-The p	ooling	layer-	1x1 C	วทงอโเ	ition-
Unit-3 - Pe	erformance Optimi	zation	nanuwnitten uigit	is. The Fully Co		ayer				-	-										9	Hour
Number of tuning - Ap T1: Implem T2: Implem	hidden layers -Nun propriate layer plac nent a CNN with Ad nent a CNN and ap	ber of neurc ement -Build am optimize ply dropout	ons per hidden l Iding the second er operations with	ayer -Batch nor I CNN by putting TensorFlow, T	malization g everythi 3 Impleme	-Advanced regularization a ng together - Dataset descr nt a CNN with a validation	and avoid iption and techniqu	ing ov 1 prep e	erfittin roces	ng -Ap sing -	plying o Creating	ropout the C	opera NN m	ations w odel -T	ith Ter raining	nsorFlo 1 and e	ow -Wh evaluati	nich opt ing the	imizer netwoi	to use rk.	? -Me	mory

Unit-4 - Popul	lar CNN Model Architectures	9 Hour								
Introduction to	ImageNet -LeNet -AlexNet architecture -VGGNet architecture -VGG16 image classification code examp	le -GoogLeNet architecture -Architecture insights -Inception module -ResNet architecture.								
T1: Implement	Image Net model for a Dataset									
T2: : Traffic sig	an classifiers using AlexNet									
T3 : Implement	t VGGNet model for a Dataset									
Unit-5 - Image	Classification	9 Hour								
CNN model ar	rchitecture-Cross-entropy loss (log loss)-Multi-class cross entropy loss-The train/test dataset split-Da	asets-ImageNet-CIFAR-Loading CIFARBuilding the CNN graph-Learning rate scheduling-								
Introduction to	Introduction to the tf. data API-Main training loop-Model Initialization-Do not initialize all weights with zeros-Initializing with a mean zero distribution-Xavier-Bengio and the Initializer-Improving generalization by									
regularizing-L2	2 and L1 regularization.									
T1: Implement	Image classification with TensorFlow									
T2: Build Tense	orFlow input pipelines for image									
T3: Implement	a CNN for Image processing L2 regularization									
Learning Resources	<ol> <li>Iffat Zafar, Giounona Tzanidou, Richard Burton, Nimesh Patel, Leonardo Araujo," Hands-On Convolutional Neural Networks with TensorFlow", ", Packt Publishing,,2018.</li> <li>Mohit Sewak, Pradeep Pujari, Md, Rezaul Karim, "Practical Convolutional Neural Networks:</li> </ol>	<ol> <li>Charu C. Aggarwal. Neural Networks and Deep Learning: A Textbook. Springer. 2019.</li> <li>Stanford University Course http://cs231n.stanford.edu/2018/syllabus.html</li> </ol>								

Implement Advanced Deep Learning Models Using Python, ",Packt Publishing ,2018

arning Assessme	ent		Continuous Learning	Assessment (CLA)		_			
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CLA (10	Learning A-2 %)	Final Examination (40% weightage)			
		Theory	Practice	Theory	Practice	<u>The</u> ory	Practice		
Level 1	Remember	15%		15%	- 100	15%	-		
Level 2	Understand	25%		20%	1	<mark>2</mark> 5%	-		
Level 3	Apply	30%		25%	and the second second	30%	-		
Level 4	Analyze	30%	- 10	25%		30%	-		
Level 5	Evaluate	State Street	- 114	10%	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	-	-		
Level 6	Create	All and a second	- 63%	5%		-	-		
	Total	10	0 %	100 %		100 %			

Course Designers	MCARAMAR FRAN	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.Gowtham Kumar Jyayachandiran, Assistant Vice President Nomura		1. Dr.K.Arthi, SRMIST

Course Code	21CSO357T	Course Name	e	DATA VISI	UALIZATIO	ON BASIC <mark>S</mark>		Cor Cate	urse gory	0				OPEN	ELEC	TIVE				- T 2 1	P 0	C 3
Pre-requi Course	site s	Nil		Co- requisite Course <mark>s</mark>		Nil			Progre Cour	ssive ses						Nil	1					
Course (	Offering Departm	ent	Schoo	ol of Computing		Data Book /	Codes / Stan	dards							Nil							
Course Le	arning Rationale	(CLR):	The purpose	<mark>of learnin</mark> g this c	ourse is t	:o:			17	1	5.	Prog	am Ou	utcome	s (PO)	)				P	rogran	n
CLR-1:	Learn the basics	of EDA an	nalysis and expl	loring PyViz, Holo	Viz for data	a visualization		1	2	3	4	5	6	7	8	9	10	11	12	S	pecific	: 
CLR-2:	Know to perform	D3 for dat	ta visualization	1	1.1		at a shire	e		of	s of	24	iety			ĸ		Ð				
CLR-3:	Utilize the Matpl	otlib library	∕ to vi <mark>sualize d</mark> ai	ta	1	1.12	1000	vled		ent o	ation	de o	soc			M No		Janc	D			
CLR-4:	Explore the Tab	eau to visu	ual <mark>ize data</mark>	~ ~		Week.	- 1.5	Ano X	lysis	mdo	stige	Usa	anc	ઝ્		[ean	u	& Fir	arnin			
CLR-5:	Explore the Apa	che Supers	s <mark>et to visua</mark> lize (	data	Ē			eering	em Ana	jn/devel	uct inve		engineer	onment	0	dual & 7	nunicati	ct Mgt.	ong Lea	5	5	3
Course Ou	Itcomes (CO):		At the end of	^f this course, lear	rners will I	be able to:	A and the		Probl	Desig	Cond	Ande	he	Envir	Ethics	ndivi	Comr	roje	life L	-OS	Ś	-OS
CO-1:	Use EDA techni	ques to ide	entify insights of	data and data visi	ualization i	using PyViz and	d HoloViz	-		-	- 0	-		-	-	-	1	-	-	-		-
CO-2:	Create effective	visualiza <mark>tic</mark>	on using D3 terr	iplates	922-		1022	- 1	-		-	3	-	<u> </u>	-	-	-	-	-	-	-	-
CO-3:	Implement the c	ode to vi <mark>su</mark>	alize data using	y Matplotlib		99	1. 1. 1	-		-		-		-	-	-	2	-	-	-	-	-
CO-4:	Visualize differe	nt kinds <mark>of e</mark>	dataset using T	ableau	2.4	10.22	1.1		L	-	-	-	-	-	-	-	2	-	-	-	-	-
CO-5:	Visualize differe	nt kinds of	dataset using A	pache Superset	1.5	10.2			2	1.	6 -	-	-	-	-	-	1	-	-	-	-	-
<b>Unit-1 - Int</b> Fundament several typ	troduction to ED tals of EDA-EDA es of Leaflet maps	<b>A, PyViz ar</b> with Persor s using folio	nd HoloViz nal Email-Desci um.	riptive Statistics-El	DA on Wir	ne Quality Data	Analysis-Expl	oratory d	lata ana	alysis u	ising se	aborn-	Using	PyViz /	HoloV	iz (Ge	oviews	s, Datas	shader	, HvPle	<b>9  </b> ot)-cre	<b>Hour</b> ating
T1: A data- Unit-2 - Da	centric approach ta Driven Docun	to visualiza ients-D3	atio <mark>n using p</mark> lot,	T2: Building intera	activity in p	plots, T3: Build	ding da <mark>s</mark> hboard	ls using	Panel		-	1									91	Hour
Introduction stacked vie T4: Identify	n to D3-Getting sta w-Bar chart-Multi ing appropriate te	arted with E ole Donuts- mplate for	D3-D3 <mark>visualiza</mark> S-Stacked Area- The available da	tion sample templa <mark>Pie</mark> chart ataset. T5: Display	ates-Displa /ina results	iying Results Us s usina D3. T6:	sing D3-Create	a sumn	nary file showin	for vis	sualizat hart. do	on-Visi onuts. p	ializati ies <mark>usi</mark>	on usin na D3	g HTN	/L doc	cument	-Data v	risualiz	ation s	howing	g the
Unit-3 - Vis	sualization with l	Matplotlib			ingreente	uonig 20, 10				,	riarej ac	rrace, p		ig z c							9 I	Hour
Simple Line Customizin T7: Implem	e Plots-Simple So g-Ticks-Customiz pent simple plotting	atter Plots- ing Matplot a using Mat	S-Visualizing Err tlib: Configuration tolotlib . T8: Cu	ors-Density and C ons and Styleshee ustomizing colorba	Contour Plo sts-Three-E ars. multiple	ots-Histograms, Dimensional Plo e subplots. text	, Binnings, and otting in Matplo and annotation	l Density tlib-Geog n usina N	/-Custo graphic /atplotl	mizing Data v b. T9	Plot Lo vith Bas : Imple	egends emap- ment g	-Custo Visuali eograp	<mark>mizing</mark> zation v hic data	Colorb vith Se a visua	ars-M aborn lizatio	ultiple n usinc	Subplo Seabo	ots-Tex orn	t and <i>i</i>	Annota	tion-
Unit-4 - Ta	bleau Your Data	J ··· J ···	1						- 1	., .		i i j	- 9 - 1-						-		9 I	Hour
Creating Vi Building Yo function rel T10: Explo	isual Analytics wit our First Visualizat ference-Bringing I ring the workspac	h Tableau I ion-creatin All Togeth es of Table	Desktop: shortc og calculations to her with Dashbo eau, T11: Buildi	omings of tradition o enhance Your Da oards: understandii ing simple visualiz	nal informa ata: Showr ng, right w ation usinç	ation analysis, V me, Trendline, s 'ay, best practic g Tableau, <u>T12</u>	Workspace-Co. sorting, filters, es 2 Building dash	nnecting sets, gro nboards (	to You ups-Cro using T	r Data eating ableau	:Conne Calcula	ction, ( tions to	Genera Enhai	ited vali nce You	ues, Da ur Data	ata Ex a: Aggr	tract, J regatio	loining, n, calci	Blend ulated	ing, Da /alues,	ita Qui Form	ality- ulas,

Unit-5 - Apac	he Su	perset		9 Hour
Getting Starte	d with	Data Exploration: Installing, sharing, configuring, add database, uploading, customization	n -Co	nfiguring Superset and Using SQL Lab: setting wen server, creation, migration, securing, caching,
mapbox-User	Authe	ntication and Permissions: security, google sign in, list users page, views/ menus, list	st pei	mission, user statistics page-Visualizing Data in a Column-Comparing Feature Values-Drawing
Connections b	etwee	n Entity Columns-Mapping Data That Has Location Information-Building Dashboards	a doo	bhearda using Superat
TTS. Exploring	uie v	orkspaces of Supersel, 114. Building simple visualization using Supersel, 115 Building	juas	niboarus using Superset
	1	Jake VanderPlas (2017) Puthon Data Science Handbook: Essential Tools for Working	5	Rig Data Visualization James D Miller Convright © 2017 Packt Publishing Ltd
	1.	with Data First Edition O'Reilly Media Inc. ISBN-10: 1491912057 ISBN-13:978-	6	Tableau Your Data East and Easy Visual Analysis with Tableau Software- Daniel G Murray with
		1491912058	0.	the InterWorks team. John Wiley & Sons. Inc. ISBN: 978-1-118-61204-0
	2.	Suresh Kumar Mukhiya, Usman Ahmed (2020). Hands-On Exploratory Data Analysis	7.	Shai Vaingast, "Beginning Python Visualization Crafting Visual Transformation Scripts", Apress,
Learning		with Python: Perform EDA techniques to understand, summarize, and investigate your		2nd edition, 2014.
Resources		data, Copyright © Packt Publishing Ltd.	8.	Wes Mc Kinney, "Python for Data Analysis", O'Reilly Media, 2012.
	З.	Shashank Shekhar (2018). Apache Superset Quick Start Guide-Develop interactive	9.	Wesley J.Chun, "Core Python Applications Programming, 3rd ed, Pearson, 2016
		visualizations by creating user-friendly dashboards, -Copyright © Packt Publishing Ltd.	10.	https://pyviz.org/

4. Mike Dewar (2012). Getting Started with D3. O'Reilly Media, Inc., ISBN:9781449328795 11. https://holoviz.org/

	and the second se		Continuous Learning	Assessment (CLA)	1	Sum	motivo
	Bloom's Level of Thinking	Format CLA-1 Average (50%	tive of unit test 5)	Life-Long CL (10	Learning A-2 %)	Final Exa (40% we	amination eightage)
	and the second se	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	the Carlot Carlot Physics	20%		40%	-
Level 2	Understand	40%	Contraction of the	20%		40%	-
Level 3	Apply	10%		20%	-	10%	-
Level 4	Analyze	10%		20%		<mark>1</mark> 0%	-
Level 5	Evaluate		-	10%		- 12	-
Level 6	Create	-	- 1/	10%	-	-	-
	Total	100 9	%	100	)%	10	0 %

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Vishwa Prasath T S, Technology Analyst, Accenture Pvt Ltd	1. Mr.C.M.T.Karthikeyan, Asst. Professor, Government College of Engineering - Bargur	1. Dr. P.Rajasekar, SRMIST

Course Code	21CSO358T	Course Name		NET	WORK SEC	CURITY	C	Cours atego	e ry	0			(	OPEN E	ELECI	IVE			l	- T 2 1	P 0	C 3
Pre-requis Courses	ite S	Nil		Co- requisite Courses		Nil		Pro	ogres Cours	sive es						Nil						
Course C	ffering Departm	ent	Sch	nool of Computing		Data Book / Codes / Sta	andards								Nil							
Course Lea	arning Rationale	(CLR):	The purpos	se of learning this	course is t	o:		4	1	×.		Progr	am Ou	tcome	s (PO)	)				Pi	ograr	n
CLR-1:	Gain a complete	knowledge	on types of	security attacks, s	ervices and	mechanisms.		1	2	3	4	5	6	7	8	9	10	11	12	S	pecifi	0
CLR-2:	Understand the ii	nplementat	tion of Interr	network security m	odel and its	standards and vulnerabilitie	es.	Ð	-		of	3	ety			×				00	com	,5
CLR-3:	Demonstrate the	Conventior	nal Encryptic	on Principles and t	he Public ke	v cryptography principles		ledg		int of	tions	e	soci		4	Wor		ance	-			
CIR-4:	Take un proiects	on Email n	rivacy syste	m and compare P	retty Good P	Privacy (PGP) and S/MIME		Nou	/sis	pme	tigat	Jsag	and	~*		eam	L	Fina	minç			
CI R-5:	Ruild a model of	Firewall and	d test the se	curity issues	ony coour		7,3%	ng K	Analy	evelo	nves	00	neer	ent 8 bility		& T	catic	gt. &	Lea			
02.11 01	Dana a moder en	nonan an					_	Jeeri	em	gn/de	luct i	T	engir	onm	s	idual	muni	ect M	-ong	<u>-</u>	-2	က္
Course Out	tcomes (CO):		At the end	of this course, le	arners will	be able to:	127	Engi	Probl	Desig	Conc	Mode	The (	Envir Susta	Ethic	ndiv	Com	Proje	Life L	OS ^C	SOS	SOS
CO-1:	identify security b	reache <mark>s in</mark>	a computer	network		LO CLE V	4	-	1	2	-	-			-	-	-	-	-	-	-	-
CO-2:	discuss major iss	ues con <mark>cer</mark>	rning compu	iter security.	a star			-	( e.)	2	-	-		-	-	-	-	-	-	-	-	-
CO-3:	use standard sec	urity too <mark>ls t</mark>	t <mark>o loc</mark> ate and	d fix security leaks	in a comput	er network.	1	-	-		-	2	- 20	-	-		-	-	-	-	-	-
CO-4:	understand a var	iety of c <mark>rypt</mark>	tographic al	gorithms and proto	cols underly	ving network security applic	ations.	14	-			2	-	-	-	-	-	-	-	-	-	-
CO-5:	Understand the s	ystem-l <mark>eve</mark>	l security iss	sues.	1.15	1	1.1	23	-	2	-	-	24	- 100	-	-	-	-	-	-	-	-
					C.A.				67													
Unit-1 - Inti	roduction	nieme Soci	urity Attacks	Socurity Sorvio	os Intogrity	chock digital Signature au	ithontica	tion h	20.20	orithm	10	_	-								9	Hour
Unit-2 - Sec	cret Key Cryptog	raphy		s, Security - Service	es, integrity	check, ulgital Signature, au	linentica	1011, 11	as aiy	Ununn	13.		-								9	Hour
Block Encry	ption, DES round	s, S-Boxes	IDEA: Over	view, comparison	with DES, K	ey expansion, IDE <mark>A rounds</mark>	, Uses c	f Secr	et key	Crypt	ograph	y; ECE	B, CBC	, OF <mark>B</mark> ,	CFB, I	Multipl	e encry	/ptions	DES			
Unit-3 - Has	sh Functions and	Message	Digests	And SHS) MD2: A	laorithm (Pa	dding chocksum passos	MD4 on	d 5: al	aorith	m (na	ddina s	tages	diaost	compi	Itation	1 646	· Ovon	iow n	addino	stag	91	Hour
Unit-4 - Pul	blic key Cryptogi	aphy	VID4, IVIDJ, 1	And SI IS) MDZ. A	iyonunn (Fa	uuniy, checksun, passes.j		u J. ai	yonun	iii (pa	Julliy, S	layes,	uigesi	compu	lalion	.) 3113	. Over	new, p	auuiiiy	, staye	,s 9	Hour
Algorithms,	examples, Modula	ar arithmetic	c (additio <mark>n, l</mark>	<mark>multiplicati</mark> on, inve	rse, and exp	oonentiation) RSA: generati	ng keys,	encry	ption	and de	ecryptio	n. Oth	er Algo	orithms:	PKCS	S, Diffie	e-Helln	nan, El	-Gama	l signa	tures,	
DSS, Zero-I	knowledge signati thoretication	ires		-			-	_													0	Hour
Password E Certification	Based, Address E Revocation, Inter	ased, Cryp - domain, g	otographic A groups, dele	Authentication. Pagation	sswords in	distributed systems, on-line	e vs off	line :	guess	sing, s	toring.	Crypto	graphi	c Authe	enticat	ion: pa	asswor	ds as	keys,	protoc	ols, K	DC's
Learning Resources	1. Atul Kal 2. Kaufma in a pub	nate, Crypto n, c., Perlm lic world, 2r	ography and an, R., and nd ed., Pren	Network Security, Speciner, M., Netw htice Hall PTR., 20.	. <mark>McGraw Hi</mark> vork Security 21.	II. v, Private Communication	3. Sta PT 4. Sta	llings, R.,202 Ilings,	W.,C 20. W. N	ryptog etworl	raphy a	and Ne	etwork entials:	Securit Applic	y: Prii ations	nciples and st	and F	Practice Is, Pre	e, 3rd e ntice H	əd., Pr Iall, 20	entice 20.	Hall

Learning Assessme	ent						
			Continuous Learni	ng Assessment (CLA)		Sum	mativa
	Bloom's Level of Thinking	Form CLA-1 Avera (5)	<mark>native</mark> ige of unit test 0%)	Life-Long CL (1	g Learning LA-2 0%)	Final Ex (40% w	ranination reightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%		15%	-	15%	-
Level 2	Understand	25%	-	20%	A -	25%	-
Level 3	Apply	30%	-	25%	1	30%	-
Level 4	Analyze	30%		25%		30%	-
Level 5	Evaluate	100 Mar 100	1000	10%		- 11	-
Level 6	Create	S. 20 -	112-1-123	5%		-	-
	Total	10	0%	10	0 %	1(	0 %

Course Designers			
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
1. Mr.M.Vivekanandan,Nokia	1. Karthikeyan.C.M.T,Govt College of Engg,Bargur	1. D.Saveetha, SRMI <mark>ST</mark>	
2. Mr.Santhosh Kumar,CTS	2. Syedthouheed, Reva University, Bangalore		



Course Code	21CSO359T	Course Name	FUNDAMENTALS OF INF	FORMATION SYSTEM SECURITY	Cour Categ	se ory	0				OPEN	ELEC	TIVE				- T 2 1	P 0	C 3
Pre-requi Course	site s	Nil	Co- requisite Courses	Nil	Pi	rogres Cours	sive ses						Nil						
Course (	Offering Departme	ent	School of Computing	Data Book / Codes / Stan	dards	_						Nil							
Course Le	arning Rationale	(CLR): 7	The purpos <mark>e of learnin</mark> g this co	urse is to:		1			Progra	am Ou	itcome	s (PO)	)				Pr	rogra	m
CLR-1:	Gather and docur	ment securi	ty requirements	10 Sec.	1	2	3	4	5	6	7	8	9	10	11	12	S	pecifi tcom	c es
CLR-2:	Design and docu	ment securi	ty plan	and an and and a	e		4	of	30	ety			¥						
CLR-3:	Develop data/info	rmation as	surance plans and implementatio	n strategies	ledg		ento	tions	е	soci			Wor		ance	_			
CLR-4:	ldentify, analyze,	and evalua	te infrastructure and network vuli	nerabilities	Now	ysis	opme	stiga	Usaç	and	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		eam	ы	Ein	minç			
CLR-5:	Identify and asse	ss curren <mark>t a</mark>	nd anticipated security risks and	vulnerabilities	ering h	n Anal	/devel	ct inve	T Tool	gineer	nment		ual & T	unicati	Mgt. 8	ng Lea			
Course Ou	itcomes (CO):		At the end of this course, learn	ers will be able to:	Engine	Problei	Design	Condu	Modern	The en	Enviror Sustair	Ethics	Individ	Comm	Project	Life Lo	PS0-1	PSO-2	PSO-3
CO-1:	Understand Secu	rity Req <mark>uire</mark>	ments	A DECK MARKEN	1215	-	2		-		-	-	-	-	-	-	-	-	-
CO-2:	Carry out Security	y Plan	2 100				2	-	-		-	-	-	-	-	-	-	-	-
CO-3:	ldentify, analyze,	and ev <mark>alua</mark>	te infrastructure and network vulr	nerabilities	1			-	2	- 10	-	-	-	-	-	-	-	-	-
CO-4:	Develop data/info	rmation ass	surance plans and implementatio	n strategies	1.24	-	1.5	-	2	-	-	-	-	-	-	-	-	-	-
CO-5:	ldentify, analyze,	and evalua	<mark>te infr</mark> astructure and network vulr	nerabilities		1.5	2	-	-	1	-	2	-	-	-	-	-	-	-
	<u> </u>	· o		and an a set of the set															
Unit-1 - In	e Security Proble	m in Comp	uting outer Criminals Methods of Defe	200					-									9	Hour
Unit-2 - Pr	ogram Security	unty, com		1136														9	Hour
Secure Pro	ograms, no maliciou	ıs Program	Errors, viruses and other - malici	ous code, Targeted Malicious code, co	ntrols Aga	inst Pı	rogram	Threat	s. Prot	ection	in - Ge	neral-	Purpo	se ope	rating s	system			
Unit-3 - Da	ta base Security	Ŭ			, in the second se		Ū		-						0			9	Hour
Security re	quirements, Reliab	ility and inte	grit <mark>y, Sensitive</mark> data, Inference, 1	nultilevel database, proposals for multi	ilevel secu	rity.			1										
Unit-4 - Ac	Iministering Secu	rity		11. 1. XICA - 1. D	1.1.1			10.00	1									9	Hour
Security Pl	anning, Risk Analy	sis, Organiz	ational Security policies, Physica	al Security. Legal Privacy and Ethical Is	sues in Co	ompute	er Secu	ırity											
Unit-5 – So	Oftware Ethics	Informatio	n and the low Pights of Employ	and Employers Software failures	Computor	Crimo	Droio	Ethioo	licouror	in Co	moutor	Coou	rity oo	oo otuc	lice of	Ethioo		9	Hour
Frotecting	riogranis and dala	, mornalio		es and Employers, Soltware failures,	Computer	Jiiiie,	r i aid,	Eunical	issues		inputer	Secu	iny, ca	se siuc	1162.01	≡uncs.			
Learning	1. Security	+ Guide to I	Vetwork Security Fundamentals,	5th Edition Mark Ciampa Cengage 2.	Fundam	entals	of Inf	ormatio	n Syst	ems S	Security	, 3rd I	Edition	by Da	vid Kii	m, Mic	hael C	. Soli	omon

Resources Learning (2019)ISBN: 978-1-305-09391-1

October 2018, Jones & Bartlett Learning ISBN: 9781284116465

ing Accesoine			Continuous Learning	Assessment (CLA)			
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	ge of unit test	Life-Long CL	<mark>y L</mark> earning A-2 0%)	Sum Final Ex (40% w	mative amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%		15%		15%	-
Level 2	Understand	25%		20%		25%	-
Level 3	Apply	30%	-	25%	A -	30%	-
Level 4	Analyze	30%	-	25%	2	30%	-
Level 5	Evaluate	1000		10%		-	-
Level 6	Create		1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	5%		-	-
	Total	10	0%	10	0%	10	0%

Course Designers	1. 1. 1. 1.		
Experts from Industry		Experts from Higher Technical Institutions	Internal Experts
1. Mr.M.Vivekanandan,Nokia		1. Karthikeyan.C.M.T,Govt College of Engg,Bargur	1. D.Saveetha, SRMIST
2. Mr.Santhosh Kumar,CTS	the second second	2. Syedthouheed, Reva University, Bangalore	A 4-



Course Code	21CSO360T	Course Name	S	ECURITY POLI		Cour Categ	se ory	0			(	OPEN	ELEC	TIVE				- T 2 1	P 0	C 3
Pre-requi Course	isite es	Nil	Co	o- requisite course <mark>s</mark>	Nil	P	rogres Cours	sive ses						Nil						
Course	Offering Departme	ent	School of	Computing	Data Book / Codes / Stan	dards							Nil							
Course Le	earning Rationale	CLR): T	The purpose of le	arning this cou	rse is to:		1			Progra	am Ou	itcome	s (PO)	)				P	rogra	m
CLR-1:	Understand the c	ommon Info	ormation Systems	Security models	1. 200	1	2	3	4	5	6	7	8	9	10	11	12	S	pecifi	C es
CLR-2:	Review CIA chara	acteristics –	confidentiality, in	tegrity and availa	bility				-	1										
CLR-3:	Understand secu dimensions.	rity measure	es from Technolog	gy, Policy & Prac	tice and Education/Training/Awaren	wedge ssa		ent of	ations of s	ge	l society			n Work		Jance	6			
CLR-4:	Understand risk n	nanage <mark>ment</mark>	n <mark>t – identif</mark> ication, o	quantification, res	ponse and control.	Knov	lysis	mdo	stiga	Usa	and	৵		[ean	U	& Fir	arnin			
CLR-5:	Learn disaster ree	covery pr <mark>oce</mark>	edures and count	ermeasures for th	e business enterprise.	ring	Ana	level	inve prot	Tool	inee	nent bility		<u>ا</u> ھ	nicat	Agt.	g Le;		l	
					<ul> <li>Base of the second secon</li></ul>	inee	olem	ign/c	duct plex	em	eng	ironr taina	S	vidua	Inmr	ect N	Long	-	-2	-3
Course Or	utcomes (CO):	ŀ	At the end of this	s course, learne	rs will be able to:	Eng	Prot	Des	Con	Moc	The	Env	Ethi	Indiv	Con	Proj	Life	PSC	PSC	PSC
CO-1:	Students impleme	ent IT ri <mark>sk m</mark>	<mark>nanag</mark> ement plans			2-1-1	-	2	· -			-	-	-	-	-	-	-	-	-
CO-2:	Identify alternate	sites fo <mark>r pro</mark>	ocessing mission-o	critical application	s, and techniques	1	-	2		-	- 74	-	-		-	-	-	-	-	-
CO-3:	Handling information	tion sec <mark>urity</mark>	/	C DATE	1200 811 100	-	-	171	-	2	-	-	-	-	-	-	-	-	-	-
CO-4:	Personnel and fa	cilities; <mark>prote</mark>	<mark>ection</mark> of sensitive			-	-	1	1.25	2	-	-	-	-	-	-	-	-	-	-
CO-5:	Identify emerging	securit <mark>y ris</mark> l	<mark>ks and</mark> implement	security policies		1 2 1	-	2	-	-	-	-	-	-	-	-	-	-	-	-
Unit-1 - In	troduction and Th	reats to Ent	terprise Security	/ Socurity Pospons	00						-	_							9	Hour
Unit-2 - 1	T. Enterprise Sec	uritv Issues	s	security Respons	85					10									9	Hour
Common E	Enterprise Security	Issues - Ethi	nic <mark>al Issues</mark> - Lega	al and Regulatory	Issues - Asset Security - Security R	isk			1.00	1										
Unit-3 - Se	ecurity Policies, St	andards an	nd Procedures	100		1.1				10									9	Hour
Security P	olicies - Rationale f	or Policies, S	Standards and Pr	rocedures - Prepa	ring and Gathering Information - Po	licy Param	eters -	Policy	Tiers -E	Enterpr	rise-Tie	er Polic	<mark>ies</mark> - 7	Topic-T	ier Pol	icies - I	Applica	ation-T	ïer Po	licies
- Asset Cla	assification	urity Manac	nement	12	TT MY ALCOLO	11		-											0	Hour
Common (	Dperational Security	/ Manageme	ent - Quality Assu	rance in Software	e Development - Security in system of	developme	nt -Spe	ecialize	d Issue	s in Op	peratio	nal Se	curity I	Manag	ement					nour
Unit-5 - I.	T. Business Conti	nuity				1	1						Ĺ	U					9	Hour
Preparatio	n - An introduction	to business	s continuity and d	isaster recovery	- Reviewing business continuity cor	ncepts - Es	tablish	ning pri	nciples	of disa	aster r	ecovery	y plan	ning -F	Review	ng ste	ps for	disaste	er rec	overy
planning -	Preparing to develo	p a disaster	r recovery plan - F	Preparing for I.T.	continuity - Assessing risks - Prioritiz	zing assets	tor rec	covery	- Devel	oping p	olans a	and pro	cedure	es - Le	arning	organiz	zationa	l relati	onshi	ps

	1.	Information Security Policies and Procedures: A Practitioner's Reference by Thomas	3.	Security Policies and Procedures: Principles and Practices Sari Greene (2021) Prentice Hall ISBN
Learning		R. Peltier, Second edition, Auerbach, ISBN 0-8493-1958-7		0-13-186691-5
Resources	2.	Guide to Disaster Recovery Erbschloe, M. (2021) Thomson Course Technology ISBN		
		9 780619 131227		

			Continuous Learning	Assessment (CLA)		Sum	mativa			
	Bloom's Level of Thinking	Forr CLA-1 Avera (5	native age of unit test 0%)	Life-Long CL (10	ı Learning A-2 )%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	15%		15%		15%	-			
Level 2	Understand	25%	Distance in the	20%		25%	-			
Level 3	Apply	30%	A State State	25%		30%	-			
Level 4	Analyze	30%		25%		30%	-			
Level 5	Evaluate			10%	-	-	-			
Level 6	Create		Section Section	5%		-	-			
	Total	10	0%	10	0%	10	0%			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. T Ravichandran, Product Manager, Servis2 IT Team, Chennai.		1. Dr. P. Balamurugan, SRMIST
2. Dhanvanth Kesavan, NTT Data, Cyber security analyst, Chennai	and and the second s	



Course Code	21CSO451T	Course Name	DEEP LEAR		Cou Cate	irse gory	0				OPEN	ELEC.	TIVE				- T 3 0	P 0	C 3
Pre-requis Courses	site S	Nil	Co- requisite Courses	Nil		Progre Cours	ssive ses						Nil						
Course C	Offering Departme	ent	School of Computing	Data Book / Codes / Star	ndards	-						Nil							
Course Lea	arning Rationale	(CLR): 7	The purpos <mark>e of learning</mark> this co	urse is to:		1	1	611	Progr	am Ou	utcome	s (PO	)				P	rograi	n
CLR-1:	Understand the c	oncepts of I	Neural <mark>Networks an</mark> d Deep Learn	ing	1	2	3	4	5	6	7	8	9	10	11	12	ou	pecifi itcom	c es
CLR-2:	Understand the D	eep neural	network and layered learning app	roach	e		of	s of	20	iety			¥		Ø				
CLR-3:	Study and unders	stand CNN a	and RNN for deep learning	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	wledg		ent o	ations	ge	soc			oW n		Jance	Ð			
CLR-4:	Learn and unders	stand Auto E	Encoders and its applications	162- W.S.	Knov	lysis	opm	stig	Usa	r and	৵		Tean	io	& Fir	arnin			
CLR-5:	Understand the c	oncept o <mark>f tra</mark>	ansfer learning and its application	S	ering	n Ana	deve	t inve x prot	Tool	ginee	ment		al & -	inicat	Mgt.	ig Le:			
	(00)				dine(	oblen	sign/	ution nduc mple;	dern	e enç	viron stain	lics	ividu	mm	oject	e Lor	0-1	0-2	0-3
Course Ou	tcomes (CO):	/	At the end of this course, learn	ers will be able to:	Ш.	o Pro	De	<u>S S S</u>	Mo	Ĕ	Su:	击	Ind	රි	Prc	Life	PS	R	R
CO-1:	Apply basic math	ematica <mark>l co</mark>	ncepts learning algorithms	A CONTRACTOR	1-1-	2	-	-	2		-	-	-	-	-	-	-	-	-
CO-2:	Apply the knowle	dge of g <mark>radi</mark>	-	2	-	-	2	-	-	-	-	-	-	-	-	-	-		
CO-3:	Deal with Convol	ution N <mark>eura</mark> i	l Networks	A STATE OF A STATE OF A	-	2	-	-	2	- 10	-	-	-	-	-	-	-	-	-
CO-4:	Analyze various t	ypes of <mark>data</mark>	<mark>a enc</mark> oders			2	1	-	1	-	-	-	-	-	-	-	-	-	-
CO-5:	Apply Various ne	twork m <mark>ode</mark>	ls in deep learning	a - Tax and the	-	2	11-	- 1	1	2	-	-	-	-	-	-	-	-	-
Unit-1 - Dee	ep Learning Basi	cs		A A A A A A A A A A A A A A A A A A A	2				-	-		÷						9	Hour
Introduction Learning - 7 <b>Tutorial</b> 1. To imp	– Basics - Learni The Curse of Dime Dement data class	ng Algorith <mark>n</mark> nsionality – ification usi	ns - Supervised and Unsupervise Perceptron Learning Algorithm – ng simple ML algorithm. 2. To in	d Training - Hyper parameters Vs Pa Linear Separability – Multilayer perc plement Planer data classification w	arameters - eptron – B vith a hidde	valida ackprol n laver	tion se bagati 3. I	ets - Esti on. Veural Ne	mators etwork	, Bias, to pre	Varian	ice – F	Regular	rization th Kera	- Chal s.	lenges	Motiv	ating I	Эеер
Unit-2 - Dee	ep Neural Networ	ĸ							150	_								9	Hour
Introduction	to a simple DNN -	Platform for	r deep learning - requirements to i	build DNN - Deep learning software li	braries - Te	ensorfic	w, Ke	ras, PyT	orch - l	Deep –	- Hyper	paran	neter T	uning,	Batch I	Vormal	lizatior	ı - Lea	rning
Tutorial	ilent-Baseo Learni	ng - various	s types of Gradient Descent lunch	ons – Eany Stopping – Drop out.															
1. To imp	lement gradient de	escent and l	backpropag <mark>ation in deep ne</mark> ural n	etwork, 2. Create a simple deep ne	ural netwo	rk and t	une ti	he hyper	parame	eters.									
3. To buil	d a simple feed for	rward neura	I network to recognize handwritte	n character.															
Introduction	to convolution neural	wetworks	k = operation = motivation = poc	ling – Normalization – sequence mo	odelina – \	/GGNe	t IA	Net – Re	curren	t Nei	ıral Net	work -	- Topo	loaies	– Long	Short	Term	Mem	ory –
Bidirectiona	I LSTMs – Bidirec	tional RNNs	= LSTM with Keras.		saoning - 1	50146	, 19		Junon				1000	109100	Long	Gilon	10111	mont	J
Tutorial	CNN model to al	anify Cata	nd dag imaga 2 Davalar I STM	Madala far Tima Sarian Enrangeting	2 Implan	antot:	n to :	radiat th	o price	o of of	looko	ing th	o "Coo	alo ata	ok prio	o" data	unin		
i. Duilù a		issily Cal al	iu uoy iillaye. Z. Develop LSTM	woders for time Series Forecasting.	. S. Implen	ienali		neuici lii	e price	:s ui si	OCKS US	siriy (ri	e G00	iyie slu	uk pilo	e uala	using	LOIN	л.

Unit-4 - Encoder and Decoder 9 H	Hour
Encoder – Decoder – Auto Encoder Introduction – Auto Encoders – Under complete Auto Encoder – Regularized Auto Encoder – Stochastic Auto Encoder – Denoising Auto Encoder – Contractive Auto Encoder	der –
Applications – Dimensionality Reduction – classification using Auto encoders	
Tutorial	
1. To Perform compression on mnist dataset using auto encoder, 2. Image Dimensionality reduction using encoders, 3. Anomaly detection using auto encoder	
Unit-5 - Transfer Learning 9 H	Hour
Deep Architecture in Vision – AlexNet to ResNet – GoogleNet - Transfer Learning – Siamese Networks – Metric Learning – Ranking – Tripet Loss – CNN – RCNN – Applications.	
Tutorial	
To implement a Pre-trained CNN model as a Feature Extractor using Transfer Learning	
1. Image recognition using CNN. 2. Object detection using CNN	

	1.	Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016	4.	Christopher and M. Bishop, "Pattern Recognition and Machine Learning", Sprin	ger Science
Looming		(available at http://www.deeplearningbook.org)		Business Media, 2006.	
Decourses	2.	Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012	5.	Jason Brownlee, "Deep Learning with Python", ebook, 2016.	
Resources	З.	Michael Nielsen, "Neural Networks and Deep Learning", Online book, 2016			
		(http://neuralnetworksanddeeplearning.com/)			

		- J-1	Summativa					
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	Final Ex (40% w	amination eightage)				
		Theory	Practice	Theory	Practice	Theory	Practice	
Level 1	Remember	40%		20%		<u>40%</u>	-	
Level 2	Understand	40%		20%		<mark>4</mark> 0%	-	
Level 3	Apply	10%	-	20%		10%	-	
Level 4	Analyze	10%	- 115	20%	-	10%	-	
Level 5	Evaluate	1	- ////	10%	-	-	-	
Level 6	Create	A COLOR		10%	100	-	-	
	Total	10	0%	)%	10	0 %		

Course Designers	THE PART OF MADE	12333	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
		1. Dr. S. Srividhya, SRMIST	
		2. Dr.M.Prakash, SRMIST	

Course Code	21ECO1	01T	Course Name	e	SHORT RANGE	WIRELESS COMMUNICATION	Ca	ours atego	e ory	0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3
Pre-requ Course	isite es		Nil		Co- requisite Cour <mark>ses</mark>	Nil		Pro	ogres Cours	sive es						Nil						
Course	Offering De	partme	ent		ECE	Data Book / Codes /	Standards								Nil							
Course Le	earning Rati	onale (	CLR):	The purpos	se <mark>of learnin</mark> g this	course is to:		-	1			Progr	am Ou	itcome	s (PO	)				P	rogra	m
CLR-1:	Overview o	of differ	ent modu	lation schem	<mark>e and wi</mark> reless sys	tem		1	2	3	4	5	6	7	8	9	10	11	12	S OU	pecifi Itcom	ic ies
CLR-2:	Familiarize	the va	rious com	nponen <mark>ts tha</mark>	<mark>t used</mark> to implemen	t a short-range radio system.		ge		of	s of	10	iety			rk		е				
CLR-3:	Analysis of	f the va	rious kind	's of t <mark>ransmitt</mark>	t <mark>ers</mark> and receivers u	sed for Short range Wireless Commu	unication	wled	6	nent o	ation	age	d soc			n Wo		nanc	bu			
CLR-4:	CLR-4: Know about regulations and standards of ISM band communications							Kno	alysis	lopn	estig	I Use	er and	< too		Tear	tion	& Fi	arnir			
CLR-5:	Design and	d analy	sis of sho	rt-range radi	o like UWB and Vis	ible light		eering	em Ana	in/deve	uct inve lex pro	rn Too	nginee	onmeni	(0	dual &	nunicat	ct Mgt.	ong Le	-	2	3
Course O	utcomes (CC	<b>)</b> :		At the end	l of this course, le	arners will be able to:	1. 27 C	Engin	Proble	Desig	Cond	Mode	The e	Envire Susta	Ethics	Indivi	Comr	Proje	Life L	-OS-	-SQ-	-OS-
CO-1:	Familiarize wireless sy	e the va /stem p	arious forr properti <mark>es</mark>	ms of signals	s used for informat	ion transmission and modulation, ar	nd overall	2	2		-	5-3		-	-	-	-	-	-	-	-	-
CO-2:	Present va	rious c	ompon <mark>en</mark>	<mark>t types</mark> that c	can be used to impl	ement a short-range radio system.	100	- 1	-	2	1	-	-	- 10	-	-	-	-	-	-	-	-
CO-3:	Describe th	he vario	ous kind <mark>s</mark>	<mark>of tran</mark> smitte	ers and receivers.			-	-	3	2	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Aware the	regulat	tions an <mark>d s</mark>	<mark>standa</mark> rds of	ISM band commu	nications	-	2	-		42	-	1	-	-	-	-	-	-	-	-	-
CO-5:	Gain the kn	lowledg	ie of the <mark>m</mark>	<mark>iost impo</mark> rtant	new developments	in short-range radio like UWB and Visi	ible light.	-11	-	1	2	-		-	-	-	-	-	-	-	-	-
Unit-1 - W Introductio of Wireles	<b>fireless Syst</b> on to wireless s Communica	e <b>ms</b> syster ation S	ns, Reasc ystems, R	ons for the S Receiver Wire	pread of Wireless , eless Local Area N	Applications Characteristics of Short etworks (WLAN), WIFI Network Arch	t-range Radic hitecture, Blu	o, Wii Jetool	reless th, Tr	s Appli anscei	cations ver, Blu	Eleme	entsof n Mode	Wireles es Zigb	s Con ee Arc	nmunic hitectu	ation S re, Fra	System me Str	s, Trar ructure	nsmitte Applie	<b>9</b> er Elei cation	Hour nents is and

**Case study:** Design and analyze the WLAN hardware module

# Unit-2 - Antennas and Baseband Coding Basics

Types of Antennas-Dipole, ground plane, loop Helical, Patch antennas, Antenna Characteristics, Impedence, directivity and gain, Effective area Polarization, Bandwidth, Antenna factor Baseband Data Format and Protocol - Radio Communication Link Diagram Code Hopping, Baseband Coding- Digital systems Wireless Microphone System RF Frequency and Bandwidth-factors, Propagation characteristics Modulation types Modulation for digital event communication, Continuous Digital Communication, Advanced Digital Modulation Spread Spectrum, DHSS Spread Spectrum, FHSS RFID transceiver, Design issues for RFID

### Unit-3 - RF Transceivers

RF Receivers- Introduction RF Source, Frequency control Modulation types Amplifiers Impedance matching in transmitter and receivers Filtering, SAW band pass filter matching, Tuned Radio Frequency (TRF), ASH Receiver Super regenerative Receiver, Block diagram Super regenerative Receiver, Operation Super heterodyne Receiver, Block diagram Super heterodyne Receiver, Operation Direct Conversion Receiver, Block diagram Super heterodyne Receiver, Operation Direct Conversion Receiver, Block diagram Super heterodyne Receiver, Operation Direct Conversion Receiver, Block diagram Super heterodyne Receiver, Operation Direct Conversion Receiver, Block diagram Super heterodyne Receiver, Operation Direct Conversion Receiver, Block diagram Super heterodyne Receiver, Operation Direct Conversion Receiver, Block diagram Super heterodyne Receiver, Operation Direct Conversion Receiver, Block diagram Super heterodyne Receiver, Operation Direct Conversion Receiver, Block diagram Super heterodyne Receiver, Operation Direct Conversion Receiver, Block diagram Super heterodyne Receiver, Operation Direct Conversion Receiver, Block diagram Super heterodyne Receiver, Operation Direct Conversion Receiver, Block diagram Super heterodyne Receiver, Operation Direct Conversion Receiver, Block diagram Super heterodyne Receiver, Operation Direct Conversion Receiver, Block diagram Super heterodyne Receiver, Operation Direct Conversion Receiver, Block diagram Super heterodyne Receiver, Operation Direct Conversion Receiver, Block diagram Super heterodyne Receiver, Operation Direct Conversion Receiver, Block diagram Super heterodyne Receiver, Development Receiver, Block diagram Super heterodyne Receiver, Development Receiver, Block diagram Super heterodyne Receiver, Block diagram Super heterodyne Receiver, Development Receiver, Block diagram Super heterodyne Receive

Case study: Design and analyze the simple real-time AM transceiver

9 Hour

#### Unit-4 - Wireless Standards

FCC Regulations, Terms and definitions, Nomenclature for defining Emission, modulation and transmission, Technical Background to the WPAN Concept, Regulation and Standardization Issues European Consortium: Overview Millimeter, Wave Applications and Services, PAN scenarios in the IST Magnet project, Typical LDR services connected to the IST- FP6 MAGNET project, Frequency Regulation and Standardization, Issues, Optional UM4 usage models issued from the EEE802.15.3c TG Flexible antenna gain, 60 GHz regulation status for wireless transmissions, Channel Propagation Characterization and Modeling, 60 GHz Propagation Measurements, Propagation Channel Characterization, Multipath Propagation Modeling

### Unit-5 - Optical Wireless Technologies

Fundamentals of UROOF Technologies, Conversion from RF to Optical Domain, Conversion from Optical to RF Domain, Optical Microwave Mixing Used for UWB Over Systems, Integrated UROOF Transceiver (IUT), Mixed Wireless-wired UROOF Channel, Carrier-to-noise Ratio, Laser and Photodetector Noise Baseline, Clipping Distortion Implication, Latency, Modelling the Propagation through the Fibre, Analysis of UWB Technologies forUROOF, Comparing UWB Technologies for Radio-over- fibre MB-OFDM, Over Multimode Fibre, All-optical Generation of Ultra-wideband Impulse Radio Operation, Principles and Theoretical Approach VLC Link, Transmitter, The VLC Channel Receiver, Modulation, Potential Applications, Challenges

	1. Alan Bensky, "Short range Wireless Communications- Fundamentals of RF system	3.	Rolf Kraemer and Marcos Katz, "Short-range wireless communications emerging technologies
Learning	design and Applications", Elsevier Inc, 2004		and applications", Wiley WWRF series, March 2009
Resources	2. Antti V. Raisanen, Arto Lehto, "Radio engineering for wireless communication and	4.	Shlomi Arnon, John Barry, George Karagiannidis, Robert Schober, Murat Uysal, "Advanced Optica
	sensor applications", Artech House, 2003	1.3	Wireless Communication Systems", Cambridge University Press, 2012

Bloom's Level of Thinking         Continuous Learning Assessment (CLA)         Life-Long Learning CLA-1 Average of unit test (50%)         Life-Long Learning CLA-2 (10%)         Summative Final Examination (40% weightage)           Level 1         Remember         15%         -         20%         7heory         Practice         7heory         Practice           Level 2         Understand         25%         -         20%         -         15%         -           Level 3         Apply         30%         -         25%         -         30%         -           Level 4         Analyze         30%         -         25%         -         30%         -           Level 5         Evaluate         -         -         25%         -         -         -           Level 6         Create         -         -         -         -         -         -	Learning Assessme	ent 🚽 🚽		No. of the second	Carlos and a second								
Bloom's Level of Thinking         Formative CLA-1 Average of unit test (50%)         Life-Long Learning CLA-2 (10%)         Summary CLA-2 (10%)         Summary Final Examination (40% weightage)           Level 1         Remember         15%         -         20%         Theory         Practice         Theory         Practice           Level 2         Understand         25%         -         20%         -         15%         -           Level 3         Apply         30%         -         25%         -         30%         -           Level 4         Analyze         30%         -         25%         -         30%         -           Level 5         Evaluate         -         -         25%         -         -         -           Level 6         Create         -         -         -         -         -         -			V	Continuous Learning	g Assessment (CLA)		Summative Final Examination (40% weightage)						
Image: Problem state         Theory         Practice         Theory         Practice         Theory         Practice           Level 1         Remember         15%         -         20%         -         15%         -           Level 2         Understand         25%         -         25%         -         25%         -           Level 3         Apply         30%         -         30%         -         30%         -           Level 4         Analyze         30%         -         25%         -         30%         -           Level 5         Evaluate         -         -         25%         -         -         -           Level 6         Create         -         -         -         -         -         -		Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (10	g Learning A-2 0%)							
Level 1         Remember         15%         -         20%         -         15%         -           Level 2         Understand         25%         -         25%         -         25%         -           Level 3         Apply         30%         -         30%         -         30%         -           Level 4         Analyze         30%         -         25%         -         30%         -           Level 5         Evaluate         -         -         25%         -         30%         -           Level 6         Create         -         -         -         -         -         -         -		and the second	Theory	Practice	Theory	Practice	Theory	Practice					
Level 2         Understand         25%         -         25%         -         25%         -           Level 3         Apply         30%         -         30%         -         30%         -           Level 4         Analyze         30%         -         25%         -         30%         -           Level 5         Evaluate         -         -         25%         -         30%         -           Level 6         Create         -         -         -         -         -         -	Level 1	Remember	15%		20%		15%	-					
Level 3         Apply         30%         -         30%         -         30%         -           Level 4         Analyze         30%         -         25%         -         30%         -           Level 5         Evaluate         -         -         -         -         -         -           Level 6         Create         -         -         -         -         -         -	Level 2	Understand	25%		25%	- C	25%	-					
Level 4         Analyze         30%         -         25%         -         30%         -           Level 5         Evaluate         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         <	Level 3	Apply	30%		30%		<mark>3</mark> 0%	-					
Level 5         Evaluate         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -	Level 4	Analyze	30%		25%		<mark>3</mark> 0%	-					
Level 6 Create	Level 5	Evaluate	2		-		-	-					
	Level 6	Create		- 10	-	-	-	-					
Total 100 % 100 % 100 %		Total	10	0%	10	0%	10	0%					

and the second	
ts from Higher Technical Institutions	Internal Experts
r. Meenakshi, Professor of ECE, CEG, Anna University, eena68@annauniv.edu	1. Dr. P.Prabhu, SRM IST
r. Venkatesan, Sr. Scientist, NIOT, Chennai, venkat@niot.res.in	
r	s from Higher Technical Institutions . Meenakshi, Professor of ECE, CEG, Anna University, sena68@annauniv.edu . Venkatesan, Sr. Scientist, NIOT, Chennai, venkat@niot.res.in

9 Hour

Course Code	21EO102J	Cour Nam	ise Ie	ELECTRONICS C	IRCUITS AND SYSTEMS	Cour Categ	se ory	0				OPEN	ELEC	TIVE			l	- T 2 0	P 2	C 3
Pre-requi Course	site 18	BECO10	)6J	Co- requisite Course <mark>s</mark>	Nil	P	rogres Cours	sive ses						Nil	1					
Course	Offering Departme	ent		ECE	Data Book / Codes / Stand	ards							Nil							
Course Le	arning Rationale	(CLR):	The purp	oose of learning this co	urse is to:	1	1			Prog	am Ou	itcome	es (PO	)				Р	rogra	m
CLR-1:	Provide a basis for of operation	or under	standing ser	miconductor material, how	w a PN junction is formed and its princip	le 1	2	3	4	5	6	7	8	9	10	11	12	5 Οι	pecif itcom	ic Ies
CLR-2:	Describe the bas their use as an ar	ic struct nplifier	ure, op <mark>erati</mark>	on and characteristics of	transistors BJTs and FETs, and discu	SS			1.5	0		ility								
CLR-3:	Learn the basics	of op-an	np: t <mark>he princi</mark>	i <mark>ple,</mark> operation, character	istics and fundamentally important circu	its g		oť	ls of		ciety	linab		sk		e				
CLR-4:	Describe and ana application.	alyze the	e basic oper	ation of sinusoidal oscilla	ators and use a 555 Timer in an oscilla	or nowled	Sis	pment	tigation	Isage	and so	, Susta		am W		Finano	ning			
CLR-5:	Learn the fundam telephones	entals c	f analog and	l digital communication, r	networking, radio transmission and mob	eering K	em Analy	n/develo	uct inves lev proble		ngineer a	onment 8		dual & Te	nunicatio	ct Mgt. &	ong Lear		5	3
Course Ou	itcomes (CO):		At the e	nd of this course, learn	ers will be able to:	Engin	Proble	Desig	Cond	Mode	Lhe e	Envire	Ethics	ndivi	Comr	roje	_ife L	-OSc	-OSc	-OSc
CO-1:	Understand the o demonstrate its in	peration nportan	n, character	istics, parameters and s _i s	pecifications of semiconductor diodes	and 3	3		-	3	-10	-	-	-	-	-	-	-	-	-
CO-2:	Review the trans application in am	stor (BJ plificatio	<mark>T &amp; FET</mark> ) co n	nstruction, operation, ch	aracteristics and parameters, as well as	s its 3	3		3	3		÷	-	-	-	-	-	-	-	-
CO-3:	Identify different frequency respon	configu se of op	r <mark>ations o</mark> f o pe <mark>rational-</mark> ar	p-amp and analyze the nplifier.	parameters of op-amp and observe	the 3	3	-	-	3	-	-	-	-	-	-	-	-	-	-
CO-4:	Understand & de	monstra	te <mark>different</mark> a	applications based on op	erational-amplifier and special <mark>linear</mark> IC	s 3	3	-	-	3	-	-	-	-	-	-	-	-	-	-
CO-5:	Understand the b	asic cor	ncepts and te	echniques of telecommu	nication systems and networks	3	3	-	-	3	-	-	-	-	-	-	-	-	-	-
Unit-1 - Ac	tive Discrete Con	ponen	ts & Circuit	s – I		-			4	1				-					12	Hour
Types of se Zener diod <b>Practice</b> : V	emiconductors, Cui e as a voltage regu /I characteristics of	rent me ilator, B	chanism in s JTs: Structu	semiconductors, Basic op re & Operation, IV Chara diode, Clipper and Clam	peration of PN junction diode, VI Charac acteristics, Small Signal Model, BJT as per BJT IV characteristics, Differential A	teristics o amplifier, Amplifier	of diode CE BJ	e, App T amp	lication lifier op	s of dic peratior	de: HV a, Diff <mark>e</mark> l	VR & F rential	WR, C amplifi	lippers er opei	& Clar ration	npers,	Breako	lown N	Necha	nism,
Unit-2 - Ac	tive Discrete Con	nponen	ts & Circuit	ts – II		inpinol													12	Hour
MOSFETs CS MOSFI	Structure & Opera ET, CS-MOSFET a	tion, Ch mplifier	aracteristics operation, \	& Parameters, IV Chara /oltage gain, Input and c	cteristics, Early Effect, MOSFET Biasir utput resistance, Differential amplifier of	g (Voltag peration	e-Divid	der Bia	asing), s	Small s	ignal n	nodel,	MOSF	ET as	an am	plifier,	Freque	ncy R	Respor	ise of

Practice: VI characteristics MOSFET, Biasing, MOS frequency response, CS Amplifier. Differential Amplifier

# Unit-3 - Linear Integrated Circuits

introduction to Op-amp, Basic op-amp and its characteristics, Op-amp modes, Parameters, Op-amp circuits: Scale changer, Adder, Subtractor, HWR & FWR, Clipper & Clamper Log & Antilog amplifiers, Instrumentation amplifier, Comparator, Comparator applications, Schmitt trigger

Practice: Single stage Op-Amp, HWR and FWR, Comparator, Schmitt Trigger

B.Tech / M.Tech (Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

## Unit-4 - Oscillators and Timers RC Phase-Shift oscillator Operation & Design, Wein bridge Oscillator operation & Design LC oscillators operation: Hartley Oscillator, Colpitts Oscillator, 555 Timer IC: Basic Operation, Astable Operation, Monostable Operation, Applications of 555 Timer, Voltage-Controlled Oscillators

Practice: Oscillator, VCO Unit-5 - Telecommunications

# 12 Hour

12 Hour

Analog & Digital Communication: Stages in telecommunication systems, Carriers and Modulation, Carriers and Modulation, Pulse Modulation, Pulse Modulation, Digital Transmission, Frequency Division, Multiplexing Time Division Multiplexing, Networks: RS-232, circuit switching, Message switching, TCP/IP, Radio Transmission: Electromagnetic, Spectrum, Ground waves, Sky waves, Antennas, Directional transmissions, Transmitters, Receivers, Mobile telephones

Practice: Modulation and demodulation

Learning 1. Owen Bisnop, "Electronic Circuits and Systems", 4th edition, Elsevier, 2011. 3. Paul Scherz, "Practical Electronics for Inventors", McGraw-Hill, 2000.	
Resources 2. Harry Kybett, Earl Boysen, "All New Electronics", 3rd edition, Wiley, 2008. 4. Digital Communication John G. Proakis, 5th edition, McGraw-Hill, 2014	

Learning Assessme	ent										
	1.0		Continuous Learning	g Assessment (CLA)	11 - A.	Cum	mativa				
	Bloom's Level of Thinking	Forn CLA-1 Avera (4	native ige of unit test 5%)	Life-Long CL (1:	g Learning A-2 5%)	Final Examination (40% weightage)					
	100 million (1997)	Theory	Practice	Theory	Practice	<u>The</u> ory	Practice				
Level 1	Remember	30%			20%	30%	-				
Level 2	Understand	30%			30%	<u>30%</u>	-				
Level 3	Apply	40%			40%	<u>40%</u>	-				
Level 4	Analyze				10%	-	-				
Level 5	Evaluate					-	-				
Level 6	Create		-	A CARLON AND	-	-	-				
	Total	10	0%	10	0 %	10	0 %				

Course Designers			
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
	1. Mr. Saivineeth, ML Accelerator Architect @ Google	1. Dr. Rajesh Agarwal, SRMIST	
		2. Dr. Soumy <mark>a Ranjan,</mark> SRMIST	

Course Code	21ECO103T	Course Name	MODERN WIRELE	SS COMMUNICATION SYSTEM	Co Cate	urse egory		0				OPEN E	ELECT	TIVE			1	- T 3 0	P 0	C 3
Pre-requis Courses	site s	Nil	Co- requisite Course <mark>s</mark>	Nil		Progi Cou	essi Irse	ive s						Nil						
Course C	Offering Departme	ent	ECE	Data Book / Codes / Stan	dards								Nil							
0	in a Detienele (		The sum of the sector their	and the second s												D	oara			
Course Lea	arning Rationale (		ine purpose of learning this	course is to:		_			-	Progr	am Ol	tcome	s (PU	)	-	1		S	pecifi	C
CLR-1:	Learn to analyze t	ine transm	ission of various wireless comin	nunication systems	1		2	3	4	5	6	7	8	9	10	11	12	ou	tcom	es
CLR-2:	Understand the fu	ındamenta	ls of <mark>various netw</mark> orks in wirele	ss communication	e e	b D		đ	s of		iety			돈		a				i i
CLR-3:	Understand the te	chniques	invo <mark>lved in pe</mark> rsonal communic	ation services.	v Porto			ent o	ation	ge	soc			٥W ر		anci	5			ı
CLR-4:	Introduce various	wireless s	y <mark>stems for</mark> 3G and future comn	nunication			)SIS	mdc	stige	Usa	and	æ		ean	Б	Ξ	nin			i i
CLR-5: Learn to analyze wireless networks for short range communication and understanding the fundament								develo	inve prob	Tool	ineer	ment ability		al & T	nicatio	Mgt. 8	g Lea			I
									duct	lern	eng	iron	S	vidu	nmu	ect	Lon	-1	)-2	-3
Course Ou	tcomes (CO):		At the end of this course, lea	nners will be able to:	L L		01	Des	Con	Moc	The	Sus	Ē	Indiv	Con	Proj	Life	PSC	PSC	PSC
CO-1:	Discuss the funda	amental <mark>s o</mark>	<mark>f trans</mark> mission in wireless syste	ms	1.1.	50		-	3	5-1	1	-	-	-	-	-	-	3	-	-
CO-2:	Provide an overvi	ew of v <mark>ario</mark>	<mark>ous ap</mark> proaches to communicat	on networks	-	1		4	3	-	-	-	-	-	-	-	-	-	-	3
CO-3:	Study the numero	ous diffe <mark>rer</mark>	nt-generation technologies with	their individual pros and cons			-	-	3	-	-	-	-	-	-	-	-	2	-	3
CO-4:	Discuss about the and CDMA and th	e princip <mark>les</mark> neir pros al	<mark>s of o</mark> peration of the different ad nd cons	ccess technologies like FDMA, TDMA, SI	DMA -	-	1	4	3	-		-	-	-	-	-	-	2	-	3
CO-5:	Learn about the Fundamentals	various r	nobile data services and sho	rt-range networks and gain knowledge	e on -	h S		-	3	-	-	-	-	-	-	-	-	3	-	3
IInit-1 - Tra	ansmission Funda	amentals	the second						_	-									9	Hour
Cellphone	Generations- 1G a	and 2G- 2	.5G- 3G- 4G Transmission Int	roduction- 4G Transmission Fundament	als- Tim	e don	nain	conc	epts- F	requei	ncy do	main co	oncept	ts- Rad	lio Mec	lia- Ani	alog Vs	Digita	al- Ch	annel
capacity- Tr	ransmission media-	- Signaling	Schemes						100	1	-							•		
Unit-2 - Nei	twork Concepts							0 "	<b>D</b> /					r			-	<i>,</i> .	9	Hour
TDMA SDM	ation Networks, Li MA CDMA Spectra	ANS, MAN al efficienc	is, WAINS, Circuit switching,	Packet switching, ATM Cellular Netwo	orks intro	oaucti	on,	Cells	, Dupie	exing, i	NUITIPI	exing, V		coaing,	Multip	le Acc	ess Ie	cnniqu	ies: Fi	JMA,
Unit-3 - Per	rsonal Communic	cation Ser	vices	A Landa Charles and the second second	11														9	Hour
Personal co	rsonal communication Introduction, HSCSD, GPRS, D-AMPS, CDMA One, CDMA Two, Packet Data Systems- GSM-HSCSD- GPRS- D-AMPS- CDMA Introduction-CDMA One- CDMA Two- Packet Data Systems																			
Unit-4 - 3G	and Beyond																		9	Hour
3G Introduc	tion- M1-2000 Intro	oduction- II	MI-2000- W-CDMA Introduction	- W-CDMA- CDMA 2000 Introduction- EL	)GE- Wi-	Fi Intr	oduc	ction-	WIMAX	Introd	luction	- WIMA	X-OF	DM- M	IMO				0	Haur
Mohile Data	nit-5 - Mobile Data Services and Snort Range Network						hectr	rum	WI ANG	cord	less te	lenhon	/ IrD∆	Rlup	tooth S	Smart F	Phones	Futu	9 renhr	nour
Mobile Data Services Introduction Messaging, wireless web, WAP, site design Short-Range Wireless Networks: Unlicensed spectrum, WLAN mobile OSs, smart phone applications- Data Services- Messaging- Wireless web-WAP- Site design- Short-Range Wireless Networks- Unlicensed Spectrum, WLAN Phones- Future phones- Mobile Oss- Smart phone applications									- Unlice	nsed	spectri	ım- WL	ANs-	Cordle	ess tele	phony	- IrDA-	Bluet	ooth S	Smart

1. Simon Haykin, David Koilpillai, Michael Moher," Modern Wireless Communication", 1/e, Pearson Education, 2011.         2. Rappaport T.S, "Wireless Communications: Principles and Practice", 2nd edition, Pearson education.         3. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, Aug. 2005.         4. Andy Doman, "The essential guide to wireless communications applications: from cellular systems to Wi-Fi", 2nd Edition, Prentice Hall, 2002	<ol> <li>Ian F.Akyildiz, David M. Gutierrez Estevez, and Elias Chavarria Reyes, "The evolution of 4G cellular systems: LTE advanced", Physical communication, Volume 3, No. 4, pp. 217-298, Dec. 2010\</li> <li>William Stallings, "Wireless Communication &amp; Networking", Pearson Education Asia, 2004.</li> <li>Andrea.F. Molisch, "Wireless communications", 2nd edition, Wiley Publications.</li> </ol>
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

		1.1.	Continuous Learning	Assessment (CLA)	2	Cum	no fil vo				
	Bloom's Level of Thin <mark>king</mark>	Forn CL <mark>A-1</mark> Avera (50	native ge of unit test 0%)	Life-Long CL (10	Learning A-2 )%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	15%	and the second second	15%		15%	-				
Level 2	Understand	25%		20%	1	25%	-				
Level 3	Apply	30%		25%	-	30%	-				
Level 4	Analyze	30%	A STATISTICS	25%		30%	-				
Level 5	Evaluate			10%		-	-				
Level 6	Create		1 Sec. 3 M	5%	·	-	-				
	Total	10	0%	10	0%	100 %					

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Anuj Kumar, Bombardier Transportation, Ahmedabad,	1. Dr. Meenakshi, Professor of ECE, CEG, Anna University,	1. Dr. Sandeep Kumar P, SRMIST
kumaranuj.anii@gmail.com	meena68@annauniv.edu	
2. Mr. Hariharasudhan - Johnson Controls, Pune,	2. Dr. Venkatesan, Sr. Scientist, NIOT, Chennai, venkat@niot.res.in	
hariharasudhan.v@ici.com		



Course Code	21ECO104J	Course Name	PCB DESIGN	AND MANUFACTURING	C Ca	ourse	e ry	0				OPEN	ELEC1	ΓIVE				- T 2 0	P 2	C 3
Pre-requi Course	site s	Nil	Co- requisite Course <mark>s</mark>	Nil		Pro	gress ourse	sive es						Nil						
Course C	Offering Departme	ent	ECE	Data Book / Codes /	Standards	1.00							Nil							
r				in the later	11-			1												
Course Le	arning Rationale	CLR): The p	ourpo <mark>se of learnin</mark> g this c	course is to:		Program Outcomes (PO)												PI	rogra	m
CLR-1:	Explore the termi	nologies of PCB	des <mark>ign and ele</mark> ctronic com	ponents		1	2	3	4	5	6	7	8	9	10	11	12	OU OU	itcom	es
CLR-2:	Understand the d	esign and othe <mark>r</mark>	<mark>consideratio</mark> n involved in F	PCB design		ge		of	s of	Pre-	iety			ork		е				
CLR-3: Understand the PCB design consideration for special application circuits								ient o	ation s	age	soc			n Mo		Janc	Ð			
CLR-4:	CLR-4: Design a PCB layout using PCB designing tool							lopr	stig: olem	Usa	r and	৵		Tear	U	& Fii	arnir			
CLR-5:	LR-5: Explore various PCB manufacturing techniques							n/deve	uct inve lex prol	rn Tool	nginee	onment		ual & .	nunicat	st Mgt.	ong Le:	~	2	
Course Ou	itcomes (CO):	At th	e end of this course, lear	rners will be able to:	1.127	Engin	Proble	Desig	Condi	Mode	The e	Envire Susta	Ethics	ndivid	Comn	^o rojec	_ife L	-OSc	-OSc	- S O
CO-1:	Identify the variou	is types of PCB	and electronics componen	ts packaging	341-1	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-
CO-2:	Select suitable de	esign an <mark>d consid</mark>	er appropriate parameters	involved in PCB design		2	1	1	-	-	-	-	-	-	-	-	-	-	-	1
CO-3:	Apply the approp	riate de <mark>sign rule</mark>	s in designing PCB for spe	cial application circuits	10	3	-	2	-	-		-	-	-	-	-	-	- 1	-	2
CO-4:	Design and devel	op a P <mark>CB layou</mark>	using PCB designing tool	Careful States and	10	1		3	-	-	-	-	-	-	-	-	-	3	-	-
CO-5:	Identify and selec	t the re <mark>quired P</mark>	CB manufacturing technolo	ogy	-	2	-	2	-	-	2	-	-	-	-	-	-	-	-	-
			1	Contraining of the later													•			
Unit-1 - Ba	sics of PCB and	Electronic Con	ponents																	Hour
Need for Pl Design and Microcontro <b>Practice</b> : L	rinted Circuit Board I Manufacture, PCI ollers, Surface Mou Demonstration of e	I, Classification ( 3 Standards. Ty Int Devices, Hea lectronic compo	or Printed Circuit Boards, No bes, Symbols, Packaging, at Sinks, Transformer, Rela nents- Passive and active zer, IC tester (Analog and	tanutacturing of basic PCB - Single shapes and terminal details of Elec ays, Connectors. components, analog and digital in Digital J CR meter	e-and Double ctronic Com tegrated cire	e-siaei poner cuits (	d Plai nts, In (IC), I	ted Th ntegrat Demor	rougn-ri ed Circo istratior	oles, N uits (di of tes	duiti-la gital & sting a	ayer Bo & linear and me	ards, F ), Ran asuring	dom A	e Board Access	as, Cha Memo	allenge ry, Re	s in m ad Oni	odern ly Mei	РСВ mory,
Instrumenta	R Design Consid	Spectrum analy	zer, io lester (Analog and		12.4	-	-	-		100	-		-						12	Hour
PCB Desig	n Considerations –	General, Mecha	nical and Electrical Design	Considerations, PCB Design Cons	iderations –	Cond	luctor	Patter	ns. Coi	npone	nt Pla	cemen	Rules	.Fabri	cation	and As	sembl	v Con	sidera	tions.
Environme	Environmental Factors, Cooling Requirements and Packaging Density, Layout Design.																			
Practice: [	Design and analysis	s of RL and RC o	circuits - Schematic in EDA	tool, Design and analysis of RLC of	circuits - Sc	hema	tic in	EDA	tool, PC	C <mark>B La</mark> y	out D	esign	-RL, I	RC and	dRLC a	ircuits.				
Unit-3 - PC	B Design Rules																		12	Hour
PCB Desig Interference Practice: S	CB Design Rules - Analog Circuits, Digital Circuits, High Frequency Circuits, Fast Pulse Circuits, Microwave Circuits, Power electronic circuits. High-density Interconnection Structures, Electromagnetic terference/Compatibility (EMI/EMC).																			

### Unit-4 - Schematic and PCB Layout Design

Schematic Capture – Introduction to schematic capture tool, Simulation of simple electronic circuit, Schematic to layout transfer, PCB Layout Design - Conception Level introduction, Specifying Parts, Packages and Pin Names, Libraries, Checking foot prints of the components, Part list, Net list, Making Net list Files, Mounting Holes, Adding Text, DRC, Pattern Transfer, Layout printing. Practice: Schematic and layout design using PCB design tool: Single Digit Pulse Counter, Electronic turn ON/OFF timer using IC555, etc. (Open Choice). 12 Hour

#### Unit-5 - PCB Fabrication

Image Transfer Techniques- Screen Printing, Pattern Transferring Techniques, Printing Inks, Photo Printing, Laser Direct Imaging (LDI), Copper Clad Laminates - Properties of Laminates, Types of Laminates, Evaluation of Laminates. Etching Techniques – Wet Chemical Etching, Mechanical Etching, PCB Assembly Process - Through-hole, Surface Mount, Mixed Technologies, Soldering. Practice: Manufacturing and testing the PCB: Single Digit Pulse Counter, electronic turn ON/OFF timer using IC555, etc. (Open Choice)

	1.	Raghbir Singh Khandpur, "Printed Circuit Boards: Design, Fabrication, and Assembly" McGrawHill Electronic	5.	Douglas Brooks "Signal Integrity Issues and Printed Circuit Board Design", Prentice Hall PTR,
		Engineering, 2006.		2003.
Learning	2.	Charles A. Harpe, "High Performance Printed Circuit Boards", McGraw Hill Professional, 2000.	6.	Mark I. Montrose "Printed Circuit Board Design Techniques for EMC Compliance: A handbook for
Resources	3.	Bruce R. Archambeault, James Drewniak, "PCB Design for Real-World EMI Control", Volume 696 of The		designers" Wiley, 2 Edition, 2015.
		Springer International Series in Engineering and Computer Science, Springer Science & Business Media, 2013	7.	Esim open-source tool: http://esim.fossee.in/
	4.	Kraig Mitzner, "Complete PCB Design Using OrCAD Capture and PCB Editor", Newnes/Elsevier, 2009.	8.	INA/Orcad User manual

			Continuous Learning	Assessment (CLA)		Sum	mativo				
	Bloom's Level of Thinking	Forn CLA-1 Avera (4)	native ge of unit test 5%)	Life-Long CL (1:	g Learning A-2 5%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	15%			15%	15%	-				
Level 2	Understand	25%		-0. Mar - 7. 12	20%	25%	-				
Level 3	Apply	30%	-	ALC: NOT THE OWNER OF	25%	30%	-				
Level 4	Analyze	30%		A PARTY OF	25%	<mark>3</mark> 0%	-				
Level 5	Evaluate	and the second sec			10%		-				
Level 6	Create			-	5%		-				
	Total	10	0%	10	0%	10	0 %				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
	1. Mr. Anuj Kumar, Program Delivery Manager, Nagarro Software's Pvt Ltd.	1. Dr. P. Eswaran, SRM IST
	A STATE AND A STAT	2 Dr. Sanjay Kumar Sahu, SRM IST

Course Code	21ECO105T	Course Name		FIBER OP	ICS	Cour Categ	se ory	0				OPEN	ELEC.	TIVE				- T 3 0	P 0	C 3		
Pre-requi Course	site s	Nil		Co- requis Courses	site	Ni	il	Pr	ogres Cours	sive ses						Nil	1					
Course (	Offering Departm	ent		ECE		Data Book	/ Codes / Standard	s	-						Nil							
Course Le	arning Rationale	(CLR): T	The purpos	e <mark>of learning</mark> t	this course	e is to:	IL	Program Outcomes (PO)									Pi	ogra	n			
CLR-1:	Analyze the basi classification of c	ic laws and t optical fibers	theorems of	^r light <mark>as</mark> sociat	ed with the	optical fiber comn	nunication and the	1	2	3	4	5	6	7	8	9	10	11	12	S ou	pecifi tcom	C ƏS
CLR-2:	Address concept	ts related to t	tran <mark>smissio</mark> i	<mark>n cha</mark> racteristic	cs suc <mark>h a</mark> s a	attenuation and dis	spersion	e		of	s of	10	ety			¥		9				
CLR-3:	Explore the fund	amentals of <mark>c</mark>	op <mark>toelectro</mark> i	nics Sources a	nd Detector	rs	THE CALL	wledo	S	nent c	ations	age	d soci			n Wo		nance	бL			
CLR-4:	Illustrate the inte	gration meth	h <mark>ods avai</mark> lab	le for optoelec	tronic circui	its and devices	TRACKS IN AND	Kno	Ilysi	lopn	stig	Us	r an	~~ \		Tear	<u>lo</u>	& Fi	arnii			
CLR-5:	Gain to information on Optical modulators and amplifiers								n Ana	/deve	ct inv∈ ex prol	Tool	ginee	nment		lal & .	unicat	Mgt.	ng Le:			
Course Ou	tcomes (CO):	Acres 17	Ingine	roble	Design	Condu	Aoderr	he en	Enviror	Ethics	ndivid	Comm	roject	ife Lo	SO-1	°SO-2	sO-3					
CO-1:	Apply the basic theorems related to fiber optic communication, and attain knowledge of types of c fibers								2	-	-	-	-	-	-	-	-	-	1	-	-	1
CO-2:	Define the optica	al signal <mark>disto</mark>	ortion factor	s in op <mark>tic</mark> al fibe	er communic	cation		3	2	1.	-	-	-	-	-	-	-	-	1	-	-	1
CO-3:	Interpret the prin	ciple an <mark>d ope</mark>	peration of va	arious, l <mark>i</mark> ght so	urces and a	letectors	100	3	2	3		-			-	-	-	-	1	-	-	1
CO-4:	Summarize the v	various o <mark>ptoe</mark>	<mark>electro</mark> nic in	tegrated circuit	ts and Opto	electronic Devices		3		2	-	-	2	-	-	-	-	-	1	-	-	1
CO-5:	Gain the knowled	dge of va <mark>riou</mark>	<mark>us opto</mark> elect	ronic mo <mark>dula</mark> to	ors and amp	olifiers		3	2	-	-	-	-	1		-	-	-	1	-	-	1
Unit-1 - Ba	sics of Optical F	iber		1000	-		100					-	-	-							9	Hour
Evolution o ravs. Optic	f fiber optic systen al fiber modes. Op	n, Elements <mark>o</mark> tical fiber col	of an optica	l fiber transmis , Single mode	ssion link. C fibers. Mult	Characteristics and timodeFibers. Step	behaviour of light. 7 Index Fibers, Grad	otal in ed Inde	ternal ex Fibe	reflecti ers.	ion, Ac	ceptan	ce ang	ıle Num	erical	apertu	re, Crit	ical an	gle, Ra	iy optic	cs Typ	es of
Unit-2 - Fil	per Attenuation a	and Dispers	sio <mark>n Chara</mark>	cteristics								10									9	Hour
Attenuation and Interm	– Absorption, Atte odal dispersion, M	enuation units laterial dispen	ts, Scatterin ersion, Wave	<mark>g lo</mark> sses, Bend eguide dispersi do Eibors	ling losses, ion, Signal,	micro-bending and distortion in single	l macro bending los mode fibers, Polari	ses, Co zation	ore cla mode,	dding l dispei	osses, rsion, lı	Signal ntermo	distor dal <mark>dis</mark>	tion in c persior	ptical 1, Puls	waveg e Broa	uides, dening	Types o in Gra	of disp ded In	ərsion- dex W	Intran avegu	iodal ides,
Unit-3 - Se	miconductor Opt	ical Sources	s and Detec	tors	1 m m		_	_	-		1	-									9	Hour
Light sourc	Light source materials, Surface emitting LEDs, Edge emitting LEDs, Quantum efficiency and LED power – Internal quantum efficiency derivation, Quantumefficiency and LED power – External quantum efficiency and										y and											
total LED, Semiconductor laser diode, Modes and threshold condition, Photo detection principle, PIN Photodiode								hotodi	ode - A	Avalan	che Ph	otodiod	<mark>le, A</mark> va	alanche	Photo	diode,	Noise	mecha	nism iı	1 photo	odeted	tors
Unit-4 - Int	Unit-4 - Introduction to Optoelectronic Integrated Circuits							1-1-4-		-114	Ol-h				- 1-4-		4				9	Hour
nhoto recei	leed tor Integration - Hybrid and Monolithic Integration, Materials and processing of OEICs, Application of opto hoto receivers. Photo receiver noise and bandwidth considerations. PIN-HBT photo receivers OEIC, transmit						ElC transmitters –	auival	lent ci	rcuit fo	s, Siab or integ	rated	ipvvav receivi	eguide ers. Co	s, mie molex	ji aleđ circuit	uansm ts and	arravs	Intear	ated t	- FIOF ransm	itters
and receive	and receiversproto receiver hoise and bandwidth considerations, Pin-HBT proto receivers. OF C trans and receivers -optical control and microwaveoscillators, Guided wave devices – Waveguide and coupler										intog		000100			onoun		anayo	mogr		anon	
## Unit-5 - OEIC Modulators, Switches and Amplifiers

Electro optic (EO) effect, EO Modulators, Single waveguide EO Modulators, Dual channel waveguide EO Modulators, Mach-Zehnder EO Modulator, Acousto optic modulator, Raman Nath modulator, Bragg modulator, Optical switching and logic devices, Optical switching and logic devices – Bipolar controller modulator Optical switching and logic devices tuneable threshold logic gate, Switching speed and energy, Optical Amplifiers, Semiconductor optical amplifiers, Optical gain – Limitations, Erbium doped fiber amplifiers – energy level diagram and amplification mechanism, Fiber Raman Amplifier onfiguration, Forward pumping, Backward pumping.

Learning	1.	Gerd Keiser, "Optical Fiber Communications", 5th Edition, McGraw Hill Education	3.	J. Wilson and J. Hawkes, "Optoelectronics – An Introduction", Prentice Hall, 1995.
Learning		(India), 2015.	4.	Robert G. Hunsperger, Integrated Optics Theory and Technology, Springer, 2009
Resources	2.	Khare R P, "Fiber Optics and Optoelectronics", Oxford University Press, 014	5.	Pallab Bhattacharya, "Semiconductor Optoelectronic Devices", Prentice Hall of India Pvt. Ltd, 2006

Learning Assessme	nt							
		A 2 4	Continuous Learning	Summativa				
	Bloom's Level of Thinking	Form CLA-1 Averag (50	ative ge of unit test %)	Life-Long CL (10	y Learning A-2 0%)	Final Examination (40% weightage)		
		Theory	Practice	Theory	Practice	Theory	Practice	
Level 1	Remember	30%		30%		30%	-	
Level 2	Understand	20%		20%		20%	-	
Level 3	Apply	40%		40%		<u>40</u> %	-	
Level 4	Analyze	10%		10%	· · · · ·	10%	-	
Level 5	Evaluate		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	N. 1724A	-		-	
Level 6	Create	7			- Annual I		-	
	Total	100	)%	10	0 %	10	0%	
		100 March 100 Ma			and an and a second second			

Course Designers		ALC
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
	1. Mr. Anuj Kumar, Program Delivery Manager, Nagarro Software's Pvt Ltd.	1. Dr. Bandaru Ramakrishna, SRMIST



B.Tech / M.Tech (Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

9 Hour

Course Code	21ECO106J	Course Name	EMBEDDED	SYSTEM DES	GN USING ARDUINO	Ca Ca	ourse tegor	e ry	0				OPEN E	ELECT	IVE			1	- T 2 0	P 2	C 3
Pre-requis	site s	Nil	Co- requ Courses	isite	Nil		Pro C	gress ourse	sive es						Nil						
Course C	Offering Departme	ent	ECE		Data Book / Codes / St	tandards								Nil							
Course Lea	arning Rationale (	CLR): Th	he purpo <mark>se of learnin</mark> g	this course is	to:			1	4		Progra	m Ou	itcome:	s (PO)	)				Pi	rogran	n
CLR-1:	Get to know abou	t ARDUINO I	hard <mark>ware details a</mark> nd er	nvironment			1	2	3	4	5	6	7	8	9	10	11	12	S OU	pecifi	) es
CLR-2:	To understand the	e core eleme	nts of ARDUINO progra	amming languag	je	-	e		Ļ	s of	10	ety			¥		0				
CLR-3:	Create insights to	the concepts	s <mark>of serial co</mark> mmunicatio	on	1000	100	vledc		ento	tions	ge	soci			٥M		ance	0			
CLR-4:	To use common i	nput and out	put devices		W62- 44		Von	lysis	mdo	stiga olema	Usa	and	<b>∝</b> δ		ear	ы	& Fin	arnin			
CLR-5:	Apply the ARDUII	NO programm	ning into real time appli	cations	1. 1. R. 2. 2. S. 1. 1.		ing	Ana	evel	inve prob	Tool	neer	nent bility		1 & 1	licati	Agt. 8	) Lea			
							ineel	olem	ign/d tions	duct plex	em	engi	ironn taina	cs	vidue	Jmur	ect N	Long	-1	)-2	-3
Course Ou	tcomes (CO):	A	<mark>t the</mark> end of this cours	e, learners wil	l be able to:	122.0	Eng	Prot	Desi	Con	Mod	The	Envi Sust	Ethi	Indiv	Con	Proj	Life	PSC	PSC	PSC
CO-1:	Apply the program	nming s <mark>kill</mark>	100		the cust of	21-1	3	2	2	-	1	-	-	-	-	-	-	-	-	3	-
CO-2:	Apply the real tim	e data' <mark>s into</mark>	<mark>digi</mark> tal	A			1	3		2	3	-		-	3	-	2	-	-	3	-
CO-3:	Interact with almo	st man <mark>y devi</mark>	ices	1.00		1	3	1	-	3	1	-	_	-	3	-	3	-	-	3	-
CO-4:	Learn techniques	to han <mark>dle tin</mark>	<mark>ner</mark> delays and IO devic	es		100	1	1	3	2	2	-	-	-	3	-	3	-	-	3	-
CO-5:	Use and modifyin	g the e <mark>xisting</mark>	g libraries		Test of the second		2	-	3	3	3	2	-	-	3	-	3	-	-	3	-
Unit-1 - Int	troduction to Ard	uino Platfor	m	Carlo and Carlos		2						-								12	Hour
Arduino I/C Arduino IDE <b>Practice</b> : C	) Board Block dia E-Writing, saving, c Getting Started Wit	gram- AT me compiling with th Aduinno: (	ega 328p architecture- 1 IDE. CCS And AVR Studio	Pin function-	Overview of main features- GPIO LED: Switch Based	I/O ports- I Led Con	Feat trol, :	ures- DISP	timers, LAY II	interru NTERF	pts- Fo	eature SEGI	es-PWN MENT: I	I, SEI	RIAL F 6x2 M	PORT- atrix	Featur	es-AD	C- Intr	oducti	on to
Unit-2 - Int	roduction To Ard	uino C		11							14									12	Hour
Arduino C I Practice:-S	Data Types- Decis Sensor Interfacing	ion Making ii For Temper	n C <mark>- Program</mark> Loops in ature Monitoring Sens	C- Functions i sor Interfacing	n C- Introduction to Pointers	s-Using P rement P	ointei WM	rs Eff BASI	ectivel	y- Stru RVO	ctures, MOTO	Unior RINTI	ns, and ERFAC	Data ING	Storag	le- Ard	uino Li	braries			
Unit-3 - An	alog and Serial Co	ommunicatio	n	sor interfacing				27101												12	Hour
Introduction	n To Analog Comm	nunication- P	Pulse Width Modulation-	RS232- 12C- 3	SPI Protocol- Interfacing wit	th sensors	and	actua	tors	-											
Unit-4 - IO	Programming	ICATION, AC	ctuators – Stepper Mot	or, DC MOTOR	Υ															12	Hour
Introduction	n To Timer/Counte	rs- Timer pro	ogramming- Interrupts-	Interrupts prog	ramming- External interrupt	ļ.															
Practice: In	nterrupt Programm	ing, Watch E	Dog Timer, I2C					_	_											40	
Wireless C	ommunication Usir	na Ziabee- B	luetooth- Robotics -Mo	tor And Sensor	- Security-RFID. Infrared- B	Bio medica	l app	licatic	n- GP	S Navi	ation									12	Tour
Practice: R	RFID, Infrared	0 0 1 1									,										

	1.	Michael-Margolis, "Arduino-Cookbook"., Revised edition, O'Reilly,1st edition, 2011	4.	Jack Purdum , "Beginning C for Arduino" , Apress, 2012
Learning	2.	D.Dale.Wheat, "Arduino.Internals", TIA publication, 5th edition, 2011	5.	Tianhong Pan, Yi Zhu, "Designing Embedded Systems with Arduino", Springer publication. 2018
Resources	З.	James M. Fiore, "Embedded Controllers Using C and Arduino ARDUINO open source	6.	Rajesh singh, "Arduino-Based Embedded Systems", Taylor & Francis, 2018
		community, 2018		

Learning Assessme	ent			1 - 2 -					
			Continuous Learning	Cum	m o fil vo				
	Bloom's Level of Thinking	Form CLA-1 Avera (45	ative ge of unit test %)	Life-Long CL (15	l Learning A-2 5%)	Final Examination (40% weightage)			
		Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	20%			20%	20%	-		
Level 2	Understand	20%		1	20%	20%	-		
Level 3	Apply	30%	The I want have		30%	30%	-		
Level 4	Analyze	30%			30%	30%	-		
Level 5	Evaluate	SV/ - ES		1.100	-	-	-		
Level 6	Create			10.0120		- 11	-		
	Total	100	)%	10	0 %	10	0 %		

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
	1. Mr. Anuj Kumar, Program Delivery Manager, Nagarro Software's Pvt Ltd.	1. Mr.T.Saminathan, SRMIST



Course Code	21ECO107J	Course Name	EMBEDDED SYSTEM DESIG	GN USING RASPBERRY PI	Con	Course Category			OPEN ELECTIVE								_ T 2 0	P 2	C 3
Pre-requi Course	site s	Nil	Co- requisite Courses	Nil		Progres Cours	ssive ses						Nil						
Course	Offering Departme	ent	ECE	Data Book / Codes / Sta	andards							Nil							
Course Le	arning Rationale	CLR): Th	e purpos <mark>e of learnin</mark> g this course	is to:		- 1	1	-	Progr	am Ou	tcome	es (PO)	)			1	P	rogra	m c
CLR-1:	Understanding th	e programmin	ng of p <mark>ython for R</mark> aspberry Pi	10 Jan 10	1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	es
CLR-2:	Applying python   Pi	programming	on GPIO and interfacing motors, sv	vitch and keyboard using Raspl	berry		7	1	15		lity								
CLR-3:	Create insights to gas detection	the concepts	and programming of motion detect	ion, GPS programming, light se	ensor e		nt of	ons of	0	society	stainab		Work		nce				1
CLR-4:	Analyze and under ultrasonic rangefi	erstand the wo	orking principle and data sheet of te ation and light sensor	mperature sensor, gas sensor A	ADC,	alysis	lopmei	estigati blems	Usage	r and s	& Sus		Team	ion	& Fina	arning			1
CLR-5:	Utilize the techno	logy of n <mark>ode j</mark>	s , cloud service and MQTT Protoco	for moving sensor data to web	eering	em Ana	n/deve	uct inve ex pro	'n Tool	nginee	nment		ual &	nnicat	st Mgt.	ong Le	-	2	<i>т</i>
Course Ou	itcomes (CO):	At	the end of this course, learners v	vill be able to:	Fnain	Proble	Desig	Condu	Moder	The e	Enviro	Ethics	Individ	Comr	Projec	Life Lo	PSO-	PSO-2	PSO-:
CO-1:	Remember the fu	ndame <mark>ntals o</mark>	<mark>f p</mark> ython Platform and Programming	100 A 100 A 100 A	3		1.1	-	2	-16	- 10	-		-	-	-	-	-	-
CO-2:	Write the GPIO a	nd inter <mark>facing</mark>	motor program in python using Ras	pberry Pi	1	-	3	-	2	-	-	-	-	-	-	-	1	-	-
CO-3:	Express the know	rledge i <mark>n data</mark>	sheet and functioning sensors	and the second	-	-	3	1.2	2	-	-	-	-	-	-	-	1	-	-
CO-4:	Apply the concep	t of sen <mark>sor an</mark>	d display device		100	6	3	-	2	-	-	-	-	-	-	-	1	-	-
CO-5:	Construct the not	le js, clo <mark>ud se</mark>	rvice and MQTT Protocol for moving	g sensor data to web	1	-	3	-	2		-	-	-	-	-	-	1	-	-
														•		•			-

## Unit-1 - Basic Python Programming

Python Basics- Editing Python Programs with IDLE, Variables, displaying Output, Reading User Input, Arithmetic, Creating Strings, Concatenating (Joining) Strings, Converting Numbers to Strings, Converting Strings to Numbers, Find the Length of a String, Find the Position of One String Inside Another, Extracting Part of a String, Replacing One String of Characters with Another Inside a String, Converting a String to Upper- or Lowercase, Running Commands Conditionally, Comparing Values, Logical Operators, RepeatingInstructions an Exact Number of Times, Repeating Instructions Until Some Condition Changes, Breaking Out of a Loop, Defining a Function in Python, Creating a List, Accessing Elements of a List, Find the Length of a List, Adding Elements to a List, Removing Elements from a List, Creating a List, Creating Up a List. Applying a Function to a List, Creating a Dictionary, Accessing a Dictionary, Removing Things from a Dictionary, Iterating over a List, Enumerating a List, Sorting a List, Cutting Up a List. Applying a Function to a List, Creating a Dictionary, Removing Things from a Dictionary, Iterating over Dictionaries

**Practice:** Python basics- Arithmetic and string, Loop operations, Lists and Dictionaries

Unit-2 - Controlling Hardware- Motor control, Digital Inputs

Controlling Hardware-Connecting an LED-Controlling the Brightness of an LED,Making a buzzing sound, Switching a High-Power DC Device Using Transistor and Relay,Programming with Interrupts, Controlling Servo Motors using PWM, Controlling the Speed and direction of a DC Motor, Using a Unipolar Stepper Motor, Using a Bipolar Stepper Motor, Digital Inputs-Connecting a Push Switch-Toggling with a Push Switch-Using a Two-Position Toggle or Slide Switch, Using a Rotary (Quadrature) Encoder and Using a Keypad.

Practice: LED blinking and Brightness control, Switching a High-Power DC Device, Programming on interrupts, Programming on Stepper Motor and stepper Motor, : Programming on Switch and keypad

B.Tech / M.Tech (Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

12 Hour

12 Hour

Unit-3 - Sensor Interface and Programming	12 Hour
Detecting Movement-PIR sensor, Data sheet analysis of PIR sensor, Using Resistive Sensors, Measuring Light, Detecting Methane, Data sheet analysis of gas sensor, Measuring	g a Voltage using MCP3008 And
data sheet of MCP3008, Using Resistive Sensors with an ADC, Measuring Temperature with an ADC, Measuring Acceleration and data sheet discussion of Acceleration sensor,	
Practice: Programming on PIR sensor, light sensor, gas sensor, ADC, Programming on measuring Acceleration.	
Unit-4 - Temperature Sensor and Display Interface Programming	12 Hour
Measuring Temperature Using a Digital Sensor, Data sheet analysis Digital Temperature Sensor, Measuring Distance-ultrasonic rangefinder, Data sheet analysis ultrasonic rangefinder	r, Logging to a USB Flash Drive,
Using a Four-Digit LED Display, Displaying Messages on an I2C LED matrix with data sheet discussion, Displaying Messages on an Alphanumeric LCD.	
Practice: Programming on Digital Temperature Sensor, ultrasonic rangefinder, Four-Digit LED Display, I2C LED matrix, Alphanumeric LCD	
Unit-5 - Publishing Sensor Data on Web Service	12 Hour
Cloud service for IOT, Publish sensor data on web service-building a home security dash board, MQTT Protocol- installation and setting account token creation, reading sensor d	ata and pushing to things board,
basis of java parinta, node in Madulas HTML madulas file, avant. LED blinking using Nade is building java parint diant using MOTT braker	

basic of java scripts –node.js, Modules-HTML module, Modules –file –event, LED blinking using Node.js, building java script client using MQTT broker **Practice:** Publish sensor data on web service, Programming on node js -HTML module and event module, Programming on LED blinking using node.js, Programming on LED and Push button using node.js, Building java script client using MQTT broker

	1.	Simon Monk, "Raspberry Pi Cookbook", O'Reilly Media, Inc, 2014.	3.	Colin Dow, "Internet of Thing: Programming Projects - Build modern IoT solutions with	the
Learning	2.	Volker Ziemann, "A Hands-On Course in Sensors Using the Arduino and Raspberry Pi,		Raspberry Pi 3 and Python", packtpub 2018.	
Resources		CRC Press, 2018.	4.	https://thingsboard.io/docs/	
		the second se	5.	https://www.w3schools.com/nodejs/nodejs_raspberrypi_blinking_led.asp	

earning Assessme	ent 🔤 🚽 🔤	Contraction of the second							
		A CONTRACTOR	Continuous Learning	Sum	notivo				
	Bloom's Level of Thinking	Form CLA-1 Avera (4)	native ge of unit test 5%)	Life-Long Le CLA-2 (15%)	earning 2 )	Final Examination (40% weightage)			
		Theory	Practice	Theory	Practice	<u>Th</u> eory	Practice		
Level 1	Remember	15%			15%	15%	-		
Level 2	Understand	25%		<u>-</u>	25%	25%	-		
Level 3	Apply	30%	- 1/15	-	30%	30%	-		
Level 4	Analyze	30%	-	-	30%	30%	-		
Level 5	Evaluate		11 A A A	-		-	-		
Level 6	Create	1100					-		
	Total	10	0%	100 %	6	10	0 %		

Course Designers	A REAL PROPERTY AND A REAL AND A					
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts				
	1. Mr. Anuj Kumar, Program Delivery Manager, Nagarro Software's Pvt Ltd	1. Mrs.Suganthi Brindha.G, SRMIST				

Course Code	21ECO108J Course Name 3D PRINTING HARDWARE AND SOFTWARE					Cou Cate	rse gory	0				OPEN E	ELECT	ΓIVE			1	- T 2 0	P 2	C 3
Pre-requis Courses	site s	Nil		Co- requisite Courses	Nil	F	Progres Cours	ssive ses						Nil						
Course C	Offering Departm	ent		ECE	Data Book / Codes / Sta	indards							Nil							
Course Lea	Course Learning Rationale (CLR): The purpose of learning this course is to:					Program Outcomes (PO)									Program		m			
CLR-1: Understand the tools available for 3D printing					1	2	3	4	5	6	7	8	9	10	11	12	outcomes			
CLR-2:	Familiarize with	3D desigi	n softwa <mark>re and h</mark>	ardware	Line and the second	e		of	s of	10	iety			¥		a)				
CLR-3:	Understand the	3D desigi	n criter <mark>ia and its</mark>	limitations	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	vledg		ento	ations	ge	soci			oWu		ance	D			
CLR-4:	Learn the contemporary technology available for 3D design and printing					Knov	lysis	mdo	stige	Usa	and	৵		Team	ы	& Fir	arnin			
CLR-5:	Understand various post processing methods involved in 3D printing technology				ering	m Ana	I/deve	ct inve ex prot	n Tool	Iginee	nment		ual & ⁻	unicat	t Mgt.	ng Le:				
Course Ou	tcomes (CO):		At the end o	f this course, learne	ers will be able to:	Engine	Proble	Design	Condu	Moder	The er	Enviro Sustai	Ethics	Individ	Comm	Projec	Life Lc	PSO-1	PSO-2	PSO-3
CO-1:	Apply the 3D pri	nting too <mark>l</mark>	l <mark>s for com</mark> ponent	s design	Sites Curs Vo	3	1.2	3	-	5	-	-	-	-	-	-	-	-	-	-
CO-2:	Optimistically se	lect the <mark>3</mark>	<mark>BD desig</mark> n softwa	re an <mark>d h</mark> ardware for t	he given problem	2	2	100	-	-		-	-	-	-	-	-	-	-	1
CO-3:	Solve 3D compo	nents de	<mark>sign pro</mark> blems	27 50-	100 C 100 C 10	3		2	-	-	-	-	-	-	-	-	-	3	-	-
CO-4:	Choose the cont	emporar <mark>y</mark>	<mark>y techno</mark> logy ava	iilable for 3D design a	and printing	1	-	0	-	-	-	÷	-	-	-	-	-	-	-	-
CO-5:	Apply various po	st proce <mark>s</mark>	s <mark>sing met</mark> hods in	volved in 3D printing	technology	2	-	1.1	- 1	-	1	-	-	-	-	-	-	2	-	-
Unit-1 - Int	roduction to MA	YA as a	3D Design Too		alas a second by a	2				-	-	<u> </u>							`12	Hour
Introduction Modeling w Practice: L import/expo	Introduction to Mark as a 3D pesign room internation of the international sector of the internation sector of the international sector of the																			
An overvie	12 Hour																			
and elasticity, Locks, bolts, and fasteners, Threading (taps and dies), Interfacing, support, and reinforcement, Form and function, visualizing the assembly process, Complex interactions and motorizations. <b>Practice:</b> Creating a part negative, Creating Text in Maya the proper way (NURBS Curves, surface lofts, conversion to polygon), Painterly tools, Sketch/drawing based workflows, Overview of manufacturing techniques - Molding, sculpting, lathing, lofting, welding, cutting, drilling, gluing, etc.																				
Unit-3 - De The good, t up, Roughin Practice: F	Unit-3 - Design Rules T2 Hour The good, the bad, and the ugly of design, Prominent Designers, Early decision-making criteria, Knowing the product, Vision and Reality, Scale and cost, Calculating the totalcost, Tolerances, Initial scene set- up, Roughing in the model, Structural integrity, Range of motion. Practice: Franchises Success stories, Pop culture, Brainstorming and critique in the early design phase, Group critiques of in- progress projects																			

Unit-4 - Manufacturing Techniques	12 Hour
Evolution of 3D printing - types of 3D Printing technologies and techniques- Stereolithography (SLA), Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS), Fused Deposition Modeling (FDM),	Laminated
Object Manufacturing (LOM), Electron Beam Melting (EBM), 3D Printing (3DP), Selective laser melting (SLM), Post processing and its techniques.	

Practice: Vacuum forming, Resin casting, Injection Molding, Terms and standards for injection molding systems, Printing Resolutions and Tolerances, Materials Properties (Temperature, Flexibility, Strength, Brittleness), Planning for injection molding - 3D Printing for injection molding

Unit-5 - 3D Printing Workflow and Product Visualization

Workflows for printing, Software and Drivers, Formats for Printing (SLA, OBJ, CAD, etc.), Clean-up and airtight modelling, Post and export, Print lab setup, Loading models and arranging print stage, Special topics – 3D Scanners and its types, Reverse engineering - Concepts and its hardware and software.

Practice: Post and Export, Print Lab setup, Printing, Removing support material, High speed machining

Learning	1.	Hod Lipson, Melba Kurman, "Fabricated: The New World of 3D Printing", Wiley, 2013	3.	Rob Thompson, "Manufacturing Processes for Design Professionals", Thames & Hudson;
Resources	2.	Matthew Griffin, "Design and Modeling for 3D Printing", Maker Media, Inc., 2013.		Reprint edition, 2007.

Learning Assessmen	t	$\sim$	Atom Sale							
			Continuous Learning	g Assessment (CLA)		Sum	mativa			
	Bloom's Level of Thinking	Form CLA-1 Avera (45	native ge of unit test 5%)	Life-Long CL (15	g Learning A-2 5%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	<u>The</u> ory	Practice			
Level 1	Remember	15%			15%	15%	-			
Level 2	Understand	25%		No. 21 Kit A	20%	<mark>25</mark> %	-			
Level 3	Apply	30%			25%	<u>30</u> %	-			
Level 4	Analyze	30%			25%	<u>30</u> %	-			
Level 5	Evaluate				10%	-	-			
Level 6	Create				5%		-			
	Total	10	0%	10	0%	10	0 %			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
	1 Mr. Anuj Kumar, Program Delivery Manager, Nagarro Software's Pvt Ltd.	<ol> <li>Mr. S. Karuppudayan, Mechanical, SRM IST</li> </ol>
		2. Dr. Sanja <mark>y Kumar S</mark> ahu, ECE, SRMIST

B.Tech / M.Tech(Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses - Syllabi-Control Copy

12 Hour

Course Code	21EEO301T	Course Name			E-MOBILI	TY		Cour Categ	se ory	0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3
Pre-requi Course Course	site s Offering Departmo	Nil ent E	C Electrical and Electrical	Co- requisite Courses ectronics Engin	eering	Nil Data Book / C	odes / Standa	Pi	ogres Cours	sive ses					Nil	Nil	1					
									1.0	1.0												
Course Le	arning Rationale	(CLR): 7	The purpo <mark>se of</mark>	learning this o	course is	to:			1	10	1.1	Progr	am Ou	<mark>itcom</mark> e	s (PO	)				P	rogran	m
CLR-1:	Afford a classifica	ation of elect	ctric vehicle	1	0	1		1	2	3	4	5	6	7	8	9	10	11	12	00	pecifi itcom	c es
CLR-2:	Impart knowledge	e on E-Mobil	ility		1	6	and the second	e		of	s of	10	iety			ž		0				
CLR-3:	Familiarize the fu	inctional req	quir <mark>ements of</mark> Ba	ttery managem	nent and E	nergy storage sys	tem	vledç		ento	ations	ge	soc			oW r		ance	b			
CLR-4:	Distinguish differ	ent types of	^r power converte	rs for E-mobility	у	Mer-		Anov	lysis	mdo	stiga	Usa	and	৵		Tear	и	ъ Ц	arnin			
CLR-5:	Acquire knowledge on charging station and testing						sering !	m Ana	n/devel	ct inve ex prob	n Tool	Igineer	nment		ual & T	unicati	t Mgt. 8	ng Lea				
Course Ou	utcomes (CO):		At the end of th	nis course, lea	rners will	be able to:	C. Ont	Engine	Proble	Design	Condu	Moder	The er	Enviro Sustai	Ethics	Individ	Comm	Projec	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Learn the basic o	concepts of e	<mark>electri</mark> c vehicle te	echnology and	its classifi	cations	23.34	3	-		-		-	2	-	-	-	-	-	-	-	-
CO-2:	Acquire the know	/ledge o <mark>n E-</mark>	-Mobility	1.000			18. J.	3		1	-	-	-	2	-	-	-	-	-	-	-	-
CO-3:	Acquire knowled	ge on B <mark>atter</mark>	<mark>ry ma</mark> nagement a	and Energy sto	orage syste	em	100	3	1			-	- 200	1	-		-	-	-	-	-	-
CO-4:	Recognize suitab	ole powe <mark>r co</mark>	onverters for EV	applications	120		100	3	-		-	-	-	1	-	-	-	-	-	-	-	-
CO-5:	Comprehend the	concep <mark>t of c</mark>	charging station	and testing me	ethods	1000		3	-	1.1	- 1	-	244	2	-	-	-	-	-	-	-	-
Unit-1 - Cl	assification of EV	/s	-		Card of	the P	1122						-								9	Hour
Overview of	of EVs and challen	ges, EV m <mark>ar</mark>	rket and Promoti	on, Parameter	s comparis	son, Classification	and Configura	tions of L	EVs			_	-									
Unit-2 - E-	<i>mobility</i> n - concept of E-m	obility E-Mo	obility Business I	Models e-mobi	ility for var	ious transportation	E-mobility fo	r 2 and 3	whoo	lors	-	1									9	Hour
Unit-3 - Er	nergy storage	oomty, <b>∟</b> -wo			inty for vari			2 010 0	WIICCI	1013	-	1									9	Hour
Energy Sto	nergy Storage Requirements in Hybrid and Electric Vehicles, Various Storage devices, EV energy source technologies, Battery Management System																					
Unit-4 - Po	Init-4 - Power Electronics for E-mobility 9 Hour																					
Basic Pow	er Electronic Devic	es, DC-DC	Converters for F	Hybrid Vehicle	Systems, I	Rectifiers and Inve	erters for E-Mo	bility						_							0	Hour
Solar Powe	ered Electric Vehic	le Charging	Station, Require	ement to prever	nt fire for E	EVs Charging Stat	ions, Testing o	f EVs ch	arging	statior	IS											ioui
Learning Resources	<ol> <li>Iqbal Husain, "Electric and Hybrid vehicles Design Fundamentals", CRC Press, second edition, 2013.</li> <li>James Larminie, John Lowry, "Electric vehicle technology Explained", Wiley, second edition, 2012.</li> <li>Ali Emadi, "Hand book of Automotive Power Electronics and Motor Drives", CRC Press, second edition, 2015.</li> <li>Ali Emadi, "Hand book of Automotive Power Electronics and Motor Drives", CRC Press, second edition, 2015.</li> <li>Ali Emadi, "Hand book of Automotive Power Electronics and Motor Drives", CRC Press, second edition, 2015.</li> <li>Ali Emadi, Mehrdad Ehsani, John M. Muller, "Vehicular Electric Power Systems", Marcel Dekker, Inc., 2014.</li> </ol>																					

Learning Assessment										
		Continuous Learning Assessment (CLA)								
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Lon Ci (1	g Learning LA-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%		20%	-	20%	-			
Level 2	Understand	20%		20%	-	20%	-			
Level 3	Apply	30%	-	30%	~	30%	-			
Level 4	Analyze	30%	-	30%		30%	-			
Level 5	Evaluate					-	-			
Level 6	Create	1	and the second second			-	-			
	Total	10	0%	10	00 %	10	0 %			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. K. Kumaresan, NTPC	1. Dr. S. S. Dash, GCE KJR	1. Dr. R. Palanisamy, SRMIST
2. Mr. A. Kannan, Seshasayee Paper Mills Ltd, Tirunelveli	2. Dr. A. Venkadesan, NIT Puducherry, Karaikkal	2. Dr. V. Pradeep, SRMIST



Course Code	21EEO302T	Course Name	WEA	WEARABLE TECHNOLOGY			se ory	0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3
Pre-requi	isite es	Nil	Co- requisit Courses	•	Nil	Pr	ogres Cours	sive ses						Nil						
Course	Offering Departme	ent E	lectrical and Ele <mark>ctronics En</mark> g	ineering	Data Book / Codes / Standa	ards							Nil							
Course Learning Rationale (CLR): The purpose of learning this course is to:						1	4		Progr	am Ou	utcome	es (PO	)				P	rogra	m	
CLR-1:	Comprehend the	need for de	velopmen <mark>t of weara</mark> ble devic	es and its in	fluence on various sector	1	2	3	4	5	6	7	8	9	10	11	12	00	itcom	c es
CLR-2:	Familiarize about	the differen	t sen <mark>sor used fo</mark> r wearable a	pplications	and the second second second	e		f	s of	10	ety			¥		0				
CLR-3:	Focus on energy	harvesting <mark>u</mark>	usi <mark>ng wearab</mark> le devices.	1	100 C	vledo		ento	ations	ge	soc		-	oW r		ance	ກ			
CLR-4:	Acquire the know	ledge of var	ious wearable devices	1		Anov	lysis	mdo	stige	Usa	and	જ		ean	ы	& Fir	arnin			
CLR-5:	Realize IoT in wearable technology employed for real life applications					ering	m Ana	/devel	ct inve	1 Tool	igineer	nment		ual & T	unicati	t Mgt.	ng Leá			
Course O	rse Outcomes (CO): At the end of this course, learners will be able to:				Engine	Proble	Design	Condu	Moder	The er	Enviro	Ethics	Individ	Comm	Project	Life Lo	PSO-1	PSO-2	PSO-3	
CO-1:	Integrate the knowledge of wearable devices					3	-	-	-	-	-		-	-	-	-	-	-	-	-
CO-2:	Elucidate the nec	essity o <mark>f ser</mark>	nsor for wearable systems	100		3		3	-	-		-	-	-	-	-	-	-	-	-
CO-3:	Interpret the level	of ener <mark>gy ir</mark>	<mark>nvolv</mark> ement in wearable syst	ems		3	2	-	-	-	-10	-	-		-	-	-	-	-	-
CO-4:	Enumerate the ta	xonom <mark>y of t</mark> i	<mark>he w</mark> earable devices based	on environm	ental and health aspects	3	-	-	-	-		2	-	-	-	-	-	-	2	-
CO-5:	Identify the role o	f loT in <mark>wea</mark> l	rable technology			3	-	1.1	-	-	1	2	-	-	-	-	-	-	2	-
Unit-1 - In	troduction to Wea	rable Techr	nology	16.45							-							1	9	Hour
Fundamen	Fundamentals of wearable technology- History of wearable technology-Need for wearable systems- emergence of wearable computing and wearable electronics, Industry sectors overview, E-Textiles.																			
Unit-2 - W	Jnit-2 - Wearable Sensors and Applications 9 Hour																			
Unit-3 - Er	Unit-3 - Energy Harvesting for Wearable Devices 9 Hours electronic and the sense of																			
Solar cell,	Solar cell, heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Wearable Optical Sensors, UV exposure indicators, speech recognition using lasers																			
Unit-4 - W	earable Devices	ofWoorablo	a The Meta Wearables and	Social Acros	ate: Interpretation of Acathotics	Adaption	ofInn	votion	On Pr	du Inte	ractio	n: Coor	Stud	( Intoll	igont o	lothing	Moor	ablaa	9 Challe	Hour
and Oppor	tunities, Future and	Research F	s, me viela vearables, and Roadmap.	Social Aspec	is. Interpretation of Aesthetics, i	чиориоп		valion,	UII-BC	ay inte	acilo	n, Case	= Study	y, intell	iyeni Ci	ouning	vvedla	ables:	Unalle	nyes
Unit-5 - Re	ole of IoT in Weara	ble Device:	S																9	Hour
Smart con	mart connectivity and Big picture of IoT-smart devices, networks, Wireless technologies and need for data analysis. Evolution of wearable technology, Wearable IoT based case studies.																			

Learning Resources	1. 2.	Michael J. McGrath, Cliodhna Ni Scanaill, Dawn Nafus, "Sensor Technologies: Healthcare, Wellness and Environmental Applications", A press Media LLC, first edition, 2015. Subhas C. Mukhopadhyay, "Wearable Electronics Sensors-For Safe and Healthy Living", Springer International Publishing, first edition, 2015.	3.	Edward Sazonov, Applications", Acad
			1	1.2.

Edward Sazonov, Michael R Neuman, "Wearable Sensors: Fundamentals, Implementation and Applications", Academic Press, Elsevier, second edition, 2018.

			Continuous Learning	Assessment (CLA)		Sum	motivo		
	Bloom's Level of Thin <mark>king</mark>	Form CLA-1 Avera (50	native ge of unit test )%)	Life-Long CL (1)	g Learning "A-2 0%)	Final Examination (40% weightage)			
		Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	20%		20%		20%	-		
Level 2	Understand	20%	A State Same	20%		20%	-		
Level 3	Apply S	30%		30%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	30%	-		
Level 4	Analyze	30%		30%		<mark>3</mark> 0%	-		
Level 5	Evaluate		1.57 - 1.000		2000		-		
Level 6	Create		1		1 A 1		-		
	Total	100 %		10	0%	100 %			

Course Designers		2 mm
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Allwyn Blessing Johnson, L& <mark>T Energ</mark> y, Mumbai	1. Dr. Suresh Perumal, Indian Institute of Technology, Jodhpur	1. Dr. S. Lourdu Jam <mark>e, SRMI</mark> ST
2. Mr. M. UmaSanker, Bharat Electronics Limited	2. Dr. Pandivarasan Veluswamy, IIITDM Kancheepuram	2. Dr. V. Pradeep, SRMIST



Course Code	21EEO303T	Course Name		E-WAS	TE MANA	GEMENT	C	Cours atego	e ory	0			(	OPEN E	ELECT	IVE				- T 3 0	P 0	C 3
Pre-requis	site s	Nil		Co- requisite Course <mark>s</mark>		Nil		Pro	ogres: Course	sive es						Nil						
Course C	Offering Departme	ent	Electrical and El	ectronics Engine	ering	Data Book / Codes / S	tandards								Nil							
Course Lea	arning Rationale	(CLR):	The purpose of	Flearning this c	ourse is t	0:		-		A.		Progra	am Ou	tcome	s (PO)					Pi	ograr	n
CLR-1:	Gain the knowled	lge on envi	ironmental impac	cts of e-waste	1.15	1		1	2	3	4	5	6	7	8	9	10	11	12	S	pecifie tcome	C es
CLR-2:	Examine the e-wa	aste manag	geme <mark>nt hierarch</mark> y	y		and and	-	e	-	f	of	20	iety			¥		0				
CLR-3:	Familiarize the ro	le of variou	us n <mark>ational an</mark> d ir	nternal act and l	aws	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	1	vledç		ent o	ations	ge	soc			oW r		ance	b			
CLR-4:	Distinguish e-was	ste manage	e <mark>ment mea</mark> sures	on national and	global leg	islations	1	Knov	ılysis	lopm	stiga	Usa	r and	~× _		Tean	u	& Fir	arnin			
CLR-5:	Acquire knowledg	ge in enviro	o <mark>nmentall</mark> y sound	d e-waste manag	gement		1.0	ering	n Ana	/devel	ct inve x prot	I Tool	ginee	ment		- al &	unicat	Mgt.	ng Le;			
Course Ou	tcomes (CO):		At the end of t	his course, lea	mers will .	be able to:		ingine	roble	Jesign olution	Condu	Aodem	he en	inviror	thics	Ipivibr	Comm	roject	ife Lo	SO-1	SO-2	SO-3
CO-1:	Summarize the e	nvironm <mark>ent</mark>	tal impacts of e-v	waste		the cure of	Sec	3	-	-	-	-	7	2	-	-	-	-	-	-	-	-
CO-2:	Apply various cor	ncept le <mark>arne</mark>	<mark>ed un</mark> der e-wast	e <mark>man</mark> agement i	hierarchy	Service Services		3	( e.,	12	-	-	1	2	-	-	-	-	-	-	-	-
CO-3:	Distinguish the ad	ct and la <mark>ws</mark>	<mark>: appli</mark> cable for e	-waste manager	ment and h	andling		2	27		-	-	-30	-	1		-	-	-	-	-	-
CO-4:	Analyze the e-wa	ste man <mark>ag</mark> e	<mark>emen</mark> t measures	5	2.5		100	2			-			2	-	-	-	-	-	-	-	-
CO-5:	Apply the concep	t of eco <mark>frie</mark>	ndly e-waste ma	nagement		1		2		1.1	-	-	1	2	-	-	-	-	-	-	-	-
Unit 1 Int	roduction to a w	oto Monor	nomont		Codia		- 94		00				-	N	-						0	Hour
Introduction	, Indian and globa	l scenario d	of e-Waste, Poss	sible hazardous	substance	s present in e-waste, Step	os in recy	cling a	and red	covery	of mate	erials	-									Ioui
Unit-2 - E-v	waste Hazardous	on Global	Trade	N																	9 /	Hour
Essential fa	ctors in global was	ste trade eo	c <mark>onomy, Im</mark> port c	of hazardous e-w	vaste in In	dia, E-waste economy in t	he organi	zed ar	nd und	organiz	ed sect	tor. Es	timatio	n and r	ecyclii	ng of e	e-waste	in me	tro citie	s of In	dia.	
Unit-3 - E-V	vaste Control ive	asures	d onvironmontal	protoction laws	in India Ex	tondod Producors Pospo	nsibility /	Admini	ictrativ	o Con	trols &	Enging	oring	controls	Pod	uction	ofwas	to at se	ourco		91	Hour
Unit-4 - E-v	vaste Legislation	guarus anu			ii iiiula, L	tended i Toducers Respo	nsionity, r		Suauv	e com	1013 & 1	_ngine	ening	Jonulois	, neu		01 Was		Juice		9/	Hour
E-waste (M	anagement and H	andling) Ru	ules, Go <mark>vernmen</mark>	nt assistance for	TSDFs. T	he international legislation	– conver	ntions,	Restr	ictions	of Haz	ardou	s Subs	tances	Direct	ive.						
Unit-5 - En	vironmental e-wa	iste Manag	gement	1				_	1.11												9	Hour
Emerging re	ecycling and recov	ery technol	logies, Guideline	es for environme	ntally sour	nd management of e-wast	e, Life cy	cle ass	sessm	ent of	a produ	ict, Ca	se stu	dies an	d uniq	ue initi	iatives	from a	round t	he wo	1d.	
Learning Resources	1. Johri R. global b 2. Hester F 2012.	, "E-waste. est practice R.E., Harris	: implications, re es", TERI Press, son R.M, "Electro	egulations, and second edition, onic Waste Man	managem 2015. agement S	ent in India and current Science", second edition,	3. Fou 4. Wa 201	wler B iste to 14.	, "Elec resou	tronic rces - /	Waste - A waste	– Toxi mana	cology gemer	and Pu nt Hand	ıblic H book,	ealth I The Ei	ssues" nergy a	, Elsev and Re:	ier, firs source	t editic s Instit	n, 201 ute (Ti	17. ERI),

Learning Assessme	ent						
			Continuous Learning	Assessment (CLA)		Sum	mativa
	Bloom's Level of Thinking	Forn CLA-1 Avera	native ge of unit test %)	Life-Lon Ci (1	g Learning LA-2 10%)	Final Ex (40% w	vamination reightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%		20%	-	20%	-
Level 2	Understand	20%		20%		20%	-
Level 3	Apply	30%		30%	2	30%	-
Level 4	Analyze	30%	-	30%	1	30%	-
Level 5	Evaluate				10	-	-
Level 6	Create					-	-
	Total	10	0 %	10	00 %	10	0 %

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. P. Kanagavel, NIWE, Chennai	1. Dr. S. S. Dash, GCE KJR	1. Dr. R. Palanisamy, SRMIST
2. Mr. A. Kannan, Seshasayee Paper Mills Ltd, Tirunelveli	2. Dr. M. Balaji, SSN CE	2. Dr. V. Pradeep, SRMIST



Course Code	21EEO304T	Cours Name	e e	ENERGY E	FFICIEN	PRACTICES	Co Cat	ourse tegory		0				OPEN I	ELEC	ΓIVE			l	- T 3 0	P 0	C 3
Pre-requis Courses	site S	Nil		Co- requisite Courses		Nil		Prog Co	ress urse	sive es						Nil						
Course C	offering Depart	ment	Electrical and	d Electronics Engin	eering	Data Book / Codes / Stand	ards	-							Nil							
Course Lea	arning Rationa	e (CLR):	The purpos	e of learning this (	course is	to:		1	Í.	1		Progr	am Ou	utcome	s (PO	)				Pr	ograr	n
CLR-1:	Interpret prese	nt energy so	cenario and pu	<mark>irpose o</mark> f energy efi	ficiency in	engineering and its application		1 :	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	: es
CLR-2:	Comprehend to	ne concept o	of ener <mark>gy effic</mark>	iency in electrical s	u <mark>pply</mark> syst	em and machines		e	3	f	s of	1	ety			¥		0				
CLR-3:	Describe energ	y efficiency	, prac <mark>tices in v</mark>	arious basic electri	c utilities			viedg		ent o	tions	ge	soci			No!		ance	D			
CLR-4:	Inspect probler	ns on lightin	ng a <mark>nd DG s</mark> ys	tems to provide eff.	icient solu	tions		Nouv	IJSIS	opm	stiga	Usa	and	<b>∞</b> δ		earr	uo	& Fin	arnin			
CLR-5:	Analyze energ	scenario a	an <mark>d efficien</mark> t so	lutions in industrial	sector			ering r		I/devel	ct inve ex prob	n Tool	Igineer	nment nability		ual & T	unicati	t Mgt. 8	ng Lea			
Course Ou	tcomes (CO):		At the end	of this course, lea	rners will	be able to:		Engine	LIODIE	Design	Condu	Moder	The er	Envirol Sustaii	Ethics	Individ	Comm	Project	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Apprehend ene	ergy scena <mark>ri</mark>	<mark>io and e</mark> fficiend	cy opportunities		12 1 Curr 10.4	1.1	3	-	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-2:	Analyze efficie	ncy of ele <mark>ctr</mark>	<mark>rical su</mark> pply sy:	stem and energy sa	aving meth	nodologies		3	d.		-	-	-	-	2	-	-	-	-	-	-	-
CO-3:	Perform energ	/ efficienc <mark>y  </mark>	<mark>practice</mark> s in ele	ectric utility system	s through	new technologies		3			-	-	-	-	2	-	-	-	-	-	-	-
CO-4:	Design the effi	cient lighti <mark>ng</mark>	<mark>g and D</mark> G syste	em	2.5			3	- 10		-	-		-	-	-	-	-	-	-	-	-
CO-5:	Examine indus	trial system	to determine e	energy efficient pot	ential	and the second		3	-		-	-	1	-	-	-	-	-	-	-	-	-
Unit-1 - En	ergy Scenario			6	Cal Milant							7									9	Hour
Introduction	: Commercial a	nd Non-com	n <mark>mercial e</mark> nerg	y, primary and sec	ondary en	ergy resources, ener <mark>gy nee</mark> ds c	of grow	ing ecc	non	ny, ene	ergy pr	icing,	Energy	y Conse	rvatio	n Act-2	2001, E	Bureau	of Ene	rgy Eff	icienc	<u>y.</u>
Electrical su	ipply system. co	<b>System</b> Imponents (	of AC power. (	Concept of sanction	ed load, n	naximum demand, contract den	nand a	nd AC	mac	chines		-									91	10ur
Unit-3 - En	ergy Efficient I	Practices			ou loud, li		iana, a	nario	mat	ormitee		1									9	Hour
Energy effic	ciency in electric	al utilities, ti	ips for energy	<mark>savi</mark> ng, compresse	d air syste	em, Energy saving opportunities	in HV/	AC and	refr	rigerat	ion sys	stem, i	mpact	of Powe	er Eleo	ctronic	s in en	ergy ef	ficiency	/		
Unit-4 - Lig	hting and Dist	Types of	f different lam	e <b>ms</b> os design and their	foaturos	energy efficiency opportunities	in liaht	ina an	d die	stribute	nd ann	aration	sveto	me							9	lour
Unit-5 - Ind	ustrial Sector	is, i ypes oi	r unierent iamp		iealuies,	energy eniciency opportunities	migin	ing and	i uis	sindute	u yem	sialioi	I Sysle	1115							9	Hour
Energy effic	eiency in industr	al sector, m	nain challenge	s to improve energy	efficiency	/ in industry, Energy Efficient Te	chnolo	ogies, l	ndus	strial A	Automa	tion, li	nd <mark>ustri</mark>	<mark>ial S</mark> ens	ors							
Learning Resources	1. Bose, centu 2. Hegg archit	B. K., "G y", IEEE Tr er, M., Fuc ecture", Wa	Nobal energy ransactions on chs, M., Star Iter de Gruyter	scenario and imp Industrial Electron k, T., & Zeumer, ; 2012.	oact of point ics, 60(7), M., "Ene	ower electronics in 21st 3. 2638-2651, 2012. 4. rgy manual: sustainable 5.	El-H Malii effici Dobi	awary, nauska iency ii rotkova	M. E ite, ind , Z.,	E., "El J., Jo lustry: , Luka:	ectrica uhara, EU an s, A., S	l energ H., A d natio	gy syst hmad onal po J., "En	ems", C , L., Mi olicies ir ergy Efi	CRC P Iani, T Italy	ress, s M., Mc and the	econd ontorsi, e UK. I dustry"	edition L., & Energy , World	, 2018. Ventui ', 172, I Bank	relli, N 255-20 Group	1., "Er 69, 20 9, 2018	nergy 19. 3.

Learning Assessme	ent						
			Continuous Learning	Assessment (CLA)		Sum	mativa
	Bloom's Level of Thinking	Forn CLA-1 Avera	native ge of unit test %)	Life-Lon Ci (1	g Learning LA-2 10%)	Final Ex (40% w	vamination reightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%		20%	-	20%	-
Level 2	Understand	20%		20%		20%	-
Level 3	Apply	30%		30%	2	30%	-
Level 4	Analyze	30%	-	30%	1	30%	-
Level 5	Evaluate				10	-	-
Level 6	Create					-	-
	Total	10	0 %	10	00 %	10	0 %

Course Designers	2,222,311,921,111	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Kusuma Eshwar, Danfoss ind <mark>ustries P</mark> vt Itd, Chennai	1. Dr. K V Praveen Kumar, SVNIT Surat	1. Dr. Ravi Eswar K M, SRMIST
2. Dr. Patnana Hema Kumar, Hella India Automotive Private limited, Pune, Maharashtra	2. Dr. Hari Priya Vemuganti, NIT Raipur	2. Dr. V. Pradeep, SRMIST



B.Tech / M.Tech(Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses –Syllabi-Control Copy

Course Code	21EEO305T	Cours Name	se e	SURVEILI	LANCE T	ECHNOLOGY	Cor Cate	urse egory	C	C				OPEN	ELEC	ΓIVE			ļ	L T 3 0	P 0	C 3
Pre-requ Course	isite es	Nil		Co- requisite Cour <mark>ses</mark>		Nil		Progro Cou	essiv rses	/e						Nil	1					
Course	Offering Departme	ent	Electrical	and Electronics Engin	neering	Data Book / Codes / Stand	ards								Nil							
Course Le	earning Rationale	(CLR):	The purp	os <mark>e of learnin</mark> g this (	course is	to:	Т	17	1	ť,		Progr	am Ou	itcome	es (PO	)				P	rogra	m
CLR-1:	Analyze the revo	lutionary	technologie	<mark>s of surve</mark> illance, their	r pros and	l cons	1	2		3	4	5	6	7	8	9	10	11	12	01	pecifi itcom	ic ies
CLR-2:	Learn about the r	many sur	veillanc <mark>e tec</mark>	<mark>chnolog</mark> ies and the fie	lds in whi	ch they are employed			×.,		-	2		lity								
CLR-3:	Focus on new t analytics, data m	rends an ining, and	nd de <mark>velopn</mark> d so <mark>cial mec</mark>	<mark>nent</mark> s such as minia <mark>lia</mark> networks	turized d	evices, wireless communication	s, eppe	5	nt of	5	ons of	0	society	tainabi		Nork		nce				
CLR-4:	Judge the balar technologies on t	nce betw the societ	reen the in by	vasiveness and imp	lications	and need of these surveilland	Knowl	sisvie	Innme		estigati blems	I Usage	er and s	t & Sus		Team ¹	tion	& Fina	arning			
CLR-5:			_	24	_		eering	em An;	avah/u	ons	uct invi lex pro	ern Too	enginee	onmen	(0	dual &	nunica	ct Mgt.	ong Le	5	2	ę
Course O	utcomes (CO):		At the en	d of this course, lea	rners wi	I be able to:	- nair	Probl	Posic	soluti	Cond	Mode	The e	Envir	Ethic	ndivi	Com	roje	_ife L	-OSc	-OSc	-OSc
CO-1:	Assess the histor	ry that s <mark>e</mark>	t the develop	oment of modern high	-tech equ	ipment in context with surveillan	ce 3	-	20	-	-	-	1	-	1	2	-	-	-	-	-	-
CO-2:	Compare the con	ntrasting <mark>f</mark>	eatures of o	ptical and satellite vis	ual surve	illance techniques	3	-			-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Distinguish the fu	Inctional	aspects of a	udio, radi <mark>o,</mark> and net s	urveilland	e technologies	3	L	1	-	-	-	2	-	2	-	-	-	-	-	-	-
CO-4:	Analyze techniqu	ies and <mark>n</mark>	<mark>ethods</mark> for e	employers, animals, g	enetics, a	nd seismic surveillance	3	-	1	-	-	-	2	-	-	3	-	-	-	3	-	-
CO-5:	List and discuss I	laws regu	<mark>lating the</mark> im	pact of surveillance te	echnology	on human society and their priva	acy 2	96-		-	-	-	2	-	2	-	-	-	-	-	-	-
Unit-1 – S	urveillance - Histo	orv and D	)evelopmer	at the second								-	-	-		_					9	Hour
Surveilland	ce- Its emergence-	Abuse a	nd use- Pub Surveillanc	plic dispute and accou	untability-	Evolution-Discoveries and Inven	tions- D	Devices	, con	npor	nents-	Comp	uters a	and Wo	o <mark>rld wic</mark>	<mark>le w</mark> eb	- Long	distan	ce con	nmuni	cation	-Data
Unit-2 - St	urveillance by Opt	tics	Carvonano		1.0							1									9	Hour
Visual surv	veillance-Security w	vith came	ra vision <mark>-Ne</mark>	<mark>w deve</mark> lopments- Fish	n eye lens	s, scanners, micro cameras-Seleo	tive vis	ion-Ro	botic	sen	sors-C	CTV-A	Aerial s	urveilla	ance-B	alloons	s-Uninl	habited	aerial	vehicl	es-Air	crafts
(border, m	ilitary, urban) surve	<u>eillance –</u>	Quadro-cop	ter-Drones - Satellite	surveillar	nce - Early warning - GPS – Traffi	c surve	illance	Lice	ense	plate r	ecogn	ition.									
Unit-3 - Ra	adio and internet a	Surveilla	nce	Page Favordropping	Nirotoppir	a Privoov ooto Multi functionalit	Dhone	00.00	2017	Dod	io ouru	oillon	DEI	D obin	Drod	unt pre	atactic	a oont	rol and	l track	y y	Hour
surveilland	ce-Wired wireless c	communia	cations-Snv	ware-QR codes-Searc	ch engine	surveillance-Social media monit	orina-W	es as : leb bro	wser	sun	o surv veilland	elliand e	,e-RFI		5-F100		NECLION	i, conti	UI allu	liack	ing-in	emet
Unit-4 - H	uman. Animal. Sei	nsor Sur	veillance		in ongino		Jing H	00 010		ouri	omana			-							9	Hour
Employer	surveillance-Data o	cards-Bio	metrics-Fing	ger-Iris and <mark>retina s</mark> ca	anners-Fa	cial recognition-Voice-Speech-S	ensor l	based	surve	eillar	ice-Alc	ohol s	ensor-	Seism	ic Sun	eillanc	ce-Anin	nal sur	veillan	ce-Ge	netics	-DNA
sampling,	profiling-CODIS-NL	)IS. Amenaiaa	Amonda	anto			_															Hour
Justice AF	P Shah Privacy Prir	nciples-In	ternational i	principles on the appl	lication of	human rights to communication	s surve	illance	-Ame	endn	nents t	o Nati	onal la	ws on	survei	llance-	Amena	dments	to lice	ense a	areen	inour ients-
Periodic re	eview of legislation	and pract	ices-Penalti	es-Safeguards for Int	ernationa	l co-operation-Authorizing author	ities-Co	ontent i	equir	reme	ents for	surve	illance	direct	ions.						,	

Loorning	1.	J. K Petersen, "Introduction to Surveillance Studies", CRC Press, first edition, 2013.	3.	1
Desources	2.	Policy-recommendations-for-surveillance-law-in-india-and-analysis-of-legal-provisions-on-		e
Resources		surveillance-in-india-and-the-necessary-and-proportionate-principles.pdf (cis-india.org).		

Vlado Damjanovski, "CCTV-From Light to Pixels", Butterworth-Heinemann, Elsevier, third edition, 2014.

Learning Assessme	ent			100 M			
			Continuous Learning	Assessment (CLA)		Cum	mativa
	Bloom's Level of Thinking	Form CLA-1 Avera (50	ative ge of unit test %)	Life-Lon CL (1	g Learning _A-2 0%)	Final Ex (40% w	native amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	and the second	20%		20%	-
Level 2	Understand	20%		20%		20%	-
Level 3	Apply	30%	1. State 182.00	30%		30%	-
Level 4	Analyze	30%	A State State	30%		30%	-
Level 5	Evaluate					-	-
Level 6	Create	SM/ - 19		Contract and		-	-
	Total	100	)%	10	0%	10	0 %

Co	urse Designers	10 March 10			
Ex	perts from Industry	Ex	perts from Higher Technical Institutions	Int	ternal Experts
1.	Mr. G Akilan, Embedded System <mark>s, Croat</mark> ia	1.	Dr. R Selvarasu, Adama Science and Technology University, Ethiopia	1.	Dr. <mark>K Subha</mark> Sharmini, SRMIST
2.	Mr. Sumit Barnwal. Honeywell. Czech Republic	2.	Dr. G Kumaravel, University of Technology and Applied Sciences, Sultanate of Oman	2.	Dr. <mark>V Pradee</mark> p. SRMIST



Course Code	21EEO306T	Cours Nam	e e	SUSTAIN	IABLE DEVEI	OPMENT PRACTICES	(	Cours Catego	se ory	0				OPEN	ELEC	TIVE			;	L T 3 0	P 0	C 3
Pre-requ Course	isite es	Nil		Co- rec Cours	uisite es	Nil		Pr	ogres Cours	sive es						Nil	1					
Course	Offering Departme	ent	Electrical	and Electronic	<mark>s Engineering</mark>	Data Book / Codes	/ Standard	s							Nil							
Course Le	earning Rationale	(CLR):	The purp	ose of learnin	g this cours	e is to:		-	1			Progra	am Ou	itcome	s (PO	)				P	rogra	m
CLR-1:	Gain a basic und	erstandir	ig on sustair	n <mark>able devel</mark> opi	nent	12 200		1	2	3	4	5	6	7	8	9	10	11	12	S	pecifi tcom	C es
CLR-2:	Understand the n	ecessity	of societal of	development to	wards sustai	nability		Ð		<u> </u>	of	1	ety			×						
CLR-3:	Familiarize the in	tegrated	strate <mark>gies o</mark>	o <mark>f sus</mark> tainable (	levelopment			rledg		ent o	tions	Je	soci			Wor		ance	-			
CLR-4:		-		~	200	Western		Von	lysis	opme	stiga	Usaç	and	8		eam	ы	Ë	Ining			
CLR-5:				-				sering l	em Ana	n/devel	ict inve ex prob	n Tool	ngineer	nment nability		lual & T	nunicati	t Mgt. 8	ong Lea			~
Course O	utcomes (CO):		At the en	nd of this cou	rse, learners	will be able to:	an 17	Engin	Proble	Desig	Condu	Mode	The e	Envirc	Ethics	Individ	Comr	Projec	Life Lo	-OS4	PSO-2	-So-S
CO-1:	Familiarize the ne	ecessity <mark>o</mark>	o <mark>f sustai</mark> nab	le developmer	t by various s	take holders	S.4.	127	-	- 1	-	-		3	3	-	-	-	-	-	-	-
CO-2:	Recognize the fea	asibility,	<mark>approac</mark> hes,	, techniqu <mark>es</mark> , a	nd outcomes	of sustainable developmen	t	2	-	100	-	-		3	-	-	-	-	-	-	-	-
CO-3:	Interpret various	policies <mark>a</mark>	and integrate	ed approa <mark>ch</mark> es	for adaption	of sustainable environment		2		-	-	-		3	-	-	-	-	-	-	-	-
Unit-1 - In	troduction to Sust	tainable	Developme	ent		STILL S		100	-		di la		-								9	Hour
Definition,	scope and element	ts, Stake	holders of s	sustainable dev	velopment: Pe	ople, Government, Investo	rs, Industry,	Judici	ary, ar	nd inter	nationa	al orgai	nizatio	ns worl	kin <mark>g fo</mark>	<mark>r sus</mark> ta	ainable	develo	pment			
Unit-2 - De	evelopmental Nee	ds of Ind	lian Society	<u>/</u>	ator deficien	a share way and a	unnlu conit	otion	unaali	ntific .	vo ata in		mont	la alt a	f trans	nortat	an faa	11100	مارزاله	duran	9	Hour
Poverty, u	nempioyment, inad vards political activi	equate n ties	ousing, uns	ate arinking w	ater, deficien	cy of energy sources and s	supply, sanit	ation,	unscie	entific v	vaste n	nanage	ement,	аск о	r trans	portati	on taci	lities, l	INSKIIIE	a wori	( TOFC	) and
Unit-3 - Se	ocial Interventions	for Sus	tainable De	velopment									1			_					9	Hour
Education,	skill development,	people's	participatio	on in decision i	naking, wome	n empowerment, inclusive	society, hun	nan rig	ghts, to	oleranc	e to div	ersity,	reduc	tion of	health	inequ	ality, s	ocial sa	afety ne	et and	Рори	lation
control					1		100					14										
Unit-4 - Er	nvironment Protec	ction Mea	asures			and the second								_							9	Hour
Environme	ent protection policie	es, waste •	manageme	<u>ent, pollution c</u>	ontrol, reduce	the use, reuse and recycle	, sustainable	energ	gy, pre	servat	ion of fo	prest a	nd wa	ter sour	rces.							
Unit-5 - In	regrated Approact	nes blo dovo	lonmont Pu	ublic privato pr	rtnorship dog	ontralization of nowor Stra	togios to bo	omo -	a dovo	lonod	country	Eutur	tron	de in in	tograti	od anr	roacha	c 020	n etudu	,	y	Hour
minovalive	moutis of sustailla		юртнени. Ри	iblic private pa		entranzation of power. Stra	iegies io Del			loped	Journay	, r utur	euen		eyial	σα αμμ	Jacile	<i>3, L</i> ast	- Sludy			
	1. Ghate, I	P., "India	n microfinar	nce: The challe	enges of rapid	growth", SAGE Publication	ns, 3. Ch	nopra,	K., Go	pal, K.	"Oper	ational	ising S	Sustaina	able De	evelop	ment",	Sage F	Publica	tions, i	first ea	lition,

Ghate, P., "Indian microfinance: The challenges of rapid growth", SAGE Publications, first edition, first edition, 2007.
 Green, F.J., Chambers, B.W., "The Politics of Participation in Sustainable Development Governance", United Nations University Press, first edition, 2006.
 Chopra, K., Gopal, K., "Operationalising Sustainable Development", Sage Publications, first edition, 1999.
 Green, F.J., Chambers, B.W., "The Politics of Participation in Sustainable Development Governance", United Nations University Press, first edition, 2006.
 Chopra, K., Gopal, K., "Operationalising Sustainable Development", Sage Publications, first edition, 1999.
 Hans, C.B., Christina, V., "Sustainable Development in International and National Law", Groningen: Maunsbach Europa Law Publishing, first edition, 2008.

			Continuous Learning	Assessment (CLA)		•	
	Bloom's Level of Thinking	CLA-1 Avera	native ge of unit test 0%)	Life-Lon CL (1	g Learning _A-2 0%)	Sum Final Ex (40% w	mative amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%		20%		20%	-
Level 2	Understand	20%	-	20%		20%	-
Level 3	Apply	30%	-	30%	<b>N</b> .	30%	-
Level 4	Analyze	30%	-	30%	2	30%	-
Level 5	Evaluate					-	-
Level 6	Create			· · ·		-	-
	Total	10	0%	10	0 %	10	0%

Course Designers			
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
1. Mr. M. Umasankar, Bharat Electronics Ltd, Andhrapradesh	1. Dr. S. S. Dash, GCE KJR	1. Dr. V. Pradeep, SRMIST	
2. Dr. P. Kanagavel, NIWE, Chennai	2. Dr. A. Venkadesan, NIT Puducherry, Karaikal.	2. Dr. R. Ramya, SRMIST	



Course Code	Irse 21EEO307T Course Name CLEAN AND GREEN ENERGY					Co Cat	urse egory	0				(	OPEN	ELEC	TIVE			:	- T 3 0	P 0	C 3
Pre-requis Courses	site s	Nil	Co	- requisite	Nil		Progre Cour	ssive ses							Nil	1					
Course C	Offering Departme	ent	Electrical and Elect	ronics Engineering	Data Book / Codes /	/ Standards								Nil							
Course Lea	arning Rationale (	(CLR):	The purpose of le	arning this course is	s to:	1	17		5	Р	rogra	m Ou	tcome	s (PO	)				Pr	ograr	n
CLR-1:	Get knowledge or	n energy s	system and solar rad	liation	100	1	2	3	1	4	5	6	7	8	9	10	11	12	Specific outcomes		
CLR-2:	CLR-2: Impart knowledge on solar energy and its applications							÷	of	5		ety			¥						
CLR-3:	Familiarize the im	portance d	of wind, tidal and wa	ive energy	4.555		6no i	ent o	tions		ge	soci			Wor		ance	0			
CLR-4:	Acquire knowledg	je on bio –	– e <mark>nergy</mark>	S 1	W		lysis	obme	stica	lems	Usa	· and	৵		Feam	uo	& Fin	arning			
CLR-5:	Acquire knowledg	ge on geo <mark>t</mark> l	t <mark>hermal an</mark> d oceanic	energy	1.1.2.2.2.2.		n Ana	/devel	ns ct inve	x prob	Tool	gineer	nment ability		Jal & J	unicati	Mgt. 8	ng Lea			
Course Ou	tcomes (CO):		At the end of this	course, learners wi	Il be able to:		Proble	Design	Condu	somple	Noder	lhe en	Enviror	Ethics	ndivid	Comm	Project	life Lo	-SO-1	2-02c	20-3
CO-1:	D-1: Learn the basic concepts of energy systems and significance of solar radiation data						3 -			-	-	1	2	-	-	-	-	-	-	-	-
CO-2:	Illustrate the princ	ciple of <mark>sol</mark>	<mark>lar the</mark> rmal conversion	on, solar PV systems	and its applications	3	3 -	-		-	-	-	2	-	-	-	-	-	-	-	-
CO-3:	Elucidate the prin	ciple of <mark>po</mark>	<mark>ower g</mark> eneration by v	vind, tidal and wave e	energy	2	2 -	-		-	-	- 20	1	-		-	-	-	-	-	-
CO-4:	Delineate about b	oiomass <mark> re</mark>	esources and bioma	ss energy conversion	technologies	2	? -	-		-	-	-	2	-	-	-	-	-	-	-	-
CO-5:	Expound the prine	ciple of <mark>ge</mark>	eo and ocean therma	l energy	Test of Contract	2	? -	-	6	-	-	2	2	-	-	-	-	-	-	-	-
Unit-1 - Fui	ndamentals of En	ergy Syst	tems and Solar Ra	diation	ALC: NOT THE OWNER OF	1														9	Hour
Introduction	to Energy, classif	ication of E	Energy Resources,	Energy for Sustainab	e Development, Analy <mark>sis</mark>	of Solar Radia	tion Da	ta		1											
Solar Colleg	lar Thermal Conv	of Collecto	tors Selection of Co	S lector for Various An	lications History of PV	- auivalent Circ	uit and	Floctr	ical (	harac	toristi	ics of	Silicon	PV C	alle Sc	lar Pa	nol Anr	licatio	ne	9	Hour
Unit-3 - Wi	nd. Tidal and Way	/e Enerav		lector for various App		_quivalent Circ	untanu	LICCUI	carc	narac	lensu	03 01	Silicon	1 1 00	5113, 00			nicatio	13.	9	Hour
Nature of th	e Wind, Power in	the Wind,	Force <mark>s on the B</mark> lad	es and Wind Energy	Conversion, Types of Win	nd Machines,	Applicat	ions o	f Win	d Ene	ergy, T	Tidal F	Power,	Comp	onents	s and (	Operati	on of T	ïdal Po	ower F	Plant,
Wave Energ	gy, Wave Energy (	Conversion	n Devices	7.3.3	LAR AND	A. Cak				1	1										
Unit-4 - Bio	o – energy			Di	union to share lowing Toma															9	Hour
Photo Synti	nesis, Usable Form	ns of Blom	nass, Biomass Reso	urces, Biomass conv	ersion technologies, Type	s of Blogas Pla	ants, Ap	piicati	ons											0	Hour
Energy insid	de the Earth. Geot	hermal We	ells, Types of Geoth	ermal Power Plants.	Ocean Energy Resources	. Types of OT	EC. Met	hods	of Oce	ean T	herma	al Elec	ctric Po	wer G	Generat	tion.				9	1001
Learning Resources	1. G.D.Rai, 2. R.K. Ra Compan	, "Non-Cor ajput, "No ny Ltd. seco	nventional Energy S on-Conventional En cond edition, 2014.	ources", Khanna Pub ergy Sources and	lishers, sixth edition, 2009 Utiliza <mark>tion",</mark> S.Chand an	9. 3. John ad 4. B.H.I	Twidell Khan, "N	and T Ion-Co	ony V onven	Veir, ' tional	"Rene I Ener	wable gy Re	e Energ esource	iy resc es", Ta	ources' ta McC	", Routi GrawHi	ledge, t II, third	hird ed editior	lition, 2 1, 2017	2015.	

ning Assessme	ent									
			Continuous Learning	Assessment (CLA)		C	mativa			
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (10	l Learning A-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%		20%		20%	-			
Level 2	Understand	20%		20%		20%	-			
Level 3	Apply	30%		30%	2	30%	-			
Level 4	Analyze	30%		30%	1 and 1 and 1	30%	-			
Level 5	Evaluate		Concerning and the second			-	-			
Level 6	Create		100 C			-	-			
	Total	10	0%	10	0%	100 %				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. K. Kumaresan, NTPC	1. Dr. S. S. Dash, GCE, KJR	1. Dr. S. Vidyasagar, SRMIST
2. Mr. A. Kannan, Seshasayee Paper Mills Ltd, Tirunelveli	2. Dr. A. Venkadesan, NIT Puducherry, Karaikkal	2. Dr. V. Kalyanasundaram, SRMIST



B.Tech / M.Tech(Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses –Syllabi-Control Copy

Course Code	21EEO308T	Course Name		SMART CITIES	AND COMMUNITIES	C Ca	ourse	e y	0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3
Pre-requi Course	site s	Nil	Ci	o- requisite Courses	Nil		Progressive Nil														
Course (	Offering Departme	ent E	Electrical and Elec	tronics Engineeri	ing Data Book / Codes / S	Standards	1.00							Nil							
Course Le	arning Rationale	CLR): T	The purpo <mark>se of le</mark>	arning this cou	rse is to:		4	1			Progr	am Ou	utcome	s (PO	)				Progra		m
CLR-1: Elucidate the smart city infrastructure							1	2	3	4	5	6	7	8	9	10	11	12	01	pecifi itcom	c es
CLR-2:       Acquire the knowledge of Intelligent Transportation Systems         CLR-3:       Understand the National and Global policies         CLR-4:       Classical and Clobal policies								sis	ment of	igations of ms	sage	nd society			am Work	_	Finance	ing			
CLR-4: CLR-5:	CLR-4: CLR-5:						gineering Kn	blem Analys	sign/develop utions	nduct investi nplex proble	dern Tool U	engineer a	vironment &	ics	ividual & Tea	mmunicatior	ject Mgt. & I	: Long Learr	0-1	0-2	0-3
Course Ou	itcomes (CO):	1	At the end of this	s course, learne	rs will be able to:	10.25	ц	Pro	Des	Col	Mo	The	Sus	Eth	pul	Ŝ	Pro	Life	PS	PS	PS
CO-1:	Explain the neces	sity of i <mark>nfra</mark>	<mark>struct</mark> ural develop	iment and plan fo	or smart cities	1000	3	3	-	-	-	-	2	-	-	-	-	-	-	-	-
CO-2:	Understand smar	t transp <mark>ort s</mark>	<mark>syste</mark> m and water	resources syster	ns for smart city and its applicati	ion	3	3	1.	-	-	-	2	2	-	-	-	-	-	-	-
CO-3:	Describe the Nati	onal an <mark>d Gl</mark>	<mark>lobal</mark> policies to in	n <mark>plement</mark> fo <mark>r s</mark> ma	rt city development		2	3		-	-	-	2	2		-	-	-	-	-	-
Unit-1 - Fu Introduction	ndamentals of Sn	n <b>art City In</b> t City world	frastructure and India – Neces	ssity of Smart Cit	y - Smart Governance - Challen	ges of mana	aging	infras	structu	re in wo	orld an	d India	Э.							9	Hour
Unit-2 - Pla	anning and Develo	opment of s	Smart City Infras	tructure	Adding processing in the		0 0													9	Hour
City Wide N	Vetwork - Wireless	Networks -	sustainable greer	<u>) building – safety</u>	Y - Policy instruments for inclusive service of the service of	e smart city	/ deve	lopm	ent - S	mart in	frastru	ucture	design	princip	oles						
Unit-3 - Int	elligent Transpor	t Systems	Sustama (ITS) E	nvironmontal Aar	posts of ITS Concentualization	of amort urk	on tra	nonc	rtation	ovotor	no C	morty	obiolog	and fu				kotina		9	Hour
Init-4 - Ma	nagement of Wat	er Resourc	ces and Related	Infrastructure		or smart urt	)an tra	inspc	lalion	syster	115 - 31	nart ve	enicies		ers Gr	3, GP3	) - E-lic	keung.		9	Hour
Storage an	d conveyance syst	em of water	r- sustainable wat	er and sanitation	- sewerage system - flood mana	agement - c	onsen	/atior	n syste	т.	4										Hour
Integrated	infrastructure Mana	gennent sys	stems for smart o	ity - applications	for existing smart city - Worldwig	de nolicies :	for sm	art c	ity - Go	Vornm	ont of	India	- nolicy	for sn	nart cit	v Mice	tion sta	tomon	t and	<b>e</b> Iabiun	inos -
Case studie	es of smart city.	igoment sys			ior onisiting smart ony - Worldwit	ue policies i	0 311	un Ci	iy - 00	v GI IIII		inuid -	policy	101 311		<i>y</i> , <i>wii</i> se	5011 310	aGIIIGII	anu	juluen	1100 -

Learning Resources	1. 2. 3.	Xianyi Li, "Smart City on Future Life - Scientific Planning and Construction", Chinese Edition, 2012. Nicos Komninos, "The Age of Intelligent Cities: Smart Environments and Innovation- for-all Strategies (Regions and Cities)", first edition, 2018. Anthony Townsend, "Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia", W. W. Norton & Company; reprint edition, 2014.	<b>4</b> . 5.	Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regiona Science, Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler- Milanovic; Evert Meijers, 2007. <u>www.smart-cities.eu</u> Mission statement and guidelines on Smart City Scheme, Government of India, Ministry of Urbar Development, http://smartcities.gov.in/upload/uploadfiles/files/Smart City Guidelines.

		1.11	Continuous Learning Assessment (CLA)								
	Bloom's Level of Thi <mark>nking</mark>	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (1)	g Learning A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%	And the second second	20%		20%	-				
Level 2	Understand	20%		20%		20%	-				
Level 3	Apply	30 %		30 %		30 %	-				
Level 4	Analyze	30%	2	30%		30%	-				
Level 5	Evaluate		0.000	- 19 P		-	-				
Level 6	Create	- 14 S	Los Carellas	4 La 1 - Ge 1 - G	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	-	-				
	Total		0%	10	0%	100 %					

Course Designers		Contraction of the second seco	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
1. Dr. Ananda K Akkarapaka, Matter Motor Works Pvt. Ltd, Gujarat	1. Dr. S. Senthil kumar, NIT, Trichy	1. Dr. C. Anuradha, SRMIST	
2. Mr. M.Umasankar, Bharat Electronics Ltd, Andhrapradesh	2. Dr. A. Venkadesan, NIT Puducherry, Karaikal.	2. Dr. S. Vijavalakshmi, SRMIST	



Course Code         21EEO309T         Course Name         ELECTRICAL TRADING							Cours atego	se ory	0				OPEN	ELEC	TIVE				- T 3 0	P 0	C 3
Pre-requi Course	site s	Nil	Co C	o- requisite Courses	Nil		Pro	ogres Cours	sive es						Nil	1					
Course	Offering Departme	ent E	Electrical and Elec	tro <mark>nics Engineer</mark> in	g Data Book / Codes / S	Standards	1000							Nil							
-					a hall	1		100	1.00												
Course Le	arning Rationale (	CLR): 7	The purpo <mark>se of le</mark>	earning this cours	e is to:			1	010		Progra	am Ou	Itcome	s (PO)	)				Pr s	ogran	n c
CLR-1:	Gain a basic unde	erstanding o	on needs of Electr	rical market	10.200		1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	es
CLR-2: Recognize the feasibility, approaches, techniques of power exchange and outcomes of Electrical tradin									-	of	1	ety			¥						
CI R-3:	Importance of Pri	ce Predictio	on price Volatility a	and communication	n information on trading	Ű	edg		nto	ions	e	soci			Wor		ance				
					Third adding		Mor	SIS.	ame	igat ems	sag	pug			am	c	Fina	ning			
CLR-4.			_	<u> </u>	and the second second	-	g Ki	naly	/elo	vest		Ser 8	int &		& Te	atio	t. &	-ear			
CLR-5:					and the second second second		erin	٩	n/dev	st in	n To	gine	nme Jabi		ual	unic	t Mg	ng L			_
	(00)		A			-	gine	oble	sign	npu	der	e er	virol staii	nics	livid	mm	ojeci	еLo	<u>-</u>	0-2	0 0
Course OL	itcomes (CO):		At the end of this	s course, learners	will be able to:		ш	Pre	De	83	Mo	£	ы Su	击	Inc	ပိ	Pre	Life	PS	R	R
CO-1:	Understand integr	rated ap <mark>pro</mark>	<mark>paches</mark> to Electrica	al Market	March and M	541-1	3	1	- 1	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Identify the needs	s, appro <mark>ach</mark>	<mark>nes, a</mark> nd strategies	of power exchang	e and Trading		3	1.	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Gain knowledge o	on price <mark> for</mark> e	r <mark>ecast</mark> ing and ethic	on information of t	trading		2	-		-	-	- 10	-	2	-	2	-	I	-	-	-
Unit-1 - Int	troduction to Elect	trical Mark	ket				-													9	Hour
Introduction	n- Deregulation, Ty	oes of R <mark>est</mark>	tructuring Model, N	Aajor Players, Natu	ral Gas, Electricity, Electrical G	eneration,	Bilate	eral C	ontract	ts Mode	el, Need	d of IS	O, Role	e o <mark>f IS</mark>	O, <mark>Hy</mark> t	rid Mo	del, Ela	astic – I	nelast	ic Mar	kets-
Cost comp	onents in transmiss	sion <b>-</b> Mecha	<mark>anics of</mark> the Physic	cal Electricity Marke	et, Crude Oil Markets- Issues in	n energy tr	ading.														
Unit-2 - Po	wer Transaction o	on Trading	<mark>7</mark>											01 1						91	Hour
Formation Power whe	of power pools- Eco oling - Typos of wh	onomic Exc	change of Energy -	- Energy Brokerage	e system. Types of electricity m	arket- Stri	ucture	e of Uł	K Elect	ricity d	eregula	ted m	arket -	Structi	ure of	Nordic	Electri	city dei	egulat	ed Ma	arket-
Unit-3 - Fr	eray Tradina	eening trans		1					_	1	17			-						9	Hour
Electric En	erav Tradina – Intra	oduction-Es	ssence of Electric	Energy Trading-En	ergy Trading Framework -Deriv	vative Inst	rumer	nts of	Enera	/ Tradii	na-Forv	vard C	Contract	ts-Futi	ire Co	ntracts	Option	Contr	acts- F	Put Op	otions
(Puts) cont	racts- Energy tradii	ng HUBSE	Brokers in Electrici	ity Trading- Green	Power Trading				- 57		5										
Unit-4 - El	ectricity Pricing			70.00	I ARA AL	1.11		-	1.1	1.11	1									9	Hour
Introduction	n - Volatility, Risk a	nd-Forecas	sting-Factors in Vo	platility-Measuring	Volatility-Tutorial Problems of M	Neasuring	Volati	ility-El	lectricit	y Pricir	ig Risk	-Elect	ricity Pi	rice In	dexes	– case	study	on vola	atility -(	Challe	nges
of Electricit	y Pricing-Reliable F	-orward Cu	urves-Construction	of Forward Price	Surves-Price Forecasting, Shore	t term Pric	e For	recast	ing.	-										0	Hour
Onen Acce	ess Same Time Info	ormation Su	vstem (OASIS) – I	Introduction-EERC	889-Structure of OASIS - Hist	orical Bac	karou	nd-Fu	Inction	ality of	OASIS	-Archi	itecture	of O4	SIS-C	ASIS	Phases	Phase	- 1	<b>y i</b> Phase	-14
Phase -2-7	ypes of information	available i	in OASIS-Informati	tion Requirements	of OASIS-Users of OASIS-Tran	sfer capa	bility c	of OA	SIS –D	efinitio	ns PJM	OAS	IS, ER(	COT 0	ASIS.				, 1		<i>.,</i> ,

	1.	Mohammad Shahidehpoura, Muwaffaq A Iomoush, "Restructured Electric Power	3.	Zaccour.G. "Deregulation of Electric Utilities", Kluwer academic publishers, first edition, 1998.
Learning		System operation trading and volatility", Macsel Dekker Inc, first edition, 2001.	4.	Lai L L, "Power System Restructuring and Deregulation: Trading, Performance and Information
Resources	2.	Kankar Bhattacharya, "Operation of Restructured Power Systems", Kluwer academic		Technology", John Wiley, first edition, 2001.
		publishers, first edition, 2001.	5.	THE ELECTRICITY ACT, 2003, http://www.cercind.gov.in/Act-with-amendment.pdf

		1 1 m	Continuous Learning	Assessment (CLA)		Sum	mativa			
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (10	Learning A-2 1%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%		20%		20%	-			
Level 2	Understand	20%		20%		20%	-			
Level 3	Apply	30%	A State Server	30%		30%	-			
Level 4	Analyze	30%	1	30%		30%	-			
Level 5	Evaluate	- VV - C:			-	-	-			
Level 6	Create		the states	17/000		-	-			
	Total	10	0%	10	)%	10	0 %			

Course Designers	A CONTRACTOR OF		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
1. Mr. R.Viswanathan, Power Grid corporation	1. Dr. S.S.Dash, GCE KJR	1. Dr. V. Kalyanasundaram SRMIST	
2. Mr. R.Ramar, NTPI, Neyveli	2. Dr. A.Venkadesan, NIT Puducherry, Karaikkal	2. Dr. S. Vidyasagar, SRMIST	



Course Code	Course Code         21EEO310T         Course Name         UNMANNED AERIAL VEHICLE							c	Course atego	e ry	0				OPEN	ELEC	ΓIVE				L T 3 0	P 0	C 3
Pre-requis Courses	site s	Nil		Co- requisit Courses	te		Nil		Pro	gres	sive es						Nil						
Course C	Offering Departn	nent	Electrical a	nd Electronics En	gineering	Data Bo	ook / Codes / Sta	ndards		_						Nil							
Course Lea	arning Rationale	e (CLR):	The purpo	s <mark>e of learnin</mark> g th	is course is	s to:			-	Č.	1		Progr	am Ou	itcome	s (PO)	)				P	ograr	n
CLR-1:	Understand the	fundamenta	als of Unma	nned Aerial Vehic	les	1			1	2	3	4	5	6	7	8	9	10	11	12	S OU	pecific tcome	; es
CLR-2:	Outline the arch	itecture of L	Jnman <mark>ned /</mark>	Aerial Vehicle	1	1			e		+	of	3	ety			¥						-
CLR-3:	Understand the	basic mode	elling <mark>of Qua</mark>	dcopter	/-		1.20		/ledg		ent o	tions	ge	soci			Wo		ance	5			
CLR-4:	R-4: Apply the concept of Unmanned Aerial Vehicle modeling for Battery management system								Know	lysis	obm	stiga	Usa	and	৵		Team	ы	& Fin	arnin			
CLR-5:	Understand the	customized	Unmannec	Aerial Vehicle					eering I	em Ana	n/devel	uct inve lex prot	rn Tool	ngineer	onment	6	dual & J	nunicati	ot Mgt.	ong Lea	1	2	33
Course Ou	tcomes (CO):		At the end	l of this course,	learners wil	Il be able to:	Andre	- 7	Engin	Proble	Desig	Cond	Mode	The e	Envire Susta	Ethics	ndivi	Comr	Proje	-ife L	-OSc	-OSc	-OSC
CO-1:	Familiarize the	different t <mark>yp</mark>	es of Unma	nned Aerial Vehic	les	Same a	aure Will	4	3	-	-	-	1		-	-	-	-	-	-	-	-	-
CO-2:	Illustrate the val	rious part <mark>s c</mark>	o <mark>f the U</mark> nma	nned Aerial Vehic	les and thei	r functions	6 C		3	2		-	-			-	-	-	-	-	-	-	-
CO-3:	Mathematically	model th <mark>e L</mark>	<mark>Inman</mark> ned A	erial Vehicle	200	222.0	19. 2		3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Design the lithiu	ım-ion/po <mark>lyn</mark>	ner battery i	models and batte	ry managem	ent system		100	3	2	-	-	÷	1		-	-	-	-	-	-	-	-
CO-5:	Enumerate the	sensors u <mark>se</mark>	<mark>ed in Un</mark> mar	ned Aerial Vehicl	es	100			3	2	3	-	-	1	-	-	-	-	-	-	-	-	-
Unit-1 - Int History of U	roduction to Un IAVs; Types of U	manned Ae AVs: Based	erial Vehicle	es Nano, Micro, Srr	nall, Medium	, and Large;	Based on structu	ire: Fixe	ed wing	g, Rot	ary Wi	ing, Fla	pping	wing, I	Fixed v	ving H	<mark>ybri</mark> d V	TOL, I	Airship	s; Appi	lication	<b>9  </b> s of U	<b>lour</b> AVs;
Unit-2 - Are	chitecture of UA	<u>vs; UAV Mai</u> <b>V</b>	rket; Safety	Guidelines.								-	1		_							9	Hour
Parts: Carb	on Frame; BLDC	Motor: Co	nstruction a	nd Working; Fligh	nt Controller:	: Case study	PIXHAWK 4; Ele	ectronic	Speed	d Con	troller	s; Ante	nna ar	nd Typ	es; Ra	dio cor	ntroller	s; Tele	metry;	Prope	ller an	d its ty	pes:
Materials, N	lo. of blades; Bla	ckbox; FPV	camera; Ba	attery; Gimbal; FP	V Goggles.	Design: Desi	ign Requirements	; Trade	-off; D	esign	Steps,	Flight	Time	Analys	is.							0	Hour
Quadcopter Dynamic Model and Simplified Dynamic Model: Control System: Root Locus Design Technique and Frequency Domain Design									esign	Techni	que; C	Controll	er Con	figurat	tion an	d Arch	itecture	e: Stat	e feed	back			
control con	figuration, Series	feedback c	ompensatio	<mark>n and Time</mark> scale	d flight contr	rol system arc	chitecture; PID Co	ontrolle	MAT	LAB e	examp	le					0						
Unit-4 - Ba	ttery Selection a	and Manage	ement Syst	ems	ottory State	of Charge E	otimation mathed	lo: Dott		1.000	olizotic	n nroh	lom: T	hormo	Looptr	l. Dro	tootion	intorfo	001 80	C Eati	motion	91	<u>lour</u>
Power estin	nation: Battery M	anagement	System: De	ery Monitoring, Be	wer Module.	: Battery: DC	Sumation method /DC Converter: B	s, balle Battery P	Pack S	afety:	Batter	v Stan	dards	& Test	s contro S	<i>)</i> , P10	lection	mena	ice, 30	IC ESU	malion	, Ener	yy ∝
Unit-5 - Se	nsors and Appli	cations					- 1	,														9	lour
Accelerome Microcontro	ccelerometer Sensor, Gyroscope Sensor, Airspeed sensor, Altitude sensor: Radar and Mechanical Altir licrocontrollers with Case Studies.							eter, Pr	essure	sens	sor, Cl	ock/Tin	ner, C	ompas	s, Mag	inetom	eter, I	MEMS	inertia	l Modi	ıle, Op	en-Sc	urce

Le Re	earning esources	1. 2.	M hti 20 Jii Li	inistry tps://di )21_Ga uchun thium-i	of gitalsk azette Jiang on Ba	Civil xy.dgca %20ve , Caip ttery N	Aviation, a.gov.in/a rsion_14- ing Zhan lanageme	"The ssets/file Jul-2021 g, San ent in Ele	Drone s/Draft-L .pdf Ping Jia ctric Driv	Rules", DronesRu ng, "Fun re Vehicle	Gazette les- damental es". Wiley.	e of s and first e	India, Applica	2021, ation of 015.	3. 4. 5.	Mohammad H. Sadraey, "Design of Unmanned Aerial Systems", Wiley, 2020. Paul Gerin Fahlstrom, Thomas James Gleason, "Introduction to UAV Systems", Wiley Publication, John Wiley and Sons, Ltd, fourth edition, 2012. Landen Rosen, "Unmanned Aerial Vehicle", Alpha Publication, 2015.
			LI	unum-i	un Da	liery iv	anayenne				s, wiicy,	111 51 6	uili011, 2	015.	1	1.2.

	Bloom's Level of Thin <mark>king</mark>	Form CLA-1 Avera (50	Continuous Learning native ge of unit test %)	Assessment (CLA) Life-Long CL (1)	g Learning A-2 0%)	Summative Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%		20%		20%	-				
Level 2	Understand	20%	the second states	20%		20%	-				
Level 3	Apply	30%		30%		30%	-				
Level 4	Analyze	30%		30%		30%	-				
Level 5	Evaluate		7 1 1 1 A 1	10/21-11-1		- 15	-				
Level 6	Create	-				-	-				
	Total	100	)%	10	0%	10	0 %				

Course Designers	· · · · · · · · · · · · · · · · · · ·	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Chandrasekhar, DRDO, India	1. Dr. Abhinav Kumar, Indian Institute of Technology Hyderabad.	1. Dr. C. Bharatiraja, SRMIST
2. Mr. Chandru Rajendran, Airdonex, India	2. Dr. Pappa N, Anna University, MIT Campus, Chennai	2. Dr. Phani Teja Bankupalli, SRMIST



Course	210E0101T	Course		Course	0		L	Т	Ρ	С	
Code	ZIGEOIUTI	Name	DENAVIORAL DIOLOGI	Category	0	OPEN ELECTIVE	3	0	0	3	

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offeri	ng Department	Genetic Engineering	Data Book / Codes / Standards	01.00	Nil

Course Le	earning Rationale (CLR):	The purpo <mark>se of learning</mark> this course is to:				1	Progr	ram Ou	utcome	s (PO	)				P	rogra	m
CLR-1:	Categorize the types of le	earning, s <mark>timuli and co</mark> nditioning	1	1         2         3         4         5         6         7         8         9         10         11         12										01	utcon	ic ies	
CLR-2:	Classify concepts of socia	al facilitation and imitation behavior	e		of	s of	-	iety			Ł		e				
CLR-3:	3: Understand information on kinship theory				ent o	ation	ge	soc			n Wo		Jano	Ð			
CLR-4:	R-4: Acquire information on the types of communication and territoriality behavior				lopm	estig:	Usa	r and	∞		Tean	.u	& Fir	arnin			
CLR-5:	Summarize concepts on a	ag <mark>gression</mark> and game theory	ering	n Ane	deve	t inve x prol	Tool	ginee	ment		lal & .	Inicat	Mgt.	ig Le:			
Course O	utcomes (CO):	At the end of this course, learners will be able to:	Engine	Probler	Design	Conduc	Moderr	The en	Enviror Sustair	Ethics	Individu	Commu	Project	Life Loi	PSO-1	PSO-2	PSO-3
CO-1:	Interpret conditioned and	unconditioned stimuli and learnability		2	1	-	-	-	-	-	-	-	-	3	-	-	-
CO-2:	Analyze concepts in socia	al learning		2	1	-	-	- 30	-	-	-	-	-	2	-	-	-
CO-3:	Discuss the concept of in	clusive fitness and family dynamics	1-0.34	2	14	3	-		-	-	3	-	-	-	-	-	-
CO-4:	Relate coalition behavior	and concept of interspecific mutualism		2	1.1	-	-	-	-	-	2	-	-	3	-	-	-
CO-5:	Explain the concept of ag	g <mark>ression</mark> behavior	-	2	-	-	-	-	· -	-	3	-	-	2	-	-	-

Unit-1 - Types of Learning	Hour
Introduction to behavior - Natural selection - Individual learning - Cultural transmission - Stimulus - Sensitization - Habituation - Conditional learning - Learnability - Instrumental conditioning	
Unit-2 - Social Transmission 91	Hour
Social facilitation - Imitation in infants - Local enhancement - Social learning in children- Imitation behavior in animals - Vertical transmission - Oblique transmission - Horizontal transmission	
Unit-3 - Kinship Behavior 91	Hour
Kinship, Kinship theory – Relatedness - Inclusive fitness - Family dynamics - Dynasty building in acorn woodpeckers - Parent-offspring conflicts - In-utero conflicts in humans - Sibling rivalry - Kin recognition - S	Social
grooming - Grooming in primates	
Unit-4 - Cooperative Behavior 91	Hour
Coalitions - Interspecific mutualism – Communication - Honey bees and the waggle dance- Chemical communication in ants - Vibrational communication in ants - Habitat choice – Territoriality – Migration - Migr	gration
of monarch butterflies	
Unit-5 - Aggression and Play Behavior 91	Hour
Aggression - Fight or flight response - Intruder aggression - Game theory - The hawk-dove game - Effect of intrauterine position on aggression in mice - Play behavior - Object play - Locomotor play - Social p	play -
Play fighting - Effect of testosterone in play fighting	

Learning Resources	1. 2.	Dugatkin, L.A. (2020) "Principles of Animal Behavior", Fourth Edition, University of Chicago Press, 576 pp. Manning, A. and M.S. Dawkins (2012) "An introduction to Animal Behaviour", Sixth Edition, Cambridge University Press, 467 pp.	3. 4.	Attenborough, D. (2022) "The rials of life: A natural history of animal behviour" William Collins, 288 pp. Organ, C.L. (2021) "Animal Behaviour" MJP Publisher, 352pp.

			Continuous Learning	Assessment (CLA)		0	
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test 0%)	Life-Lon CL (1	g Learning _A-2 0%)	Sum Final Ex (40% w	mative amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	15%		15%	-
Level 2	Understand	25%		20%	- 100	25%	-
Level 3	Apply	30%		25%		30%	-
Level 4	Analyze	30%		25%		30%	-
Level 5	Evaluate			10%			-
Level 6	Create		100 CO. 30 State	5%		-	-
	Total	10	0%	10	0 %	10	0%

C	ourse Designers			5	
E	xperts from Industry	Ex	perts from Higher Technical Institutions	Int	ernal Experts
1	. Dr. Selvaraj Vellaisamy,, Regenix Drugs Limited, Chennai	1.	Dr. K. Emmanuvel Rajan, Bharathidasan University,	1.	Dr. S. Kirankumar, SRM IST
	selvarajv@yahoo.co.in	2.0	Tiruchirapalli, Tamilnadu emmanuvel@bdu.ac.in		
2	. Dr. James Bhaskar, ITC, Bangalore James.bhaskar@gmail.com	2.	Dr. M. Singaravel, Banaras Hindu University, Varanasi, Uttar	2.	Dr. A. Devi, SRM IST
			Pradesh m.singaravel@bhu.ac.in		



Course Code	21GEO102T	ES AND SOCIETY	Cour Categ	se ory	0				OPEN	ELEC	TIVE			l	. T 3 0	P 0	C 3		
Pre-requi Course	site s	Nil	Co- requisite Courses	Nil	P	rogres Cours	sive ses						Nil	1					
Course (	Offering Departme	nt	Genetic E <mark>ngineering</mark>	Data Book / Codes / S	tandards							Nil							
Course Le	arning Rationale (	CLR): TI	he purpos <mark>e of learning</mark> this co	urse is to:	1 A	1			Progra	am Ou	itcome	s (PO	)				Pr	ogra	m
CLR-1:	Illustrate about fu	ndamentals o	of micr <mark>obiology</mark>		1	2	3	4	5	6	7	8	9	10	11	12	S  ou	pecifi tcom	c es
CLR-2:	Create interest in	exploring the	e mi <mark>crobial world</mark>	and an and a second	e		Į.	s of	20	lety			Ł		0				
CLR-3:	R-3: Provide knowledge on the use of microbes in biotechnology						ento	tions	ge	soc		-	Wo		ance	b			
CLR-4:	<b>R-4:</b> Initiate interest in microbes and tools of genetic engineering						opme	stiga	Usa	and	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		eam	ы	ž Fin	urnin			
CLR-5:	Understand the co	oncept of infe	ectious diseases and treatment	1000	eering t	em Ana	n/devel	uct inve ex prob	m Tool	ngineer	onment inabilit <mark>v</mark>		dual & T	nunicati	st Mgt. 8	ong Lea	-	2	3
Course Ou	tcomes (CO):	A	t the end of this course, learr	ers will be able to:	Engin	Proble	Desig	Condu	Mode	The e	Enviro Susta	Ethics	Individ	Comn	Projec	Life Lo	-OS4	PSO-	PSO-:
CO-1:	Recall knowledge	about <mark>namir</mark>	<mark>ng, cl</mark> assification, and history of	microbiology	3	2	2	-	-		-	-	-	-	-	-	-	-	-
CO-2:	Discuss knowledg	je abou <mark>t mic</mark> i	robial metabolism		3	3	3	-	-	-0	-	-	-	-	-	-	-	-	-
CO-3:	Discover the role	of micr <mark>obes</mark> .	<mark>in f</mark> ood, agriculture, and pharma	aceuticals.	1	1		-	-	- 20	-	-	-	-	-	2	-	_	-
CO-4:	Identify tools of m	olecula <mark>r gen</mark>	<mark>etic</mark> s that are derived from micr	oorganisms	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Apply knowledge	on stud <mark>ying</mark> :	<mark>the r</mark> ole of microbes in public he	ealth and infectious diseases	1.	3	2	2	-	2	-	-	-	-	-	-	-	_	-
Unit-1 - Int	<b>roduction to the N</b> In to the microbial w	<b>licrobial Wo</b> orld - History	orld / of microbiology - Classificatior	of microbes - Morphology and cha	aracteristics - E	Bacteria	a – Fun	gi – Pr	otozoa	– Viru	ıs – Alg	yae.						9	Hour
Unit-2 - Mi	crobes in Disease	S																9	Hour
Microbes in Sexually tra	i diseases - Water ansmitted diseases	borne infect	i <mark>ons – Path</mark> ogenesis, diagnosis r-borne disease, Malaria	s, treatment (Cholera, Typhoid), Fo	odborne infec	tions ty	ypes - E	Botulisi	n, Airb	orne i	nfectior	ns type	es - Co	orona v	virus -	Tuberci	llosis	- Antr	nrax -
Unit-3 - Mi	crobes in Industri	al Products		1 1 4 4 4 4 1 T				-	144									9	Hour
Role of mic	robes in industries	– Productior	n of A <mark>lcohol, wine,</mark> beer – Antibi	otic – Milk products, cheese, yogurt	t –Food and fe	rmente	ed prod	ucts Bi	ofertiliz	zer – E	Biofuel -	– Prob	iotics						
Unit-4 - Mi Microbes in	crobes in the Environment – Mic	ronment	restrial environment - Aquatic e	nvironment – Microhes in air – Evtr	reme environm	ent_	Microbe	s in sk	in _ Mi	crohe	s in aut	L- Micr	nhas i	nsnac	۵			9	Hour
Unit-5 - Co	ntrol of Microorga	anisms			CITE CITAIIOIIII			5 111 31	–	UDDE.	s in gut	- WIG	0003 1	n spac	0			9	Hour
Physical m	I method – Chemical method – Antibiotics and antibiotic resistance – Radiation based – Wastewate					nods –	Hygien	e and	infectio	n con	trol – H	lospita	l Acqu	ired inf	fection				

	1. Microbiology, An Introduction, Pearson publishing, 12th edition, by Tortora, Funke, and Case,	3. Pelczar MJ, Chan ECS & Kreig NR. 1997. Microbiology: Concepts and
Learning	Publishing. ISBN: 978-0-321-92915-0	Application. TataMcGraw Hill
Resources	2. Weeks, Benjamin S., and I. Edward Alcamo. Microbes and society. Jones & Bartlett Learning, 2008.	

Irning Assessm	ent		1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	150							
			Sum	Summative							
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (1)	g Learnin <mark>g</mark> .A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	15%		15%		15%	-				
Level 2	Understand	25%		20%		25%	-				
Level 3	Apply	30%		25%		30%	-				
Level 4	Analyze	30%	and the second sec	25%		30%	-				
Level 5	Evaluate			10%		-	-				
Level 6	Create			5%		-	-				
	Total	10	0%	10	0%	10	0%				
	1.0		And the second second	1.4 5 6 7 7 1	Con an ann						

Course Designers	A REPAIR BARANCE THE REPAIR A	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Rajeev Kumar Sukumaran, NIIST, Trivandrum	1. Dr.Natarajasrinivasan, Professor, Department of Microbiology, Bharathidasan University, Tiruchirappalli	1. Dr. T.Anand, SRMIST
2. Dr.Ayyadurai , Scientist, CLRI , Chennai	2. Dr.Mohammed Jaabir, Associate Professor, National college, Trichirapalli	2. Dr. M.Ramya, SRMIST



Course Code	Course Code         21GEO103T         Course Name         BIOFERTILIZERS – AN ENTREPRENEURIAL PERSPECTIVE								se ory	0				OPEN	ELECT	ΓIVE			L	- T 3 0	P 0	C 3
Pre-requi Course	isite es	Nil		Co- requisite Courses		Nil		Pr	ogres Cours	sive es						Nil						
Course	Offering Departme	ent	Ger	netic Engineering		Data Book / Codes /	Standard	S	_						Nil							
Course Le	arning Rationale (	CLR): Th	he purpos	e <mark>of learnin</mark> g this	course is	to:		4	1			Progr	am Ou	Itcome	es (PO)	)				Pi	rograi	m
CLR-1:	Understand the si	ignificance of	f biofertiliz	ers	100			1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	c es
CLR-2:	Classify the types	of microbial	l bio <mark>fertilize</mark>	ers	A	Constant and		e		f	of	1	ety	oility		¥		0				
CLR-3:	Acquire information	on on vermico	omposting		- /-		1.16	vledç		ento	tions	ge	soc	ainat	_	oW I		ance	0			
CLR-4:	CLR-4: Prioritize the packaging , storage and marketing of Biofertilizers							<ul><li></li></ul>	lysis	mdo	stiga	Usa	and	Sust		earr	ы	& Fin	arnin			ı
CLR-5:	CLR-5: Summarize agribusiness and government policies								em Ana	n/devel	ict inve ex prob	n Tool	ngineer	nment &		lual & T	Iunicati	t Mgt. å	ong Lea	_		~
Course Ou	utcomes (CO):	A	t the end	of this course. lea	arners will	be able to:		ngin	roble	lesig		lode	he el	nvirol	thics	divio	umo	rojec	ife Lo	, S	So-S	Ś
CO-1:	Describe about th	e biofertilizer	rs				14	-	-	-		2		3	ш -	-	-	-	3	-	<u> </u>	<u> </u>
CO-2:	Relate the types of	of biofertilizer	rs and its a	applications	1999					3	2		-	2	-	-	-	-	-	-	-	-
CO-3;	Correlate the imp	ortance and u	production	of vermicompost		10 C						-	- 10	_	3	_	-	2	2	-	-	-
CO-4:	Criticize the polici	es and steps	s involved	in the agribusiness	1		100		-	2	-	-	-	3	_	2	-	-	-	-	-	-
CO-5:	Integrate the laws	govern <mark>ing t</mark> h	<mark>he m</mark> anufa	cturing		100 C			÷	1.1	-	-	1	-	2	-	-	-	3	-	-	-
Unit-1 - Fu	Indamentals of Bio	o fertilizers			C. A.	Law Party	12		60				-	× -							9	Hour
Bio fertilize	rs-Introduction, Cla	ssification <mark>, P</mark>	Plant Nutrie	ents-sources and its	role in pla	nt growth, Role of manure	es, crop rot	ation,	green	manu	ing, Bio	fertiliz	zers in	sustair	n <mark>able</mark> a	<mark>gric</mark> ultu	ure, Qı	ıality st	andard	l for bio	o fertil	izers,
Nitrogen fix	kation-symbiotic – A icrobial Biofertiliza	Asymbiotic, C	constraints	in Bio fertilizer pro	duction, Bi	o fertilizers and their adva	antages ou	er che	emical	fertiliz	ers.	-		_	-						0	Hour
Microbes in and ectom	n bio fertilizer, Azolla ycorrhiza, Microbes e. Types of mycorrh	a, Bacterial B s beneficial fo izae and asso	Bio fertilizer for recyclin sociated pla	rs, Azospirillum, Az g of Organic waste ants, Mass inoculu	otobacter - s & Comp m producti	classification, characteris osting, Media used for bio on of VAM, field applicatio	tics – crop o fertilizers ons of Ecto	respo s - ion mycoi	nse, C cheala rhizae	Synoba ator -   e and \	cterial t ootash i /AM,	bio fert nobiliz	ilizers- ers, F	Anaba actors	ena - l affectir	Vostoc ng plar	- funga nt grow	al bio fe th, Enc	rtilizers lophyte	s- AM əs, Imj	mycor portan	rhiza ce of
Unit-3 - Ve	ermicompost and i	its types			100	-															9	Hour
Vermicom Vermiwash	post-Introduction, E n, Different methods	arthworms - of vermicom	<ul> <li>Ecologican Ecologican Ecologican Ecologican Ecologican Ecologican Ecologica Ecologi</li></ul>	<mark>al strategies,</mark> Basic Small and Large sc	traits and ale, Bed m	life cycle, Application of ethod, Pit method. Harves	f earthworn sting of ve	ms in rmicor	Waste npost.	e mana	agemen	t, Role	e of ea	arthwor	rms in	Bio fe	rtilizer	produc	tion. L	iquid t	fertiliz	ers –
Unit-4 - Pa	ckaging and Mark	et Survey						<u> </u>													9	Hour
Methods of Market Su	t quality control ass rvev. Concepts of m	essment in re narket survev	espect to b / Survey n	notertilizer <mark>s, Metho</mark> methods, society ne	ds of packi	ng, Biotertilizers – Storag ation of marketing, BIS st	ie, shelt life tandards re	and r	narket nendat	ting, Si tion for	oring a	nd pac lizers	kaging	of ver	micom	post, N	larketi	ng of P	roducts	s – Foi	reign t	rade,
Unit-5 - Ag	gribusiness and Fi	unding Oppo	ortunities								STOTOTO										9	Hour
Agribusine	ss, Types of compa	nies, Registr	ration, Org	anic farming – Prir	iciples, Pol	icies, Certification agenci	i <mark>es, Fundi</mark> n	g Age	ncies,	Profe	ssional	selling	skills	and kn	owledg	ie, Rur	al Dev	elopme	ent prog	grams,	, NAB,	ARD,
Self Help (	Froups, Basic conce	ept & need fo	or auditing,	Detection and pre	vention of	rauds and errors.																-

	1.	Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers	4.	Charantimath, P.M., 2009, Entrepreneurship development and Small Business Enterprises,
Learning	2.	Tanenbaum A S, Woodhull A S, 2006. Text book of Agricultural Biotechnology,		Pearson Education, India
Resources		3rd Edition. PHI Learning.	5.	Smita Diwase. 2017. Indian Agriculture and Agribusiness Management (3rd Edition). KRISHI
	З.	M. K. Rai. 2005. Handbook of Microbial Biofertilizers, Food Products Press, New York.		Resource Management Network

Learning Assessme	nt			1.24							
			Continuous Learning	Assessment (CLA)		Sum	mativa				
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (1)	g Learning _A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	15%		15%		15%	-				
Level 2	Understand	25%	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	20%		25%	-				
Level 3	Apply	30%	States Land	25%		30%	-				
Level 4	Analyze	30%		25%		30%	-				
Level 5	Evaluate			10%		-	-				
Level 6	Create	- · ·	1. 1.	5%		-	-				
	Total	10	0%	10	0 %	10	0 %				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Mahesh, Senior Lead Scientist - Microbiology,	1. Dr.Jibu Thomas,,Professor,	1. Dr. P.Senthilkumar,, SRMIST
CavinKare Research Center, Ch <mark>ennai</mark>	Karunya Institute of Technology and Sciences	The second se
2. Dr.Mithun Chakraborty, Head-R&D, J.K Agri. Genetics Ltd.	2. Dr.Ashok, Associate Professor, Vels Institute of Science Technology	2. Dr.S.lyappan,, SRMIST
	and Advanced Studies	



Course Code	Course Code         21GEO104T         Course Name         COMPUTATIONAL GENOMICS								Cour Categ	se ory	0			(	OPEN	ELEC	TIVE				L T 3 0	P 0	C 3
Pre-requ Course	isite es	Nil		Co- requ Course	iisite s		Nil	day of	P	ogres Cours	sive es						Nil						
Course	Offering Departme	ent	Ger	netic Enginee	ering		Data Book /	Codes / Stand	dards							Nil							
							the state		December (DO)														
Course Le	earning Rationale (	(CLR): T	he purpos	e of learning	g this co	ourse is t	0:	_	_		-		Progr	am Ou	tcome	es (PO	)				- 5	inecif	m ic
CLR-1:	Summarize the co	oncepts of g	enomics ar	<mark>nd centra</mark> l dog	gma of n	molecular	biology.		1	2	3	4	5	6	7	8	9	10	11	12	ou	itcom	ies
CLR-2:	Implement the str	ategy for the	e us <mark>age of</mark>	different data	bases a	and file for	mats.	the second data	je		of	s of	30	iety	oility		¥		0				
CLR-3:	CLR-3: Correlate the modules and functions of R with genomic data.							100	wledo	(0	ient o	ations	ge	d soc	stainat		n Wo		nance	b			
CLR-4:	CLR-4: Test the hypothesis by integrating Bioconductor to transcriptomic data.								Kno	lysis	ndo	stig	Use	and	Sus		Fear	u	к К	arnir			
CLR-5:	CLR-4:       Test the hypothesis by integrating Bioconductor to transcriptomic data.         CLR-5:       Manage different biopython modules for the analysis of genomic data.								leering	em Ana	jn/devel	uct inve lex prot	m Tool	engineer	nment 8	0	dual & ⁻	nunicati	ct Mgt.	ong Lea	<u>.</u>	5	ę
Course O	utcomes (CO):	4	At the end	of this cours	se, learr	ners will l	be able to:	Course!	Engir	Probl	Desig	Cond	Mode	The e	Enviro	Ethics	Indivi	Comr	Proje	Life L	-OS4	PSO-	PSO-
CO-1:	Understand the b	asic co <mark>ncept</mark>	<mark>ts of</mark> biolog	y and genom	nics.		200 64	28.54	3	-	2	-	2	1	-	-	-	-	-	-	-	-	-
CO-2:	Apply different bio	oinform <mark>atics</mark>	<mark>data</mark> bases	and file form	ats to st	tudy seque	ence data	이문 문	3	3	1	-	2	-	_	-	-	-	-	-	-	-	-
CO-3:	Illustrate the basi	cs of R <mark>to be</mark>	applied to	genomic dat	ta.	1.14	12.5	1.1	2	2			2	- 350	-	-		-	-	-	-	-	-
CO-4:	Predict the inform	nation in the s	transcripto.	me data by in	ntegratin	ng Biocond	ductor package.	1.1.1	1	3	2		3	-	-	-	-	-	-	-	-	-	-
CO-5:	Devise a strategy	[,] to impl <mark>eme</mark> r	<mark>nt Py</mark> thon t	o study the g	enomic (	data using	g Biopython.			3	2	-	3	200	-	-	-	-	-	-	-	-	-
<b>Unit-1 - G</b> Introductio	enome Structure n to computational	biology – Cl	hromosome	es - Genome	Structu	ure - Intron	ns & Exons - Ba	asic properties	of DNA &	its str	ucture	- Basio	prope	erties a	nd stru	ucture	of RNA	А - Тур	es of I	RNA - I	Centra	<b>9</b> al Dog	Hour ma of
Molecular	Biology - Overview	of Replicatio	o <mark>n - Ove</mark> rvie	ew of Transci	ription -	Genetic C	Code - Overview	of Translation	n – Genom	ics – 7	ranscri	ptomic	s - Pro	teomic	s			,,					
Unit-2 - B	iological Resource	es and File F	Formats	rad Seare B	opion of	Coguono	a Alianmont I	dontitu Cimi	ilority Ho	molog	v Ort	hology	P Dor	alagu	Nuola	io Aoir		ionoo l	Databa		Oratair	9	Hour
Databases	sequence data - So	equence Qu mats – Gent	hank - Fast	eu Score- Ба ta & Fasta - S	SAM file	format - E	BAM file format -	- Gene Ontolo	av - Levels	of Ge	ne Ont	oloav -	Cance	alogy - er aeno	me da	atabase	i Sequ es – T(	CGA - I	Pataba Pathwa	ses - r ivs Dat	abase	seques - KF	-GG
Unit-3 - :	R and Bioconduct	or		.g u l'uotu e		ionnat 2			3) _0101	0.00		0.09)	Carro	J. gene	inte de					<i>je 2</i> a.		9	Hour
Introductio in R - Biod	n to R – Installation conductor Project - I	& R-Studio Installation o	- Data Typ f Biocondu	<mark>oes &amp; D</mark> ata sti ictor Package	ructures e – Gene	s – scalars Iomic Rang	s – vectors – ma ges Package –	trices - data fr Grange - Usa	rames – lis ge & Seqii	ts - fao nfo - IF	ctors ar Ranges	nd table & Gen	es; Dat omic S	a Visua Structu	alizatio res - C	on – ch Constru	arts & cting &	types - & Intera	- ggplo acting I	t2 – Si Range	tring m s - Intr	anipu roduct	lation tion to
BIOSTINGS	– BSGenome - Ger anscriptomics and	d Pathway 4	nalvsis																			9	Hour
Introductio	n to transcriptomics	s – Biocondu	ictor - Edge	eR Package	- Microa	array analy	sis using Bioco	nductor - LIM	MA Packa	ge - G	EOquel	ry pack	age -	biomal	Rt pack	kage- 1	ools f	or plott	ing figu	ıres - E	3ioGra	ph &	Gviz -
Annotation	Annotation Hub- Pathway packages - cluster profiler - GSEA									, .			0			0.		1	5 5			,	

## Unit-5 - Biopython

Basics of Python - Data types in Python - Functions in Python - File and sort Functions in Python - String manipulation in Python - Join- Split & Replace functions in Python - Panda- numpy - Introduction of Biopython - Parsing FASTA and Genbank sequence file formats - Connecting with Biological databases - SeqRecord object – FASTA and Genbank - Turning Seq Objects into strings - String manipulation - Nucleotide sequences and (reverse) complements - MutableSeq objects

	1.	Attwood.T.K.Parry-Smith D.J."Introduction to Bioinformatics"- 1st Edition- 11th Reprint-	4.	Matloff N. "The art of R programming: A tour of statistical software design". No Starch Press; 2011.
Loorning		Pearson Education. 2005.	5.	Online Sources: http://biopython.org/DIST/docs/tutorial/Tutorial.html
Desources	2.	Arthur Lesk. "Introduction to Genomics" OUP Oxford; 3rd edition- 2017.	6.	https://bioconductor.github.io/BiocWorkshops/r-and-bioconductor-for-everyone-an-
Resources	3.	Dan MacLean. "Bioconductor to perform RNAseq genomics data visualization and		introduction.html https://www.bioconductor.org/packages/
		bioinformatic analysis". Packt Publishing Limited. 2019.		

Learning Assessme	ent	~ ~ ~										
		/	Continuous Learnin	g Assessment (CLA)		C	motivo					
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL	g Learning _A-2 0%)	Final Examination (40% weightage)						
		Theory	Practice	Theory	Practice	Theory	Practice					
Level 1	Remember	15%		15%		15%	-					
Level 2	Understand	25%	the second second	25%		25%	-					
Level 3	Apply	30%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	30%		30%	-					
Level 4	Analyze	20%		20%		<mark>20</mark> %	-					
Level 5	Evaluate	10%		10%		10%	-					
Level 6	Create	No. of Concession				-	-					
	Total	10	0%	10	0 %	10	0%					

Course Designers		100									
Experts from Industry	and the second sec	Exp	perts from Higher Technical Institutions	Internal Experts							
1. Dr.C.Ramakrishnan- Principal Scientist- Molecul	ar Design Division, Aroniter	1.	Dr Shandar Ahamad- Professor- Jawaharlal Nehru	1.	Dr.Habeeb. <mark>S. K. M-</mark> SRMIST,						
Co Seoul- South Korea, ramakrishnan@aronti	er.co		University- shandar@jnu.ac.in	15							
2. Mr. Sudheendra Rao- Director- DataLore Labs-	Bengaluru	2.	Dr. Michael Gromiha-Indian Institute of Technology	2.	Dr.Thirumurthy Madhavan- SRMIST						
			Madras- Chennai.gromiha@iitm.ac.in								

B.Tech / M.Tech(Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses –Syllabi-Control Copy

9 Hour

Course Code	rse 21GEO105T Course BIOLOGY FOR EVERYDAY LIFE Name							Cour Categ	se ory	0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3	
Pre-requi	isite es	Nil		Co C	- requisite ourse <mark>s</mark>		Nil	-	Pi	ogres Cours	sive ses						Ni	I					
Course	Offering Departme	ent	(	Genetic Er	ngineering		Data Book /	Codes / Standar	ds							Nil							
Course Le	earning Rationale	(CLR):	The purp	pose of le	arning this co	ourse is to	o:		-	71	1		Progr	am Ou	utcome	s (PO	)				P	rogra	m
CLR-1:	Comprehend the	basics of	life			1.1	2		1	2	3	4	5	6	7	8	9	10	11	12	- S	pecifi utcom	ic 1es
CLR-2:	Reconstruct the e	volution	of life f <mark>orm</mark>	IS					Φ		4	of	34	ety			÷						
CLR-3:	CLR-3: Illustrate homeostasis and practicing healthy life							100	/ledg		ento	tions	ge	soci		-	NoI		ance	5			
CLR-4:	Attribute the role	of biolog	/ in moderr	n-day appl	ications	-	100		Know	lysis	obme	stiga	Usa	and	∞ .		eam	uo	& Fin	arnin			
CLR-5:	Appraise the role	played b	y <mark>biology i</mark> r	n the susta	inable develo	pment of t	his planet		leering l	em Ana	jn/devel	uct inve lex prob	rn Tool	engineer	onment	6	dual & T	nunicati	ct Mgt. 8	ong Lea	5	5	<u>ب</u>
Course O	utcomes (CO):		At the e	and of this	course, learn	ners will b	be able to:	Name?	Engir	Probl	Desig	Cond	Mode	The e	Envir Susta	Ethic	ndivi	Comr	Proje	_ife L	-OSc	-OSc	-OSc
CO-1:	Define life and ba	sic biol <mark>o</mark>	gical proce	sses			12 10 15		-	-	-	3		-	2	2	-	-	-	-	-	-	-
CO-2:	Recognize variou	ıs life fo <mark>rr</mark>	<mark>ns and</mark> thei	ir interrelat	tions	978-2	S- 8		- 1	2	100	-	-	-	-		-	2	-	2	-	-	-
CO-3:	Employ healthy li	festyle <mark>pr</mark>	<mark>actices</mark> for	r an active	life	1.12					2	-	-	3	-	-		-	-	3	-	-	-
CO-4:	Execute interdisc	iplinary <mark>p</mark>	<mark>rojects</mark> with	h biologica	l principles	1.5	100	100	3	-	2		-	-	-	-	-	-	-	-	-	-	-
CO-5:	Develop biomime	tics for <mark>v</mark>	<mark>arious a</mark> ppl	lications			1.5		(Fr)	-	14	3	-	2	-	3	2	-	-	-	-	-	-
Unit-1 - Di	iversity of life			1				4.4.5											· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·			Hour
Organizati	on of life forms-Cla	ssificatio	n and Tax	onomy- Al	gae, Fungi an	nd Moses-	Gymnosperms	s and Angiosperm	s-Bacte	ria an	d virus	es,-Pro	tozoar	ns, Me	tazoan	s <mark>- S</mark> po	onges	and cn	idarian	is-Snai	ils and	starfi	ishes-
Fishes, Sa	lamanders and frog	g-Snakes	, lizard and	<mark>d birds-Prin</mark>	nates-Life Cyc	cle,-Alterna	ations of gener	ations, Reproduct	ion, Alie	ens													
DNA and F	evels of Organizati RNA-Proteins-Orga	i <b>on</b> nelle- Mit	ochondria a	and Chlore	plast- Photos	vnthesis-	Sunlight to Foo	od. Respiration - F	ood to E	nerav	. Immu	nitv – T	The ars	senal a	and how	to fia	ht the	invadei	rs- Ner	vous si	vstem	9 The c	nour control
center- Ho	rmones The reg	gulators,	Reproducti	ive system	the Sperm an	nd Ova Fe	rtilization and,	Embryogenesis- L	Digestio	n and	excreti	on .	no are	, or rai o		to ng			0		,		0.112.01
Unit-3 - He	omeostasis					0.01	246.2	ALL DO					1									9	Hour
Feedback	systems- Symptom	is, disord	ers, diseas	se, and syn	dromes- Infec	ctious dise	ases-Lifestyle	e diseases- Metab	olic dise	ases,	-Hered	itary di	seases	,-Can	cer- Xe	nograf	ft -tran	splantir	ng orga	ans, Or	gan do	onatio	n and
Ilnit-4 - Fo	cology and Evolut	iys, anu ion	UEISUIIAI III	leuicine- A		ease- CO	VID-EXERCISE a	and metabolism- L	iel anu	metal	0115111-7	Allellia	IVE III	UICITIE	;							9	Hour
Principles	of ecology-Special	tion-habit	at. and div	versitv- Ac	aptation-inter	dependen	ce and evoluti	ion-Nutrient cvcle	sEcos	vstem	s-Outsi	zed ro	e of tl	he hur	nan po	pulatio	on-Pol	lution a	and its	tvpes.	Proci	reatio	n and
recreation- Lamarck's theory of evolution-Darwin's theory of evolution- Modern view of evolution-Challenges to e society									olution t	heory-	Mutatio	on-Gen	es- He	redity-	- Princij	oles of	f hered	lity-Imp	act of	evoluti	onary	theori	ies on
# Unit-5 - Bioinspired Applications

Flight of birds, how man conquered the sky- Bio Inspired design in architecture-Biomimetic swimming robots- Down feather insulation-Termite mound cooling, Humpback whale wind turbines-Beetle water collection-Spider web glass-Artificial intelligence-Neural networks-Bio paints and bio cement- Symbiotics-Nanorobots- Nano motors- DNA lithography-DNA as a memory storage device- Synthetic biology- Antibiotics-Honey bee dance- Animals as disease models- Behaviour studies and their applications

Learning Resources	1. 2.	Carl Stone, Basics of Biology, Greenwood publishers, India, ISBN:0313317860 Oppurtunities in Biology, Peter H Raven, National Academy Press, Washington US.ISBN 0309039274	3. 4.	Mader Silvia S, Human Biology, 14th Edition, Mc Graw Hill publications, India. ISBN :1260710823 Biology: A Global Approach, Enhanced eBook, Global Edition, 12th edition, Neil A. Campbell, Pearsons Publications.ISBN 9781292170435

Learning Assessment	t										
			Continuous Learnir	ng Assessment (CLA)		Cum	a a thua				
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (1	g Learning "A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	15%		15%		15%	-				
Level 2	Understand	25%	1	20%		25%	-				
Level 3	Apply	30%		25%		30%	-				
Level 4	Analyze	30%	10 0.35	25%		30%	-				
Level 5	Evaluate			10%		-	-				
Level 6	Create	Distance in the second	6 (George 19)	5%	-	- III -	-				
	Total	10	0 %	10	0 %	10	0 %				

Co	ourse Designers	1.00	the second se		
Ex	perts from Industry	Exp	perts from Higher Technical Institutions	Int	ernal Experts
1.	Ramya. R.G., Senior Manager CMC and Regulatory Affairs (Global), Syner-	1.	Dr. Sathyaraj, Principle scientists, CLRI-CSIR, Adyar,	1.	Dr. N S Raja, SRMIST
	G Pharma Consulting, LLC, Bangaluru, ramya.swamy@gmail.com		Chennai. vijayagsatya@gmail.com		No. of Concession, Name
2.	Dr. Arun D, Associate Scientist, L'Oréal, Bangalore,	2.	Dr.G. Mathan, Associate professor, Bharathidasan	2.	Dr. S. Iyappan <mark>, SRMIST</mark>
	arun.duraisamy@gmail.com		University, Tiruchirappalli, mathan@bdu.ac.in		



B.Tech / M.Tech (Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

Course Code	21MHO301T	Course Name	T FARMING	C	Cours atego	e ry	0				OPEN	ELEC	ΓIVE				- T 3 0	P 0	C 3		
Pre-requis	site s	Nil		Co- requisite Cour <mark>ses</mark>	Nil		Pro	ogres Cours	sive es						Nil						
Course C	Offering Departmo	ent	Mecha	tronics Engineering	Data Book / Codes / Sta	andards		-						Nil							
Course Lea	arning Rationale	(CLR):	The purpos	e of learning this cou	rse is to:		-	1			Progr	am Ou	Itcome	s (PO	)				Pr	ogra	n
CLR-1:	Appraise the fun machine	damental o	concepts and	l terminologies used in	the agriculture and various agricu	ıltural	1	2	3	4	5	6	7	8	9	10	11	12	Si ou	Specific outcomes	
CLR-2:	Acquire the know	vledge of s	senso <mark>rs and it</mark>	s applications in agricu	Ilture		ge		of	s of	15	iety			ork		e				
CLR-3:	Understand the p	orinciples o	of di <mark>fferent m</mark>	echatronics based auto	omated farming systems		vledo		ent o	ation	ge	soc			oW r		anci	D			
CLR-4: Apply the concepts of IoT and edge computing in agriculture							<b>V</b> nov	lysis	mdo	stige	Usa	. anc	~ ຈ		Fean	ы	& Fir	arnin			
<b>CLR-5:</b> Acquire the knowledge and applications of Artificial Intelligence and data analytics in agriculture							eering	em Ana	n/devel	uct inve lex prot	m Tool	ngineer	onment inability		dual & 7	nunicati	ot Mgt. 8	ong Lea	~	2	e
Course Ou	tcomes (CO):	_	At the end	of this course. learne	rs will be able to:	121	ngin	roble	lesig	omp	lode	hee	invirc	thics	oivid	omn	rojec	ife L	-os	SO-	So
CO-1:	Learn the basic o	concepts of	o <mark>f agricu</mark> lture a	nd working principles o	of different agricultural machines	9.00	3	-	,		-	- E	ш	-	-	-	-	-	-	-	-
CO-2:	Gain the basic kr	nowledg <mark>e c</mark>	of sensors an	d its farming application	18		3		1	-		-	-	-		-	-	-	-	-	-
CO-3:	Design the auton	nated fa <mark>rm</mark>	ning systems a	and understand its work	king principle		3		- 1	-			-	-	-	-	-	-	-	-	-
CO-4:	Implement Intern	et of Th <mark>ing</mark>	<mark>gs (IoT</mark> ) and E	dge computing techniq	ues in various farming applications	s	3	-	2	-	-		1	-	-	-	-	-	-	-	-
CO-5:	Gain the knowle applications.	dge of <mark>dif</mark>	fferent Artifici	al Intelligence (AI) and	d Data Analytics for different agri	culture	3		2	-	1	1	-	-	-	-	-	-	-	-	-
Unit-1 - Eu	ndamentals of Ar	riculture	Engineering	and Agriculture Mach	nines	1														٥	Hour
Classificatio	on of soils – Class	sification o	of crops – Effe	ect on weather parame	eters on crop growth and develop	ment – D	Definiti	ion ar	nd diffe	erentiati	on of	agricu	lture te	rms - A	Agricult	ure ma	chines	: Hitchi	ng sys	tem –	Tires
and Traction	n – Soil Tillage met	hods and e	equipments –	Crop planting methods a	and equipments – Fertilizer spraying	gmethod	s and	equip	ments	–Grain	s, fruit	s and v	/ege <mark>tab</mark>	le har	esting	metho	ods and	equip	ments		
Unit-2 - Pre	ecision Agricultur	re pogriaultu	uro Conoine	tachnology for provini	on aron formingoneoro for Date		tion	Conc	oro foi		nditio	moni	toring	propi	ion ni	triant	20000	mont		<b>9</b>	Hour
manageme	nt – precision wee	d manade	ement – sensing	sion crop diseases iden	tification – precision grain guality n	a acquisi manaden	uon – nent	Sens	5015 101	SOII CC	Παιτιοι	1 mom	ioning -	precis	SION IIL	ilinenit i	nanaye	ennenn	- preci	ISION	valer
Unit-3 - Me	chatronics Syste	ms for Ag	griculture			nanagon	lone		20		-									9	Hour
Current trer	nds in smart farmii	ng and aut	tomation syst	em - Overview of mech	atronic system for weed managem	nent – R	obots	for sp	oatially	and ter	npora	lly uns	tructure	ed agri	culture	enviro	onment	– Тур	es of c	amera	as for
agriculture	<ul> <li>Image processing d water manager</li> </ul>	g-based ci	crop segmenta	itio <mark>n – Image</mark> processin	ng based fruit, vegetable sorting sy	vstems –	Соор	erativ	e robo	tic syst	ems in	agrici	ulture –	Applie	cation (	of dron	es in s	oil ferti	lity ma	nagei	nent,
Unit-4 - Ap	plication of IOT a	nd Edae (	Computina ir	Agriculture																9	Hour
IoT Introdu	ction – Benefits of	f loT in agi	priculture – Iss	sues and challenges in	the adoption of IoT in agriculture	– Applic	ation	of IoT	r in hy	droponi	c farm	ing –	loT bas	sed cro	op mar	nagem	ent sys	tem –	loT be	ised S	Smart
irrigation an	d water managem	ent systen	m – IoT based	plant monitoring – data	collection - Edge computing Introd	luction –	Applic	cations	s of ed	ge com	outing	in agri	culture	– Impl	ement	ation o	fedge	compu	ting in a	agricı	ltural
Secior								-													

 Unit-5 - Artificial Intelligence and Data Analytics in Agriculture
 9 Hour

 Introduction to artificial Intelligence - Prediction of crop yield and pest disease infestation – Decision making system for crop selection based on soil – Soft computing based plant leaf disease detection – Soft computing based fruit sorting system – Al based pest management system – Al based remote monitoring and predictive analytic system for crop and livestock

Learning Resources	<ol> <li>R.K.Sharma, A.K.Soni, R. Bhagat, N. Pandey and V.K. Pandey,Basics of agriculture for Engineers, Daya Publishing House, 2014</li> <li>Ajit K. Srivastava &amp; Carroll E. Goering - Engineering Principles of Agricultural Machines, Amar Society of agricultural and Biological Engineers, 2nd edition, 2005</li> <li>Ancha Srinivasan, Hand book of precision agriculture: Principles and applications, CRC press, 2020</li> </ol>	4. 5.	Dan Zhang, Bin Wei, Robotics and Mechatronics for agriculture, CRC press, 1st Edition, 2017 Ajith Abraham, Sujata Dash, Joel J.P.C. Rodrigues, Biswaranjan Acharya, Subhendu Kumar Pani - AI, Edge and IoT-based Smart Agriculture (Intelligent Data-Centric system), Academic press Inc, 2021
	press, 2020	-	

			Continuous Learning	Assessment (CLA)		Cumm	a a til va		
	Bloom's Level of Thinking	Form CLA-1 Averag (50	ative ge of unit test %)	Learning A-2 %)	Final Exa (40% we	mination ightage)			
		Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	15%	Contraction of the last	15%		15%	-		
Level 2	Understand	25%	Start Print La	20%	100 A 10	25%			
Level 3	Apply	30%	-	25%	· · · · ·	<u>30%</u>	-		
Level 4	Analyze	30%	1	25%		30%	-		
Level 5	Evaluate		5 M C 14 M / M	10%		-	-		
Level 6	Create			5%	-		-		
	Total	1	100 %	1	00 %	1	00 %		

Course Designers	and the second se	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Uthayan Elangovan, Neel smartec consultant,	1. Dr.T. Mohanraj, Assistant Professor, Amrita Vishwa	1. Dr.S.Senthilraja, SRMIST
uelan@neelsmartec.com	Vidyapeetham,t_mohanraj@cb.amrita.edu	
2. Mr.G, Vijayaram, TAFE, vijayaram@tafe.com	2. Dr. R. Jegadeeshwaran, Professor, Vellore Institute of Technology,	2. Mr. J. Arivarasan, SRMIST
	jegadeeshwaran.r@vit.ac.in	



Course Code	urse 21MEO101T Course FUNDAMENTALS OF COMPOSITE MATERIALS							urse egory	0			TIVE	l	- T 3 0	P 0	C 3					
Pre-requis Course	site s	Nil		Co- requisite Courses	-	Nil	_	Progre Cour	ssive ses						Nil	1					
Course C	Offering Departme	ent	mechan	ical engineering	Data Boo	ok / Codes / Stand	dards							Nil							
Course Le	arning Rationale (	CLR):	The purpose	of learning this co	ourse is to:			17	1		Prog	ram O	utcome	es (PO	)				Pi	ogra	m
CLR-1:	Understand the fu	, Indamenta	als of composite	e materials			1	2	3	4	5	6	7	8	9	10	11	12	S ou	pecifi tcom	.c es
CLR-2:	Apply the concept structural compon	t of anisotr nents.	ropic, i <mark>sotropic</mark> ,	and orthotropic ma	aterial behavior in the	analysis of laminat	ted	2	of	s of	1	ciety			r,		е				
CLR-3:	Understand how o	composite	es ar <mark>e manufa</mark> ct	ured through vario	us techniques		helv		ent o	ation	ge s	soc			M No		Janc	Ð			
CLR-4: Recognize several methods employed in assessing the performance and quality of composites							Nu v	lysis	, do	stige	Usa	and	ø		[ean	U	& Fir	arnin			
CLR-5:	CLR-5:       Gain knowledge on recent advancements in composites and their applications							em Ana	jn/devel	ons luct inve	ern Tool	engineer	onment	S	dual & 7	nunicati	ct Mgt.	ong Lea	÷-	5	က္
Course Ou	tcomes (CO):		At the end of	this course, learn	ners will be able to:			Probl	Desiç	Cond	Node	The	Envir	Ethic	ndivi	Com	Proje	_ife L	-OSc	-SO	0Sc
CO-1:	Describe the prop	erties and	d characteristics	of constituents in	a composite material	2453.02	3		-	-	-		-	-	-	-	-	-	-	-	-
CO-2:	Analyze the mech	anics of la	aminated comp	osites subjected u	nder different stresses	S	1	3		-	- 1	-11	- T	-		-	-	-	-	-	-
CO-3:	Demonstrate the p	procedure	es involved in va	nious composite p	rocessing techniques	101 010	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Choose the appr composites	ropriate <mark>te</mark>	esting method	to analyze the p	erformance and qua	lity of as-synthes	ized -		2	3	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Express the impor	rtance a <mark>nc</mark>	<mark>d applic</mark> ations o	f advanced compo	osites		-	16-	-	-	3	-	1	-	-	-	-	-	-	-	-
<b>Unit-1 - Int</b> Composites particles, fla	roduction to Com s – definition and ne akes, whiskers, sho	<b>posite Ma</b> eed, prope ort fibers, c	<b>aterials</b> perties, advantag continuous fiber	ges, disadvantages rs, or sheets. Matri	s, and applications of ix materials –metals, p	composites. Composites. Composites.	posite ai amics. Ir	rchitecti iterface	ures. ( s- con	Classifi cept of	cation– Ioad tra	matrix ansfer,	and fib bon <mark>din</mark>	e <mark>r-bas</mark> g mecl	ed rein nanism	forced s.	сотро	sites. I	Reinfo	9 rceme	<b>Hour</b> ents –
Unit-2 - Me	echanical Analysis	s of Comp	posit <mark>es</mark>		-															9	Hour
Micromech	anics – rule of mixt	tures, elas	stic constants, i	mechanical and th	ermal properties, me	chanics of load tra	ansfer fro	om mat	rix to i	fiber. N	acro m	echani	cs –ela	stic co	nstant	s of an	isotroj	oic mat	terial a	nd la	mina.
Unit-3 - Co	mposite Processi	ina	Tallis allu allalys		imposites. Stresses a		T IIDel-le	IIIIOICE	Indie	iidis. L	amaye		iposite	Indlein	ais — II	lechan	151115.			9	Hour
Thermoset molding, sh chemical re	matrix composites- neet molding compo eaction techniques,	-hand layu ound, and sol-gel, po	up and spra <mark>y teo</mark> 1 thermoforming polymer infiltratio	<mark>chniques</mark> , filament . Metal matrix con on and pyrolysis (F	winding, pultrusion, re nposites: solid, liquid PP), self-propagating	esin transfer moldir and powder state high-temperature	ng, and a process synthesi	autoclav es. Cer s (SHS	ve-bas amic r ), and	ed met natrix d electro	hods. T omposi phoretic	hermoj ites: ho depos	plastic r ot press sition.	natrix o ing, re	compo action	sites – bondin	injectio g proce	n mold esses,	ling, co infiltra	ompre tion, i	ssion n-situ
Unit-4 - Co	mposite Performa	ance and	Quality Inspec	tion																9	Hour
Tension, co ultrasonic ii	ompression, flexura nspection, radiogra	i, shear, s phy, acou	single fiber pull- istic emission, a	out, single fiber pu and acoustic-ultras	sh-out and push-down onic method	n test– indentation	and thre	e-poin	t bend	ing. W	ater abs	orption	and fla	ammab	nity tes	sts. No	n-destr	uctive	testing	meth	iods -

# Unit-5 - Advanced Composites

Un-conventional composites – carbon fiber/carbon matrix composites and multifilamentary superconducting composites. Nanocomposites – polymer clay nanocomposites, self-healing composites, self-reinforced composites, bio-composites, and hybrid composites. Electronic grade MMCs. Manufacturing of green composites.

	1.	Krishnan K Chawla, Composite Materials: Science and Engineering, International	4.	M. Balasubramanian, Composite Materials and Processing, CRC Press, Taylor and Francis Group,
		Edition, Springer International Publishing, 2019.		2014.
Learning	2.	An Introduction to Composite Materials, D. Hull & T.W. Clyne, Edition 3rd, Cambridge	5.	Barbero, Ever J, Introduction to composite materials design, Edition 3rd, CRC press, 2018.
Resources		University Press, 2019.	6.	Ramesh, Talreja, and Singh V. Chandra, Damage and failure of composite materials, Cambridge,
	3.	Mallick, P.K. and Newman. S, Composite Materials Technology, Hanser Publishers,		United Kingdom, 2012.
		2003.		

Learning Assessme	ent	N									
			Continuous Learnin	g Assessment (CLA)		Sum	motivo				
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (1	g Learning LA-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	15%	100 C 100 C 100 C 100 C	15%		15%	-				
Level 2	Understand	25%	the state of the	25%		25%	-				
Level 3	Apply	30%		30%		30%	-				
Level 4	Analyze	30%	1 . The St.	30%	S	<mark>30</mark> %	-				
Level 5	Evaluate						-				
Level 6	Create	and the second		100 100 100		-	-				
	Total	10	0%	10	0 %	10	0 %				

Co	ourse Designers	1.00		1	
Ex	perts from Industry	Ex	perts from Higher Technical Institutions	Int	ernal Experts
1.	Mr S. Srinivasan, Ashok Leylandsrinchand@gmail.com	1.	Dr. G. Arthanareeswaran, NIT, Tiruchirappalli arthanareeg@gmail.com	1.	Dr. Shubhabrata Datta, SRMIST
2.	Mr.A.Venugopal, WABCO venugopal.a@wabco-auo.com	2.	Dr. R. Elansezhian, Pondicherry Engineering College.	2.	Mr. S.Sasikumar, SRM IST.
			elansezhianr@amail.com		



B.Tech / M.Tech(Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

Course Code	urse 21MEO102T Course REVERSE ENGINEERING AND 3D PRINTING							0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3
Pre-requis Course	site s	Nil		Co- requisite Course <mark>s</mark>	Nil	P	rogres Cours	ssive ses						Nil	1					
Course C	Offering Departme	ent	Mecha	anical Engineering	Data Book / Codes / Stan	dards							Nil							
Course Le	arning Rationale (	(CLR):	The purpose	e <mark>of learnin</mark> g this cour	se is to:		1	1	2.1	Progr	am Ou	utcome	es (PO	)				P	rogra	m
CLR-1:	Familiarize with R	Reverse en	ngineering prii	nciples.	10 200	1	2	3	4	5	6	7	8	9	10	11	12	0L	pecifi itcom	iC Ies
CLR-2:	Understand variou time applications	us post pro	ocessi <mark>ng met</mark> l	hods involved in Revers	e engineering and apply that in the i	real		of	s of	1	iety			¥		Φ				
CLR-3:	Learn the contem	porary tec	chno <mark>logy ava</mark> ii	lable for Rapid prototyp	ing	vled		ent o	tion	ge	soc			Mc Mc		anc	0			
CLR-4:	-4:						lysis	do	stige	Usa	and	∞ŏ .		ear	ы	& Fir	arnin			
CLR-5:	R-5:					ing	Ana	evel	inve	Tool	neer	bility		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	licati	Agt. 8	) Lea			
					neer	em	p/ug		ern e	engi	onn aina	ş	idua	unu	sct 🖸	ouc	-	-2	က္	
Course Ou	Course Outcomes (CO): At the end of this course, learners will be able to:				s will be able to:	Engi	Prob	Desi	Conc	Mod	The	Envi	Ethic	Indiv	Com	Proje	Life	PSO	PSO	PSO
CO-1:	Define reverse Er	ngineeri <mark>ng</mark>	methodologi	es and Principles	A DECK SHARE	3	-	-	-	-		-	-	-	-	-	-	-	-	-
CO-2:	Apply reverse Eng	gineerin <mark>g l</mark>	Process in rea	al time applications.	1.25	3	-		-	-	- 10	<i>.</i>	-		-	-	-	-	-	-
CO-3:	Apply the various	processe	<mark>s in R</mark> apid Pro	ototyping		3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11:54 1:54	reduction to Dov							1	10		-									Harris
Reverse Fr	naineerina_The Ge	neric Proc	cess Forward	Engineering vs Revers	e Engineering Computer Vision an	d Reverse	Engin	eerina	Structi	ired-lic	ht Rar	nae Ima	aina i	and Sc	anner	Pinelin	e		9	пош
Unit-2 - Re	verse Engineerin	g: Hardwa	are and Softw	ware			Liigiin	ooning,	Oli doll	nou ng	int i tai	igo inta	ignig, (		annor	i ipoiiri	0.		9	Hour
Classificatio	on of measuring o	devices, C	C <mark>ontact M</mark> etho	ods, Non-Contact Meth	ods - Optical Techniques, Non-op	otical Tech	niques	s and	Transit	ive Te	chniqu	es, De	s <mark>truc</mark> ti	ve Mei	thod. F	Revers	e Engi	neerin	g Sof	tware
Classificatio	on, Reverse Engine	eering Pha	as <mark>es, Fund</mark> am	nental Reverse Enginee	ring Operations.				1.1											
Unit-3 - Da	ta Processing		The Oales	tion Decision Decist Occ		the Court		4- 0-			D 4			1-4-					9	Hour
Selecting a	Reverse Engineer	ing Syster	n - T <u>ne Selec</u> neering	tion Process, Point Cap	oture Devices, and Post processing	the Captul	ed Da	ta - Ca	se Stud	lies in i	Post pi	rocessi	ng of c	iata.					0	Hour
Product De	velopment and Mar	nufacturino	a. Biomedical	Engineering, Case Stud	lies - Reverse Engineering in the Au	tomotive. A	erosp	ace an	d Media	al Dev	ice Ind	ustrv. L	egal A	spects	ofRev	verse E	nainee	rina. F	Relatic	onship
Between R	everse Engineering	g and Rapi	id Prototyping	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	3 3								- 3	-,						
Unit-5 - 3D	Printing Techniq	ues		5-11			1.1	1112											9	Hour
Introduction	n - Classifications - wfacturing (LOM)	Stereolitho	ography App <mark>a</mark> odelling (M IN	ratus (SLA), Solid Grou	nd Curing (SGC), Selective Laser S chnology (PLT) Selective laser me	intering (S Itina (SLM	LS), La - Bior	aser Ei nedica	ngineer Lannlic	ed Net	Shapii	ng (LEN	νS), Fι	used D	epositi	on Moo	deling (	FDM)	Lami	nated
		manijet MC	ouching prividiv		childred aser the laser the		וטום	nouica	appill	unons										

	4	Minach Dais and Kings I. Farmandas Davanas Farmanaires An Industri	1 2									
	1.	Vinesn Raja and Kiran J. Fernandes Reverse Engineering: An Industria	1 3.	Chua C. K., Leong K.F and Lim C.S, RAPID PROTOTYPING: PRINCIPLES AND APPLICATIONS,								
Learning		Perspective(Springer series in advanced manufacturing)		2nd Edition, World Scientific Publishing Co. Pte. Ltd.								
Resources	2.	Kamrani, Ali K. and Nasr, Emad Abouel, Rapid Prototyping: Theory and Practice	e 4.	Miltiadis A. Boboulos, CAD-CAM & Rapid Prototyping Application Evaluation, Venus Publishing								
		(Springer series in Manufacturing Svstems Engineering		ApS, 2010.								

		Continuous Learning Assessment (CLA)										
	Bloom's Level of Thin <mark>king</mark>	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Lon Cl (1	g Learning LA-2 0%)	Final Ex (40% w	amination eightage)					
		Theory	Practice	Theory	Practice	Theory	Practice					
Level 1	Remember	15%		15%		15%	-					
Level 2	Understand	25%	And the state	20%		25%	-					
Level 3	Apply	30%		25%		30%	-					
Level 4	Analyze	30%		25%		30%	-					
Level 5	Evaluate		and the second second	10%		-	-					
Level 6	Create			5%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	-	-					
	Total	10	0%	10	0 %	100 %						

Course Designers											
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts									
1. Dr. N. Babu, CVRDE, DRDO, Avadi, babu.n.cvrde@gov.in	1. Dr. Shankar Krishnapillai, IITMadras, skris@iitm.ac.in	1. Mr. J. Daniel Glad Stephen, SRM IST,									
2. Mr. Parameswaran, Nokia, Chennai, parameswaran.s@nokia.com	2. Dr. Raju Abraham, NIOT, Chennai, abraham@niot.res.in	2. Dr. S. Karuppudaiyan, SRM IST									



Course Code	rse 21MEO103T Course FUNDAMENTALS OF BIOMECHANICS						Cou Cate	rse gory	0				OPEN I	ELEC	TIVE				L T 3 0	P 0	C 3	
Pre-requis Courses	site s	Nil		Co- requisit Courses	e	-	Nil	1	Progre Cour	ssive ses						Nil	1					
Course C	Offering Departme	ent	Mech	nanica <mark>l Engineeri</mark>	ng	Data Bo	ok / Codes / Stan	dards							Nil							
Course Lea	arning Rationale (	CLR): T	he purpos	e of learning th	is course i	is to:			1	4	5.	Prog	ram Ou	Itcome	s (PO	)				Pr	rogra	m
CLR-1:	Understand the c	oncepts bion	mechanics	and anatomical	eference	2000		1	2	3	4	5	6	7	8	9	10	11	12		pecifi itcom	c es
CLR-2:	2: Understand hard& soft tissue mechanics						e		f	s of	1	iety			¥		0					
CLR-3:	Analyze mechanics applied in various movement and loads in upper extremities						vledo		ent c	ations	de o	soc			oW r		ance	b				
CLR-4:	Analyze mechanics applied in various movement and loads in lower extremities					Anov	lysis	bm	stiga	Usa	and	৵		Team	u	& Fir	arnin					
CLR-5:	LR-5: Understand qualitative aspect in sports biomechanics					ering	n Ana	devel	t inve	Tool	gineer	ment ability		al & J	nicati	Mgt.	ig Lea			1		
Course Ou	ourse Outcomes (CO):						ngine(	oblen	esign/	onduc	odern	le en	ly iron Istain	hics	dividu	Jmmc	oject	fe Lor	0-1	30-2	SO-3	
	Apply principles a	nd concents	of kinom	of this course,		hody		山。	ā	ŏ	S C	SŽ	È	ப்ல	Ш	<u>_</u>	ŏ	2	<u> </u>	<u>ă</u>	č	č
CO-1.	Apply principles a	nice of bord	and coff tic		in numan i	bouy		2			-		-		-	-	-	-	-			-
00-2.	Apply the mechan	lics of hard a	anu son us	sue				3			-	-			-	-	-	-	-	-		-
CO-3:	Apply the function	ality and val	rious torce	s applied in uppe	r extremitie	es	10.0	3	-	-		-	- 20	-	-	-	-	-	-	-	<u>г</u> Ц	-
CO-4:	Apply the function	nality an <mark>d va</mark> i	rious force	s applied in lowe	r extremitie	es		3	-	10	-	-	- 10	-	-	-	-	-	-	-	-	-
CO-5:	Analyze the sport	s biome <mark>char</mark>	<mark>nics a</mark> ctivit	es in qualitative	ispect	The second	-	3	2	111	6 -	-	24	-	-	-	-	-	-	-	-	-
Unit-1 - Int	roduction to Bion	echanics		<u> </u>	C. A.	-		-					-								9	Hour
Kinesiology	-Kinematics-basic	mechanics	involved in	n Anatomy- Stand	lard refere	nce planes, te	rminology terms, m	novement	s with r	efere	nce pla	nes	-									Tour
Unit-2 - Tis	sue Mechanics																			·	9	Hour
Hard Tissue	e Mechanics: Mech	nanical pro <mark>pe</mark> Structuro, Eu	erties of be	one, cortical and	cancellous	s bones, viscoe	elastic properties, I	Aaxwell a	nd Voi	ght m	odels –	anisoti	opy. So	oft Tissu	le Me	chanic	s: Psei	udo ela	sticity,	nonlin	iear st	ress-
Init-3 - Bic	mechanics of Un	ner Extrem	ities			kin, ilgaments	and tendons					14									9	Hour
The structu	re. movements and	load acting	in the up	per extremity of s	houlder- el	lbow and radio	oulnar ioints - wrist	and finge	s			1.5	-									Tour
Unit-4 - Bio	omechanics of Lo	wer Extrem	ities		199	1 - 100					911										9	Hour
The structu	re, movements and	l loads actin	ng in the lo	wer extremity - P	elvic and h	nip - knee joint	- ankle and foot. C	ombined	moven	nent o	f pelvis	and tru	<mark>nk -</mark> Po	sture -	Condi	tioning						
Unit-5 - Sp	orts Biomechanic	S																			9	Hour
Introduction	to sports Biomech	nanics-activit	ties- case	study <mark>on qualitati</mark>	<mark>ve and qua</mark>	antitative analy	sis of kicking and	batting-d	rop jun	р- со	mmon	ports i	njuries									
Learning Resources	Learning Resources 1. NihatOzkaya and Margareta Nordin, "Fundamentals of Biomechanics: Equilibrium, Motion, and Deformation", Springer- Verlag; Second Edition, 2016. 2. Fung Y C, "Biomechanics: mechanical properties of living tissues", Second Edition. Springer-Verlag, 1993.																					

			Continuous Learning	Assessment (CLA)		•				
	Bloom's Level of Thinking	CLA-1 Avera	native ge of unit test 0%)	Life-Long CL (1)	<mark>y Learning</mark> A-2 9%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	15%		15%		15%	-			
Level 2	Understand	25%	-	20%		25%	-			
Level 3	Apply	30%	-	25%	A -	30%	-			
Level 4	Analyze	30%	-	25%	2	30%	-			
Level 5	Evaluate			10%	· · · · ·	-	-			
Level 6	Create		- 19 - 19 - 19 - 19 - 19 - 19 - 19 - 19	5%		-	-			
	Total	10	0%	10	0%	10	0 %			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. N. Babu, CVRDE, DRDO, Avadi, babu.n.cvrde@gov.in	1. Dr. Amit Roy Chowdhury, amit@aero.iiests.ac.in, IISER Shibpur	1. Dr <mark>. S. Karu</mark> ppudaiyan, SRM IST, KTR
2. Mr. Parameswaran, Nokia, Chennai, parameswaran.s@nokia.com	2. Dr. Shankar Krishnapillai, IITMadras, skris@iitm.ac.in	2. Dr <mark>. Sandipa</mark> n Roy, SRM IST, KTR



Course Code	21MEO104T Course TQM AND RELIABILITY ENGINEERING					Cou Cate	irse gory	0				OPEN	ELEC ⁻	TIVE				- T 3 0	P 0	C 3		
Pre-requi Course	site s	Nil		Co- requisite Courses		Nil	-		Progre Cour	ssive ses						Nil	1					
Course (	Offering Departm	ent	Mechan	ical Engineering		Data Book /	Codes / Standa	ards						_	Nil							
Course Le	arning Rationale	(CLR):	The purpose of	of learning this o	course is	s to:	1					Progr	am Qi	utcome	s (PO	)				Pr	oara	m
CLR-1:	CLR-1: acquire the importance of TQM and its concepts, tools and techniques and apply in the real-work environment						d 1	2	3	4 5 6			7 8		8 9 1		11 12		Speci outcor		c es	
CLR-2:	Analyze the role of human involvement to improve the quality of product and service					e		of	s of		iety			¥		a)						
CLR-3:	<b>2-3:</b> Understand, apply and evaluate the tools and techniques used for product and service quality				vledo		ento	ations	ge	soc			٥۲		ance	b		ļ				
CLR-4:	<b>R-4:</b> familiarize the basic concepts of reliability, apply and evaluate reliability for different systems					Knov	lysis	mdo	stige	Usa	and	∞		Tean	ы	& Fir	arnin		ļ			
CLR-5:	impart the conce	ept of mai <mark>nt</mark> a	<mark>ainability</mark> of a s	ystem to evaluate	te time f <mark>o</mark> i	r different cases		Deering	em Ana	gn/devel	luct inve	ern Tool	angineer	onment	s	dual & ⁻	municati	ct Mgt.	ong Lea	÷	5	e.
Course Ou	itcomes (CO):		At the end of	this course, lea	rners wi	Il be able to:	Source?	Engir	Probl	Desig	Cond	Mode	The e	Envir Susta	Ethic	Indivi	Com	Proje	LifeL	- OS	-SO	-OS
CO-1:	Illustrate the imp	ortance <mark>of T</mark>	TQM and its co	ncepts, tools and	d techniqu	les.	12.11.29	- 1-		-	-		1	-	-	-	-	3	2	-	-	-
CO-2:	Define the role o	f human <mark> inv</mark>	volvement to im	prove the quality	of produ	ct and service	1. 1. 1.		1.	1	-	2	- 10	-	-		-	3	2	-	-	-
CO-3:	Explore the tools	s and tec <mark>hnic</mark>	ques used for _l	product and servi	ice quality	y	1.00	-	- 1	1	-	-	-	-	-	-	-	3	2	-	-	-
CO-4:	Discuss the cond	cept of r <mark>eliat</mark>	bility		100		ALC: NO	-	1	1	-	-	-	-	-	-	-	3	-	-	-	-
CO-5:	Explain the conc	ept of m <mark>aint</mark>	tainability of a :	system.	1.1.1	12/20		-	3	11.5	-	-		-	-	-	-	2	-	-	-	-
Unit 1 Ev	volution Theories	and Impla	montation		Cords.	Nor-	100														0	Hour
Evolution o	f Total Quality Ma	nagement -	Definition of g	uality, Dimension	is of Qual	lity- Deming's the	ory - Juran and	Crosby	theorie	s - Tag	uchi an	d Ishik	awa th	eories	- Quali	ity cosi	ts, Pro	duct qu	ality Vs	s Servi	ce qu	ality -
Goal settin	g - Strategic Quali	ity planning -	- TQM implem	entation – Kaizen	n – JIT – I	Kanban – ĽEAN -	– Value Steam N	lapping	– Was	te Man	agemei	nt.						,	,			
Unit-2 - Pr	inciples and 7 QC	C Tools			0				0			4 0				0	1	4. <b>Г</b> .			9	Hour
motivation	Sausiacuon – Type – Maslow's hieraro	es of custoff hv of needs	ners, customer s - Herzhera th	supplier chain - C	ment and	team work - Sev	en OC tools – Cl	euback	- Cusi	listoara	ms co	ntrol ch	usioni arts -	Pareto	diagra	servic m Cai	ie quali use an	ly - EII d effeci	ipioyee t diaara	irivoiv am - St	ratific	ation
Scatter dia	grams – Problem 3	Solving Tecl	hnique – using	7QC Tools - ISC	09000 Q	uality system.		10011 011	010 1	lotogro	1110, 001	na or or	ianto	raioto	ulugiu	m, ou	100 um	<i>a</i> 011001	ulugiu		auno	20011,
Unit-3 - Ma	anagement Tools	U U		6	100		- 1 Mar 1			123											9	Hour
Affinity diag	gram – Relations c	diagram - Tr	ree diagram <mark>– I</mark>	<mark>Matrix diagram –</mark> I	Matrix da	ata analysis diagr	am - Process de	cision p	rogran	i chart,	Arrow	diagrai	n - 5S	Princip	oles - C	Quality	Functi	on Dep	loymer	nt (QFI	D) - F	ailure
Mode Effec	Mode Effects and Unticality Analysis (FMEUA) - cause & effect analysis, poka-yoke - Introduction to Six Sigma – Define—Measure—Analyze—Improve—Control (DMAIC) – Measurement System Analysis -Process Canability Study – SMED - TRIZ Taguchi Loss function. Case studies and problems																					
Unit-4 - Re	Sluuy – SMED - Ti Aliahility	rtiz, Tayuch	III LOSS IUNCTION	i. Case siudies al		enis.															٥	Hour
Probabilisti	ic nature of failures	s - Mean failu	ure rate – Mear	time between fail	lures - Ha	azard rate – Haza	rd models - Weik	ull mod	el - Svs	tem rel	iability i	mprov	ement	– Redu	Indanc	v - Ser	ies–Pa	arallel a	and Mix	ed cor	nfiqura	ations
- Problems	in Series – Proble	ems in Paral	llel and Mixed	configurations - A	Accelerat	ed Life Testing -	Failure Mode A	nalysis	Distrit	outions	Used ir	Relia	bility E	nginee	ring.						5	

257

#### Unit-5 - Maintainability

Introduction Availability and Maintainability - Types of maintenance strategy - Mean time- to repair (MTTR) - Factors contributing to Mean Down Time (MDT) - Fault diagnosis, and routine testing for unrevealed faults - Factors contributing to Mean Maintenance Time – (MMT) on condition maintenance - Total Productive Maintenance (TPM) - Periodic condition monitoring, Continuous condition monitoring - Economics of maintenance - Overall Equipment Efficiency (OEE) - Phases of TQM implementation.

	1.	M. P. Poonia, S.C. Sharma, "Total Quality Management", Khanna Publishing, 2019.	5.	Roderick A Munro. Govindaraian Ramu and Daniel J Zrvmiak. "The Certified Six Sigma Green
	2.	R Kiran, "Total Quality Management: Key Concepts and Case Studies", Elsevier Inc.,		Belt Handbook", Second Edition, American Society for Quality, USA, 2015.
Learning		2017.	6.	L S Srinath, "Reliability Engineering", Fourth Edition, Affiliated East West Press, 2008.
Resources	3.	Dale H Besterfield, "Total Quality Management", Fourth Edition, Pearson Education	7.	E Balagurusamy, "Reliability Engineering", Tata McGraw Hill Education, 2010.
		Asia, 2015	8.	Total Quality Management and Operational Excellence: Text with Cases, Routledge, 2014.
	4.	John Oakland, Peter Morris "TQM – A pictorial guide for managers", Routledge, 2011.	9.	A Textbook of Reliability and Maintenance Engineering, Charles Ebeling, UBSPD, 2017.

Learning Assessme	ent		10000								
		N 1	Continuous Learning	g Assessment (CLA)		Sum	motivo				
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test )%)	Life-Long CL (10	g Learning _A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	<u>Th</u> eory	Practice				
Level 1	Remember	15%	the second second	15%		15%	-				
Level 2	Understand	25%		20%		<mark>25</mark> %	-				
Level 3	Apply	30%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	25%		<u>30%</u>	-				
Level 4	Analyze	30%		25%	-	<mark>30</mark> %	-				
Level 5	Evaluate		-	10%		-	-				
Level 6	Create	1000	-	5%	-		-				
	Total	10	0%	10	0 %	100 %					

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Interna <mark>l Experts</mark>
1. Mr. Gowrishankar, NIQR Secretary	1. Dr. Raju Abraham, Scientist-F, National Institute of Ocean Technology,	1. Dr. E. Vijayaragavan, SRM IST, KTR
	Velachery- Chennai 601 302, abraham@niot.res.in	
2. Dr. N Saravanan, Principal Engineer, Smart Implements & Machinery	2. Dr. N. Arunachalam, Associate Professor, IITM	2. Dr. J. Santha Kumar SRM IST, KTR
and Sustainability, Mahindra Research Valley, Chengalpattu	AT A TAX AND A T	

Course Code         21MEO105T         Course Name         OCCUPATIONAL SAFETY AND DISASTER MANAGEMENT							Cours Catego	se ory	0				OPEN	ELEC	TIVE			;	L T 3 0	P 0	C 3
Pre-requ Course	isite es	Nil		Co- requisite Courses	Nil		Pr	ogres Cours	sive						Nil	1					
Course	Offering Departme	ent	Mechai	nical Engineering	Data Book / Code	es / Standard	s							Nil							
Course Le	earning Rationale (	CLR):	The purpo <mark>se</mark>	<mark>of learnin</mark> g this co	urse is to:			1			Progra	am Ou	itcome	es (PO	)				P	rogra	m
CLR-1:	Understand the ca	ausation ar	nd prevention	approaches of accid	dent		1	2	3	4	5	6	7	8	9	10	11	12	01	pecifi utcom	ic ies
CLR-2:	Classify the Occu	pational Ha	lazard <mark>s and its</mark>	associated risk	1 and the	and lower				-	10		lity								
CLR-3:	CLR-3: Portray the safety consideration in an industrial operation to conduct risk assessment in materia								nt of	ions of	σ	society	stainabi	Ξ.	Work		ance				
CLR-4:	CLR-4: Perform the Environmental Impact Assessment for any projects and understand the concept of disas							alysis	lopme	estigat blems	l Usag	er and \$	t & Sue		Team	tion	& Fina	arning			
CLR-5:	Identify the various regulations, acts and rules in terms of Health, Safety and Environment		eering	em An	n/deve	uct inview	m Too	nginee	nmen		dual &	nunica	t Mgt.	ong Le	F	~	~				
Course O	utcomes (CO):		At the end o	f this course, learn	ers will be able to:	N. Cal	Engin	Proble	Desig	Condu	Mode	The e	Enviro	Ethics	Individ	Comn	Projec	Life Lo	PSO-	PSO-	PSO-3
CO-1:	Categorize the ac	cident t <mark>hec</mark>	<mark>ories a</mark> nd its pl	redominant safety fa	actors		2		24	1	-	1	-	-	-	-	-	-	-		-
CO-2:	Classify the Occu	pationa <mark>l Ha</mark>	l <mark>azard</mark> s and its	associated risk	1. St. 612	100	-	-	1	- 1	-	- 34	3	-	-	-	-	-	-		-
CO-3:	Portray the safety process	consid <mark>erat</mark>	<mark>ition in</mark> an indu	strial operation to co	onduct risk assessment in mat	terial handling		-		3		2	2	-	-	-	-	-	-	-	-
CO-4:	Perform the Envir management	onment <mark>al I</mark>	Impact Assess	sment for any projec	cts and understand the conce	ept of disaster	5		W.	-	-	3	1	-	-	-	-	-	-	-	-
CO-5:	Identify the variou	ıs regulat <mark>io</mark>	o <mark>ns, acts</mark> and r	ules in terms of Hea	alth, Safety and Environment	1 de	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-
Unit-1 - Pi	rinciples of Safety	Managem	ient		act and condition - contribu	tion factor for	accid	ont_	Theori	as and	princir	oles of	accide	ont car	isation	- acci	donts .	Accid	ont ro	9	Hour a and
investigati	ons, Safety Perform	ance Monit	itorin <mark>g - React</mark> i	ve and proactive mo	phitoring techniques , Calculat	ion of acciden	t indice	<del>en –</del> es - Ri	sk Ass	essmer	nt – Saf	ety Edi	ucation	and T	raining	g - Impo	ortance	of trai	ning-io	dentific	cation
of training	needs-training meth	nods – train	ning evaluation	<mark>n methods,</mark> Safety c	ommittees and their need, typ	pes and advar	ntages														
Unit-2 - O	ccupational Hazard	<b>ds</b> ration Tom	nnoraturo and	Padiation moasu	ring mothods, standards and	its impact (	homic	al Ha	ard r	ocoani	tion of	chomi	cal has	ards c	luct fu	moe r	niet vo	nour f	ioa ar	<u>9</u>	Hour and its
concentrat	ion - Exposure vs. [	ose, TLV -	- Methods of E	Valuation - Material	Safety Data Sheet- Biological	Hazard - clas	sificati	on of E	Bio-haz	ardous	agent	s –bac	terial a	gents,	funga	l, paras	sitic age	ents, in	fection	us dise	eases
Unit-3 - Sa	afety in Industrial (	Operation	1 18281 45 - 25			μι.														9	Hour

General safety consideration in material handling - Ropes, Chains, Sling, Hoops, Clamps - Selection, operation and maintenance of Mobile cranes, Tower crane and industrial trucks – Working at Heights - Safe Access - Safe Use of Ladders and Scaffoldings - Fall Prevention & Fall Protection - Safety Belts - Safety nets - Work permit system - Fire Safety - fire extinction, stages and modes of fire, classes of fire - fire extinguishers and types- Safety color codes – OSHA and ANSI standards

#### Unit-4 - Environment and Disaster Management

Introduction to Environment – assessment of and quality standards and impact in air, water and soil – Environmental impact assessment - Legislative and environmental clearance procedure in India- Disaster Management – Types of disaster, phases and levels – Disaster Management Cycle – Hydrological disasters – Technological Disasters – Manmade disasters – Resettlement and Rehabilitation - Disaster Case Studies. 9 Hour

### Unit-5 - Regulations for Health, Safety and Environment

Factories act and rules - Workmen compensation act – Gas Cylinder rules – Environmental Pollution act – Bio-medical waste Management rules - Building and other construction act – Green Building Concept – Indian motor vehicle act and rules - Indian Petroleum act – Sendai Framework on Disaster Risk Reduction

	1.	Tushar Bhattacharya, "Disa <mark>ster Science</mark> and Management", McGraw Hill India	6.	Canter.R.L, "Environmental Impact Assessment", (2nd Edition), McGraw Hill, 1996
		Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361	7.	IS CODES: IS 5903, IS 807, IS 2760, IS 14469, IS 13367-1, IS 5324, IS 7167, IS 7155, IS
Learning	2.	Rieske, David W., Asfahl and C. Ray, "Industrial Safety and Health Management", 6th		1800.1, IS 3521 of Oil Industry Safety Directorate, Govt. of India
Decourses		Edition, Prentice Hall Professional Technical Ref. 2009	8.	Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13:
Resources	3.	Heinrich.H.W, "Industrial Accident Prevention", McGraw-Hill, 1980.		978- 9380386423
	4.	Alexandrov.M.P, "Material Handling Equipment", Mir Publishers, Moscow, 1981.	9.	Moore, T. "Handbook of Disaster and Emergency Management: Principles and Practice" (2016).
	5.	Lees.F.P, Loss "Prevention in Process Industries", Butterworths, NewDelhi, 1986.	11	

Learning Assessme	ent 🗾			1. 1. 1. A						
		Sum	motivo							
	Bloom's Level of Thinking	Form CLA-1 Avera (50	ative ge of unit test %)	Life-Long CLA (10	Learning A-2 %)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	15%		15%		15%	-			
Level 2	Understand	25%		20%		25%	-			
Level 3	Apply	30%		25%		30%	-			
Level 4	Analyze	30%		25%		30%	-			
Level 5	Evaluate	1	-	10%			-			
Level 6	Create			5%	-	-	-			
	Total	100	)%	100	%	10	0%			

Course Designers											
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts									
1. Mr. Rajkumar, Cluster EHS Manager (South), L&T Construction, PVT. LTD.	1. Dr S. Kalai Selvam, Professor, Anna University	1. Dr Vignesh K.S, SRM IST									
2. Mr. Karthik Rajan. Lead EHS Specialist, Grundfos Pumps PVT. LTD.	2. Dr. Anil Kumar Gupta, NIDM, New Delhi	2. Mr. Thirugnanam. A, SRM IST									

Course Code	se 21MEO106T Course Name INTRODUCTION TO ROBOTICS		Cour Categ	se ory	0				OPEN I	ELECT	ΓIVE			l	- T 3 0	P 0	C 3				
Pre-requi Course	site s	Nil	(	Co- requisite Courses		Nil	Pr	ogres Cours	sive es						Nil						
Course Offering Department         Mechanical Engineering         Data Book / Codes / Standards         Nil																					
Course Learning Rationale (CLR): The purpose of learning this course is to:									Progra	am Qu	Itcome	s (PO)					Pr	rogra	m		
CLR-1: Discuss the basic terminologies and classifications associated with Robot and Manipulators]					1	2	3	4	5	6	7	8	9	10	11	12	S	pecifi tcom	C es		
CLR-2:	Analyze robot kin	ematics and	its associated i	transformation o	f joints		e		f	s of	24	iety			¥		0				
CLR-3:	Acquire the know	ledge about r	ro <mark>botic cont</mark> rol	system, sensors	and feedback dev	ices	vledo		ento	ations	ge	soc			oW r		ance	g			
CLR-4:	Develop program	s for robot ap	oplications	2			Knov	Ilysis	mdo	stiga	Usa	r anc	৵		Tean	ion	& Fir	arnin			
CLR-5:	Recognize differe	nt robot and	and its working principle		leering	em Ana	jn/devel	uct inve lex prot	ern Tool	enginee	ironment tainabilit	S	dual & ⁻	nunicat	ct Mgt.	ong Le:	<del></del>	Ņ	က္		
Course Ou	tcomes (CO):	A	t the end of th	nis course, learr	ners will be able to	o:	Engir	Probl	Desig	Cond	Mode	The e	Envir Susta	Ethic	Indivi	Comr	Proje	Life L	PSO-	PSO-	PSO-
CO-1:	Explain the basic	: termin <mark>ologie</mark>	<mark>es an</mark> d classific	ations of Robot a	and Manipulators	Aug 14	100		3	-	-	1		-	-	-	-	-	-	-	-
CO-2:	Analyze robot kin	ematics <mark> and s</mark>	<mark>the</mark> transforma	tions associated	with the joint motion	on	- 1	3	1	- 1	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Acquire the know	ledge a <mark>bout r</mark>	robotic control	system, sensors	and feedback dev	ices	1		3	-	-	- 100	-	-	-	-	-	-	-	-	-
CO-4:	Develop program	s for ro <mark>bot ap</mark>	oplications		1000		1	2-	1	-3	-	÷.	-	-	-	-	-	-	-	-	-
CO-5:	Recognize differe	nt robo <mark>t and</mark>	<mark>its w</mark> orking prir	nciple		-			3	-		N.	-	-	ł	-	-	-	-	-	-
Unit-1 - Ro	bot Fundamental	s and Manip	oulators			- W-					-	-	<u> </u>							9	Hour
Robotics - repeatabilit pneumatic, <b>Unit-2 - Ro</b>	Concepts, RIA Defi y of Robotics-Simp hydraulic operatec <b>bot Kinematics</b>	inition, La <mark>ws,</mark> ble problems- l grippers, ne	, Anatomy, Joir -Specifications eedle gripper, b	nts and links, No of Robot-Speed pellow gripper, Fl	tations, Motion, Co I of Robot- Robot I exible grippers, so	onfigurations. Degree Drive systems. Mech ft gripper-Gripper forc	of freedor nanical grip ce analysis	n-redu opers-, -Gripp	indant : Actuation Der desi	system, on - Slie ign-Sim	Precis der cra ple pro	sion M ank, Se oblems	loveme crew, R s	nt – Sj Rotary,	oatial r Cam ·	esoluti Magne	on, Coi etic griµ	mplian opers-\	ce, Ac /acuur	curac n grip <b>9</b>	y and pers- <b>Hour</b>
Robot kiner problems u	matics- open chain sing programming	, closed chai software	in kinematics. T	Transformation c	of joints and links-F	Forward and Inverse -	- simple pr	oblem	s, Horr	ogeneo	ous Tra	ansfor	mation,	Multip	ole trar	isforma	ation-Si	imple p	robler	ns. So	olving
Unit-3 - Co	ntrol System, Ser	nsors and Ro	obot <mark>Vision.</mark>	100	A Same State	A	100											_		9	Hour
Control sys	Jontrol system for robot joint-Control actions-P, Pi, Pi Controllers. Adaptive controller, optimal controller, Motion Interpolations and positioning Sensors in robot – Fouch sensors Factule sensor – Proximity and range sensors Feedback devices-Encoder. Resolver, LVDT – Force sensor-Light sensors -Pressure sensors Robotic vision sensor-Sensing and digitizing. Image processing and analysis.																				
Unit-4 - Ro	bot Programming	leouer, resol I	1001, EVDT - T	orce sensor Ligi			31011 301130	001	ising u	ia aigia	zing. n	nuge	process	sing ai		iy 313.				9	Hour
Programmi with Simple	ng methods, OFF a program.	and ONLINE	programming,	Lead through m	ethod, powered an	d Manual lead throug	h and Tea	ch pei	ndent n	nethod,	Funda	menta	als of R	APID	Progra	mming	, ROS	and sii	nulatio	on sof	tware

# Unit-5 - Robot Types and Application

# 9 Hour

Micro/Nanorobot, Wall climbing micro robot -Biomimetic robot-Swam robot-. Corobot, Universal Robot, Mobile Robot, Mecanum wheel robot, Delta Robot working principle. Robot applications in manufacturing Inspection, assembly, material handling, spraying. Applications in medical field surgical robot, Rehabilitation Robots, Nanorobot in targeted drug delivery system. Robot application in space, under sea water and agriculture.

	1.	Mikell P. Groover, "Industrial Robotics Technology Programming and	5.	Klafter.R.D, Chmielewski.T.A and Noggins, "Robot Engineering: An Integrated Approach",
		publications",McGraw Hill Co., New Delhi, 2012.	٩.	Prentice Hal of India Pvt. Ltd., New Delhi, 2010.
	2.	Deb .S.R, "Robotics technology and flexible automation", Tata McGraw Hill publishing	6.	Craig, John J Introduction to Robotics: Mechanics and Control. United
Learning		company limited, New Delhi <mark>, 2010.</mark>		Kingdom: Pearson, 2018. S. Mukherjee, Robotics, Khanna Book Publishing Co., New Delhi
Resources	З.	Niku, Saeed B, Niku, Saeed Benjamin. Introduction to Robotics: Analysis, Control,	7.	Xi, Ning. Liu, Leaning. Wang, Zhidong. Yuan, Shuai. AFM-Based Observation and Robotic
		Applications. United Kingdom: Wiley, 2020.		Nano-manipulation. Germany: Springer Nature Singapore, 2020.
	4.	Gonzalez, Rafael C., Lee, C. S. George., Fu, King Sun. Robotics: Control, Sensing,	8.	Selected Topics in Micro/Nano-robotics for Biomedical Applications. Netherlands: Springer New
		Vision, and Intelligence. Singapore: McGraw-Hill, 1992.		York, 2013.

		Continuous Learning Assessment (CLA)							
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (10	g Learning _A-2 0%)	Final Ex (40% w	amination eightage)		
	-	Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	15%	the second second	20%		15%	-		
Level 2	Understand	25%		20%	- 2000	25%	-		
Level 3	Apply	30%		30%		<u>30</u> %	-		
Level 4	Analyze	30%		30%	-	<mark>30</mark> %	-		
Level 5	Evaluate			Statistics of the second			-		
Level 6	Create	Contraction of the second	- Ho -				-		
	Total	10	0%	10	0 %	10	0 %		

Course Designers											
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts									
1. Dr. N Saravanan, Principal Engineer, Smart Implements & Machinery and	1. Dr.Saravanaperumal, Assistant Professor, Department of	1. Dr.R.Ambigai, SRMIST									
Sustainability, Mahindra Research Valley, .SARAVANAN@mahindra.com	Mechanical Engineering, Thiagarajar College of Engg., Madurai.										

Course Code	rse 21MEO107T Course FUNDAMENTALS OF NANO ENGINEERING		Co Cat	ourse tegory	y	0				OPEN	ELEC	TIVE			;	L T 3 0	P 0	C 3					
Pre-requi Course	site es	Nil		Co- requis Courses	ite	N	111		Prog	gress ourse	sive es						Ni	1					
Course	Offering Departme	ent	Mec	nanical Engineer	ring	Data Book	/ Codes / Standa	irds								Nil							
Course Le	arning Rationale (	(CLR):	The purpo	se of learning t	his cours	se is to:							Progr	am Ou	utcome	es (PO	)				Ρ	rogra	m
CLR-1: Find the fundamental properties of functional materials, nano engineering and nanotechnology					1	2	3	4	5	6	7	8	9	10	11	12	S	pecifi Itcom	ic ies				
CLR-2: Outline the uses of carbonaceous nanomaterials in engineering applications					e		f	s of	1.	iety			ž		0								
CLR-3:	Examine the print	ciple of syn	nthe <mark>sis and</mark>	characterization	of nanon	naterials	Sec. Sale		lledg		ent o	tions	e	soci		-	Mol		ance	D			
CLR-4:	Illustrate the cond	cept of bion	nedical mat	erials engineerir	ng	WC-1			Mon	ysis	emdc	stiga Iems	Usaç	and	₀ð		eam	ы	Fin	rninç			
CLR-5:	Explain the conce	epts on fabi	r <mark>ication m</mark> ei	hods and applic	ations	-			leering r	em Anal	jn/develo ons	uct inve	Im Tool	angineer	onment	8	dual & T	nunicati	ct Mgt. 8	ong Lea	<del></del>	5	3
Course Or	utcomes (CO):		At the end	of this course,	learners	will be able to:	Aconst		Ingir	Probl	Desig	Cond	Mode	The e	Enviro	Ethics	ndivi	Comr	Proje	-ife L	-OSc	-OSc	-OSc
CO-1:	Identify the funda	mental fact	tors using e	ngineering and i	nanotech	nological knowledge	e		3	-	-	-	-	-	-	-	-	-	-		-	-	-
CO-2:	Explain the role o	f carbo <mark>nac</mark>	ceous nanor	naterials on nan	o enginee	ering and technolog	У		3	-			1	-	-	-	-	-	-	-	-	-	-
CO-3:	Discuss the techn	niques o <mark>f sy</mark>	<mark>ynthe</mark> sis an	d characterizatic	n of nand	omaterials and their	uses		2	-		-	3	-	-	-	-	-	-	1	-	-	-
CO-4:	Determine the fur	ndamen <mark>tal i</mark>	<mark>ideas</mark> of na	notechnology on	biomedia	cal materials	1000		3	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO-5:	Perform the effec	tive nan <mark>ote</mark>	<mark>echnol</mark> ogy o	n various fabrica	ations and	l nano engineering a	applications		3	-	1.1	-	3	-	-	-	-	-	-	5	-	-	-
				1		dial Surface								-							1		
Unit-1 -Int	roduction to Nano	technolog	an quantur	dot: Possible a	nnlication	of Nanoonginoorin	a in Science & To	chnol	ogy: E	Thic	alach	octs of	Nanot	ochno	loav: Si	ciontifi		lution:	Emora	nco ot	nano	9 tochni	Hour
Challenges	s in nanotechnology	/: Classifica	ation of Nar	omaterials: Adv	anced Na	anomaterials.	iy in Science & re	CIIIOI	Uyy, L	_01100	ai aspe	5013 01	Nanol	CUIIIO	uyy, Si			uuon, i	Linerye		nano	.ecilit	Jiogy,
Unit-2 - Na	anotechnology in	Carbon Ma	aterials				1.000					10	17									9	Hour
Allotropy o	f Carbon; Carbon a	ge - new fo	orm <mark>s of carl</mark>	oon graphene sh	eet to CN	IT; Fullerenes and (	Carbon Nanotube	s; Full	erene	s as	nano-	structu	res - s	tructur	res of C	60, Ci	70 and	higher	fullere	nes; C	arbon	Tubul	les as
Nano-struc	tures; Observation	of Carbon	Nanotubes	<mark>: Me</mark> chanical Pro	operties o	f CNTs & Graphene	e; Electronic struct	ure of	f CNT	's & (	Graphe	ene; Ele	ectroni	ic and	Biologi	cal pro	pertie	s of Na	nomate	erials.			
Unit-3 - Sy	nthesis and Char	acterizatio	on		20.00		Contraction of the				1		1						<u> </u>			9	Hour
Nanomate	rial synthesis; Macr	oscopic to	microscopi	crystals and na	anocrysta oriol Cho	ls; Large surface to	volume ratio; Top	-dowr	n and l	botto	om-up a	approa	ches;	Self-a	ssembly	y proce	əss; Gi	rain bo	undary	volum	e in na	inocry	rstals;
Delects III	nanocrysials; Suna omedical Material	ice enecis (	on the prop	erties; Nariomat	enai Cha	racienzations - Tech	nniques.	-	-		-	-	-									0	Hour
Introductio	n to Biomaterials: S	s Surface an	nd Bulk Pro	perties of Bio m	aterials:	Biological Building I	Blocks: Size of hi	iildina	Block	ks ai	nd Nai	nostruc	tures:	Biolog	nical na	nostri	ctures	-Exan	nples o	f Prote	ins. N	<b>a</b> Iiscell	s and
Vesicles, N	Iutilayer Films; Dru	g delivery;	Soft tissue	engineering; Ha	rd tissue	engineering; Implan	nts & Prosthetics.		2.00					2.0.08									
Unit-5 - Fa	brications and Ap	plications	5															-		-	-	9	Hour
Nano MMC	Cs; Nano PMCs; Na	no CMCs;	Electronic	cooling system;	Integrated	d circuits; MEMS; N	EMS; Sensors; Na	ano-m	agnet	tics a	and bio	engine	ering.										

	1.	M.A. Shah & M.A. Shah, Nanotechnology: The Science of Small, Wiley, 2nd Edition, (2020).	5.	Hari Singh Nalwa, Handbook of Nanostructured Materials & Nanotechnology Optical
	2.	T.I. Awan, A. Bashir, & A. Tehseen, Chemistry of nanomaterials: fundamentals and		Properties, Academic Press, (2000).
Learning		applications. Elsevier, (2020).	6.	Guozhong Cao, Nanostructures and Nanomaterials, Synthesis Properties and Applications,
Resources	3.	S. M Lindsay, Introduction to Nanoscience, Oxford, (2010).		Imperial College Press, (2004).
	4.	C.P. Poole Jr. and F.J. Owens, Introduction to Nanotechnology, Wiley Interscience, (2003).	7.	Niemeyer, Christof M., and Chad A. Mirkin, eds. Nanobiotechnology: Concepts, Applications
				and Perspectives. Vol. 1. John Wiley & Sons, 2004.

		Summativa					
	Bloom's Level of Thi <mark>nking</mark>	Form CLA-1 Avera (5)	g Learning LA-2 0%)	Final Ex (40% w	rative amination eightage)		
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	the same line	15%		15%	-
Level 2	Understand	25%		20%		25%	-
Level 3	Apply 📃	30%		25%	-	30%	-
Level 4	Analyze	30%	22 C	25%		30%	-
Level 5	Evaluate	-		10%		-	-
Level 6	Create		1 Sugar	5%	· · · ·	-	-
	Total	10	0%	10	0 %	10	0%

Course Designers			
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
1. Dr. Sumitesh Das, Chief Graphene Business, Tata Steel	1. Dr. Sudip Kr. Sinha, Assistant Professor, NIT Raipur	1. Dr. Sumit Pramanik, SRMIST	
2. Dr. Tapas Senapati, Senior Manager HPC at Emami Limite	d 2. Dr. Sk. Ariful Rahaman, Professor, VIT, Vellore	2. Dr. Shubhabrata Datta, SRMIST	



Course Code	21MEO108T Course COMPUTER NUMERICAL CONTROL PROGRAMMING AND OPERATION			NTROL PROGRAMMING AND	Cours Catego	se ory	0	OPEN ELECTIVE										P 0	C 3
Pre-requi Course	site s	Nil	Co- requisite Courses	Nil	Pr	ogres Cours	sive ses						Nil						
Course	Offering Departm	ent	Mechanical Engineering	Data Book / Codes / Stand	dards							Nil							
		(a)			11	-	1.0		_			(7.6)					р.		
Course Le	arning Rationale	(CLR): /	he purpose of learning this course	is to:	_			1	Progr	am Ou	itcome	s (PO)					S	becifi	n C
CLR-1:	Impart knowledg	e of CNC Ar	chitecture, Hardware, and Software		1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	es
CLR-2:	familiar with type	s of CNC ma	achin <mark>es an </mark>	- understand	ge		of	s of		ciety			Ł		e,				1
CLR-3:	conversant with	basic conce <mark>p</mark>	ots <mark>of part pro</mark> gramming		wled		lent	ation	ge	l soc			n We		Janc	þ			
CLR-4:	acquainted with	part program	ming for turning operations	Wei- We	Knov	Ilysis	opm	stig	Usa	r and	৵		Tear	on	& Fii	arnir			
CLR-5:	familiar with part	programmin	g for milling operations		heering	em Ana	gn/devel	uct inve lex prot	ern Tool	enginee	onment	s	idual & ⁻	nunicat	ct Mgt.	-ong Le:	-	-2	S
Course Ou	itcomes (CO):	1	<mark>At the</mark> end of this course, learners v	vill be able to:	Engi	Prob	Desig		Mode	The (	Envir	Ethic	ndiv	Com	Proje	_ife [	So	SOS	SO
CO-1:	Familiarize the b	basics of CN	C, CNC hardware, and Software	1	2	-	-	-	-		-	-	-	-	-	-	-	-	-
CO-2:	Acquire knowled	ge of typ <mark>es c</mark>	o <mark>f CN</mark> C Machines	A STATE OF A STATE OF A	2	-	1	-	-	-	-		-	-	-	-	-	-	-
CO-3:	Acquaint knowle	dge of th <mark>e ba</mark>	asics of part programming for lathe an	d milling operations		2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Develop part pro	grammin <mark>g fo</mark>	or machining components using CNC L	Lathe	0.2	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Develop part pro	grammin <mark>g fo</mark>	o <mark>r mac</mark> hining components using CNC I	Milling Machine	-	2	3	-	-	1	- 10	-	-	-	-	-	-	-	-
Unit-1 - Int	troduction to Nun	nerical Cont	trol and CNC	and the second						e								9	Hour
Definition of	of Numerical Contr	ol, Conven <mark>tio</mark>	onal and CNC Machining - Numerical	Control Advantages - Types of Cl	NC Machir	ne Toc	ols - Pe	ersonne	for Cl	VC, Sá	afety Re	lated	to CN(	C Work	- CNC	: Mach	ine Ar	chitec	ture -
Unit-2 - Cl	VC Machines - On	eration							1									9	Hour
CNC Millin Axes - Axe EDM, Rout	g: Types of Milling s Designation, Tw ers	Machines - o-Axis Lathe	Machine Axes, Vertical Machining Ce , Thr <mark>ee-</mark> Axis Lathe - Four-Axis Lathe	enters - Horizontal Machining Cen & Six-Axis Lathe - Features and S	ters - Hori. Specificatic	zontal ns, Ty	Boring pical I	g Mill, T Machine	ypical Speci	Specif ificatio	ications ns - Co	ntrol F	Turnii eature	ng: Typ s. Spe	bes of ( cial CN	CNC La IC Mad	athes, hines	Numt – Wir	er of Cut
Unit-3 - Ba	sics of CNC Prog	gramming		La MAL STOLLE	15.													9	Hour
Coordinate Program D Symbols in Feed rate (	Geometry, Real N ata Override, Syst CNC Programmir Control, Tool Func	lumber Syst tem Options ng, Typical P tion – Refere	em, Rectangular Coordinate System, 1 – Program Planning, Steps in Progra Program Structure, Program Header – ence Points, Register Commands, Pos	Machine Geometry – Control Sys am Planning – Part Program Struc Preparatory Commands (G – Coc sition Compensation - Work Offset	stem, Gene cture, Basi des) & Miso ts, Tool Lei	ral De c Prog cellane ngth C	escripti gramm eous F Offset, s	ion, Sys iing Ten unction Simple	tem Fe ms, Pr s (M C CNC P	eatures ogram odes) rogran	s <mark>, M</mark> anu ming Fo – Sequ ns – Tu	al Pro ormats ence I torials	gram I s, Word Block, I	nterrup d Addre Input o	tion, M ess For f Dime	lanual i rmat, F nsions,	Data lı ormat Spino	nput (l Notat lle Co	ИDI), ion – ntrol,
Unit-4 – C	NC Programming	– Turning																9	Hour
Rapid Posi Evaluation, Tooling on	tioning, Machine Z Drilling Operation Lathes - Math in C	ero Return - s, Peck Drill NC Progran	Linear Interpolation, Block Skip Func- ing, Reaming, Boring, Tapping, Patter nming: Geometry, Taper & Advanced	tion, Dwell Command - Fixed Cyci n of Holes - Lathe Cycles: G90, G Calculations - Tutorials on Progra	les: G81, G 94, G71, C mming	682, G 672, G	83, G7 73, G	7 <mark>3, G</mark> 84 70, G74	G74, , G75	G85, ( - Groo	386, G8 ving on	37, G8 Lathe	8, G89 s - Pai	), G76 · rt-Off &	• Mach & Single	ining H e Point	oles: S Threa	Single Iding -	Hole · Live

# Unit-5 - CNC Programming – Milling

Face Milling, Circular Interpolation - Cutter Radius Offset, Plane Selection - Contour Milling - Slots and Pockets - Subprograms, Datum Shift, Mirror Image - Coordinate Rotation, Scaling Function - Helical Milling -Horizontal Machining - Tutorials on Programming, Introduction to APT Programming

ſ		1.	Thyer G. E., Computer Numerical Control of Machine Tools, Industrial Press, 1988	5.	Gibbs D and Crandell T M, Introduction to CNC Machining and Programming, Industrial Press, 2003
		2.	Smid P, CNC Programming Handbook, Industrial Press, 2008	6.	Marciniak K, Geometric Modeling for Numerically Controlled Machining, Oxford University Press,
	Learning	3.	Madison J, CNC Machining Handbook: Basic Theory, Production Data and		1991
	Resources		Machining Procedures, Industrial Press, 1996	7.	Overby, Alan. CNC machining handbook: building, programming, and implementation. McGraw-Hill,
		4.	Mattson M, CNC Programming Principles and Applications, Cengage Learning,		Inc., 2010.
			2009		

-

	Bloom's	Forn	anti un	ų ( /		<u> </u>	
	Level <mark>of Thinking</mark>	CLA-1 Avera (50	ge of unit test (9%)	Life-Long CL (10	Learning A-2 %)	Final Ex (40% w	native amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1 Re	emember	15%	100 C 100 C 100 C	15%		15%	-
Level 2 Un	nderstand	25%	the second second	20%		25%	-
Level 3 Ap	oply	30%		25%		30%	-
Level 4 An	nalyze	30%	10	25%		<u>30%</u>	-
Level 5 Ev	valuate	1 1 - 1		10%		-	-
Level 6 Cro	reate	No. And		5%		-	-
	Total	10	0%	10	)%	10	0%

Co	ourse Designers				and the second sec	
Ex	perts from Industry	Ex	perts from Higher Technical Institutions	Inte	ernal Experts	
1.	Mr. Vignesh Shanmugam, Manager, Hyundai Motors India Ltd.	1.	Dr. Davidson Jebaseelan, Professor, VIT Chennai	1.	Mr. V. Veeranaath,	SRMIST
2.	Dr. N Saravanan, Principal Engineer, Smart Implements &	2.	Dr. Raju Abraham, Scientist-F, National Institute of Ocean	2.	Dr.J.Santhakumar,	SRMIST
	Machinery and Sustainability, Mahindra Research Valley,		Technology, Velachery-Tambaram Road, Pallikaranai, Chennai			
	N.SARAVANAN@mahindra.com		601302, abraham@niot.res.in	1.2		

B.Tech / M.Tech(Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

Course Code	urse 21MEO109T Course RESOURCE MANAGEMENT TECHNIQUE						irse gory	0					OPEN I	ELECT	ΓIVE			l	- T 3 0	P 0	C 3
Pre-requis	site s	Nil		Co- requisite Course <mark>s</mark>	Nil	ľ	Progre Cour	ssive ses	•						Nil						
Course C	Offering Depart	ment	M	echanical Engineering	Data Book / Codes / Stand	ards								Nil							
			1		the second se	-	-	-	-			_									]
Course Lea	arning Rationa	le (CLR)	: The purp	bose of learning this cou	irse is to:					P	rogra	am Ou	tcome	s (PO)	)				S	ograf	n c
CLR-1:	Discuss the ne	cessity,	scope, applica	a <mark>tions of op</mark> erations resea	rch in industries	1	2	3	5	4	5	6	7	8	9	10	11	12	ou	tcom	as
CLR-2:	Outline various	resourd	e manage <mark>me</mark> l	<mark>nt techni</mark> ques and their ap	plications in industries	e		f	•	s of	10	iety			Ł		Ð				
CLR-3:	Construct real	life prob	lems into mod	<mark>eling</mark> and solving for decis	ion making	vled		ento	-	s	ge	soc			M C		Jano	б			
CLR-4:	Apply cost effe	ctive tec	hniqu <mark>es for co</mark>	ost and time reduction of t	ne projects with reduced resources	You Y	lysis	do		stige	Usa	anc	∞ _		Tean	ы	E E	arnin			
CLR-5:	Recommend s	uitable d	lecisi <mark>ons unde</mark>	r competitive and uncerta	in environments	bui	Ana	evel		prot	00	neer	hent		8	icati	lgt.	) Lea			
				a second second		neer	lem	gn/d	ions	plex	Ъ	engi	ronn aina	s	idua	mur	ect N	Long	$\overline{\mathbf{x}}$	Ņ	က္
Course Ou	tcomes (CO):		At the e	nd of this course, learne	ers will be able to:	Engi	Prob	Desi	solut	Conc	Mod	The	Envi	Ethic	ndiv	Com	Proje	life	SO	SO	SO
CO-1:	Create the line within the give	ear progi n constra	ramming mod ain <mark>ts</mark>	el and apply various tech	niques to optimize the objective funct	ion _	1	3	}	-	1	1		-	-	-	-	-	-	-	-
CO-2:	Solve transpor	tation an	nd <mark>assignm</mark> ent	models for cost effective	solutions		1	-			1	- 10	- T	-	-	-	3	-	-	-	-
CO-3:	Identify suitab replacement of	le job s ^f individu	e <mark>quencing</mark> fo al <mark>, group i</mark> tem	r reducing idle time of a s for saving investment	resources, and to identify ideal time	of -	1	-		2	1	-0	-	-	-	-	3	ı	-	-	-
CO-4:	Evaluate decis resources	ion varia	ab <mark>les of qu</mark> eu	ing and inventory models	for ensuring prompt service with limi	ted _	1	16	6	-	1	1	-	-	I	-	3	I	-	-	-
CO-5:	Construct the p apply various t	project n echnique	etw <mark>ork for co</mark> si es to <mark>determi</mark> n	t and time effective project e best strategies under co	completion with limited resources, and mpetitive and uncertain environments	I to	1	-		-	1	5		•	-	-	3	-	-	-	-
Unit-1 - Lir	near Programm	ing Mod	lel								1									9	Hour
Necessity of	of OR in industry	- Conce	ept and formul mont Models	ation of LP models for the	real life and industrial problems – Gra	phical m	nethod ·	– Sim	plex	metho	od – B	Big M I	nethod.	. Solv	ing tute	orial pr	oblems	susing	softwa	ire.	Hour
Transportat software.	tion model – ba	sic feasi	ble solution u	sing Least Cost, VAM –	Optimality test using U-V method. Ass	ignmen	t mode	I – M	linim	ization	and	Maxin	nization	probl	ems. S	Solving	tutoria	l probl	ems u	sing	1001
Unit-3 - Se	quencing & Re	placeme	ent Models		ATT THE REAL PROPERTY.	1.1														9	Hour
Sequencing	g model – Proce	ssing of	'n' jobs on 2 8	3 <mark>machines.</mark> Replaceme	nt models – items that deteriorate with	time – it	ems tha	at fail	com	pletely	/ — ind	lividua	<mark>l an</mark> d g	roup r	eplace	ment p	olicy. S	Solving	tutoria	il prob	lems
Using softw Unit-4 - Qu	are. Ieuina & Invent	orv Mod	lels																	9	Hour
Queuing th	eory - Poisson	arrival a	nd exponentia	al service times – single s	server with limited, unlimited number of	of arriva	ls allov	ved. I	Inver	ntory n	nodels	s – Ρι	irchase	and I	Manufa	acturin	g deter	ministi	c mod	els wi	thout
shortages a	allowed. Solving	tutorial p	problems usin	g software.																	
Unit-5 - Pro	oject Network I PM tochniquos	Review	Game Theory	Mo CPM cost model C	ame theory 2 persons zero sum com	os Du	o and	mixor	d otr	atogia		thod	of domi	nanco	Mot	riv od	Imont	nother	l for n	91	Hour
Solving tuto	prial problems us	sing soft	ware.	ine – Crivi Cost Inodel. G	ame meory- 2 persons zero sum gam	es. Pul	e anu	mixed	J SUG	aleyies	s. ivie			nance	– wal		intent i	neurou		л II (II	αιτιλ.
	1	<b>v</b>																	-		

	1.	Hamdy A Taha, Operations Research : An Introduction, 10th edition, Prentice Hall of	4.	Duraivelu K and Balasubramanian M, Operations Research, 2nd Edition, DeaR Publications,
l comina	0	India, New Deini, 2017	E	2022 Sundanaan V. Consective Subramanian and Canadan K. Operationa Basearch, 4th Edition
Resources	Ζ.	Ltd., New Delhi, 2015	Э.	A.R.Publicattions, 2006.
	З.	Panneerselvam R, Operations Research, Prentice Hall of India, 2nd edition, New Delhi,	6.	Software tool for solving tutorial problems : TORA software:
		2016	1	www.mediafire.com/file/t48w3vjo6os9pxp/ToraSystem7th.zip/file

			Continuous Learning	Assessment (CLA)		Sum	motivo			
	Bloom's Level of Th <mark>inking</mark>	Formative CLA-1 Average of unit test (50%)		Life-Lon Cl (1	g Learning LA-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	15%	The same links	15%		15%	-			
Level 2	Understand	25%		20%		25%	-			
Level 3	Apply 📃	30%		25%		30%	-			
Level 4	Analyze	30%	22.0	25%		30%	-			
Level 5	Evaluate	-		10%		-	-			
Level 6	Create		Sec. 2942.197	5%		-	-			
	Total	10	0%	10	00 %	10	0%			

Co	urse Designers	14			
Ex	perts from Industry	Exp	perts from Higher Technical Institutions	Inte	ernal Experts
1.	Mr. A. Muguntharajan, Vice President, OBTim Consulting	1.	Dr. M. Raj Mohan, Professor, Dept of Industrial Engineering, CEG	1.	Dr. K. Duraivelu, SRMIST
	Services, Bangalore		campus, Anna University, Chennai		
2.	Dr. D. Arivudainambi, Secretary, Operations Research	2.	Dr. Usha Mohan, Professor, Dept of Management Studies, IIT-Madras,	2.	Dr. S. Oliver Nasaraj, SRMIST
	Society of India, Chennai Chapter		Chennai		and the second se

Course Code	Durse Code         21MEO110T         Course Name         ENERGY SYSTEMS FOR SUSTAINABLE BUILDIN					NGS		Cour Categ	se ory	0				OF	PEN	ELEC	TIVE				L T 3 0	P 0	C 3								
Pre-requis Course	site s		Nil			Co	o- req Cours	luisite es				1	Nil			Pi	ogres Cours	sive es							Ni	1					
Course C	Offering Depa	rtmer	nt		Mech	anical	Engir	neering	g		Data	a Boo	ok / Co	des / St	andaro	ls	-							Nil							
Course Lea	arning Ration	nale (C	CLR):	The p	ourpos	e <mark>of l</mark> e	earnir	ng this	cours	se is t	to:					<u> </u>	1	1	2.1	Pro	gram (	Duto	ome	s (PO	)				P	rogra	m
CLR-1:	Describe the	energ	gy transfe	er in b	uildings	6			1							1	2	3	4	5	6		7	8	9	10	11	12	01	utcom	ies
CLR-2:	CLR-2: Represent the solar passive heating and cooling systems					-	ge		of	s of	2	ietv				ork		е													
CLR-3:	Examine the	lightir	ng syster	ns of <mark>l</mark>	ouilding	S		~	-/				100	3		wled	6	ient o	ation	s	soc				N NO		nanc	b			
CLR-4:	Implement th	ne Hea	at control	l a <mark>nd v</mark>	entilatio	on me	thods	in buil	ldings			R		14		Kno	alysis	lopr	estig	Ulse	r and	•	× ×		Tear	ion	ы М	arnir			
CLR-5:	Propose and	l analy	ze the c	oncep	t of gre	en bui	ldings	;		Ę		5				neering	lem Ana	gn/deve	duct inve	ern Too	encinee	D	ronmen ainabilit	S	idual &	municat	ect Mgt.	-ong Le	-	-2	ကု
Course Ou	Course Outcomes (CO): At the end of this course, learners will be able to:					127	Engi	Prob	Desi	Conc	Mode	The		Sust	Ethio	Indiv	Com	Proje	Life I	PSO	PSO	PSO									
CO-1:	Compute the	e heati	ing an <mark>d c</mark>	ooling	load ca	alculat	tions (	on enei	rgy effic	icient	buildin	ngs	Sec.	242	9	3	3	-	-	4	-	1	-	-	-	-	-	-	-	-	-
CO-2:	Analyze the	conce	pt of s <mark>ola</mark>	ar pas	sive hea	ating a	and co	ooling			1		6	15		3	3		-	-	-		-	-	-	-	-	-	-	-	-
CO-3:	Create the d	esign	param <mark>et</mark>	ers inf	luencin _.	g ther	m <mark>al</mark> d	esign o	o <mark>f build</mark> i	lings	22.5		14	18		3		-	-	-	-		-	-	-	-	-	-	-	-	-
CO-4:	Evaluate the	conce	ept of <mark>da</mark> j	<mark>y light</mark> i	ng and	electr	ric <mark>al</mark> li	ghting :	system	าร		1	1		12	3	2	6	-				-	-	-	-	-	-	-	-	-
CO-5:	Apply the co	ncept	of gre <mark>en</mark>	buildi	ngs and	d certii	ficatio	ns		E						2		1.1	-	-	-	-	3	-	-	-	-	-	-	-	-
Unit-1 - En	ergy Transfe	r in B	uildings			1	-	_	200			_									-									9	Hour
Concepts of thermal comfort and energy efficient buildings, Conventional versus Energy Efficient Buildings-Climate and its Heat transmission in building structures, Energy balance for cooling and heating of buildings- Estimation of heating and buildings design consistence.					nd its in g and o	fluenc cooling	e in bu g loads	ilding ;, Low	desig and	n for e zero e	nerg nerg	y req y bui	uirem Idings	ent- Tl - Glob	hermal bal and	proper I Indiar	ties of energ	buildin y scer	g mat nario-F	ərials, ⁼uture											
Unit-2 - So	lar Heating &	Cool	ing						1						1	***C														9	Hour
General pri	nciples of acti	ve and	d passive	e solar	heating	g- Key	, desiç	jn eler	nents o	of past	sive he	eating-	- Direct	t solar h	eat gai	t by Tr	ombe	mass	valls-	Passi	/e coo	ling	and i	ts key	desig	n elem	ents, -	Water	walls,	evapo	rative
Cooling- Co	at Control &	ops a <b>Ventil</b>	na solar Iation	cnimn	ey eπe	CIS, II	ierma	I Bridge	e and L	barrie	er, Ther	rmai in	nsulatio	on, Ioad	control	, air ini	itratio	n- Oac	r rem	ovai a	na nea	nt rec	cover	y in ia	rge bl	illaings	i.			9	Hour
Air currents	s around the l	buildin	ig, Air m	oveme	ent thro	ugh th	he bu	ildings,	, air ch	nange	s, qua	ality of	f air- P	sychome	etrics, I	Design	paran	neters	influe	ncing	therm	al de	esign	of bu	ildings	- Impa	act of n	nicro a	nd ma	cro cl	imatic
changes- H	leat transmiss	ion thi	rough bu	ilding	section	s-Effe	ct of c	o <mark>rientat</mark>	tion of t	buildii	ngs. Ve	entilati	tion, rea	quireme	nts for	heat co	ntrol i	n buila	ings-	Stand	ards fo	or ve	ntilat	ion-Ve	entilati	on des	igns.				
Introduction	n to lighting system	stems	of buildir	is na-Fui	nctional	and a	esthe	tic asp	ects of	f liahti:	ina - Of	ffices	Reside	ences. H	lospital	s. Malls	. Musi	eum l i	ahting	-Glaz	ng ma	teria	ls: So	ources	and c	oncen	ts of on	tical m	aterial.	s- Cor	ncepts
of day lighti lighting con	ing- Compone trol for day lig	nts of hted b	daylight ouildings-	factor - Com	s and R parison	lecom of day	mend y and	ed day electri	(light fai ical ligh	ictors- iting	- Day li	lighting	g analy	sis- Eleo	ctrical li	ghting	and III	umina	ion re	quire	nent-S	elec	tion o	of lumi	naries	and p	erforma	ance pa	aramet	ters-E	lectric

### Unit-5 - Green Buildings and Standards

9 Hour

Sustainability - need and challenges, Environment benefits of green buildings, Integrated ecological design, Effluent management systems-environmental acts and protocols-ISO 14000-Green building features and green construction materials-Green building standards, ratings and certifications - Green Globe, LEED, GRIHA, IGBC, Socioeconomic aspects of green buildings, Sustainable urbanization, Governmental proposal on green buildings.

	1.	Means R.S., "Green building: project planning and cost estimating", Kingston, 2006	4.	Eicker U., "Low Energy Cooling for Sustainable Buildings", Wiley, 2009
Loorning	2.	Kibert C.J., "Sustainable Construction: Green Building Design", 2nd edition, Wiley,	5.	Gevorkian P., "Alternative Energy Systems in Building Design", McGraw-Hill, 2010
Dessuress		2007	6.	Jan. F. Kreider, "Hand book of heating, ventilation and Air-conditioning", 1st Edition, CRC press,
Resources	3.	Boecker J., Scot Horst, Tom Keiter, Andrew Lau, Markes Sheffer, Brian Toevs, Bill		2019
		Reed, "Integrative Design Guide to Green Building", Wiley, 2009.	7.	Eagan D. M., "Architectural Lighting", 2nd Ed. McGraw-Hill, 2002.

Learning Assessme	ent						
			Continuous Learn	ing Assessment (CLA)		Quin	motivo
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CLA (109	Learning A-2 %)	Final Ex (40% w	native amination eightage)
		Theory	Practice	Theory	Practice	<u>Th</u> eory	Practice
Level 1	Remember	20%	Sec. Print St.	20%		20%	-
Level 2	Understand	20%		20%		20%	-
Level 3	Apply	60%	S	60%		<u>60%</u>	-
Level 4	Analyze	7	10 S H B 10 S		-	-	-
Level 5	Evaluate						-
Level 6	Create						-
	Total	10	0%	100	%	10	0%

C	burse Designers		
E	operts from Industry	Experts from Higher Technical Institutions	Internal Experts
1	. Mr. R.Karthick GM Operations Flexiflo India Pvt Limited Alwarpet	1. Dr. S. Suresh, Associate Professor, Dept. of Mechanical Engineering, National	1. Dr C. Selvam, SRMIST
	Chennai,karthik@flexiflo.ae	Institute of Technology, Tiruchirappalli - 620 015	
2	. Mr R.M Raghunathan Assistant Vice President, TamilNadu	2. Dr. Lovelyn Theresa Innocent, Senior Project Manager, Energy, Environment &	2. Dr. R. Senthil, SRMIST
	PetroProducts Limited, Manali Chennai,mlrmr@hotmail,com	Climate Change (EECC), Renewable Cogen Globe, St. Thomas Street, Egattur,	
		Navalur, Chennai – 603103	
		A STATE OF	3. Dr.P. Sundaram, SRMIST

Course Code	21ME0111T	Course Name	EN	IVIRONMENTAL POL	LUTION AND ABATEMENT	Cor	urse gory	0				OPEN	ELEC	TIVE				- T 3 0	P 0	C 3
Pre-requi Course	site s	Nil		Co- requisite Course <mark>s</mark>	Nil		Progres Cours	ssive ses						Nil	1					
Course	Offering Departme	ent	Mechan	nical Engineering	Data Book / Codes / Stan	ndards							Nil							
Course Le	arning Rationale	(CLR): T	The purpose of	of learning this cour	se is to:		1			Progr	am Ou	utcome	s (PO	)				Pi	rograi	m
CLR-1:	Familiar the princ	iples and me	ethods of con	trolling various types	of pollution.	1	2	3	4	5	6	7	8	9	10	11	12	S OU	pecifi tcom	c es
CLR-2:	Understand the e	mission con	ntrol t <mark>echnique</mark>	es.	Summer 1	ď		+	of	34	ety			¥		6				
CLR-3:	understand water	treatment a	and solid remo	oval methods	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	leda		ent o	tions	e	soci			Wor		ance	5			
CLR-4:	Familiar with aero	bic and ana	a <mark>erobic tre</mark> atm	nents.	We have been	Mou	lysis	opme	stiga	Usaç	and	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		eam	uo	& Fin	urninç			
CLR-5:	Familiar with the	nature of <mark>sol</mark>	o <mark>lid wast</mark> e and	their disposal.			m Ana	/devel	ct inve	n Tool	Igineer	nment		ual & T	unicati	t Mgt. 8	ng Lea			
Course Or	utcomes (CO):	A	At the end of	this course, learner	s will be able to:	Enaine	Proble	Design	Condu	Moder	The er	Envirol Sustaii	Ethics	Individ	Comm	Project	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Explain the basic	s of poll <mark>ution</mark>	<mark>n and</mark> the con	trol methods	A DECK PLANE	120	-	-	-	-	2	2	-	-	-	-	-	-	-	-
CO-2:	Differentiate abou	ıt variou <mark>s air</mark>	<mark>ir poll</mark> utants ar	nd emission control te	chniques.	-	10.00		-	-	3	3	-	-	-	-	-	-	-	-
CO-3:	Compile the wate	r treatm <mark>ent i</mark>	methods and	solid removal	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1			3		_	2	-	-		-	-	-	-	-	-
CO-4:	Describe the Aero	obic an <mark>d ana</mark>	aerobic treatm	nents			-		-	-		3	-	-	-	-	-	-	-	-
CO-5:	Analyze the vario	us Soli <mark>d was</mark>	<mark>iste di</mark> sposal n	nethods.	Contraction of the	-15-		1	-	-	2	3	-	-	-	-	1	-	-	-
Unit-1 - Ba	asics of Pollution	and Preven	ntion	C. N. C.							£								9	Hour
Environme energy rec Solid waste	ntal Laws, Rules a overy and waste uti e effects, control	nd Standa <mark>rd</mark> ilization, Mat Nuclear was	<mark>ds – Cl</mark> assifica terial and ener ste- effects, co	ation of pollutions, So rgy balance for polluti ontrol. e-waste materi	urces of pollutions and its impacts, on minimization. Air pollution- effect al and its impact. Pollution control th	Process s, control, brough ho	modific Water usekee	ation: a use - ei ping ar	alternati ffects, c nd main	ve raw ontrol, tenanc	Land	rial, rec pollutio aitive er	overy n - effe nissio	of by p ects, co n, efflue	oroduci ontrol, I ents an	t, Recy Noise p nd leak	cle and ollutior ages	d reus า- effec	e of w cts, co	aste, ntrol,
Unit-2 -Air	Pollution							, y e			-, 3			,					9	Hour
Air quality formation of concentrat sources an Fabric filte	<ul> <li>factors affecting of carbon monoxide ion, alternatives for d its impact, Contro rs and absorbers, F</li> </ul>	air quality- s , Total Susp CFCs, glob ol techniques Pollution cont	stand <mark>ards of a</mark> pended Partic pal warming a s of air pollutic atrol - Design o	air quality, Air pollutio ulate Matter, Respiral nd climate change, O ons, Wet Gas Scrubbin consideration and limi	n from Industry, power plants, Vehi ole Particulates, Photo-chemical oxi zone layer depletion- ozone depleti ng Techniques, Gaseous Emission ( tations, Modern Tool usage - monito	icle air po idants. Ot ing proces Control By oring	llution, her poll sses, oz Absorp	Source utants, one ho otion M	es and f Greenh le. Env ethods	ormati ouse e ironme and Ac	on of S effect, ental ef Isorptie	Sulfur c -greenl ffects a on Meth	oxides house nd stra hods, (	(SOx); gases: ategies Cyclone	; nitrog : CO2, : for oz es, Ele	en oxic CH4, N one lay ctrostai	tes (No 120, C ver prot tic Prec	Dx), So FCs, v tection cipitatio	ources vater v , Acid on- De	3 and /apor rain- 3sign,
Unit-3 - W	ater Pollution	ad induction :	Motor poll: #	an from due industri	and intrinductors Mator as the stars for	10 m tou!!!	la att-	n in d	ten ( Di-	la gia -	Luntel		lluto	ь <i>Г</i> #-		Dallutar	40.0-	Land	9	Hour
vvater poll	ution – Domestic al	na industry,	vvater pollutio	on from aye industry	and Ink Industry, water pollution fr	rom textile	, leathe	er indus	stry, Bic	logical	uptak	te ot po	nutant	s, Ette	ct Ut F	ollutar		Land	vegeta	ation,

Water pollution – Domestic and industry, Water pollution from dye industry and ink industry, Water pollution from textile, leather industry, Biological uptake of pollutants, Effect Of Pollutants On Land Vegetation, Effect Of Pollutant, Consequences on human health., Physical treatment- pre-treatment, solids removal by settling and sedimentation, Filtration and centrifugation, Coagulation and flocculation's On Land Animals And Human Health, Bio-deterioration, bioaccumulation, Bio-magnification and eutrophication, Infectious microbial agents in water system

Unit-4 -	Biologica	al Treatment
----------	-----------	--------------

9 Hour

Anaerobic degradation of organic matter, Trickling filter – Process description, Aerobic treatment – aeration units, Biochemical kinetics: hydraulic detention time, mean residence time, Types of activated sludge process, Tapered aeration, Stepped aeration, sludge separation, Aerobic treatment units (ponds, lagoons, oxidation ditch, Factors affecting anaerobic digestion process, Secondary Biological treatment: Aerobic activated, sludge process, Sequential batch process. fluidized bed Reactor, Secondary Biological treatment: Anaerobic-UASB, MBR –Merits and Demerits, Sludge Treatment: Volume Reduction, Dewatering; Sludge drying; Composting, Sludge Treatment: Fluidized bed, incineration

#### Unit-5 - Solids Disposal

9 Hour

Solids waste disposal – composting process and its phases, Sanitary landfill- Principle and process, Gasification process, Upward, Downward, cross draft gasifier, Incineration and Pyrolysis, Quantum and nature of solid waste, bio methanation -phases involved and factors, Pelletization, landfill and gas recovery municipal solid waste disposal- Best management practices for containers, Reuse, Recycling, and Resource Recovery, Hazardous Waste- Waste Processing And Handling- Transportation Of Hazardous Wastes- Recovery Alternatives, Radioactive Waste – Source of radioactive waste, Health effects, Solid and Hazardous, Waste Law.

	1.	Vallero D; "Fundamentals of Air Pollution", 4 th Ed; Academic Press, 2008	4.	Pichtel J; "Waste Management Practices: Municipal, Hazardous and Industrial", CRC, 2005
Learning	2.	Eckenfelder W.W; "Industrial Water Pollution Control", 2 Ed; McGraw Hill, 2000	5.	Tchobanoglous G., Burton F. L. and Stensel H.D., "Waste Water Engineering: Treatment and
Resources	3.	Kreith F. and Tchobanoglous G., "Handbook of Solid Waste Management", 2 Ed; Mc		Reuse", 4th Ed; Tata McGraw Hill,2010
		Graw Hill, 2002	6.	Ruth F.Weiner and Robin A.Mathews Environmental engineering 4th edition

Learning Assessme	nt			Carlo Carlo							
			Continuous Learning	Assessment (CLA)	1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	Summative Final Examination (40% weightage)					
	Bloom's Level of Thinking	Form CLA-1 Avera (50	ative ge of unit test %)	Life-Long CL (10	Learning A-2 1%)						
		Theory	Practice	Theory	Practice	<u>The</u> ory	Practice				
Level 1	Remember	15%		15%		15%	-				
Level 2	Understand	25%		25%	.)	25%	-				
Level 3	Apply	30%		30%	· · ·	30%	-				
Level 4	Analyze	30%		30%		<mark>3</mark> 0%	-				
Level 5	Evaluate						-				
Level 6	Create				-	-	-				
	Total	100	)%	100	0%	10	0 %				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. M Malathi, Manager R &D, IP Rings	1. Dr. S.K. Rani Professor& Dean (SP &CS) Crescent Institute of Science and Technology	1. Dr. V. Praveena, SRMIST
2. Mr . R.Karthick GM Operations Flexiflo India Pvt Limited	2. Dr. P. Thirumal, Government College of Engineering Bargur	2. Dr. P. Chandrashekaran, SRMIST
Alwarpet Chennai.karthik@flexiflo.ae		

Course Code	21MEO112T	Course Name	RCES AND APPLICATIONS	Cour	se ory	0				OPEN	ELECI	IVE			L 3	- T 3 0	P 0	C 3		
Pre-requi Course	site s	Nil	Co- requ Course	isite s	Nil	P	rogres Cours	sive es						Nil	1					
Course (	Offering Departme	ent	Mechanical Engine	ering	Data Book / Codes / Stan	dards							Nil							-
-				-	to the second	-	1.0	1												]
Course Le	arning Rationale	(CLR): The	e purpo <mark>se of learnin</mark> g	this course	is to:		1	-		Progra	am Ou	Itcome	s (PO)	)			-	- Pr	ograr necifi	n C
CLR-1:	Enrich the studen	its in the basic	es of solar energy	- 12	1	1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	es
CLR-2:	CLR-2: Develop knowledge in wind energy conversion system								s of	5	iety			ork		е				
CLR-3: Knowledge on ocean, tidal energy and geothermal								ento	ation	ge	soc		-	א ר		Janc	g			
CLR-4:	Enrich knowledge	e in energy <mark>ge</mark>	neration by biomass			Ano	lysis	mdo	stiga	Usa	anc	৵		Tean	ы	& Fir	arnin			
CLR-5:	Acquire knowledg	ge in fuel <mark>cell a</mark>	and other energy conv	ersion system	S	ring I	Ana	level	inve	Tool	neer	nent bilitv		al & T	icati	Agt. 8	g Lea			
			A State of the second sec			nee	lem	ign/c	duct	ern	eng	taina	S	/idu	Inwu	ect I	Lon	÷	-2	-3
Course Ou	itcomes (CO):	At	the end of this cours	e, learners w	ill be able to:	Eng	Prot	Des	Con	Mod	The	Sus	Ethi	Indiv	Con	Proj	Life	PSC	PSC	PSC
CO-1:	Recognize solar e	energy s <mark>ystem</mark>	<mark>is a</mark> nd current applicat	ions	ALC: NAME AND	3	-	-	-			3	-	-	-	-	-	-	-	-
CO-2:	Describe knowled	lge on <mark>wind er</mark>	nergy conversion syste	ems		3	-	100	-	-		3	-	-	-	-	-	-	-	-
CO-3:	Discuss the ocea	n, hydr <mark>o and g</mark>	<mark>geo</mark> thermal energy the	ories and con	cept	3	-		-	-	1	3	-	-	-	-	-	-	-	-
CO-4:	Enumerate the us	se biolo <mark>gically</mark>	degradable resources	and its energ	y conversion processes	3	-	-	-	-	1	3	-	-	-	-	-	-	-	-
CO-5:	Identify renovate	future e <mark>nergy</mark>	<mark>nee</mark> d towards renewa	ble en <mark>ergy</mark>	Tat of the second	3	-	1.1	-	-	1	3	-	-	-	-	-	-	-	-
Unit-1 - So Introduction global radia plants. Class Solar photo Unit-2 - Wi Wind energ Horizontal Betz's law, Unit-3 - Oc Current soc	Iar Energy n to Energy Science ation. Measurement ssification of solar of sovoltaic systems: be ind Energy gy scenario in India axis wind turbine A Wind Turbine Aero sean, Hydro and G searo, Ocean Th	e & Technolo, at of global - o concentrators, asic working p a and the world cuch as Single bodynamics, win <b>Seothermal En</b> ergy	gy, Forms of Energy, liffuse - beam radiatio Basic definitions - con rinciple, components, d, Origin of wind, natu blade, Two blades, T hd turbine types and the nergy	Vature of sola 1. Principle of centration ratio and its applica re of wind, wir ypes of Horiza teir construction wstem - open	r radiation - spectrum - constan working of solar water heating s o, angle of acceptance, Drawback ations. ad data measurement, Variation ontal axis wind turbine such as I on, wind-diesel hybrid system, en	t - extra-tei systems - ( ks/Real fiel of Wind Sp Multi blade nvironment	rrestria cooker d issue beed w s, Duto al aspe	I radiat s- desa es in sou ith Heig ch and ects, Wi	ion on Ilinatior Iar thern ght, Bas Sail typ ind Ene	a horiz o syste mal syste sics of e, Ver ergy St	contal ms - p stems, fluid n tical a orage.	surface oonds - sensib nechan xis wind	, atten chimn le and ics, Es d turbi	uation ey pov latent timatic ne suc	of sola wer pla heat th on of V ch as S	ar radia ant, cer ermal e Vind En Savoniu	ation, b htral po energy nergy a s Roto	eam, c wer to storag t a Site r, Dan	9 diffuse wer p e syst 9 e: Typ rieus 9 conve	Hour and ower ems, Hour res of Type, Hour
systems, G	eothermal energy:	Origin, applic	ations, types of geothe	rmal resource	es. Hydroelectric power plant.	nai inipacti	, uidi	enyes,	uuai ei	ergy -	Siriyit	มลงเป		UDIE D	αδιτι μι	ano. V	vave el	leigy	JOINE	131011
Unit-4 - Bio	omass																		9	Hour
Biomass, S Operation o	Sources of biomass of biogas plants, Ap	s, Pyrolysis, co oplications	ombustion and gasifica	tion pr <mark>ocess,</mark>	Updraft and downdraft gasifier, I	Fluidized b	ed gas	ifier, Fe	ermenta	ation a	nd dig	estion p	proces	s, Fixe	ed and	floating	l digesi	ter bio	gas pl	ants,

9 Hour Hydrogen - properties - production techniques - storage - transportation. Fuel cell principles and its classification, Types - Phosphoric acid, polymer electrolyte membrane fuel cell, molten carbonate fuel cell and solid oxide fuel cell, Fuel cell conversion efficiency and applications.

	1.	G.D Rai, "Non-Conventional Energy Sources", Khanna Publishers, 5th Edition, New	3.	B.H Khan, "Non-conventional Energy Resources", 2nd Edition, New Delhi, Tata McGraw Hill,
Learning		Delhi, 2011	1	2009
Resources	2.	Godfrey Boyle, "Renewable energy", 2nd Edition, Oxford University Press, 2010	4.	S.P. Sukatme, J.K. Mayak, "Solar Energy-Principles of thermal collection and storage", 3rd edition,
				New Delhi, McGraw Hill,2008

rning Assessme	ent		1997 C		11					
		A. A. A.	Summativo							
	Bloom's Level of <mark>Thinking</mark>	Form CLA-1 Avera (50	native ge of unit test 1%)	Life-Long CL (10	g Learning .A-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	25%		25%		25%	-			
Level 2	Understand	25%		25%		25%	-			
Level 3	Apply	50%		50%		50%	-			
Level 4	Analyze			-1		-	-			
Level 5	Evaluate			the second		-	-			
Level 6	Create	D TOT PAS		The second		- 12	-			
	Total	100	)%	10	0%	100 %				

Course Designers													
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts											
1. Dr. GireeshYanamashetti, National Aerospace Laboratory, Bangalore	1. Dr. T. Venugopal, VIT Chennai	1. Dr. V. Mathanraj SRMIST											
2. Dr. G. Muthuselvan, National Aerospace Laboratory, Bangalore	2. Dr. Saleel Ismail, NIT Calicut	2. Dr. S. Balaji, <mark>SRMIST</mark>											



Course Code	21MEO113J	Course Name	ELECT	RONICS	THERMAL MANAGEMENT	Cou Categ	rse J <mark>ory</mark>	0				OPEN	ELEC	TIVE				- T 2 0	P 2	C 3
Pre-requi Course	site s	Nil	Co- ree Cours	uisite es	Nil	P	rogres Cours	sive ses						Nil	,					
Course	Offering Departme	ent	Mechanical Eng	neering	Data Book / Codes / Stand	lards							Nil							
Course Le	arning Rationale	CLR): T	he purpo <mark>se of learni</mark>	ng this co	ourse is to:		1	1		Progr	am Ou	itcome	s (PO	)				Progra		m
CLR-1:	Understand the th	nermodynam	nics and <mark>heat trans</mark> fer	for electro	nic cooling applications	1	2	3	4	5	6	7	8	9	10	11	12	00	pecifi itcom	ic ies
CLR-2:	Understand how	e for electronic cooling	e		J.	s of	30	lety			ž		0			,				
CLR-3:	Understand the u	or the thermal management of electronic	/ledc		ento	tions	e	soc			Ŵ		ance	5						
CLR-4:	Familiarize with r	adiation heat	t transfer for electronic	cooling a	applications	- Vou	ysis	bmqo	stiga	Usaç	and	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		eam	ы	ΥE	min			
CLR-5:	CLR-5: Familiarize with methods for the thermal management of electronics							evel	inve	8	neer	bility		I & T	icati	lgt. 8	Lea			
								gn/d	duct	ern 1	engi	ronm ainal	s	idua	unu	ect N	-ong	5	4	က္
Course Outcomes (CO): At the end of this course, learners will be able to:						Engi	Prob	Desi	Conc	Mode	The	Envii Sust	Ethic	Indiv	Com	Proje	Life I	PSO	PSO	PSO
CO-1:	Explain the therm	odynam <mark>ics</mark> a	<mark>and h</mark> eat transfer for e	l <mark>e</mark> ctronic d	cooling applications	2	-	-	-	-			-	-	-	-	-	-	-	-
CO-2:	Apply the concep	ts of ele <mark>ctror</mark>	<mark>nics</mark> thermal managen	nent desig	n process in printed circuit boards	3	1	-	-	3		-	-	-	-	-	-	-	-	-
CO-3:	Use conduction h	eat tran <mark>sfer</mark> .	<mark>met</mark> hods for electronic	cooling a	applications			-		3	- 10	-	-		-	-	-	- 1	-	-
CO-4:	Apply radiation he	eat tran <mark>sfer r</mark>	<mark>meth</mark> ods for electronic	cooling a	pplications	1		-	1	3		-	-	-	-	-	-	- 1	-	-
CO-5:	Analyze the instru	ımentat <mark>ion n</mark>	<mark>netho</mark> ds for the therma	al manage	ement of electronics		-	1.1	1	3	1	- 10	-	-	-	-	-	-	-	-
			1		Colling of the second								-							
Unit-1 - Ini	troduction	nda alaatra	nia naakasing and ma	tariala ha	at transfer mechanisme in electronic ab			forala	atua mi a	analia	× 1/00	lalina a	n d aine	ulation	ofolo	otronio	avatar		<u>12</u>	Hour
Semiconal	ncior lecrinology life	nas, electrol ansfer	nic packaging and ma	enais, ne	at transfer mechanisms in electronic chi	ps, requi	ement	ior eie	ctronic	coonn	<i>], MOC</i>	eiing a	na sin	ulation	i oi eie	ctronic	systen	is coc	<u>))))))</u> 12	Hour
Conduction	- thermal resistance	e networks	conduction in chip ca	riers and	PCB Modeling and simulation of electro	onic syste	ems' co	olina		27				_					12	noui
Unit-3 - Co	onvection Heat Tra	ansfer		nore and				oningin		1									12	Hour
Natural and	d forced convection	, heat sinks,	fan selection, cold pl	ate - mini	and microchannel heat exchangers, jet i	mpinger	ent, m	odeling	and si	mulatio	on of e	lectron	<mark>ic sy</mark> st	ems' c	ooling.					
Unit-4 - Ra	diation Heat Tran	sfer		1	$C = 1 + \lambda + \delta + \lambda + \lambda + \delta + \delta + \delta + \delta + \delta + \delta$	1.1.1.	-		1.11	1									12	Hour
Radiation intensity - emissive power- blackbody radiation- radiative properties of surfaces, radiosity, view factors, radiation transfer between black bodies, modeling and simulation of electronic																				
Unit-5 - Fl	ectronic Systems	and Measu	rements			-			-										12	Hour
Measurem	ents in electronic s	/stems, flow	Rate - pressure -velo	city - tem	perature - acoustic Noise, simulation of e	electronic	system	ns' cool	ling.											

	<ol> <li>A Younes Shabany, "Heat Transfer", CRC Press, Taylor &amp; Francis Group, 2010</li> </ol>
Loarning	2. L. T. Yeh, R. C. Chu, "Thermal Management of Microelectronic Equipment', ASME
Learning	Press Book Series on Electronic Packaging, ASME Press New York, 2007
Resources	3. Ansys® Academic Research Mechanical, Release R 2021, Help System, Coupled
	Field Analysis Guide, ANSYS, Inc. Drive Canonsburg, PA 15317, July 2021.

 Santiago Pagani Jian-Jia Chen, Muhammad Shafique Jörg Henkel, "Advanced Techniques for Power, Energy, and Thermal Management for Clustered Manycores", Springer Nature, 2018.
 Kothandaraman. C. P., Subramanyan, S, "Heat and Mass Transfer Data Book", New Age International, 7th edition, 2012.

			Continuous Learning	g Assessment (CLA)		Summative Final Examination (40% weightage)					
	Bloom's Level of Thinking	Forn CLA-1 Avera (45	native ge of unit test 5%)	Life-Lon CL (1	g Learning _A-2 5%)						
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	15%			15%	15%	-				
Level 2	Understand	25%	Start Cold		25%	25%	-				
Level 3	Apply	30%			30%	30%	-				
Level 4	Analyze	30%		Contraction of the	30%	30%	-				
Level 5	Evaluate		and the second	17/23-144		-	-				
Level 6	Create			A	25 J . 1-	-	-				
	Total	10	0%	10	0 %	10	0%				

Co	ourse Designers				
Ex	perts from Industry	Exp	erts from Higher Technical Institutions	Inter	rna <mark>l Experts</mark>
1.	Dr. Prabhakar Subrahmanyam prasub@gmail.com	1.	Dr. Raju Abraham Scientist NIOT, Chennai	1.	Prof. B. K. Gnanavel, SRMIS
2.	Dr. N Saravanan, Principal Engineer, Smart Implements &	2.	Dr. Pandiyarasan Veluswamy, IITDM, Chennai Email: pandiyarasan@iiitdm.ac.in	2.	Dr. S. Manikandan, SRM IST
	Machinery and Sustainability. Mahindra				



Code	21MEO114T	R SOCIETAL APPLICATIONS	Cat	burse tegory		0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3			
Pre-requi Course	site es	Nil		Co- requisite Course <mark>s</mark>	Nil		Progr Cou	ress urse	ive s						Ni	I					
Course	Offering Departme	nt	Mech	anical Engineering	Data Book / Codes / Stand	dards								Nil							
Course Le	arning Rationale (	CLR):	The purpos	e <mark>of learning this co</mark>	urse is to:				1		Progr	am Ou	utcome	s (PO	)				P	rogra	m
CI R-1:	Familiarize with th	e hasics	s of solar radia	tion data and its meas	surement		1 3	2	3	4	5	6	7	8	9	10	11	12	Specific		
CI R-2-	Familiarize with th	o constr	ruction and an	plications of low-temp	erature solar thermal energy systems				Ű	of .	-	Ę		Ŭ	v v	10			ou	tcom	es
CI P_2	Comprohend the		edge		nt of	suo	0	ocie			Nor		nce								
CLR-J.		-11	in in	SIS	Iamo	igati	sage	spu			am	_	Fina	ning							
CLR-4:	Familiarize with th	e aesigi	n of solar photo	ovoitaic systems for s	andaione and grid-tied applications	``	g VL	naly	/elop	vest		er a	int & lity		& Te	atior	t. &	-ean			
CLR-5:	illustrate solar ene	ergy utiliz	zation in buildii	ngs and architectural	applications		serin	E H	ns ns	ct in ex pi	n To	gine	nme nabi		ual 8	unic	t Mg	ng L			
Course Or	Itcomes (CO):		At the end	of this course learn	ers will be able to:		ahlo	obie	esign	upulo mple	oder	le er	nviro ustai	thics	divid	mmo	ojec	fe Lc	SO-1	SO-2	SO-3
	Recognize solar	radiatio	n geometry	solar angles, and th	e working of solar radiation measu	urina L		Σ		08	Σ	Ē	шō	Ξ	<u>_</u>	Ō	ā		ă,	č -	ă
CO-1:	instruments	, aaraa a	, geeniea), t	sonar angroo, ana a		g	-	1	1	• -		-		-	-	-	-	-	-		-
CO-2:	Analyze the com industrial applicati	ponent <mark>s</mark> ons	s and working	of low-temperature	solar thermal systems for domestic	and	- :	3		-	-	1	3	I	-	-	-	-	-	-	-
CO-3:	Identify the selecti	ive pro <mark>ce</mark>	<mark>esses o</mark> f conce	entrated solar collector	rs for maximum utilization of solar radia	ation	-	3	-	-	-	-	3	-	-	-	-	-	-	-	-
CO-4:	Utilize solar radiat	ion for <mark>p</mark>	o <mark>hotovolt</mark> aic po	wer generation and se	elective applications	1	- 2	2		-	-	1	3	-	-	-	-	-	-	1	-
CO-5:	Utilize solar energ	y for bu	i <mark>lding ther</mark> mal a	and visual comforts th	rough active and passive techniques.		- 2	2	-	-	-	-	3	-	-	-	-	-	-	-	-
Unit-1 - So	blar Radiation Meas	sureme	nts plar anglos rad	liation mossuring inst	umonte Duranomator Durhaliamator	Durao	omotor		1 Suna	hino ra	cordo	r	_	-						9	Hour
Unit-2 - Lo	w-Temperature Sc	olar Svs	stems	auon measuring insu	uments – r yranometer, r ymenometer	, r yrge	Unielei	anu	i Suna	silli e re	corue			-						9	Hour
Solar thern	nal collectors – Flat	plate an	nd eva <mark>cuated tu</mark>	ube solar collectors- s	olar dryers- desalination-solar pond. C	ase stu	dies or	n Fla	t plate	e solar	collect	ors.									
Unit-3 - Hi	gh-Temperature Se	olar Sys	stems			-					100	-								9	Hour
High tempe	erature solar collect	ors – Co	oncentration pr	inciples, Compound p	arabolic collectors, Parabolic trough co	ollector	s, Para	bolic	c dish	collect	ors, Li	near F	resnel	collect	tors, D	irect S	team g	enerati	ion, Ce	entral	tower
Init-4 - Sc	eradon. Industrial pr plar Photovoltaics	ocess n	lealing applicat	lions. Case studies of			-	-	-		-									9	Hour
Solar photo	ovoltaics, componen	nts of ph	otovoltaic pow	er plants, fill factor, m	aximum power point tracking, standaloi	ne and	grid-co	nneo	cted s	ystems	, Stree	et light	ing, bifa	icial P	V, floa	ting ph	otovolt	aic plaı	nts, hy	brid ei	nergy
systems, B	Building integrated p	hotovolta	taic systems. C	ase s <mark>tudies on sola</mark> r p	photovoltaic plants.		-														
Unit-5 - So	olar Energy Utilizat	ion in B	Buildings		<b>T</b> 1	r. 1. c			,			0.1								9	Hour
Active and systems, s	passive heating, so olar vapor absorptio	olar pas on coolin	sive architectu ng systems.	re, building orientatio	n, sunspaces, Trombe mass wall, day	riighting	, light i	oipe,	, solai	r earth	tunnel	, Sola	r photo	voltaic	c opera	ated va	pour co	ompres	ssion r	etrigei	ation

Learning Resources	1. 2. 3.	Soteris A Kalogirou, Solar Energy Engineering: Processes and Systems, Academic Press, UK, 2nd Edition, 2014. S P Sukhatme, J K Nayak, Solar Energy, McGraw Hill Education, 4th Edition, 2017. John A. Duffie, William A. Beckman, Solar Engineering of Thermal Processes, Wiley, 4th Edition, 2013.	4. 5. 6.	G.N. Tiwari, A. Tiwari, Shyam, Handbook of Solar Energy: Theory, Analysis and Applications, Springer, Singapore, 2016. D. Yogi Goswami, Principles of Solar Engineering, 4th Edition, CRC Press, 2015. R. Foster, M. Ghassemi, A. Cota, Solar Energy: Renewable Energy and the Environment, CRC press, 1st Edition, 2010.
			1	

			Continuous Learning	Assessment (CLA)		Cum	mativa				
	Bloom's Level of Thin <mark>king</mark>	Form CLA-1 Avera <u>c</u> (50	ative je of unit test %)	Life-Lon Cl (1	g Learning LA-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%		20%		20%	-				
Level 2	Understand	20%	A start have	20%		20%	-				
Level 3	Apply	30%		30%		30%	-				
Level 4	Analyze 📃 🔤	30%-		30%-	-	30%-	-				
Level 5	Evaluate		and the second	19/1		-	-				
Level 6	Create			A	25 J . /-	-	-				
	Total	100	%	10	0 %	10	0%				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Soumitra Mukhopadhyay, SMS India Pvt. Ltd, Kolkatta	1. Dr. M.K. Gaur, MIGTS, Gwalior	1. Dr. R. Senthil, SRMIST
2. Mr. Prabhat Kumar, Adani Power Ltd, Pune	2. Dr. P. Thirumal, Government College of Engineering Bargur	2. Dr. S. Manikandan, SRMIST
		3. Dr. V. Thirunavukkarasu, SRMIST



Course Code	e 21MEO115T Course INTRODUCTION TO DRONES				ON TO DRONES	C	Cours atego	e ory	0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3
Pre-requi Course	site s	Nil	Co- Coi	requisite Jrse <mark>s</mark>	Nil		Pro	ogres Cours	sive es						Nil						
Course (	Offering Departm	ent	Mechanical <mark>E</mark>	ngineering	Data Book / Codes /	Standards	5							Nil							
Course Le	arning Rationale	(CLR): 7	The purpose of lear	ning this cours	se is to:			1			Progra	am Ou	Itcome	s (PO	)				P	rogra	m
CLR-1:	Classify the basi	cs of aerial v	vehicles		1. 200		1	2	3	4	5	6	7	8	9	10	11	12	S OU	pecif utcom	ic Ies
CLR-2:	Explain the basic	s principles	of flig <mark>ht</mark>		1 and the	1	Ð		<del>т</del>	of	3	ety			¥		-				
CLR-3:	Understand the d	components	of flight control system	ems			vledg		ent o	ations	ge	soci			Nor C		ance	D			
CLR-4:	R-4: Examine the navigation and control of aerial vehicle							lysis	mdo	stige	Usa	and	৵		[ean	u	& Fi	arnin			
CLR-5:	LR-4:       Examine the navigation and control of aerial vehicle         LR-5:       Acquire knowledge of design principles of drones							em Ana	jn/devel ons	uct inve lex prot	rn Tool	angineer	onment inability	0	dual & 7	nunicati	ct Mgt.	ong Lea	5	5	
Course Ou	Itcomes (CO):		At the end of this c	ourse, learners	s will be able to:	111.127	Engir	Probl	Desig	Cond	Mode	The e	Envin Suste	Ethics	Indivi	Comr	Proje	Life L	-OS-	-OS-	-OS
CO-1:	Classify the vario	ous unm <mark>anne</mark>	<mark>ed ae</mark> rial vehicles		A State States	34	2	1		-	2	1	-	-	-	-	-	-	-	-	-
CO-2:	Examine the vari	ous prin <mark>ciple</mark>	<mark>es in</mark> volved in flight d	control system			2	1	10		-	-	_	-	-	-	-	-	-	-	-
CO-3:	Classify the vario	ous devi <mark>ces</mark> d	of drones		1.11.11.11.11.11		1	1	- 2-	-	2	- 10	-	-		-	-	-	-	-	-
CO-4:	Classify the navig	gation a <mark>nd c</mark>	control devices of ae	rial vehicles	and the second second	200	2	1		-	1	-	-	-	-	-	-	-	-	-	-
CO-5:	Investigate the d	esign an <mark>alys</mark>	<mark>sis and</mark> manufacturin	g of drones	1		-	1	List.	2	-	2	- 10	-	-	-	-	-	-	-	-
Unit-1 - Int UAV histor	troduction to Unn y, Director Genera	nanned Aer al of Civil Au	<mark>ial Vehicle</mark> viation (DGCA) clas	sifications of U	AVs, Types and Characteristi	cs of Drone	es - Fi	xed ro	otor, m	ultiroto	r, and	flappiı	ng wing	ı, Appl	licatior	ns - De	fense,	civil a	nd en	<b>9</b> vironn	<b>Hour</b> nental
monitoring, Unit-2 - Fu	ndamentals of FI	iaht		6						-	-									9	Hour
Different ty	pes of Flight vehic	les, Compo	one <mark>nts and fun</mark> ctions	of an airplane,	Forces acting on airplane, ph	nysical prop	erties	and s	tructure	e of atn	nosphe	ere, Ae	erodyna	amics ·	- aerof	oil non	nenclat	ure, Cl	haract	eristic	s, Lift
and Drag, I	Propeller theory/M	omentum the	eory, propulsion and	l airplane struct	ures	100		-			125	-									
Componen	ements of Unman	ned venici	e electronic speed cor	troller (ESC) fli	ight controller - propulsion. Da	ta link Son	sore a	nd Pa	who	GPS		iaht [	otactio	n and	Ranai	na (LiE	AR) I	manino	1 Cam	<u>9</u>	Hour Hyper
spectral se	nsors, Laser Deteo	ction and Ra	anging(LADAR), Syn	thetic Aperture	Radar(SAR), Thermal camera	as, ultra - so	nic de	tector	s.	, 01 0,	110, 1		electio	ii anu	nanyi	ig (LiD	, ny, n	naying	Came	<i>i</i> as, i	туры
Unit-4 - Na	vigation and Gui	dance								-										9	Hour
Introduction	n to navigation sys	tems, types	of guidance, mission	n planning and o	control, case studies on paylo	ads.			-	-										0	Hour
Design of c	sign of drone components, structural and Aerodynamic analysis, Building of Drones - main parts - 3D print						ə studi	es												9	nour

	1.	Andey Lennon, "Basics of A/C Model aircraft Design" Model Airplane News	4.	John Baichtal, Building your Own Drones; A Beginers' Guide to Drones, UAVs, and ROVs, Pearson
		Publication, 1996		Education, 2015
Learning	2.	Terry Kilby and Belinda Kilby, "Make: Getting Started with Drones", Maker Media,	5.	K. Valavanis, George J Vachtsevanos, handbook of Unmanned Aerial Vehicles, New York, Springer,
Resources		Inc, 2016.		2016.
	3.	Donald Norris, "Build Your Own Quadcopter -Power up Your Designs with the	6.	Randal W. Beard, Timothy W. McLain, "Small Unmanned Aircraft", Theory and Practice, Princeton
		Parallax Elev-8", McGraw-Hill Education, 2014.	1	University Press, 2012.

Learning Assessme	ent		Continuous Leorning	x Assessment (CLA)			
	Bloom's Level of Thin <mark>king</mark>	Forn CLA-1 Avera (50	ative ge of unit test 0%)	Assessment (CLA) Life-Lon Cl (1	g Learning LA-2 0%)	Sum Final Ex (40% w	mative amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	A State of the second	15%		15%	-
Level 2	Understand	25%		20%		25%	-
Level 3	Apply 📃	30%		25%		30%	-
Level 4	Analyze	30%		25%		30%	-
Level 5	Evaluate	-		10%		-	-
Level 6	Create		100 Co. 55 M	5%	-	-	-
	Total	10	0%	10	0 %	10	0%

Course Designers			
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
1. Dr. Gireesh Yanamashetti, National Aerospace Laboratory, Bangalore	1. Dr. Ranjith Mohan, IIT Madras	1. Dr M. Gunasekaran, SRMIST	
2. Dr. G. MuthuSelvan, National Aerospace Laboratory, Bangalore	2. Dr. V. Babu, IIT Madras	2. Dr P. Balakrishnan, SRMIST	



B.Tech / M.Tech(Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses –Syllabi-Control Copy

Course Code	21NTO301	21NTO301T Course APPLICATIONS OF NANOTECHNOLOGY										C	Cours atego	se ory	0			OPEN ELECTIVE								P 0	C 3	
Pre-requi Course	site s		Nil			Co- re Cour	quisite se <mark>s</mark>				Nil			Pr	ogres Cours	sive es						Nil	1					
Course	Offering Depa	rtme	nt	Phys	sics an	id Nano	technolo,	gy		Data Bo	ook / Cod	des / Stan	ndards	3							Nil							
Course Le	arning Ration	ale (	CLR):	The purp	oose o	of learn	ing this	course	e is to:					4	đ			Progr	am Ou	utcome	s (PO	)				P	rogra	m
CLR-1:	Acquire knov	ledg	e on enviro	onmental	l applic	cations	of nanote	echnolo	ogy	200				1	2	3	4	5	6	7	8	9	10	11	12	S	pecifi tcom	C es
CLR-2:	Understand t	he th	eory of na	note <mark>chno</mark>	ology ir	n agricu	lture and	l food t	technole	logy				e		÷	of	34	ety			¥		0				
CLR-3:	CLR-3: Familiarize Electrical, Electronics and Energy Applications of Nanotechnology							0.564		vledç		ent o	tions	ge	soc		_	oW I		ance	5							
CLR-4:	CLR-4: Know Nanotechnology in Textiles and Cosmetics								Knov	lysis	mdo	stiga	Usa	and	∞ .		earr	uo	Z Fin	arnin								
CLR-5:	CLR-4:       Know Nanotechnology in Textiles and Cosmetrics         CLR-5:       Explore the concept of Biomedical Applications of Nanotechnology									eering !	em Ana	jn/devel	uct inve lex prob	em Tool	angineer	onment	s	dual & T	nunicati	ct Mgt. 8	ong Lea	Ţ.	2	ç				
Course Ou	tcomes (CO)		-	At the e	nd of	this co	urse, lea	rners	will be	able to	):	(Greek	47	Engir	Probl	Desig	Cond	Mode	The e	Envir	Ethic	ndivi	Comr	Proje	_ife L	-OSc	-SO	-OSc
CO-1:	Apply skills to	o ider	ntify ne <mark>w m</mark>	naterials f	for env	vironme	ntal appl	ication	IS	1.00	Pier P	20034		3		2	-	-	-	-	-	-	-	-	-	2	-	-
CO-2:	Analyze the	ole o	of nanot <mark>ech</mark>	nology in	n agric	culture a	nd food	techno	ology			12				12	2	-	-	-	-	-	-	-	-	3	-	-
CO-3:	Discriminate	elect	trical, e <mark>lect</mark> i	ronic and	d energ	gy appli	cations o	f nano	technol	logy	197	84		3	1		3	-	- 10	-	-		-	-	-	-	3	-
CO-4:	Apply the tec	hniqu	ues of n <mark>anc</mark>	otechnold	ogy in	textil <mark>e</mark> a	and cosm	netics	12.00	10/5:	1.1	1	- 1	1	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO-5:						-		1.5	1		-			3	-	1.1	- 1	3	200	-	-	-	-	-	-	-	-	3
<b>Unit-1 - En</b> Environme of nanotect	<b>vironmental l</b> ntal pollutants hnology in was	<b>Pollu</b> in air tewa	tion Treat , water, so ter treatme	<mark>ment Us</mark> il- Types ent- Drink	of toxi	anotecl ic and h ater pur	hnology azards w ifications	/astes. - Air pı	Nanorr urificati	naterials ions- Ga	s - Introdu as purifical	ction- App tions- Nar	olicatio no Moi	on. Nai nitorin	notech g- Nai	nnolog no Bio:	y - Intro sensors	oductic s – Ove	n- App erview.	olicatior	n of nai	notech	nology	in indu	istrial v	vaste-	<b>9</b> Applic	<b>Hour</b> ation
Unit-2 - Na Nanotechn Pesticide D	notechnolog ology in Agricu Detection- Nand	<i>in A</i> Iture Bio:	Agriculture - Precision sensors for blocksping	e n farming r Plant Pa tolligent r	g - Sma athoge	art deliv en Dete	ery syste	em - Na no Bio	ano fert	tilizers a	and types - Pesticide E	- Nano ur Degradatio	rea ani on- So	d mixe il Stru	ed ferti cture-	ilizers- Soil s	Nano i tructure	ertigat Remo	tion- N ediatio	ano pe n - Nar	sticide. otechr	s- Nan iology	o-seed in Foo	Scien d indus	ce- Nai stry- Na	no Bio ano pa	<b>9</b> senso ckagii	Hour rs for ng for
Unit-3 - Na	notechnolog	/ in E	Energy De	vices Ap	oplicat	tions		ssing-	FOOUS	salely- D	no-securit	ly- Electro	CHEIM	icai se	115015	- 36/15	015101	000 a	laiysis	-contai	i ili i ai il	ueleci	1011				9	Hour
Electronic circuit chips- ICs-Moore's law- Nanosensors and actuators- Optical switches- Diodes- Nano-wire transistors- Advantages of nano electrical and electronic devices- Memory storage- Lighting display											splay	s and																
filters- Qua	rs- Quantum computers- Medical diagnosis and conductive additives- Lead-free solder- Nano coatings and EMI shielding- Energy devices- Fuel cells- role of nanomaterials in fuel cell Applications- Photovoltaic																											
Unit-4 - Na	nofibre and N	lanoi	materials	for Texti	ile and	d Cosm	etic Indu	in trans	sportati S		VIS and IN	IEIVIS-UVE	iview.														9	Hour
Modern ap shark-skin nanocarrie water base	Iern applications of Nanotechnology in textiles-Nanofibre production in Textiles- Electrospinning- Contro rk-skin effect- Soil repellence- Lotus effect- Nano finishing in textile- Modern textiles Nano polymers ocarriers-Nanoemulsion for cosmetic product-Polymeric nanocarriers for topical drug delivery in skin cr er based nanoperfumes, sun care products, hair care-Toxic risk of nanocosmeticsBiocompatibility										Controllin mers in r skin crean	g mor nedica n-Orga	pholog al Tex anic U	gies of tiles- V filte	f nano Introdu r Ioade	fibers- iction t ed nan	Nano- o cosi ocarrie	fillers en netics- rs with	embedo Polyme 1 broad	led po ers, na spect	lypropy nocon rum pl	ylene f nposite notopro	ibers- l s, -Tra itection	Bionics nsdern -Emerg	- Swin nal an ging a _l	n-suits d bioa oplica	3 with active tions:	

# Unit-5 - Nano biomedical applications

Introduction to biomedical applications- Bioreceptors and their properties- Biochips- Integrated nanosensor- DNA based biosensors- Natural nanocomposite systems- Nanomaterials in bone substitutes and Dentistry- Implants and Prosthesis- Tissue Engineering- Neuroscience- Neuro-electronic Interfaces- Nanorobotics- Photodynamic Therapy- Protein Engineering- Nanosensors in Diagnosis- Drug delivery- Cancer therapy- Other therapeutic applications. Nanobots – overview

	-		-	
	1.	Fulekar, M. H., and Bhawana Pathak. Environmental nanotechnology. CRC Press, 2017.	5.	P.J.BrownandK.Stevens,NanofibersandNanotechnologyinTextiles,WoodheadPublishing
	2.	Lynn J. Frewer, WillehmNorde, R. H. Fischer and W. H. Kampers, Nanotechnology in the		Limited, Cambridge, (2007).
Loarning		Agri-food sector, Wiley-VCH Verlag, (2011).	6.	Nanda, Arun, Sanju Nanda, Tuan Anh Nguyen, Yassine Slimani, and Susai Rajendran,
Desources	3.	JenniferKuzmaandPeterVerHage, Nanotechnologyin agriculture and food production,		eds. Nanocosmetics: fundamentals, applications and toxicity. Micro and Nano Technologies,
Resources		Woodrow Wilson International Center, (2006).		2020.
	4.	Axelos, Monique AV, and Marcel Van de Voorde, eds. Nanotechnology in agriculture and	7.	Neelina. H, Malsch (Ed.), "Biomedical Nanotechnology", CRC Press2005
		food science. John Wile <mark>y &amp; Sons,</mark> 2017		

			Continuous Learning	Assessment (CLA)		Sum	motivo
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test %)	Life-Long CL (1)	r Learning A-2 0%)	Final Ex (40% w	amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%		20%		20%	-
Level 2	Understand	20%	1	20%		<mark>20</mark> %	-
Level 3	Apply	30%		30%		<u> </u>	-
Level 4	Analyze	30%		30%		<mark>30</mark> %	-
Level 5	Evaluate		-	1000	-	-	-
Level 6	Create			A shake of the second		-	-
	Total	100	0%	10	0%	10	0%

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. N. VIJAYAN, CSIR-NPL, nvijayan@nplindia.org	1. Prof. S. Balakumar, University of Madras, balakumar@unom.ac.in	1. Dr. J. Archana, SRMIST
<ol> <li>Dr. Krishna SurendraMuvvala, Saint Gobain Research India, India, Krishna.muvvala@saintgobain.com</li> </ol>	2. Prof. V. Subramaniyam, IIT Madras, vsubbu@iitm.ac.in	2. Dr. S. Harish, SRMIST

Course Code	21NTO302T	Course Name	ourse SOLID STATE ELECTRONIC DEVICES						0			(	OPEN	ELEC	TIVE			l	L T 3 0	P 0	C 3
Pre-requi Course	isite es	Nil		Co- requisite Course <mark>s</mark>	Nil		Pr	ogres Cours	sive es						Ni	1					
Course	Offering Departme	ent	Physic	s and Nanotechnology	Data Book / Co	odes / Standard	s							Nil							
Course Le	arning Rationale (	CLR):	The purpo	se <mark>of learnin</mark> g this co	urse is to:			1			Progr	am Ou	tcome	es (PO	)				P	rogra	m
CLR-1:	Realize the basic	s of solid s	tate physic	s with particular empha	sis on semiconductors.		1	2	3	4	5	6	7	8	9	10	11	12	S	pecifi	C es
CLR-2:	Provide in-depth	understand	ling o <mark>f diod</mark>	es, acquire knowledge	of various types and opera	ation of diodes.				-	36		ity								
CLR-3: Develop key understanding related to basics of transistors along with processes involved in workin transistors							edge		it of	ons of		ociety	tainabil		Nork		nce				
<b>CLR-4:</b> Understand the important ingredient towards technological application of transistors, specifically, effect transistors							Knowle	alysis	lopmer	estigati	l Usage	r and s	t & Sus		Team \	tion	& Fina	arning			
CLR-5:	Get acquainted w	ith variou <mark>s</mark>	solid state	devices and application	n.		ering	n An	/deve	ot inv x pro	Too	ginee	men		Jal &	unica	Mgt.	ng Le			
Course Ou	utcomes (CO):	-	At the end	d of this course, learn	ers will be able to:		ingine	robler	)esign	Conduc	Aoderr	he en	inviror	:thics	Ipivipu	Commu	roject	ife Lo	SO-1	SO-2	SO-3
CO-1:	Appreciate the im	portanc <mark>e c</mark>	o <mark>f "soli</mark> d stat	te devices" for the adva	ncement of technology	19 E E	3	-	-	3	-	-	-	-	-	-	-		3	-	-
CO-2:	Analyze diodes a	nd und <mark>erst</mark>	<mark>and it</mark> s sigr	nificance in technologica	al application		3	3		- 1	-	- 10	_	-	-	-	-	-	3	-	-
CO-3:	Obtain the knowle	edge on <mark> th</mark>	e transistor	s and its working princi	ples	100	3	3	-	3	-	-	-	-	-	-	-	-	-	2	-
CO-4:	Achieve knowledg	ge abou <mark>t v</mark>	<mark>ariety o</mark> f tra	nsistors and difference	between various transisto	ors	3	-	1	3	-	-	-	-	-	-	-	-	-	2	-
CO-5:	Evaluate the work	king prin <mark>cip</mark>	<mark>oles of e</mark> xist	ing devices based on s	olid state electronics	NA ST	3	3	3	-	-		-	-	-	-	-	-	-	2	-
Unit-1 - Ba Crystal stru statistics, C states, Exc	asics of Solid State ucture in solids, Ele Carrier transport, Ca sitons in semicondu	e <b>Physics</b> ectronic ba arrier mobil ctors, Carl	ind structur	e. Energy bands in so ing mechanisms, Non-e ration, Hall effect, Hall	lids, Band structure calcu quilibrium conditions, Qua resistivity, Hall resistivity o	lation, Elementa asi Fermi levels, I lependence on m	l and Recom	compo binatio	ound si on proc	emicon cesses, ntum Ha	ductor: Currei	s, Dopi nt dens	ing in s ity, Co	semico ntinuity	onducto y equa	ors, Sh tions, S	allow a Surface	and de recon	ep lev ıbinati	<b>9</b> els, C on, Sı	Hour arrier ırface
Unit-2 - Ur	nderstanding of Di	ode Char	acteristics		oolouvity, Hail Toolouvity a		ragitot		, duu	itani ne	in one.									9	Hour
Basic struc breakdown contacts, S	cture of p-n junction mechanisms, Zene Schottky barrier dioc	n, Current er diode, U le, Fermi I	transpo <mark>rt in</mark> nique featu evel pinning	n p-n junction diode, Ze res associated with Zer g, C-V characteristics of	ro applied bias: Electric f er diode, Heterojunctions: f a Schottky diode, Curren	ield, Built-in pote Band alignment: t transport proce	ential, j s, Ene sses	iunctio rgy ba	n capa nd dia	acitance grams c	e, Diffu of hete	ision ca rojuncti	apacita ions, T	nce, G wo din	Genera nensio	tion-re nal elec	combin ctron ga	ation c as, Met	urrent al-sen	ts, Jui nicond	iction luctor
Unit-3 - Tr	ansistor Types an	d Operati	ons	and action of DND		on of molevity	d mains -	ulture -	union -l	atribut.		una la cala		. in t	malat-	- Tr-	nolote -		lifier	9	Hour
as switch,	ransistor, Bipolar transistors, Theory of operation and action of PNP and NPN transistors, Description of majority s switch, Application of transistor in switching, Open-circuited transistors-biasing in active region, Ways to bias a						u mino nsistoi	rity ca r, Scho	ottky tr	ansisto	rs <mark>, Ope</mark>	eration	of Sch	s in tra iottky t	ransisto ransist	rs, rrai ors, Op	otical tr	as amp ransisto	onner, ors, Ap	i rans oplicat	istors ion of
#### Unit-4 - Field Effect Transistors and Metal Oxide Semiconductor FET

Field Effect Transistors (FET), Working principle of FET, Junction FET, Theory of operation and current equation, Metal semiconductor FET (MESFET), Application of MESFET, Metal oxide semiconductor FET, (MOSFET): working principle, Application of MOSFET, VI Characteristics of MOSFET, Depletion and enhancement types - threshold voltage, Gate capacitance inversion and accumulation layers, Complementary MOSFET, High electron mobility transistor (HEMT), Ways to achieve HEMT, Charge coupled devices (CCD) 9 Hour

## Unit-5 - Semiconductive Devices Application

Light emitting diode (LED), Materials for LED, Multilayers heterojunctions for LED, Photodiodes-current and voltage in an illuminated junction, Photodetectors-noise, Bandwidth of photodetectors, Semiconductor lasers, Population inversion at a junction, Emission spectra for p-n junction lasers, Heterojunction lasers-materials for semiconductor lasers, Semiconductor laser applications, Solar cells, Relevance of semiconducting materials in solar cell application, Transistors as building block of memory devices, Solid state memory devices and comparison with magnetic memory devices

Learning Resources	<ol> <li>Solid State Electronic Devices, by Streetman and Ben Garland, Prentice Hall, 2000</li> <li>Physics of Semiconductor Devices, by S. M. Sze and Kwok. K. Ng, John Wiley &amp; Sons, Inc., 2007</li> </ol>	<ol> <li>Art of Electronics, by Horowitz and Hill, Cambridge University Press, 2nd ed., 1989</li> <li>Fundamentals of Solid State Engineering, Manijeh Razeghi, Springer, 2019</li> </ol>

Learning Assessme	ent									
			Continuous Learning	Summative						
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (1)	g Learning "A-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%		20%	· · · · · ·	20%	-			
Level 2	Understand	20%		20%	1	20%	-			
Level 3	Apply	30%	CONTRACTOR OF THE OWNER	30%	- Annual Contraction	<u> </u>	-			
Level 4	Analyze	30%		30%	The second s	30%	-			
Level 5	Evaluate	ALC: NO.		States and a	-		-			
Level 6	Create			A DECK	1		-			
	Total	10	0%	10	0%	10	0 %			

Co	urse Designers		
Ex	perts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.	Dr. Hemant Dixit, GlobalFoundaries,USA, aplahemant@gmail.com	1. Dr. Debanjan Bhowmik, IIT Delhi, debanjan@ee.iitd.ac.in	1. Dr. Ja <mark>ivardhan</mark> Sinha, SRMIST
2.	Dr. Krishna Surendra Muvvala, Saint G <mark>obain Res</mark> earch India, India,	2. Dr. M. S. Ramachandra Rao, IIT Madras, msrrao@iitm.ac.in	2. Dr. S. Chandramohan, SRMIST
	Krishna.muvvala@saintgobain.com	CADA STREET	2

Course Code         21NTO303T         Course Name         MICRO AND NANOELECTRONICS							C	Cours atego	e ry	0				OPEN	ELEC.	TIVE				_ T 3 0	P 0	C 3				
Pre-requi Course	site s		Nil		Co- req Course	uisite s			Nil			Pro	ogres ours	sive es						Nil	1					
Course	Course Offering Department Physics and Nanotechnology Data Book / Codes / Stand																		Nil							
							1.00	the second second					1	1										_		
Course Le	arning Rationa	le (Cl	LR): <i>Ti</i>	he purpose	of learnin	g this cou	urse is	to:						100		Progr	am Ou	utcome	s (PO	)			1	- P	rograi	n c
CLR-1:	Acquire knowl	edge	on basic e	electronic co	mponents	and physic	cal effe	cts at sen	niconductor	rjunctions		1	2	3	4	5	6	7	8	9	10	11	12	00	tcom	es
CLR-2:	CLR-2: Learn construction of MOSFETs and its operation							ge		of	s of	10	tiety			¥		е								
CLR-3:	Understand of	peratio	on of vario	us <mark> types o</mark> f a	amplifiers	1						vled		ento	ation	ge	soc			oW r		lanc	g			
CLR-4:	Realize IC and	d its p	assive co <mark>n</mark>	nponents	~	2.1		- 547		122		Kno	alysi	opm	stig	Usa	ranc	~~~		Tean	ion	& Fir	arnin			
CLR-5:	Get acquainte	d with	the future	<mark>e of mic</mark> ro an	d nanoele	ctronics	-		1.20			ring	i Ana	devel	t inve	Tool	lineel	ment		ଣ &	nicati	Mgt.	g Le:			
-								199	1.00	1.00		inee	oler	ign/	duct	ern	eng	taina	S	/idu	nmu	ect I	Lon	-	-2	ဗို
Course Ou	utcomes (CO):		A	t the end o	f this coul	se, learne	ers will	l be able	to:		17	Eng	Prot	Des	Con	Mod	The	Sust	Ē	ndiv	Don	Proj	Life	PSC	PSC	SC
CO-1:	Apply basic se of logic gates	emicol	nduct <mark>or ph</mark>	ysics for the	working o	semicond	ductor d	levices, B	loolean alge	ebra, opera	tion	3		-	2	5-)			-	-	-	-	-	2	-	-
CO-2:	Analyze mode	ls of I	MOS <mark>FET</mark> a	and CMOS	<u></u>	24.97	1.1	1		14.1		2	-	-	2	-	- 10	- N	-		-	-	-	-	2	-
CO-3:	Apply CMOS	desigr	ning a <mark>nd ci</mark>	ircuits			1	1957		12		3	-	171	3	-	-	-	-	-	-	-	-	-	-	3
CO-4:	Evaluate impo	rtance	e of i <mark>nterco</mark>	onnects and	its usage			1.15	-			3	-	1	2	-		-	-	-	-	-	-	-	-	3
CO-5:	Visualize futur	istic n	nanom <mark>ateri</mark>	<mark>ials a</mark> nd its ι	isage in ac	vanced el	lectronic	c devices	1	1		2	-	5	3	-		-	-	-	-	-	-	-	3	-
Unit-1 - El Introduction of p-n junc	ectronic Mater n to electronic n tion transport a	i <b>als al</b> nateria nd op	nd Compo als and cla peration, D	onents ssification, v viode as circ	Origin of ei suit elemer	iergy band it, Large s	d gap, l signal a	Density of and small	f states, Fe signal ope	rmi energy ration of di	level, iode, .	Type Applic	s of s ations	emico s of die	nducto odes: l	rs, Doj imiting	oing in circui	semico ts-volta	nduct ge do	ors, Fo ubler-s	ormatio hifters	n of p-ı and sv	n juncti vitches	on, El , Curr	9 ectros ent-vo	<b>Hour</b> tatics oltage
characteris	tics and operati	on of	bipolar jun s: Binary a	nction transis	stors, Eber	s-Moll repl	resenta al numb	ation of tra	ansistor for	circuit elen	nent, . mbor	AC OF	perations R	on of tr	ansisto	or, Larg	ge and	small s	signal h table	model,	Ampli	fiers, T R NO	ransist г мам	or cor	nectio R gat	ns in
Unit-2 - M	OSFET and CM	OS	s. Dinary a			xuuccimu		ching Ool	1001310113 D	ciwcon nu	TIDCI	595101	113, D	Joican	uigooi	и, соу	ic guit		i tubic	3 101 7	<i>IVD</i> , 0	N, NO1	, 11/-111	<i>D</i> , NC	<u>9</u>	Hour
Introductio	n to MOSFET, I	I- and	I P-MOSFI	ET, D <mark>C ope</mark> l	ration of M	OSFET, D	Derivatic	on of I-V c	characteristi	ics, Modelli	ing of	MOS	FET, S	Small s	signal i	nodel,	AC op	eration	of MC	SFET	, Enha	nceme	nt and	deplet	ion m	odes,
Threshold	voltage, Introdu	ction t	to Complei	mentary Me	tal Oxide S	emicondu	ictor (C	MOS), CI	MOS inverte	er and its o	perati	ion	1.1	1.1	1.1											
Unit-3 - Ty	pes of Amplifi	ers				110		• •	" 1100			_		·	~			,							9	Hour
MUSFEI &	amplifiers, Reali ased circuits-no	zation n_line:	Of Current	sources, Di	fferential a	mplifier: ge	eneral (	considera	Itions-MUS	differential ents-high fi	pair-	casca	ae ait Iodels	t. amp, s-low a	Casci nd hig	ade sta	ages al	nd curre	ent mil	rors, C	peratio	onal an	nplitier:	as ar	DIACK	DOX-
Unit-4 - IC	. Passive Com	oner	nts and In	terconnect:	s	oquonoy I	-ospone	<u>,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,</u>		optomighti	oque	110 11	100013		ia nigi	noqu	oneyr	030013	0						9	Hour
Introductio	n to Integrated o	ircuits	s (ICs), Mo	onolithic inte	- gration, Ac	tive and pa	assive	devices, I	Passive dev	/ices: resist	tor-ca	pacito	r-indu	ictor, li	ntercor	nects,	Interc	onnect	Paran	neters:	Capac	itance-	Resist	ance-	nduct	ance,
Electrical v	vire model: idea	wire-	lumped m	odel-lumped	RC mode	I, Trans <mark>mi</mark>	ission li	ine respor	nse, Types	of terminat	ions										•					

# Unit-5 - Futuristic Electronic Devices with Nanomaterials

Introduction to 1D CNT and 2D materials for electronic devices, Operation and Characteristics of 2D-Materials-Based FETs, Important Figures of Merit, Negative differential resistance-resonant diode-applications, Tunnel Field-Effect Transistors, Concept of Negative Capacitance and its devices, Introduction to spintronics and spin-based devices

	1.	Behzad Razavi. Microelectronics, 2nd Ed, John Wiley & Sons, 2015	4.	Majumder, Kumbhare, Japa, Kaushik, Introduction to Microelectronics to Nanoelectronics,
Learning	2.	Jan M Rabaey; Anantha P Chandrakasan; Borivoje Nikolić. Digital integrated circuits : a		Taylor & Francis and CRS Press, 2021
Resources		design perspective, Pearson Education, 2003	5.	Muhammad Mustafa Hussain, Advanced Nanoelectronics, Wiley-VCH, 2019
	3.	Ke-Horng Chen. Power management techniques for integrated circuit design, Wiley, 2016		
				1) X.A.

Learning Assessme	ent										
			Continuous Learnin	g Assessment (CLA)		Sum	motivo				
	Bloom's Level of <mark>Thinking</mark>	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (10	g Learning A-2 0%)	Final Examination (40% weightage)					
Level 1		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%		20%		20%	-				
Level 2	Understand	20%	1.1.1	20%		<mark>2</mark> 0%	-				
Level 3	Apply	30%		30%	1 · · · · · · · · · · · · · · · · · · ·	30%	-				
Level 4	Analyze	30%	1000	30%		<mark>30</mark> %	-				
Level 5	Evaluate						-				
Level 6	Create	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	10 A 10 A 10 A	ALC: NO	-	- III -	-				
	Total	10	0 %	10	0 %	100 %					

Course Designers	the set of	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Pramod Rajanna, HHV Bangalore, pramod@hhv.in	1. Dr. Aditya Sadhanala, IISc Bangalore, sadhanala@iisc.ac.in	1. Dr. Abhay A. Sagade, SRMIST
2. Dr. Krishna Surendra Muvvala, Saint Gobain Research India, India,	2. Dr. N. N. Murthy, IIT Tirupati, nnmurty@iittp.ac.in	2. Dr. P. Malar, SRMIST
Krishna.muvvala@saintqobain.com		



Pre-requisite Courses       Nil       Co- requisite Courses       Nil       Progressive Courses       Nil         Course Offering Department       Physics and Nanotechnology       Data Book / Codes / Standards       Nil       Nil         Course Learning Rationale (CLR):       The purpose of learning this course is to:       Program Outcomes (PO)       Program Specific         CLR-1:       Acquire knowledge on Nanotechnology in environmental and health effects       1       2       3       4       5       6       7       8       9       10       11       12
Course Offering Department       Physics and Nanotechnology       Data Book / Codes / Standards       Nil         Course Learning Rationale (CLR):       The purpose of learning this course is to:       Program Outcomes (PO)       Program Specific         CLR-1:       Acquire knowledge on Nanotechnology in environmental and health effects       1       2       3       4       5       6       7       8       9       10       11       12
Course Learning Rationale (CLR):       The purpose of learning this course is to:       Program Outcomes (PO)       Program Specific         CLR-1:       Acquire knowledge on Nanotechnology in environmental and health effects       1       2       3       4       5       6       7       8       9       10       11       12       2       11       12       3       4       5       6       7       8       9       10       11       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       1
CLR-1: Acquire knowledge on Nanotechnology in environmental and health effects 1 2 3 4 5 6 7 8 9 10 11 12 Specific
CLR-2: Understand the effect of Nanomaterials for Environmental Protection
CLR-3: Describes the effect of nanomaterials in Environment
CLR-4: Explains the nanomaterials for Environmental remediation
CLR-5: Gain knowledge on different Sustainable Nanotechnologies
Course Outcomes (CO): At the end of this course, learners will be able to:
CO-1:       Elucidate the effects to human health and the environment       3       -       2       -       -       -       -       -       2       -
CO-2: Analyze the Relationships between key properties of nanomaterials and environment protection 3 2 3
CO-3:       Utilize the different nanomaterials for hazardous management       2       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       3       -       -       -       -       -       3       -       -       -       -       -       3       -       -       -       -       -       3       -       -       -       -       -       3       -       -       -       -       3       -       -       -       -       3       -       -       -       -       3       -       -       3       -       -       3       -       -       3       -       -       3       -       -       3       -       -       3       -       -       3       -       -       3       -       -       3       3       -       3       -       <
CO-4: Approach the influence of the behaviour of nanomaterials in the environment remediation 2 3 2 -
CO-5: Elucidate the use of nanoparticles and nanotechnology for environmental remediation and sustainability 2 3 2
Unit 1. Nanotechnology in Environmental and Health Effects
9 Hours 9 Hour
wastes- Challenges to occurational health. Challenges to occurational hydrae. Toxicity of anonanticles- Effects of inhaled panositized particles- Single sposure to panoparticles. Imach of CNTs on respiratory
systems Hazards of exposure to papoparticles. Bisks of exposure to papoparticles - Diseases directly related to papoparticles - Screening of papoparticles for understanding operaticles to the operation of the o
the environment- Mapping of the environmental fate of nanomaterials- Relationships between key properties of nanomaterials and their environmental fate- Transport and transportation of nanomaterials- Bio
distribution and toxicity of nanomaterials – Effect of micro/nano plastics in human health.
Unit-2 - Nanomaterials for Environmental Protection 9 Hou
Nanomaterials for Environmental Protection- Nano technology processes- Nano Engineering materials for Pollution Prevention- Green Chemistry- Energy efficient resources and materials- Nano technology products
Nanomaterials- Nanodevices and nanosystems- Synthesis of nanomaterials by Physico-chemical approaches-Bionanocomposites- Nano particles and Microorganisms- Microbial Synthesis of Nano materials
Biological Methods for Synthesis of nano-emulsions using bacteria- Fungi and Actinomycetes- Different plants based nanoparticle synthesis- Plants based nanoparticle synthesis of nano-emulsions using bacteria- Fungi and Actinomycetes- Different plants based nanoparticle synthesis- Plants based nanoparticle synthesis of nano-emulsions using bacteria- Fungi and Actinomycetes- Different plants based nanoparticle synthesis- Plants based nanoparticle synthesis of nano-emulsions using bacteria- Fungi and Actinomycetes- Different plants based nanoparticle synthesis- Plants based nanoparticle synthesis of nano-emulsions using bacteria- Fungi and Actinomycetes- Different plants based nanoparticle synthesis- Plants based nanoparticle synthesis- Plants based nanoparticle synthesis of nano-emulsions using bacteria- Fungi and Actinomycetes- Different plants based nanoparticle synthesis- Plants based nanoparticle synthesis- Plants based nanoparticle synthesis-
Fibres- Devices and Structures- Nano Bio systems
9 Hours
puenuncarion and characterization of mazaroous waster Nano Pointinon-Air/Gas Contaminants- Water Contaminants- Son Contaminants- reenuncation and Characterization of Organics Nano Membranes, Nano Membranes, Nano Meshes, Nano Fibres, Nano Clave, and Advertents, Zoolitos, Nano Catalyste, Carbon Nano-Tubos, Bir
Polymers- Single Enzyme Nano particles- Bio Metallic Iron Nano Particles- Nano Metallic Iron Nano Particles- Nano Metallic Iron Nano Particles- Nano Semi-Conductors- Photo catalysis- Nano-sensors

#### Unit-4 - Environmental Nano Remediation

Environmental Nano Remediation Technology- Thermal methods- Physical methods- Chemical methods- Biological Methods- Nano Filtration methods for treatment of waste water- removal of organics & inorganics and pathogens- removal of inorganics- removal of pathogens- Nanotechnology for water remediation and purification- Treatment of hi-tech industrial waste waters using nano particles/ modified structures/devices-Treatment of hi-tech industrial wastewaters using modified structures- Treatment of hi-tech industrial wastewaters using dyes-Groundwater remediation- Surface water treatment-Titanium dioxide- Challenges-Environmental Benefits of nanomaterials- Oleophilic nano materials for problem due to oil spills, nano materials for dye degradation in fresh waters.

### Unit-5 - Sustainable Nanotechnology

9 Hour

9 Hour

Sustainable Nanotechnology- Application of industrial ecology to nanotechnology- Fate of nanomaterials in environment- environmental life cycle of nano materials- environmental impacts of nano materials- health impacts of nano materials- toxicological threats- eco-toxicology- exposure to nano particles – biological damage- threat posed by nano materials to humans- environmental reconnaissance and surveillance- Corporate social responsibility for Nanotechnology- Combining Life Cycle and Risk Assessment- Proposed Solutions to prevent toxicology- Safety measurements- Education and understanding of sustainable nanotechnology-Applications of nanotechnology for sustainability- Nano materials in future – implications, roles and responsibilities for nanotechnologists for safer implementation of nanotechnology.

Learning	1.	Nanotechnlogy: Health and Environmental risk by Jo Anne Shatkin. CRC press, 2017.	3.	Environanotechnology by Mao Hong fan, Chin-pao Huang, Alan E Bland, Z Honglin Wang,
Resources	2.	Nanotechnologies, Hazards and Resource efficiency by M. Steinfeldt, Avon Gleich, U. Potschow, P. Haum, Springer, 2007	1	RachidSliman, lan Wright. Elsevier, 2010.
		reischow, N. Haum. Springer, 2007.	4.	Nanostructured conductive polymers. Edited by All Elteknam. Wiley, 2010.

Learning Assessme	nt			A CONTRACTOR OF THE OWNER OWNER OWNER OF THE OWNER OWN							
			Continuous Learning	Summativa							
	Bloom's Level of Thinking	Form CLA-1 Avera (50	ative ge of unit test %)	Life-Long CL (10	g Learning A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	<u>Theory</u>	Practice				
Level 1	Remember	20%		20%		20%	-				
Level 2	Understand	20%		20%		20%	-				
Level 3	Apply	30%		30%		30%	-				
Level 4	Analyze	30%		30%		<mark>30</mark> %	-				
Level 5	Evaluate	and the second second					-				
Level 6	Create	1.1.1		-	-	-	-				
	Total	100	)%	10	0 %	10	0 %				

Co	ourse Designers		
Ex	operts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.	Dr. N. VIJAYAN, CSIR-NPL, nvijayan@nplindia.org	1. Prof. S. Balakumar, University of Madras, balakumar@unom.ac.in	1. Dr. M.Navaneethan, SRMIST
2.	Dr. Krishna SurendraMuvvala, Saint Gobain Research India, India,	2. Prof. V. Subramaniyam, IIT Madras, manianvs@iitm.ac.in	2. Dr. E. Senthil Kumar, SRMIST
	Krishna.muvvala@saintqobain.com		

Course Code	Course 21NTO305T Course Name		MEDICAL NANO	TECHNOLOGY	Course Category		OPEN ELECTIVE									L T 3 0	P 0	C 3	
Pre-requi Course	site es	Nil	Co- requisite Courses	Nil	Progressive Courses Nil														
Course	Offering Departme	ent	Physics and Nanotechnology	Data Book / Codes / Standar	ds							Nil							
Course Le	arning Rationale	(CLR): T	he purpose of learning this course	is to:		2			Progra	am Ou	itcome	s (PO)	)				P	rogra	m
CLR-1:	Understanding th	e basics of r		1	2	3	4	5	6	7	8	9	10	11	12	S OU	pecif tcom	c es	
CLR-2:	Know the various	Know the various classification of nanomedicine						s of	3	tiety			ork		e				
CLR-3:	Getting knowledg	ge about int <mark>e</mark>	ra <mark>ction of na</mark> nomaterials with biologica	al environment	wled		ient o	ation	age	d soc		-	n Wo		nano	b			
CLR-4:	Gain a broad und	lerstanding <mark>a</mark>	about nanosystems for the diagnosis a	and therapy	Kno	alysis	lopn	estig	Use	r and	8		Tear	tion	i⊑ ∞	arnir			
CLR-5:	Get acquainted w	vith future as	spects of nanosurgery		ering	m Ana	ns ns	ict inv ex pro	n Too	Iginee	nment		ual &	unicat	t Mgt.	ong Le			
Course Or	utcomes (CO):	4	At the end of this course, learners will be able to:			Proble	Design	Condu	Moder	The er	Enviro Sustai	Ethics	Individ	Comm	Projec	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	To distinguish the	e advant <mark>ages</mark>	<mark>s betw</mark> een conventional and nanomed	icine	3	-		2	-	-	-	-	-	-	-	-	2	-	-
CO-2:	Analyze the conc	epts of <mark>medi</mark>	ical nanotechnology		3	1.1	100	2	-	-	-	-	-	-	-	-	3	-	-
CO-3:	Apply concepts of nanomedicine to a focused clinical area of their choice					100	2	-	-	-	-	-		-	-	-	-	3	-
CO-4:	Apply the nanosy		3	-	3	-	-	÷,	-	-	-	-	-	-	-	2	-		
CO-5:	CO-5: Apply the concepts of nanosurgery						2	-	-	1	-	-	-	-	-	-	-	-	2
Unit-1 - Na	anotechnology in	Medicine							1	+	-							9	Hour

Conventional medicine-- Prospect of nanomedicine- Current Medical Practice- Challenges in Current Medical Practice- Evolution of Scientific Medicine- Drawinian medicine- Volitional Normative Model of Disease-Disease Nominalism, Disease Relativism- Treatment Methodology- Conventional methods- Evolution of Bedside Practice- Benefits of Bedside Practice- Molecular Nanotechnology- Introduction and Basic principles-Pathways to Molecular Manufacturing- Molecular Transport- Molecular Sortation- Types of Molecular Sortation

# Unit-2 - Nano sensors for Monitoring

Nanosensors & nanoscale scanning-Nanosensor Technology- Chemical Nanosensor- Molecular Nanosensor- Displacement Sensor- Motion Sensors- Force Nanosensor- Thermal Nanosensor- Electric and Magnetic Sensing- Cellular Bio scanning – Macrosensing- Intergated nanosensor technologies- Genomics- Methods in Genomics- Proteomics- Methods in Proteomics- Real-time monitoring- in vivo medical monitoring, molecular nanobots for medicinal applications

## Unit-3 - Nanoparticles for Imaging and Drug Delivery

Nanoparticles for imaging & drug delivery- Types of Nanoparticles for drug delivery- Nanoparticles for medical imaging- Enhancement for X-ray- MRI imaging- IR imaging- Visible imaging- UV imaging- Nanoparticles for targeted imaging- Targetting moieties- Nanoparticles for delivery of energy- Types of nanoparticles for delivery of energy- Nanoparticles for delivery of energy- Nanoparticles for delivery of drugs- Types of nanoparticles for delivery of drugs- Materials for drug delivery- Fabrication for drug delivery- Nanocapsulation for drug delivery- Application of Nanocapsulation for drug delivery – target specification and controlled drug delivery.

9 Hour

#### Unit-4 - Nanotechnology in Diagnosis and Therapeutics

Nanodiagnostics- Nanosensors for Diagnosis- Nanoarrays for Molecular Diagnostics- Types of Nanoarrays- Nanoparticles for Molecular Diagnostics- Gold Nanoparticles- Magnetic Nanoparticles- Quantum Dots for Molecular Diagnostics- DNA Nanomachines- DNA Nanomachines for Molecular Diagnostics- Nanobarcodes Technology- Commerically available Nanobarcodes- Cantilevers as Biosensors for Molecular Diagnostics Types of Cantilevers as Biosensors for Molecular Diagnostics for the Battle Field- Uses of Nanodiagnostics for the Battle Field- Nanodiagnostics for Integrating Diagnostics with Therapeutics.-Advantages of Integrating Diagnostics with Therapeutics. Nano coating sensors for diagnosis of diabetes

### Unit-5 - Nanodevices for Clinical Nano Diagnostics

Nanodevices for Clinical Nanodiagnostics- Types of Nanodevices for diagnosis- Nanoendoscopy- Uses and advantage of nanoendoscopy- Nanobiotechnology and Drug Delivery Devices- Types of Nanodevices for drug delivery- Tools for Nanosurgery- Nanoscale Laser Surgery- Nanorobotics for Surgery- Nanotechnology for Detection of Cancer- QDs for Sensing Cancer Cell Apoptosis- Dendrimers for Sensing Cancer Cell Apoptosis- Gold Nanoparticles for Cancer Diagnosis- Nanotubes for Detection of Cancer Proteins- Nanoparticles for the Optical Imaging of Tumours- Nanolaser Spectroscopy for Detection of Cancer in Single Cells-Nanoparticles-MRI for Tracking Dendritic Cells in Cancer Therapy- Advantages of Nanopartice tracking

Learning	1.	Robert .A. Freital.Jr, "Nanomedicine"- Landes Bioscience Press2010.	4.	Mahendra Rai, Mro	unali l	Patel,	"Nanotechnology	in	Medicine:	Toxicity	and	Safety"Wiley-
Desources	2.	Harry F.Tibbals, "Medical nanotechnology & Nanomedicin' - CRCpress, 2011.		Blackwell, October 2	2021					-		
Resources	3.	Jain.K.K, "Handbook of Nanomedicine"- Springer, 2012.	20	1.00			-					

			Continuous Learning	g Assessment (CLA)		Sum	motivo
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long L CLA- (10%	earning -2 6)	Final Ex (40% w	amination eightage)
		Theory	Practice	Theory	Practice	<u>The</u> ory	Practice
Level 1	Remember	20%	1	20%	-	20%	-
Level 2	Understand	20%		20%		20%	-
Level 3	Apply	30%	-	30%	-	30%	-
Level 4	Analyze	30%	1	30%		30%	-
Level 5	Evaluate	and the second				-	-
Level 6	Create	1.1		-	r.		-
	Total	10	0%	100	%	10	0%

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. K. Chandru Trivitron Healthcare Pvt. Ltd. Chennai, chandru.k@trivitron.com	1. Dr. Amit Kumar Mishra , IIT Jodhpur, amit@iitj.ac.in	1. Dr. Devanandh venkata subhu, SRMIST
2. Dr.Nagesh Kini, Thermax, Pune, Maharastra, nagesh. kini@gmail.com	2. Dr. Sampath Kumar T.S,IIT Madras, tssk@jitm.ac.in	2. Dr. K. Janani Sivasankar, SRMIST

9 Hour

Course Code	21NTO306T	Course Name		NANOSCALE SURI	FACE ENGINEERING	Cours Catego	se ory	0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3
Pre-requ Course	site es	Nil	(	Co- requisite Course <mark>s</mark>	Nil	Pr	ogres Cours	sive es						Nil						
Course	Offering Departme	ent	Physics and	Nanotechnology	Data Book / Codes / Standard	ds							Nil							
Course Le	arning Rationale	(CLR): 7	The purpose of	learning this cours	e is to:		23		1.1	Progra	am Ou	itcome	s (PO	)				P	rogra	m
CLR-1:	Obtain vast know	ledge on Su	urface an <mark>d Interf</mark> a	aces and its structur	e	1	2	3	4	5	6	7	8	9	10	11	12	- S 00	pecifi itcom	c es
CLR-2:	Understand the p	rocess invo	olved i <mark>n surface</mark> a	nd Interfaces	and and and and	ge		of	s of	2	iety			rk		æ				
CLR-3:	Understand the D	Diffusion pro	oce <mark>ss involve</mark> d in	surface and related	laws	vled		ento	ation	ge	soc			۲ Mc		Jano	D			
CLR-4:	Describe the law	s related to s	surface phenom	ena		Knov	Ilysis	mdo	stige	Usa	r anc	~~~~		Tean	io	& Fir	arnin			
CLR-5:	Gain knowledge	on Surfac <mark>e</mark> /	Analysis Techniq	jues	1	ering	n Ana	/devel	ct inve x prot	I Tool	ginee	nment ability		- 8 ler	unicat	Mgt.	ng Le;			
Course O	utcomes (CO):		At the end of th	is course, learners	will be able to:	Engine	Proble	Design	Condu	Moden	The en	Envirol Sustair	Ethics	Individ	Comm	Project	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Apply the concep	t of Sur <mark>face</mark>	<mark>e crys</mark> tallography	to understand the s	urface structure	3		-	-	-		-	1	-	-	-	-	-	2	-
CO-2:	Able to analyze s	urface r <mark>elate</mark>	<mark>ted pr</mark> ocess and i	its measurements		3	1	12	-	-	1		-	-	-	-	-	-	1	-
CO-3:	Apply the concep	t of Fick <mark>'s la</mark>	<mark>aw to</mark> have clear	a <mark>understandin</mark> g on	surface diffusion process			2	-	-	-	-	-		-	-	-	-	2	-
CO-4:	Analyze the diffe	rent me <mark>chan</mark>	nisms involved in	surface diffusion a	nd Kinetics	-	-	-	3	-	-	-	-	-	-	-	-	2	- 1	-
CO-5:	Utilize the Photoe of Surface	electron <mark>spe</mark>	ectroscopic and S	Secondary electron t	echniques to understand the properties		9	12	2	-	1	-	-	-	-	-	-	-	-	3
Unit-1 - In	troduction to Surf	aces and In	nterfaces	1					-	-		-		-					9	Hour
Surfaces a unit cell, P transforma states)- Su	nd interfaces in ma rimitive cell in bulk tion approach- Wo <u>rface states struct</u> u	aterials surfa crystals Co od notation o ure (for two o	face energy, surface concept of ideal c description- Unit dimension)- Surf	ace tension and sur rystal Surface struct mesh transformatio ace electronic struc	face states- Some basic concepts of b ure and surface order- surface crystallon n approach- Matrix notation and classifi ture (for two dimension)	ulk crys ography ication	stallog y- Suri of ove	raphy: face Cr rlayer i	Direct I ystallog nesh <mark>e</mark> s	attices graphy - Elect	and of of a p fronic s	lirection lane- A structur	ns- Sy nd its e (for i	mmetr point a three d	y group and spa limensi	os and ace gro on)- De	planes oup syn ensity c	:- Strue nmetry of State	cture d '-Unit i es (Su	of the mesh ırface
Unit-2 - St	Inface Adsorption	and Desor	rption				0					0		,	,				9	Hour

Adsorption and desorption: Definition & Concept- Various types of adsorptions and desorption- Basics of adsorption kinetics- Concept of coverage dependence- Coverage dependence derivation- Langmuir Isotherm-Temperature dependence Kinetics- Temperature dependence derivation- Angular dependence Kinetics- Kinetic energy dependence Kinetics- Thermal deposition- Theory of Desorption kinetics- Thermal desorption spectroscopy: Basic working Principle- Thermal desorption spectroscopy: Instrumentation- Adsorption Isotherms: A detailed study- Various types of Adsorption Isotherms- Non-Thermal desorption- Types of Non-Thermal desorption

# Unit-3 - Surface Diffusion

Concept of Random-walk motion- Basic equations -random-walk motion- Fick's laws: Definition and its explanation- Tracer diffusion- Chemical, diffusion- Intrinsic diffusion- Mass transfer diffusion- Anisotropy of surface diffusion- Atomistic mechanisms of surface diffusion and its types- Atomistic mechanisms of surface diffusion: hopping mechanism- Atomistic mechanisms of surface diffusion: Vacancy mechanism- Atomistic mechanisms of surface diffusion: Atomic exchange mechanism- Atomistic mechanisms of surface diffusion: Tunneling mechanism- Nucleation and Equilibration via Surface Diffusion- Experimental study of surface diffusion

#### Unit-4 - Surface Characterization Tools

Surface specificity- Spectrum of secondary electrons- Photoelectron spectroscopy – Physical process: photoemission, spectral feature- Photoelectron spectroscopy -depth specificity- Photoelectron spectroscopy (XPS and UPS) - compositional information- Photoelectron spectroscopy (XPS and UPS) - compositional information- Photoelectron spectroscopy (XPS and UPS) - spectral resolution and depth profiling- Photoelectron spectroscopy (XPS and UPS) -spectral resolution and depth profiling- Photoelectron spectroscopy (XPS and UPS) -spectral resolution and depth profiling- Photoelectron spectroscopy (XPS and UPS) -spectral resolution and depth profiling- Photoelectron spectroscopy (XPS and UPS) -spectral resolution sources- Energy analyzers and detectors- Auger Electron spectroscopy (AES): physical process: photoemission- Spectral feature and depth Specificity- AES and ISS: compositional information- AES and ISS: elemental sensitivity- AES and ISS: energy analyzers and detectors

### Unit-5 - Nanoscale Studies of Surfaces and Interfaces

Nanoscale Characterization for Surfaces- Scanning tunneling microscopy (STM) – historical perspective and theory- STM: electron tunnelling- STM imaging- Scanning tunneling spectroscopy- STM: Instrumentation-Semiconductor surfaces- Semiconductor surfaces: Si (111)- Semiconductor surfaces: Si (100)- Semiconductor surfaces: GaAs (110)- Photo induced process- Different types involved in Photo induced process- Metal – semiconductor surfaces- Analysis of Metal – semiconductor - Analysis of Alkali – metal – semiconductor interfaces properties Growth of trivalent metals on Si (001) and its surface interface studies

			0	
Learning	1.	John Dinardo N., "Nanoscale Characterization Of Surface And Interfaces", Wiley-VCH, 2008	3.	Unerti W.N., "Physical structure" Elsevier Science B. V, 2006
Desourcos	2.	Oura K., V. G. Lifshits, A. A. Saranin, A. V. Zotov and M. Katayama, "Surface Science – An	4.	Riviere J.C and Myhra S., "Handbook of Surface and Interface analysis", CRC Press, 2009
Resources		Introduction" Springer, 2013.		

			Continuous Learning	Assessment (CLA)		Sum	motivo				
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native nge of unit test 0%)	Life-Long CL (10	Learning A-2 1%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	<u>The</u> ory	Practice				
Level 1	Remember	20%		20%	- Permit	20%	-				
Level 2	Understand	20%		20%		20%	-				
Level 3	Apply	30%		30%	-	30%	-				
Level 4	Analyze	30%	1. Sec. 1.	30%		<mark>3</mark> 0%	-				
Level 5	Evaluate	a la contra de la c					-				
Level 6	Create	1.00		-			-				
	Total	10	0%	10	) %	10	<u>.</u> 0%				

Co	urse Designers				
Ex	perts from Industry	Ex	perts from Higher Technical Institutions	Int	ernal Experts
1.	Mr.Solomon Jonnes,Bengaluru,solomon@terracarb.com	1.	Dr.Amit Kumar Mishra , IIT Jodhpur, amit@iitj.ac.in	1.	Dr. V. Kathirvel, SRMIST
2.	Dr.Nagesh Kini,Thermax,Pune,Maharastra <mark>,nagesh.kini</mark> @gmail.com	2.	Dr.Sampath Kumar T.S, IIT Madras, tssk@iitm.ac.in	2.	Dr. A <mark>. Alagirisamy</mark> SRMIST

9 Hour

Code ZINT03071 Nar	e 21NT0307T Course NANOCOMPUTING Name				Category O OPEN ELECTIVE 3							- T 3 0	P 0	3			
Pre-requisite Nil	Co- requisite Courses	Nil	Pro	ogres Cours	sive es						Nil						
Course Offering Department	Physics and Nanotechnology	Data Book / Codes / Standards								Nil							
Course Learning Rationale (CLR):	The purpose of learning this course is	to:	4	4	1		Progra	am Ou	Itcome	s (PO)	)				Pr	rogra	m
CLR-1: Acquire knowledge on n	anoelectronics and its importance		1	2	3	4	5	6	7	8	9	10	11	12	ou	pecifi	C es
CLR-2: Introduce the concept of	f molecula <mark>r computing</mark>	and the second	Ð	-	-	of	34	ety			¥		6				
CLR-3: Understand about bioco	3: Understand about biocomputers and related nanomachines				ent o	tions	e	soci		-	Wol		ance	G			
<i>L</i> <b>CC:</b> <i>L</i> earn basics and advancements of guantum computing and guantum dot cellular automata				ysis	amdc	stiga Iems	Usaç	and	లు		eam	Б	k Fin	rninç			
<b>CLR-5:</b> Understand the architecture of processing in nanosystems, Gain knowledge on processing				em Anal	n/develo	uct inves lex prob	m Tool I	ngineer	onment a		dual & T	nunicatio	ct Mgt. 8	ong Lea	~	2	e
Course Outcomes (CO):	At the end of this course, learners wi	be able to:	Engin	Proble	Desig	Condi	Mode	The e	Enviro	Ethics	ndivi	Comn	Proje	-ife L	-OSc	-OSc	-OSc
CO-1: Acquire basics of nanoc	omputing and nanoelectronic devices	The Auge Williams	3	-	-	3	-		-	-	-	-	-	-	2	-	
CO-2: Explain major advances	in molecular computing	State Barrier Hall	2	÷.,	12	2	-	-	-	-	-	-	-	-	3	-	-
CO-3: Recognize the evolution	and advancements of biocomputers		3		-24	2	-	- 300	-	-	-	-	-	-	-	2	-
CO-4: Express the principles a	nd development of quantum computers		2	-	1	2	-	-	-	-	-	-	-	-	-	3	-
CO-5: Realize the importance of	o <mark>f quantum</mark> dot cellular automata		2	-	2	-	-	1	- 10	-	-	-	-	-	-	-	2
O-5:       Realize the importance of quantum dot cellular automata       2       2       -       -       -       -       -       -       -       -       2																	

# Unit-5 - Architectures of Processing in Nanosystems

Parallel Architectures for Nanosystems-Architectural principles- Mono and multiprocessor systems- Some considerations to parallel processing- Influence of delay time- Power dissipation and Parallelism- Architecture for processing in nanosystems-Classic systolic arrays- Processor with large memories- Processor array with SIMD and PIP architectures- Reconfigurable computers- Teramac concept as a prototype-

Learning Resources 1. Vishal Sahni and Debabrata Goswami, "Nanocomputing: The Future of Computing", Tata 2. Karl Goser, Peter Glösekötter and Jan Dienstuhl, "Nanoelectronics and Nanosystems: From McGraw-Hill Education, 2008

		11.1	Continuous Learning	Assessment (CLA)	A	0					
Bloom's Level of Thi <mark>nking</mark>		Form CLA-1 Avera (5)	native age of unit test 0%)	Life-Lon CL (1	g Learning _A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%	Martin Cold	20%	1.1	20%	-				
Level 2	Understand	20%		20%		20%	-				
Level 3	Apply	30%		30%		30%	-				
Level 4	Analyze	30%		30%		30%	-				
Level 5	Evaluate					-	-				
Level 6	Create		10 Sup 10	ter i constante	·		-				
	Total	10	0%	10	0 %	10	0%				

Co	urse Designers	1.5			
Ex	perts from Industry	Ex	perts from Higher Technical Institutions	Int	ernal Experts
1.	Dr. Hemant Dixit, Global Foundaries, USA, aplahemant@gmail.com	1.	Dr. Ranjit Kumar Nanda, IIT Madras, nandab@iitm.ac.in	1.	Dr. V. J. Surya, SR <mark>MIST</mark>
2.	Dr. Krishna Surendra Muvvala, Saint Gobain Research India, India,	2.	Dr. G. P. Das,IIT Kharagpur gpdas@metal.iitkgp.ac.in	2.	Dr. Saurabh Ghos <mark>h, SRMIS</mark> T
	Krishna.muvvala@saintgobain.com				



B.Tech / M.Tech (Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

Course Code	Course 21NTO308T Course Name SMART SENSOR SYSTEMS				Cours Catego	se ory	0			(	OPEN I	ELECT	ΓIVE			L S	- T 3 0	P 0	C 3
Pre-requi Course	site es	Nil	Co- requisite Courses	Nil	Pr	ogres Cours	sive es						Nil						
Course	Offering Departm	ent	Physics and Nanotechnology	Data Book / Codes / Stan	dards	-						Nil							
Course Le	arning Rationale	(CLR): 7	he purpos <mark>e of learning</mark> this course is	to:		1			Progra	am Ou	tcome	s (PO)	)				Pr	ograr	n
CLR-1:	Acquire knowled	ge on variou	s sensor <mark>systems</mark>		1	2	3	4	5	6	7	8	9	10	11	12	SI OU	pecifi tcom	: es
CLR-2:	R-2: Understand different conversion phenomena involved in sensors						of	s of	20	iety			rk		a)				
CLR-3:	Describe constru	iction and fur	nction of different sensors	1000	vledç		ento	ations	ge	soc		-	٥W ۲		ance	б			
CLR-4:	Gain knowledge	on the mater	r <mark>ial requir</mark> ement for different sensing me	chanisms	Knov	Ilysis	lopm	estiga	Usa	r anc	৵ঽ		Tean	ion	& Fir	arnin			
CLR-5:	Gain knowledge	on individ <mark>ua</mark> l	sensing devices and integration of tech	nnologies	heering	lem Ana	gn/devel	luct inve olex prot	ern Tool	enginee	onment	ş	idual & ⁻	municat	ect Mgt.	-ong Lei	5	-2	ۍ ا
Course Ou	utcomes (CO):	/	<mark>At the</mark> end of this course, learners wil	I be able to:	Engi	Prob	Desig	Conc	Mode	The (	Envir Susta	Ethic	Indiv	Com	Proje	Life I	PSO	PSO	PSO
CO-1:	Explain basic col	ncepts, p <mark>rinc</mark>	ipals and means of detection in smart se	ensing.	3	3	- 1	-	-	1		-	-	-	-	-	2	-	-
CO-2:	Apply acoustic, r	nagnetic <mark>, Fo</mark> i	r <mark>ce,</mark> Strain, and Tactile and pressure se	nsors	3	3	100	-	-	-	<u> </u>	-	-	-	-	-	3	-	-
CO-3:	Explain the deter	ction con <mark>cept</mark>	t <mark>s an</mark> d devices for light, radiation, therma	al and chemical sensing	3	3		-	-	- 20	-	-		-	-	-	-	3	-
CO-4:	Apply suitable te	chnique <mark>s for</mark>	biosensing and microsystem engineerir	ng and integration	3	2		-	-		-	-	1	-	-	-	-	3	-
CO-5:	Explain Microsys	tem fabr <mark>icati</mark>	on techniques and prospectus of Nanot	echnology, future trends	3	2		-	-	2	-	-	I	-	-	-	-	-	2
Unit-1 - Int Definitions Sensor Cha Electric fiel Unit-2 - Co Acoustic wa Microphone	Init-1 - Introduction to Sensor Systems         Verificitions of Sensors and Smart Sensors, Integrated Smart Sensors and Applications, Sensors classifications, Detection means used in sensors and conversion phenomena, Measurements, Units of Measurements, ensor Characteristics: Transfer Function, Calibration, Static Characteristics, Accuracy, Calibration Error, Hysteresis, Nonlinearity, Resolution, Dynamic Characteristics, Physical principles of sensing: electric charges, ilectric fields, and potentials, Capacitance, dielectric constant, Magnetic Principle, Induction Principle, Electrical Resistance, Piezoelectric effect, Pyroelectric effect, Hall effect Principle, Seebeck and Peltier effects         Init-2 - Conversion Phenomena in Sensors       9 Hour         coustic waves: Fundamentals, Piezoelectric materials for acoustic sensors, Solid state SAW sensors, Applications of SAW sensors, Acoustic Sensors: Resistive Microphones, Condenser Microphones, Piezoelectric for Sensors: Resistive Microphones, Condenser Microphones, Piezoelectric																		
Capacitive	Pressure Sensor								-, -					,					,
Unit-3 - Fu Light Detec Sensors: F Sensors, C sensors (C	Inctional Sensors Ctors, Photodiodes, Functional Principle Optical Temperatur Chemoresistive sen	: Photoresiste e, Heat Tra e Sensors, ( sors), Filed E	ors, HgCdTe infrared sensors, Visible-lig nsfer Mechanisms, Temperature Senso Chemical sensors: Classes of Chemica Effect Transistor for Gas sensing, FET o	ht color sensors, high-energy p ors, Thermo resistive Sensors, I Sensors, Interaction of gased levices ion sensing	hotodiodes Thermoele ous species	, Radia ectric s at se	ation D Contac emicon	etectors t Senso ductor S	s: Scin ors, Th Surface	tillating ermoo es, Ca	g Detec couple , talysis,	tors, S Assen the a	Semico Iblies, ccelera	nducto Semic ation o	r Radia onduct f chem	ntion De or PN- ical rea	ətector Juncti action:	<b>9 I</b> rs, The on the s, Thii	<b>Hour</b> Prmal Prmal Prmal

#### Unit-4 - Biosensing, Microsystem Engineering and Integration

Biosensors definition, Bioreceptors, Construction of different biosensors, Immobilization of biological elements, Transduction principles used in biosensing, Lab-on-chip/Microsystems/MicroTAS, Microfluidics, Microfluidic unit operations, Microsystem Integration, System organization and functions, Interface electronics, Fundamentals of interfacing, Signal Conditioning, Universal transducer interface-Three-Signal Technique, Introduction to microsystems engineering, Micro technologies, Systems development: methods and tools, Constructive and connective techniques 9 Hour

# Unit-5 - Micro Fabrication Tools and Prospects of Nanotechnology

Fundamentals of MEMS-Fabrication: Frequently Used Microfabrication Processes, Lithography, thin film deposition, Oxidation, Etching (wet and dry), MEMS fabrication technologies: Bulk micromachining and structures, Surface micromachining and structures, High-aspect-ratio technology, LIGA (Lithographie, Galvanoformung, Abformung), Microsystem components, Application of different Microsystem, components, Integration of Micromachining and Microelectronics, Semiconductor Packaging Applied to Sensors, Nanotechnology: product prospects - applications Future trends

	1.	Jacob Fraden, "Handbook of Modern Sensors: Physics, Designs, and Applications",	4.	Gerard Meijer, Kofi Makinwa, Michiel Pertijs Smart Sensor Systems: Emerging Technologies and
Learning		Springer; 4th ed. 2010		Applications 1st Edition, Wiley, 2014
Resources	2.	S. M. Sze, "Semiconductor Sensors", Wiley-Interscience, 1994	5.	Randy Frank, Understanding Smart Sensors, 3rd Edition, 2013 Artech House
	3.	Gerard Meijer, "Smart sensor systems", Wiley, 2008	11	

|--|

			Continuous Learning	Cum	mativa						
	Bloom's Level of Thinking	Form CLA-1 Averag (50	ative le of unit test %)	Life-Long CL (1)	g Learning "A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%	A State State	20%		20%	-				
Level 2	Understand	20%		20%		20%	-				
Level 3	Apply	30%		30%		30%	-				
Level 4	Analyze	30%		30%	-	30%	-				
Level 5	Evaluate	-		A CONTRACTOR			-				
Level 6	Create	and the second second	- 10.5								
	Total	100	%	10	0 %						

C	Course Designers	1 TOWN TO A REAL PROPERTY OF THE REAL PROPERTY	
E	Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
	<ol> <li>Dr. N. VIJAYAN, CSIR-NPL, nvijayan@nplindia.org</li> </ol>	1. Prof. S. Balakumar, University of Madras, balakumar@unom.ac.in	1. Dr. A. Ka <mark>rthigeyan, S</mark> RMIST
1	2. Dr. Krishna Surendra Muvvala, Saint Gobain Research	2. Prof. V. Subramaniyam, IIT Madras, manianvs@iitm.ac.in	2. Dr. M.Kiran, SRMIST
	India, India, Krishna.muvvala@saintgobain.com	LOW LINE WEAR DURING A DECKNO	

Course Code	Course Code         21NTO309T         Course Name         2D MATERIALS AND APPLICATIONS							Cou Cate	rse gory	0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3
Pre-requi Course	site s	Nil		Co- requisite Course <mark>s</mark>		Nil		F	rogres Cours	ssive ses						Nil						
Course (	Offering Departm	ent	Physics	and Nanotechnolog	ay .	Data Book / Co	odes / Standa	irds	-						Nil							
Course Le	arning Rationale	(CLR):	The purpos	e of learning this o	course is	to:		1	1	1		Progr	am Ou	utcome	s (PO	)				P	rogra	m
CLR-1:	Acquire knowled	ge on gra	phene and its	unique combination	of physic	al properties		1	2	3	4	5	6	7	8	9	10	11	12	S	pecifi	C AS
CLR-2:	Gain the knowled	dge on ato	omically thin se	emiconducting Nan	osheets a	nd their layer depe	ndent physica	al e		of	s of	25	iety			¥		۵				
CLR-3:	<b><i>R-3:</i></b> Understand top-down and bottom-up production techniques for the synthesis of 2D materials							vledg		ento	tion	ge	soc			οMι		anci	0			ĺ
CLR-4:	<ul> <li>Chief stand top-down and boton-up production techniques for the synthesis of 2D materials</li> <li>Understand the 2D materials physical properties using microscopy and spectroscopy techniques</li> <li>Cale knowledge on applications 2D materials in himodical and engineering applications</li> </ul>						Knov	alysis	mdo	stiga	Usa	and	8		Tean	ы	& Fir	arnin				
CLR-5:	<ul> <li><i>properties</i></li> <li><i>Understand top-down and bottom-up production techniques for the synthesis of 2D materials</i></li> <li><i>Understand the 2D materials physical properties using microscopy and spectroscopy techniques</i></li> <li><i>Gain knowledge on applications 2D materials in biomedical and engineering applications</i></li> <li><i>Gain knowledge on applications 2D materials in biomedical and engineering applications</i></li> <li><i>At the end of this course, learners will be able to:</i></li> <li><i>Understand the scientific knowledge on producing graphene</i></li> <li><i>Analyze different types of 2D layered nanomaterials in comparison with their bulk counterparts</i></li> <li><i>Extract optimized space parameters for the preparation of 2D materials</i></li> </ul>							ering	m Ana	/devel	ct inve ex prot	n Tool	Iginee	nment		ual & ⁻	unicati	t Mgt.	ng Lei			
Course Ou	itcomes (CO):	-	At the end	of this course, lea	rners will	be able to:	0.970.7	Engine	Proble	Design	Condu	Moder	The er	Enviro	Ethics	Individ	Comm	Project	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Understand the s	scientific <mark>k</mark>	<mark>knowled</mark> ge on µ	producing graphene		1 24	2.20	1 -		3	3	-	-	-	-	-	-	-	-	2	-	-
CO-2:	Analyze different	t types o <mark>f 2</mark>	<mark>2D laye</mark> red nai	nomaterials in comp	oarison wit	h their bulk counte	erparts	110	3	1	3	-	-	- "	-		-	-	-	3	-	-
CO-3:	Extract optimized	d space <mark>pa</mark>	<mark>aramet</mark> ers for t	the preparation of 2	D material	's	100	-	-	3	2	-	-	-	-	-	-	-	-	-	3	-
CO-4:	Utilize microscop	pic and s <mark>pe</mark>	<mark>ectrosc</mark> opic co	ncepts to understar	nd the prop	perties of materials	3		3	-	1.3	3		-	-	-	-	-	-	-	3	-
CO-5:	Know the usage	of the 2D	materials for (	Optoelectronics and	Biomedic	al applications	1		-	1.1	3	3		-	-	-	-	-	-	-	-	3
<b>Unit-1 - Va</b> Hybridizatio Conductivit properties,	r <b>ious Forms of C</b> on of Carbon, its a ty and Universal O Lattice Deformatic	<b>Carbon an</b> Ilotropes a Optical Con Ion and Ela	d Properties and binding en aductivity of gra astic strain.	of Graphene ergy - Band structur aphene – Magnetic	re of Grapi field effect	hene - Brillouin Zor t on graphene - Ho	ne - Electronic mogeneous N	proper Aagnetic	ties of g Field -	graphe - Land	ne and e au Leve	carrier Is in B	densit ilayer	y - Klei Graphe	n Tunr ene - A	neling - nomale	High I Dus Qu	Mobility antum	∕ of gra Hall E	phene ffect -	<b>9</b> - Min Mecha	<b>Hour</b> imum anical
Unit-2 – 21	D layered Nanoma	aterials ar	nd De <mark>vices</mark>		1							100									9	Hour
Graphite in Traps and Topologica	tercalated compou defects - Mechani I Insulators – Blac	unds – Gra cal proper k phospho	aphene <mark>/graphi</mark> rties - Strain el orus Nanoshee	te Oxide - Graphen ffect on band gap – ets and its physical	e composi Layer dej - 2D Cryst	ites -Transition mei bendant physical p als Based Heteros	tal dichalcoge roperties and tructures - Tra	nides (1 spin-or ansistor	MD), C bit coup s Based	Crystal oling –L d on 2L	structur Density D Hetero	es an Functi ostruct	d allot onal t <mark>l</mark> ures	ropes – neory ca	Brillou alculat	uin Zor ions- c	ne - Ele other M	ectronic Ionoele	c and o menta	ptical I Nanc	prope sheet	rties - s -2D
Unit-3 – 2L	D Materials Prepa	ration Me	ethods and Cl	haracterization To	ols Jonar Dar	position Duland L	anar Danaaiti	on En	itovial	arouth	Dhua	and Va	nour	donositi	ion I	lioro r	nachai	vical E	vfaliati	on Li	9 auid r	Hour
exfoliation	and bottom up me - Electrochemical for 2D materials c	ethoos and exfoliation quality and	a working prin n - Ball Milling l composition–	- Basic Characteriz Principles of Atom	zation of 2 ic force mi	Dosition - Puised Li D materials - UV- Coroscopy and cont	aser Depositi Vis absorptior act and non-c	on - Ep 1 Specti ontact i	itaxiai ( oscopy nodes	growth / - Ran	- Physi nan spe	car va ctrosc	opy –	Electro	on – I n inter	action	necnar with n	natter a	and ele	on - Li ectron	quia p micros	scopy
Unit-4 - Ap	oplications of 2D	Materials						- naot i													9	Hour
Application Scaffolds fo and electro	s of 2D materials or tissue engineeri ochemical sensing	- Biomedio ng - Cance - Hydroge	cal application er therapy– Ph en evolution rea	s of graphene oxide otocatalysts - Graph action and oxygen e	e – Graph nene oxide evolution r	ene networks for E for Dye degradatic eaction photo-cata	Drug delivery, on - Pollutant a lysts.	bioimag adsorpti	ing and on - Hy	d biose drogen	nsing - produc	Photo tion fo	therma rm wai	al thera ter splitt	py - ai ting - T	nti-bac MDs b	terial a ased 2	pplicat D mate	ions – erials fo	Biocol or Elec	mpatil trocat	vility - alysis

## Unit-5 - Graphene Based Electronic and Optoelectronic Device

Graphene based Radio Frequency transistors for Flexible electronics - 2D TMD based Photodetectors – Phototransistors - Hybrid Phototransistors- Heterostructure Photodetectors - 2D TMD based Light Emitters -Hot Carrier EL - Light-Emitting Diodes Circularly Polarized Light Emission - 2D TMD-Based Photovoltaics applications - Graphene membranes for water purification and separation – 2D Membranes as barrier materials - Supercapacitor electrodes - 2D Black phosphorus based FET for Sensors.

	1.	Banks, Craig E., and Dale AC Brownson, eds. "2D Materials: Characterization,	3.	Tiwari, Ashutosh, and Mikael Syväjärvi, eds. "Advanced 2D Materials" - John Wiley & Sons, 2016.
Learning		Production and Applications"- CRC Press, 2018.	4.	Dragoman, Mircea, and Daniela Dragoman,"2D Nanoelectronics: Physics and Devices of
Resources	2.	Houssa, Michel, Athanasios Dimoulas, and Alessandro Molle, "2D Materials for		Atomically Thin Materials"- Springer, 2016.
		Nanoelectronics"- CRC Press <mark>, 2016.</mark>		TO VAL

Learning Assessme	ent	1000									
	Bloom's	Forn	Continuous Learning native	Summative Final Examination							
	Level of Thinking	CLA-TAVera (50	ye or unit test )%)	(1	_A-2 0%)	(40% weightage)					
	2	Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%		20%		20%	-				
Level 2	Understand	20%		20%		<mark>20</mark> %	-				
Level 3	Apply	30%	No Crast W	30%		<u>30%</u>	-				
Level 4	Analyze	30%		30%		<mark>30%</mark>	-				
Level 5	Evaluate		St. 182. 14	「たちにんきの	-	-	-				
Level 6	Create	1 Aug - 1			-	-	-				
	Total	10	0 %	10	0 %	10	0 %				

Co	ourse Designers		
Ex	operts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.	. Dr. Hemant Dixit, GlobalFoundaries,USA, aplahemant@gmail.com	1. Dr. Ramaprabhu, IIT Madras, ramp@iitm.ac.in	1. Dr. Eswaraiah Varrla, SRM IST
2.	Dr. Krishna Surendra Muvvala, Saint Gobain Research India, India,	2. Dr. M. S. Ramachandra Rao, IIT Madras, msrrao@iitm.ac.in	2. Dr. Archana, SRMIST
	Krishna.muvvala@saintgobain.com		



B.Tech / M.Tech (Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

Course Code	21NTO310T	Course Name	NAN	3 AND MICROELE	ETROME	CHANICAL SYSTEMS	Cou Cate	irse gory	0				OPEN	ELEC	ΓIVE				- T 3 0	P 0	C 3
Pre-requi Course	site s	Nil		Co- requisite Courses		Nil		Progres	sive ses						Nil	1					
Course (	Offering Departme	ent	Physics an	d Nan <mark>otechnology</mark>		Data Book / Codes / Stan	ndards							Nil							
0	in Dationale			<u>Chamina this sec</u>					-		Dura			- (DO)					Di	oara	
Course Le	arning Rationale		ne purpose d	r learning this col	urse is t	0:	_	1.	1.	100	Progr		Itcome	S (PU	)				s	pecifi	c
CLR-1:	Acquire knowledg	ge on MEMS	S and NEMS fu	Indamentals		100	1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	es
CLR-2:	Understand differ	ent principle	es in <mark>volved in l</mark>	MEMS devices		- other address	e e		of	Is of	10	ciety			ž		g				I
CLR-3:	Describe construe	ction and fur	nct <mark>ion of ME</mark> M	S actuators	1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	vled		lent	ation	ge	l soc			Ň		Janc	ð			I
CLR-4:	<b>R-4:</b> Gain knowledge on the material requirement for different actuation mechanisms						Knov	lysis	opu	stig	Usa	and	৵		Fear	u	& Fi	arnir			I
CLR-5:	Gain knowledge o	on individual	<mark>l sensing</mark> and l	Micromechanical c	omponei	nts and their integration	neering	lem Ana	gn/devel	duct inve olex prot	ern Tool	engineel	ronment ainability	S	idual & 7	municati	ect Mgt.	Long Lea	-	-2	က္
Course Ou	itcomes (CO):	4	<mark>At the</mark> end of	this course, learn	ers will	be able to:	Engi	Prob	Desi	Conc	Mod	The	Envi	Ethic	Indiv	Com	Proje	Life	PSO	PSO	PSO ⁻
CO-1:	Apply the principl	es of se <mark>nsin</mark>	ng and actuatio	<mark>n to desi</mark> gn NEMS	and ME	MS devices	3	-	-	2	-		-	-	-	-	-	-	2	-	-
CO-2:	Analyze the suita	bility of <mark>a ac</mark>	<mark>ctuati</mark> on mecha	nism for a particula	ar applic:	ation	3	1.1		2	-	-	_	-	-	-	-	-	-	-	- 1
CO-3:	Utilize the suitable	e mater <mark>ial p</mark> i	roperties to de	sign a MEMS struc	cture	12. O.V. 2.	2	1.5	1.	3	_	- 100	-	-		-	-	-	-	3	- 1
CO-4:	Apply a suitable r	nicrosy <mark>stem</mark>	n technology to	create different na	ano and i	nicro mechanical structure	2	-	-	3	1	-	-	-	-	-	-	-	-	-	3
CO-5:	Design high aspe	ct ratio struc	cture and integ	ration with microsy	ystem teo	chnologies	3	-	1.1	3	-	2	-	-	-	-	-	-	2	-	-
llnit-1 - Eu	undamontals of MI	EMS and NE	EMS		2 Miles	in the second	_					-								0	Hou
Micro- and and Actuat	nanoelectromecha ors - Energy Doma devices – Biomim	nical system ins and Tran etics Fundar	ms-MEMS and nsducers – Me mentals – Bior	NEMS: An overvie echanical MEMS - mimetics for NEMS	ew - Nan Thermal S and MF	oelectromechanical Systems MEMS - Micro-Opto-Electro- MS - MEMS Architectures - I	s – Curren Mechanic NEMS Arc	t Develo al Syste hitectur	opmen ems - ( es	t and N	eeds - S) - Ma	Scalir gnetic	ng Laws MEMS	s <mark>– Mo</mark> S, Radi	deling o-Freq	- The luency	input-o MEMS	utput c S - Micr	oncep ofluidio	t - Sei syste	nsor ems
Unit-2 - Co	onstruction of ME	<b>MS Devices</b>	s, Integration	of MEMS							1									9	Hou
Photolithog – Metalliza Modelling e	raphy – Types and tion -Bulk microma elements: Electrical	Application: chining - Sui systems - E	ns - St <mark>ructural a</mark> Irface <mark>microma</mark> Basic Modellin	nd sacrificial mater chining – High Asp g elements: Fluid s	rials - Th bect Rations systems	in film deposition - Physical V o (LIGA and LIGA like ) techn Basic Modelling elements: T	/apor Dep nology - Mi Thermal sy	osition, EMS Int stems -	Chem tegratio Trans	ical Vap on - Pac slational	or Dep kaging pure r	oositior g con <mark>si</mark> ne <mark>char</mark>	n techni ideratio nical sy	ques - ns - Ba stems	- Oxida asic Ma - Rota	ation - odellin tional	Doping g eleme oure m	- Etchi ents: M echani	ing (W lechan cal sys	et and ical - stems	l Dry Basic
Unit-3 - Va	rious MEMS Devi	ces		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	-		_	1.000												9	Hou
Sensors an model piez of thermal a	nd Actuators – Basi o actuators - Gripp actuators	c Principles ing piezo ac	- Componen <mark>ts</mark> ctuators - Strai	: Beam - Cantileve 1 Measurement - T	r, microp hermal s	lates - Capacitive effects - Pi ensors and actuators - Thern	iezo eleme nal basics	nts - St – Theri	rain M mocou	easurer ples – 1	nents - Thermo	Press presisto	ors - Ac	d flow i tuators	neasu s base	remen d on th	ts - ME ermal e	MS Gy expans	roscoµ ion - A	ies - S pplica	Shea ation
Unit-4 - Ma	agnetic Materials i	in MEMS																		9	Hou
Magnetic n actuation F Tuner/filter	naterials used in M Principles - Essentia - MEMS Resonato	EMS - Magi al magnetic a rs - MEMS S	netic Propertie actuation conc Switches - ME	s used in MEMS epts - Magnetic MI MS Phase shifter	- Magnet EMS act	ic sensing and detection - M Jators - Bidirectional Microac	lagneto re tuators - F	sistive : RF base	sensor d com	<mark>- Hall I</mark> munica	ffect l tion sys	based stems	sensors - RF M	s – Ma EMS -	agneto MEMS	diodes S induc	– Mag tor - M	ntotran EMS V	isistor ′aracto	- Mag rs - N	ıneti IEM
																					29

B.Tech / M.Tech(Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses –Syllabi-Control Copy

# Unit-5 - Principles and Applications of Micro Optic Electro Mechanical Systems

Principles of MOEMS technology - Applications of MOEMS - Properties of Light - Light modulators - Beam splitters - Micro lens - Micro mirror - Digital micromirror device - Optical switch, Wave guide and tuning - Properties of fluid - Fluid actuation methods – Dielectrophoretic - Electrothermal flow - thermo capillary effect - Micropumps: design consideration - Lab-on-chip - IC technology - MEMS Fabrication versus IC fabrication – Integrating IC and MEMS - Prospects

Learning Resources	1. 2.	Mahalik N P, "MEMS", Tata McGraw-Hill Education, 2008 Sergey Edward Lyshevski, "Micro-Electro Mechanical and Nano-Electro Mechanical Systems, Fundamental of Nano-and Micro-Engineering", Second Edition, CRC Press, 2005	3.	Chang Liu "Foundation of MEMS", Prentice Hall, 2012	
				10 V.A.	

Learning Assessme	ent		1		1						
			Continuous Learning	g Assessment (CLA)		Cum	mativa				
	Bloom's Level of <mark>Thinking</mark>	Forn CLA-1 Avera (50	native Ige of unit test 0%)	Life-Lon Cl (1	g Learning LA-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%		20%		20%	-				
Level 2	Understand	20%		20%		<mark>2</mark> 0%	-				
Level 3	Apply	30%		30%		30%	-				
Level 4	Analyze	30%	10 Cars 10	30%		<mark>30</mark> %	-				
Level 5	Evaluate					-	-				
Level 6	Create	Distance in the second		ALC: NOT		-	-				
	Total	10	0%	10	0 %	10	0 %				

Course Designers	the second s	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. N. VIJAYAN, CSIR-NPL, nvijayan@nplindia.org	1. Prof. S. Balakumar, University of Madras, balakumar@unom.ac.in	1. Dr. R. AJAY RAKKESH, SRMIST
2. Dr. Krishna SurendraMuvvala, Saint Gobain Research India, India,	2. Dr. M. S. Ramachandra Rao, IIT Madras, msrrao@iitm.ac.in	2. Dr. M. Kir <mark>an, SRMI</mark> ST
Krishna.muvvala@saintgobain.com		



B.Tech / M.Tech (Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

Course Code	Course Code         21NTO401T         Course Name         SCIENTIFIC RESEARCH PRINCIPLES						Course O OPEN ELECTIVE									- T 3 0	P 0	C 3			
Pre-requis Course	site s	Nil	Co- requisite Courses		Nil		Prog	gress ourse	sive es						Nil						
Course C	Offering Departm	ent	Physics and Nanotechnol	ogy	Data Book / Codes / Sta	andards				-				Nil							
Course Le	arning Rationale		he nurnose of learning this	s course is t					1		Progr	am Qu	itcome	s (PO)	١				Pi	ograi	n
	Familiarize with	the concent of	of research ethics				1	2	3	1	5	6	7	8	, a	10	11	12	S	pecifi	C
	I annianze with						1	2	5	of 1	5	y v	'	0	3	10		12	ou	tcom	÷S
CLR-2:	CLR-2: Understand the concept of academic plagiarism								t of	ous o	6.5	ociet			Vork		JCe				
CLR-3:	Understand the	concept of Go	bod, Bad science and pseud	oscience	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1		owle	sis	men	gatic ms	sage	s pu			۲ MB	_	-inar	ing			
CLR-4:	Gain knowledge	on research	methodology	<u> </u>	A State Links		gKn	alys	elop	vesti oble	ol U	er al	nt & itv		Te	ation	. & F	earn			
CLR-5:	CLR-5: Learn the process of scientific writing							n Ar	/dev 1s	ct in x pr	To	gine	Inder		al 8	unica	Mgt	ng L			
C	CLR-5:       Learn the process of scientific writing         Course Outcomes (CO):       At the end of this course, learners will be able to:         CO-1:       Apply the scientific concepts of ethics and plagiarism         CO-2:       Apply the scientific concepts of ethics and plagiarism							oblei	sign	mple	den	e en	viror stair	lics	livid	mm	oject	e Lo	°0-1	30-2	SO-3
Course Ou			At the end of this course, le	arners will l	de able to:		ш	Pu	d s	<u> </u>	ž	ЧL	шぷ	Ē		ပိ	P	Lif	Å.	8	50
CO-1:	Apply the scienti	fic concepts of	of ethics and plagiarism		1 Sun S 30		1	-	-	-	-	-	-	3	-	-	-	-	-	-	-
CO-2:	Acquire the know	vledge o <mark>f glo</mark> l	bal and national research eth	nics			- 11	-	2	-	-	- 10	1	3	-	-	-	-	2	-	-
CO-3:	Ability to apprec	iate the i <mark>mpo</mark> i	r <mark>tanc</mark> e of honesty and integri	ty in academ	ic life		-	2	-	-	-	- 100	-	3	-	-	-	-	-	-	-
CO-4:	Apply scientific r	esearch <mark>met</mark> l	<mark>hodo</mark> logy for real life problem	S		12	-	-	3	-	-	-	-	3	-	-	-	-	2	-	-
CO-5:	Utilize the metho	od of scie <mark>ntific</mark>	<mark>c writin</mark> g		at a long to the	-	-	-	3	-	-	2	-	3	-	-	-	-	-	-	2
		<u> </u>		Circles	Sector Sector							-									
Principles (	nics of Science, of MOEMS technology	blogy - Applic	tions of MOEMS - Propertie	es of Liaht - I	ight modulators - Ream si	nlitters - N	Aicro le	ens -	Micro	mirror	- Diait	al mici	romirror	devic	e - On	tical sv	vitch V	Vave o	uide a	<b>9</b> nd tur	nour 1001 -
Properties of	of fluid - Fluid actu	ation method	s – Dielectrophoretic - Electro	othermal flow	- thermo capillary effect - N	/icropump	os: des	sign c	conside	ration	Lab-c	on-chip	o - IC tec	chnolo	gy - M	EMS F	abricat	ion ver	sus IC	fabric	ation
– Integratin	g IC and MEMS -	Prospects		1		<u> </u>				1	-7										
Unit-2 - Sc	ientific Miscondi	uct, Plagiaris	sm and Examples	rmo of misoo	nduct Langet MMP oution	froud on	no Ch	nontir	a Dla	aiorion	Doo	ognizir	a nlogi	oriom	Solfn	logiorio	m Do	Voree	alagia	9 iom (	Hour Choot
writing and	detection. Honor	code svstem.	. academic dishonestv. Preiu	dice. Intuitio	n. Observation bias. Self-m	isunderst	andino	a. Ea	oism. S	Some p	lagiari	sm ca	ses in l	ndia. (	Consec	nayiana nuence	of Pla	aiarism	Jiayiai I	1311 <i>1</i> , C	11031
Unit-3 - Go	od, Bad and Pse	udo-Science	9		COLUMN TO A			<u>,                                    </u>						, .						9	Hour
Good scien	ice vs. Bad scient	ce, Pseudosc	cience, Wa <mark>ys of identific</mark> ation	, Curiosity a	nd research, Empiricism, F	Rationalisi	m, Intu	iition,	, Litera	ture re	view, I	Eleme	ntary so	cientifi	c meth	ods, O	bserva	tions a	and ob	serva	ional
bias, Proble	em identification, l	Basic assump	otions, Hypoth <mark>esis, Formula</mark> ti	on of an hype	othesis, Hypothesis driven	research	design	i, Vei	rificatio	n of Hy	pothe	sis, Ide	entificat	ion of	experi	mental	techni	ques, l	mplerr	entati	on of
Unit-4 - Re	search Design												_							9	Hour
Research o	design, Design o	f the apparat	tus, Design issues and rem	edies, Expe	rimentation – sampling, E	xperimen	tation	-me	asuren	nents,	Replic	ation	of the	data,	Data a	analysis	s, Erro	r ident	ificatio	n, Eri	or in
measureme	ent, Classification	of errors, Err	ors analysis, Interpretation o	f th <mark>e data, Te</mark>	est of the hypothesis, Mathe	ematical r	nodell	ing, I	Vumeri	cal cor	nputat	ion, Re	esult pre	esenta	ntion						

# Unit-5 - Scientific Writing

Scientific Writing, Authenticity, accuracy, Originality of the work, Title preparation, List of authors and addresses, Abstract writing, introduction writing, Description of methods, Description of methodology, Measurements, Description and types of measurements, Analysis of results, Explanation of results, Result and analysis, Discussion and acknowledgement, Conflict of interest declaration, References, paper/poster presentation, Electronic publication

	1.	National academy of Science, National academy of Engineering, and Institute of	3.	David B. Resnik, "The ethics of science: An introduction", Routledge Publication, 1998
Looming		Medicine, "On being a scientist: A guide to responsible conduct in research", Third	4.	John G D'Angelo, "Ethics in Science: Ethical Misconduct in Scientific Research", Second Edition,
Learning		edition, The National Academics Press, 2009		CRC Press, Taylor & Francis Group, 2018
Resources	2.	Adam Briggle and Carl Mitcham, "Ethics and science: An Introduction", Cambridge		
		University Press, 2012		

Learning Assessme	nt	~ ~ ~								
			Continuous Learning	Assessment (CLA)		Cum	a di va			
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test )%)	Life-Long CL (1	g Learning LA-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	<u>Th</u> eory	Practice			
Level 1	Remember	20%	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	20%		20%	-			
Level 2	Understand	20%	the course with	20%		<mark>20</mark> %	-			
Level 3	Apply	30%		30%		<u>30%</u>	-			
Level 4	Analyze	30%	1 1	30%		<mark>30%</mark>	-			
Level 5	Evaluate	1 1 2 3 4 3				-	-			
Level 6	Create	1000				-	-			
	Total	10	0 %	10	00 %	100	)%			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Narayanasvamy Vijayan, National Physical Laboratory, nvijayan@nplindia.org	1. Prof. V. Subramaniam, IITM, Chennai, manianvs@iitm.ac.in	1. Dr. Sandeep Kumar Lakhera
2. Dr.A. Pandikumar, Scientist, CSIR-CERL, pandikumar@cecri.res.in	2. Prof. D. Arivuoli, Anna University, arivuoli@annauniv.edu	2. Dr. A. Karthigeyan, SRMIST



B.Tech / M.Tech (Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses - Syllabi-Control Copy

Course Code	21NTO402T	C	ourse Iame		MICRO AND NANOFLU	Cou Cate	irse gory	0				OPEN	ELEC.	TIVE				L T 3 0	P 0	C 3	
Pre-requi Course	site s	٨	lil		Co- requisite Courses	Nil		Progre Cour	ssive ses						Nil	1					
Course	Offering Departr	nent		Physics ar	nd Nanotechnology	Data Book / Codes / St	andards							Nil							
Course Le	arning Rational	e (CLF	R): The	ne purpo <mark>se</mark>	of learning this course	is to:				2.1	Progr	am Ou	utcome	s (PO	)				P	rogra	m
CLR-1:	Understand the	theory	/ of fluidic	ics in a <mark>micro</mark>	o scale	1000	1	2	3	4	5	6	7	8	9	10	11	12	S OL	pecifi itcom	ic ies
CLR-2:	R-2: Gain knowledge in micro fluidics equations						e		÷	of	30	ety			¥						
CLR-3:	Understand the	conce	pt behind	d <mark>viscous f</mark> lo	ow in micro scale		Viedo	,	ento	tions	ge	soci			No!		ance	0			
CLR-4:	Acquire the kno	wledg	e in Micro	o fluidic devi	ices and manufacturing		Anov	lysis	do	stiga	Usa	and	৵ঽ		earr	ю	& Fin	arnin			
CLR-5:	CLR-5: Gain knowledge scaling materials for manufacturing						eering	em Ana	jn/devel	uct inve lex prot	rn Tool	engineer	onment	6	dual & ⁻	nunicati	ct Mgt.	ong Lei	5	5	ę
Course Ou	Course Outcomes (CO): At the end of this course, learners will be able to:						Probl	Desig		Mode	The e	Envir Susta	Ethic	ndivi	Comr	Proje	_ife L	-OSc	-OSc	-OSc	
CO-1:	Apply the conce	ept of f	luid <mark>ics in</mark>	<mark>n mic</mark> ro and r	nanoscale	and the state of the	3	2	-	-	-	1	-	-	-	-	-	-	2	-	-
CO-2:	Analyze the flor	w and	vis <mark>cosity</mark> (	<mark> of t</mark> he fluidic	cs		3	2	100	-	-	-	0	-	-	-	-	-	-	-	2
CO-3:	Analyze the vis	cous fl	ow <mark>of mic</mark>	<mark>icro</mark> /nano flui	idic d <mark>ev</mark> ices	1995 - 1997 - F.	3		2	-	-	-	-	-	-	-	-	-	-	2	-
CO-4:	Utilize the know	vledge	ga <mark>ined</mark> fo	<mark>or d</mark> esigning	n micro/nano fluidic devic	es	2	-	3		-		-	-	-	-	-	-	-	-	-
CO-5:	Apply the vario	us fuid	ic e <mark>quatic</mark>	<mark>ons t</mark> o desig	n micro/nano fluidic devi	ces	3		2	-	-	1	-	-	-	-	-	-	-	-	2
Unit-1 - Th Introduction distribution	eory of Fluidics to Fundamenta functions, Wall s	<b>in Mi</b> als of k alip effe	croscale inetic the ects, Acco	eory, Funda	mentals of molecular m coefficients, Flow and t	odels, Kinetic theory of micro neat transfer analysis of micros	and macros cale, Couett	copic   e flows	propert , Press	ies, Bin sure driv	ary coi /en ga:	llisions s micro	s, Distrii o-flows <mark>,</mark>	bution Micro	function flows	ons, Bo with wa	oltzmar all slip	nn equ effects	ation, , Conc	<b>9</b> Maxw ept of	<b>Hour</b> /ellian f Heat
transfer in I Unit-2 - Mi	micro-Poiseuille i cro and Nanoflu	idic E	zxpressio	on for Poisel s	uille flows, Mechanism o	t micro tiows under compressio	on, Compres	SIDIIITY	and its	effects	, exam	pies		-	-					9	Hour
Introduction Classificati forces in lic for Steady Unit-3 - Vis	n to Micro and n on of fluid flow, ( uid flow, Navier- and compressible scous Flow in N	anoflu Continu Stokes e flow, <b>licro/N</b>	ids, Basic ium appro s equatior Steady a lano Flui	ic concepts roximation, L on and its pro and incompr idic Devices	in microfluidics and Nai Limitations and drawbac operties, Theory of Two- ressible flow Navier-Stok s	noscale fluidics, Governing eq ks, Kinematics of Microscale L dimensional Navier-Stokes equ es equation	uations, Ap _i iquid flow, L ation, Two-c	plicatio Derivati dimens	ns-Pre on of K ional N	paratory (inemati lavier-S	/ conce ics of M tokes e	epts, L Aicros equatic	aws of cale Liq on in ter	fluid Juid flo ms of	flows o w, Liq Reync	determ uid flov olds Eq	ination w along uation,	of tra g surfa Navie	nsport ce, Eff r-Stok	prope ect of es equ 9	erties, body Jation

Introduction to Microscale Viscous flow, Structure of flow in a pipe or channel, Poisseuille's equation, Poisseuille flow in a pipe, Velocity in slip flow of gases, Velocity in slip flow of liquids, Theory of flow in a thin film under gravity, Two and Three-dimensional approach, Derivation-thin film under gravity, Properties of thin film equation, Developing suction and Laminar flows, Flow control, Surface tension driven flow and its limitations, Sedimentation of a solid particle, Simple model for blood flow, Non-Newtonian properties of blood

#### Unit-4 - Materials and Fabrication Tools for Micro/Nano Fluidic Devices

Introduction to concepts of microfluidic devices, Microfluidic Technology, Micro fabrication tools -Fabrication of a Simple Microfluidic chip, Advantages of microfluidic devices, Fluidic transport mechanisms in Microfluidic devices, Pressure-driven and electro-kinetically driven flows in Devices, examples of microfluidic devices, Scaling of materials, Silicon materials for the manufacture, Glass materials for the manufacture, Polymer materials for the manufacture, Fluidic structures, Manufacturing a fluidic structure, Stacking sequence, Stacking sequence, Stacking-fabrication methods, Surface modifications, Different techniques involved in Surface modifications, Spotting mechanisms, Detection mechanisms-

#### Unit-5 - Electrochemical Fluidic Devices

Introduction to Electrochemistry, Electrical double layer, Electrochemical potential, Chemical potential-acid and base, Electrolyte and electrical conductivity, Semi-permeable membrane, Micro and nano fluidics devices, Applications in different fields, Fabrication and design of microfluid device, Testing of microfluid device, DNA transport, Development of artificial kidney, Electrochemical sensing ,Electrochemical Micro/Nano fluidics devices, Receptor and Transducer based classification of biosensors, Types of Biotransducers, Nanopores and nanopore membrane for biochemical sensing,Single Molecule sensing devices

Loarning	1. TerrenceConlisk, "EssentialofMicroandnanofluidics: with application stobiological and chemical	3. HenrikBruus, "Theoretical Microfluidics", Oxford Master Series inPhysics, 2007
Desources	sciences", Cambridge University Press, 2012	4. PatricTabeling, "Introduction to Microfluids", Oxford U. Press, 2005
Resources	2. Joshua Edel, "Nanofluidics", RCS publishing,2009	

		21/1	Continuous Learning A	ssessment (CLA)		Sum	motivo			
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native nge of unit test 0%)	Life-Long CL (10	g Learning A-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%	the second second	20%		20%	-			
Level 2	Understand	20%		20%	-	20%	-			
Level 3	Apply	30%		30%	and the state of	30%	-			
Level 4	Analyze	30%		30%	-	30%	-			
Level 5	Evaluate			Contraction of the local division of the loc			-			
Level 6	Create	the second second	- 4.3		1 - N	-	-			
	Total	10	0%	10	0%	10	0%			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Nagesh Kini, Thermax, Pune, Maharastra, nagesh. kini@gmail.com	1. Dr. Sampath Kumar T.S, IIT Madras, tssk@iitm.ac.in	1. Dr. Junaid MasudLaskar, SRMIST
2. Mr. K. Chandru Trivitron Healthcare Pvt. Ltd. Chennai, chandru.k@trivitron.com	2. Dr.Amit Kumar Mishra , IIT Jodhpur, amit@iitj.ac.in	2. Dr. V. Eswaraiah, SRMIST

9 Hour

Course Code	de 21NTO403T Course THINFILM PHOTOVOLTAICS						Co Cate	urse gory	0				OPEN	ELEC.	TIVE				<u> </u>	P 0	C 3
Pre-requi Course	isite es	Nil	Dhusiagan	Co- requisite Courses		Nil		Progre Cour	ssive ses					NI:I	Nil						
Course	Offering Departme	ent	Physics ar	na ivanotechnology	y	Data Book / Codes / Sta	andards						_	INII							
Course Le	earning Rationale (	CLR): TI	he purpose o	of learning this c	ourse is to:	1000		1	34	2.1	Progr	am Ou	itcome	s (PO	)				P	rogra	m
CLR-1:	Review the basic	principles ar	nd design of _l	<mark>photov</mark> oltaic cell te	chnology	1	1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	c es
CLR-2:	CLR-2: Understand the key properties of semiconductors films used in photovoltaic technology						e e		of	s of	1	iety			ĸ		a)				
CLR-3:	CLR-3: Review the basic photovoltaic device structure and design						vledc		ento	ations	ge	soc		-	oW r		ance	b			
CLR-4:	Develop an under	standing of	different thin	film photovoltaic d	levice techn	ologies and their design	Nou X	lysis	mdo	stige	Usa	and	ઝ્		[ean	u	& Fir	arnin			
CLR-5:	CLR-5:         Gain exposure to the various tools and techniques used in thin film photovoltaics						Perind	em Ana	jn/devel	ons uct inve lex prot	ern Tool	engineer	onment ainability	S	dual & ⁷	nunicati	ct Mgt.	ong Lea	5	2	ņ
Course Ou	utcomes (CO):	A	At the end of	this course, lear	ners will be	able to:	Fnoir	Probl	Desig	Cond	Mode	The e	Envir Susta	Ethic	Indivi	Comr	Proje	Life L	-OS	-OS-	-OSC
CO-1:	Differentiate betw	een diff <mark>eren</mark> t	n <mark>t typ</mark> es of pho	otovoltaic technolo	gies	Por Praise Vill	3		-	-	-	-	-	-	-	-	-	-	3	-	-
CO-2:	Interpret importar	t prope <mark>rties</mark>	of semicondu	uctors relevant to t	hin film pho	ovoltaics	3	100	1	-	-	-	-	-	-	-	-	-	-	2	-
CO-3:	Apply different ph	otovolt <mark>aic de</mark>	<mark>evic</mark> e design (	concepts for differe	ent applicati	ons		3	-	-	-	- 30	-	-		-	-	-	-	2	-
CO-4:	Appreciate advan	cemen <mark>t of di</mark>	lifferent types	of thin film solar c	ells	(1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	100	-	2	-	-	-	-	-	-	-	-	-	3	-	-
CO-5:	Appreciate the ad	lvanced cond	cepts and exp	plorations in thin fil	Im photovolt	aics	1.15	2	1.1	3	-	2	-	-	-	-	-	-	-	-	2
linit_1 - Br	asic Principle and	Dosign of P	Photovoltaic	Colle	60 M S S							5								٥	Hour
Basics and Non-idealit	asic Principle and I basic components ties, Loss mechani on-Examples of sen	of PV system sms – S-Q niconductors	ms-Mechanis limit -Optical s in PV-Device	m of PV-Sun as a & electrical loss e types in PV	source of ei mechanism	tergy-Solar spectrum , air s-Basics of solar cell de	r mass-Sola evice desig	ar Cell p n-Minin	arame nizatior	eters-De 1 of los	vice te: ses-Lat	sting-E teral d	fficienc esign-V	cy mea /ertica	isurem I desig	ents-Fi ın-Optio	F, VOC cal ver	, JSC sus el	etc for ectrica	ideal I trade	cells- eoffs-
Unit-2 - Se	emiconducting Fili	ns for Solar	r <mark>Cells</mark>	1000			1.00				1									9	Hour
Semicondu Band to ba illuminatior	uctor thin films-Optic and and Shockley- n-Photocurrent and	al absorption Read-hall re Spectral res	on-C <mark>arrier pho</mark> ecombination- sponse-Ideal o	to generation-Ban High injection effe diodes-Real p-n di	d gap-Direc ects-Surface odes-Tempe	vs. indirect bandgaps-Ca and interface recombination prature effects	arriers-Carr ation-Impli	iers trai cations	nsport- on de	Minority vice pe	carriei formar	r transj nce-PN	port pro I homo	pertie: junctic	s-Carri ons-Ca	er reco rrier tra	mbinat ansport	tion-life tundei	time a r broa	nd dei d spei	'ects- ctrum
Unit-3 - Di	ifferent Thin Film F	Photovoltaio	c Device Tec	hnologies	12-			-		110										9	Hour
Different ge and cons o CdTe/CdS cells: DSS	enerations of PV-TI of Thin film solar cel thin film solar cells Cs-QDSSCs, heter	nin film solar Is – Basic cc -Superstrate pjunctions-3	r cells-Silicon onfiguration o e structure-Cu rd generation	solar cells, First g f thin film solar cel InGaSe2/CdS thir n thin film solar cel	eneration si Ils - Thin filn n film cell teo Ils: organic F	icon solar cells, second g Silicon solar cells-Amorp Shnologies-Earth abundar V-Hybrid, perovskite sola	generation phous Silic nt alternation ar cells etc.	thin film on base ves-Thii	solar d sola n film s	cells, th r cells-a colar cel	ird gen -Si and Is base	eratior 1 a-Si: d on (	DSSC H solar Cu2ZnS	, pero cells- nS4-o	vskite, II-VI th ther m	organi in film aterials	c and µ PV-Cha s-3 rd g	oolyme alcopyi generat	r solar rite ph ion thi	r cells- otovol in film	pros taics- solar

#### Unit-4 - Preparation Techniques, Characterization and Device Modelling

Thin film deposition-Various techniques - Physical and chemical deposition techniques - Evaporation techniques-Sputtering techniques-MBE-Laser based techniques-CVD, PECVD-Spray and Non vacuum routes -Techniques to measure thickness-Optical and electronic properties of thin films-Fabrication process of thin film solar cells-Specific techniques used-Established parameters in thin film cell technologies-Basic characterization tools-Advanced characterization methods for device quality & defects-Study of interfaces, recombination etc-Basics of device modelling-Simulation softwares

#### Unit-5 - Device Architecture and Advanced Designs

9 Hour

9 Hour

Device architectures-Flexible substrates, transparent devices-Multi-junctions-Tandem solar cells-Bandgap profile optimization-Solar spectrum matching-Light trapping-Antireflection coatings-Self-cleaning coatings-Plasmonic enhancements-Luminescence concentrators-Up conversion-New concepts-quantum dots, & wires-Intermediate band solar cells-Multiple exciton generation, hot carrier solar cells-Commercial status-Hopes and challenges for thin film PV

50 B.C.A.

	1.	Solanki C.S., "Solar photovoltaics - fundamentals, technologies and applications", 3rd	4.	Green M.A., "Third Generation Photovoltaics: Advanced Solar Energy Conversion", Springer,
Looming		edition, PHI LearningPvt Ltd, New Delhi, India		2006Fundamentals of Solid State Engineering, Manijeh Razeghi, KLUWER ACADEMIC
Learning	2.	Fonash S.J., "Solar Cell Device Physics", Academic, 2010		PUBLISHERS, 2002
Resources	3.	Moller H.J., "Semiconductors for Solar Cells", Artech House, 1993	5.	Rointan. F, Bunshah," Hand Book of Deposition technologies for Thin Films and coatings by
				Science, Technology and Applications", Second Edition, Noyes Publications, 1993

			Continuous Learning	g Assessment (CLA)		Sum	motivo			
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (10	a Learning A-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	<u>The</u> ory	Practice			
Level 1	Remember	20%		20%	Person	<mark>- 20</mark> %	-			
Level 2	Understand	20%		20%		<mark>20</mark> %	-			
Level 3	Apply	30%	-	30%		<mark>- 30</mark> %	-			
Level 4	Analyze	30%		30%		<mark>3</mark> 0%	-			
Level 5	Evaluate	- Carlos				-	-			
Level 6	Create	1.1.1	-	-			-			
	Total	10	0%	10	0 %	10	0%			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. D.K. Aswal, National Physical Laboratory, dkaswal@nplindia.org	1. Dr. Ramesh Chandra Mallik, IISc Bangalore, rcmallik@iisc.ac.in	1. Dr. P. Malar, SRMIST
2. Dr. S. Sudhakar, CSIR-CECRI, sudhakar@cecri.res.in	2. Dr. Bhaskar Chandra Mohanty, Thapar University, bhaskar@thapar.edu	2. Dr. C. Gopalakrishnan, SRMIST

Course Code	21NTO404T Cou Na	nse me	NANOTECHNOLOGY IN SC	Cour Categ	se ory	0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3	
Pre-requi Course	isite Nil	Nil	Pr	ogres Cours	sive es						Nil	1							
Course	Course Offering Department Physics and Nanotechnology Data Book / Codes / Stand											Nil							
Course Learning Rationale (CLR): The purpose of learning this course is to:							Program Outcomes (PO) Program										m		
CLR-1: Provide an insight into the fundamentals of social-economic implications of nanotechnology						2	3	4	5	6	7	8	9	10	11	12	12 Specific outcome		
CLR-2:	Provide an insight into pertaining to nanotechno	knowledg <mark>e o</mark> ology	o <mark>f techno</mark> logy needs, social, p	political, and economic implications	ge		of	sof	15	ciety			ork		e				
CLR-3:	Understand the impact of	of nanot <mark>echno</mark>	o <mark>log</mark> y, challenges, ethical issue	es	vled		ient	ation	ge	l soc			n Wo		Janc	Ð			
CLR-4:	Understand the societal	impli <mark>cations,</mark>	economics, policy regulations	to Improve the quality of life	Knov	alysis	lopm	estig:	Usa	r and	8		Tear	<u>io</u>	& Fii	arnir			
CLR-5:	Understand the issues of	of p <mark>ublic awa</mark> r	eness and risks associated wi	ith nanotechnology	sering	em Ane	n/deve	Lict inve	n Tool	nginee	nment		ual & .	nnicat	t Mgt.	ong Le	_	0	~
Course Ou	utcomes (CO):	At the e	nd of this course, learners w	vill be able to:	Engine	Proble	Design	Conductor	Moder	The ei	Enviro Sustai	Ethics	Indivic	Comr	Projec	Life Lo	PSO-`	PSO-2	PSO-3
CO-1:	Address the socioecono	<mark>mic implic</mark> atic	ons of nanotechnology	CHE SHEAT	2		-	÷	2-1	- 1	-	3	-	-	-	-	2	-	-
CO-2:	Apply the knowledge of technology needs, social, political, and economic implications pertaining to nanotechnology							-5	-	e. 1	1	3	-	-	-	-	3	-	-
CO-3:	: Address the impact of na <mark>notechno</mark> logy, challenges, ethical issues						-	-	-		-	2	-	-	-	-	-	3	-
CO-4:	<b>:O-4:</b> Address the societal implications, economics, policy regulations to Improve the quality of life						6-6	-	-			3	-	-	-	-	-	2	-
CO-5:	CO-5: Handle the issues of public awareness and risks associated with nanotechnology					67	-	-	-	÷	-	3	-	-	-	-	-	-	2

## Unit-1 - Knowledge and Scientific Understanding of Nature

Knowledge and Scientific Understanding of Nature - Industrial Manufacturing, Materials and Products - Medicine and the Human Body - Sustainability: Agriculture, Water, Energy, Materials, and Clean Environment - Space Exploration - National Security- Moving into the Market - The Interactive Process of Innovation and Diffusion - - Ethical Issues and Public Involvement - Social Science Research Approaches and Methodologies Unit-2 - Technology Growth- Social, Political Implications

National Nanotechnology Initiative - The Age of Transitions - Technological Implications of Nanotechnology: Why the Future Needs Us - National Needs Drivers for Nanotechnology - Nanotechnology and Societal Transformation - Focus on Economic and Political Implications of Potential Technology - Impact of Nanotechnology on the Chemical and Automotive Industries - Societal Implications and Scaling down to Nanoelectronics - Future Implications of Nanoscale Science and Technology: Wired Humans, Quantum Legos, and an Ocean of Information - Implications of Nanotechnology in the Pharmaceutics and Medical Fields - An Economist's Approach to Analyzing the Societal Impacts of Nanoscience and Nanotechnology - The Strategic Impact of Nanotechnology on the Future of Business and Economics - - Implications of Nanoscience for Knowledge and Understanding-

# Unit-3 - Nanotechnology Challenges Education, Ethics and Legal Aspects

Nanotechnology, Education, and the Fear of Nanobots - Mathematical Challenges in Nanoscience and Nanotechnology - Implications of Nanotechnology for the Workforce - Societal Impacts of Nanotechnology in Education and Medicine - Technological and Educational Implications of Nanotechnology: Infrastructural and Educational Needs - Dynamics of the Emerging Field of Nanoscience - Focus on Medical, Environmental, Space Exploration and National Security – Implications - Challenges and Vision for Nanoscience and Nanotechnology in Medicine: - Lifecycle/Sustainability Implications of Nanotechnology - Implications of Nanotechnology for Space Exploration - Security Aspects of Nanotechnology - Focus on Social, Ethical, Legal, and Cultural Implications - Social Science Research Methods for Assessing Societal Implications of Nanotechnology - Ethical Issues in Nanotechnology -

9 Hour

9 Hour

#### Unit-4 - Nanotechnology-Unintended Consequences, Risks, Toxicity and Governance

Societal Implications of Nanotechnology - Socio-economic Research on Nanoscale Science and Technology: A European Overview and Illustration - Nanotechnology and Unintended Consequences - A Cultural Ecology of Nanotechnology Envisioning and Communicating Nanotechnology to the Public Vision, innovation, and policy Challenges for government and universities - Nanoparticle Toxicity and risk - Social impacts of nano biotechnology – issues; Problems of governance of nanotechnology Negotiations over quality of life in the nanotechnology initiative – Governance Technological revolutions and the limits of ethics in an age of commercialization - Regulatory structures and society - Nanotechnology and social trends

### Unit-5 - Public Awareness and Perception of Nanotechnology

Public Perceptions of Nanotechnology - Public Awareness of Nanotechnology - Public interaction research - Nanotechnological risks - Assessment of nanotechnological risks - Importance of Risk communication -Problems in Risk communication - Nanotechnology's social impacts - A preliminary analysis of nanotechnology in the media - Nanoscience and engineering – Public engagement - Nanophobia – Fear of Nanotechnology - Public Engagement with nanotechnology - Nanotechnology: moving beyond risk - Communication streams and nanotechnology: interpretation of a nanotechnology - Individual perspectives of nanotechnology - The case of Cold Fusion - The case of Recombinant DNA

Learning	1.	Mihail C.R., and William S.B., "Nanotechnology: societal implications", Springer	3.	Mihail C. Roco and William Sims Bainbridge," Societal Implications of Nanoscience and
Desources		publication, 2011 (97 <mark>8-1-4020- 5</mark> 432-7 (e-book))		Nanotechnology", National Science Foundation, 2001 (978-0-7923-7178-6)
Resources	2.	Ronald sandler, "Nanotechnology the Social & Ethical Issues", Woodrow Wilson, 2009	2	

Learning Assessme	ent 2											
			Continuous Learning		Summativa							
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test )%)	Life-Long CL (10	Learning A-2 %)	Final Examination (40% weightage)						
		Theory	Practice	Theory	Practice	<u>The</u> ory	Practice					
Level 1	Remember	- 20%		20%	- June	- 20%	-					
Level 2	Understand	20%		20%		20%	-					
Level 3	Apply	30%	-	30%		30%	-					
Level 4	Analyze	30%		30%		<mark>30</mark> %	-					
Level 5	Evaluate	and the second second					-					
Level 6	Create	A	- H	•	-		-					
	Total	10	0 %	100	)%	100 %						

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
<ol> <li>Mr.Ajay Kumar, Avansa Technology and services, India ajaykumar@avansa.co.in</li> </ol>	1. Dr. Hirendra N Ghosh, Institute of Nanoscience and Technology, Punjab, hnghosh@inst.ac.in	1. Dr. R. Ajay Rakkesh, SRMIST
<ol> <li>Dr. Tanvi Sharma, Nanoshel LLC, Chandigarh, India, tanvisharma@nanoshelcom</li> </ol>	2. Dr. Asish Pal, Institute of Nanoscience and Technology, Punjab,apal@inst.ac.in	2. Dr. C.Gopalakrishnan, , SRMIST

9 Hour

Course Code	21NTO405T	Course Name	POLYMER ENGINEERING				Course Category O						OPEN ELECTIVE						P 0	C 3
Pre-requi Course	site es	Nil	C.	o- requisite Courses	Nil	F	Progressive Courses Nil													
Course	Offering Departme	ent	Physics and N	Vanotechnology	Data Book / Codes / S	Standards							Nil							
Course Le	arning Rationale (	CLR): T	he purpo <mark>se of l</mark>	earning this course	is to:		1			Progr	am Ou	<mark>itcom</mark> e	s (PO	)				P	rogra	m
CLR-1:	Acquire basic kno	wledge abo	out the st <mark>ructure a</mark>	and property of polym	ners	1	2	3	4	5	6	7	8	9	10	11	12	01	itcom	es
CLR-2:	Impart chemistry	aspects on v	vario <mark>us polyme</mark> r i	materials	and and a second	e		of	s of	24	iety			ĸ		a)				
CLR-3:	Acquaint with various compounding ingredients and mixing equipments					vledç		ento	ations	ge	soc			oW r		ance	b			
CLR-4:	CLR-4: Understand the principles behind the elasticity of the polymers				Knov	Ilysis	mdo	stiga	Usa	r anc	৵		Tean	io	& Fir	arnin				
CLR-5:	CLR-5: Gain knowledge about reinforcements and effect of nanofillers				eering	em Ana	In/devel	uct inve lex prot	m Tool	Inginee	onment		dual & ⁻	nunicat	ct Mgt.	ong Le:	-	2	8	
Course Ou	utcomes (CO):	4	At the end of thi	is course, learners v	vill be able to:	Engin	Proble	Desig	Cond	Mode	The e	Envire	Ethics	Indivi	Comr	Proje	Life L	-OSc	-OSc	-OS
CO-1:	Apply the enginee	ering pri <mark>ncip</mark> l	les underlying the	<mark>e proc</mark> essing of polyr	ner raw materials	3	-	-	2	-	-		-	-	-	-	-	2	-	-
CO-2:	Extend and apply	the knowled	<mark>dge </mark> of polymers i	to materials science	and engineering	-	2	1	- 1	-	-	-	-	-	-	-	-	3	-	-
CO-3:	Identify different f	illers as <mark> rein</mark>	n <mark>forc</mark> ements	1 5000				3	2	-	-	-	-	-	-	-	-	-	3	-
CO-4:	Illustrate the work	ing of m <mark>ould</mark>	ding and extrusio	on techniques		3	-	2		-		-	-	-	-	-	-	-	3	-
CO-5:	Evaluate the mec	hanical <mark>beha</mark>	<mark>avior</mark> of polymers	S	Takker Street	2	-	3	-	-	1	-	-	-	-	-	-	-	-	2
Unit-1 - Ba	asics and chemist	ry of polym	eric materials								÷								9	Hour
Historical o	levelopments in pol	ymeric ma <mark>te</mark>	erials and general	l applications Materia	ls- Monomer & functionality-	Oligomer- Poly	mer str	ucture-	Method	ls of s	ynthes	is- Addi	ition po	olymer	ization	- Conde	ensatio	on poly	meriz	ation-
Co- polym	ers- Cross linked p - Determination of	olymers- C	rosslinking plast	icizers and fillers- C	rystallinity- Glass transition	temperature- I	Degree	of poly	ymeriza	tion- (	Classifi	ication	of pol	ymers-	• Moleo	cular w	eight-	Molec	ular w	<i>reight</i>
Unit-2 - Po	olymers materials	science and	d engineering	alar wolgne		-			-	1									9	Hour
Mechanica elongation- biomedical	l behavior of Polyr - Griffin theory- Te Polymers, mechan	ners-uses o ar test- Fati ical testing s	of pol <mark>ymers base</mark> igue and wear- F system for polym	ed on their mechanic Hardness- Compress <mark>iers</mark>	al property, Deformation- Fi ive strength- Time depende	racture in poly ent properties-	mers- Creep-	Crack Effect	growth- of wea	Tensi therin	ile stre g- Stre	ength,- ess-stra	Flexur in bel	ral stre havior	ngth- I of poly	mpact mers-	resista Mecha	ance- anical	Percei behav	ntage ior of
Unit-3 - Po	olymer viscoelasti	city and rhe	eology	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1								100							9	Hour

Polymer Viscoelasticity and Rheology- importance-Definition of elastomers- Requirements of polymer to be elastomer- Nature of viscoelasticity- Definition of elastomers- Classifications of elastomers- Stress relaxation- Relaxation and retardation times- The time - temperature superposition principle- Dynamic properties- Zener model- Polymer melt viscosity- Plasticizers- Lubricants- Polymer Rheology- Rheological concepts of polymer solutions and melts- Degradation plasticization- Various rheology modifiers, rheometer-Working principle and instrumentation

#### Unit-4 - Reinforced polymers and composites

Reinforced plastics- Nanofillers and reinforcements with examples- Synthesis methods for composite polymers, Effect of reinforcements like calcium carbonate, dolomite, silica glass- Fibrous reinforcements (inorganic and organic)- Glass fiber and boron fiber- Carbon fiber and aramide fibers- Compression moulding- Classification and characteristics of composite materials- Fibrous composite materials- Laminated composite materials- Particulate composite materials- Combinations of composite materials- Strength of composites- Failure modes of long, fibre composites- Axial tensile failure- Transverse tensile failure, shear failure- Applications of fiber reinforced polymer composites

# Unit-5 - Engineering & high-performance plastics

Elements of Design- Engineering thermoplastics- Applications of thermoplastics, Thermosets and composites- Compression moulds : positive, semi- Positive- Flash mould with horizontal and vertical Flash-Injection moulds : Two plate and three plates types- Joining and fastening- Post extrusion techniques- Metallization- electroplating- Stamping- Welding and bonding- printing and painting on plastics- Cross-linking of thermoplastics materials- Cellular plastics- Compound development- Principles of mixing- Rubbers, designing for strength

Loorning	1.	Sperling L.H., Introduction to Physical Polymer Science, Wiley inter science, 4th	З.	HullD., and Clyne W., An Introduction to Composite Materials, Cambridge University Press,
Deseuress		Edition, 2006		2ndEdition, 1996
Resources	2.	Mc Crum, Principles of polymer Engineering, 2nd Edition, Oxford, 2001	4.	Jones R.M., "Mechanics of Composite Materials", Taylor & Francis, 2nd Edition, 1999

			Continuous Learning A	Summotivo							
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (10	y Learning A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%	the start and the	20%		20%	-				
Level 2	Understand	20%		20%		20%	-				
Level 3	Apply	30%		30%		30%	-				
Level 4	Analyze	30%		30%	-	<u>30%</u>	-				
Level 5	Evaluate			and the second second			-				
Level 6	Create	Contraction of the second	- <b>1</b> 0			-	-				
	Total	10	0%	10	0%	10	0%				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. PankajPoddar, National Chemical Laboratory, p.poddar@ncl.res.in	1. Dr.G. Arthanareeswaran, NIT Trichy, arthanareeg@gmail.com	1. Dr. N. Angeline Little Flower. SRMIST
2. Dr. P. Sudhakara, CLRI – CSIR, Jalandhar, sudhakarp@clri.res.in	2. Dr. A. Kannan, IIT Madras, kannan@iitm.ac.in	2. Dr. C. Siva, SRMIST

9 Hour

Course Code	21NTO406T	C	Cours atego	se ory	0				OPEN	ELEC	TIVE				- T 3 0	P 0	C 3				
Pre-requi Course	site s	Nil		Co- requisite Courses	Nil	-	Pr	ogres Cours	sive es						Nil						
Course	Offering Departme	nt	Physics a	and Nanotechnology	Data Book / Coo	des / Standards								Nil							
Course Le	arning Rationale (	CLR):	The purpose	e of learning this cour	se is to:			1		Program Outcomes (PO)									P	Program	
CLR-1:	Understand variou	us nanot	technology tech	niques and materials fi	o <mark>m th</mark> e point of view of the	e industry	1	2	3	4	5	6	7	8	9	10	11	12	S OU	pecifi tcom	c es
CLR-2:	2-2: Understand the practical and business aspects of nanotechnology									-	1.		lity								
CLR-3:	Understand the concept of self-assembly of carbon nanostructures and various other materials and the applications								nt of	ons of	0	society	stainabi		Work		nce				
CLR-4:	<b>2-4:</b> Gain knowledge on material in the nanoscale which can be use in Electronics, Medical, Textiles Industry							Sis	pme	tigati	Isage	ands	Sus		am		Fina	ning			
CLR-5:	CLR-5: Acquire knowledge on physical properties of nanostructured materials and their size and dimensionality dependence							m Analy	I/develo	ict invest ex proble	n Tool U	ngineer a	nment &		lual & Te	unicatio	t Mgt. &	ong Lear			~
Course Or	itcomes (CO):		At the end o	of this course, learner	s will be able to:		ngine	roble	esign	ondu	loder	he er	nviro	thics	divid	omm	rojec	fe Lo	SQ-1	20-5	SO.S
CO-1:	Elucidate on adva	ntages o	of nanotechnolo	ogy based applications	in each industry		ш 3	<u>م</u>			2	- F	- Ш	<u>نن</u> -	-	- -	- P	-	3	<u> </u>	 _
CO-2:	Provide instances	of conte	emporary indus	trial applications of nan	otechnology in medical	Tel: 1 /	3		3			-	-	_	_	-	-	-	_	2	-
CO-3:	Provide an overv energy & environ	iew of <mark>f</mark> nental ir	uture technolog	gical advancements an	d increasing role of nand	otechnology in	3	-	-	2	-	-	-	-	-	-	-	-	3	-	-
CO-4:	Apply the techniqu	ues for <mark>u</mark>	ise of nanotech	nology on agriculture a	nd food industry	1	3		3	2	-		-	-	-	-	-	-	-	2	-
CO-5:	Utilize the knowle	dge on r	n <mark>anomate</mark> rial to	open a startup compar	ny <b>s</b>	1.2	-	2	-	-	3	-	-	-	-	-	-	-	-	-	2
Unit-1 - Na Nano elect	notechnology bas rical, Nano electron	sed indu ic device	Istrial applicat	ti <b>ons</b> tages - Data storage, M	emory devices - Micromec	chanical systems	s, Nan	oelect	tromec	hanical	syster	ns - La	sers, L	lse of l	asers i	n lightir	ng and	display	/s - Re	9 charg	<b>Hour</b> eable
capacitors,	Capacitance versu	s pore s	size - Character	ization of nanoparticle (	coatings, Nanoparticle coa	atings: Electrical	and e	electro	nic ap	olication	ns and	nanop	article	coatin	gs for	electric	al prod	lucts		Jubic	layor
Unit-2 - Na Nanopartic surgery , R - Cancer d nanopartic	nomaterials in bio les in bone substitu ole of nanoparticles iagnostics: nanotec les and cancer	o applica Ites, Nai s in drug hnology	<b>ation</b> noparticles in de delivery - Nand , Cancer therap	entistry - Tissue engine oparticles in targeted di oy: nanotechnology - N	eering, Regenerative medi ug delivery, Metal oxide n ano-sensor in cancer, Na	icine - Tissue er anocarriers for anoparticle prob	nginee drug c es and	ring a leliver d mole	nd nar y - Silio ecular i	notechr ca-base imaging	ology, ed nan i in Ca	Incorr o drug ncer -	oorated delive Nanon	l scaffo ry , Po nedicir	olds foi lymer l ne-base	tissue based i ed use	engine nanoma of siRl	eering aterials NA in c	- Nanc for dr ancer	9 probot ug de , Maę	Hour ics in livery netic
Unit-3 - Ro Backgroun waterborne methods of Gas-senso in solid sta	le of nanotechnol d of TiO2 as a seri pollutants, Nanom farsenic-contamina r: Techniques used te sensors, Small d	ogy in v niconduc aterials ted wate for gas- imensioi	water and envir ctor photocataly in water treatme er , Treatment of sensor, Conduc nal toxic gas se	ronment remediation yst, Photocatalytic mec ent – photocatalytic wai f arsenic using nanopar ction mechanism in sen nsor for air- quality mo	industries hanism and general path er splitting - Origin of arse ticles other than TiO2 - Ch niconducting sensing films nitoring	way -Photocata nic in groundwa NTs in water trea - Metal-oxide ba	lytic k iter, H itmen ised g	inetic: ealth techr as-se	s, TiO2 impact nology nsor de	2 nanop s of ars , Functi evices,	enic, enic, onaliz Classii	s for v Nanop ed graj fication	vater p articles ohene i of sen	urificat for tre for rem nicond	tion - I eatmen noval o uctor s	Photoca t of ars f contai ensors	atalytic senic - I minatic - Chall	degra Mecha ons and enges	dation nism o I wateı and oเ	9 of sp f treat treat oportu	Hour ecific ment nent, nities

#### Unit-4 - Nanotechnology based applications in agriculture

Applications of nanotechnology in the agriculture, Agriculture chemicals - Nanomaterials in plant protection, Diagnosis and control of plant diseases - Potential of nano-fertilizers, Nano-fertilizers: Nutritional value and health - Applications of nanotechnology in food industry, Protein nanostructures - Engineered nanoparticles in food, Silica (SiO2) and silicates nanoparticles in food - Nanomaterials in active packaging for food preservation, Barrier nanomaterials for food packaging - Nano-enabled indicators of food quality and safety, Challenges of using nanotechnology in agriculture and food sectors, Nanomaterials in active packaging for food preservation, Principles of involved nano-enabled sensing, Nanocomposite with antimicrobial properties, Nanotechnology for intelligent packaging as food freshness and safety monitoring solution -Examples

## Unit-5 - Nanofibres and nanomaterials in textiles and cosmetics

Nanotechnology and Nanofibers, Nanofibre production: Electrospinning - Basic to Electrospinning: Solution surface tension, Polymer solubility, viscosity, Electrospinning parameters: Controlling morphologies of nanofibers - Electrospun Polycrylonitrile Nanofibers, Electospun TiC/C composite for energy related application - Light-emitting polymer nanofiber, Polymer nanofiber field-effect transistors - Multifunctional polymer nanocomposites, Electrospun carbon nanofiber: electrode material - Nano finishing in textiles: UV resistant, Antibacterial, Nano finishing in textiles: hydrophilic, self- cleaning - Protective textile against electromagnetic radiation, Nanotechnology: Self-Cleaning textile - Safety evaluation of nanomaterials in cosmetic products, Nanomaterial in cosmetic: determination of physicochemical properties - Cosmetic formulation: TiO2 and ZnO nanoparticles, Nanotechnology in shampoos, hair- conditioners: Hair follicle targeting

	1.	Kenneth E.G., Craig R.H., Cato T.L., Lakshmi S.N., Biomedical Nanostructures, John	4.	M. A. Axelos, M. H. Van de Voorde, Nanotechnology in Agriculture and Food Science, John Wiley
		Wiley & Sons Inc., 2008		& Sons, 2017
Learning	2.	P. J. Brown, K. Stevens, Nanofibers and Nanotechnology in Textiles, Woodhead	5.	M. H. Fulekar, Nanotechnology: Importance and Applications, IK International Publishing House
Resources		Publishing Limited, Cambridge, 2007		Pvt. LTD, 2010
	З.	C. M. Hussain, A. K. Mishra, Nanotechnology in Environmental Science, Volume		
		2,John Wiley & S <mark>ons, 201</mark> 8	12	

				Summotivo								
	Bloom's Level of Thinking	Forr CLA-1 Avera (5	native nge of unit test 0%)	Life-Long L CLA- (10%	earning 2 .)	Final Examination (40% weightage)						
		Theory	Practice	Theory	Practice	<u>The</u> ory	Practice					
Level 1	Remember	20%		20%	-	<mark>2</mark> 0%	-					
Level 2	Understand	20%	- 177	20%	-	20%	-					
Level 3	Apply	30%	- ///	30%	-	30%	-					
Level 4	Analyze	30%	- 11	30%	-	30%	-					
Level 5	Evaluate	Sec. Sec.		-	1- 1- V	-	-					
Level 6	Create	1-1		-		· · ·						
	Total	10	0%	100 %	%	100 %						

Co	urse Designers				
Ex	perts from Industry	Ex	perts from Higher Technical Institutions	Int	ernal Experts
1.	Dr. Hemant Dixit, GlobalFoundaries,USA, aplahemant@gmail.com	1.	Dr. Pradeep T, IIT Madras, pradeep@iitm.ac.in	1.	Dr.Debabrata Sarkar, SRMIST
2.	Dr. Krishna SurendraMuvvala, Saint Gobain Research India, India,	2.	Dr. M. S. Ramachandra Rao, IIT Madras, msrrao@iitm.ac.in	2.	Dr. Senthilkumar E, SRMIST
	Krishna.muvvala@saintgobain.com				

9 Hour

Course Code	Course Code         21NTO407T         Course Name         QUANTUM COMPUTING				Co Cat	Course Category		0				OPEN I	ELECT	ΓIVE			l	- T 3 0	P 0	C 3
Pre-requ Course	isite es	Nil	Co- requisite Courses	Nil		Prog Co	ress urse	sive es						Nil						
Course	Offering Departme	ent	Physics and Nanotechnology	Data Book / Codes / S	Standards								Nil							
Course Le	earning Rationale	(CLR):	The purpose of learning this cour	rse is to:			1			Progra	am Ou	Itcome	s (PO)	)				P	rogra	m
CLR-1:	Outline the impor	tance of	quantum computation	10 200		1	2	3	4	5	6	7	8	9	10	11	12	S OL	pecifi Itcom	C es
CLR-2:	Understand the a	spects o	f quantum computational models	1 million		e		f	of	34	ety			¥		0				
CLR-3:	Comprehend the	concept	s of quantum mechanics involved in qu	uantum computing		ledg		ent o	tions	ge	soci		-	Mol		ance	0			
CLR-4:	LR-4: Familiarize with quantum circuits						ysis	opme	stiga	Usa	and	ళ		eam	и	μ	rnin			
CLR-5:	<b><i>R-5:</i></b> Realize the various aspects of quantum algorithm and quantum computer hardware					sering h	m Anal	n/develo	ct inve	n Tool	Igineer	nment nability		ual & T	unicatio	t Mgt. 8	ng Lea			
Course O	ourse Outcomes (CO): At the end of this course, learners will be able to:						Proble	Design	Condu	Voder	The er	Enviro Sustai	Ethics	ndivid	Comm	Projec	-ife Lc	-SO-1	-OSc	S-OS
CO-1:	Understand the e	volution	of quantum computing	Steel Const.		3	-	3	-			-		-	-	-	-	2	-	-
CO-2:	Analyze the vario	ous quan	tum computational models			3	3		-	-	-	_	-	-	-	-	-	-	-	-
CO-3:	Apply the principl	les of qua	antum mechanics in quantum computi	ng		3	3	-	-	-	-	-			-	-	-	-	3	2
CO-4:	Employ the quan	tum gat <mark>e</mark>	s for designing quantum circuits			3	-		3	-	-	-	-	-	-	-	-	-	-	2
CO-5:	Utilize the quantu	ım algor <mark>i</mark>	thm for real time applications	1 Tak Strategy		3	-	3	-	-	26	-	-	-	-	-	-	-	-	-
			120	dial of the later																
Unit-1 - In What is inf	troduction to Qua	ntum Co	mputing	mation Shannon's first coding t	thoorom M	oro ab	out t	tho hit	M/by	to wo	nood t	know	how to	0 man	nao infr	ormotic	n2 14	/hich t	<b>9</b>	Hou
- The gubi	ts - A brief history o	f quantu	m computation and quantum commun	ication.		ue au	outi		- vviiy (	IO WE	neeu l		110 w tt		iye init	Jinalic	11: - VV	mente	501110	.ogy:
Unit-2 - Q	uantum Computat	ional Mo	odels						1	1									9	Hou
Quantum o	computational mode	els: Elem	entary idea of complexity of an algorith	nm - Turing machine, Determinis	stic Turing ma	achine	- Pr	robabi	listic Tu	ring m	achine	e - Reve	ersible	Turing	mach	ine – Q	uantur	n Turii	ng ma	chine
- Circuit in	rinciples of Quant	n - Comp u <b>m Mecl</b>	hanics in Quantum Computing	2S	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	-	-				-								Q	How
Basic idea	s of quantum mech	anics - A	A little more of quantum mechanics - [	Density operator and density ma	atrix - Density	v oper	ator	of pur	e state	s - De	nsitv o	perator	of mix	xed sta	tes - T	The me	anina (	of enta	analen	nent -
Bell's ineq	uality and nonlocali	ity – A litt	le more algeb <mark>ra for quantum</mark> computir	ng – Bell measurement and enta	anglement - F	Partial	trac	e - 1 (	Quantui	n bit c	ommiti	<mark>nen</mark> t ar	nd qua	ntum c	coin - S	Schmid	decon	nposit	ion - F	<i>Partia</i>
transpose	and test of entangle	ement - E	<u>Entanglement witness - State discrimin</u>	nation - Trace distance and fideli	lity – No clon	ing the	eorei	m - Co	onclusio	ons fro	m n <mark>o c</mark>	loning	theore	m - Ot	her no-	-go the	orems.	·		
Unit-4 - Q	uantum Gates and	Quantu	m Circuits					· ·				C.							9	Hou
Quantum g cost - Garl	gates and quantum bage bit – Quantum	circuits - cost - D	epth and width of a circuit - Total cost	- Circuit optimization rules - Mo	e on quantum wing rule – T	a gates Templa	s – Q ite <mark>m</mark>	uantu natchir	m circu ig - Vis	its – Q Jalizin	g the q	ative me juantun	easure 1 gate.	∶s ot qu	iality of	r a circi	lit - Ga	te cou	nt or o	SIFCUI
Unit-5 - Q	uantum Algorithm	s for Re	al Time Applications																9	Hour
Quantum I Physical re	ogic gates - The De ealizations: Trapped	eutsch alg d ions - S	gorithm - Generalization to n+m qubits Superconducting gubits - Quantum dot	- The Grover search algorithm -	- The quantu	ım Fol	irier	transf	orm - T	he per	iod of	a functi	on - C	lassica	l algori	ithms a	nd qua	intum	algori	thms.

	1.	Anirban Pathak, Elements Of Quantum Computation, CRC Press, First Edition, 2013	3.	Michael A Nielsen; Isaac L Chuang, Quantum computation and quantum information, Cambridge
Learning	2.	Michel LeBellac, , A Short Introduction To Quantum Information And Quantum		university press, 2010.
Resources		Computation, Cambridge university press, 2006	4.	Tim Spiller, Hoi-Kwong Lo, Introduction to quantum computation and quantum information, World
				Scientific Publishing Company, 2001

Learning Assessm	ent		1111 11 11 11 11 11 11 11 11 11 11 11 1	1 7-2-							
			Continuous Learning	g Assessment (CLA)		Cum	mativa				
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (1)	g Learning _A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%		20%		20%	-				
Level 2	Understand	20%		20%		20%	-				
Level 3	Apply	30%	States Land	30%		30%	-				
Level 4	Analyze	30%	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	30%		30%	-				
Level 5	Evaluate					1. IST 1-	-				
Level 6	Create		the states			-	-				
	Total	10	0%	10	0%	100 %					

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Prabha Narayan , QKRISHI	1. Dr. Ranjit Kumar Nanda, IIT Madras, nandab@iitm.ac.in	1. Dr. RM Hari <mark>haran, S</mark> RMIST
2. Dr. Hemant Dixit. Global Foundaries, USA, aplahemant@gmail.com	2. Dr. G. P. Das.IIT Kharagpur gpdas@metal.iitkgp.ac.in	2. Dr. C. Siva. SRM IST



B.Tech / M.Tech(Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses –Syllabi-Control Copy

Course Code	21NTO311T	S Ca	ourse itegory		0	OPEN ELECTIVE										P 0	C 3				
Pre-requi Course	site s	Nil	Ci	o- requisite Courses	Nil		Prog Co	ress urse	sive es						Nil						
Course (	Offering Departme	ent	Physics and N	Vanotechnology	Data Book / Codes / St	andards								Nil							
Course Le	arning Rationale (	(CLR):	The purpose of le	earning this cours	e is to:		Program Outcomes (PO)											Program			
CLR-1:	Express the basis	s of cosme	eceuticals	- 10	1000		1	2	3	4	5	6	7	8	9	10	11	12	ou	pecifi itcom	c es
CLR-2: Demonstrate the classification and various types of cosmetics								3	f	s of	1	ety			rk		0				
CLR-3: Analyze about ingredients and effect of inclusion of nanoparticles in cosmetics									ento	tions	ge	soc			oW I		ance	0			I
CLR-4: Get acquainted with current trends in the field of nano based cosmetics								IJSIS	opm	stiga	Usa	and	∞ŏ		earr	uo	& Fin	urnin			I
CLR-5:	Get acquainted w	vith future a	aspects of cosmed	ceuticals	at a solution		ing l	Ana	evel	inve	Tool	neer	nent bility		I & T	licati	1gt. 8	J Lea			
				and the first of the second	1.5.1 A. 1.5.1		neer	liem	ign/d tions	duct	ern	engi	ronn aina	S	'idua	mur	ect N	Lonç		-2	<u>د</u>
Course Ou	itcomes (CO):		At the end of this	i <mark>s cours</mark> e, learners	will be able to:	1976	Eng	ы Богч	Des solu	Con	Mod	The	Envi	Ethi	Indiv	Corr	Proj	Life	PSC	PSC	PSC
CO-1:	Apply basic conc	epts of <mark>nar</mark>	notechnology in co	osmetics	Silve Curt Vi	41.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO-2:	Distinguish effect	ts of usi <mark>ng</mark>	nanoparticles ove	er conventional meth	ods in cosmetics		3		3	-			-	-	•	-	-	-	3	-	-
CO-3:	Analyze about cu	ırrent tr <mark>end</mark>	<mark>ls in t</mark> he field of co	osmetics	1995 - 1997 - F.S.	100	2.1	-	1	2	-	- 10	-	-		-	-	-	2	-	-
CO-4:	Apply basic cosm	netic co <mark>nce</mark>	<mark>epts in</mark> making nan	noformulation		10	100	-	2	-	-	-	-	-	-	-	-	-	-	-	2
CO-5:	Apply knowledge	in mak <mark>ing</mark>	organosilicone fo	ormulation		1	-	-	1	2	-	2	-	-	-	-	-	-	-	-	2
			1											-							
Unit-1 - Co	osmetics basis	noso of co	smotics Mooning	of cosmotics Classi	ication of cosmotics Cosmocou	ticals Dhr	ormaco	utica	ols in c	osmoti	cs Out	olity ch	aracto	rictics	Quality	1 2001	anco I	Dovolo	omont	9	Hour
cosmetics-	Cosmetics for Skin	n- Cosmeti	cs for hair-Cosme	etics for nails-Cosm	etics colour materials-Cosmetic	s and fra	agrance	es-O	ral ca	re cosi	metics	-Body	cosme	etics-P	hysica	l chem	istry o	f cosn	netics-	Stabil	ity of
cosmetics				12.1	/ 31	1	-			14	-7										
Oily materi	osmoceuticals	ils and fats	wax-Hydrocarbo	ns-Higher fatty acio	s-Higher alcohols esters silico	nes-Surfa	ce acti		nents	· introd	luction	-Anior	nic surfa	actant_	Cation	ic surf	actants	-Amnh	oteric	9 surfa	Hour
Non-ionic s	surfactant-Other su	irfactants- I	Humectants : intro	oduction-Choice of	humectants-Unusual humectan	ts-Specia	l uses	of h	umect	ants-Ar	ntioxid	ants :	introdu	iction-	Genera	al oxida	ative th	neory,	meası	ireme	nt of-
oxidation-A	ssessment of oxida	ant efficien	ncy-Choice of antic	oxidant	T THE MENT	11			14				1.1-								
Unit-3 - Na	inoparticles in cos	smetics	Thiskonara Turas	of this ways Dalyman	re in heir colouring Types of a	human in	haires	lour	Cand	it in min m	nalum		unfo ata	nto in	o o m d it	lanara	Clean		anta I	<u>9</u>	Hour
alcohols-Si	ilicones-Emulsions	Tvpes of p	olvmeric systems-	Natural polymers-S	imuli responsive polvmeric svst	ems-pH-re	nair co esponsi	iour ive-1	-Conal Therma	al respo	nsive-	Photo	o respoi	nis in nsive	conait	ioners	Cleans	sing ag	ents-E	шоху	lated
Unit-4 - Na	noformulations in	n Cosmetio	cs																	9	Hour
Multiple em	ulsions as novel de	livery syste	ems-Nano emulsior	n in cosmetics-Nano	crystals in cosmetics-Silicones a	nd beyon	d-Orga	n mo	odified	silicone T	s-New	ester.	s mimic	king pi	operty	for org	an moo	dified s	ilicone	s-Silic	ones
IN Shampoo	o-Minimalizing unde osomes in cosmeti	esirable sid	te effects-Substant	tive silicones-Effect	or substantive silicones-Organo	-modified	aeliver	/ Sys	stems- mnleve	i ypes	ot Urg smetic	ano-m	odified	aelive	ry syst	ems-S	llicones	s perso	onal ca	are de	livery
eyotom Elp			00 000110000 W				o aona n		proxe	0 11 00	0.110110	~									

## Unit-5 - Prospects of cosmoceuticals

Dual Nano delivery systems-Dual Nano delivery systems-Introduction-Synthesis of dual Nano delivery systems containing vitamin e for cosmetics-Synthesis of dual Nano delivery systems containing vitamin e for pharmaceuticals-Characterization of dual Nano delivery systems containing vitamin e-Various characterization techniques used Orthopaedic implant-Conventional types of Orthopaedic implant-Orthopaedic implant titanium rods-Advantages of Orthopaedic implant of titanium rods-Preparation of keratin coatings for orthopaedic implant titanium rods-Characterization of keratin coatings-Nanotherapeutics as a treatment for inflammation-Cosmetic repair and restoration-Moisturization of skin-Fortification of the skin barrier-Contact lenses types-Beauty from contact lenses beyond vision correction

	1.	New Cosmetic Science, Mitsui T. , Elsevier, 1998	3.	Delivery System Handbook for Personal Care and Cosmetic Products, Meyer R.R., William
Learning	2.	Cosmetic Nanotechnology: Polymers and Colloids in Cosmetics, Sarah E.M.,		Andrew ASP, 2005.
Resources		Kathleen O.H., Robert Y.L., American Chemical Society,2006	4.	Nanotechnology for the Preparation of Cosmetics Using Plant-Based Extracts, Siti Hamidah Mohd
				Setapar, Akil Ahmad, Mohammad Jawaid, Elsevier Science, 2022

			Continuous Learning		Summativo						
	Bloom's Level of Thinking	Form CLA-1 Avera (50	ative ge of unit test %)	Life-Long CL (10	Learning A-2 1%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1 F	Remember	20%		20%		20%	-				
Level 2 (	Understand Table	20%		20%		20%	-				
Level 3 A	Apply	30%		30%		30%	-				
Level 4 A	Analyze	30%		30%		<mark>30</mark> %	-				
Level 5 E	Evaluate	1 1 2 2 2 2 3					-				
Level 6 (	Create	No. Alasta		100 March 100 Co		-	-				
	Total	100	)%	100	0 %	10	0%				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.Solomon Jonnes,Bengaluru,solomon@terracarb.com	1. Dr. Amit Kumar Mishra , IIT Jodhpur, amit@iitj.ac.in	1. Dr. Mani Ra <mark>hulan, SR</mark> MIST
2. Dr. Nagesh Kini, Thermax, Pune, Maharastra, nagesh. kini@gmail.com	2. Dr. Sampath Kumar T.S, IIT Madras, tssk@iitm.ac.in	2. Dr. C. Siva, SRMIST



B.Tech / M.Tech (Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

Course Code	Irse 21NTO312T Course SOCIETAL IMPLICATIONS OF NANOTECHNOLOGY											OPEN	ELEC	TIVE			1	_ T 3 0	P 0	C 3		
Pre-requi	isite es	Nil	Co- Co	requisite ourse <mark>s</mark>	Nil	Progressive Nil																
Course	Offering Departme	ent	Physics and Na	notechnology	Data Book / Codes / Standar	ds							Nil									
Course Le	arning Rationale	(CLR):	The purpose of lea	is to:	1	24			Progr	am Ou	itcome	s (PO	)				P	rogra	m			
CLR-1:	Provide an insigh	nt into the	fundamentals of soc	<mark>io-economic</mark> implic	ations of nanotechnology	1	2	3	4	5	6	7	8	9	10	11	12	2 Specific outcomes				
CLR-2:	Provide an insign pertaining to nan	ge		of	s of	25	siety			ork		е										
CLR-3:	Understand the in	ies	wled		lent	ation	ge	d soc			n We		nanc	þ								
CLR-4:	Understand the s	ocietal im	npl <mark>ications,</mark> economic	s, policy regulation	s to Improve the quality of life	Kno	alysis	lopm	estig	Usa	r and	8		Tear	<u>io</u>	& Fi	amir					
CLR-5:	Understand the is	ssues of <mark>p</mark>	p <mark>ublic aw</mark> areness and	l risks associated v	vith nanotechnology	ring	Ane	deve	t inve	Tool	inee	ment		<u>ଅ</u> %	nicat	Mgt.	g Le					
Course O	utcomes (CO):		At the end of this of	course, learners w	vill be able to:	Enginee	Problem	Design/	Conduct	Modern	The eng	Environ	Ethics	Individua	Commu	Project I	Life Lon	PSO-1	PSO-2	PSO-3		
CO-1:	Address the soci	oecono <mark>mi</mark>	<mark>ic impli</mark> cations of nan	otechnology	Charles Street	2	-	1		2-1		-	3	-	-	-	-	2	-	-		
CO-2:	Apply the knowledge of technology needs, social, political and economic implications pertaining t							-	-	-	1	1	3	1-	-	-	-	3	-	-		
CO-3:	Address the impact of nanotechnology, challenges, ethical issues							1.4		-		-	2	-	-	-	-	-	3	-		
CO-4:	Address the societal implications, economics, policy regulations to Improve the quality of life							1.1	-	-	-	-	3	-	-	-	-	-	2	-		
<b>CO-5</b> : Handle the issues of public awareness and risks associated with nanotechnology						2	62	-	-	-	•	÷	3	-	-	-	-	-	-	2		
Unit-1 - Im	plications of nand	otechnolo	ogy							-	-								9	Hour		

Knowledge and Scientific Understanding of Nature - Industrial Manufacturing, Materials and Products - Medicine and the Human Body - Sustainability: Agriculture, Water, Energy, Materials, and Clean Environment - Space Exploration – National Security- Moving into the Market - Ethical Issues and Public Involvement in Decision Making - Education of Nanoscientists, Nanotechnologists, and Nanofabrication Technicians -Education of Social Scientists - Social Science Research Approaches and Methodologies - Institutional Infrastructure for Societal Implications Research

# Unit-2 - Nanotechnology in various societal applications

National Nanotechnology Initiative - The Age of Transitions - Technological Implications of Nanotechnology- National Needs Drivers for Nanotechnology - Nanotechnology and Societal Transformation - Focus on Economic and Political Implications of Potential Technology - Impact of Nanotechnology on the Chemical and Automotive Industries Information Technology – Societal Implications - Societal Implications of Scaling to Nanoelectronics - Future Implications of Nanoscale Science and Technology: - Implications of Nanotechnology in the Pharmaceutics and Medical Fields - An Economist's Approach to Analyzing the Societal Impacts of Nanoscence and Nanotechnology

## Unit-3 - Security and ethical aspects

Nanotechnology, Education, and the Fear of Nanobots - Focus on Medical, Environmental, Space Exploration and National Security – Implications - Challenges and Vision for Nanoscience and Nanotechnology in Medicine: Cancer as a Model -Nanotechnology in Medicine - Lifecycle/Sustainability Implications of Nanotechnology - Implications of Nanotechnology for Space Exploration - Security Aspects of Nanotechnology -Focus on Social, Ethical, Legal, and Cultural Implications - Social Science Research Methods for Assessing Societal Implications of Nanotechnology - Ethical Issues in Nanotechnology - Social Acceptance of Nanotechnology

9 Hour

#### Unit-4 - Economic policy regulations

Societal Implications of Nanotechnology - Socio-economic Research on Nanoscale Science and Technology: A European Overview and Illustration - Nanotechnology and Unintended Consequences - A Cultural Ecology of Nanotechnology Envisioning and Communicating Nanotechnology to the Public Vision, innovation, and policy Challenges for government and universities - Nanoparticle Toxicity and risk - Social impacts of nano biotechnology – issues; Problems of governance of nanotechnology - Regulatory structures and society - Nanotechnology and Social trends - Engagement - Nano revolution implications for the Environmental Impacts of nanomaterials

#### Unit-5 - Public awareness and risk assessment

Public Perceptions of Nanotechnology - Public Awareness of Nanotechnology - Public interaction research - Nanotechnological risks - Assessment of nanotechnological risks - Importance of Risk communication -Problems in Risk communication - Nanotechnology's social impacts - Public engagement - Fear of Nanotechnology - Public Engagement with nanotechnology - Nanotechnology: moving beyond risk - Communication streams and nanotechnology: interpretation of a nanotechnology - Individual perspectives of nanotechnology - Historical comparisons - for anticipating public reactions to nanotechnology

	1.	Mihail C.R., and William S.B., "Nanotechnology: societal implications", Springer	3.	Mihail C. Roco and William Sims Bainbridge," Societal Implications of Nanoscience and
Learning		publication, 2011 (978- <mark>1-4020- 54</mark> 32-7 (e-book))		Nanotechnology", National Science Foundation, 2001 (978-0-7923-7178-6)
Resources	2.	Ronald sandler, "Nanotechnology the Social & Ethical Issues", Woodrow Wilson, 2009	4.	Fritz Allhoff, Patrick Lin, James H. Moor, John Weckert, "Nanoethics: The Ethical and Social
				Implications of Nanotechnology", John Wiley & Sons 2007

Learning Assessme	ent											
			Continuous Learning	Summetive								
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ige of unit test 0%)	Life-Long CL (10	g Learning A-2 0%)	Final Examination (40% weightage)						
		Theory	Practice	Theory	Practice	<u>The</u> ory	Practice					
Level 1	Remember	20%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	20%	- Permit	20%	-					
Level 2	Understand	20%		20%		20%	-					
Level 3	Apply	30%		30%	-	30%	-					
Level 4	Analyze	30%		30%		<mark>3</mark> 0%	-					
Level 5	Evaluate	and the second second					-					
Level 6	Create	1.1.1.		-	-		-					
	Total	10	0%	10	0 %	100 %						

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
<ol> <li>Mr.Ajay Kumar, Avansa Technology and services, India ajaykumar@avansa.co.in</li> </ol>	<ol> <li>Dr. Hirendra N Ghosh, Institute of Nanoscience and Technology, Punjab, hnghosh@inst.ac.in</li> </ol>	1. Dr. R. Ajay Rakkesh, SRMIST
<ol> <li>Dr. Tanvi Sharma, Nanoshel LLC, Chandigarh, India, tanvisharma@nanoshelcom</li> </ol>	2. Dr. Asish Pal, Institute of Nanoscience and Technology, Punjab,apal@inst.ac.in	2. Dr. C. Gopalakrishnan, , SRMIST

9 Hour

Course Code	21NTO313T	3T Course NANOTECHNOLOGY IN FOOD SCIENCE AND PACKAGING								0	O         OPEN ELECTIVE         L         T         P           3         0         0									P 0	C 3	
Pre-requis Courses	site S	Nil		Co- requisite Course <mark>s</mark>		Nil		Prog Co	ress urse	sive es						Nil						
Course C	Offering Departme	ent	Physics	and Nanotechnolog	l <b>y</b>	Data Book / Codes / Stand	dards							_	Nil							
Course Lea	arning Rationale	(CLR): 7	The purpos	<mark>e of learnin</mark> g this c	ourse is to			17	1			Progr	am Ou	<mark>itcom</mark> e	s (PO	)			P	ograi	m	
CLR-1:	Know the various	s types of in	teraction <mark>s a</mark>	<mark>t molec</mark> ular scale	100		1		2	3	4	5	6	7	8	9	10	11	12	00	tcom	es
CLR-2:	Understand the e	effect of nan	nopa <mark>rticles</mark> c	on agricultural meth	odology an	food technology			1		f	3	۷									
CLR-3:	<b>R-3:</b> Gain knowledge on the types of diagnostic tools using nanotechnology							anna		nt of	o suo	Ð	society			Nork		nce				
CLR-4:	R-4: Acquire knowledge about the newer technologies in the food production								SIS	Iamo	igati	sage	s pu			am	_	Fina	ing			
CLR-5:	CLR-5:       Get familiarized with the new concepts of Nano Science in the packaging industries and food production						po k		em Analy:	n/develop	uct invest ex proble	n Tool U	ngineer a	nment & nability		lual & Te	unication	t Mgt. &	ong Learr			~
Course Ou	tcomes (CO):		At the end o	of this course, lear	rners will b	e able to:			Proble	Design	Condu	Moder	The er	Enviro Sustai	Ethics	Individ	Comm	Projec	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Apply the concep	ot of inte <mark>ract</mark>	tions within	the supramolecular	structures	at molecular scale	2	2	-	3	÷	-		-	-	-	-	-	-	-	3	-
CO-2:	Utilize the assay	techniq <mark>ues</mark>	in agricultu	ral and food diagno	stics		2	2	- 1	3	-	-	- 1	- N	-		-	-	-	-	3	-
CO-3:	Apply the concep	ots of nanote	echnology ii	n food products	12	10 S H P 1 G 1 J	3	3	-	3	- 1	_	-	-	-	-	-	-	-	_	3	-
CO-4:	Engineer food ing	gredient <mark>s wl</mark>	<mark>hich a</mark> re cap	bable to improve the	e bioavailab	ility	3	3	-	2		-	2	-	-	-	-	-	-	-	3	-
CO-5:	Assess the toxic	effects <mark>of th</mark>	<mark>ne nan</mark> omate	erials used in the fo	od process	ing and technology	2	2	-	3	-	-		-	-	-	-	-	-	-	3	-
Unit-1 - Su	pramolecular stri	uctures		-		1	-					<u>, -</u>		-		-					9	Hour
Intermolecu particles, a particles by assembled	lar interactions ar nd surfaces. Intro adsorbing polym structures, Langm	nd supermol oduction to s ers. Stabiliz puir layers, L	lecular struc Steric intera ation of dis Lipid bilayers	ctures – Introduction actions. Steric intera persed particles by s. ,Solid-supported	nWater actions invo adsorbing lipid bilayer	nydrophobic and hy <mark>drophilic</mark> Iving soluble polymers Aggi polymers. Polymer brushes s Micelles, Vesicles	interacti regation to preve	ions d , Depl ent pa	lispe letioi article	ersion n, agg e aggi	interac gregation regation	tion, e on of j n and	lectros particle particle	static in es by n e depos	teracti on- ac sition a	ons At dsorbin at surf	oms ai ig poly aces. S	nd sma mers, 1 Self-As	ıll mole Bridgin sembly	cules, g agg , Orga	Polyr regatio anized	ners, on of I self-
Unit-2 - Na	notechnology in	agriculture	and food s	cience	an nya a ah a	, in datasting misrahial and	nata Di			-	ma his			d dia an	antina		h	l hiana			9	Hour
Nanotechnology in Agriculture and Food diagnostics. Nanodiagnostic approaches in detecting microbial agents, Biosensors, Enzyme biosensors and diagnostics. DNA-based biosensors and diagnostics. Radiofrequency identification, Integrated nanosensor networks: Detection and Response. "Electrochemical biosensors – Gold Nanoparticles, Magnetic Nanoparticles in diagnostics. Fluorescent Nanoparticles in diagnostics, Silica Nanoparticles in diagnostics. Safety of nanotechnology in food and the impact in consumer health. Transduction Principles. Microfluidic Assays, Lateral flow (immuno) assay, Nucleic acid lateral flow (immuno) assay, Flow-through (immuno) assays, Antibody microarrays Surface plasmon resonance spectroscopy													stics. 'es in I flow									
Unit-3 - Na	notechnology in	food produ	icts		frades	tion Mard for your for t	/			<b>-</b> #:		- 4'				-4					9	Hour
rood produ value. Nand ingredients. versus Hum	Food products and its production – Introduction. Food and new ways of food production. Need for new food processing methods. Efficient fractionation of crops Efficient product structuring, Optimizing Nutritional value. Nanotechnology in Food Production. Applications of nanotechnology in foods, Sensing, packaging Encapsulation, Nano Engineering food ingredients to improve bioavailability Nanocrystalline food ingredients. Nano-engineered protein fibrils as ingredient building blocks. Preparation of food matrices. Risks of Nanotechnology. Concerns about using nanotechnology in food production. Rational argumentation versus Human feelings. Nano-emulsions																					
### Unit-4 - Risk assessment of nanotechnology in food science

Nanotechnology in Crop management - Introduction. Crop improvement - reasons to package food products. Physical properties of packaging materials, Strength, Barrier properties light absorption, structuring of interior surfaces, Antimicrobial functionality. Visual indicators, Quality assessment, Food safety indication. Product properties, Information and communication technology Sensors, Radiofrequency identification technology. Health Risks, Environmental Risks, Consumer and societal acceptance

## Unit-5 - Toxicology studies

Toxicology of Nanomaterials in food - Introduction. Characterization of engineered nanomaterials. Unique issues for characterization of engineered nanomaterials for food applications Safety assessment of oral exposure engineered nanomaterials for food application Experimental design considerations for toxicology studies. Life cycle of nanotechnology food products Environmental behavior of nanoparticles - Toxicology of nanoparticles, Molecules in foods involved in triggering allergies. Impact of nanoscale structures on allergenic potential of foods Toxicokinetics Adme (absorption), Adme (distribution) Adme (metabolism) Adme (excretion) Toxicodynamics. In vivo toxicity, In vitro toxicity, Study Reliability

ſ		1.	Nicholas A. Kotov, "Nanoparticle Assemblies and Superstructures", CRC,	3.	David S Goodsell, "Bionanotechnology", John Wiley & Sons, 2004 (ISBN 0-471-41719-X)
	Learning		September, 2019 (ISBN 9780367392284)	4.	Jennifer Kuzma and Peter VerHage, "Nanotechnology in agriculture and food production",
	Resources	2.	Lynn J. Frewer, Willem Norde, Arnout Fischer, and ransKampers, "Nanotechnology		Woodrow Wilson International, 2006 Espresso) and Page 300-307 (VASP)
			in the Agri- Food Sector", Wiley VCH, 2011 (ISBN:9783527330607		

## Learning Assessment

	Bloom's		Continuous Learning A	Assessment (CLA)		Summative Final Examination (40% weightage)					
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (10	g Learning _A-2 0%)						
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%		20%		20%	-				
Level 2	Understand	20%		20%		<mark>20</mark> %	-				
Level 3	Apply	30%		30%		<u>30</u> %	-				
Level 4	Analyze	30%		30%	-	<mark>3</mark> 0%	-				
Level 5	Evaluate	and the second second					-				
Level 6	Create	1. N	· · · ·	-	-						
	Total	10	0 %	10	0 %						

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
<ol> <li>Mr.Rajendra Moorthy Rajendran, Kemin Industries, Chennai, India rajendramoorthy.r@kemin.com</li> </ol>	1. Dr. V Geethalakshmi, TNAU, Coimbatore, directorscms@tnau.ac.in	1. Dr. C. Gopalakrishnan, SRMIST
<ol> <li>Mr. Saravanan Lokasundaram, Agro Crops, Chennai, India, sara@agrocrops.com</li> </ol>	2. Dr. A Lakshmanan, TNAU, Coimbatore, microlaxman@yahoo.com	2. Dr. E. Senthilkumar, SRMIST

B.Tech / M.Tech (Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

9 Hour

essive ses						Nil						
					Nil							
2		Progra	im Ou	tcomes	s (PO)	)		1		Pi	ogra	m io
3	4	5	6	7	8	9	10	11	12	ou	tcom	es
of	s of	<b>C</b> (1)	iety			¥		e				
lent o	ation	ge	d soc			n Vo		nanc	þ			
, udol	stige	Use	r and	ઝ		Tear	U	к М	arnir			
n/devel	uct inve lex prot	m Tool	ngineel	onment inability		dual & -	nunicati	ct Mgt.	ong Le:	~	5	e
Desig	Cond	Mode	The e	Envire Susta	Ethics	Individ	Comr	Proje	Life L	-OSc	-SO-	-OSC-
3	-	-		-	-	-	-	-	-	-	3	-
3	3	-	- 16	-	-		-	-	-	-	3	-
3	3	_		-	-	- 1	-	-	-	-	3	-
2	4.5	-	1	3	-	-	-	-	-	-	3	-
3	-	-	-	3	-	-	-	-	-	-	3	-
CO-5:       Infer advances in Modern Astronomy and Astrophysics       3       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -												
Spreede ar II lita	3 2 3 phere; cessic er of a nd Lum Diagra ative Ir smolog uence s, Sch	3       3         2       -         3       -         phere; Introduct         accession Time         er of astronom         nd Luminosity;         Diagram, Basi         ative Introduct         smology, Sun         uence stars-M         s, Schwarzsch	3       3       -         2       -       -         3       -       -         3       -       -         phere; Introduction:       -         accession Time and time and time of astronomical obtements       -         nd Luminosity; The F       -         Diagram, Basic Definative Introduction to 2       -         smology, Sun spots, unce stars-Mass lings, Schwarzschild race       -	3       3       -       -         2       -       -       -         3       -       -       -         3       -       -       -         3       -       -       -         3       -       -       -         3       -       -       -         3       -       -       -         3       -       -       -         3       -       -       -         3       -       -       -         3       -       -       -         3       -       -       -         3       -       -       -         3       -       -       -         3       -       -       -         3       -       -       -         cession Time and timekee       -       -         add Luminosity; The Period       -       -         Diagram, Basic Definitions       -       -         stive Introduction to X-ray or       -       -         smology, Sun spots, Sun F       -       -         uence stars-Mass limits, S       -	3       3       -       -       -         2       -       -       -       3         3       -       -       -       3         3       -       -       -       3         phere; Introduction: Astronomical compositions: Astronomical objects, Element of astronomical objects, Element of astronomical objects, Element of Luminon Diagram, Basic Definitions: Magnitude Introduction to X-ray observer astronomous objects, Sun Flares, Superverse stars-Mass limits, Superverse stars-Mass	3       3       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -	3       3       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -	3       3       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -	3       3       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -	3       3       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -	3       3       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -	3       3       -       -       -       -       -       3         2       -       -       -       3       -       -       -       3         3       -       -       3       -       -       -       -       3         3       -       -       3       -       -       -       -       3         9       phere; Introduction: Astronomical and Geographical Coordinate Systems, Hocession Time and timekeeping; Basic Definitions: Calendar Weeks, Months Yeer of astronomical objects, Elementary Knowledge of Night Sky and Constellation         9       nd Luminosity; The Period Luminosity (P-L) Relation, Determination of Temper Diagram, Basic Definitions: Magnification Light, Gathering Power, Resolving P ative Introduction to X-ray observation techniques, Gamma Ray Astronomy.         9       smology, Sun spots, Sun Flares, Solar Cycle; Overview of Stellar Evolution: S use stars-Mass limits, Supernovae (mass limits), Classifications of Super s, Schwarzschild radius

## Unit-5 - Advances in Astronomy

A Universe of Galaxies: Early Observations, Distances of Galaxies, Standard Candles (Cepheids and SNe Type1a), Cosmic Distance Ladder, Gravitational redshift: Hubble's Law, Classification of Galaxies (Qualitative); Concepts and Definitions: Galaxy Clusters, Super Clusters, Active Galaxies, Quasars, Dark Matter; Dark matter in Cluster of Galaxies (qualitative overview); Introductory Cosmology- Concept of Evolution of universe, Meaning of Red Shift and Age of Universe, Olber's Paradox, Visible Universe; Concepts and Definitions: the Big Bang, Cosmic Microwave Background, Beginning of the universe and various stages, Radiation Matter-Antimatter, fusion, galaxy formation and present; Idea of Epoch of Inflation.

Learning Resources	<ol> <li>Pathways to Astronomy, Thomas T Arny, Ste College, 2008)</li> <li>Universe, Freedman and Kaufmann, (W. H. Fr</li> <li>An Introduction to Modern Astrophysics, Bradl Wesley Publishing, 1996)</li> </ol>	ohen E Schneider, (McGraw-Hill 4. 5. eeman; 8th edition, 2008) ey W Carroll and Dale A Ostlie (Addison-	. Introduction to Stellar Astrophysics, Bohm, Erika. (3 Vols. Cambridge University Press, 1989) . Astrophysical Concepts, Martin Harwit (Springer Science & Business Media, Science2000)
-----------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Learning Assessme	ent										
		N I	Continuous Learning	Assessment (CLA)	1 . J	Summativo					
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test )%)	Life-Long CL (10	a Learning A-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%	the second second second	20%		20%	-				
Level 2	Understand 🔤	20%		20%		<mark>20</mark> %	-				
Level 3	Apply 🚽	30%	St. 1753 Mar.	30%		<u>30%</u>	-				
Level 4	Analyze	30%		30%	-	<mark>30</mark> %	-				
Level 5	Evaluate					-	-				
Level 6	Create	1000		INFO AL		-	-				
	Total	10	0%	10	0 %	100 %					

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. R Seshadri, Titan Company Limited, seshadri@titan.co.in	1. Dr. Ranjit Kumar Nanda, IIT Madras, nandab@iitm.ac.in	1. Dr. Rohit Dhir, SRMIST
2. Dr. DK Aswal, NPL, dkaswal@nplindia.org	2. Prof. C Vijayan, IIT Madras, cvijayan@iitm.ac.in	2. Dr. Tush <mark>ar Rana, SR</mark> MIST

Course Code	21PYO302T	21PYO302T Course PHOTONICS Name						C Ca	Course O OPEN ELECTIVE									- T 3 0	P 0	C 3			
Pre-requi	isite es	Nil		Co- requisite Courses	•		Nil		Pro C	gress ourse	sive es						Nil						
Course	Offering Departm	ent	Physics a	d Nanotechno	logy	Data Boo	ok / Codes / Stan	dards						-		Nil							
Course Le	earning Rationale	(CLR): T	The purpose	of learning thi	s course	is to:					1		Progr	am Ou	utcome	s (PO	)				Pi	rograi	n
CLR-1:	acquire the know	vledge on ligh	ht matte <mark>r inter</mark>	action	0	2.20			1	2	3	4	5	6	7	8	9	10	11	12	S OU	pecifi tcom	c es
CLR-2:	CLR-2: acquire knowledge for solving pro <mark>blems in la</mark> ser physics							e		f	s of	2	iety			¥		0					
CLR-3:	CLR-3: analyze Fabry-Perot cavity to understand laser resonator							vledo		ento	ations	ge	soc			oW r		ance	D				
CLR-4:	gain knowledge	on Q-switch <mark>e</mark>	ed and mode-	ocked lasers	1	SWC-		27	Von	lysis	opme	stiga	Usa	and	<u>مح</u>		earr	ю	& Fir	arnin			
CLR-5:	enable the stude	ent for purs <mark>uin</mark>	<mark>ng resea</mark> rch ir	photonics rela	ated fields				neering I	em Ana	gn/devel	uct inve lex prob	ern Tool	angineer	onment ainability	s	dual & T	nunicati	ct Mgt. 8	ong Lea	÷	5	ę
Course O	utcomes (CO):	A	At the end of	this course, I	earners w	vill be able to:	A ware	17	Engir	Probl	Desig	Cond	Mode	The e	Envir Susta	Ethic	ndivi	Com	^o roje	_ife L	ÖS	SO	-OSc
CO-1:	understand the b	oasic pro <mark>cess</mark>	ses involved i	the interaction	n between	atom and light	Sec. 194	1.1	3	-	3	-	-		-	-	-	-	-	-	-	-	-
CO-2:	learn the theory	for laser <mark>amp</mark>	olification	21.00		1.5	6 C		3		3	-	-	-	-	-	-	-	-	-	2	-	2
CO-3:	gain the knowled	lge on th <mark>e no</mark>	onlinearity ass	ociated with a	laser ampi	lifier	18 8.4		3		3	-	-	- 30	-	-		-	-	-	2	-	-
CO-4:	understand on tu	ining the prop	<mark>perti</mark> es of a la	ser	1.20	100			3	-	3	-	-		-	-	-	-	-	-	-	2	-
CO-5:	acquire the know	vledge o <mark>n opt</mark>	<mark>tical p</mark> ropertie	s of metals		100		21	-	1	3	3	-	2	-	-	-	-	-	-	-	2	-
Unit-1 - Li	aht Matter Interac	ction	-		Cint	1.1								-								9	Hour
Energy lev function ar A and B c	vels, Occupation of ad transition streng oefficients, Line br	f energy level th, Relation b roadening, Lif	els, Boltzmani between trans fe time broad	distribution, F sition cross sec ening, Collision	ermi-Dirac ction and s broadenii	c distribution, Ir spontaneous lifi ng, Inhomogen	nteraction betwee fe time, Stimulatec eous broadening,	n an a d emiss Enhan	tom a sion a liced s	nd el nd ab ponta	ectrom psorption aneous	agneti on, Tra emiss	c mod nsition ion, Pu	e, Spo induc urcell f	ntaneou ed by n factor	us em nonoc	ission, hromai	Trans tic light	ition cr and b	oss se roadba	ction, i Ind ligi	Line s ht, Ein	hape istein
Unit-2 - La	aser Physics	n nhotons a	and atoms	Photon ass F	lackbody	radiation spec	trum Thermoora	nhy F	orms	of	uminos	conco	Cath	odolui	ninesce	nco	Chomi	lumino	sconce	Flor	trolum	<b>9</b>	Hour
Phtolumine	escence, Fluoresce	ence and Pho	osporescence	Theory of las	er amplific	ation. Gain and	d bandwidth, Gain	coeffic	ient, F	Phase	shift o	ceffici	ent for	Loren	tzian lin	e sha	be. Am	plifier (	oumpin	g: Rate	eque	itions.	Rate
equations	in the absence of a	amplifier radia	ation (Steady	state populatio	n differenc	ce), Rate equat	tions in the presen	nce of a	mplifi	ier rad	diation,	Four I	evel p	umping	g, Comp	arisol	n of thr	ee and	l four le	vel pu	mping	,	
Unit-3 - La	aser Resonator				24					1.11												9	Hour
Amplifier n	nonlinearity:Saturat	ted gain in ho	omogeniously	broadened me	ədia and iı	nhomogeneous	sly braodened me	dia, Ho	ole bu	rning,	Ampli	fier no	ise (Ar	mplifie	d spont	aneou	s emis	ssion),	Fabry-	Perot o	cavity,	Coeff	icient
Unit-4 - Ti	uality factor (Qua ining of Laser	antative descri	πριιοπ)		_																		Hour
Theory of	laser oscillation: La	aser amplifica	ation, Feedba	ck and loss in	a resonat	or. Gain condit	tion: laser thresho	ld, Pha	ise co	nditio	on: Las	er frea	uencie	s. Fre	quencv	pullin	g. Stea	adv sta	te inter	nal ph	oton fi	lux de	nsity.
Output pho	oton flux density, O	ptimization o	of photon flux	density, Prope	rties of a C	Gaussian beam	, Selection of the	laser lii	ne,pol	larizat	tion, tra	ansver	se and	longit	udinal n	nodes	Pulse	d lase	rs, Q-s	, vitchin	g, Mod	delock	ing

323

 
 Unit-5 - Optical Properties of Metals
 9 Hour

 Effective permittivity of metals, Drude Model, Plasma frequency, Metal dielectric boundary-Surface plasmon plariton, Generation and detection of surface plasmon polaritons, Metallic nanospheres: Localized surface
 plasmons and applications.

Learning	<ol> <li>B.E.A. Saleh and M.C. Teich, Fundamentals of Phtonics, 2nd Ed., Wiley, 2012.</li> <li>K. Thyagarajan and A.K. Ghatak, Lasers Theory and Applications, 1st Ed. Macmilan Publishers, 2010.</li> </ol>	4. 5	Yariy, Quantum Electronics, 3rd Ed., John Wiley, New York, 1989 Seigman Lasers, 3rd Ed., Oxford Univ, Press, 1986
Resources	<ol> <li>O. Svelto, Principles of lasers, 4th Ed., Springer, 1998.</li> </ol>	6.	S. A. Maier, Plasmonics: Fundamentals and Applications, Springer, 2007

Learning Assessme	ent	111	and the second sec	0							
			Continuous Learning	g Assessment (CLA)		Cuman	a ti va				
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Lon Cl (1	g Learning LA-2 0%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%		20%		20%	-				
Level 2	Understand	20%		20%		20%	-				
Level 3	Apply	30%	12 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	30%		<mark>3</mark> 0%	-				
Level 4	Analyze	30%		30%		<mark>30</mark> %	-				
Level 5	Evaluate		100 Courses	1 - 1 - K K.		-	-				
Level 6	Create	Create					-				
	Total	10	0 %	10	0 %	100 %					

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. N Vijayan, NPL, nvijayan @nplindia.org	1. Prof. V Subramanian, IIT Madras, manianvs@iitm.ac.in	1. Dr. K Shadak Alee, SRMIST
2. Mr. R Seshadri, Titan Company Limited, seshadri@titan.co.in	<ol><li>Prof. C Vijayan, IIT Madras, cvijayan@iitm.ac.in</li></ol>	2. Dr. Junaid Masud Laskar, SRMIST



Course Code	code 21PYO303T Course Name QUANTUM OPTICS						C	Cours Catego	se ory	0				OPEN	ELEC	TIVE				L T 3 0	P 0	C 3
Pre-requi Course	site es	Nil	Co- rec Cours	uisite es		Nil		Pr	ogres Cours	sive es						Nil	1					
Course	Offering Departme	ent	Physics and Nanote	chnology	Da	ta Book / Codes /	Standards	S							Nil							
Course Le	arning Rationale (	CLR): 7	The purpos <mark>e of learni</mark>	g this cour:	se is to:	true		-	Program Outcomes (PO)								Р	rogra	m			
CLR-1:	Emphasize the in	portance o	f Quantum optics to gu	antum inform	nation scienc	се		1	2	3	4	5	6	7	8	9	10	11	12	S	pecifi	C AS
CLR-2:	, Understand quan	' tum nature	of light	1				Ð			of	3.	ety			×				00		53
CLR-3:	Learn cavity-base	d light-mat	ter interaction		×	1.00		rledg		ent of	tions	ge	soci			Wor		ance	-			I
CLR-4: Acquire more advanced knowledge on quantum optics							1	Know	lysis	opme	stiga	Usaç	and	∞ŏ .		eam	uo	& Fin	arning			I
CLR-5:     Learn atom-photon interactions								eering I	em Ana	n/devel	uct inve ex prob	rn Tool	ngineer	onment inability		dual & T	nunicati	st Mgt. 8	ong Lea	F	2	~
Course Or	utcomes (CO):	L	At the end of this cou	rse, learners	s will be ab	ole to:	1.17	Engin	roble	Desig	Condu	lode	The e	Enviro	Ethics	ndivic	Comn	rojec	-ife Lo	-OSc	:-OSc	Sos
CO-1:	Concepts on Pho	ton stat <mark>istic</mark>	s		100	a cust	34	3	-	-	-	-		-	-	-	-	-	3	-	-	2
CO-2:	Non-classical beh	naviour <mark>of li</mark> g	<mark>ght: P</mark> hoton antibunchin	g	1-5	<ul> <li>Internet</li> </ul>		3			-	-		<u> </u>	-	-	-	-	3	2	-	-
CO-3:	Detect and gener	ate squ <mark>eez</mark> e	ed states of light	1000	1.25	1.1		3		-	3	-	-10	-	-		-	-	-	-	2	-
CO-4:	Formulate the phe	oton nu <mark>mbe</mark>	er states	1	100	121	010	3		3	-			-	-	-	-	-	-	-	-	-
CO-5:	Gain knowledge o	on atom <mark>-cav</mark>	vity coupling		1996			3	-	1.	-	-	1	- 10	-	-	-	-	3	-	-	2
<b>Unit-1 - Q</b> Photon St	uantum Optics atistics_Coherent	liaht: Poiss	conian photon statistic	Classificat	tion of light	t by photon statis	stics. Supe	r-Pois:	sonian	liaht.	Sub-P	oisson	ian lie	aht. Th	ermal	light.	Theory	of ph	notodei	ection	<b>9</b>	Hour antum
theory of p	photodetection, sho	t noise in pl	hotodiodes, Observatio	of sub-Pois	ssonian pho	oton statistics	, Cape.			. ingini,	Cun !	0.000.		<i></i> ,		ngni,		о. р.			, quu	
Unit-2 - Qu	u <b>antum Nature of</b> I n to the intensity it	Light	ers Hanbury Brown-Ti	viss experim	nents and c	lassical intensity t	fluctuations	Seco	nd or	der co	rrelatio	n funci	tion H	lanhur	Rrow	n-Twis	S AVN	rimon	ts with	nhoto	9 ns P	Hour hoton
bunching a	and antibunching, E	xperimenta	l de <mark>monstration</mark> of phot	on antibunch	ning, Single	Photon sources	nucluations,	, 0000			relation	Tuno		landary	DIOW	11 1 110	55 0.200		S WILLI	prioto	113, 11	101011
Unit-3 - Li	ght Matter Interact	tion		7.0		A A ash	1.1					1									9	Hour
Light wave	s as classical harm	onic oscilla	itors, Li <mark>ght as a quant</mark> u	n harmonic o	oscillator, T	he vacuum field, C	Coherent sta	ates, S	Shot n	oise ar	nd num	ber-ph	ase ui	ncertair	nty, Sq	ueeze	d state	s, Sete	ection o	of Squ	ezed	light,
Unit-4 - Ad	dvances in Quantu	s Im Optics						_			-										9	Hour
Operator s	solution of the harn	nonic oscilla	ator, The number state	representat	tion, Photor	n number states,	Coherent s	tates,	Quan	tum th	eory of	Hanb	ury Bi	own-Ti	viss e	xperim	ents, T	Two-le	/el ato	т арр	roxim	ation,
Coherent s	superposition states	, Density m	natrix, Time-dependent	Schrodinger	equation, T	he weak field limit	: Einstein's	B coe	fficien	t, The	strong	field lin	nit: Ra	bi oscil	llations	6						
Atom-cavit Cavity qua	y coupling, Weak c ntum electrodynam	oupling: Pr ics, Experin	eliminary consideration nental observations of	s, Free-spac strong coupli	ce spontane ing, Applicat	ous emission, Spo tions of cavity effe	ontaneous e <mark>cts and qua</mark>	emissi antum	on in a inform	a singl nation s	e mode science	cavity	(Puro	cell effe	ct), Ex	cperim	ental d	emons	tration	Stror	<b>y</b> Ig cou	pling:

Learning	1. 2.	Quantum Optics: An Introduction, Mark Fox, (Oxford University Press) Quantum Optics, M.O. Scully, M.S. Zubairy, (Cambridge University Press)	3.	Introduction to Quantum Optics: From Light Quanta to Quantum Teleportation, Harry Paul (Cambridge University Press)
Resources			4.	Quantum Optics for Beginners, Z. Ficek, M. R. Wahiddin (Pan Stanford Publishing)

_earning Assessme	ent										
	Bloom's	Form CLA 1 Avora	Continuous Learning . ative	Assessment (CLA) Life-Loi	ng Learning	Summative Final Examination					
	Level of Thinking	(50	9%)		10%)	(40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%	and the state of the	20%		20%	-				
Level 2	Understand	20%		20%	1.2	20%	-				
Level 3	Apply	30%		30%		30%	-				
Level 4	Analyze	30%	and the second second	30%		30%	-				
Level 5	Evaluate		1. S.		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	-	-				
Level 6	Create			and the second		- 100	-				
	Total	100	)%	1	00 %	10	0 %				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. N Vijayan, NPL, nvijayan @nplindia.org	1. Prof. V Subramanian, IIT Madras, manianvs@iitm.ac.in	1. Dr. Shadak Alee, SRMIST
2. Mr. R Seshadri, Titan Company Limited, seshadri@titan.co.in	2. Prof. C Vijavan, IIT Madras, cvijavan@jitm.ac.in	2. Dr. Junaid M. Laskar, SRMIST



# ACADEMIC CURRICULA

**Engineering Science Courses** 

**Regulations 2021** 



## SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

## (Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Chengalpattu District 603203, Tamil Nadu, India

Pre-requ	uisite		Co- requisite	A.P.			Progre	ssive	A.I'I												
Course Of	es //// ffering Department	SRM Innovation	and Design Centre	INII	Data Book / Cor	os / Standards		ses	INII			-									
000130 01	nering Department	Or Winninovador	rand Design Ochic																		
Course I	Learning Rationale	e (CLR): The pur	pose of learning this c	ourse is to	):					P	oarar	n Ou	Itcome	s (PO	)				Pr	ogram	n
CIP-1 ·	Designed to explore	res mindset, skill set	and toolset associated	d with desi	sign		1	2	3	4	5	6	7	8	, 0	10	11	12	S	pecific	;
ULN-1.	Designed to work w	ith guided epplication	no to froming and oak	ing proble	ome from the person	tives of both	1 0	2	5	4	5	0	/	0	2	10	11	12	ou	tcome	S
CLR-2 :	business and engine	neering writing		ning proble	ans nom me perspec		vledç		ent c	ms	ge				_		ance	D			
CLR-3 :	Exposing students	diverging to generate	e solutions and conver	rging to se	elect among them	14 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Nov	ysis	mdc	stiga	Usa	and	∞ŏ	_	earr	Б	Ein	rnin			
CLR-4 :	Design methods to a	create concept gene	eration methods, conce	ept selection	ion methods, imagini	ng alternative futures	ng 4	Anal	evelo	inve:	0	leer	ility		R T	icati	lgt. 8	Lea			
	-					and the second se	leer	em /	gn/de	nple	T L	engir	onmainat	s	dual	unu	ct M	ong	<del></del>	Ņ	ņ
Course (	Outcomes (CO):	At the e	nd of this course, learn	ners will be	e able to:		ingir	robl	Desig	Cond	Aode	he e	invir	thic	Vork	Comr	roje	ife L	SO.	-So	SO
CO-1:	learn and understand t	technology design co	oncepts			100		-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	learning mindset, skills	set and toolset assoc	iated with design			A CONTRACTOR	-	-	-	3	-	-		-	-	-	-	-	-	-	-
CO-3:	identify the best solution	ons an <mark>d convergi</mark> ng t	o select among them.		12-CE 16-14	St 124-1		2	-		-	1	-	-	-	-	-	-	-	-	-
CO-4:	understand concept ge	enerati <mark>on metho</mark> ds, c	oncept selection meth	ods, imagi	ining alternative futu	res	1.0	-	3	2	-	-	-	-	-	-	-	-	-	-	-
Design Fra Brainstorm	ameworks - Engineerin nina	ng Desi <mark>gn Proble</mark> m S	olving - Developing De	esign Solu	ıtions - Making Desig	n Solutions - Evaluatir	ng Desigi	n Solu	tions - I	Project	Introd	uctic	on and	Team	format	ion -St	akehol	der M	ар -		0110
Unit-2-Pro	ototyping		100 million 100			N. 66	100	_			1.0									1	5 Ho
Prototyping Usability T	g Planning - Concept F Test Demo	Refineme <mark>nt and St</mark> or	yboard - Envisioning F	-uture - Co	onceptual design - C	reative Matrix, Morpho	logical S	Synthe	sis, Cor	ncept P	oster	Bas	sic Pre	s <mark>ent</mark> ai	tion - Pi	roject L	Discuss	sion w	ith Tea	ching	Tearr
Unit-3- Us	er Assessment					11111														1	5 Ho
Usability T	est - Understanding Us	lsers - Lear <mark>ning abou</mark>	t Customer - Clusterin	g & Abstra	act Laddering - User	Testing - Project Discu	ussion w	ith Tea	aching	Team											
Unit-4 – V	alue Proposition Des	sign	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.1																1	5 Ho
Value Prop Team - Pro	oosition Design and Ma oject Mini-showcase - F	apping, - Proto <mark>typing</mark> Project Discussion w	& Competitor Study - ith Teaching Team	Competito	ors / Complementor's	s Map - Design Methoo	lologies	- Capi	tal Bud	geting: I	Risk A	naly	vsis witi	h Sce	narios -	Proje	ct Disc	ussior	n with T	^r eachi	ng
Unit-5– Bu	usiness Model			A.L.	L'ANCA	-ne p				1										1	5 Ho
Business I	Model Canvas - Busine	ess pitch - Pitching st	r <mark>ategies - IP a</mark> nd Parti	nerships -	Forecasting Financia	al Statements - Project	Discuss	sion wi	ith Teac	hing Te	eam -	Fina	l Proje	ct Pre	sentatio	on - De	sign S	howca	ase		
Learning	t. Dr. R. Thoma	as Wright, Dr. Greg	J. Strimel, and Dr.M	lichael E.	Grubbs Foundation	ns of 2. II	khlaqsidl	hu , In	novatio	n Engin	eering	g; a p	oractica	al guio	le to cre	eating a	anythin	ig new	/		

DESIGN THINKING AND METHODOLOGY

Course

Category

S

Course

Code

21DCS201P

Course

Name

L T P C 1 0 4 3

ENGINEERING SCIENCES

v			Со	ntinuous Learning ,	Assessment (CLA			_				
	Bloom's Level of Thinking	CLA-1 Aven	mative age of unit test 0%)	Project Ba Ci (6	sed Learning LA-2 60%)	Report a	and Viva Voce (20%)	Final Examination (0% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	10%			10%		10%	-	-			
Level 2	Understand	20%		-	20%	100	20%		-			
Level 3	Apply	20%		_	20%		20%	-	-			
Level 4	Analyze	20%			20%		20%	-	-			
Level 5	Evaluate	20%			20%	St	20%	-	-			
Level 6	Create	10%	-		10%		10%	-	-			
	Total	10	0 %	10	00 %		100%		-			

Course [	Designers			
Experts f	rom Industry	Experts from Higher Technical Institutions	Internal	Experts
1.	Dr.Ramakrishnan R,CDOO,Intellect Design Arena, Chennai		1.	Dr Shantanu <mark>Patil, SR</mark> MIST.
2.	Mr Ramakrishnan, CDOO,In <mark>tellect De</mark> sign Arena, Chenna	<i>i</i> i <u>2</u> .	2.	Dr. Ananth Ku <mark>mar R, S</mark> RMIST
3.	Mr Anirban Chowdhury, Co-Founder & Director, Frugal Labs,Bengaluru	3.	3.	Dr.M.B Muke <mark>sh Krishn</mark> an, SRMIST



B.Tech / M.Tech(Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses –Syllabi-Control Copy

Course	21CSS303T	Course		Course	S	ENGINEERING SCIENCES	L	Т	Р	С
Code		Name	DATA SCIENCE	Category			2	0	0	2

Pre-requisite			Co- requisite			Progressive	
Courses	Nil		Courses	Nil	and the second second second second	Courses	Nil
Course Offering	g Department	Data Science and	l Business Systems		Data Book / Codes / Standards	Nil	

Course	Learning Rationale (CLF	R): The purpose of learning this course is to:	Program Outcomes (PO)												Pr	ogram
CLR-1 :	1: Understand the basics of data			2	3	4	5	6	7	8	9	10	11	12	out	comes
CLR-2 :	Learn the Pandas library to	analyze data frames	e		df.	s of		iety			¥		æ			
CLR-3 :	Utilize different methods of	data acquisition and data cleaning	vledç		ento	tions	ge	soc			oW r		lance	b		
CLR-4 :	R-4 : Explore the visualization tools for different kinds of input data formats		Knov	lysis	opm	stige	Usa	r and	~ ર		Tean	io	& Fir	amin		
CLR-5 :	-5: Apply supervised and unsupervised learning to learn the hidden patterns from the data and predict the output		Mgt.	ng Lea												
Course	Outcomes (CO):	At the end of this course, learners will be able to:	Engine	Probler	Design. solutior	Conduc	Moderr	The en	Enviror Sustain	Ethics	Individu	Commu	Project	Life Loı	PSO-1	PSO-2 PSO-3
CO-1:	Understand the relationship be	e <mark>tween d</mark> ata		-	111		1	-	÷	-	-	-	-	-	-	
CO-2:	Identify the different data struc	stures to represent data		-	-		1		-	-	-	-	-	-	-	
CO-3:	D-3: Identify data manipulation an <mark>d cleaning</mark> techniques using pandas			-	-	1.	1	,		-	-	-	-	-	-	
CO-4:	4: Constructs the Graphs and plots to represent the data using python packages			-	-	-	1			-	= -	-	-	-	-	
CO-5:	C-5: Apply the principles of the data science techniques to predict and forecast the outcome of real-world problem.			-		-	1	-	-	-		-	-	-	-	

## Unit-1 - Introduction to Data Science, Numpy & Pandas

10 Hour

Introduction to Data science: Facets of data, Data Science Process Introduction to Numpy: Numpy, creating array, attributes, Numpy Arrays objects: Creating Arrays, basic operations (Array Join, split, search, sort), Indexing, Slicing and iterating, copying arrays, Arrays shape manipulation, Identity array, eye function Pandas: Exploring Data using Series, Exploring Data using DataFrames, Index objects, Re index, Drop Entry, Selecting Entries, Data Alignment, Rank and Sort, Summary Statistics, Index Hierarchy Data Acquisition: Gather information from different sources, Web APIs, Open Data Sources, Web Scrapping.

## Unit-2- Data Wrangling, Data Cleaning and Preparation

Data Handling: Problem faced when handling large data-General techniques for handling large volume of data- General programming tips for dealing large data sets Data Wrangling: Clean, Transform, Merge, Reshape: Combining and Merging Datasets, Merging on Index, Concatenate, Combining with overlap, Reshaping, Pivoting Data Cleaning and Preparation: Handling Missing Data, Data Transformation, String Manipulation, summarizing, Binning, classing and Standardization, outlier/Noise& Anomalies.

### Unit-3- Visualization

Customizing Plots: Introduction to Matplotlib, Plots, making subplots, controlling axes, Ticks, Labels & legends, annotations and Drawing on subplots, saving plots to files, matplotlib configuration using different plot styles, Seaborn library. Making sense of data through advanced visualization : Controlling line properties of chart, creating multiple plots, Scatter plot, Line plot, bar plot, Histogram, Box plot, Pair plot, playing with text, styling your plot, 3d plot of surface

10 Hour Combining

Learning Resources	1. 2. 3. 4.	Grus, J. (2019). Data Science from Scratch, 2nd Edition. O'Reilly Media, Inc. Jiawei Han, Micheline Kamber and Jian Pei (2012), Data Mining Concepts and Techniques, Third Edition, Elsevier. Davy Cielen, Arno D. B. Meysman, and Mohamed Ali (2016), Introducing Data Science: Big data, machine learning, and more, using Python tools, Manning Publications. McKinney, W. (2018). Python for data analysis: Data wrangling with pandas, NumPy, and IPython. O'Reilly Media, Inc.	5. 6. 7. 8.	Vanderplas, J. T. (2017). Python data science handbook: Essential tools for working with data. O'Reilly Media, Inc. Jeffrey S. Saltz and Jeffrey M. Stanton (2018), An Introduction to Data Science, Sage Publication. Shai Vaingast (2014), "Beginning Python Visualization Crafting Visual Transformation Scripts", Second Edition, Apress. Wes Mc Kinney (2012). "Python for Data Analysis", O'Reilly Media.
		all services	100	14.30

CNV

ng Assessme		N	Continuous Learning	Assessment (CLA)	1. 1	-			
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test 1%)	Life-Long CL (10	Learning A-2 %)	Final Examination (40% weightage)			
		Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	40%		20%		40%	-		
Level 2	Understand	40%		20%		<mark>40</mark> %	-		
Level 3	Apply	10%		20%		10%	-		
Level 4	Analyze	10%		20%		<u>10%</u>	-		
Level 5	Evaluate	1		10%			-		
Level 6	Create	. E		10%	-		-		
	Total	10	0%	100	)%	10	0 %		

Course I	Designers		
Experts f	rom Industry	Experts from Higher Technical Institutions	Internal Experts
1.	Dr. Veeramanickam. M.R.M, Associate Professor Chitka University Institute of Engineering and Technology	a 1. Mr. Snehith Allam Raju Senior Manager Advanced Analytics & Architecture Envista Holdings Corporation, Hyderabad.	1. Dr.V.Kalpana, SRMIST
			2. Dr.G.Vadivu, SRMIST



# ACADEMIC CURRICULA

**Mandatory Courses** 

**Regulations 2021** 



## SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

## (Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Chengalpattu District 603203, Tamil Nadu, India

Course Code	21PDM201L	Course Name	9	VERB	AL REASO	NING	Cour Categ	rse J <mark>ory</mark>	М				NON	CRE	DIT			 (	L T D 0	P 2	C 0
Pre-requi Course	site s	Nil		Co- requisite Course <mark>s</mark>		Nil	P	rogres Cours	sive ses						Ni	1					
Course (	Offering Departme	ent	Caree	⁻ Development Centre	9	Data Book / Codes / Standard	ds							Nil							
Course Le	arning Rationale (	CLR):	The purpos	se <mark>of learning this</mark> co	ourse is to		r i	1	1.0		Proar	am Oı	utcome	s (PO	)				P	rogra	m
CLR-1:	Understand the s	tructure, c	rganization,	tone, and main idea o	of the pass	age.	1	2	3	4	5	6	7	8	9	10	11	12	S	pecifi tcom	es
CLR-2:	Determine the gra	ammatical	, synta <mark>ctical</mark>	and logical accuracy	of sentenc	es.	Φ		-	of	10	ety			¥						
CLR-3:	Comprehend an a	argument	s lin <mark>e of reas</mark>	oning and recognize	the logical	coherence of ideas in a text.	vledg		ent o	ations	ge	soci		-	Nor N		ance	b			
CLR-4:	Enable students u	Inderstan	d s <mark>ubtle me</mark> a	anings of words used	in academi	c texts.	Knov	lysis	mdo	stige	Usa	anc	∞ _		Tean	ы	& Fir	arnin			
CLR-5:				N11			ering	n Ana	devel	t inve x prot	Tool	gineer	ment		al & J	Inicati	Mgt.	ig Lea			
Course Ou	tcomes (CO):		At the end	of this course, learr	ners will be	e able to:	Engine	Probler	Design/	Conduc	Modern	The en	Environ Sustain	Ethics	Individu	Commu	Project	Life Lor	PSO-1	PSO-2	PSO-3
CO-1:	Build vocabulary	through <mark>m</mark>	<mark>lethodic</mark> al ap	proaches and nurture	e passi <mark>on f</mark> o	or vocabulary enrichment.	12	1		1	-			-	2	3	-	3	-	-	-
CO-2:	Detect and correc	t gram <mark>ma</mark>	<mark>itical, s</mark> yntac	tical, and logical fallac	cies.		-	1	1	-	-		-	-	2	3	-	3	-	-	-
CO-3:	Hone critical thin author's point of v	king sk <mark>ills</mark> riew.	by analyzir	ng arguments with ex	xplicit and i	mplicit premises to validate the		-	-	1	-	1.1		-	2	3	-	3	-	-	-
CO-4:	Analyze and eval based on their fur	uate te <mark>xts</mark> action, use	<mark>critic</mark> ally in and charac	multifarious ways an teristics.	nd identify n	elationships between sentences	-		2	4.2	-			-	2	3	-	3	-	-	-
Unit-1 - Se	ntence Correction	1		1	Kenter	1		1.60				e								10	Hour
Subject Ve	rb Agreement, Pror	nouns, Te	<mark>nse, Com</mark> pa	risons, Modifiers, para	allelism, Su	bjunctive Mood				_	_	-	_							10	Hour
Single Blan	k. Double and Trip	n le blanks.	Sentence C	ompletion- Grammar.	. Svnonvms	and Antonyms				-	10	-	-							10	noui
Unit-3 – Cı	ritical Reading	, and an			,		Sec.				1									10	Hour
Critical Rea	asoning – Facts, Ini	ference, J	udge <mark>ment,</mark> S	Strengthening and We	eakening an	Argument, Para jumble, Para C	Comple	tion			15	_									
Learning Resources	1. Charles Vocabul 2. Norman	Harringto ary, Rand Lewis, Ho	on Elstor, om House R ow to Read B	Verbal Advantage: T Reference, 2002 Better and Faster, Goy	Ten Easy oyal, 4 th Edit	Steps to a Powerful 3. F c ion 4. M	ranklir Compre Ianhat	n GRE ehensio tan Pre	Word on Gra op GRI	List, 38 I, Wiley E : Rea	61 GR , 2016 ding C	E Wor ompre	rds, Fra hensior	nklin n and l	Vocab Essays	Systen s, 5th E	n, 2014 dition	Wiley':	s GMA	AT Re	ading

ning Assessme	ent								
			Ca	ontinuous Learnin	g Assessment (CL	_A)			
	Bloom's Level of Thinking	Forr Cl (3	native LA-1 0%)	Forn CL (30	native A-2 0%)	Sumi (40	native )%)	Final Ex (0% we	amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember		30%		30%	10-	30%	-	-
Level 2	Understand		20%		20%		20%	-	-
Level 3	Apply	-	30%	-	30%		30%	-	-
Level 4	Analyze		20%		20%		20%	-	-
Level 5	Evaluate			and the second second				-	-
Level 6	Create		· · ·				·	-	-
	Total	10	0 %	10	0%	10	0%		-

Co	urse Designers			h. 1	
Ex	perts from Industry	Ex	perts from Higher Technical Institutions	Inte	ernal Experts
1.	Mr.Pratap Iyer, Study Abroad Mentors,pratap.iyer30@gmail.com	1.	Mr Nishith Sinha, dueNorth India Academics LLP,	1.	Dr. P. Madhusoodhanan, SRMIST
2.	Mr. Ajay Zener, Director, Gradsquare ajayzenner@gmail.com	2.	Dr.Dinesh Khattar, Delhi University, dinesh.khattar31@gmail.com	2.	Dr. M. Snehalatha, SRMIST
				3.	Dr Jayapragash J, SRMIST
				4.	Ms. I. Jerlina John, SRMIST



Course Code	21PDM202L	Course Name	•	CRITICAL AND CRE	ATIVE THINKING SKILLS	Co Cat	urse egory	М				NON	I CREI	DIT				L T 0 0	P 2	C 0
Pre-requi Course	site es	Nil		Co- requisite Course <mark>s</mark>	Nil		Progre Cour	essive rses						Ni	1					
Course	Offering Departm	ent	Career D	Development Centre	Data Book / Codes / Stan	dards							Nil							
Course Le	arning Rationale	(CLR):	The purpose	of learning this cou	rse is to:	T	1	1.1	21	Prog	am O	utcome	es (PO	))				P	rogra	m
CLR-1:	Enable to solve p	problems us	sing fundamer	ntal principles and rec	ogn <mark>ize the log</mark> ical coherence of idea	s. 1	2	3	4	5	6	7	8	9	10	11	12	01	pecit utcom	ic ies
CLR-2:	Interpret the stru	cture, orgai	nizatio <mark>n, tone,</mark>	and main idea of the	content.	- e		÷	of	34	ety			¥						
CLR-3:	Arrive at solution	s to mather	mati <mark>cal proble</mark>	ms with requisite spe	ed & accuracy.	ledo		ento	tions	e	soci	16		Mo		ance	5			
CLR-4:	Provide the right	knowledge	e, <mark>skill and a</mark> pti	itude to face any com	petitive examination.	Mon	lysis	bmdo	stiga	Usaç	and	οŏ		eam	ы	k Fin	ui.			
CLR-5:					and southern	- ind	Anal	evel	inve	00	neer	bility		8 T	icati	٩d. ٤	Lea			
				Provide State		neer	lem	p/ug	duct	em	engi	ronn	g	idua	unu	ect N	Lonç	<u> </u>	2	က္
Course Ou	utcomes (CO):		At the end of	f this course, learne	rs will be able to:	Enai	Prob	Desi	Con	Mod	The	Envi	Ethio	Indiv	Com	Proj	Life	PSO	PSO	PSO
CO-1:	Analyze and eva	luate co <mark>nte</mark>	ents critically ir	n multifarious ways.	The case of	1.1	1.0		1	-	-	-	-	3	3	-	3	-	-	-
CO-2:	Grasp the approa	aches an <mark>d s</mark>	<mark>strate</mark> gies to e	enhance logical reasor	ning ability.	-	10.0	-	-	-	-		-	3	3	-	3	-	-	-
CO-3:	Acquire requisite	skill to <mark>con</mark>	n <mark>ceptu</mark> alize & s	solve aptitude questio	ns quickly.	1	1.0	-		-	- 10	-	-	3	3	-	3	-	-	-
CO-4:	Gain appropriate	skills to <mark>su</mark>	<mark>icceed</mark> in preli	minary selection proc	ess for recruitment.			10	-	-	-	-	-	3	3	-	3	-	-	-
						15	2.0	-	6			-								
Unit-1 – Se	entence Completi Equivalence and T	on and Ari	tion - Time an	d Work- Pines & Cista	arns - AP /GP (Progressions)	-		_			-	-							10	Hour
Unit-2 – R	easoning			a work- ripes a cisit	ans - Al 701 (l'rogressions)	-					-								10	Hour
Critical Thi	nking Skills – Assu	Imption, Pa	a <mark>radox, Lo</mark> gica	l Conclusion – Venn I	Diagram – Syllogism - Opera <mark>tor B</mark> ase	d Questi	ions (Qı	uantita	tive Rea	soning	1) - Oro	dering a	nd Se	quenci	ing.					
Unit-3 – Se	entence Rearrang	ement and	d Arithmetic-	1						-	_								10	Hour
Reading C	omprehension – P	ara Jumble	e - Time and D	listance- Problems on	Trains- Boats & Streams- Races- Es	scalators	-Circula	nr Trac	ks – Qu	adratic	Equat	ions.		_						
Learning Resources	1. Ni 2. Di 3. Cl Ha	shit K. Sinh nesh Khatta narles Harri puse Refere	na, The Pearso ar-The Pearso ington Elstor, V ence, 2002	on Guide to Quantitati on Guide to Quantitati Verbal Advantage: Tel	ive Aptitude and Data Interpretation i ve Aptitude for competitive examinat n Easy Steps to a Powerful Vocabula	for the Ca ions ry, Rando	AT 4. 5. om 6. 7	Nor Fra 201	man Le nklin GF 4Wiley': nhattan	wis, Ho RE Wor s GMA Prep G	w to R d List, T Read RF : F	Read Be 3861 C ding C Reading	etter ar RE W ompre	nd Fas /ords, l ehensio prehen	ter, Go Franklii on Grai sion ar	yal, 4 th n Voca l, Wiley nd Essa	Edition b Syste v, 2016 avs. 5tt	n ≩m, n Editic	 วท	

rning Assessme	ent								
			Co	ntinuous Learnin	g Assessment (Cl	_A)			
	Bloom's Level of Thinking	Forr Cl (3	mative LA-1 0%)	Forn CL (3	native A-2 0%)	Sumi (40	native 0%)	Final Ex (0% we	amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	30%		30%	1	30%	-	-
Level 2	Understand		20%		20%		20%	-	-
Level 3	Apply	-	30%	-	30%	N. S. S.	30%	-	-
Level 4	Analyze	1	20%	-	20%	1.	20%	-	-
Level 5	Evaluate				-			-	-
Level 6	Create			1.5	1000		A		-
	Total	10	0 %	10	0%	10	0%		-

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.Pratap Iyer, Study Abroad Mentors,pratap.iyer30@gmail.com	1. Mr Nishith Sinha, dueNorth India Academics LLP, nsinha.alexander@gmail.com	1. Dr. P. Madhusoodhanan, SRMIST
2. Mr. Ajay Zener, Director, Gradsquare ajayzenner@gmail.com	2. Dr.Dinesh Khattar, Delhi University, dinesh.khattar31@gmail.com	2. Dr. M. Snehalatha, SRMIST
		3. Dr Jayapra <mark>gash J, S</mark> RMIST
	A CALL THE ALL AND A CALL AND A C	4. Ms. I. Jerlina John, SRMIST



Course Code	21PDM301L	Course Name		ANALYTICAL AND LOG	ICAL THINKING SKILLS	Cour Categ	se ory	М				NON	CREI	DIT				L T 0 0	P 2	C 0
Pre-requi Course	site s	Nil	Caroor	Co- requisite Courses	Nil	P	rogres Cours	ssive ses					Niil	Ni	I					
Course	Shering Departme		Career	Development Centre	Data Book / Codes / Standar	us							INII							
Course Le	arning Rationale (	CLR): T	he purpos	e of learning this course	e is to:	1	1	100		Progr	am Ou	utcome	s (PO	)				P	rogra	ım
CLR-1:	Recapitulate fund	amental ma	athematical	concepts and skills.		1	2	3	4	5	6	7	8	9	10	11	12	- S οι	pecif Itcom	ic ies
CLR-2:	Arrive at solutions	s to mathem	natica <mark>l probl</mark>	<mark>ems w</mark> ith requisite speed	& accuracy.				of	3	y									
CLR-3:	Sharpen logical re	easoning thr	rou <mark>gh skillfu</mark>	Il conceptualization, hone	analytical thinking skills.	adge		it of	ons c	-	ociel		-	Vork		JCe				
CLR-4:	understand and i examinations.	master the	mathematic	cal concepts to solve typ	es of problem tested in competitive	Knowle	alysis	lopmer	estigatio	Usage	r and s	8		Team V	ion	& Final	arning			
CLR-5:				100		ering	n Ana	/deve	st inve x prol	I Tool	ginee	abilit		lal &	unicat	Mgt.	ng Le			
Course Ou	itcomes (CO):	4	At the end o	of this course, learners	will be able to:	Engine	Probler	Design	Conduc	Moderr	The en	Enviror Sustair	Ethics	Individu	Comm	Project	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Build a strong bas	se in th <mark>e fun</mark>	<mark>ndam</mark> ental n	nathematical concepts.				-	۰.	-	-	-	I	3	3	-	3	-	-	-
CO-2:	Identify the appro	aches a <mark>nd s</mark>	<mark>strate</mark> gies to	o solve problems with spe	ed and accuracy.	2 -	-	-			-	-	-	3	3	-	3	-	-	-
CO-3:	Understand, com individually.	prehen <mark>d ar</mark>	nd provide	logical conclusions to s	olve problems in teams, groups and	-	-	E.	-	-		-	I	3	3	-	3	-	•	-
CO-4:	Gain appropriate	skills to <mark> suc</mark>	cceed in pre	liminary selection proces	s for recruitment.	E.	-	-/	-	-	-	-	-	3	3	-	3	-	-	-
Unit-1 - Nı	Imbers	_		2															10	Hour
Numbers -	Logarithm			A Carlos						7	Sec. 1									
Unit-2 – M	odern Mathematic	s		No. No.	1.0														10	Hour
Permutatio	n and Combination	– Probabilit	it <mark>y - Clock</mark> al	nd Calendars – Crypt Ari	hmetic				1	27										
Unit-3 – Al	nalytical Ability		Cubas	Occurrentes Managemetices	Tringerenter Detalatementation	Data	0		_										10	Hour
Number, W	ora Series – Coain	ig Decoaing	j – Cubes –	Geometry, Mensuration -	- Trigonometry - Data Interpretation -	- Data	Sumici	ency												

	1. Nishit K. Sinha, The Pearson Guide to Quantitative Aptitude and Data Interpretation for	3. Arun Sharma, How to Prepare for Quantitative Aptitude for CAT, Tata McGraw Hill
Learning Resources	the CAT 2. Dinesh Khattar-The Pearson Guide to Quantitative Aptitude for competitive examinations	Contraction of the second s

earning Assessm	ent								
			Ca	ontinuous Learnin	g Assessment (CL	_A)			
	Bloom's Level of Thinking	Forr Cl (3	native _A-1 0%)	Forr CL (3	native .A-2 0%)	Sumi (40	native 0%)	Final Ex (0% we	amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember		30%		30%	1	30%	-	-
Level 2	Understand		20%		20%		20%	-	-
Level 3	Apply	-	30%	-	30%	N. S. S.	30%	-	-
Level 4	Analyze	-	20%		20%		20%	-	-
Level 5	Evaluate		- <u> </u>	and the second second	-			-	-
Level 6	Create		· · ·	Sec. Con	1.1			-	-
	Total	1(	00%	10	0%	10	0%		-

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.Pratap Iyer, Study Abroad Mentors,pratap.iyer30@gmail.com	1. Mr Nishith Sinha, dueNorth India Academics LLP, nsinha.alexander@gmail.com	1. Dr. P. Madhusoodhanan, SRMIST
2. Mr Ajay Zenner, Career Launcher, ajay.z@careerlauncher.com	2. Dr.Dinesh Khattar, Delhi University, dinesh.khattar31@gmail.com	2. Dr. M. Sneha Latha, SRMIST
		3. Dr Jayapr <mark>agash J,</mark> SRMIST
		4. Ms. I. Jerlina John, SRMIST



Course Code	21PDM302L	Course Name	EMPLOYABILITY SKILL	S AND PRACTICES	Cours Catego	se ory	М				NON	CREE	DIT			 (	- T ) 0	P 2	C 0
Pre-requis Course	site s	Nil	Co- requisite Courses	Nil	Pr	ogres Cours	sive es						Nil						
Course (	Offering Departme	ent	Career Development Centre	Data Book / Codes / Standard	ds							Nil							
Course Le	arning Rationale	CLR): Th	e purpos <mark>e of learning</mark> this course i	s to:	-	1			Progr	am Ou	Itcome	es (PO	)				P	rogra	m
CLR-1:	Equip the student	s to build the	r profil <mark>e and unde</mark> rstand the nuances	of resume building	1	2	3	4	5	6	7	8	9	10	11	12	S OU	pecifi tcom	ic es
CLR-2:	Utilize the group of	discussion ac	tiv <mark>ity to exhibit</mark> their knowledge and s	kills	ge		of	s of	10	iety	bility		rk		е				
CLR-3:	Get exposure on	the interview	t <mark>echniques</mark> and get practical experier	nce of attending an interview	vled		ent o	ation	ge	l soc	tainal		n Wo		Jano	Ð			
CLR-4:	Enhance present	ation skills al <mark>c</mark>	ong with exploration of opportunities		Kno	alysis	lopm	estig: blem	Usa	r and	sus \$		Tean	ion	& Fir	arnin			
CLR-5:					ering	I Ana	deve	t inve k pro	Tool	jinee	Tent 8		al &	nicat	Mgt.	g Le			
Course Ou	tcomes (CO):	At	the end of this course, learners w	ill be able to:	Enginee	Problem	Design/	Conduc complex	Modern	The enc	Environn	Ethics	Individu	Commu	Project	Life Lon	PSO-1	PSO-2	PSO-3
CO-1:	Create a persona	l brand <mark>and p</mark>	repare an effective and powerful resu	ime	12		-		5		-	2	-	2	-	-	-	-	-
CO-2:	Participate and pe	erform i <mark>n grou</mark>	<mark>p</mark> discussion with an objective of gett	ing the best out of group discussion	- 1		100	-	-	-	-	-	3	3	1	-	-	-	-
CO-3:	Approach person	al and t <mark>echnic</mark>	al interviews with clarity and confider	nce	-		-	-	-	- 100	-	2	-	3	-	-	-	-	-
CO-4:	Present views and career opportunit	d ideas <mark>in an c</mark> ies.	organized way and get an understand	ing of the industrial expectations and	-	-			-		-	-	3	3	-	-	-	_	-
Unit-1 - Pro	ofile Building	tria Taata C		ding. Dala of appial modio in profili			Duildi			las Dru	file							10	Hour
Personal pi Unit-2 - Gr	oning - Psychome oup Discussion	tric Tests - Co	ompetency Mapping – Personal Bran	aing – Role of social media in profili	ng – Re	esume	Bullali	1g - Sol	- VIC	ieo Pro	otile							10	Hour
Purpose an	d Role of GD in re	cruitment <mark>– G</mark>	D preparation - Types of GD topics –	Roles played in GD – Mock GDs –	Case si	tudy-b	ased G	<i>D</i>	1										
Unit-3 - Pe	rsonal Interview	inu. Tunna i	finter inv. Di proporation Mark I	ntan iawa Oraya intan iawa Uinta	oudou	halla		unation				hing of		0.00				10	Hour
Introduction	to personal interv	iew – Types c	TINTERVIEW – PI preparation – Mock I	nterviews – Group Interviews – High	oraer (	cnaller	iging q	uestion	s – Dis	scussio	on - Etr	nics at	workp	ace					
	1. Anukul	Varshney, I'r	n no <mark>t afraid of</mark> GDPI, India, PEARSO	N Publication, 2016.	4.	Edg	ar Thor	pe, Wir	nning a	at Inter	views,	5 th Edi	tion, P	EARSO	ON Pul	olicatio	n, 201	3.	

	1. Anukul Varshney, I'm not afraid of GDPI, India, PEARSON Publication, 2016.	4. Ed	dgar Thorpe, Winning at Interviews, 5 th Edition, PEARSON Publication, 2013.
Learning	2. Ramachandran and Karthik, From Campus to Corporate, India, PEARSON Publication, 2016.	5. Wi	filliam F. Roth, Ethics in the Workplace, PEARSON Publication, 2004.
Resources	3. Michele Gilbert, Listening skills, Createspace Independent Publishing Platiform, New York,	6. Do	orie Clarke, Reinvent <mark>you, Harvar</mark> d Business Review Press, 2013.
	2015.	7. Tra	ran Le Hue Nghi, Building Soft skills for Employability, Routledge,2020

•		Continuous Learning Assessment (CLA)										
	Bloom's Level of Thinking	Forr CL (3	native A-1 0%)	Form CLA (30	ative 4-2 %)	Sumi (4)	native 0%)	Final Examination (0% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	-	30%		30%	10 ·	30%	-	-			
Level 2	Understand		20%	-	20%	100	20%	-	-			
Level 3	Apply		30%	-	30%	1.1	30%	-	-			
Level 4	Analyze	-	20%	-	20%		20%	-	-			
Level 5	Evaluate				-			-	-			
Level 6	Create		A	and the second second				-	-			
	Total	10	0 %	100	%	10	0%		-			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Ms. Sudha Mahadevan, Career Launcher,	1. Mr. Nishith Sinha, dueNorth India Academics LLP,	1. Dr. P. Madhusoodhanan SRMIST
sudha.m@careerlauncher.com	nsinha.alexander@gmail.com	
2. Mr Ajay Zenner, Career Launcher,	2. Dr.Dinesh Khattar, Delhi University, dinesh.khattar31@gmail.com	2. Mr. P. Priyanand, SRMIST
ajay.z@careerlauncher.com		
		3. Mrs. M. Kavitha, SRMIST



Course Code	rse 21LEM201T Course PROFESSIONAL ETHICS de Name			C	Cours atego	se ory	М				NON	CRED	ЛГ				- T 1 0	P 0	C 0			
Pre-requi Course	site es	Nil		Co- requisite Courses	•	Nil	-	Pr	ogres Cours	sive es						Nil	1					
Course	Offering Departme	ent	English ar	nd Foreign Langu	lages	Data Book / Codes / St	tandards								Nil							
Course Le	arning Rationale	(CLR):	The purpos	e of learning thi	s course i	is to:		÷	1		Program Outcomes (PO)					rogra	m					
CLR-1 :	connect the learn	ners to their	r potential - ι	Inderstand moral	, professio	onal and personal values.		1	2	3	4	5	6	7	8	9	10	11	12	01	tcom	IC Ies
CLR-2 :	introduce the lea	rners to pro	ofessi <mark>onal et</mark> i	hics and to enabl	e them tov	vards decision making skills		Ð		-	of	3	ety			×			<u> </u>			
CLR-3 :	draw the learners	' attention t	tow <mark>ards busi</mark>	ness ethics.	1			ledg	edg	into	tions	Ð	soci			Wor		ance	_			
CLR-4 :	strengthen and e	nhance pro	ofe <mark>ssional</mark> eth	ics through psyc	hological a	approach		Know	Ilysis	opme	stigat	Usag	r and	৵		Team	ion	& Fin	arning			
CLR-5 :	cultivate a spirit c	of working ir	n diverse wol	rld by understand	ling workp	lace ethics.		heering	lem Ana	gn/deve	luct inve olex prol	ern Tool	enginee	onment	ş	idual & ⁻	municat	ect Mgt.	-ong Le	-	-2	ę
Course Ou	Irse Outcomes (CO): At the end of this course, learners will be able to:				. 197	Engi	Prob	Desig	Conc	Mode	The (	Envir Susta	Ethic	ndiv	Com	Proje	_ife [	So	SOS	SOS		
CO-1:	Equip themselves	themselves with an understanding of moral, professional and personal values				4	-	-	-	-			-	3	-	-	-	3	-	-	-	
CO-2:	Understand the n skills.	need of <mark>ethi</mark>	ics in shaping	y their profession	The learn	ners will hone their decision -	making	-			-	-	-	2	3	2	-	-	3	-	-	-
CO-3:	Refine their busin	ness eth <mark>ics</mark>	based on ps	ychologi <mark>c</mark> al and p	ohilosophic	cal perspective.		-	-	-1	-	-	3	-	3	-	-	-	-	-	-	-
CO-4:	Have an edge ov	er the e <mark>thic</mark>	al systems in	1 workplace.	1.00				-		12	-	- 24	-	3	2	-	-	3	-	-	-
CO-5:	assess the need	for a ba <mark>lanc</mark>	<mark>ce betw</mark> een e	ecology, engineer	ring and ea	conomy			1	L. A.	-	-	2	3	3	-	-	-	-	-	-	-
Unit-1 - In	troduction	_		-			-					1				_					3	Hour
Individual a	and Professional Et	thics: Introd	luction to Pro	ofessional Ethics,	Morals, V	alues and Ethics - Personal a	and Profe	ssion	al - Se	nsé of	Engine	ering	Ethics	- Code	of Eth	ics by	NSPE	- Maki	ng dec	isions	with e	ethical
limensions	s - definition - roadi Isiness Ethics	map to ethic	cal decision i	naking - commoi	n standard	s - Internal obstacies - dias - i	empatny.									_					- 3	Hour
Philosophic authority a	cal approaches to I nd domination - Glo	Business E obal Busine	Ethics - ethica	al reasoning - eth	nical issue:	s in business - Social Respo	nsibility c	of Bus	iness	- confl	ict of in	terest	- cultu	ıral rela	tivism	- Ethic	cal lea	dership	) - Res	isting	un - e	ethical
Unit-3 - Ps	ychological Appr	oaches			1.4.1	L'ANGA SHI															3	Hour
Ethical The	eories - Psychologie	cal and Phil	ilosohpical ap	o <mark>proaches</mark> - Myth	s about Mo	orality - conflict of interest in p	osycholog	gical p	berspe	ctive -	Courag	e - Int	egrity ·	- ethical	dilem	ıma - E	Emotior	าal Inte	lligenc	e.		
Unit-4 - W	orkplace Ethic	f Decearst	a a a da mi - i	integrity inteller	tual han = =	ty Dala of Engineers and M		Eth:		una lu	Divers	word	1000	0.0 mm	lition	fra a			tiality	<u></u>	3	Hour
Intellectual	bropertv rights - di	i Research iscriminatio	- academic i n.	ntegrity - intellect	iual nones	ly - Rule of Engineers and Ma	anagers -	- Ethio	ai issi	ues in i	Diverse	workp	nace -	compe		iree w	/III - CO	maent	iality -	emplo	iyee ri	ynts -
Unit-5 - Sa	fety, Responsibili	ities and R	Rights																		3	Hour
Ecology, E	ngineering, Econor	ny - Risk be	enefit analys	is and reducing r	isk - SDGs	s - Corporate social responsib	oility and	Corpo	orate S	Sustain	ability -	CSR I	in India	a - Sust	ainabi	lity Ca	se Stu	dies.				

	1.	Subramanian. R., Professional Ethics, Oxford Publication, 2013.	5.	https://www.nspe.org/resources/ethics/code - ethics
	2.	Nagarasan. R.S. Professional Ethics and Human Values. New Age International	6.	https://www.toolshero.com/tag/ethical - decision - making/
Looming		Publications, 2006.	7.	https://pagecentertraining.psu.edu/public - relations - ethics/introduction - to - public - relations -
Learning	З.	Mike W Martin and Roland Schinzinger, Ethics in Engineering,4th edition, Tata		ethics/lesson - 1/ethical - theories/
Resources		McGraw Hill Publishing Company Pvt Ltd, New Delhi,2014	8.	https://www.ewh.ieee.org/soc/pes/switchgear/presentations/tp_files/2017 -
	4.	https://soaneemrana.org/onewebmedia/Professional%20Ethics%20and%20Human		1_Thurs_Shiffbauer_Singer_Engineering_Ethics.pdf
		%20Values%20by%20R.S%20NAAGARAZAN. pdf	9.	https://peer.asee.org/case - studies - in - engineering - ethics.pdf

			C	ontinuous Learnin	g Assessment (CL	_A)			
	Bloom's Level of Thi <mark>nking</mark>	Forr Cl (3	native _A-1 0%)	Forr CL (3	native A-2 0%)	Sumi (4)	native )%)	Final Ex (0% we	amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	30%		30%		30%		-	-
Level 2	Understand	20%		20%		20%		-	-
Level 3	Apply	30%		30%	107-101	30%		-	-
Level 4	Analyze	20%		20%	1999 - 1985	20%	1 7	-	-
Level 5	Evaluate	- L C		1	6 L - F - S - G		1 A	-	-
Level 6	Create		100 C			1000 - 20	and the second	-	-
	Total	10	0 %	10	0 %	10	0%		-

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Ms. Woanyuh Zoe Tsou Founder and proprietor, IF Lingua Cultural studio. Hsinchu. Taiwan.	1. Dr. S. Soundiraraj, Professor and Head, Dept of English, College of Engineering, Anna University Guindy Campus, Chennai,	1. Dr. P. Tamilarasan, SRMIST.
	2. Dr. J. Mangayakarasi, Dean of Academics Affairs & Head, PG and Research, Dept of English, Ethiraj College for Woman, Chennai.	2. Dr. J. Michael Raj, SRMIST
		3. Dr. S. Ramya, SRMIST
		4. Dr. K.R. Sondaraya SRMIST.

Course Code	ourse         21LEM202T         Course         UHV-II: UNIVERSAL HUMAN VALUES – UNDERSTANDING           Code         Name         HARMONY AND ETHICAL HUMAN CONDUCT			VALUES - UNDERSTANDING	Cour Categ	se ory	М				NON	GRAD	ED				L T 2 1	P 0	C 3
Pre-requi	isite es	Nil	Co- requisite Courses	Nil	P	rogres Cours	sive es						Nil	1					
Course	Offering Departme	nt	EFL-Value Education Cell	Data Book / Codes / Standa	rds							Nil							
Course Le	arning Rationale (	CLR): Th	e purpos <mark>e of learning</mark> this course	e is to:		1			Progr	am Ou	itcome	s (PO	)				р	roara	m
CLR-1 :	Help the students to understand need of value education, appreciate the essential complimentarily between 'values' and 'skills' and to ensure sustained happiness and prosperity which are the core 1 2 3 4 5 6 7 8 9 10 11 aspirations of all human beings					11	12	<ul> <li>Progr</li> <li>Spec</li> <li>outco</li> </ul>		c es									
CLR-2 :	Help students initi life and profession	iate a proces. n.	s <mark>of dialog</mark> within themselves to kno	w what they really want to be' in thei			SL	olex	2	2									
CLR-3 :	Help students to u holistic perspectiv living in a natural	nderstand the ve forms the way.	e meaning of happiness and prospe basis of Universal Human Values	rity for a human being. Understanding and movement towards value-based	de la		of solutior	is of comp	J.	ciety	inability		ork		ø				
CLR-4 :	Help students on levels of human li	right und <mark>erst</mark> ving, an <mark>d live</mark>	anding of the Human reality and the accordingly.	e rest of existence, harmony at all the	Jowled	Sis	pment	tigatior	Isage	and so	susta		am W	E	Financ	ning			
CLR-5 :	Highlight plausible trustful and mutua	e implication ally fulfil <mark>ling h</mark>	s of such a Holistic understanding uman behavior and mutually enrich	in terms of ethical human conduct ing interaction with Nature.	eering K	m Analy	n/develop	ict invest	n Tool L	ngineer a	nment &		lual & Te	unicatio	t Mgt. &	ing Lear			
Course O	utcomes (CO):	A	the end of this course, learners	will be able to:	Engine	Proble	Design	Condu	Moder	The er	Enviro	Ethics	Individ	Comm	Projec	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Evaluate the sign profession	ificanc <mark>e of</mark> v	alue inputs in formal education an	d start applying them in their life ar	nd -	-	8	1.5	-	111	-	3	2	-	-	3	-	-	-
CO-2:	Distinguish betwe Body, Intention an	en valu <mark>es an</mark> Id Comp <mark>eten</mark>	<mark>d sk</mark> ills, happiness and accumulatic <mark>ce of</mark> an individual, etc.	n of physical facilities, the Self and th	. e	87	-	-		5	<b>.</b> -	3	2	-	-	3	-	-	-
CO-3:	Analyze the value	of harmonio	<mark>us rela</mark> tionship based on trust and r	espect in their life and profession	-	-	-	-	-	-	-	3	2	-	-	-	-	-	-
CO-4:	Examine the role	of a human <mark>b</mark>	<mark>eing in</mark> ensuring harmony in society	/ and nature.	-	-	-	-	-	2	2	3	-	-	-	3	-	-	-
CO-5:	Apply the underst	anding of eth	ical conduct to formulate the strate	gy for ethical life and profession.	-	-		1	1	-	-	3	2	-	-	3	-	-	-
Unit-1 - In	troduction-Basic H	luman Aspir	ation, its fulfillment through All-	encompassing Resolution			-		18	-				•	•			9	Hour

The basic human aspirations and their fulfillment through Right understanding and Resolution, Right understanding and Resolution as the activities of the Self, Self being central to Human Existence; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution

Unit-2 - Right Understanding (Knowing)- Knower, Known & the Process

The domain of right understanding starting from understanding the human being (the knower, the experiencer and the doer) and extending up to understanding nature/existence – its interconnectedness and coexistence; and finally understanding the role of human being in existence (human conduct).

Unit-3 - Understanding Human Being

Understanding the human being comprehensively as the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Basis for harmony/contradiction in the self

B.Tech / M.Tech (Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses -Syllabi-Control Copy

9 Hour

# Unit-4 - Understanding Nature and Existence 9 Hour A comprehensive understanding (knowledge) about the existence, Nature being included; the need and process of inner evolution (through self-exploration, self- awareness and self-evaluation), particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence). 9 Hour Unit-5 - Understanding Human Conduct, All-encompassing Resolution & Holistic Way of Living 9 Hour Understanding Human Conduct, different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All- encompassing Resolution covering all four dimensions of human endeavor viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from Self to Nature and entire Existence

	1.	Gaur R.R., Sangal R., Bagaria G.P., 2019 (2nd Revised Edition), A Foundation Course in Human	8.	A N Tripathy, 2003, Human Values, New Age International Publishers.
		Values and Professional Ethics, Excel Books, New Delhi.	9.	Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh,
	2.	Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA		Amravati.
	3.	E.F. Schumacher, 1973, small is Beautiful: a study of economics as if people mattered, Blond &	10.	E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford
Learning		Briggs, Britain.		University Press
Resources	4.	Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991	11.	M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values),
	5.	Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits		Eastern Economy Edition, Prentice Hall of India Ltd.
		to Growth – Club of Rome's report, Universe Books.	12.	B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
	6.	A Nagraj, 1998, Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak.	13.	B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow.
	7.	P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.	1	Reprinted 2008.

aning Assessine												
	Bloom's Level of Thinking	Forr CL (5	native LA-1 0%)	Forn CL (3	A-2 0%)	Sum (2	mative 0%)	Final Examination (0% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	30%			30%	-	30%	-	-			
Level 2	Understand	20%	and the second		20%	-	20%	-	-			
Level 3	Apply	30%		-	30%	-	30%		-			
Level 4	Analyze	20%	-	- / / / /	20%	-	20%	-	-			
Level 5	Evaluate			-	-	-	1000		-			
Level 6	Create	1000	- A.		1000		<b>1</b> -	-	-			
	Total	10	0 %	10	0 %	10	00%		-			

Course Designers	A PERSONAL PROPERTY AND A PERSON AND A PERSO	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.	1.	1Dr.P.Supraja, SRMIST

Course Code	21LEM301T	Course Name	INDIAN ART	FORM	Cours Catego	ategory M NON CREDIT				L 1	. T I 0	P 0	C 0						
Pre-requi Course	site s	Nil	Co- requisite Courses	Nil	Pr	ogres Cours	sive es						Nil						
Course	Offering Departme	nt	English and Foreign Languages	Data Book / Codes / Standard	Standards Nil														
Course Le	arning Rationale (	CLR): Th	e purpose of learning this course is	to:		1			Progra	am Ou	tcome	s (PO)	)				Program		
CLR-1:	introduce the lea significance of val	rners to the rious Indian a	changi <mark>ng art form</mark> s in different period rt fo <mark>rms</mark>	ds of time: richness, variety and	1	2	3	4	5	6	7	8	9	10	11	12	S ou	pecifi tcom	c es
CLR-2:	enable the studer geographical loca	ts to recogniz tions	ze and appreciate paintings of different	schools prevalent in the different				1	5		ility								
CLR-3:	draw the learner's themes behind the	attention tow	vards the various types of sculpture ba	sed on the materials used and the	edge		nt of	ions of	Ð	society	stainab		Work		ance				
CLR-4:	cultivate a sense	of apprec <mark>iatic</mark>	on about the aesthetics of drawing as a	n integral part of our daily life	Inow	Sis	pme	tigat	Isag	; pue	sus		am	Ē	Fina	ning			
CLR-5:	orient the learner changing facets o	s about t <mark>he c</mark> f Moder <mark>n Indi</mark>	<mark>chan</mark> ging Indian social scenario and ti i <mark>an A</mark> rt Forms	ne ways they are reflected in the	ering KI	n Analy	/develo	ct inves x proble	J Tool L	gineer a	ment 8		ual & Te	unicatio	: Mgt. &	ng Lear			
Course Ou	utcomes (CO):	At	t the end of this course, learners will	be able to:	Engine	Problei	Design	Condu	Moderr	The en	Enviror	Ethics	Individ	Comm	Project	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Classify with an a	warene <mark>ss of t</mark>	<mark>the</mark> rich cultural heritage of India	15 11 14 17	1			-5	-	3	-	-	-	-	-	3	-	-	-
CO-2:	Understand the co	ontexts <mark>and s</mark>	ignificance of various Indian art forms		1	-	1	-	-	3	-	-	-	-	-	3	-	-	-
CO-3:	Understand how t	he con <mark>fluenc</mark>	<mark>e o</mark> f the diverse art forms of India creat	e the mosaic of the Indian nation	1 3				3	-	-	-							
CO-4:	Differentiate each and functional obj	artwor <mark>k fron</mark> ect	n different periods be it an architecture	e, sculpture, painting or decorative			-	-	-	3	-	-	-	-	-	3	-	-	-
CO-5:	Relate with history	/ and dev <mark>elop</mark>	<mark>elopment</mark> of Art and its historical, social, cultural, religious and political cont			-	-	-	-	3	-	-	-	-	-	3	-	-	-

### Unit-1 - Indian Art over Ages - An Overview

Ancient India: An Overview, Raj-Ravi Verma: religious stories like mythologies of Hindu gods, Mysore and Tanjore Art: included themes revolving around Hindu epics like, Ramayana and Mahabharata, Indian artists from different fields, Folk Art, Folk art and popular culture: Classical and folk art. Influential factors giving rise to modern art. Concepts and Motifs behind modern art Mughal paintings. Astonishing contemporary paintings by Indian artists. Fairs, festivals and local deities in the development of art forms. Myth, legends, snippets from epic, multitudinous gods born out of dream and fantasy in art forms.

### Unit-2 - Indian Painting

Indus Valley civilization paintings on pottery. Cave paintings from different parts of India. The paintings of the Ajanta and Ellora caves. Paintings of North India, South India, East India, West India, Central and Deccan India, Thanjavur, Madhubani paintings, Analyzing the recurrent themes style through selected illustrations. Kalamkari paintings – Features of organic art; obtaining colours from natural sources, Attempting Simple Kalamkari/Madhubani paintings using natural colours, Pattachitra paintings, Students, presenting and sharing their paintings, Moghal paintings, Moghal paintings from the various Moghal dynasties and identification of the common features

## Unit-3 - Indian sculpture

Sculpture during the Harappan period, Terra Cota – What? Where? When? – A discussion, Rock cut sculpture – Differences between rock cut sculpture and stone sculpture , Sculptures in religious buildings, Buddhism, Hinduism, and Jainism in sculpures, Visit to Mahabalipuram and submitting a report by the students, Bronze sculptures in India, Cultural stonework in India - in the form of primitive cupule art, the Buddhist Pillars of Ashoka of the Mauryan period, The figurative Greco-Buddhist sculpture of the Gandhara and Mathura schools, and the Hindu art of the Gupta period: Brief Introduction, Khajuraho Temples in Madhya Pradesh, Debate on "Religion and Art Today"

3 Hour

3 Hour

### Unit-4 - The Indian Art of Floor Decoration

Kolam - the traditional floor drawing of South India, Daily life and Kolam - Line drawings, geometric designs and natural world - Some examples, Beliefs behind Kolam, Rangoli – Occasions and motifs, Kalamezhuthu in Kerala - Religious significance Mandana paintings of Rajasthan and Madhya Pradesh by oldest tribal communities, Bengal's floor art-Alpona, Festival specific Floor Art across India, Festival specific Floor Art across India. Pookalam: The Onam Floral Rangoli, Body Art: Traditional Mehendi, Mehendi designs, religious and cultural significances 3 Hour

## Unit-5 - Modern Art

Matching the picture with the artist, Tracing the major ideas through paintings – Going back to Hindu themes, Student presentations on individual artists, Tracing the major ideas through paintings – Indian Village Life and nationalist themes, Student presentations on individual artists, European influences (British) – Trends in, painting – portrait, landscape and realistic, Collection and display of paintings by various artists, British Gothic and Indo Saracenic architecture through examples, Field trip to places in Chennai which have Indo Saracenic, architecture and report submission, Indian Art post-Independence Progressive Artists Group and their Influence ,Fusion of western style and Indian themes

Learning	1. Ketkar, Anil Rao Sandhya. The History of Indian Art (Paperback). Jyotsna Prakashan, 2017.	
Resources	<ol><li>Haturvedi, P. N. Encyclopedia of Indian Art and Architecture. M. D. Publications Pvt. Ltd., 2009.</li></ol>	

Learning Assessmer	nt								
			C	ontinuous Learnir	ng Assessment (CL	_A)	1 - A.		
	Bloom's Level of Thinking	For Ci (3	mative LA-1 80%)	Forr Cl (3	mative LA-2 10%)	Sumi (4	mative 0%)	Final Ex (0% w	kamination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice	<u>Th</u> eory	Practice
Level 1	Remember	30%	and the second second	30%		30%			-
Level 2	Understand	20%		20%	- A- 512	20%	"water"		-
Level 3	Apply	30%	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	30%	-	30%	,Perma	-	-
Level 4	Analyze	20%	2000	20%	and a state of	20%	-	-	-
Level 5	Evaluate		100					-	-
Level 6	Create		1. S. 1. S. 1. S. 1.			- M. K.			-
	Total	10	0 %	10	0 %	10	0%		-

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
<ol> <li>Dr. Usha Kodandaraman, ABK AOTS , Chennai drushsk@gmail.com</li> </ol>	<ol> <li>Dr. S. P.Dhanavel, Professor of English, IIT, Chennai dhanavelsp@iitmac.in</li> </ol>	1. Dr.K.Anbazhagan, SRMIST
2. Mr. Durga Prasad Bokka, TCS Chennai durgaprasad@tcs.com	2. Ms. Subashree, Asst. Prof., VIT, Chennai subashree@vit.ac.in	2. Dr.Sukanya Saha, SRMIST

Course Code	21LEM302T	E	Cour Categ	se ory	М				NON	CREE	DIT			ļ	L T 1 0	P 0	C 0				
Pre-requi Course	site es	Nil	Co- Co	requisite urses	٨	lil	Pr	rogres Cours	sive es						Nil						
Course	Offering Departme	ent	English and Forei	ign Languag	es Data Book	Codes / Standa</td <td>rds</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Nil</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	rds							Nil							
Course Le	arning Rationale	(CLR): 7	The purpo <mark>se of lea</mark>	<mark>rnin</mark> g this c	ourse is to:	11-11	1	1		2.1	Progra	am Ou	itcome	es (PO	)				P	rogra	m
CLR-1:	Introduce the lear	mers to the	early and traditional	l environmer	ntal friendly agricultural	practices	1	2	3	4	5	6	7	8	9	10	11	12	00	pecifi itcom	c es
CLR-2:	Enable the stude	nts to recog	nize <mark>and appreci</mark> ate	the contribu	<mark>ition</mark> of India to astrono	mical studies				-	10		lity								
CLR-3:	Draw the learner'	s attention t	tow <mark>ards the h</mark> olistic	approach be	hind Indian system o <mark>f</mark> r	medicine	ge		of	s of	-	ciety	inabi		¥		e				
CLR-4:	Cultivate a sense and resource spe	of apprecia cific	a <mark>tion about</mark> ancient i	Indian Engin	eering and Technology	r as diverse, culture	nowled	sis	pment	tigation	lsage	and soc	ι Susta		eam Wo		Financ	ning			
CLR-5:	Develop an unde through a compa	rstanding a rison of th <mark>e</mark>	bout the connection linguistic phrases a	n of daily life n <mark>d s</mark> ayings a	to the environment and and analyzing them from	d a healthy lifestyle n today's science	eering K	em Analy	n/develo	uct inves ex proble	m Tool L	ngineer a	onment 8		dual & Te	nunicatio	ct Mgt. &	ong Lear	~	2	3
Course Ou	utcomes (CO):		At the end of this o	course, lear	ners will be able to:	1996	Engin	Proble	Desig	Condi	Aode	The e	Enviro	Ethics	ndivid	Comn	rojec	life L	-OS	-OSc	SOS
CO-1:	Describe the and associated with it	ent Ind <mark>ia's</mark>	eco consciousness	s and India's	s contribution to astron	nomy and the belie	fs _	-	-	-	-	3		-	-	-	-	3	-	-	-
CO-2:	Classify the India and religious wor	n aesth <mark>etic</mark> ship	sensibility which is e	evidenced in	the architectural monu	ments, economic li	fe -	•	13	-	-	3	-	-	-	-	-	3	-	-	-
CO-3:	Understand how soul	Indians hav	<mark>e had</mark> a holistic appl	roach toward	ds human life integrating	g the body, mind ar	d _	-	6.7	-	-	3		-	-	-	-	3	-	-	-
CO-4:	Understand the ir	nportanc <mark>e c</mark>	o <mark>f Tradi</mark> tional knowle	dge in Agric	ulture and Medicine.			0.1	-	-	- 1	3		-	-	-	-	3	-	-	-
CO-5:	relate the tradition	nal knowled	<mark>lge</mark> in different secto	ors		11/1F	-	-	-	-	-	3	-	- 1	-	-	-	3	-	-	-
Unit-1 - Aç	griculture	_	-	5							1									3	Hour
Early agric friendly pra	ultural settlements actices -Group pres	- Influencin sentations c	ng <mark>Factors –</mark> locale a Ion th <mark>e tradition</mark> al ag	and climate- ricultural pra	Locating the early agriation actices in selected state	cultural settlements es-Ancient Indian V	in the l Vater ma	Indian anagei	map a ment a	nd indi nd irrig	cating ation r	the tin nethod	neline - Is -A re	-Crop o egion-t	cultivat based	tion - C study c	Commu of natu	nity ba ral wat	sed E er res	nviror ource	iment s and
Unit-2 - Ma	athematics & Astr	onomy		1	A L MAL	ALC: NOT	12													3	Hour
Concepts	of time and space	- Knowledg	ge of the Universe-	Quiz based	on the Indian concept	of time and distan	ce betw	een th	e plan	ets-Gre	eat ast	ronom	ers an	d math	ne <i>mati</i> o	cians o	f ancie	ent Indi	ia-The	resp	ective
Unit-3 - Me	edicine		nauciaris - me plane	alary system	anu mulan Astrology: E	DASIC FACIS-DISCUS		a lew S	ample		Idits d	nu pre	uiction	5 111806	5					3	Hour
Introductio	n to the school of A	vurvoda Si	ddha and Naturonat	hy: Compa	re and Contrast of the n	nethodologies non	ılar holid	ofe m	the an	d truth	ahout	modic	ations	Comn	non for	turos -	Holisti	c Thor	anouti	c Ann	roach

Introduction to the school of Ayurveda, Siddha and Naturopathy: -Compare and Contrast of the methodologies, popular beliefs, myths and truths about medications-Common features - Holistic Therapeutic Approach – Natural elements, individual constitution (Humours), and the balance recommended -Understanding the rationale behind selected sample treatments provided or advised, Case Studies- Yoga and its Universal Appeal -Discussions on worldwide popularity of Yoga and meditation

## Unit-4 - Engineering & Technology

Architecture – Temples, forts, palaces, houses and town planning-Group Discussions through examples from different historical periods and geographical locations Metallurgy – Coins, Traditional Indian Metal Carvings, Discussions on historical periods and their architectural influences- Textile technology - Region / Culture specific Fiber, Fabric and weaving Comparing the Temple Architecture of North and Southern Indian States 3 Hour

## Unit-5 - Customs, Sayings and Life Truths

Regional myths, beliefs, and cultural practices, Noting the idioms, proverbs in mother tongues connected to seasons and festivals, Traditional Foods of India in accordance with the climate and availability of the resources, collecting old sayings in specific regions of India, Translating Regional sayings into English, Traditional sayings about Hygiene and practices pertaining to them

Learning	1. V. Sivaramakr	ishnan (Ed.), <mark>Cultura</mark>	I Heritage of India-c	ourse material,	Bharatiya V	/idya Bhavan,	Mumbai. 5th	Edition, 2014.
Resources	2. Basham, A.L.	Ed. A Cultural Histor	ry of India. OUP, 19	97.				

Learning Assessme	nt		1	1.000					
			Co	ontinuous Learnin	ng Assessment (Cl	.A)			
	Bloom's Level of Thinking	Forr Cl (3	mative LA-1 10%)	Forr CL (3	native _A-2 0%)	Sumi (40	native )%)	Final Ex (0% w	kamination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	30%		30%		30%		-	-
Level 2	Understand	20%		20%	4	20%		-	-
Level 3	Apply	30%	-	30%		30%	and the second second	-	-
Level 4	Analyze 🚽 🚽	20%		20%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	20%	100		-
Level 5	Evaluate	- / S-f-	1.1.1.1.1.1.1	10 - N		100 C	Parma	-	-
Level 6	Create		1000		and the second second		the second second	-	-
	Total	-10	00%	10	0%	10	0%		-

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
<ol> <li>Dr. Usha Kodandaraman, ABK AOTS , Chennai, drushsk@gmail.com</li> </ol>	1. Dr. S. P.Dhanavel, Professor of English, IIT, Chennai, dhanavelsp@iitmac.in	1. Dr.K.Anbazhagan, SRMIST
2. Mr. Durga Prasad Bokka, TCS Chennai durgaprasad@tcs.com	2. Ms. Subashree, Asst. Prof., VIT, Chennai subashree@vit.ac.in	2. Dr.S.Ramya, SRMIST

# ACADEMIC CURRICULA

Humanities & Social Sciences including Management Courses

**Regulations 2021** 



## SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956) Kattankulathur, Chengalpattu, Tamil Nadu, India

Course Code	21PDH201T	Course Name		SC	OCIAL EN	IGINEE	RING		C	Cours Catego	e ry	Н		HUN	IANITI	es ani	D SOC	CIAL SC	CIENC	ES		L T 2 0	P 0	C 2
Pre-requis Courses	site s	Nil		Co- requisi Courses	ite		N	Vil		Pro	ogres Cours	sive es						Nil						
Course C	Offering Departme	ent	Career D	evelop <mark>ment C</mark>	Centre		Data Book	k / Codes / Sta	ndard	5							Nil							
Course Lea	arning Rationale	(CLR): 7	The purpo <mark>se</mark>	<mark>of learning</mark> tl	his cours	e is to:					1			Prog	ram Ou	utcome	s (PO	)				P	rogra	m
CLR-1:	Create personal	awareness a	and soci <mark>al res</mark>	ponsibility tov	wards the :	society				1	2	3	4	5	6	7	8	9	10	11	12	- S 01	pecifi itcom	c es
CLR-2:	Equip students o	n social com	npete <mark>ncies to</mark>	be self-reliant	t, res <mark>ourc</mark> e	eful and	industrious	s				lent	-	ge	_			c.			Ď			
CLR-3:	Gain knowledge	on social en	ntre <mark>preneurs</mark> h	ip and design	social bus	siness p	plan	Asc in	16		Ilysis	mqo	s of	Usa	r and	৵	-	Tean	io	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	arnin			
CLR-4:	Apply knowledge	and skills in	n the pursuit c	of humanitaria:	in goals		MAC:	- 14		ring	Ana	devel	ation	Tool	ineel	ment		al & ⁻	nicati	Mgt.	g Lei			
г	• 						1.00	10.00		inee	blem	ign/c	iduct	dern	eng	taing	S	vidu	nmu	ject N ance	Lon	5	<u> </u>	0.3
Course Out	tcomes (CO):	ŀ	<mark>At the</mark> end of	this course,	, learners	will be	able to:			Eng Kno	Prol	Des of s	Con	Moc	The	Env Sus	Ethi	<u>Indi</u> Woi	Con	Proj Finé	Life	PS(	PSC	PSC
CO-1:	Identify and addr	ess social pr	roblems and t	the needs of s	social resp	oonsibili	ities	Agan	127	-	-	-		-	2	2	-	-	-	-	-	-	-	-
CO-2:	Understand socia	al respo <mark>nsibi</mark>	<mark>ility co</mark> mpeter	icies and invol	lve in soci	ially res	sponsible ac	ctivities	4	1-5		1		-	-	-	2	-	-	-	3	Τ	[	
CO-3:	Build a business	plan to <mark>mee</mark> t	<mark>t soc</mark> ial need:	s and gain rea	al time exp	oerience	9			-		3	-	-	2	-	-	3	-	-	-	T - I	- I	-
CO-4:	Possess an insig	iht of so <mark>cial e</mark>	<mark>engin</mark> eering a	nd c <mark>aus</mark> e soci	ial change:	9	2012	8 8 -			-	1	-	-	- 10	-	3		-	-	3	- 1	-	-
11.11.11.4	<b>.</b>						10.2			1														
Unit-1 – So Introduction	to Social Enginer	<b>(esponsibili</b> erina – Impor	i <b>ties</b> rtance – Socii	al Ethics – Vis	tion & Miss	sion tou	vards societ	tv – Social Cha	nge – li	ndividı	al So	cial Re	snonsi	hility (	ISR) L	Inited N	lations	Sustai	nable	Develo	nment	Goals	UNS	Hour DGs)
– Relevance	e & impact of Sust	tainable Dev	velopment Go	als (SDGs)		Jon	fundo coonce,	ty coolar criss	iigo	Turr.u.		0.01.12	0,000.00	Sincy (	(Ci (y), 2	11100.1	u	Guete	1100.0	B010.5	pine	000.0	10	<b>DCC</b> ,
Unit-2 – So	cial Competenci	es													-								10	Hour
Personal Re	esponsibility Comp	petencies (P	PRC) – Self-de	etermination –	- Self regu	Ilation –	- Well-being	g (PERMA) – V	oluntee	erism -	- Soci	al Res	ponsibi	lity Co	ompete	ncies (	SRC) -	- Contri	ibuting	to con	nmunit	y & en	vironn	nent
Responsibil	litv – Evolution - B	7, valuing un enefits – Tvi	nes – Legal N	Ing relations. Aandate	nips – Non	1-Gover	mmentai Or	rganizauons (n	IGO) –	Tuncad	115 -	Types	– Аррі	Jache	S – NO	//- <i>F</i> /////	Uryai	lization	IS (INF	0) – Ci	Πρυται	.0 3001	ai	
Unit-3 – So	cial Entrepreneu	irship	poo	run e si e	10	-		1000	1.5	-				1									10	Hour
Social Mark	eting – Marketing	mix - Proces	ess - <mark>Social Er</mark>	<mark>itr</mark> epreneurshi	ip – Histor	ry – Imp	oact – Type:	es, Social Entre	preneu	rs – S	ocial E	Enterpi	rises –	Socia	Busin	ess mo	del ca	nvas	-					
Learning Resources	<ol> <li>Joel Ma Busines</li> <li>Simen S UK, 201</li> <li>Adam G Group,</li> <li>David B</li> </ol>	keower, Bey s and the W Sinek, Start w 11 Grant, Give & 2014 Bornstien, Ho	yond The Boy Vorld,Oct,1995 with Why, Hov and Take: W	tom Line: Put 5 v great leaders hy Helping ot the world. Ox.	tting Socia 's Inspire E thers drive (ford Unive	al Resp Everyon es our s ersity Pi	onsibility to to Take A success, Or ress, 2007	o work for your Action, Penguin rion Publishing	5. 6. 7. 8.	Nicho Unive Ronal Rober Neil N	lls, Ale rsity F d R. S t A. R lalhoti	ex,ed., Press, 2 Sims, E Pohm, F ra, Fro	Social 2008 Ethics a Positive ntiers in	Entrej nd Co Pers n Soci	rporate onality al Inno	rship – Social Profiles vation.	New M Resp s, Pers Harva	Nodels o onsibili sonality rd Busi	of Sus ty: Wh Insigh iness I	tainable ny Giana nts, Inc, Review	∍ Socia ts fall, 1 2006 Press,	3l Char 2003 , 2022	ige, O	vxford

Learning Assessme	ent						
			Continuous Learr	ning Assessment (CLA)		Sum	motivo
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native ge of unit test 0%)	Life-Lon Cl (1	<mark>g Learning</mark> LA-2 (0%)	Final Ex. (40% we	native amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%		20%	A	20%	-
Level 2	Understand	20%	-	20%	1	20%	-
Level 3	Apply	30%			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	30%	-
Level 4	Analyze	30%	11122.74	30%		30%	-
Level 5	Evaluate		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	11/2 Sec.		-	-
Level 6	Create		A Low Lab			-	-
	Total	10	0%	10	0 %	10	0%

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Ajay Zener, Director, Gradsquare	1. Dr.J.Vanitha, Dept. of Sociology, Loyola College.	1. Dr.P.Madhusoodhanan, SRMIST
		2. Mr.P.Priyanand, SRMIST
		3 Ms M Kavitha SRMIST



Course Code	21GNH401T	Cours Name	e e	BEHAVIO	URAL PS	SYCHOLOGY		Cour Categ	se ory	Н		HUN	IANITI	ES AN	D SOC	CIAL S	CIENC	ES		L T 2 1	P 0	C 3
Pre-requ Course	isite es	Nil		Co- requisite Course <mark>s</mark>		Nil	-	P	rogres Cours	ssive ses						Ni	1					
Course	Offering Departme	ent	College of Eng	ginee <mark>ring and Tech</mark>	nology	Data Book / Co	des / Standard	ls							Nil							
Course Lo	earning Rationale	(CLR):	The purpose	of learning this c	ourse is	to:	-	1	1			Progr	am Oi	utcome	es (PO	)				P	rogra	m
CLR-1:	understand the in individual	nportance	e of self and <mark>att</mark>	<mark>litude, d</mark> evelop emo	otion matu	urity to become a pos	sitive	1	2	3	4	5	6	7	8	9	10	11	12	่ S   อเ	pecifi Itcom	ic es
CLR-2:	help students mo	ve toward	ds pro <mark>blem solv</mark>	ving and creative th	inking	10.000	a 1910-	е		of	s of	15	ety			논		0				
CLR-3:	help students to a	develop lit	ife ski <mark>ll like res</mark> i	lience, communicat	tion		S Call	/ledc		ento	tions	ge	soc			oW I		ance	5			
CLR-4:	explore and asse	ess the pe	erception of stre	ess and their coping	g strategie	es	1.4.1	<b>Non</b>	lysis	obme	stiga	Usa	and	∞ ,		Fear	ы	& Fin	arnin			
CLR-5:	understand the in	ntercorrela	a <mark>tion betw</mark> een µ	personality, nationa	ilism, e <mark>thi</mark>	ics and human value	S	ering I	n Ana	/devel	ct inve	Tool C	gineer	ment		ual & J	unicati	Mgt. 8	ng Lea			
Course O	utcomes (CO):		At the end o	of this course, lear	ners will	be able to:	NRC: 17	Engine	Problei	Design	Condu	Modern	The en	Enviror Sustair	Ethics	Individ	Comm	Project	Life Lo	PS0-1	PSO-2	PSO-3
CO-1:	know the concept	of self a <mark>nc</mark>	<mark>d attitude</mark> and bu	uild emotional intellig	gence	Section 200	S. W. Street	1.	2	-	3	5-3		-	-	-	-	-	-	-	-	-
CO-2:	analyse the proces	ss of pro <mark>bl</mark>	lem solving and	creative approache	s		Sec. 27		-	3	-	-	- 1	1	-	3	-	-	-	-	-	-
CO-3:	strengthen the life	skills and	l resilience			1.00	100	-	-	-	2	_	-	-	-	3	2	-	-	-	-	-
CO-4:	examine the condi	ition of stre	ess and coping		1	- 11 mar 14		-	2		12	-			-	2	-	-	-	-	-	-
CO-5:	develop the ration	al for hum	nan values			1000	1	-	1	W.	_	-	2	-	3	-	-	-	-			
Unit-1 - U	nderstanding Self	for Effec	tiveness		C.C.PT.Lat		1					1			÷						9	Hour
Self and C	Competency; Techni	iques of S	Sel <mark>f Awarene</mark> ss,	Building Positive A	Attitude; o	ptimism, acceptance	and Attitude fo	ormatio	on. Sel	lf Estee	m; Cor	npone	nts of a	Self-est	teem, l	<mark>build</mark> ing	g self-e	steem	. and B	uildin	g Emo	tional
Competen	ice; understanding L	Emotions,	, Emotional Ma	turity and emotiona	al intellige	ence.	-				-	1										
Unit-2 - P	robiem Solving an	nking net	ture of thinking	thinking and reaso	ning Pro	blem-Solving Proble	om-Solvina Pri	2200	nrohle	m solv	ina skil	ls and	strato	nios ar	nd cros	tivo th	inkina	mode	l of cros	ativo tl	<b>9</b> hinking	HOUI
Unit-3 – 1	ife Skills	iking, nau			Juliy. 110	bient-Solving, Frobi	enr-Solving i T	10033,	proble	3017	ing ski	is and	Silaicy	gies. ai			inning,	mouer	01 01 00	uve u	<u>ni iki ik</u>	How
Life skills	development: comp	onents of	f life skills. Inter	personal Skills: Co	ncents of	Resilience: develop	ina resilience	Comm	unicat	tion skil	ls em	oathv a	and co	mmunia	ation	Import	ance a	and an	olicatior	of life	a skills	
Unit-4 - S	tress and Coping S	Strategie	IS				ing roomonoor		annout	arorr oran	,					mport		ina apr	moutor		9	Hour
Concepts	of Stress, Stages of	f Stress, N	Models of Stres	ss, Causes and Syr	nptoms o	f Stress, Strategies	of Stress Mana	gemei	nt	_		-										
Unit-5 - P	ersonality, Nationa	alism and	d Human Valu	es																	9	Hour
Individual strategies	difference & Perso to manage diversity	onality; pe y, Ethics; (	ersonality types ethical framew	s, components of p ork and moral beha	ersonality aviour.	y development. Soci	ialization; prind	cipals o	of soci	ializatio	on, soc	ial skill	ls and	interac	tion N	lanagii	ng Div	ersity;	Psycho	logy c	of Dive	ərsity,

	1.	Organization Behaviour – Keith Davis, Tata Mcgraw Hill; Tenth Edition (1 January 2001)		6.	Effective small group and Team communication – Judith D. Hoover, Wadsworth
	2.	Understanding Social Behaviour – Bates Alan P & Joseph Julian, Publisher : Houghton			Publishing Co Inc; 2nd edition 2004
Loarning		Mifflin School		7.	Sociology : The Study of Human Interaction – David Dressler, Donald E.Carns, Edition,
Deseuress	3.	Handbook of Social Psychology – Lindzey G & Borgatta, Publiser : Springer			2 ; Publisher, Knopf, 1973
Resources	4.	How to be a Better Problem Solver – Michael Stevens, Kogan Page; 1st edition 1996	1	8.	Studies in Stress and its Management – Pestonjee DM, Pareek Udai, Agrawal Rita
	5.	How to be better at Creativity – Geoffrey, Petty, Publisher : Lulu.com 2017		9.	Coping with Stress in a changing world – Richard Blonna, McGraw-Hill Education; 5th
					edition 2011

arning Assessme	ent	1. A. C. C.	100 C 100 C 100	1.1.1.			
			Continuous Learning	g Assessment (CLA)		Sum	motivo
	Bloom's Level <mark>of Thinkin</mark> g	Forn CLA-1 Avera (50	native ge of unit test %)	Life-Long CL (10	ן Learning A-2 ואר)	Final Ex (40% w	amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	30%	100 m 100 m 100 m	20%	25 J	20%	-
Level 2	Understand	40%	1 Sugar	20%		20%	-
Level 3	Apply	30%		30%		30%	-
Level 4	Analyze	E		30%		30%	-
Level 5	Evaluate	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	A Contraction of the	-		-	-
Level 6	Create	and the second second	a la seconda de la		- M	-	-
	Total	10	0%	10	0%	10	0%

Course Designers								
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts						
1. Dr. Nappinnai Seran, Consultant Psychologist, Professor Dept. Of Psychiatry at Meenakshi Medical College	<ol> <li>Dr. Ragitha Radhakrishnan, IQAC co-ordinator &amp; Head, Department of Psychology, Dr.MGR Janaki College of Arts &amp; Science for Women, Chennai-600 028.</li> </ol>	1. Dr.Emilda Judith Ezhil Rajan, Associate Professor, Clinical Psychology, SRM MCH & RC						
<ol> <li>Prof. (Dr.) S.Srividhya Clinical Psychologist, Wellbeing expert &amp; the soul saviour specialist</li> </ol>	ZALEARA CHRAP. FRAM	2						

# ACADEMIC CURRICULA

Project Work, Seminar,

## Int<mark>erns</mark>hip in Industry / Higher Technical Institutions

Courses

**Regulations 2021** 



## SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956) Kattankulathur, Chengalpattu, Tamil Nadu, India

354

Course Code	21GNP301L	Course Name	COMMUNITY CONNECT Cours			se ory	Ρ	PROJECT WORK, SEMINAR, INTERNSHIP IN INDUSTRY / HIGHER TECHNICAL INSTITUTIONS								(	- T 0 0	P 2	C 1
Pre-requisite         Nil         Co- requisite         Nil           Courses         Nil         Courses         Nil			P	Progressive Nil Courses															
Course (	Offering Departme	ent		Data Book / Codes / Star	ndards	-	1.					Nil							
Course Le	arning Rationale (	CLR): Th	e purp <mark>ose of learn</mark> ing this course is t	to:		-		15	Progra	am Ou	Itcome	s (PO	)				Р	rogra	m
CLR-1:	Train oneself in fin the future	ding the aspe	cts in real-time work environment and pre	oare them to join the workforce	<i>in</i> 1	1 2 3			5	6	7	8	9	10	11	12	Specific outcomes		
CLR-2:	Gain the exposure	to the society	he society including rules, regulations and safety practices		of	s of	1	iety			£		a a						
CLR-3:	CLR-3: Enhance social service and skills of the students			vledç	lysis	ento	ations	ge	and soc	∞,		M L	Ю	& Finano	b				
CLR-4:	CLR-4: Develop the students in terms of ability, competence and interpersonal relationship			Anov		mdo	stiga	Usa				ean			arnin			1	
CLR-5: Enhance students' knowledge in one particular technology		eering	em Ana	n/devel	uct inve lex prot	m Tool	ngineer	onment inability		dual & ⁻	nunicati	ct Mgt.	ong Le:	-	2	e			
Course Ou	tcomes (CO):	A	t the end of this course, learners will i	be able to:	Engin	Probl	Desig	Cond	Mode	The e	Envire Susta	Ethics	Indivi	Comr	Proje	Life L	-OS4	-OS4	PSO-
CO-1:	1: Apply social knowledge in the real world of work and get attached to the community		1.	-		-		3	-	-		-	-	-	-	-	-		
CO-2:	<b>0-2:</b> Demonstrate competency in societal problems and finding solutions			-		- 1	-	-	3	-	-	3	-	-	-	-	-	-	
CO-3:	-3: Effectively implement skills in professional communication, technical writing and using multimedia tools					1.00	-	-	3	-	-	3	2	-	-	-	-	-	
CO-4:	0-4: Develop ability to work as an individual and in a group as an effective team member			100		11	-	-	3	-	-	3	-	-	-	-	-	-	
CO-5:	5: Master the professional and ethical responsibilities of a social worker					-	-	-	3	· -	3	-	-	-	-				

Students shall undergo social service in government recognized NGOs/Hospitals/Service organizations for a duration of 4 to 6 weeks during the IV semester vacation. At the end of the community connect, the student shall submit a report to the department and make a presentation during the 5th semester, which will be assessed by a committee constituted by the department or school.

The second second

Learning Assessment	
Community Connect Certification and Report Submission (80% weightage)	Final Presentation (20% weightage)

Note: Final Presentation Evaluation would be done by the expert Committee formed by the Department.
Course	21ASP302L	21AIP302L	21AUP302L	21BTP302L	21BMP302L	21CHP302L	21CEP302L	21CSP302L	Course		Course		PROJECT WORK, SEMINAR, INTERNSHIP IN	LTF	PC
Code	21ECP302L	21EEP302L	21EVP302L	21EIP302L	21FPP302L	21MEP302L	21MHP302L	21NTP302L	Name	PROJECT	Category	Ρ	INDUSTRY / HIGHER TECHNICAL INSTITUTIONS	006	63

Pre-requisite Courses	Nil	Co- requ <mark>isite</mark> Cou <mark>rses</mark>	Nil	Progressive Courses	Nil	
Course Offeri	ng Department		Data Book / Codes / Standards	1	Nil	

Course L	_earning Rationale (CLR):	The purpo <mark>se of learn</mark> ing this course is to:			01	5	Prog	ram O	utcom	es (PC	))				P	rogram
CLR-1:	Learn responsible and pro	fessional way of working	1	2	3	4	5	6	7	8	9	10	11	12	01	pecific itcomes
CLR-2:	Practice development-orie	nted ap <mark>proach to wo</mark> rk	e		of	s of		iety			Ę		D.			
CLR-3:	LR-3: Enhance students' knowledge in one particular technology					ations	ge	soc			oW r		ance	D		
CLR-4:	Create awareness of the s	oc <mark>ial, cultural,</mark> global and environmental responsibility as an engineer	Knov	lysis	mdo	stige	Usa	and	ઝ		Fean	U	& Fir	arnin		
CLR-5:	Grow more empathetic, be	come systems thinkers, become explorers, problem-solvers.	eering	em Ana	n/devel	uct inve ex prot	n Tool	ngineel	nment		lual &	nunicati	t Mgt.	ong Lei	_	0 0
Course C	Dutcomes (CO):	At the end of this course, learners will be able to:	Engin	Proble	Desig	Condu	Model	The e	Enviro	Ethics	ndivid	Comn	² rojec	-ife Lo	, OSc	:-OSc
CO-1:	Develop capability to acqu	ire and apply fundamental principles of engineering	3	3	3	3	3	-	3	3	3	3	3	3	-	
CO-2:	Become updated with all the	he latest changes in technological world	3	3	3	3	3	-	3	3	3	3	3	3	-	
CO-3:	Make deep connections be	e <mark>tween id</mark> eas	3	3	3	3	3	-	3	3	3	3	3	3	-	
CO-4:	Learn to take creative risks		3	3	3	3	3	-	3	3	3	3	3	3	-	
CO-5:	Be ready for the creative e	conomy also engage in iterative thinking and divergent thinking	3	3	3	3	3	-	3	3	3	3	3	3	-	

Project Work Selection: Project Work Titles for students would be finalized by the Department Project Work Evaluation Committee.

	<u> </u>	Continuous Le (100%		Final Examination (0%)	
	Review - 1	Review - 2	Project Report	Viva-Voce	
Project	30 %	40%	10 %	20 %	-

Note: Final Presentation Evaluation would be done by the expert Committee formed by the Department.

Course	21ASP303T	21AIP303T	21AUP303T	21BTP303T	21BMP303T	21CHP303T	21CEP303T	21CSP303T	Course		Course		PROJECT WORK, SEMINAR, INTERNSHIP IN	LTPC
Code	21ECP303T	21EEP303T	21EVP303T	21EIP303T	21FPP303T	21MEP303T	21MHP303T	21NTP303T	Name	MOOC	Category	Ρ	INDUSTRY / HIGHER TECHNICAL INSTITUTIONS	3003

Pre-requisite Courses	Nil	Co- requisite Courses	Nil Progressive Courses	Nil
Course Offerin	ng Department		Data Book / Codes / Standards	Nil

Course L	earning Rationale (CLR):	The purpo <mark>se of learning</mark> this course is to:			1	5	Prog	ram O	utcome	es (PC	))				Р	rogra	m
CLR-1:	Improve Student Academ blogs	nic Characteristics and learning goals through forums, discussion groups, and	1	2	3	4	5	6	7	8	9	10	11	12	S OL	pecifi itcom	C es
CLR-2:	Improve Student Persona	al Charac <mark>teristics th</mark> rough self-learning habits	0			of	-	ty			~						
CLR-3:	Characterize self-learning assessments	g envir <mark>onment th</mark> at includes pedagogy, tools, tasks, duration, feedback and	vledge	(0	lent of	ations	ge	d socie			n Worł		Jance	b			
CLR-4:	Improve lifelong learning	habits and Learning process	Kno	lysis	opm	stig: olem	Usa	and	8		Tear	ion	& Fii	arnir			
CLR-5:	Characterize learning eng	gag <mark>ement m</mark> ethods and activities	eering	em Ana	n/devel	uct inve lex prot	m Tool	nginee	onment		dual & -	nunicat	ct Mgt.	ong Le:	-	5	3
Course O	utcomes (CO):	At the end of this course, learners will be able to:	Engin	Proble	Desig	Cond	Mode	The e	Envire Susta	Ethics	Individ	Comr	Proje	Life L	PSO-	-OS4	PSO-
CO-1:	Inculcate student charact matriculation	teristics: prior-knowledge, prior-experience, expertise, academic achievement and	3	2		-		-		-	-	-	-	3	-	-	-
CO-2:	Inculcate self-motivation, task-orientation	self-confidence, intrinsic motivation, participation, social economic statute, and	3	2				-	Paris -	-	-	-	-	3	-	-	-
CO-3:	Enhance self-learning thr	ough peer learning, learning groups, positive collaboration	3	2	1.1	-	-	-		-	-	-	-	3	-	-	-
CO-4:	Explore different learning	styles and activities, identify self-learning pace, difficulties and remedial measures	3	2	-	-	-	-	-	-	-	-	-	3	-	-	-
CO-5:	Identify ways of students	'engagement, achievement, and attrition	3	2	-	-	-	-	-	-	-	-	-	3	-	-	-

MOOC Course Selection: List of MOOC Courses that are Approved to be learned by the student will be displayed by the Department MOOC Committee. Student can pick any course from that list.

I cornin	allecocement
Leannin	u Assessiiieiii

MOOC Certification Obtained (100% weightage)

B.Tech / M.Tech(Integrated) Programmes-Regulations 2021- Volume-20 - Common Courses –Syllabi-Control Copy

Course	21ASP401L	21AIP401L	21AUP401L	21BTP401L	21BMP401L	21CHP401L	21CEP401L	21CSP401L	Course		Course	PROJECT WORK, SEMINAR, INTERNSHIP IN	LTPC
Code	21ECP401L	21EEP401L	21EVP401L	21EIP401L	21FPP401L	21MEP401L	21MHP401L	21NTP401L	Name	PROJECT	Category P	INDUSTRY / HIGHER TECHNICAL INSTITUTIONS	0 0 30 15

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil	
Course Offeri	ng Department		Data Book / Codes / Standards		Nil	

Course L	earning Rationale (CLR): The purpo <mark>se of learning</mark> this course is to:			2	5	Prog	ram O	utcom	es (PC	))				P	rogram
CLR-1:	Learn responsible and professional way of working	1	2	3	4	5	6	7	8	9	10	11	12	01	pecific
CLR-2:	Practice development-oriented approach to work	ge		of	s of		iety			£		a)			
CLR-3:	Enhance students' knowledge in one particular technology	vledç		ento	ations	ge	soc			oW r		ance	D		
CLR-4:	Create awareness of the social, cultural, global and environmental responsibility as an engineer	Knov	lysis	mdo	stiga	Usa	and	~		Fean	ы	& Fir	arnin		
CLR-5:	Grow more empathetic, become systems thinkers, become explorers, problem-solvers.	eering	em Ana	n/devel	uct inve	rn Tool	ngineel	onment		dual & ⁻	nunicati	ct Mgt.	ong Lei	5	3 8
Course C	Putcomes (CO): At the end of this course, learners will be able to:	Engin	Proble	Desig	Cond	Mode	The e	Envire	Ethics	ndivid	Comn	^o roje(	-ife L	-OSc	OS OS
CO-1:	Develop capability to acquire and apply fundamental principles of engineering	3	3	3	3	3	-	3	3	3	3	3	3	-	
CO-2:	Become updated with all the latest changes in technological world	3	3	3	3	3	-	3	3	3	3	3	3	-	
CO-3:	Make deep connections b <mark>etween id</mark> eas	3	3	3	3	3	-	3	3	3	3	3	3	-	
CO-4:	Learn to take creative risks	3	3	3	3	3	-	3	3	3	3	3	3	-	
CO-5:	Be ready for the creative economy also engage in iterative thinking and divergent thinking	3	3	3	3	3	-	3	3	3	3	3	3	-	

Project Work Selection: Project Work Titles for students would be finalized by the Department Project Work Evaluation Committee.

	SE	CONTRACTOR OF	Continuous Learning Assessm (100% weightage)	ent	
	Review - 1	Review - 2	Revie <mark>w -</mark> 3	Project Report	Viva-Voce
Major Project	10 %	20 %	30 %	10 %	30 %

Note: Final Presentation Evaluation would be done by the expert Committee formed by the Department.

Course	21ASP402L	21AIP402L	21AUP402L	21BTP402L	21BMP402L	21CHP402L	21CEP402L	21CSP402L	Course		Course	PROJECT WORK, SEMINAR, INTERNSHIP IN	LTP	С
Code	21ECP402L	21EEP402L	21EVP402L	21EIP402L	21FPP402L	21MEP402L	21MHP402L	21NTP402L	Name	PROJECT	Category	P INDUSTRY / HIGHER TECHNICAL INSTITUTIONS	0 0 20	10

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil	
Course Offeri	ng Department		Data Book / Codes / Standards		Nil	

Course L	earning Rationale (CLR): The purpo <mark>se of learning</mark> this course is to:			2	5	Prog	ram O	utcom	es (PC	))				P	rogram
CLR-1:	Learn responsible and professional way of working	1	2	3	4	5	6	7	8	9	10	11	12	01	pecific
CLR-2:	Practice development-oriented approach to work	e		of	s of		iety			£		a)			
CLR-3:	Enhance students' knowledge in one particular technology	vledç		ento	ations	ge	soc			oW r		ance	D		
CLR-4:	Create awareness of the social, cultural, global and environmental responsibility as an engineer	Knov	lysis	mdo	stige	Usa	and	~		Fean	ы	& Fir	arnin		
CLR-5:	Grow more empathetic, become systems thinkers, become explorers, problem-solvers.	eering	em Ana	n/devel	uct inve	rn Tool	ngineel	onment		dual & ⁻	nunicati	ct Mgt.	ong Lei	5	3 8
Course C	Putcomes (CO): At the end of this course, learners will be able to:	Engin	Proble	Desig	Cond	Mode	The e	Envire	Ethics	ndivid	Comn	^o roje(	-ife L	-OSc	OS OS
CO-1:	Develop capability to acquire and apply fundamental principles of engineering	3	3	3	3	3	-	3	3	3	3	3	3	-	
CO-2:	Become updated with all the latest changes in technological world	3	3	3	3	3	-	3	3	3	3	3	3	-	
CO-3:	Make deep connections b <mark>etween id</mark> eas	3	3	3	3	3	-	3	3	3	3	3	3	-	
CO-4:	Learn to take creative risks	3	3	3	3	3	-	3	3	3	3	3	3	-	
CO-5:	Be ready for the creative economy also engage in iterative thinking and divergent thinking	3	3	3	3	3	-	3	3	3	3	3	3	-	

Project Work Selection: Project Work Titles for students would be finalized by both industry and the Department Project Work Evaluation Committee.

	55		Continuous Learning Asses (100% weightage)	sment	
	Review - 1	Review - 2	Review - 3	Project Report	Viva-Voce
Major Project	10 %	20 %	30 %	10 %	30 %

Note: Students register for this industry-based major project also have to register for internship Final Presentation Evaluation would be done by the expert Committee formed by the Department.

Course	21ASP403L	21AIP403L	21AUP403L	21BTP403L	21BMP403L	21CHP403L	21CEP403L	21CSP403L	Course		Course	PROJECT WORK, SEMINAR, INTERNSHIP IN	LTPC
Code	21ECP403L	21EEP403L	21EVP403L	21EIP403L	21FPP403L	21MEP403L	21MHP403L	21NTP403L	Name	NTERNSHIP	Category P	INDUSTRY / HIGHER TECHNICAL INSTITUTIONS	0 0 10 5

Pre-requisite Nil	Co- requisite Cou <mark>rses</mark>	Nil	Progressive Courses	Nil	
Course Offering Department		Data Book / Codes / Standards	4	Nil	

Course L	earning Rationale (CLR):	The purpo <mark>se of learning</mark> this course is to:			1	5	Prog	ram O	utcom	es (PC	<b>)</b> )				P	rogram
CLR-1:	Become job ready along	with real corporate exposure	1	2	3	4	5	6	7	8	9	10	11	12	0L	pecific itcomes
CLR-2:	Increase self-confidence	and help <mark>s in finding</mark> their own proficiency	e		of	s of		iety			Ę		a)			
CLR-3:	LR-3: Cultivate leadership ability and responsibility to perform or execute the given task		vledç		ento	ations	ge	soc			oW r		ance	D		
CLR-4:	Inculcate learners hands	on p <mark>ractice wit</mark> hin a real job situation	Knov	lysis	mdo	stige	Usa	and	ø		Fean	ы	& Fir	arnin		
CLR-5:	Create awareness of the	social, cultural, global and environmental responsibility as an engineer	ering	m Ana	/devel	ct inve	ר Tool	Igineel	nment		ual & T	unicati	t Mgt.	ng Le:		
Course C	Outcomes (CO):	At the end of this course, learners will be able to:	Engine	Proble	Design	Condu	Moder	The er	Enviro	Ethics	ndivid	Comm	Project	-ife Lo	-SO-1	°SO-2
CO-1:	Enhance capability to acc	u <mark>ire and a</mark> pply fundamental principles of engineering	3	2	2	3	3	3	-	3	3	3	3	3	-	
CO-2:	Become master in one's	s <mark>pecialize</mark> d technology	3	2	2	3	3	3	-	3	3	3	3	3	-	
CO-3:	Become updated with all	t <mark>he latest</mark> changes in technological world	3	2	2	3	3	3	-	3	3	3	3	3	-	
CO-4:	Demonstrate hands on pr	ra <mark>ctice withi</mark> n a real job situation	3	2	2	3	3	3	-	3	3	3	3	3	-	
CO-5:	0-5: Inculcate self-improvement through continuous professional development and life-long learning		3	2	2	3	3	3	-	3	3	3	3	3	-	

Internship Training Selection: List of Industries / Research Centre's for Internship Training for students would be finalized by the Department Internship/Industrial Training Committee.

	55	CONTRACTOR OF	Continuous Learning Assess (100% weightage)	ment	
	Review - 1	Review - 2	Review - 3	Project Report	Viva-Voce
Major Project	10 %	20 %	30 %	10 %	30 %

Note: Students register for this internship also have to register for industry-based major project. Final Presentation Evaluation would be done by the Internship/Industrial Training Committee formed by the Department.

10.00

Course	21CSP501L	21ECP501L	Course		Course	D	PROJECT WORK, SEMINAR, INTERNSHIP IN INDUSTRY /	L	Т	Р	С	٦
Code	21MEP501L	21NTP501L	Name	SPECIALIZATION PROJECT	Category	P	HIGHER TECHNICAL INSTITUTIONS	0	0	10	5	٦

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offer	ing Department		Data Book / Codes / Standards	CION INC.	Nil
		and the second se			

Course L	earning Rationale (CLI	R): The purpo <mark>se of learn</mark> ing this course is to:				1	Prog	ram O	utcom	es (PC	<b>)</b> )				P	rogra	m
CLR-1:	Become job ready alor	ng with real co <mark>rporate expos</mark> ure	1	2	3	4	5	6	7	8	9	10	11	12	01	itcom	lc les
CLR-2:	Increase self-confident	ce and help <mark>s in finding</mark> their own proficiency	Je		of	s of		iety			¥		ⁿ				
CLR-3:	-3: Cultivate leadership ability and responsibility to perform or execute the given task				ento	tions	ge	soc			Mo		ance	0			
CLR-4:	R-4: Inculcate learners hands on practice within a real job situation		Anov	lysis	mdo	stige	Usa	and	<b>∞</b> δ		earr	ы	Ë	arnin			
CLR-5:	Create awareness of the	he soc <mark>ial, cultur</mark> al, global and environmental responsibility as an engineer	Sering F	m Ana	n/devel	ict inve	n Tool	ngineer	nment		lual & T	unicati	t Mgt. 8	ong Lea			~
Course C	Outcomes (CO):	At the end of this course, learners will be able to:	Engine	Proble	Design	Condu	Moder	The el	Enviro	Ethics	Indivic	Comm	Projec	Life Lo	PSO.	PSO-2	PSO-3
CO-1:	Enhance capability to a	acqu <mark>ire and a</mark> pply fundamental principles of engineering	3	2	2	3	3	3	-	3	3	3	3	3	-	-	-
CO-2:	Become master in one	's s <mark>pecialized</mark> technology	3	2	2	3	3	3	-	3	3	3	3	3	-	-	-
CO-3:	Become updated with	all t <mark>he latest</mark> changes in technological world	3	2	2	3	3	3	-	3	3	3	3	3	-	-	-
CO-4:	Demonstrate hands or	pra <mark>ctice withi</mark> n a real job situation	3	2	2	3	3	3	-	3	3	3	3	3	-	-	-
CO-5:	Inculcate self-improvement through continuous professional development and life-long learning		3	2	2	3	3	3	-	3	3	3	3	3	-	-	-

Internship Training Selection: List of Industries / Research Centre's for Internship Training for students would be finalized by the Department Internship/Industrial Training Committee.

	55.	AT Sant	Continuous Learning Assessn (100% weightage)	nent	
	Review - 1	Review - 2	Revie <mark>w</mark> - 3	Project Report	Viva-Voce
Major Project	10 %	20 %	30 %	10 %	30 %

Note: Students register for this internship also have to register for industry-based major project. Final Presentation Evaluation would be done by the Internship/Industrial Training Committee formed by the Department.

- And



### SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Chengalpattu District 603203, Tamil Nadu, India

# ACADEMIC CURRICULA

## UNDERGRADUATE/ INTEGRATED POST GRADUATE DEGREE PROGRAMMES (With exit option of Diploma)

and Bring the state of the

(Choice Based Flexible Credit System)

**Regulations 2021** 

Volume – 2 (Syllabi for First Year Courses-All Programmes) (Revised in July 2023)



### SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Chengalpattu District 603203, Tamil Nadu, India



### Contents (Volume-2)

<u>No</u>		Syllabi for First Year Courses	Page No
1	Humanities and Se	ocial Sciences including Management courses	3
	21LEH101T	Communicative English	4
	21LEH102T	Chinese	6
	21LEH103T	French	8
	21LEH104T	German	10
	21LEH105T	Japanese	12
	21LEH106T	Korean	14
	21LEH107T	Spanish	16
	21GNH101J	Philosophy of Engineering	18
	21MGH101T	Fundamentals of Economics	20
	21MGH102T	Fundamentals of Management	22
	21MGH103T	Basics of Accounting and Costing	24
2	Basic Science co	urses	26
	21BTB102T	Introduction to Computational Biology	27
	21BTB103T	Biology	29
	21BTB104T	Biology: Human Physiology And Anatomy	31
	21BTB105T	Cell Biology	33
	21MAB101T	Calculus and Linear Algebra	35
	21MAB102T	Advanced Calculus and Complex Analysis	37
	21MAB301T	Probability and Statistics	39
	21PYB101J	Physics: Electromagnetic Theory, Quantum Mechanics, Waves and Optics	<mark>4</mark> 1
	21PYB102J	Semiconductor Physics And Computational Methods	43
	21PYB104J	Physics: Mechanics	45
	21CYB101J	Chemistry	47
3	Non Credit Cours	es	49
	21CYM101T	Environmental Science	50
	21LEM101T	Constitution of India	52
	21PDM101L	Professional Skills and Practices	54
	21PDM102T	UHV-I: Universal Human Values – Introduction	56
	21PDM102L	General Aptitude	58
	21GNM101L	Physical and Mental Health using Yoga	60
	21GNM102L	National Service Scheme	62
	21GNM103L	National Cadet Corps	64
4	Engineering Scien	ice Courses	66
	21CSS101J	Programming for Problem Solving	67
	21EES101T	Electrical and Electronics Engineering	69
	21MES101L	Basic Civil and Mechanical Workshop	71
	21MES102L	Engineering Graphics and Design	73

1

	21MES101T	Engineering Mechanics	78
	21ASS101T	Applied Engineering Mechanics	80
	21AUS101L	Artifact Dissection Laboratory	82
	21AIS101J	Foundation of Data Analysis	84
Pro	fessional Core	Courses	86
	21BTC101T	Biochemistry	87
	21BMC101J	Biomedical Sensors	89
	21CEC101T	Building Materials in the Built Environment	91
	21CHC101J	Physical and Analytical Chemistry	93
	21CSC101T	Object Oriented Design and Programming	95
	21EEC101J	Electric Circuits	97
	21ECC101J	Electronic System and PCB Design	99
	21ECC112J	Systems Programming	101
	21EIC101J	Sensors and Actuators	103
	21MHC101P	Elements of Mechatronics Systems	105
	21NTC101T	Nanoscience and Nanotechnology	107
	21NTC111T	Physics of Materials	109
Bas	ic Sciences - E	Bridge Courses (For Lateral Entry Students)	111
	21MAB205B	Mathematics	112
	21PYB105B	Engineering Physics	114
	21CYB102B	Chemistry	116

# ACADEMIC CURRICULA

Humanities and Social Sciences including Management Courses

Regulations 2021



### SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Chengalpattu District 603203, Tamil Nadu, India

Course       21LEH101T       Course       Course       H       HUMANITIES       L       T         Code       Name       COMMUNICATIVE ENGLISH       Category       H       HUMANITIES       L       T													P 0	C 3									
Pre-req Cours	uisite ses <i>Nil</i>	Freelist	h and Famia	Co- requisite Courses	e _{Nil}	Data Daale ( Card	o / Chandarda	Progr Cou	ressiv urses	ve s N	il												
Course C	mering Department	Englisi	in and Foreig	n Languages		Data Book / Code	es / Standards	INII															
Course	Learning Rationa	ale (CLR):	The purpos	e of learning this	course is to:	1200		90	1	Χ.,		Pr	ograi	m Ou	Itcome	s (PO)					Pr	oaram	
CLR-1: provide an understanding about the importance of communication focusing on primary language skills (LSRW) in personal and professional contexts and also give practice to the learners in writing brief paragraphs using appropriate techniques								1		2	3	4	5	6	7	8	9	10	11	12	Sl	comes	i.
CLR-2 :	enable the studen	ts to efficientl	ly u <mark>se Englis</mark>	<mark>h for accessing s</mark>	scientific and t	echnical knowledge	No. Const.			<b>B</b> .	(0	xe											
CLR-3 :	introduce the students the methods of using efficiently English in gaining knowledge through the internet and the CLR-3 : vice versa. To make them understand the importance of acceptable online behaviors and the factors behind multiplicity in media projections of an event								0		of solutions	s of compl	È	siety	inability		Ł		Q				
CLR-4 :	improve the learn increased opportu	ers' employ <mark>ab</mark> Inities for e <mark>mp</mark>	bility related ployment.	communication s	kills and there	by equipping thems	elves for the	belwoo		sis	oment	igation	sage	nd soc	Sustai		am Wo	_	Financ	guir			
CLR-5 :	equip the learners communication	s with the appr	propriate busi	ness vocabulary	by introducing	g them to the nuance	es of business	aring Kr		n Analy:	/develop	ct invest ns	U lool u	gineer a	ment &		ual & Te	unicatior	Mgt. &	ng Learr			
C		_	At the and	af their answers to			2000		DIII A	oblei	sign	obler	pderr	le en	Iviror	hics	divid	mmo	oject	e Lo	<u>5</u> 0-1	30-2	SO-3
Course	domenetrate the ver	iouo turoo mu	At the end	of this course, lea	arriers will be	able to:	DW akilla and put	Li Li	1	۲ ۲	ă	Ŭ ā	Ň	Ę	ш	ш	<u>n</u>	ŏ	۲ ۲	Ľ.	Å,	ъ	ĕ,
CO-1:	awareness into effect	ctive use.	ioues, chann	els anu parners (	or communica	uon, locusing on LS	RVV SKIIIS and put	- uns		-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO-2:	incorporate the mea	nings of t <mark>echn</mark>	<mark>nical t</mark> erms ir	a scientific text	and explain th	e manufacturing pro	ocess and interpre	et data -	-	97	•	-	-	-	-	-	2	3	-	-	-	-	-
CO-3:	analyze digital platfo and problem-solving	orms not o <mark>nly t</mark> skills, but als	to acquire in so to create e	formation from e -content followir	-sources for d	eveloping research s es of social media.	skills, analytical sl	kills -		ų,	-	-	-	•	-		2	3	-	-	-	-	-
CO-4:	develop an understa career exploration p	nding of the e rocess.	employability	skills and how to	o develop th <mark>e</mark> r	m, which will gradua	lly help them in th	neir -		-	-	-		-	-	-	2	3	-	-	-	-	-
CO-5:	apply nuances of bu	siness com <mark>m</mark> u	nunication eff	ectively	¥		110	-		-	-	-	-	-	-	- 1	2	3	-	-	-	-	-

#### Unit-1 -Understanding Communication

9 Hour Introduction to Definition and Process of Communication, Types of communication - verbal and nonverbal - Channels of communication – communication of contexts - types of contexts - barriers to communication- Basic listening models- Competitive or combative listening, passive and attentive listening. Active and reflective listening- Barriers of communication- -barriers to effective listening- Listening to speeches of pioneer engineers and making a critical review on them - Delivering presentations- extempore on language learning experiences - prepared speech on language learning strategies - Presentation techniques - Creating Visual Support-Developing Paragraphs -Strategies to manage the writing process. Precis Writing- Creative Writing- Expository essay- writing for clarity- summarizing – paraphrasing - Story through images, Autobiography of Concrete objects - writing slogans-Types of phrases, clauses and sentences- Sentence patterns - Word order of English

#### Unit-2-English: The Language of Science & Technology

Scientific method and Engineering Design Process - Single sentence definition and Extended definition of technical terms-Describing types of technical problem through verbs and adjectives describing technical problems-Assessing and interpreting faults through words describing faults and their severity; phrases describing certainty/uncertainty; adjectives with prefixes describing technical problems- text :Air Transat Flight 235 Discussing dimensions and precision through phrases related to scale ;Describing design phases and procedures through phrases related to tolerance, length, width, thickness, etc., - Task-based activities- describing /explaining /defining /classifying objects, etc. - Scientific and technical texts, Skimming for main ideas, Scanning for specifics, Predicting, inferring and guessing the meaning, etc- note making-Abstracting-Interpretations & Transcoding (Pie Chart, Bar Diagram, Flow chart, Tables) - writing Instructions and Checklists -process description -describing the working of a machine and the manufacturing process- assignment and thesis writing -activity verbs-paper presentation -Specific Grammar Items in Scientific and Technical Communication (Use of modal auxiliaries in technical English, Conditional sentence connectives in technical communication.

B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-2(Revised-July2023)-First Year Syllabi-Control Copy

4

#### Unit-3- English in Digital World

Framing of search terms / keywords in search engines - tools to support synchronous communication such as webinar platforms, and asynchronous communication such as forums and social media. - What is online communication - types of online communication - advantages and disadvantages of online communication - Acceptable online roles and behaviors - netiquettes- etiquettes of social media – problems and opportunities in handling digital resources - presenting with audio and visual aids - Listening to the voice over of a short film/documentary - ted talks- Observing non-verbal cues- learning IPA, framing question tags, stress and intonation through online sources -Tools to check grammar, to cite references, to design logos, to check plagiarism - importance of academic integrity- analyzing the reasons why different sources take different angles while Mass media gives shape to an event as perceived in multiple countries.

#### Unit-4 – English for Employability

1 Curry Michael Drastical Fradiah Users OUD 1005

Difference between career and job-Listening to interviews (choice of career) - Group discussion, Interview skills (Preparation for Interviews, Stress management), Telephone Interview conversation, Mock Interviews -Email writing, Email etiquettes, Job application and Curriculum Vitae - letter of motivation - it's role in job application - components of letter of motivation- critical reasoning- analyzing the text -Vocabulary building strategies techniques of correct understanding of a text - Reading comprehension - Types of reading- Skimming, Scanning, Extensive reading and Intensive reading-Analogy, Error analysis, Abbreviations, Acronyms and Initialism synonyms and antonyms, parallelism.

#### Unit-5– Business English

Appropriate interactions in right contexts- role of interactions in team building - role of paralinguistic features in business communication - Role plays on -customer-centric marketing methods,- Telephone conversation-Negotiation-Listening to talks, Business conversations (short and long)-customer relationship management, methods of retaining customers.-Drawing and describing an organizational chart -Conducting meetings- writing notice. agenda and minutes-Writing paragraphs on the case studies, articles related to ethics- employment trends, Business English vocabulary- Report Writing ( Feasibility and sales)- Memo- Circular-Public Notice - Enguiry & complaint letter- Proposal writing-writing Advertisement- caption and slogan Poster-Brochure-Voices. Tenses. Direct and Indirect. Connectives- Concord and Comparative forms

Learning 2. Ku Resources 3. Su Impo	ran, michael. Practical English Usage. C mar Sanjay and Pushpa Lata. Commun cientific English: A Guide for Scientists rt, 16 June 2011	ication Skills. OUP, 201 and Other Profession	1. als, 3rd Edition Paperbac	4. Graduate A Ck – 5. Great Busin Moore Mba	ness English - Phrases, Verbs • 2013	and Vocabulary for Speak	king Fluent English by Hilary
Learning Assessm			Continuous Le	earning Assessment (CLA)			
	Bloom's Level of Thinking	CLA-1 A	Formative verage of unit test (50%)	Life	-Long Learning CLA-2 (10%)	Final (40%	mmative Examination weightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	10%	-	10%	-	10%	-
Level 2	Understand	10%	-	10%		10%	-
Level 3	Apply	20%		20%	111	20%	-
Level 4	Analyze	20%	- 20% -			20%	-
Level 5	Evaluate	20%		20%		20%	-
Level 6	Create	20%	1 Million	20%		20%	-
	Total		100 %		100 %		100 %

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	nternal Experts
1. Dr. Usha Kodandaraman, ABK AOTS, Chennai. drushak@gmail.com	1. Dr. S. P. Dhanavel, IIT, Chennai. dhanavelsp@iitm.ac.in	1. Dr. P. Tamilarasan, SRMIST.
<ol> <li>Ms. Steffi Pearl Vinodhini, LIC Financial Advisor, Chennai. Steffipearl8@gmail.com</li> </ol>	. 2. Dr. S. Vijayakumar, B.S. Abdur Rahman Crescent Institute of Science and Technology, Chennai. vijayakumar@cresent.education	2. Dr. M.M. Umamaheshwari, SRMIST.

B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-2(Revised-July2023)-First Year Syllabi-Control Copy

9 Hour

9 Hour

9 Hour

5

Course 21LEH102T Course CHINESE								н				HL	JMAN	ITIES				L	T	P C
Coue		Name				oategory												2	1	0 5
Pre-rec	luisite		Co- requisite			Prog	gressiv	/e												
Cour	rses Nil		Courses	Nil		Co	ourses	Nil												
Course (	Offering Department	English and For	eign Langua <mark>ges</mark>	Data Book /	Codes / Standards	Nil														
Course	Learning Rational	0		and the second second	draw the	1													D	
(CLR):	Examing Rational	The purpose of I	earning this course i	is to:		Program Outcomes (PO) Specific											ic			
CLR-1 :	Recall Chinese Pinyi	n, tones, scripts and g	reetings.			1 2 3 4 5 6 7 8 9 10 11 12								12		outcom	es			
CLR-2 :	Construct simple affin time and date in Chir	rmative, negative, inter nese	rrogative sentences	with Chinese grammar. App	oly numbers translate			tions	mplex	R.										
CLR-3 :	Apply basic gramma	r asking abo <mark>ut nationa</mark>	<mark>lity,</mark> direction, locatio	n.				solut	of co		₹	ability								
CLR-4 :	Translate sentences	with more vocabulary	knowledge.	1 - 15	the later is	edge		nt of	ons (		ociet	taina		Vork		nce				
CLR-5 :	Apply construction an and city.	nd few frequ <mark>ently use</mark> a	words framing sent	ences; acquire knowledge a	about Chinese festival	Knowle	alysis	elopmer	estigati	ol Usage	er and s	it & Sus		Team \	tion	& Fina	saming			
-				1000	24	ering	n An	deve	st inv	Too	gine	men		al &	inica	Mgt.	ng Le			
Course	Outcomes (CO):	At the end of this	s course, learners wi	ill be able t <mark>o:</mark>		Engine	Problen	Design/	Conduc	Modern	The en	Environ	Ethics	Individu	Commu	Project	Life Lor	PSO-1	PSO-2	PSO-3
CO-1:	Write Chinese Romar	nization <mark>, Outline</mark> of Ch	nina and th <mark>e</mark> Chinese	speaking countries, basic	characters, Greetings	-			-	-	-	Ċ.	-	-	3	-	3	-	-	-
CO-2:	Construct basic conve Chinese.	ersation <mark>s with sim</mark> ple s	entences, counting	numbers, Greet each other,	express time and date	in -				-	-	•	-	-	3	-	3	-	-	-
CO-3:	Create WH words ma	ke interr <mark>ogative s</mark> ente	nce, translate senter	nces into Chinese.		-	-	,	25	-	-	-	-	-	3	-	3	-	-	-
CO-4:	Develop the knowled	lge of va <mark>rious Chin</mark> ese	grammar and vocal	bulary and introduce own se	elf.		-	<i>3</i> - 1	-	-	-	-	-	-	3	-	3	-	-	-
CO-5:	Implement knowledge	e about Ch <mark>inese fes</mark> tiv	als and culture, adap	ot conversational skills				-		-	-		-	-	3	-	3	-	-	-
			in the second									_								
Unit-1 -					11/10															9 Hour

Chinese speaking country - Introduction of initials and finals in Mandarin - Tables of combination of initials and finals in Putonghua (Mandarin) - Basic greetings and phrases used in daily life (In Pinyin) - Introduction of Four Tones in Chinese language - Pronounce words using Four Tones. - Introduction of Chinese characters - The eight basic strokes of characters - Chinese characters with proper stoke orders. - Personal Pronouns and relations words - Plural forms of pronouns - Writing characters with proper stroke order - Sentence structure with the adjective 混, negative sentence with adjectives - adverb 世 - Interrogative particle 吗 and 呢, application & Usages Possessive/ Structural Particle #9, Writing Chinese characters - basic conversation related to greetings - Writing greetings in characters with proper stoke order

Unit-2-

Counting numbers and numeric system - Chinese monetary system (India, China and Taiwan), Sentences with currency. - Converse to greet others and express your need - Asking your need - Telling phone number in Chinese Converting numbers - Time & time related greetings - Days, Seasons - The basic sentence patterns in Chinese, S - V - O sentences with detailed examples. Framing simple sentences - Introduce 是 and 不是 - Asking date and time - Introducing each other - Weekdays in Chinese, Month, Year & Writing Date - Introduction of 有 and 没有 - Framing of basic interrogative sentences with modal particle 吗 - Introduction of few basic interrogative words and framing basic interrogative sentences - asking Nationality - Introducing one's nationality 9 Hour

Unit-3-

Making question with 几,多少 - Asking price - Politely and formally asking names ,Expressing apology. - Make sentences with 在, and few correlated location words like 这儿 · 那儿 with example - Important locations used in daily life. - Asking about places - profession related vocabulary application with examples - Basic conversation about persons occupation - Asking about occupation.

B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-2(Revised-July2023)-First Year Syllabi-Control Copy

9 Hour

#### Unit-4 –

conversation how to make suggestion, how to accept of dealing suggestion and to make comments - Subject verb construction as its predicate - Fruit related vocabulary, application - Usage of verbs - Usage of adjectives with different adverbs - Sports & Games related vocabulary, special usages, application with examples. Unit-5 –

### 9 Hour

9 Hour

Conversation how to describe your family members and talk about university and department - Introduction & application of few frequently used words in Chinese (以前, 以后, 还是) - , application with examples. - Famous Chinese festivals - Introduction & Application of the basic optative verbs like 会, 能, 可以. Conversation how to describe likes, dislikes - Colour and vocabulary.

1. New Practical Chinese Reader Textbook - 1. Learning Resources

Learning Assessment		
	Bloom's	CLA-

			Continuous Lean	Summative								
	Bloom's Level of Thinking	Fo CLA-1 Ave	ormative erage of unit test (50%)	Life	Long Learning CLA-2 (10%)	Final Examination (40% weightage)						
		Theory	Practice	Theory	Practice	Theory	Practice					
Level 1	Remember	40%		40%		40%	-					
Level 2	Understand	30%	1 S	30%		<mark>30</mark> %	-					
Level 3	Apply	30%	1	30%		30%	-					
Level 4	Analyze 🥂 🚽	and the second second	1			-	-					
Level 5	Evaluate			1. A.	9 2 . ~		-					
Level 6	Create	a second			2		-					
	Total		100 %	Sector March	100 %	100 %						

Continuous Learning Assessment (CLA)

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Korogi Yu, DGM, Renault Nissan, Japan	1. Ms. Woanyuh Zoe Tsou. Founder and proprietor, IF Lingua Cultural studio, Hsinchu, Taiwan.	1. Dr. P. Tamilarasan , SRMIST
	2. Dr. J. Mangayakarasi, Head, PG and Research, Dept. of English, Ethiraj College for Woman, Chennai	2. Ms. Poulomi Ghosal, SRMIST.
		3. Ms. Ling Yun Tsai, SRM IST



Course         21LEH103T         Course         Course         Course           Code         Name         FRENCH         Catego											Н					HUM	ANIT	TIES					L 2	T 1	P 0	C 3
Pre-requ Course	isite es <i>Nil</i>	English	and Famin	Co- requis Courses	site /	Nil	Data Baak (	(Cadaa / Stan	dordo	Progr Cou	essive rses	Nil														
Course Of	rening Department	English	i anu Foreigi	I Languages			Data BOOK /	Codes / Stari	uarus	/\//																
Course I (CLR):	earning Rationale	e The	e purpose of	learning this c	course i	is to:	199			14	1	2.4			Prog	gram	Outc	come	s (PC	D)				Pi S	rograi pecif	m ic
CLR-1 :	Extend the knowled	lge in the Fre	ench L <mark>angua</mark>	<mark>ige usin</mark> g basi	ic gramı	mar, Self-i	introduction ar	and Greetings.				1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	es
CLR-2 :	Illustrate lexicon rela	ated to adjec	ctive <mark>s, prepo</mark>	<mark>sition</mark> s, posse	ssives /	Adjectives	s, using 1st gro	roup verbs.			200	-						y								
CLR-3 :	Construct phrases using 2nd group verbs, pronominal verbs, future tense and time, framing questions with Interrogative w										ords.	0		1	of		sty	abilit		×						
CLR-4 :	4 : Make use of 3rd group verbs, demonstrative adjectives and vocabularies related to clothing.										vledge		ent of	ations s	ge	socie	ustain		n Worl		Jance	D				
CLR-5 :	Utilize the adverbs i	related to ali	i <mark>mentatio</mark> n, p	entation, partitive articles and negation.							Knov	alysis	mqole	'estiga	ol Usa	er anc	nt & Si		Tean	tion	& Fir	eamin				
Course (	Dutcomes (CO):	At t	the end of th	is course, lear	mers wi	ill be able	to:	339				Engineering	Problem An	Design/deve solutions	Conduct inv complex pro	Modern Too	The engine	Environmer	Ethics	Individual &	Communica	Project Mgt	Life Long Le	PSO-1	PSO-2	PSO-3
CO-1:	develop a dialogue b	y using <mark>Fren</mark>	n <mark>ch g</mark> reetings	, expressions	and se	lf- Introdu	ction.	242.2		1.1	1	-	-	-	1	-	-	-	-	-	3	-	3	-	-	-
CO-2:	create the map and fi	ind dire <mark>ction</mark>	S.		20		100	10.00		h = 51	27	-		-		-	-	-	-	-	3	-	3	-	-	-
CO-3:	write simple routine ta	asks us <mark>ing r</mark> e	<mark>eflex</mark> ive verb	IS.		1	121.21	1.00		10.0	1.7	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
CO-4:	compile paragraph to	o descri <mark>be a j</mark>	person with	adjectives, col	lours an	nd clothing	g.	a state of the		-	25	-	3.	-	-	-	-	-	-	-	3	-	3	-	-	-
CO-5:	apply adverbs of qua	ntity rel <mark>ated</mark>	<mark>to foo</mark> d in se	ntences.	25		12.2	1	1	Sec.		-	-	- 1	-	-	-	-	-	-	3	-	3	-	-	-
<b></b>				1 - N		CON LA	100																			
Unit-1 - :	L'alphabet		eviete Lee			lana alan I	habitan Cana	uteenter / Dut								-1 <i>4 <b>6</b>1 - 4</i>								h	<u>9 H</u>	lour
- Les accent	s - Les salutations - Le - Les mois - Des portr	es pronoms raits de pavs	sujets - Les s francophon	es - Les article	avoir, s es défin	s appeier, i nis - Les pi	nabiter - Se pr ronoms toniqu	ues - Demande	senter q er polim	iueiqu un - S ient - Répond	informe dre polii	er sur ment.	qqn - I	Les ani	cies ini	aenni	s - co	omm	uniqu	ler er	1 class	ie - Le	es nom	bres (	je u a	a 69
Unit-2-				180		-		100			- 1		1	1											9 H	lour
Les nombr	es de 70 à 1000 - Le 1	1er groupe v	verb <mark>e - Les v</mark>	erbes venir et	aller - I	les profess	sions - les cou	uleurs - Les pa	ays - la i	nationalité - L	e genr	e des	adject	tifs - les	nomb	re de	s adj	iectifs	s - Le	es pré	positi	ons de	e lieu (	1) - D	écrire	ə son
Voisin - De	crire votre profession ·	- La descript	tion priysique	) - Les adjectil	is posse	essirs (sing	g. / pl.) - Les c	orientations - I	ies mont	uments - la n	nonnaie	- La i	amilie	-											9 F	lour
Les mots ir goûts / pré	nterrogatifs - Les verbe férence - Exprimer une	es : Vouloir, e envie - Act	pouvoir, dev tivité auotidie	oir - les verbe enne - Le futur	es prono r proche	ominaux - I e - L'heure	Les 2eme gro - Demander	oupes verbes - / dire l'heure -	- Faire u - Le svst	ine enquête · tème éducati	- Les go f en Fra	oûts de ance.	es auti	res - Le	s temp	os libr	es et	t les l	loisir	s - Pa	arler de	e ses i	loisirs	- Expi	rimer	ses
Unit-4 –			arno quodan		provino	2	201110110017		20 0)00																9 H	lour
Les adjecti	fs démonstratifs - le sa	aisons - Les	verbes : sor	tir, partir - Les	s 3eme <u>(</u>	groupes v	rerbes - Propo	oser une sortie	èàqqn-	Proposer à	qqn de	faire o	luelqu	e chos	ə - App	orécie	r qqr	ı - Ne	e pas	appr	récier	qqn -	Les vé	temei	nts - I	Les
adverbes o	le fréquence - Les adv	verbes de ter	mps - Décrir	e une tenue - l	Décrire	les acces	ssoires - la mo	ode en France	- Dema	nder le prix -	Faire o	des co	urses.													
Unit-5–					A 1			1										h - h *		- P	(	,			<u>9 H</u>	lour
Les article	s partitifs (du) et les i mmander au restauro	quantitès - L Int - Donner	Les verbes (e	r, ger, yer, ce	er) - Les mar à tr	adverbes	s de quantité -	- le pronom "el	n" de qu	iantité - Les	express	sions (	ie qua	ntitė -	Impé	ratıt -	Les	nabit	udes	s alım	entain	es - la	nègai	ion - I	Ecrire	) une
	annunuur au residura		son apprech	10011 - O GAPIII	nici a la	1010 - 200																				

Learning	1. SA	AISONS 1 - Didier – 2017						
Resources	2. BI	ENVENUE - Course Book in	French - Department of I	EFL, SRMIST - 2017.	A REPORT			
Learning Asse	essment							
				Continuous Learni	ng Assessment (CLA)			
		Bloom's Level of Thinking	CLA-1	Formative Average of unit test (50%)	Life	Long Learning CLA-2 (10%)	Final E (40%	nmative Examination weightage)
			Theory	Practice	Theory	Practice	Theory	Practice
Level 1	1 <i>R</i> e	emember	40%		40%	1/1 .	40%	-
Level 2	2 Ur	nderstand	30%		30%	12	30%	-
Level 3	3 Aµ	oply	30%		30%		30%	-
Level 4	4 Ar	nalyze					-	-
Level 5	5 <i>E</i> v	valuate	1 N. C. 1	110-1-124			-	-
Level 6	6 Cr	reate	-		120 10 10		-	-
		Total	C	100 %	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	100 %		100 %
		Total		100 %		100 %	1	100 %

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Ms. Woanyuh Zoe Tsou, Founder and proprietor, IF	1. Mr. Eric Perrotel Attaché de coopération pour le français - Zone Sud Institut français en	1. Dr. P. Tamilarasan, SRMIST.
Lingua Cultural studio, Hsinchu, Taiwan	Inde - Embassy of France in India, Bureau de France - Chennai	
	2. Dr. J. Mangayakarasi, PG and Research, Dept. of English, Ethiraj College for Woman,	2. Mr. J. Sabastian Satish, SRMIST
	Chennai.	
		3. Dr. Walter Hugh Parker, .SRMIST,



Course Code	2	1LEH104T	Course Name				GERMA	AN			Co Cat	ourse egory	Н					HUN	1ANI ⁻	TIES					L 2	T 1	P 0	C 3
	1																									1		
Pre-requ	isite	Niil			Courses	lite	Nil					Progres	SIVE	Nil														
Course Of	fering	Department	Englis	h and Foreigr	1 Languages		/ •//	Data Bo	ook / Codes / S	Standards		Nil		1.411														
								101		1		A																
Course I (CLR):	learni	ing Rational	e Th	ne purpose of	learning this c	course	is to:	18			2	14	1	2			Pro	gram	Outo	come	es (Po	D)				P	rogra	m
CLR-1 :	Help num	students learr bers.	n about the o	country, its cu	lture, basic gra	ammar	r element	ts such as	greetings, self	f - introduct	ion, al	phabet an	nd	1	2	3	4	5	6	7	8	9	10	11	12	OL	itcom	es
CLR-2 :	Fam	iliarize the bas	ic sentence	structure with	<mark>i correspondin</mark>	ng verb	conjuga	ations.	1.845	2043	١.					1.				2			ı.					
CLR-3 :	Intro	duce nominativ	ve elements	s an <mark>d directi</mark> on	IS.		X		1000	1.62.7				c)			ď		ety	abili		×	I					
CLR-4 :	Intro	duce accusativ	ve and ti <mark>me</mark>	elements.	1				S. S. R.L.	1				wledg	(0)	ient of	ations	ge	d socie	ustain		n Wor	1	nance	þ			
CLR-5 :	Prior	ritize using moo	dal verbs, <mark>s</mark> e	<mark>eparable</mark> verb	s and possess	sive pro	onouns ir	n real - time	e conversation	1.		1154		Kno	alysis	ndola	estig	I Use	r an	t & S		Tear	tion	& Fi	amir			
								1.00	1.74		0.77	100		ering	Ana	deve	tinve	Too T	ginee	men		al &	nica	Mgt.	ig Le			
Course (	Dutco	omes (CO):	At	the end of th	s course, lear	ners w	vill be a <mark>bl</mark> e	le to:						Enginee	Problem	Design/	Conduc	Modern	The enc	Environ	Ethics	ndividu	Commu	Project	_ife Lon	-SO-1	-SO-2	-SO-3
CO-1:	demoi	nstrate the feat	tures of <mark>cult</mark>	<mark>ure, g</mark> eograph	ıy, gre <mark>eti</mark> ng an	nd self -	- introduc	ction.	100.1			10.0	10	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
CO-2:	constr	ruct simple sen	itences <mark>with</mark>	personal pro	rouns and cor	rrespor	nding ver	rb conjugati	ions.	÷		1.0			-	-	-	-	-	-	-	-	3	-	3	-	-	-
CO-3:	develo	op sentences v	vith nom <mark>inat</mark>	tive elements	and directions	6.	24	100	1	100		44 J. 1	13	-	-	-		-	-	-	-	-	3	-	3	-	-	-
CO-4:	create	e conversationa	al senten <mark>ces</mark>	<mark>s using</mark> accusa	ative and time	eleme	nts.	1.0			J.F	13.5	1	-	-	-	Sec.	-	-	-	-	-	3	-	3	-	-	-
CO-5:	expres	ss thoughts in a	sentenc <mark>es u</mark>	<mark>ising m</mark> odal ve	erbs, separabl	le verb	s and po	ossessive p	ronouns in rea	al <mark>- time</mark> cor	iversa	tion.		-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
Unit-1 :					500																						9 H	lour
Begrüßung Telefonnur Redewend	ien und nmer ι ungen	l Verabschiedu und E - Mail -	ingswörter, Adresse n	Sich vorstelle ennen, Bund	n - Name, Zał esländer und	hlen (bi Haupt	is 100), L tstädte, V	Länder und W - Frager	l Sprachen, W n - Wer, Wie,	ohnort, Ber Wie alt, V	ufe, H Vas, V	lobbys, Ve Noher, W	erb Ko ′o, We	njuga Iche	tione. Waru	n - kon ım, Ta	nmen, ge, Mo	wohn onate,	en, le , Jah	eben, resze	heiß eiten,	en, s Zeit	ein un angab	d spre en ar	əchen, n, im,	Buch Grun	stabi dsätz	əren, :liche
Unit-2 :	ungen.					· · · ·	-				÷					×											91	lour
Personal F	Pronom	en im Nomina	tiv, Konjuga	ation - Regelm	näßige Verber	n und L	Jnregelm	näßige Verl	ben ausführlic	h lernen, Z	ahlen	bis eine l	Million	, Sat	zbau	formuli	eren -	Auss	age .	Satz,	Ja /	Nein	Frage	e Satz	r und I	N - F	rage	Satz,
Formular a	usfülle	n, Grundsätzlic	che Redewe	endungen.																								
Unit-3:	- 1	n Distraction	Cabinda		L Cabulasaha	- T	المعناء بيما	l Carita ha		It's Case		Manairad	. D.			A	الم يو ما		. 11.	h t	· 4		<u></u>			Nee	<u>9 F</u>	our
keine, kein	. Nach	n - Platze und dem Weg frag	Gebaude, ien und eine	verkenrsmitte en Weg besch	reiben - links.	n, reci rechts.	nnik und . geradea	aus und die	e Himmelrichtu	kuv - Gege Ingen, Ordi	ntelle, nal Za	hlen lerne	iv - Be en. ein	en Te	nter <i>i</i> ext ve	rstehei	aer, ai 1 und a	e, da Intwo	s, un rten.	Desti	mmu	ər Art	ikei ei	n, ein	e, em,	neg	alion	kein,
Unit-4 :	,									<b>U</b> ² , 2, <b>2</b> ,			,														9 H	lour
Lebensmi W Fragen	ttel - Ül - Wen,	ber Essen und Wie viel, Wohi	' Getränke s in, Wann, W	prechen, Eink lie oft, Wie vie	(auf planen, Ü ele, Wie lange,	İber pre , Die U	eise wiss hrzeit ve	sen, Akkusa erstehen un	ative Bestimm Id nennen - Sir	ter Artikel ongular und	den, di Plural,	ie, das, U Texte ve	nbesti rstehe	mmte n und	er Artii 1 antv	kel eine vorten.	en, ein	e, ein	, Neg	gatio	n keii	nen, k	keine,	kein,	Verbei	n mit .	Akku	sativ,

#### Unit-5:

Modal Verben - müssen, können, wollen, sollen, möchten, dürfen, mögen, Modal Verb im Satz, Kurze Alltags Gespräch führen und verstehen, Trennbare Verben, Possessive Pronomen im Nominativ - mein, dein, sein . . ., Über die Familie schreiben und sprechen, Andere vorstellen, Präteritum - sein und haben, Texte verstehen und antworten.

Learning	Netzwerk A1.1 Neu, Klett, München		1 million 1	And and a second second			
Resources				Color States			
Learning Assessme	ent			A literation			
			Continuous Learnir	ng Assessment (CLA)		S.	immotivo
	Bloom's Level of Thinking	F CLA-1 Av	Formative verage of unit test (50%)	Life Lo	ng Learning CLA-2 (10%)	50 Final (40%	Examination 5 weightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%		40%		40%	-
Level 2	Understand	40%		40%		40%	-
Level 3	Apply	20%	State State State	20%		20%	-
Level 4	Analyze	S				-	-
Level 5	Evaluate			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		-	-
Level 6	Create	-	A State of County	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	States and States	-	-
	Total		100 %		100 %		100 %

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Y. S. Kiran Kumar, Robert Bosch, Bangalore.	1. Dr. Dagmar Hellmann Rajanayagam, Professor, Universität Passau, Bayern, Germany.	1. Dr. P. Tamilarasan, SRMIST.
	2. Dr. J. Mangayakarasi, PG and Research, Dept. of English, Ethiraj College for Woman, Chennai.	2. Mr. G. Sugumar, SRMIST.
		3. Ms. Bhuvana Udhaykumar, SRMIST.



B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-2(Revised-July2023)-First Year Syllabi-Control Copy

9 Hour

Course	21LEH105T	Course	Course     Course     H     HUMANITIES     L     T     P     Course       Name     JAPANESE     Category     Cate								C 3													
ooue		Nume						ategory													2	1	0	5
Pre-requi	isite			Courses	Nil			Progre	essive	Nii														
Course Of	fering Department	English	h and Foreig	n Langua <mark>ges</mark>		Data Book / Codes / Sta	andards	Nil	303 1	NII .														
C	D. C. 1					- Lilli	<u> </u>	1	m.r															
(CLR):	earning Kauonai	e The	e purpose of	^f l <mark>earning this</mark> cou	rse is to:				540				Prog	ram (	Dutco	omes	; (PO)					Pr S	ograi pecifi	m ic
CLR-1 :	Explain basics con	cept and fact	ts of Jap <mark>ane</mark> s	<mark>se langu</mark> age.	1			1		1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	es
CLR-2 :	Compare demonstr	rative pronou	uns t <mark>o ask int</mark>	formation.	100	C and the second					1	1				y								
CLR-3 :	Select different ver	bs, demonstr	rat <mark>ive pronou</mark>	uns for place	1		2016			Φ	۳.		of		ety	abilit		×						
CLR-4 :	Outline Japanese e	etiquette by u	using vocabu	laries related to c	laily activities	and time.	397.1			vledg		ent of	tions	ge	socie	Istain	:	Wor		ance	6			
CLR-5 :	Explain diverse foo	d habits of <mark>J</mark> a	l <mark>apanese</mark> .	S						Knov	Ilysis	lopm	stiga blem:	Usa	r and	& Sl		Tear	ion	& Fin	amin			
				- N			100			ering	n Ana	deve	t inve k prol	Tool	jinee	ment		a∣⊗	nicat	Mgt.	g Le			
Course (	Dutcomes (CO):	At t	the end of th	is course, learnei	rs will be able	e to:	1944 1944			Enginee	Problem	Design/solution	Conduc	Modern	The enc	Environ	Ethics	Individu	Commu	Project	Life Lon	PSO-1	PSO-2	PSO-3
CO-1:	Write Japanese alph	abet pr <mark>onun</mark>	<mark>ciatio</mark> n, gree	tings, <mark>self</mark> - introd	luction	10 SH23		1.5	1		1	-	-	-	-	-	-	-	3	-	3	-	-	-
CO-2:	Apply the class activ	ity throu <mark>gh c</mark>	conversation	with other studen	ts	77 TO 14	6 m	1.5	3.7	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
CO-3:	Analyze directions u	sing diff <mark>erent</mark>	<mark>t grou</mark> p of ve	erbs	1.5	and the second second	1.	100	10	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
CO-4:	Develop knowledge	in about <mark> fest</mark> i	<mark>ivals</mark> and cul	lture. Summarize	everyday cor	nversations.	-		1.54	-1	-	-		-	-	-	-	-	3	-	3	-	-	-
CO-5:	Demonstrate the foo	ionstrate the food habits <mark>of Japan</mark> ese and others								-	-		-	-	-	-	-	-	3	-	3	-	-	-

#### Unit-1 :

9 Hour

9 Hour

Japanese language and culture - Self-Introduction - Greetings, classroom expressions - Introduction to others - Grammar (wa, ka, mo, no) - grammar (no/desu/ja arimasen) - Introduction to Japanese Script - Hiragana, Katakana, and Kanji. - Hiragana Lesson-1 (a, i, u, e, o) vowels and related words - Hiragana Lesson 2 (ka, ki, ku, ke, ko) related words - Hiragana Lesson 2 (ga, gi, gu, ge, go) related words. Are wa nan desu ka. - Grammar -Demonstrative Pronouns (kono, sono, ano, dono) - grammar (ni, ga, particules and Arimasu. Imasu sentence pattern and usage of dare, donata) - grammar like kore, sore, are, dore etc. - Days of the week - Numbers - Months of the year - Hiragana Lesson 3 (vowels and related words) - Hiragana Lesson 4 (vowels and related words) - Japanese Festivals (hinamatsuri, obon, oshougatsu, shichi go san, tanabata etc.) different occupations - Kanji -Days of the week.

#### Unit-2 :

Sore o kudasai - grammar (time expressions using hours and minutes) - using gozen and gogo. Location markers line ue, shita, naka etc., and its usage. Using Locations grammar koko, soko, asoko doko etc., asking the price of the commodity. Requesting things using o particle like kore o kudasai, mizu o kudasai etc., Numbers upto one lakh. Japanese seasons and weather - Japanese Culture - origami, ikebana, bonsai, rakugo, kabuki etc., - Hiragana Lesson 5 (vowels and related words) - Hiragana Lesson 6 (vowels and related words) - Hiragana Lesson 7 (vowels and related words) - Hiragana Lesson 8 (vowels and related words) - asking things and persons using of doko desu ka. Different places in town Toukyo Tawaa wa docchi desu ka - Grammar(kochira, sochira, achira and Dochira) - Grammar (kocchi, socchi, docchi) Hiragana Lesson - 9 Double consonants - Hiragana Lesson - 10 long vowels - Days of the week - Numbers and Months of the year compound consonants - revision of Hiragana Lesson - 12 particles, wa, e, o writing system. - Kanji Numbers 1 - 10, 100,1000,10000 and yen Colours and Directions. Locations - migi, hidari, mae, ushiro etc., Japanese martial arts (sumo, kondo, karate, yakyuu) around the station

#### Unit-3:

Keeki o yattsu kudasai. - Grammar (general counter ~tsu and person counter ~nin, animals ~hiki vehicles counter ~dai and floors kai) - family members plain and polite way - usage tachi and tame ni etc., - Japanese house and living style. Katakana rules and writing system. Kanii - otoko, onna, ko, hito etc.

#### Unit-4 :

Verbs: Ikimasu, okimasu, nemasu, tabemasu etc. Verbs - Past tense, negative - ~mashita, ~masen deshita. Grammar - usage of particles e, de, to, ni, o, ga(but) and exercises Katakana rules and related vocabulary. Kanji - ikimasu, mimasu, yasumimasu and kaimasu Grammar: ~mo (nanimo, dokoemo, donatamo) - negative i - ending and na - ending adjectives - introduction Common daily expressions and body parts (vocabulary) Religious beliefs, Japanese house and living style.

#### Unit-5:

Usage of ~masen ka and mashou, Adjectives (present/past - affirmative and negative) Stationery and transport (vocabulary) Grammar - Usage of ~te form, Grammar - Usage of ~tai form Kanji - ookii, chiisai, eki and chuui Japanese tea ceremony and Japanese political system and economy

#### Learning Resources

#### Learning Assessment Continuous Learning Assessment (CLA) Summative Formative Life Long Learning Final Examination Bloom's CLA-1 Average of unit test CLA-2 (40% weightage) Level of Thinking (50%) (10%)Practice Practice Practice Theory Theory Theory 40% 40% 40% Level 1 Remember . 30% 30% Level 2 Understand 30% ---30% 30% 30% Level 3 Apply -_ -Level 4 Analyze --1 ---Level 5 Evaluate -----Level 6 Create -----..... Total 100 % 100 % 100 %

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
<ol> <li>Ms. Woanyuh Zoe Tsou Founder and Pro Lingua Cultural studio, Hsinchu, Taiwan.</li> </ol>	oprietor, IF 1. Mr. Korogi Yu, DGM, Renault Nissan, Japan.	1. Dr. P. Tamilarasan, SRMIST.
	2. Dr. J. Mangayakarasi, PG and Research, Dept. of English, Ethiraj College for Woman, Chennai.	2. Ms. P.R. REKHAA, SRMIST.
		3. Ms. V. SUNDRAVALLI, SRMIST.

9 Hour

9 Hour

9 Hour

Course Code	21LEH106T	Course Name			KOREAN	N	C	Course ategory	H				HUMA	ANIT	IES					L 2	T 1	P 0	C 3
Pre-req Cours Course C	uisite ses <i>Nil</i> Offering Department	English	C and Foreign La	Co- requisite Courses nguages	Nil	Data Book / Codes / Sta	ndards	Progressiv Courses	ve Nil														
			v	0 0		10-11-11-1		let and															
Course (CLR):	Learning Rational	e The	purpose of lear	ming this cours	se is to:	- and -	1.20	- 4	2.			Prog	gram (	Dutco	omes	; (PO)					Pi	rogran	m
CLR-1 :	Spell, pronounce, a about Korea, its cu	and demonstra Iture, and its l	ate the Korean s angu <mark>age.</mark>	<mark>scrip</mark> t, and to d	lefine onese	If and other people in the la	anguage. Ge	et to know	1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	es
CLR-2 :	Illustrate sentence	ending expres	ssio <mark>ns, Num</mark> ber	s, Shopping ar	nd Teaching	money				1	1				у								
CLR-3 :	Construct phrases	using action v	ve <mark>rbs for pre</mark> sen	t and Past dail	ly life activiti	es				1.1		of		ity	abilit		×						
CLR-4 :	Tell time, to socialize: make appointments, phone calls																						
CLR-5: Determine expressing abilities, hopes, intentions, requests																							
					1	12 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		1000	ring I	Ana	level	inve	T00	ineer	nent		al & T	nicati	Agt. 8	g Lea			
Course	Course Outcomes (CO): At the end of this course, learners will be able to:										Design/d	Conduct	Modem .	The eng	Environn		ndividua	Commur	Project N	_ife Lonç	-SO-1	-SO-2	-SO-3
CO-1:	Write words by using	g Korea <mark>n scrip</mark>	<mark>ot - S</mark> elf Introduc	ction, Greetings	s in Korean			1 Beech	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
CO-2:	Demonstrate Numbe	er and m <mark>oney</mark>	<mark>term</mark> s, managin	ng daily life acti	ivities in Kor	rean	1	2.2.7	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
CO-3:	Develop simple daily	/ life tas <mark>ks usi</mark>	<mark>ng V</mark> erb conjuga	ation in Presen	t and Past		100	10-17	-	- T	-	-	-	-	-	-	-	3	-	3	-	-	-
CO-4:	Construct time, to so	ocialize make	<mark>appo</mark> intments, p	ohone call etiqu	uettes	1. 1		PACT	- 1	-	-	-	-	-	-	-	-	3	-	3	-	-	-
CO-5:	Express the express	sions rela <mark>ted t</mark>	<mark>o the</mark> daily life a	activities	1000		- 41		-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
<b></b>				1			Get																
Unit-1 :		. +1 =				1.0											-10	-1 0	N 74			<u>9 H</u>	our
Introductio	on to Korea and Kore	an (안글소/	(#, 안국 소개)	) - Single vowe	el ( <i>난모음)</i>	) - Double vowels & basic	consonants	s ( <i>미중모음</i> _	박 사음	) - Do	uble co	onsonai	nts &	sylla	bles	(8)	사음.	과 품	<i>(설</i> ) ·	- Batc	him 8	: sylla	ables
(받짐과	음설) - New vocabula	ary (Nationalit	y & Occupation)	) - Self-Introdu	ction - Gree	tings.																	
Unit-2 :						1. 1. 1. N. 1. 1.																9 H	our
Grammar	point: Topic marking p	particles(은/분	=) - Sentence er	nding expressi	ons ( 0/ 0// <u>1</u>	요/예요) - Formal sentence	e ending exp	oressions (	-/다/습	L/Eŀ,	ыЦX	깨습니	/ <i>フフ</i> ト) -	Tead	ching	Num	ber S	Systen	n (Sin	io Kor	ean N	umbe	ərs) -
New voca	bulary (counter noun)	- Grammar po	pint - 있다없L	⊑/ - Subject ma	arking partic	le: 이/ 가- Interrogative w	vords (뭐, 은	[제, 누구, 어	' <i>⊏ </i> ), Ob	ject m	arking _l	particle	(을, :	를) -	Loca	ation n	narki	ng pa	rticle	(0  /0	<i>  ,</i> ,/).	- Part	icles
Noun ( <i>와</i>	/과, N(이)랑, Noun 히	하고, N <i>의</i> ).																					
Unit-3:																						9 H	our
Conjugati	on of a Verb - Preser	nt tense (0f1	요/어요), Past i	tense (았/었,	₩Ŋ wea	ther new vocabulary (seas	son & wea	ther) - Progres	ssive te	nse -	vb. ヱ	있 <i>다</i> , I	Particl	es (l	<i>۷.도,۱</i>	N <i>₽</i> ,	N(	2)로, 1	N( <i>O</i> /)	) <i>L </i> , N	晉) -	Neg	ative
expressio	ns - Word negation ( 2	2/- adj. / vb. (	야요/어요))																				

#### Unit-4 :

Time system - Days of the week - Months of a year - Conjugation of a Verb in Future Tense (으) 르거예요 - Listening and contrast - adj. / vb. 고 - vb. 지만, N보다,N바다 - Confirming Information - adj. / vb. 지요, Irregular verbs 드

#### Unit-5:

Ability & possibility (vb. (으) ^르수있다/없다) - obligations/permissions vb. (으) 세요, vb. 지마세요 - Making requests vb. 아어주세요 - Expressions of hope vb. 고싶다 - Asking opinions and making suggestions vb. (으) 르까요? - Discovery and surprise adj. vb. 네요.

Learning Resources	1. 2. 3.	Seo gang Korean 서강 new 한국어 1A - Student book Korean Grammar in Use : Beginning to Early Intermediate Seo gang Korean <mark>서강 new</mark> 한국어 1A Workbook	

		~ /	Continuous Lea	arning Assessment (CLA)			Summotivo
	Bloom's Level of Thinking	CLA-1 A	Formative Average of unit test (50%)	Life	Long Learning CLA-2 (10%)		I Examinative K weightage)
		Theory	Practice	Theory	Practice	Th <mark>eory</mark>	Practice
Level 1	Remember	40%	State Card	40%		40%	-
Level 2	Understand	30%		30%	20 X X X X X X X X X X X X X X X X X X X	<mark>30%</mark>	-
Level 3	Apply 🚽	30%		30%		30%	-
Level 4	Analyze	7 10 100				-	-
Level 5	Evaluate	1000			1	-	-
Level 6	Create	10.0				-	-
	Total		100 %		100 %		100 %

Course Designers		And a second sec
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
<ol> <li>Ms. Woanyuh Zoe Tsou Founder and Proprietor, I Lingua Cultural studio, Hsinchu, Taiwan.</li> </ol>	1. Mr. Lee Hwarang, Professor, Korean Language, Madras Christian College, Chennai.	1. Dr. P. Tamilarasan, SRMIST.
	2. Dr. J. Mangayakarasi, Head, PG and Research, Dept.of English, Ethiraj College for Woman	n, Chennai. 2. Ms. M. Ratna kumari, SRMIST.

9 Hour

9 Hour

Course Code	21LEH107T	Course Name	e SPANISH Course H HUMANITIES L c						T 1	P 0	C 3											
Pre-requ Cours Course O	uisite les <i>Nil</i> ffering Department	Englis	sh and Foreign	Co- requisite Courses Languages	Nil	Data Book / Codes / Standards	Progressiv Courses Nil	e Nil														
Course l (CLR):	Learning Rational	le Ti	he purpose of	learning this cour	rse is to:	Sena	44	2			Prog	gram	Outc	ome	s (PO	)	1.0			PS	rogra Specit	.m ic
CLR-1 :	show the students	about the la	anguage and to	o select the usage	e of Gramm	ar, Self - introduction and greetings.	C.	1	2	3	4	5	6	./	8	9	10	11	12	OL	tcom	es
CLR-2 :	utilise the adjective	age, now to es. to ask ar	ntroauce one	self, to ask and g ons. and an overv	ive informat	ion about others and express simple ral conversations.	conversations.		1	5	÷		٨	bility								
CLR-4 :	identify and to deve	elop the abi	ilit <mark>y to read,</mark> un	derstand and init	iate sentenc	e formation.	20	ledge		int of	ions o	e	societ	stainal		Work		ance	_			
CLR-5 :	maximise the basic	c conversati	ional skills.	-			1.1	g Know	nalysis	elopme	vestigat	ol Usag	er and	nt & Su		k Team	ation	t. & Fina	eaming			
Course	Outcomes (CO):	Ai	t the end of thi	s course, learner	s will be able	e to:		Engineerin	Problem A	Design/dev solutions	Conduct in	Modern To	The engine	Environme	Ethics	ndividual 8	Communic	^o roject Mg	-ife Long L	-SO-1	SO-2	SO-3
CO-1:	demonstrate the cult	ture, geo <mark>gra</mark>	<mark>aphy, g</mark> reetings	s and introducing	themselves	A SHOW	1.0.0		-	-	-	-	-	-	-	-	3	-	3	-	-	-
CO-2:	create the dialogue	between <mark> lea</mark>	arners in the us	se of g <mark>ra</mark> mmar an	d vocabular	у.	1. S. 2. S.	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
CO-3:	develop a map to fin	nd the dir <mark>ect</mark>	tions by using v	vocabularies		190 C	123	•	-	-	-	-	-	-	-	-	3	-	3	-	-	-
CO-4:	incorporate a paragr	raph rela <mark>ted</mark>	d to shopping a	nd daily routine.	1.0	the state of the second se			-	-		-	-	-	-	-	3	-	3	-	-	-
CO-5:	construct the senten	ice using <mark>va</mark>	<mark>arious g</mark> ramma	r tenses to impro	ve the conve	ersational skills.	Sec. 2	<i>1</i> 0 - 1	-	-	-	-	-	-	-	-	3	-	3	-	-	-
Unit-1 :		-		5	te ette				- 1	÷	-										91	lour
El Abeced	lario, a Saludar y a de	espedirnos	- Las nacional	lidades, las profe	siones y sol	bre las palabras - Los Números 1 -	100 - La Presenta	ción - l	El Voc	abulario	o - hab	lar - I	Pron	ombr	e Per	rsonal	l - Día	as de	la ser	nana	y me	ses -
Unit-2 :	porauas en España y		es - Anticulos u		e los verbos	auxiliares - Los verbos ser, terier y r		I Idillillo	1.												91	lour
Artículos I - El Vocab ER - IR ve	ndefinidos - Los Núme ulario - Escuchar: Esc erbos regulares - Algu	eros 1000 y cribe los núi inos Usos d	/ Vocabulario - meros - El pres	a expresar inten sente de Indicativ por y para - Oraci	ciones - Neg vo (verbos te ones de eier	ación y traducción - Números telefó rminados en - ar, - er, - ir - conjugac nplo para y por - Tipos de colores y	nicos - Direccione ión de - AR verbo el articulo determi	s cardir s regula nado - l	nales y ares - l Descril	r medio Forman be tu cl	s de tra do ora ase o c	anspo cione colegii	orte - s en o en	Preg tiem espa	untar po pre ñol	por d esente	direcci e - El	iones Ejerci	y des icio - c	cribir conjug	un ca Jaciór	mino 1 de -
Unit-3:	inderegalaree ruga		<u></u>		<u></u>							orogr	0 011	oopu							9 H	lour
Ser y Esta verbos Irre Superlativ	ar - Números ordinale egulares - Leyendo la o - Explicar: un/una/ui	s y días - a a comprensi nas/unos y (	a expresar exis sión y respondi oraciones - Ex	tencia - El Vocal iendo las pregun plicar: mucho/mu	oulario - Dife tas - a habl icha/muchos	erenciación entre ser y estar con ora ar de Clima - Ejercicios: conjugacio s/muchas y oraciones - Preguntas: q	ciones de ejemplo nes de verbos - a Jé /cuál /cuáles /c	o - Ejer algunos uantos	cicio d usos /cuánt	le escu de hay as /dón	cha - A r - orac ide y co	A habi ciones ómo.	lar de s de	e Ubi ejem	icació plo pa	n - El ara ha	l Ejero ay - E	cicio - El Eje	- conju ercicio	igació - Esc	n de ucha	- AR r - El
Unit-4 :						,															9 I	lour
FI Tiempo	- Escuchar y Escribi	ir - a identif	ficar obietos -	Fiercicio de esci	icha - El Vo	cabulario - A comprar en tiendas: u	preguntar por proc	luctos	pedir	precios	s etc	- Col	niuae	ación	de ve	erbos	:-ah	nablar	de pi	refere	ncia	- Los

El Tiempo - Escuchar y Escribir - a identificar objetos - Ejercicio de escucha - El Vocabulario - A comprar en tiendas: preguntar por productos, pedir, precios etc.., - Conjugación de verbos - a hablar de preferencia - Los demostrativos: este/esta/estos/estas/esto - Escribe el tiempo - el/a/los/las + adjetivo - Oraciones de adjetivo - qué + sustantivo / cuál/cuáles - El Ejercicio. - tener qué + Infinitivo - Encuadrar las oraciones - el verbo IR - Las prendas de vestir.

Unit-5:

9 Hour Hablar del aspecto y del carácter - A expresar gustos e intereses - El Vocabulario - A preguntar sobre gustos - a contrastar gustos - escuchando y entendiendo - El Ejercicio - Ir a un restaurante, ordenar la comida y pagar, hablar sobre un evento - El restaurante: Juego de rol - el verbo gustar - Encuadrar las oraciones - los posesivos - Oraciones del posesivos - tus actividades diarias.

Learning	Aula 1						
Resources				Contraction of the second			
Learning Ass	essment						
			Continuous Learnir	ng Assessment (CLA)		C.um	motivo
	Bloom's Level of Thinking	F CLA-1 Av	Formative verage of unit test (50%)	Life Lon Ci (1	g Learning LA-2 10%)	Final Ex (40% w	native amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	1 Remember	40%		40%		40%	-
Level 2	2 Understand	30%		30%		30%	-
Level 3	3 Apply	30%	State State State	30%		30%	-
Level 4	4 Analyze				and the second of	-	-
Level 5	5 Evaluate			10 A 10 A 10	10. 10. 10 March 10.	-	-
Level 6	6 Create		1	1977 - 1989	2.00	-	-
	Total		100 %	- 10	00 %	10	0 %

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Ms. Woanyuh Zoe Tsou Founder and Proprietor, IF Lingua Cultural studio,Hsinchu, Taiwan.	1. Mr. Xavier, Assistant Professor, Vellore Institute of Technology, Chennai.	1. Dr. P. Tamilarasan, SRMIST.
	<ol> <li>Dr. J. Mangayakarasi, Head, PG and Research, Dept. of English, Ethiraj College for Woman, Chennai.</li> </ol>	2. Mr. J. Sabastian Satish, SRMI <mark>S</mark> T.
		3. Dr. Walter Hugh Parker, SRMIST



Course Code	21	GNH101J	Course Name	•	PH	ILOSOPHY OF E			Course Category	Н					HUM	ANIT	TIES					L 1	Т 0	P 2	C 2
Pre-requi Course Course Off	isite ^ es fering D	lil Department			Co- requ Course	isite <u>Nil</u> s	Data Book / Codes /	Standards	Progre Cour Nil	essive rses	Nil														
Course L (CLR):	earnin	ng Rationa	le	The purpose	e of learning this	course is to:	1 Sen				2.4			Pro	gram	Outo	ome	s (PC	D)				P	rogra	m ic
CLR-1 :	Inspire	e a holistic o	verview of	engineerin <mark>g</mark>		100					1	2	3	4	5	6	7	8	9	10	11	12	OL	itcom	es
CLR-2 :	Enligh	nten the meth	hods and n	nethod <mark>ologie</mark>	<mark>es for bui</mark> lding o	ntologies for syst	ems engineering			-							y								
CLR-3 :	Acqua	aint with eng	ineering kn	owled <mark>ge, bu</mark>	<mark>ıilding</mark> engineer	ing knowledge ar	nd value of engineering	100			d)			of		aty	abilit		×						
CLR-4 :	Upski	ll the engine	ering desig	n p <mark>rocess in</mark>	aspects of con	ceive, design, im	plement and operate me	ethodology	die.		rledg		ent of	tions	e	socie	stain		Wor		ance	5			
CLR-5 :	Instill	the role of er	ngineers in	society, coo	de of ethics and	socio-politics of	technology and enginee	ring			ing Know	Analysis	evelopme	investiga	Fool Usag	neer and	nent & Su		l & Team	lication	1gt. & Fin	l Learnin			
Course C	Outcon	nes (CO):	,	At the end o	f this course, le	arners will be abl	e to:	Str. 7			Engineer	Problem	Design/d	Conduct	Modern	The engi	Environn	Ethics	Individua	Commun	Project N	Life Long	PSO-1	PSO-2	PSO-3
CO-1:	Analyze	e the relation	n betwee <mark>n /</mark>	<mark>Arts, Ma</mark> then	natics, Science,	Technology and	Engineering and desire	d attributes of	^r an engineei	r	1	-	-	3	-	1	-	1	3	3	-	3	-	-	-
CO-2:	Build or	ntologies for	systems <mark>e</mark>	<mark>nginee</mark> ring u	ising conc <mark>ep</mark> t/m	ind mapping tech	nniques	No. 1	1.2.2	Ū,	3	-	-	3	3	-	-	-	3	3	-	3	-	-	-
CO-3:	Analyze	e the knowle	dge base <mark> i</mark>	<mark>n engin</mark> eerin	ng, distinctive fe	atures of enginee	ering design and RIASEC	C model	1		3	-	-	3	-	-	-	-	3	3	-	3	-	-	-
CO-4:	Illustrat	e the engine	ering de <mark>sig</mark>	<mark>n proce</mark> ss fo	or the given app	lication, analyze	the requirements of CD	IO engineers		5	3	1	3	3	3	-	-	-	3	3	-	3	-	-	-
CO-5:	Evaluat organiz	te designs or ations	n their en <mark>vi</mark>	ronmental a	nd societal asp	ects and do orga	nizational analysis on pr	ofession engi	neering	(The second	3	3	3	3	•	3	3	3	3	3	-	3	-	-	-
	0					Y.		1					1.1												
Unit-1 : In	troduct	ion to Philo	sophy of L	E <mark>ngineeri</mark> ng																				9 H	lour
Define Eng	ineering ramid -	r - History of Practice 2: S	Engineerin	g <mark>Developm</mark> amid Analys	ent - Practice 1	: Compare Prehi xt Necessary? -	story, Medieval and Pres Desired Attributes of an	sent Engineer Engineer - Er	ing Developi naineerina Ha	ment - abits of	Relat Mino	ion be	etween	Arts, N Case	lathe Study	matio	s, So Attrib	cienc utes	e, Te of an	chnolo Enain	ogy ar	nd Eng	ineer	ing -	
Unit-2 : On	tology	of Engineer	ring					Engineer Er	igino oning rit		mina	110	01100 0.	Cubb	oluuy	UIII		atoo	or an	Engin	001.			9 H	lour
Ontology -	Referen	ice Ontology d Manning -	and Applic	cation Ontolo	ogy - Practice 4	: Reference Onto	ology using Concept/Min	nd Mapping - S Induct Life Cycl	Suites of Ont	tology I usina C	Nodul	es - F	unction d Manr	s and (	Сара	bilitie	s - P	ractio	ce 5:	Engin	eering	ı Appli	catior	n Ont	ology
Unit-3: Ep	istemo	logy of Eng	ineering	c 0ytic - 0t		vices and minuse		duct Life Oyer	c ontology c	Joing O	oncop	0 10111	a wapp	ing										91	lour
Relations b Engineering Epistemolo	etween g - RIAS gy of Er	Science, Te SEC Model - ngineering D	chnology a Practice 8: esign	nd Engineei Case Study	rin <mark>g - Questions</mark> / on RIASEC TI	on Philosophy on Philosophy on Philosophy of Career C	f Engineering - Practice hoice - Epistemology of	7: Analyze th f Engineering	e nature, cor Design - Rig	ntents a our, Cr	and co eativii	omple: ty and	xity of t Chang	he kno le in Er	wledg iginee	ge ba ering	se in - Pra	i engi actice	ineeri 9: A	ing Fo nalyze	ur Din Distii	nensio nctive	ns of Feati	ires (	of
Unit-4 : Me	etnodol	ogy of Engi	neering																					91	iour

Unit-4 : Methodology of Engineering
Difference between Scientific Method and Engineering Design (ADDIE)- CDIO Engineers in Industry - Practice 10: Relate ADDIE and CDIO Methodology - Conceive and Design - Engineering Design Process Practice 11:
Illustrate the Engineering Design Process for the given Application - Implement and Operate - Operational Factors in System Design - Practice 12: Analyze the Requirements of Operational Engineers

#### Unit-5: Axiology of Engineering

Engineering and Society- Engineers Code of Ethics - Practice 13: Evaluate Popular Inventions and apply their new point of view to Re-Design - Sustainability and Diversity - Engineer's role to achieve Sustainable Development - Practice 14: Case Study on Achieving Sustainable Development Goals - Socio-Politics of Technology & Engineering - Professional Engineering Organizations - Practice 15: Case Study on Professional Engineering Organizations

Learning	<ol> <li>Louis L. Bucciarelli, Engineering Philosophy, Illustrated, DUP Satellite, 2007</li> <li>Gregory Bassett, Philosophical Perspectives of Engineering and Technology Literacy,</li> </ol>
Resources	I, Original writing Ltd, 2014
	3. Philosophy of Engineering Volume L Royal Academic of Engineering (UK) 2010

4. Christensen, S.H, Engineering Identities, Epistemologies and Values, Springer, 2015

5. Van De Poel, Ibo, Philosophy and Engineering, An Emerging Agenda, Springer, 2010

6. Diane P. Michelfilder, The Routeledge Handbook of The Philosophy of Engineering, Routledge, 2020

Learning Assessmen	t				11		
			Continuous Lear	ning Assessment (CLA)	1.1		
	Bloom's Level of <mark>Thinking</mark>	CLA-1 A	Formative verage of unit test (45%)	Life	Long Learning A-2 – Practice (15%)	Fina (40)	I Examination % weightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%			15%	20%	-
Level 2	Understand	20%		1000	15%	20%	-
Level 3	Apply	20%	A COLUMN AND A	10000 - 25	20%	20%	-
Level 4	Analyze	20%	State Provide State	1000	20%	20%	-
Level 5	Evaluate	10%			15%	10%	-
Level 6	Create	10%		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	15%	<mark>10%</mark>	-
	Total		100 %		100 %		100 %

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sainarayanan Gopalakrishnan, HCL Technologies, sai.jgk@gmail.com	1. Dr. R. Kumar, NIT Nagaland, rajagopal.kumar@nitnagaland.ac.	in 1. Dr. Rajeev Sukumaran, SRM-CARE, SRMIST
2. Dr. Sricharan Srinivasan, Wipro Technologies, sricharanms@gmail.com	2. Dr. B. Surendiran, NIT Puducherry, surendiran@nitpy.ac.in	2. Dr. G. Vairavel, SRM-CARE, SRMIST



B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-2(Revised-July2023)-First Year Syllabi-Control Copy

9 Hour

Course Code	21MGH101T	Course Name		FUNDAME	ENTALS OF ECONOMICS		Course Category	Н				ŀ	HUMA	ANITI	ES				L 3	T 0	P 0	C 3
Pre-requ Cours	isite es <i>Nil</i>		Co	- requisite Course <mark>s</mark>	Nil		Progre	ssive ses	Nil													
Course O	tering Department	Faculty	of Management		Data Book / Codes / Sta	andards	INII															
Course I (CLR):	Learning Rational	le The	e purpose of learni	ing this cours	se is to:	1	4.7	U	2.4			Prog	ram (	Outco	mes (	PO)				P	vrogra Specif	am fic
CLR-1 :	Understand the fur	ndamentals o	of economic princip	oles					1	2	3	4	5	6	7 8	9	10	11	12	οι	utcom	ies
CLR-2 :	Gain knowledge of	f demand and	d sup <mark>ply analysis</mark> ir	n business er	nvironment			3										$\square$				
CLR-3:	Study various theo	ries of produ	ictio <mark>n, costs a</mark> nd re	venue		1.11		1			2	of		ty	ability				l			
CLR-4 :	Illustrate key chara	acteristics and	d consequences of	f different forr	ms of markets	39.7	24		vledge		ent of	ations (	ge	l socie	ustaina	n Work		Jance	D			
CLR-5 :	Equip the learners	with macro-e	economic tools for	business ana	alysis				g Knov	nalysis	/elopm	roblem	ool Usa	er and	ent & Si	& Tean	ation	t. & Fir	eamin			
Course (	Dutcomes (CO):	At t	the end of this cou	rse, learners	will be able to:	12.57			Engineerin	Problem A	Design/dev solutions	Conduct in complex pr	Modern To	The engine	Environme	Individual 8	Communic	Project Mg	Life Long I	PSO-1	PSO-2	PSO-3
CO-1:	Apply economic con	icepts in <mark>ratio</mark>	o <mark>nal a</mark> llocation of re	esources	100 Mar	1000	1.1.1.1.1	-	-		-	3	-	-	3 3	2	2	-	-	-	-	-
CO-2:	Assess the demand	and sup <mark>ply a</mark>	a <mark>naly</mark> sis in busines	s environmer	nt	1. 1. 1	1. 2.2	1.1	2		3	3	-	-	3 3	-	-	2	-	-	2	-
CO-3:	Analyze the relations	ship bet <mark>ween</mark>	<mark>1 prod</mark> uction, cost a	and price for e	effective decision making			1.75	3	3	2	3	-	-		-	2	2	-	-	-	2
CO-4:	Assess the different	competitive e	environment in wh	ich the firm o	operates			1.1	-	3	-	1000	-	-	-	2 2	2	-	-	- 1	2	-
CO-5:	Identify potential ma	arket opp <mark>ortur</mark>	<mark>nities</mark> based on ma	acro-economi	ic indicators		1.00	14	-	2	-	2	2	-	2 -	-	3	2	<u> </u>	-	3	-
llnit_1 ·I	atraduction		1		Real and a second second		10														0 F	Hour
Meaning-E	Definitions of Econom	ics - Nature	& Scope of Econo	omics – Subi	iect Matter of Economics – Branches	of Econom	ics – Releva	ance o	f Ecoi	nomic	s in En	aineeriı	na. U	Itilitv á	analvs	is. Ma	rainal	Theor	v of ut	tilities	and	Eaui-
Marginal th	neory of utility											0	5		.,.	-, -	<b>J</b> .		<u> </u>			
Unit-2 : De	emand and Supply F	unction		12.2	<u> </u>					1	14										9 F	lour
Meaning o Elasticity o	f demand - Demand t f Supply - Consumer	theory and ob Equilibrium -	bjectives- Demand - Consumer Surplu	l analysis - De Is	emand schedule - Demand Curve - La	aws of Dem	and - Elastic	city of L	Demai	nd -Ty	rpes an	d Meas	urem	nent -	Indiffe	rence	curves	; analy	∕sis - L	.aws (	of Sup	pply -
Unit-3: Th	eory of Production,	Cost and Re	evenue		13 X 15 A 16 A 16 D	M.U					1										9 F	lour
Production the Short F	: Firm as an Agent of Run- Costs in the Lon	f Production- g Run- Profit	Factors of product Maximization and	tion - Concep Cost Minimiz	ot of Production Function- Law of Varia zation- Equilibrium of the Firm- Techni	able Propor ical/Technol	tions - Isoqu logical Char	iants- F ige- Co	Returr oncept	ns to S t of Re	Scale- E even <mark>ue</mark> :	Conom Total,	ies & Avera	Dise age al	conon nd Ma	nies of rginal	Scale. Reven	Cost	s & Re	venu	e: Cos	sts in
Unit-4 : M	arket Analysis	~																			9 F	lour
Perfect con Competitic Monopolis	mpetition – Short Run n – General and Cha tic Competition- Oligo	n and Long Ri Imberlin Appr Ippoly	un- Equilibrium of roaches to Equilibr	the Firm and ium- Equilibri	Industry - Price and Output Determina ium of the Firm and Group with Produc	ation – Supj ct Differenti	oly Curve- N ation and Se	Aonopo elling C	ly – S Sosts-	hort r Exces	un and ss Capa	Long ru acity un	ın Eq der N	uilibri Ionop	um- P olistic	rice Di and Ir	scrimii nperfe	nation ct Cor	– Mor npetitic	iopoli: on- Ci	stic riticisr	m of
Unit-5: Mo	oney, Banking and T	rade																			9 F	lour
Money- na – Direct ar	ture and functions – I Ind Indirect taxes – GS	Inflation and L ST- Impact an	Deflation – Kinds o d Incidence of tax	of Banking – c - Concept of	commercial banks – Central banking – National Income – Features with refer	- Credit inst ence to dev	rument - Mo relopina cou	onetary Intries.	Polic	y – Int	ternatio	nal trad	le – E	Balanc	ce of tr	ade ai	nd Bala	ance c	of Payr	nents	- tax	ation

Learning Resources	1. P.L 21s 2. J.P 3. P.N 4. C.M.C	. Mehta, "Managerial Economics- st Edition, 2019 . Mishra, "Business Economics", 3 A. Salwan, Priyanka Jindal, "Busin haudhary, "Business Economics",	Analysis, Problems & Cas Sahitya Bhavan Publication ress Economics – Second , RBSA Publishers, 13th E	res", Sultan Chand & Sons, ns, Agra, 2022 Edition", TAXMANN, 2022 dition, 2016.	<ol> <li>Zahid A khan: Er</li> <li>Francis Cherunil 2017.</li> <li>Panneer Selvam Delhi, 2013</li> <li>Nick Wilkinson, "Ma University Press, 2022</li> </ol>	ngineering Economy, "Engin am, "Business Environmen , R, "Engineering Economic nagerial Economics, Proble	neering Economy", Dorling F ", Himalaya Publishing Hou ss", Second Edition, PHI Lea em-Solving in a Digital Worl	Kindersley, 2012 se, Mumbai - 04, 25th Edition, arning Private Limited, New d – Second edition", Cambridge
Learning As	sessment			Continuous Learnir	Assessment (CLA)	10		
		Bloom's Level of Thinking	CLA-1 A	Formative verage of unit test (50%)	Life	Long Learning CLA-2 (10%)	S Fina (409	ummative   Examination 6 weightage)
			Theory	Practice	Theory	Practice	Theory	Practice
Level	1	Remember	20%	and the second second	20%		20%	-
Level	12	Understand	20%		20%		<mark>2</mark> 0%	-
Level	13	Apply	20%		20%		20%	-
Level	4	Analyze	20%		20%		20%	-
Level	15	Evaluate	10%	1	10%	- CP 2 - 1	10%	-
Level	16	Create	10%		10%	1. T. J. T. M.	<u> </u>	-
		Total		100 %	1.5	100 %	2	100 %

Course Designers			The state of the second s
Experts from Industry	Experts fr	rom Higher Technical Institutions	Internal Experts
1. Expert member from TCS	1.	Dr. N. Siva Sankaran, XLRI, Jamshedpur	1. Dr. Kumar. N, SRMIST
2. Mr. Madhan Raj, General Manager (Audit), Hyundai Motors India Ltd., Chennai	2.	Dr. Narasiman, IIM Bangalore	
3. Dr. T.N. Sekhar, CA, CIMA			



Course	21MGH102T	Course		Course	Н	HUMANITIES	L	Т	Р	С
Code		Name	FUNDAMENTALS OF MANAGEMENT	Category			3	0	0	3

Pre-requisite			Co- requisite			Progressive	
Courses	Nil		Courses	Nil		Courses	Nil
Course Offering	J Department	Faculty of Manage	ement		Data Book / Codes / Standards	Nil	

Course (CLR):	Learning Rationale	The purpose of learning this course is to:				Pro	gram	Out	come	es (PC	C)				P	Progra Speci	am ific
CLR-1 :	Acquire knowledge about	the historical evaluation and the fundamental concepts of Management	1	2	3	4	5	6	7	8	9	10	11	12	οι	utcon	nes
CLR-2 :	Develop an understanding	g of plannin <mark>g, Decision m</mark> aking tools and techniques.															1
CLR-3 :	Evolve practical application	on of org <mark>anizing and</mark> the staffing function.		1	2	of		sty	ability		×						
CLR-4 :	Enable the learners to pra	actice to be an effective leader and motivational concepts in an organization	ledge		ent of	tions	e	socie	stain		Worl		ance	_			
CLR-5 :	Exercise controlling techn	iques in an organization for measuring organizational performance and managerial actions.	Know	Ilysis	opme	estiga	Usac	r and	& Su		Team	ion	& Fin	aminç			
Course	Outcomes (CO):	At the end of this course, learners will be able to:		oblem Ana	esign/deve	onduct inve mplex prol	odern Tool	he enginee	Ivironment	hics	dividual & [.]	ommunicat	oject Mgt.	fe Long Le	so-1	SO-2	SO-3

											<u> </u>					
CO-1:	Understand the concepts related to management and current practice of Management		-	-	-	2	-	-	-	-	-	2	2	-	-	3
CO-2:	Use the techniques and tools of planning and make prudent decisions	2	2	3	2	1	-	-	-	-	-	2	-	-	2	2
CO-3:	Able to formulate effective organizational structure and Identify how organizations adapt to uncertain environment and learn the recruitment process	3	2		-	-	-	2	-	2	2	2	3	-	-	-
CO-4:	Practice concepts related to leadership, motivation and communication.	-		-	-	-	3	2	-	2	3	-	-	-	1	-
CO-5	Apply controlling techniques in husiness		3	3	2	2		2		-	-	3	2	_	1	3

#### Unit-1:

### 9 Hour

9 Hour

9 Hour

9 Hour

Management- definition-Different levels of Management -Functions of Management-Kinds of managers (Corporate, Business and Functional Managers)- Managerial roles-Managerial skills-Evolution of management-Prescientific Management Period-Principles of Scientific Management - Taylor principles- Henry Fayol contribution for management -14 principles -Trends of Management in global scenario-Challenges of Management in global scenario and generation of management in global scenario-Challenges of Management in global scenario-Challenges of Management in global scenario

#### Unit-2 :

Planning- Definition-Nature & purpose of planning-Benefits of Planning-Types of plans-Strategic & tactical Plan-planning process & The Planning Cycle-MBO -Need for Management by Objectives -Process of MBO-Decision making-Rational decision making-Decision Making Process-Decision Making Techniques -Decision support System-Individual decision making-Group decision making-Using groups to improve decision making-Managing Work teams

#### Unit-3:

Organization –Definition-Nature and characteristic of organizing-Organizational structure –meaning-Significance of Organization Structure-Types of Organizational structure-Types of organization & Organisational Culture-Span of control-Basis of power and authority-Delegation of authority-Centralization and decentralization-Departmentalization-Strategic business unit-Staffing - Meaning - Importance of staffing-Recruitment-Selection- Trainingperformance appraisal

#### Unit-4:

Leadership –meaning-Scope and Elements of Leadership-Approaches of Leadership-Leadership style-Skill requirements of leader-Qualities of Effective Leadership –Motivation-Nature and characteristics of motivation -Motivation theories -Applications of Motivational theories –Communication-Importance of effective communication -Kinds of communication-barriers in communication-How to improving communication-Avoiding pitfalls of communication

#### Unit-5:

Coordination-meaning-Principles of Coordination-importance of Coordination-Techniques of Coordination-Control -meaning-Control process-Requirements for effective control-Techniques of Managing Control-Types of control-Strategic Control-challenges in control-Management By Exception-Process of MBE-Principles of MBE-Management Information System-Management audit-Strategic management-Role of Strategy in Management

Learning Resources	1. 2. 3.	William/ Tripathi, MGMT - A south Asian Perspective, 1st edition, Cengage Learning, 2022 Dr.J.Jayasankar, Principles of Management, 1st edition, Margham Publications, 2021. P.C Tripathi & P.N Reddy, Principles of Management, 4thedition, Tata McGraw Hill, 2021.	4. 5. 6. 7.	Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition. L.M.Prasad, Principles and Practice of Management, 7ed, S.Chand Publishers, 2020Richard Daft, Principles of Management, 10th edition, Cengage Learning, 2021. https://lecturenotes.in/subject/62/principles-of-management-pom https://www.slideshare.net/ersmbalu/principles-of-management-lecture-notes

			Continuous Lear		Summative				
	Bloom's Level of Thinking	CLA-1 A	Formative verage of unit test (50%)	Life	Long Learning CLA-2 (10%)	Fina (40	l Examinative / Examination % weightage)		
		Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	20%		20%		20%	-		
Level 2	Understand	20%		20%		<mark>20</mark> %	-		
Level 3	Apply	20%		20%		20%	-		
Level 4	Analyze	20%	A DOLLARS	20%		20%	-		
Level 5	Evaluate	10%		10%	10 10 10 10	10%	-		
Level 6	Create	10%		10%	2 1 S	<mark>10%</mark>	-		
	Total		100 %		100 %		100 %		

Course Designers	The second second second		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
1. Expert member from TCS	1.Dr.Jayasanker,D.G Vaishnav college, Arumbakkam, Chennai	1. Dr.M.Srinivasan, SRMIST	
2. Mr.Rajan, CEO, XYZ private Ltd, Chenn <mark>ai. drraja</mark> n(	Dgmail.com	2. Dr.L Jayanthi, SRMIST	



B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-2(Revised-July2023)-First Year Syllabi-Control Copy

9 Hour

Course Code	21MGH103T Cou Na	urse me	BASICS OF A	CCOUNTING AND COSTING	Ca Ca	ourse tegory	Η					HUM	ANIT	IES					L 2	T 1	P 0	C 3
Pre-requ Cours	iisite Nil es		Co- requisite Courses	Nil		Progree	ssive ses	Nil														
Course O	itering Department	-acuity of Managem	ent	Data Book / Codes / Stand	ards	N																
Course I (CLR):	Learning Rationale	The purpose of le	earning this course	e is to:		11	9	2.4			Prog	gram	Outco	omes	(PO	)				Pr Si	ogran	n c
CLR-1 :	Understand the fundament	ntals of Accounting				Provide State		1	2	3	4	5	6	7	8	9	10	11	12	out	tcome	s
CLR-2 :	Gain knowledge on the b	asics and p <mark>reparatio</mark>	on of statutory final	ncial statements			1 m							,								
CLR-3 : Learn to analyse the financial statements using ratios					Ð			of		ety	ability		×									
CLR-4 : Understand the importance of costing and the method of preparation of cost sheet			vledg		ent of	tions	ge	socie	Istain		Wor		ance	6								
CLR-5 :	Study the technique of ma	he technique of marginal costing and budgetary control		Know	g Knov	lysis	elopm	vestiga oblems	ol Usaç	er and	nt & Su		, Tearr	ation	: & Fin	eamin						
Course (	Outcomes (CO):	At the end of this	s course, learners	will be able to:				Engineerin	Problem Ana	Design/dev solutions	Conduct inv complex pn	Modern To	The engine	Environme	Ethics	Individual 8	Communica	Project Mgt	Life Long L	PSO-1	PSO-2	PSO-3
CO-1:	Acquire the knowledge on	fo <mark>undations</mark> of acco	unting and accoun	ting cycle		1.0	-	2	-	-	1	-	-	3	2	-	-	-	3	-	-	-
CO-2:	Acquire the ability to prepa	re <mark> statutor</mark> y financia	l statements	ALL ALL ALL	1 20			-	-	-	3	3	-	3	1	2	3	3	3	-	2	-
CO-3:	Analyse the financial state	m <mark>ents usin</mark> g ratios		1 - 2 - 2 - 4 - 4 - 4 - 4 - 4 - 4 - 4 - 4				3	3	2	3	2	-	3	-	3	2	3	-	-	-	1
CO-4:	Appreciate the concepts of	Cost accounting sy	stems	a second and the second second				2	-	3		-	2	-	2	-	1	3	3	-	2	-
CO-5:	Apply the techniques of ma	ar <mark>ginal costi</mark> ng and b	oudgetary control			100	144	-	3	2	2	3	2	2	-	2	3	2	2	-	3	-
			201	Contract of the second se																		
Unit-1:											-										<u>9 H</u>	our
Introductio	n to Accounting: Concepts a Accounts. Golden rules of Ac	and Conventions - F counting – Journal E	-inancial Statemen Entry: sample prob	ts: Significance, interpretation – Accour lems – Ledger posting: sample problem	nting proces Is – Trail Ba	ss: steps i lance: sa	in acco mole p	ounting problei	g cycl ms – (	e, Booł Comput	keepin erized	ig, Ré Book	ecord S.	Main	ntena	ance -	– Princ	ciples	s of Ac	counti	ing: B	asic
Unit-2 :		<u> </u>					<u> </u>		1												9 H	our
Financial s	statements: Types, Significa with simple adjustments.	nce, and Contents –	- Final Accounts: F	Preparation of Trading Account – probler	ms with sim	ple adjus	tments	s, Prep	oaratio	on of Pe	&L acco	ount ·	- prot	blems	with	n simp	ole adj	ustm	ents, E	Balanc	e She	əet -
Unit-3:			1	TUT MEASIN	200			10.1	1	1											9 H	our
Ratio Anal ratio, Inter turnover -	lyses: Types, Significance al val measure (NWC ratio) - I Case Discussion	nd Characteristics – Leverage ratios: Tot	Benefits of Ratios al Debt ratio, D/E	s – Calculation of Ratios: Profitability rat ratio, Capital Equity ratio, Interest Cove	ios: Gross I erage ratio	Profit Rati -Turnover	io, Net r ratios	Profit : Inve	Ratic ntory	, ROI, turnove	ROE, P er ratio,	ROA, , Deb	EPS tor tu	, PE ı ırnove	ratio er, C	- Liq Collect	uidity tion pe	ratios eriod,	s: Curr Asset	ent ra s turn	itio, Q iover,	uick WC
Unit-4:																					9 H	our
Costing S Process C	ystems – meaning of cost; osting – meaning, applicatio	Types of costs - Ele n - Job Costing – m	ements of Cost – eaning, applicatior	Material, Labour and Overheads - Cost n ; Absorption Costing – meaning, applic	t sheet – si ation (only	mple prol theory).	blem -	Cost	Beha	vior an	d Cost	Alloc	catior	n (the	ory)	; Ove	erhead	l Allo	cation	- Unit	t Cosi	ting,
Unit-5:		•	÷																		<b>9 H</b>	our
Marginal C	Costing - Cost Volume Profit	(CVP) Analysis – us	ses, application; C	VP chart - Simple problems in CVP anal	ysis; ABC A	Analysis -	Budge	ts – n	neanir	ig, use	s, types	s (onl	y the	ory).								

	1.	Robert N Anthony, David Hawkins, Kenneth Merchant, Accounting: Texts and Cases,	4.	S.P. Jain and K.L. Narang, Cost Accounting: Principles and Practice, Paperback, Kalyani Publishers 2014
Learning	2.	Dr. Narayana Swamy, Financial Accounting for Managers, Tata McGraw Hill, 2021	5.	Case Study Materials: To be distributed for class discussion
Resources	3.	edition Eugene F. Brigham and Joel F. Houston, Fundamentals of Financial Management,	6.	Equity research reports published by Citi group, Barkley's and HSBC on fundamental analysis; Also book titled "Balance sheet reading" by Dun and Brad street and YouTube videos on how to
		14th Edition, Cengage Learning India Pvt. Ltd., 2021.		read a Balance Sheet
Learning Ass	sessment			

		1.00	Continuous Lean		Summotivo				
	Bloom's Level of T <mark>hinking</mark>	CLA-1 A	Formative verage of unit test (50%)	Life	Long Learning CLA-2 (10%)	Fina (40	l Examinative % weightage)		
		Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	20%		20%		20%	-		
Level 2	Understand	20%		20%		20%	-		
Level 3	Apply	20%	172 C - 4	20%		20%	-		
Level 4	Analyze	20%		20%	the state of the s	<mark>20%</mark>	-		
Level 5	Evaluate	10%	A COLSA	10%		10%	-		
Level 6	Create	10%		10%	10 - C - C - C - C - C - C - C - C - C -	10%	-		
	Total		100 %	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	100 %		100 %		

Course Designers	The second of the second	2.5 Stars 200	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
1. Expert member from TCS	Dr. N. Siva Sankaran, XLRI, Jamshedpur	Dr. Maria Evelyn Jucunda. M	
2. Mr. Madhan Raj, General Manager (Audit), Hyundai Motors India Ltd., Chennai	Dr. Narasiman, IIM Bangalore		
3. Dr. T.N. Sekhar, CA, CIMA			





Course Code	21BTB102T         Course Name         INTRODUCTION TO COMPUTATIONAL BIOLOGY         Cou Categories	urse gory	В			BA	SIC S	CIEI	NCES				L 2	T 0	P C 0 2
Pre-requi Course	site Co- requisite I S Nil Courses Nil	Progress Course	sive es <i>Ni</i>												
Course Off	ering Department Biotechnology Data Book / Codes / Standards N	Vil													
Course L	earning Rationale (CLR): The purpose of learning this course is to:	1				Prog	ram (	Dutco	omes	(PO)				P	rogram
CLR-1 :	Explain the cell structure and function from its organization		1	2	3	4	5	6	7	8 9	10	11	12	S	pecific tcomes
CLR-2 :	Define the molecular and biochemical basis of an organism and the impact of human genome project					of		ty						00	
CLR-3 :	Discuss protein structure and its prediction		edae		int of	ions	Θ	socie		Work		ance	_		
CLR-4 :	R-4 : Acquire knowledge of neurons and workings of the brain				opme	stigat lems	Usag	and	ð	eam	ы	& Fina	aming		
CLR-5 :	.R-5 : Impart the knowledge of immune system and prediction of vaccines				devel	t inve k prob	Tool	gineer	ahility	al & T	nicati	Mgt. 8	ig Lea		
			dinee	oblem	sign/	mpley	dem	e enc	stain:	lividu	nmm	oject	e Lon	0-1	0-2 0-3
Course C	Dutcomes (CO): At the end of this course, learners will be able to:		<u> </u>	đ	۵ S	<u> </u>	ž	F			ů č	Ę	Lif	6	
CO-1:	Correlate cell growth, reprodu <mark>ction, an</mark> d differentiation	1.1	1.0	-	-	1	-	-	-		-	-	-	-	
CO-2:	Categorize the concepts and principles of biochemistry and relate their application in genomics	14	2	-	-	2	-	-	-		-	-	-	-	
CO-3:	Solve protein sequence analysis and biological structure prediction using computing techniques		2	3	-	1	3	-	-		-	-	-	-	
CO-4:	Integrate neuronal mechanisms and computer applications that replicate its workings	1	3	2	2	1	3	-	-		-	-	-	-	
CO-5:	Integrate the immune system and its workings to predict vaccine candidates	1 m - 1	3	-	2	2	3	-	-		-	-	-	-	
Unit-1 : ( Cell theory,	Cell and evolution Whitaker's kingdom classification, cell organelles, and their functions, homeostasis, Replication and cell Division, tissu	ue differe	entiation,	stem c	ells and	their a	applic	ation	s, ger	netic a	lgorithr	ns.			6 Hour
Unit-2 : B	asics in biochemistry	omioo Co	~~~~~	databa		OT to									6 Hour
Unit-3: St	ructure biology	UIIIICS, SE	equence	ualava	SES, DLA	137 100	).								6 Hour
Protein syn	thesis, Secondary structure of the protein, Structure and function, Structural databases, protein visualizing tools, Secon	ndary str	ucture p	edictio	n algoriti	hms									••
Unit-4 : N	eurobiology			-											6 Hour
Basic of Ne	urons, glial cells, Brain and its parts, Artificial neural networks, concepts, and differences with biological neural networ	rks. – use	es of AN	V, maci	nine lear	rning <mark>, a</mark>	nd da	ta m	ining i	in biolo	ogy				
Unit-5: Imi	nunobiology			11	1										6 Hour
Elements of	f the immune system, Types of the immune response, Active and passive immunity, Immunoinformatics, epitope predi	liction too	ols												
Learning Resources	<ol> <li>Thyagarajan S, N.Selvamurugan, R.A.Nazeeret.al., Biology for engineers McGraw Hill 3. Norman Education. 2012</li> <li>Parish, and Twyman, Instant notes, Bioinformatics, Westhead (1st edition), Bios Scientific Publishers Ltd., 2003</li> </ol>	n Lewis, w-Hill Edu K. Attwo il, Marke <mark>t</mark>	Gabi Nin ucation. od, D <mark>avi</mark> a J., and	dl Wait 2007 d Parry Jerem	e, Lee F -Smith, I / O. Bau	R. Waite Introduc Im. Unc	e et.al ction t dersta	., Ap o Bio ndin	plied binforr g Bioi	Cell a matics	nd Mol Pears atics. G	ecular on Edu Garland	Biolog ication Sciend	y for L ,2001 ce, 20	Engineers.

rning Assessme	ent											
			Continuous Learn	ing Assessment (CLA)			Summotivo					
	Bloom's Level of Thinking	CLA-1 A	Formative <mark>verage</mark> of unit test (50%)	Life	Fina (40	al Examinative % weightage)						
		Theory	Practice	Theory	Practice	Theory	Practice					
Level 1	Remember	15%		15%	-	15%	-					
Level 2	Understand	25%		20%	A 2	25%	-					
Level 3	Apply	30%		25%	10	30%	-					
Level 4	Analyze	30%	-	25%		30%	-					
Level 5	Evaluate		Contraction of the local division of the loc	10%		- 1	-					
Level 6	Create			5%			-					
	Total	1 No. 10	100 %	Sec. 1 - Sec.	100 %		100 %					

Course Designers		Total International Contraction of the International Contractional Contractionae Contractionae Contractionae Contractionae Contrac
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. C. N. Ramchand, Saksin Life sciences, ramchand@saksinlife.com	1. Dr. K Subramaniam, IITM Chennai, subbu@iitm.ac.in	1. Dr. Priya Swaminathan, SRM IST
2. Dr. S. Sam Gunasekar, Orchid Pharma Ltd.,sam@orchidpharma.com	2. Dr. R. B. Narayanan, Anna university, arbeen09@gmail.com	2. Dr. Jagannathan K SRM IST


Course Code	code       21BTB103T       Course Name       Course Name       BIOLOGY       Course Category       B       BASIC SCIENCES       L       T       P       C         2       0       0       2       0       0       2																			
Pre-requ Course Course Of	isite es <i>Nil</i> fering Department	Biotech	Co- requisite Courses	Nil Data Boo	ok / Codes / Standards	Progress Course Nil	sive es <i>Nil</i>													
Course I	earning Rational	le (CLR):	The purp <mark>ose of learning</mark> this	s course is to:		1.1				Prog	ram (	Jutcom	es (Po	C)				Р	rogra	m
CLR-1 :	Describe the cell s	tructure and i	function and its organization	1.11			1	2	3	4	5	6 7	8	9	10	11	12	S	pecifi	IC es
CLR-2 :	Explain the molecu	ular and bioch	nemical basis of an organism					1		of		⋧								00
CLR-3 :	Acquire knowledge	e of microbial	implications in disease and in h	nealth	1 (253, 2017)		edge	1	nt of	ous	d)	socie		Work		ance				
CLR-4 :	Define biosensors	and its enviro	onmental and clinical application	าร		1.	Inow	ysis	opme	stigat ems	Jsag	ands		eam	R	Fina	ming			
CLR-5 :	Acquire knowledge	e of mechanic	al motors within the cell and bio	ologically nontoxic bior	materials	1.11	- N	Anal	develo	inves	Tool	ineer ment {		al & T	nicatio	Agt. 8	g Lea			
	2 -2 -1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0																			
Course (	purse Outcomes (CO): At the end of this course, learners will be able to: 요 같 홈 홈 ㅎ ㅎ ㅎ ㅎ ㅎ ㅎ ㅎ ㅎ ㅎ ㅎ ㅎ ㅎ ㅎ ㅎ ㅎ ㅎ ㅎ										PS									
CO-1:	Explain cell growth,	replication, re	eproduction, and differentiation	with the potential of ste	em cells	1.1.1	2	-	-	1	-		-	-	-	-	-	-	-	-
CO-2:	Integrate the concep	ots and p <mark>rinci</mark>	<mark>ples o</mark> f biochemistry in health	and the second	294223024	- 1 C.Y.	2	-	-	-	-		-	-	-	-	-	-	-	-
CO-3:	Relate microbes and	d their us <mark>efulr</mark>	n <mark>ess</mark> in human health and indus	trialization			2	3	-	100	-		-	-	-	-	-	-	-	-
CO-4:	Apply the knowledge	e on bios <mark>enso</mark>	o <mark>rs a</mark> nd molecular motor in appl	ications of human hea	Ith and the environmen	t	3	2	2	-	-		-	-	-	-	-	-	-	-
CO-5:	Elaborate biomateri	als with applic	cations in biomimetics	a state of the	11.11	a straight	3	-	2	-	-		-	-	-	-	-	-	-	-
Unit-1 ·	Cell: Basic Unit (	of Life				Ente	10			-									6 H	lour
Organelles	of cells, cell cycle, C	Cell division a	nd differentiation, Stem cells -	types and application	15					-			_							oui
Unit-2 : I	Macromolecules	and Metab	olism					J											6 H	lour
Structure of	of carbohydrates, lipio	ds, proteins <mark>, e</mark>	enzymes, DNA, and RNA. Meta	bolism of glucose, ami	ino acids, an <mark>d Fatt</mark> y ac	id; Photosynthesis	6													
Unit-3: M	icrobiology in Hu	ıman Life							100										<u>6 H</u>	lour
Medical Mi	crobiology: Pathoger	nic microorgai	nis <mark>ms: Bacte</mark> ria and Virus; Antik	piotics; Vaccines; Envir	ronmental Microbiology	r; Industrial Microb	biology	1	1-											
Unit-4 :	Basics of Bioser	isors and I	Nolecular Motors		1		<i>[</i> ]    .												6 H	lour
Types of B	iosensors, componei	nts of biosens rial and its	ors, and medical applications o	t biosensors. Linear m	iotors: actin and myosi	n, rotatory motors.	: flagella	motor a	and ATF	ase									6 4	lour
Properties	of biomaterials, type	es of biomater	ials, biomimetics in dental and l	bone applications		W th														Jui
Learning	1. Thyagara MK Jaga	ajan S, N.Selv Inathan ., Biol	vamurugan, MP Rajesh, RA.Na. ogy for engineers McGraw Hill	zeer Richard W Thilag Education. 2012	araj, S Barathi,	Michael J Pelcza	ar, EC <mark>S (</mark>	han, N	loel R K	rieg M	icrobi	iology, 1	ata N	1cGra	w-Hill,	2019	)			

 Resources
 2.
 Norman Lewis, Gabi Nindl Waite, Lee R. Waite et.al., Applied Cell and Molecular Biology for Engineers. McGraw-Hill Education. 2007
 3.
 Michael J Pelczar, ECS Chan, Noel R Krieg Microbid

Learning Assessment	ł											
			Continuous Learni	ng Assessment (CLA)		c	ummotivo					
	Bloom's Level of Thinking	CLA-1 A	Formative verage of unit test (50%)	Life	Long Learning CLA-2 – (10%)	Final Examination (40% weightage)						
		Theory	Practice	Theory	Practice	Theory	Practice					
Level 1	Remember	15%		15%		15%	-					
Level 2	Understand	25%		20%		25%	-					
Level 3	Apply	30%	No. of Concession, Name	25%	1 A	30%	-					
Level 4	Analyze	30%	· · · ·	25%		30%	-					
Level 5	Evaluate		and the second second	10%		-	-					
Level 6	Create			5%		-	-					
	Total	and the second	100 %	1. / - Star	100 %		100 %					
		1 × 1	and the state of the									

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. C. N. Ramchand, Saksin Life sciences, ramchand@saksinlife.com	1. Dr. K Subramaniam, IITM Chennai, subbu@iitm.ac.in	1. Dr. Lilly M Saleena, SRM IST
2. Dr. S. Sam Gunasekar, Orchid Pharma Ltd.,sam@orchidpharma.com	2. Dr. R. B. Narayanan, Anna university, arbeen09@gmail.com	2. Dr. S Barathi, SRM IST



Course Code	ourse       21BTB104T       Course       BASIC SCIENCES       L       T       P       C         Code       Name       BIOLOGY: HUMAN PHYSIOLOGY AND ANATOMY       Course Category       B       BASIC SCIENCES       L       T       P       C																								
Pre-requ Cours	isite es <i>Nil</i>			Co- requisi Course <mark>s</mark>	te _{Nil}					Progr	essive Irses	Nil													
Course Of	fering Department	Biotech	hnology			Data B	3ook / Codes	s / Standard	ds	Nil															
						-	_			1000															-
Course I	Learning Rationa	le (CLR):	The pur	pose of learning	g this course	e is to:				1.1					Pro	gram	Outco	mes (l	PO)				F	'rograi	m
CLR-1 :	Understand basic	human body f	functions <mark>an</mark>	<mark>d life proce</mark> sses	5	12.00	-			-	1	1	2	3	4	5	6	7 8	9	10	11	12	01	utcom	ies
CLR-2 :	Familiarize the cor	ncepts of card	diac a <mark>nd ner</mark>	<mark>vous sys</mark> tems	Sec. 1							0			ď		ty		~						
CLR-3 :	Gain knowledge a	bout functions	s o <mark>f respirat</mark> e	ory and muscule	oskeletal sy:	vstems	182	5.23	ä.,			rledge		ent of	tions	ge	socie		Work		ance	D			
CLR-4 :	Explain the structu	ire and functio	on <mark>s o</mark> f diges	tive systems an	d excretory	v systems	100 C					Non	ysis	mdc	stiga	Usa	and	5	earr	Б	Fin	min			
CLR-5 :	Attain the knowled	lge about ea <mark>r,</mark>	<mark>, eye and</mark> en	docrine system	IS		2.5.22	100	5	1		ering k	n Anal	develo	t inves x prob	Tool	gineer	ahilitv	lal & T	nicati	Mgt. 8	ng Lea			
				-			5.00	1.53		1		gine	bler	sign	nduc	derr	e en	stain ine	ividi	ШШ	oject	e Loi	0-1	0-2	0-3
Course (	Jutcomes (CO):		At the e	nd of this cours	e, learners	will be able to	to:		-0.		1.1	Ш	P	Sol De	SS	Mo	μ	i J d	n pu	රි	Pro	Life	PS	R	PS
CO-1:	Explain the human I	body fun <mark>ctions</mark>	<mark>s and</mark> life pr	ocesses		10.00	1.00	Sugar.			1.	3	-	-	1	-	-		-	-	-	-	-	-	-
CO-2:	Analyze the phenon	nena tak <mark>ing pl</mark>	l <mark>ace</mark> in the c	ardiovascular a	and nervous	s system	1 S.M.	5.352	257	1.1	1	2	-	-	-	-	-		-	-	-	-	-	-	-
CO-3:	Explain the process	taking p <mark>lace i</mark>	<mark>in th</mark> e respir	atory musculos	keletal syste	em					100	3	2	-	100	-	-		-	-	-	-	-	-	-
CO-4:	Elaborate the struct	ure and f <mark>unct</mark> i	<mark>ion o</mark> f diges	tive and excrete	ory systems	S	C THE	199		-		2	-	-	-	-	-		-	-	-	-	-	-	-
CO-5:	Summarize the stru	cture an <mark>d func</mark>	ction of visio	n, auditory and	endocrine g	glands	-			100	10	3	2	-	-	-	-		-	-	-	-	-	-	-
Unit-1 : C	ell and Circulatory	System		and the second s		1.11	-		10	100	Chu	-			-				-					6 H	lour
The function	on of the cell, Membr	ane, resting p	potential of a	cell, Action po	tential of a stimation of	cell, Phases	of action pot	otential, Pro	pagatio	n of actio	on poter	ntials,	The G	oldma	n-Hodg	gkin-K	atz eq	uatior	i, Bloo	od cell	- com	positio	n, ori	gin of	WBC
Unit-2 · Ca	ardiovascular Svste	m and Nervo	us System	ioou groups, Es	sumation of	bioou compe	JITEIIIS							-	-									6 4	lour
Blood vess	sels – Artery, capillar	y and vein, He	leart structu	re, Cardiac cycl	le, Cardiac (	cycle - grap	phs, Cardiac	: output, Co	oronary	circulatio	n, Nerv	ous s	ystem	Orgar	nization	of th	e brai	n, spir	nal co	rd, Str	ıcture,	, and f	unctic	on of n	nerve
IInit. ?	Respiratory System	and Musculo	o Skeletal S	vetem	1	-	-	-						1										6 4	lour
Lungs-in d	letail, Ventilator volur	nes – Adult hi	numa <mark>n spiro</mark> g	<mark>gram</mark> , Mechanic	cs of breath	ning, Control	of ventilation	n, Mechanis	ism of g	as excha	nge, M	uscles	s – Sk	eletal r	nuscle,	Phys	siology	of m	uscle	contra	ctions,	Slidin	g bric	lge the	eory,
Unit-4 · D	igestive System and	d Excretory S	System		1200	1.1-1-1	1.1.1.1.1					UT:												6 F	lour
Salivary gl	ands – Saliva, Tong	ue – Taste, G	GI tract, Dig	estion at the st	omach, Dig	gestion at the	e intestines, i	Accessory	organs	of Diges	tion, Fu	inctio	n of b	le, gall	bladd	er, pa	ncrea	s, Meo	chanis	sm of	ırine f	ormati	on, U	rine re	eflex,
Structure a	and function of skin, s	weat gland, T	Temperature	regulation					Ū	Ū								-							
Unit-5: Se	nsory Organs and E	Endocrine Gla	ands																					<u>6 H</u>	lour
The optic r body, Hom	nerve, optic chiasm, c neostasis of calcium i	optic tract, Visi n the body	sion pathway	, Structure and	function of	ear, Auditory	y pathway, Ei	Endocrine G	Glans-Ov	verall fund	ctions, I	Pituita	ry gla	nds, Pa	arathyro	oid gla	ands, i	Adrena	al glar	nds, H	omeos	tasis c	f Glu	cose ii	n the
Learning Resource	s 1. Sar S.C	ada Subrama Chand & Comp	anyam, K. I pany, 5th eo	Nadhavan Kutt	y and H.D.	. Singh, "Tex	xtbook of hu	uman physi	iology",	4.	J. G editi	ibson on, 19	, "Moc 981.	lern ph	ysiolog	y and	d anat	omy fo	or nur	ses", E	lackw	ell SC	Publ	ishing,	, 2nd

2.	Ranganathan T.S., "Textbook of human anatomy", S.Chand & Co. Ltd., Delhi, 5th edition, 2014.	5.	Arthur. C. Guyton, John E Hall, "Textbook of medical physiology", W.B. Saunders
3.	Tobin, C.E., "Basic human anatomy", McGraw-Hill Publishing Co. Ltd., Delhi, 2nd edition, 1997.		Company, 11th edition, 2000

			Continuous Learnir	g Assessment (CLA)			Summetive
	Bloom's Level of Thinking	CLA-1 A	Formative verage of unit test (50%)	Life	Long Learning CLA-2 – (10%)	- Fina (409	l Examination % weightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	State of the second second	15%		15%	-
Level 2	Understand	25%		20%		25%	-
Level 3	Apply	30%	and the second second	25%		30%	-
Level 4	Analyze	30%	and the second second	25%		30%	-
Level 5	Evaluate	S		10%		-	-
Level 6	Create			5%	and the second sec		-
	Total		100 %		100 %		100 %

Course Designers		100 C
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. C. N. Ramchand, Saksin Life sciences, ramchand@saksinlife.com	1. Dr. K Subramaniam, IITM Chennai, subbu@iitm.ac.in	1. Dr. Varshini Karthik, SRM IST
2. Dr. S. Sam Gunasekar, Orchid Pharma Ltd.,sam@orchidpharma.com	2. Dr. R. B. Narayanan, Anna university, arbeen09@gmail.com	2. Dr. P Muthu, SRM IST



Course Code21BTB105T NameCourse CELL BIOLOGYCourse Cell BIOLOGYB Course CategoryB BASIC SCIENCESLTPC C2002										C 2										
Pre-requi	isite es <i>Nil</i>		Co- requisite Courses Nil		Progre	essive rses	Nil													
Course Of	fering Department	Biotechno	logy Data	Book / Codes / Standards	[NII															
Course I	earning Ration	ale (CLR):	The purpose of learning this course is to:	Province of	1.1					Progr	am O	utcom	es (Po	0)				P	ograr	n
CLR-1 :	Provide the basic	c concepts and un	derstanding of cell structure and function			0	1	2	3	4	5	6 7	8	9	10	11	12	S	pecifi tcom	)
CLR-2 :	Explain the differ	ent strategies of t	he organization of organelles		-		1			đ		~	1					00		.0
CLR-3 :	Familiarize the c	oncepts of structu	Iral and functional orientation in eukaryotes	124.5.000			edge	1	nt of	ouso	0	ociet		Nork		nce				
CLR-4 : Serve as a platform to study the molecular mechanism of cellular transport							/sis	bmei	tigati ems	Jsage	ands		am /	Ę	Fina	ning				
CLR-5: Integrate the applications of different receptors and their role in diseases																				
Course Outcomes (CO): At the end of this course, learners will be able to:									Con	Proj	Life	PSC	PSC	PSC						
CO-1:	D-1: Explicate the fundamentals of cell biology.						2	-	3	-	-		-	-	-	-	-	-	3	3
CO-2:	Relate cell structur	res and fu <mark>nctions</mark>	and the second second	<ul> <li>Construction</li> </ul>	1.1.1	1	-	-	3	3	-		-	-	-	-	-	-	3	3
CO-3:	Explain the basis o	of cell stru <mark>cture an</mark>	d its function in cell development and death.	1000 000 000	1.84	1	-	-	-	3	2		-	-	-	-	-	-	3	3
CO-4:	Describe the steps	s involved <mark>in cell-c</mark>	ell signaling in mammalian cell systems.	SHOL ALL	199		-	-	3	3	-		-	-	-	-	-	-	2	3
CO-5:	Critique the fundar	mentals a <mark>nd relate</mark>	with the advances in the various areas of diag	nostic and therapeutic applic	ations of cell	s	-	3	-	3	-		-	-	-	-	-	-	3	3
Unit-1 : A	n Overview of Cell	ls and Cell Resea	arch		Er:	2	-			-	_								6 H	our
Origin and	evolution of cells, C	Drigin of Pro <mark>karyot</mark>	tes, Eukaryotes and Development of multicellula	ar organisms; Ce <mark>lls as e</mark> xperi	mental mode	els; Too	ols of c	ell bi <mark>o</mark> l	ogy, Mo	olecula	r com	positio	<mark>n o</mark> f c	cells, (	Cell m	embra	ane			
Unit-2 : Ce	II, Structure and F	Function-I																	6 H	our
Nucleus, E	ndoplasmic reticulu	im, Golgi apparati	Is, Lysosomes, Mitochondria, Chioropiasts and	Peroxisomes				-	-		-	-							6 11	0.UF
Cvtoskeleto	on: Actin and myosi	in filaments Interr	mediate filaments and Microtubules: Transport	of molecule: Cell-cell interacti	ions: Adhesic	on iunc	tions t	iaht iu	nctions	aan ii	Inctio	ns							0 П	our
Unit-4 : Co	ell Sianalina				one. Manook	Jii juito	liono, i	igneja	notiono,	, gap je									6 H	our
General pri	nciples of cell signa	aling-Modes of cel	ll- <mark>cell signalin</mark> g, Pathways of intracellular signal	transduction-function of cell	surface rece	otors; (	SPCR	pathwa	ay, MAR	PK patl	hway									
Unit-5: Cel	ll Regulation		- / J. L. J.	18.1.21.11	D	100													6 H	our
Cell division	n, Cell cycle and its	regulation; Mitos	is, Meio <mark>sis; Cell dea</mark> th: Necrosis, Apoptosis; Ca	ncer-Introduction to cancer, t	types of cano	cer, Ep	thelial	cell ca	ncer; S	tem ce	ells an	d its th	erape	eutic a	applica	tions.				
Learning Resource	1. Channa s 2. Rastogi	arayappa, "Cell bio i, S.C, "Cell biolog	ology," Universities Press, 2010. y," New Age International Publishers, 2005.	3.	Thyagara Jaganatha McGraw I	jan S, I an ., Bi Hill Edu	V.Selv ology i i <mark>cation</mark>	amuru for eng Pvt. L	gan, Mi iineers I td., Nev	<mark>P R</mark> aje: McGra w Delhi	sh, RA w Hill i, 201	A.Naze Educa 2	er Ric tion. 1	chard 2012'	W Th Biolog	ilagara ıy for l	aj, S B Engine	arathi ers "	MK Tata	

McGraw Hill Education Pvt. Ltd., New Delhi, 2012 4. .Ajoy Paul, "Textbook of cell and molecular biology", Second edition, Books & Allied (P) Ltd., 2009.

Learning Assessme	nt						
			Continuous Lea	arning Assessment (CLA)			Summativa
	Bloom's Level of Thinking	CLA-1 A	Formative verage of unit test (50%)	Life	Long Learning CLA-2 (10%)	Fina (40)	I Examinative K weightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	V	15%	1 A	15%	-
Level 2	Understand	25%	· · ·	20%	11.	25%	-
Level 3	Apply	30%	de la constance	25%		30%	-
Level 4	Analyze	30%		25%		30%	-
Level 5	Evaluate		1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	10%		-	-
Level 6	Create	~		5%		-	-
	Total		100 %		100 %		100 %
		S		A CONTRACT			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Inte <mark>rnal Expe</mark> rts
1. Dr. C. N. Ramchand, Saksin Life sciences, ramchand@saksinlife.com	1. Dr. K Subramaniam, IITM Chennai, subbu@iitm.ac.in	1. Dr.S. Sujatha SRM IST
2. Dr. S. Sam Gunasekar, Orchid Pharma Ltd.,sam@orchidpharma.com	2. Dr. R. B. Narayanan, Anna university, arbeen09@gmail.com	2. Dr. K Venkatesan SRM IST



Course Code	21MAB101T	21MAB101T     Course Name     CALCULUS AND LINEAR ALGEBRA     Course Category     B     BASIC SCIENCES     L     T     P     C       3     1     0     4																
Pre-requ Cours Course O	uisite Nil es ffering Department	Mathematics	Co- requisite Nil Courses Data Book / Codes	/ Standards Nil	ssive Nil ses													
								_			(5						Drogre	
Course	Learning Rational	le (CLR): The	e purpose of learning this course is to:					Prog	ram (	Jutcol	nes (P	(O'					Snaci	fic
CLR-1 :	Apply the concept	of Matrices in proble	em <mark>s of Scien</mark> ce and Engineering		1	2	3	4	5	6	7 8	9	10	11	12	0	utcon	nes
CLR-2 :	Utilize Taylor serie	es, Maxima minima,	composite function and Jacobian in solving various Eng	neering problems				of		ity		~						
CLR-3 :	Apply the concept	of Differential Equa	tions in problems of Science and Engineering	5 S P 5	ledge	1	int of	ions	Φ	socie		Worl		ance				
CLR-4 :	Utilize the concept	s of radius of <mark>curvat</mark>	<mark>rre,</mark> evolute, envelope in problems of Science and Engine	eering	Know	ysis	opme	stigat lems	Usag	and		eam	uc	k Fina	rning			
CLR-5 :	Apply the Sequence	ces and Seri <mark>es conce</mark>	epts in Science and Engineering		ering h	m Anal	n/devel	ct inve ex prob	n Tool	ngineer	vhilith	ual & T	unicati	t Mgt. 8	ng Lea			
Course	Outcomes (CO):	Ati	the end of this course, learners will be able to:		Engine	Proble	Design solutio	Condu comple	Moden	The en Enviroi	<u>Sustair</u> Ethics	Individ	Comm	Project	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Apply the concepts	of Matric <mark>es to find</mark> Ei	genvalues and Eigen Vectors problems solving in Science	e and Engineering	3	3	-	1	-	-		-	-	-	-	-	-	-
CO-2:	Apply Maxima and M	Ainima, <mark>Jacobian,</mark> ar	nd Taylor series to solve problems in Science and Engine	ering	3	3	-	-	-	-		-	-	-	-	-	-	-
CO-3:	Solve the different ty	/pes_Dif <mark>ferential</mark> Equ	uations in Science and Engineering applications	Sec. 18. 18.	3	3	-	1	-	-		-	-	-	-	-	-	-
CO-4:	Identify Radius, Cer	ntre, env <mark>elope_an</mark> d C	Circle of curvature and apply them in Science and Engine	ering	3	3	-	-	-	-		-	-	-	-	-	-	-
CO-5:	Identify convergence	e and div <mark>ergence</mark> of	series using different tests in Engineering applications	and the second	3	3	-	-	-	-		-	-	-	-	-	-	-
				and the second second	100													

Unit-1 : Matrices

12 Hour

12 Hour

12 Hour

12 Hour

Characteristic equation – Eigen values and eigen vectors of a real matrix – Properties of eigen values – Cayley – Hamilton theorem – Orthogonal reduction of a symmetric matrix to diagonal form – Orthogonal matrices – Reduction of quadratic form to canonical form by orthogonal transformations.

# Unit-2 : Functions of Several variables

Function of two variables-Partial derivatives - Total differential - Taylor's expansion with two variables up to second order terms -Maxima and Minima - Constrained Maxima and Minima by Lagrangian Multiplier - Jacobians of two Variables - Jacobians Problems - Properties of Jacobians and Problems

#### Unit-3: Ordinary Differential Equations

Linear equations of second order with constant coefficients when PI=0 or exponential - Linear equations of second order with constant coefficients when PI=polynomial Linear equations of second order with constant coefficients when PI=polynomial Linear equations of second order with constant coefficients when PI=polynomial Linear equations of second order with constant coefficients when PI=polynomial Linear equations of second order with constant coefficients when PI=polynomial - Linear equations of second order with constant coefficients when PI=polynomial with sinax or Cosax - Linear equations of second order with constant coefficients when PI=polynomial with sinhax or coshax - Linear equations of second order with constant coefficients - Linear equations of second order variable coefficients - Linear equations of second order variable coefficients - Linear equations of second order variable coefficients - Linear equations of Euler type - Homogeneous equation of Legendre's Type - Homogeneous equation of Legendre's Type - Homogeneous form - Equations reducible to homogeneous form - Equations reducible to homogeneous form - Equations of parameters - Variation of parameters - Simultaneous first order with constant coefficient. - Simultaneous first order with constant coefficient. - Simultaneous first order with constant coefficient.

#### Unit-4 : Differential Calculus and Beta Gamma Functions

Radius of Curvature – Cartesian coordinates - Radius of Curvature – Polar coordinates - Circle of curvature - Centre of curvature - Evolute of a parabola - Evolute of an ellipse - Envelope of standard curves - Beta Gamma Functions - Beta Gamma Functions and Their Properties Sequences – Definition and Examples - Series – Types of Convergence - Series of Five terms – Test of Convergence - Comparison test – Integral test

### Unit-5: Sequence and Series

Series of Five terms – Test of Convergence- Comparison test – Integral test- Comparison test – Integral test- Comparison test – Integral test-. D'Alemberts Ratio test ,D'Alemberts Ratio test , Raabe's root test. - Convergent of Exponential Series - Cauchy's Root test - Log test Log test - Alternating Series: Leibnitz test - Series of positive and Negative terms. - Absolute Convergence - Conditional Convergence

Learning Resources	1. 2. 3.	Erwin kreyszig, Advanced Engineering Mathem <mark>atics, 9th Edition, Joh</mark> n Wiley & Sons,2006. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008
-----------------------	----------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010
 G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002
 N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008

earning Assessme	ent	100			12.						
			Continuous Lea	Summative							
	Bloom's Level of Thin <mark>king</mark>	CLA-1	Formative Average of unit test (50%)	Life	Long Learning CLA-2 – (10%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%	10000	20%		20%	-				
Level 2	Understand	20%		20%		20%	-				
Level 3	Apply	30%		30%		30%	-				
Level 4	Analyze	30%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	30%		30%	-				
Level 5	Evaluate	-	and the second se			-	-				
Level 6	Create	1 · · ·	A Lot Card	Contract in the second		-	-				
	Total		100 %		100 %		100 %				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.V.Maheshwaran, CTS, Chennai, maheshwaranv@yahoo.com	1. Dr.K.C.Sivakumar, IIT Madras, kcskumar@iitm.ac.in	1. Dr.A.Govindarajan, SRMIST
	2. Dr.Y V S S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.i	in 2. Dr. N. Balaji, SRMIST



B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-2(Revised-July2023)-First Year Syllabi-Control Copy

Course	21MAB102T	Course		Course		BASIC SCIENCES	L	Т	Ρ	С
Code		Name	ADVANCED CALCULUS AND COMPLEX ANALTSIS	Category	В		3	1	0	4

Pre-requisite			Co- requisite			Progressive	
Courses	Nil		Courses	Nil		Courses	Nil
Course Offering	Department	Mathematics			Data Book / Codes / Standards	Nil	

Course	Learning Rationale (CLR): The purpose of learning this course is to:				Pro	gram	Out	come	s (PC	C)				F	Progra	am
CLR-1 :	Determine the Double and triple Integral and apply then in problems in Science and Engineering.	1	2	3	4	5	6	7	8	9	10	11	12	0	utcor	nes
CLR-2 :	Gain knowledge in interpretation of vector differentiation and vector integration which relates line integral, Green's, Stoke's and Gauss divergent theorem.			ų,				oility								
CLR-3 :	Identify the techniques of Laplace Transforms and inverse transform and extend them in the problems of Science and Engineering	ledge	1	ent of	tions of	ge	society	stainat		Work		ance	-			I
CLR-4 :	Construct the analytic function, discuss conformal mapping and bilinear transformation in Engineering Problems	Know	lysis	opme	stiga	Usaç	and	& Su		Feam	uo	& Fin	arninę			I
CLR-5 :	Evaluate complex integrals and power series using various theorems	ring	Ana	devel	inve	Tool	ineer	ment		al & T	nicati	Mgt.	g Le			I
Course	Outcomes (CO): At the end of this course, learners will be able to:	Enginee	Problem	Design/o	Conduct	Modern	The eng	Environ	Ethics	Individua	Commu	Project I	Life Lon	PSO-1	PSO-2	PSO-3
CO-1:	Apply multiple integrals in solving problems in Science and Engineering	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Analyze vector differentiation and vector integration and related theorems	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Apply Laplace transform tec <mark>hniques i</mark> n solving Engineering problems	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Utilize complex integrals and power series in solving engineering problems	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Apply multiple integrals in solving problems in Science and Engineering	3	- 3	-	-	-	-	-	-	-	-	-	-	-	-	-

#### Unit-1 : Integral Calculus

Evaluation of double integration Cartesian and plane polar coordinates - Evaluation of double integration of plane polar coordinates. Evaluation of double integrat by changing of order of integration - Evaluation of double integral by changing of order of integration - Evaluation of double integral by changing of order of integration - Evaluation of double integral by changing of order of integration - Evaluation of double integral by changing of order of integration - Evaluation of double integral by changing of order of integration - Evaluation of double integral by changing of order of integration - Evaluation of double integral (polar) - Triple integration in Cartesian coordinates - Conversion from Cartesian to polar in double integrals - Conversion from Cartesian to polar in double integrals - Conversion from Cartesian coordinates - Conversion from Cartesian coordinates - Conversion from Cartesian to polar in double integration in Cartesian coordinates - Area of triple Integral.

#### Unit-2 : Vector Calculus

Review of vectors in Two and Three dimensions - Gradient, divergence, - curl – Solenoidal - Irrotational fields - Vector identities -(without proof) – Directional derivatives - Line integrals - Surface integrals - Surface integrals - Volume Integrals - Green's theorem (without proof), Green's theorem (without proof), - Gauss divergence theorem (without proof), verification - Gauss divergence theorem (without proof) applications to cubes. - Gauss divergence theorem (without proof) – Verification Stoke's theorems (without proof) – Applications to cubes - Stoke's theorems (without proof) – Verification Stoke's theorems (without proof) – Applications to cubes - Stoke's theorems (without proof) – Verification Stoke's theorems (without proof) – Applications to cubes - Stoke's theorems (without proof) – Verification Stoke's theorems (without proof) – Applications to cubes - Stoke's theorems (without proof) – Verification Stoke's theorems (without proof) – Applications to cubes - Stoke's theorems (without proof) – Verification Stoke's theorems (without proof) – Applications to cubes - Stoke's theorems (without proof) – Verification Stoke's theorems (without proof) – Applications to cubes - Stoke's theorems (without proof) – Verification Stoke's theorems (without proof) – Applications to cubes - Stoke's theorems (without proof) – Verification Stoke's theorems (without proof) – Applications to cubes - Stoke's theorems (without proof) – Applications to cubes - Stoke's theorems (without proof) – Verification Stoke's theorems (without proof) – Applications to cubes - Stoke's theorems (without proof) – Applications to cubes - Stoke's theorems (without proof) – Applications to cubes - Stoke's theorems (without proof) – Applications to cubes - Stoke's theorems (without proof) – Applications to cubes - Stoke's theorems (without proof) – Applications to cubes - Stoke's theorems (without proof) – Applications to cubes - Stoke's theorems (without proof) – Applications to cubes - Stoke's theorems (without proof) – Applications to c

#### Unit-3: Laplace Transform

Laplace Transforms of standard functions -Transforms properties - Transforms of Derivatives and Integrals - Transform of derivatives and integrals - Initial value theorems (without proof) and verification for some problems - Final value theorems (without proof) and verification for some problems - Final value theorems (without proof) and verification for some problems - Inverse Laplace transforms using partial fractions - Inverse Laplace transforms sing Partial fractions - Inverse Laplace transforms section shifting theorem - Tu using Convolution theorem - problems only - LT using Convolution theorem - problems only - LT using Convolution theorem - problems only - ILT using Convolution theorem - problems only - LT using

12 Hour

12 Hour

### Unit-4 : Analytic Functions

Definition of Analytic Function- Cauchy Riemann equations - Cauchy Riemann equations - Properties of analytic function functions - Determination of analytic function using – Milne-Thomson's method - Conformal mappings: magnification - Conformal mappings: rotation Conformal mappings: inversion - Conformal mappings: reflection - Cauchy's integral theorem (without proof) - Cauchy's integral theorem applications

#### Unit-5: Complex Integration

12 Hour

12 Hour

Cauchy's integral formulae- Problems-Taylor's expansions with simple problems - Taylor's expansions with simple problems - Laurent's expansions with simple problems- Singularities - Types of Poles and Residues - Cauchy's residue theorem (without proof)- Contour integration: Unit circle. -Contour integration: semicircular contour. -Contour integration: semicircular contour.

	1.	Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley &	4.	Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint,
<b>.</b> .		Sons,2006.		2010
Learning	2.	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.	5.	G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002
Resources	3.	Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New	6.	N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint,
		Delhi,2008		2008

Learning Assessment

		1	Continuous Lea	arning Assessment (CLA)			Summotive
	Bloom's Level of Thinking	CLA-1 A	Formative Life Long Learning CLA-1 Average of unit test CLA-2 – (50%) (10%)				l Examination % weightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	A CONTRACTOR	20%		20%	-
Level 2	Understand	20%		20%	12 11 1 1	20%	-
Level 3	Apply 🚽	30%	<ul> <li>4</li> /ul>	30%		30%	-
Level 4	Analyze	30%		30%		<u>30%</u>	-
Level 5	Evaluate	1.00			C 5	-	-
Level 6	Create			D. PARK		-	-
	Total		100 %		100 %		100 %

Course Designers		No.
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.V.Maheshwaran, CTS, Chennai, maheshwaranv@yahoo.com	1. Dr.K.C.Sivakumar, IIT Madras, kcskumar@iitm.ac.in	1. Dr.A.Govindarajan, SRMIST
	2. Dr.YVSS. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	2. Dr. N. Balaji, SRMIST

Course	21MAB301T	Course		Course	В	BASIC SCIENCES	L	Т	Р	С	
Code		Name	PROBABILITY AND STATISTICS	Category			3	1	0	4	

Pre-requisite			Co- requisite			Progressive	
Courses	Nil		Courses	Nil	the second se	Courses	Nil
Course Offering	Department	Mathematics			Data Book / Codes / Standards	Nil	

Course	Learning Rationale (CLR): The purpose of learning this course is to:				Prog	gram	Outco	mes (F	PO)				F	rogra	am
CLR-1 :	Apply the basic rules and theorems of probability theory and evaluate the expectation and variance using random variables.	1	2	3	4	5	6	7 8	9	10	11	12	01	specii utcon	nc nes
CLR-2 :	Gain knowledge of theoretical distributions.				of		ty		~						
CLR-3 :	Understand how to develop Null and Alternate hypothesis and draw conclusions using hypothesis tests.	edge	1	nt of	ions	e	socie		Worl		ance				
CLR-4 :	Apply the knowledge of regression lines and analysis of variance.	(now	ysis	opme	stigat	Usag	and	5	eam	E	Fina	ming			
CLR-5 :	Acquire knowledge to solve the problems of process control.	neering k	lem Anal	gn/develo ions	duct inves	em Tool I	engineer	ainahilih/	idual & T	municatio	ect Mgt. 8	-ong Lea		-2	က္
Course	Outcomes (CO): At the end of this course, learners will be able to:	Engi	Prob	Desi	Conc	Mod	The	Ethic	Indiv	Com	Proje	Life I	PSO	PSO	PSO
CO-1:	Implement the concepts of pr <mark>obability a</mark> nd random variables.	3	3	-	3	-	-		-	-	-	-	-	-	-
CO-2:	Identify the random variables and model them using various distributions.	3	3	-	-	-	-		-	-	-	-	-	-	-
CO-3:	Infer results by using hypoth <mark>esis testi</mark> ng on large and small samples.	3	3	-	10.0	-	-		-	-	-	-	-	-	-
CO-4:	Examine the regression lines and interpret the results in the analysis of variance.	3	3	-	-	-	-		-	-	-	-	-	-	-
CO-5:	Utilize quality control techniques to solve real-world problems.	3	3		-	-	-		-	-	-	-	-	-	-

#### Unit-1 : Probability and One-dimensional Random Variable

Probability concepts, Types of Events, Axioms and theorems - Conditional probability, Baye's theorem – without proof- Applications of Baye's Theorem. Random variables – Discrete case and continuous case- Mathematical expectation, Variance - discrete case and continuous case - Raw Moments - Central Moments - Moment generating function - MGF- discrete and continuous random variable.

# Unit-2 : Theoretical Distributions

Discrete distributions – Introduction- Mean and Variance of Binomial Distribution- Fitting a Binomial distribution- M.G.F of Binomial Distribution- Poisson Distribution- Mean and Variance of Poisson Distribution- Fitting a Poisson distribution- MGF of Poisson distribution- Geometric distribution- mean and variance, Memoryless property- Continuous distributions – Introduction- Uniform distribution – MGF, Mean and Variance- Exponential distribution MGF, Mean and Variance, Memoryless property- Normal distribution.

## Unit-3: Testing of Hypothesis

Sampling Distributions – Type I and Type II errors- large sample test-Test of significance for single proportion- Test of significance for difference of proportions-. Test of significance for single mean-. Test of significance for single mean-. difference of means- Small sample tests- Student's t- test for single mean- t- test for the difference of means- Fisher's F-test- Test of significance for two sample variances- Chi -square test- for the goodness of fit- Chi-square test- for the independence of attributes.

#### Unit-4 : Correlation, Regression and ANOVA

Correlation and its Properties- Karl Pearson's coefficient of correlation- Spearman's rank correlation coefficient for repeated and non-repeated ranks- Linear Regression lines and Properties- Relation between correlation and regression coefficient- Introduction to Analysis of Variance (ANOVA) - One-way Classification – two-way classification.

Unit-5: Statistical Quality Control

Introduction – Process control – control charts for variables -  $\bar{X}$  and R,  $\bar{X}$  and S charts control charts for attributes: p-chart, c- chart, and their applications in process control.

B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-2(Revised-July2023)-First Year Syllabi-Control Copy

#### 12 Hour

12 Hour

# 12 Hour

12 Hour

Learning Resources	<ol> <li>S. Ross, A First Course in Probability, 8th Ed., Pearson Education India, 2010.</li> <li>Johnson. R.A., Miller &amp; Freund's, Probability and Statistics for Engineers, 8th Edition, Prentice Hall India, 2011.</li> <li>Veerarajan T., Probability and Statistics, Tata McGraw-Hill, New Delhi, 2010.</li> </ol>	<ol> <li>Devore (JL), Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage Learning, 2012.</li> <li>S. C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand &amp; Sons, 11th Edition, 2015.</li> <li>Vijay K. Rohatgi., A.K. Md. Ensanes Saleh, An Introduction to Probability and Statistics, 2nd Edition, Wiley, 2008</li> </ol>

			Continuous Learn	ng Assessment (CLA)	5		Summative			
	Bloom's Level of Thin <mark>king</mark>	CLA-1 A	Formative verage of unit test (50%)	Life	Long Learning CLA-2 – (10%)	Fina (40	Final Examination (40% weightage)			
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%	and the second second	20%		20%	-			
Level 2	Understand	20%		20%	and the second second	20%	-			
Level 3	Apply	30%		30%		30%	-			
Level 4	Analyze	30%	and the second second	30%	and the second second	30%	-			
Level 5	Evaluate	-		1		-	-			
Level 6	Create		COLUMN AND A	200 - A. C. C.		-	-			
	Total	- 1	100 %	The second	100 %		100 %			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	
1. Mr. Madhan Shanmugasundaram, Inf <mark>osys Tech</mark> nologies, madshan@gmail.com	1. Prof. Y.V.S.S. Sanyasiraju, IIT Madras, <u>sryedida@iitm.ac.in</u> 1. Dr. B.Vennila, SRMIST	
	2. Prof. K.C. Sivakumar, IIT Madars, kcskumar@iitm.ac.in 2. Dr.R.Varadharajan, SRMIST	



Course Code	e 21PYB101J Course Name PHYSICS: ELECTROMAGNETIC THEORY, QUANTUM M WAVES AND OPTICS	ECHANICS, Course Category B				BA	SIC S	CIEN	CES				L 3	T 1	P 2	C 5
Pre-req Cours	uisite Nil Co-requisite Co-requisite Courses	Progressive Courses	Nil													
Course C	Offering Department Physics and Nanotechnology Data Book / Cod	les/Standards Nil														
Course	Learning Rationale (CLR): The purpose of learning this course is to:					Prog	ram C	Dutcon	nes (F	PO)				Pi	rograr	n
CLR-1 : Identify the applications of electric field on materials						4	5	6	7 8	9	10	11	12	S ou	pecifi itcom	; ∋s
CLR-2 :	Identify the applications of magnetic fi <mark>eld on mater</mark> ials		0			of		aty		×						
CLR-3 :	Identify the significance of quantum theory	1000	ledge		ent of	tions	e	socie		Wor		ance	-			
CLR-4 :	Create insights to the concepts of optical effects		Know	lysis	opme	stiga lems	Usaç	& and		eam	uo	& Fin	arning			
CLR-5 :	Analyze the working principle of lasers and optical fibers		ering I	n Ana	devel	t inve k prob	Tool	gineer	ahilitv	al & J	nicati	Mgt. 8	ig Lea			
Course	Outcomes (CO): At the end of this course, learners will be able to:		Enginee	Problem	Design/ solution	Conduc	Modern	The eng Environ	Sustain: Ethics	Individu	Commu	Project	Life Lon	PSO-1	PSO-2	PSO-3
CO-1:	Express the significance of electrostatic fields	0.000 State	3	3	-	1	-		-	-	-	-	-	-	-	-
CO-2:	Analyze electromagnetic ind <mark>uction</mark>	S. M 1 . S	3	3	-	-	-			-	-	-	-	-	-	-
CO-3:	Apply quantum mechanics to basic physical problems	Sec. Sec. Sec. Sec. Sec. Sec. Sec. Sec.	3	-	-	3	-			-	-	-	-	-	-	-
CO-4:	Apply ray propagation and optical effects		3	3	-	-	-			-	-	-	-	-	-	-
CO-5:	1-5:  Understand the types of lasers, structure and propagation properties of optical fiber and analyse its applications						-			-	-	-	-	-	-	-

#### Unit-1: Electromagnetism and Dielectrics

18 Hour

18 Hour

18 Hour

Electromagnetism- Introduction- Del, divergence, curl and gradient operations in vector calculus-Gauss divergence and Stoke's theorem-Electric field and electrostatic potential for a charge distribution-Gauss' law and its applications-Laplace's equations for electrostatic potential-Poisson's equations for electrostatic potential-Poisson's equations for electrostatic potential- Concepts of electric current-Continuity equation-Laws of magnetism-Faraday's law, Ampere's law-Maxwell's equations-Maxwell's equations in free space- Characteristics impedance - Polarizations, permeability and dielectric constant-Polar and non-polar dielectrics-Types of polarization-Frequency and temperature dependence Practice 1.Determination of Internal Resistance of the given cell - Potentiometer

2 Determine dielectric constant of the sample

#### Unit-2: Magnetic Materials

Magnetization, permeability and susceptibility-Classification of magnetic materials-Ferromagnetism-Concepts of ferromagnetic domains-Hard and soft magnetic materials-Energy product--Ferrimagnetic materials-Ferrites-regular spinel and inverse spinel-Magnetic bubbles-Magnetic thin films-Spintronics-GMR-TMR-CMR-Garnets-Magnetoplumbites-Multiferroic materials-Applications of multiferroic materials

- Practice 1.Calibrate Ammeter using Potentiometer
- 1. Calibrate Voltmeter using Potentiometer
- 2. Determine magnetic susceptibility-Quincke's method

## Unit-3:Quantum Mechanics

Introduction to Quantum mechanics- Black body radiation, Concept of Photon-Photoelectric effect, Compton effect- Explanation of wave nature of particles-de Broglie hypothesis for matter waves-Heisenberg's uncertainty principle- Application of uncertainty principle- Born interpretation of wave function-Verification of matter wave -Physical significance of wavefunction-Time independent Schrödinger's wave equation-Time dependent Schrödinger's wave equation-Time dependent Schrödinger's wave equation-Time dependent Schrödinger's wave equation-Time dependent Schrödinger's wave equation-Time independent Schrödinger's wave equation-Time dependent Schrödinger's wave equation-Time dependent Schrödinger's wave equation-Time independent Schrödinger's wave equation-Time dependent 
Practice 1.Determine Planck's Constant

2. Study of I-V characteristics of a light dependent resistor (LDR)

Unit-4: Wave Optics 18 Ho
Introduction to interference-Introduction to diffraction-Fresnel diffraction-Fraunhofer diffraction-Fraunhofer diffraction at single slit-Fraunhofer diffraction at double slit-Fraunhofer diffraction at multiple slit-Diffraction gratin
Characteristics of diffraction grating-Applications of diffraction grating-Polarization by reflection-Brewster's angle-Polarization by refraction-Malu's Law-Polarization by double refraction-Nicol Prism- Ordinary and Extraordina
Rays-Optical activity-Quarter and Half Waveplate- Circular polarization - Elliptical polarization
Practice
1. Determine wavelength of monochromatic light Newton's ring
2. Determine particle size using laser
3. Determine Wavelength- diffraction grating
Unit-5: Lasers and Fiber Optics 18 Ho
Absorption and emission processes-two level-Einstein's theory of matter radiation A and B coefficients-Characteristics of laser beams-Amplification of light by population inversion-Threshold population inversion-Essen
components of laser system and pumping mechanisms-Nd: YAG laser-Semiconductor laser-CO2 laser:-Application of laser – Holography-Optical fiber-physical structure-Total internal reflection-Numerical aperture-Acceptan

components of laser system and pumping mechanisms-Nd: YAG laser-Semiconductor laser-CO2 laser:-Application of laser – Holography-Optical fiber-physical structure-Total internal reflection-Numerical aperture-Acceptance angle-Losses associated with optical fibers-Classification of optical fibers-Optical fiber communications system-Optical sensors Practice

1. Determine laser parameters – divergence and wavelength for a given laser source

No.

- 2. Study of attenuation and propagation characteristic-optical fiber
- 3. Mini project

Learning	1. David Jeffery Griffiths, Introduction to Electrodynamics, Revised edition, Pearson, 2013	3. David Halliday, Fundamentals of Physics, 7th edition, John Wiley & Sons Australia, Ltd, 2004
Resources	2. AjoyGhatak, Optics, Tata McGraw Hill Education, 5th edition, 2012	4. Eisberg and Resnick, Quantum Physics: Of Atoms, Molecules, Solids, Nuclei and Particles, 2nd Edition, 1985

Learning Assessmer	it 🖉		- CO	4 1 M 2 M 2	10. 1 S							
		7 1 1 1 1 1 1	Continuous Lea	arning Assessment (CLA)		Summative						
	Bloom's Level of Thinking	CLA-1 A	Formative verage of unit test (50%)	Lif	e Long Learning CLA-2 (10%)	Final Examination (40% weightage)						
		Theory	Practice	Theory	Practice	Theory	Practice					
Level 1	Remember	20%		· · ·	10%	20%	-					
Level 2	Understand	20%	- /	(A)	30%	<mark>2</mark> 0%	-					
Level 3	Apply	30%	- 11	-	20%	30%	-					
Level 4	Analyze	30%	2	1 P	40%	30%	-					
Level 5	Evaluate			- 10 · ·		-	-					
Level 6	Create		1 1 1 1 V 1				-					
	Total	////	100 %		100 %		100 %					

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Vinay Kumar Gupta, National Physical Laboratory, guptavinay@nplindia.org	1. Prof .C. Vijayan, IITM, Chennai, cvijayan@iitm.ac.in	1. Dr. C. Preferencial Kala, SRMIST
	2. Prof. S. Balakumar, Univ of Madras, balakumar@unom.ac.in	2. Dr. M. Alagiri, SRMIST

Course Code	Code 21PYB102J Course SEMICONDUCTOR PHYSICS AND COMPUTATIONAL METHODS Co									BA	SIC S	SCIE	NCES	5			L 3	T 1	P 2	C 5
Pre-requi Course Course Of	isite es <i>Nil</i> fering Department	Physics a	Co- requisit Courses and Nano Technology	e Nil	Data Book / Codes / Standards	Progre Cou s Nil	essive rses /	il												
Course I	earning Rational	le (CLR):	The purpose of learning	this course i	's to:	1.7				Prog	gram (	Outco	omes	(PO)				F	rogra	ım
CLR-1 : Introduce band gap and Fermi level in semiconductors and how to compute those properties							2	3	4	5	6	7	8	9 10	11	12	01	Specif utcom	ic ies	
CLR-2 :	Explain the concep	ot of carrier tran	spo <mark>rt mechani</mark> sm in p-n a	nd metal sen	niconductor junction			D		of		ity			ž					
CLR-3 :	Provide an insight	on semiconduc	t <mark>or optical transitions</mark> and	photovoltaic	effect		-	ĥ	nt of	suc		ocie		:	Nor	nce				
CLR-4 :	Procure knowledge	e of electrica <mark>l ar</mark>	nd optical measurements	n semicondu	ictor and to instigate the concepts of	of TCAD		Sis o	mer	gati	sage	s pu			an a	lina	ing			
CLR-5 :	Develop necessary basic of machine le	y skills for low d earning in image	imensional semiconducto e processing	r material pro	ocessing and characterization and t	o introduce the		Analys	develop	investi proble	Tool Us	ineer a	nent & ability		al & lea	Agt. & F	g Learn			
			1.1			Charles		olem liee	ign/c	duct	еш	eng	aina	8		ect	Lon	-1	-2	с- С-
Course (	Dutcomes (CO):		At the end of this course	, learners wi	II be able to:	10.000		Prot	Des	Con	Mod	The	Sus	Ethi	Con	Proj	Life	PSC	PSC	PSC
CO-1:	Understand and con	npute en <mark>ergy ba</mark>	and in solids and electron	occupation p	probability			} -		-	-	-	-	-		-	-	-	-	-
CO-2:	D-2: Understand and analyze the working of optoelectronic devices							} -	-		-	-	-	-		-	-	-	-	-
CO-3:	: Apply the knowledge to the development of new and novel optoelectronic devices						100	-	3	-	-	-	-	-		-	-	-	-	-
CO-4:	CO-4: Understand the working mechanism of electrical and optical measurements and gain the fundamentals of TCAD							} -	-	-	-	-		-		-	-	-	-	-
CO-5:	CO-5: Acquire knowledge of the low dimensional semiconductor material fabrication and characterization and gain insights of the concepts of machine learning						3	-	-	-	-	-	-		-	-	-	-	-	

#### Unit-1 : Energy Bands in Solids

Introduction to Classical Free electron theory-Introduction to Quantum Free electron theory-Density of states-Concepts-Energy band in solids-Kronig-Penney model--E-k diagram-Direct and Indirect band gap-Concept of phonons-Concept of Brillouin Zone-Computational determination of Band Structure – Concepts, Eigenvalue equations-Classification of electronic materials-Fermi level-Probability of occupation-Numerical determination of probability of occupation and carrier concentration-Concept of Fermi surface of a metal-Computational determination of Fermi surface of Cu as example.

Practice 1 Determination of Hall coefficient of Semiconductor material 2.Determination of Band Gap of semiconductor-Post Office Box method

Unit-2 : Carrier Transport Mechanism in Semiconductors

Intrinsic semiconductor-Dependence of Fermi level on carrier-concentration-and temperature in Intrinsic semiconductor-Extrinsic semiconductors-Dependence of Fermi level on carrier-concentration-and temperature in extrinsic semiconductor-Extrinsic semiconductors-Dependence of Fermi level on carrier-concentration-and temperature in extrinsic semiconductors-Explanation for carrier generation-Explanation for recombination processes -Carrier transport - diffusion and drift current-Continuity equation-p-n junction-Biasing concept in p-n junction-Metal-semiconductor junction -Ohmic contact -Semiconductor materials of interest for optoelectronic devices-Photocurrent in a P-N junction diode- Light emitting diode- Classification of Light emitting diode-Optoelectronic integrated circuits-Organic light emitting diodes

Practice 1.Determination of Band Gap of semiconductor-Four probe method

2 Study of I-V characteristics of a light dependent resistor (LDR)

3 Study of V-I and V-R characteristics , Efficiency of a solar cell

Unit-3: Optoelectronic Properties of Semiconductors

Concept of optical transitions in bulk semiconductor- Optical absorption process-Concept of recombination process-Optical recombination process-Explanation for spontaneous emission-Explanation for stimulated emission-Joint density of states in semiconductor-Density of states for photons-Explanation of transition rates-Numerical computation of optical loss-Finite element method to calculate Photon density of states -Basic concepts of Photovoltaic-Photovoltaic effect-Applications of Photovoltaic effect-Determination of efficiency of a PV cell-Computational approach to calculate optical excitations-Example: optical excitation in BN (Boron nitride) Practice 1.Characterization of pn junction diode (Forward and reverse bias) 2.Verify Inverse square law of light using a photo cell.

43

18 Hour

18 Hour

#### Unit-4 : Electrical And Optical Measurements

#### 18 Hour

18 Hour

Concept of electrical measurements-Two point probe technique-Four point probe technique-linear method-Four point probe technique-Vander Pauw method-Significance of carrier density-Significance of resistivity and Hall mobility-Hot-point probe measurement-Capacitance-voltage measurements-Extraction of parameters in a diode-I-V characteristics of a diode-Introduction of TCAD in basic level- Significance of band gap in semiconductors-Concept of absorption and transmission-Boltzmann Transport Equation-Scattering Mechanisms-Monte Carlo method- Concept only-Example only Monte Carlo Methods for Solution of BTE( Boltzmann equation) Practice

- 1. Determination of electron and hole mobility versus doping concentration using GNU Octave
- 2. Determination of Fermi function for different temperature using GNU Octave
- 3. Study of attenuation and propagation characteristic of optical fiber cable using laser source

### Unit-5: Low Dimensional Semiconductor Materials

Density of states in 2D-Density of states in 1D and 0D-Introduction to low dimensional systems-Quantum well-Quantum wire and dots-Introduction to novel low dimensional systems -CNT- properties and synthesis-Applications of CNT-Fabrication technique-PVD-Characterizations techniques for low dimensional systems-Principle of electron microscopy-Scanning electron microscopy-Transmission electron microscopy-Atomic force microscope-Computational and machine learning approach for electron microscopy image processing – Concepts, overview-Example of Graphene Practice

- 1. Plotting and interpretation of I-V characteristics of Diode GNU Octave
- 2. Determination of lattice parameters using powder XRD
- 3. Mini Project.

	1. J.Singh, "Semiconductor Optoelectronics": Physics and Technology, McGraw-Hill Inc. 1995.	5. Computational Materials Science: An Introduction by June Gunn Lee, Chapter 7,
Learning	2. B. E. A. Saleh and M. C. Teich, "Fundamentals of Photonics", John Wiley & Sons, Inc., 2007.	Page 227- 230 (Quantum Espresso)and Page 300-307 (VASP)
Resources	3. S. M. Sze, "Semiconductor Devices" Physics and Technology, Wiley 2008.	6. Finite Element Method GouriDhatt, Emmanuel Lefrançois, Gilbert Touzot, Wiley
	4. A. Yariv and P. Yeh, Photonics:" Optical Electronics in Modern Communications", Oxford University Press, New York 2007.	Publication, ISBN: 978-1-848-21368-5

Learning Assessm	ent 🥒	E PARTIE			-0.1 2		
			Continuous Lear	ning Assessment (CLA			Summative
	Bloom's Level of Thinking	Fo CLA-1 Ave	rmative rage of unit test (50%)		ife Long Learning CLA-2 (10%)	Fina (405	I Examination % weightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%			10%	20%	-
Level 2	Understand	20%	//	· ·	30%	20%	-
Level 3	Apply	30%		· ·	20%	30%	-
Level 4	Analyze	30%		12	40%	30%	-
Level 5	Evaluate	1 - A -	and the second sec			- 1 1	-
Level 6	Create		1 1 1 1 1 1			1	-
	Total	1	100 %		100 %		100 %
Course Designers							
Experts from Industry			Experts from Higher Tech	nical Institutions		nternal Experts	
1. Dr. Vinay Kumar Gu	ota, National Physical Laboratory, g	uptavinay@nplindia.org	1. Prof .C. Vijayan, IIT	M, Chennai, cvijayan@	iitm.ac.in	1. Dr. C. Preferencial Ka	la, SRMIST
			2. Prof. S. Balakumar, Un	iv of Madras, balakuma	ar@unom.ac.in	2. Dr.S. Saurab Ghosh S	S, SRMIST

Course Code	Course Code         21PYB104J         Course Name         PHYSICS: MECHANICS         Cour Categ										BA	SIC S	CIEN	CES				L 3	T 1	P 2	C 5
Pre-requi	isite es		Co-requisite Courses	111		Progree Cours	ssive ses	Nil													
Course Of	fering Department	Physics	and Nanotechnology	Data Book / Codes/Si	tandards	Nil															
Course I	Learning Rational	e (CLR):	The purp <mark>ose of learning</mark> this c	ourse is to:	10	1					Prog	ram (	Outcor	nes (l	PO)				P	rograr	n
CLR-1: Utilize the principles pertaining to vector mechanics and basics of vibrations to structural engineering.							2	1	2	3	4	5	6	7 8	8 9	10	11	12	ou	pecition (	c es
CLR-2 : Utilize the knowledge of rigid body mechanics to identify the forces and torques to setup equations governing the complex motions in engineering structures								ge	5	of	s of		iety		¥		e				
CLR-3 :	Apply knowledge o	f statics to de	ete <mark>rmine the fo</mark> rces and moments	in truss structures				vled	£,	ent o	ation s	ge	soc		N No		Janc	Ð			
CLR-4 :	Comprehend the fa	ailure of stru <mark>c</mark>	t <mark>ures by id</mark> entifying the principal s	tresses and strains				Kno	lysis	mqo	stig: olem	Usa	r and		[ean	ion	& Fil	arnin			
CLR-5 :	Analyze the bendin	ig types and	torsion in structural members		1.2	1		ering	m Ana	n/devel	ct inve ex prot	n Tool	n ment	dilita	ual & ⁻	unicat	t Mgt.	ng Le			
Course (	Dutcomes (CO):		At the end of this course, lear	ners will be able to:	-			Engine	Proble	Design solutio	Condu	Moder	The er Fnvirol	Sustaii Ethice	Individ	Comm	Projec	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Identify the principle	of mech <mark>anic</mark>	s and vibrations	10 C C C C C C C C C C C C C C C C C C C	12.20			3	3	-	-	-	-		-	-	-	-	-	-	-
CO-2:	CO-2: Understand the rigid body mechanics in 2D and 3D							3	3	-	-	-	-		-	-	-	-	-	-	-
CO-3:	3: Apply the knowledge of free body diagram to establish equations of equilibrium to determine the internal forces in simple t						truss	3	2	-	3	-	-	-	-	-	-	-	-	-	-
CO-4:	Analyze the principa	l stresse <mark>s an</mark>	<mark>d pri</mark> ncipal planes to understand t	he failure of materials.	1. 1. 1. 1.	-		3	3	-	-	-	-		-	-	-	-	-	-	-
CO-5:	Apply the concepts of axial and shear forces in torsion of circular shafts and understand the concept of simple bending in be						ms	3	3	3	-	-	-		-	-	-	-	-	-	-

#### Unit-1: Vector Algebra and Vibrations

Introduction to vector analysis- Scalar quantities & vector quantities- Transformation of scalars and vectors- Transformation of scalars and vectors under rotation transformation- Forces in nature- Newton's laws- Form invariance of Newton's second law- Solving Newton's equations of motion in polar coordinates- Fundamentals of simple harmonic motion- Harmonic oscillator- Damped harmonic motion- Different cases-over critically and lightly damped oscillators- Fundamentals of vibrations- Vibration model- Forced oscillations- Magnification factor of forced oscillations- Resonance- Application of resonance-Dampers and its types Practice

- 1. Determine acceleration due to gravity using Bifilar pendulum
- 2. Determine the restoring force per unit extension of a spiral spring by dynamical method

#### Unit-2: Rigid Body Mechanics

Definition and motion of a rigid body in the plane- Rotation in the plane- Kinematics in a coordinate system rotating in the plane- Kinematics in a coordinate system translating in the plane- Angular momentum about a point of a rigid body in planar motion- Euler's laws of motion- Euler's laws of motion- Euler's laws of motion- Euler's laws of motion in terms of angular velocity vector, its rate of change- Two- dimensional motion in terms of a nigid body motion of a rigid body - Precession of a body- Precession of a spinning top- Introduction to three-dimensional rigid body motion- Euler's laws of motion- Euler's laws of motion in terms of angular velocity vector, its rate of change- Two- dimensional motion in terms of Moment of inertia tensor- Three-dimensional motion of a rigid body - coplanar manner- Rod executing conical motion with center of mass fixed- Conical pendulum -Time period and tension in a string

- 3. Determine acceleration due to gravity-Compound bar pendulum
- 4. Determine spring constant-Expansion of a helical spring
- 5. Determine the coefficient of Static friction

#### Unit-3: Equilibrium and Stability of Rigid Structures

Introduction to rigid body- Free body diagrams with examples- Reactions at supports and connections for a two dimensional structure- Examples on modeling of typical joints- Equilibrium of a rigid body in two dimensions-Condition for equilibrium in two dimensions- Equilibrium of a rigid body in three dimensions- Condition for equilibrium in three dimensions- Friction- limiting cases- Friction- non limiting cases- Force-displacement relationship-

B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-2(Revised-July2023)-First Year Syllabi-Control Copy

18 Hour

18 Hour

Simple illustration of force displacement- Geometric compatibility for small deformations- Illustrations based on axially loaded members- Introduction to trusses, Planar and Space trusses- Types of Bridge and Roof trusses-Truss Analysis -Statically determinate/Indeterminate- Method of Joints

Practice

- 1. Determine Moment of inertia and angular acceleration with precision pivot bearing
- 2. Determine moment of inertia and angular acceleration- Gyroscope

# Unit-4: Deformation and Failure of Materials

Concept of stress at a point- Plane stress- Transformation of stresses at a point- Principal stresses- Mohr's circle of stress- Concept of strain at a point- Plane strain- transformation of strain at a point- Principal strains- Mohr's circle of strain. Strain gauges and its applications - Strain Rosettes and its types- Concepts of elasticity, plasticity- Failure of materials-Causes and types of failure- Concepts of fracture and yielding- Brittle and Ductile fracture-Mechanism of ductile fracture- Idealization of one dimensional stress-strain curve- Generalized Hooke's law with thermal strains for isotropic materials- Characteristics of elasticity Practice

- 1. Measurement of free fall-Dynamics method
- 2. Determine rigidity modulus-Torsional pendulum
- 3. Determine rigidity modulus using static torsion

#### Unit-5: Force in Beams and Shafts

Force analysis -axial force- Force analysis -shear force, bending moment- Twisting moment diagrams of slender members- Twisting moment diagrams of slender members (without singularity function)- Torsion of circular shafts-Definition of torsion, effects of torsion- Generation of shear stresses- General Torsion equation -Theory of Uniform Bending- Theory of non-uniform Bending- Moment-curvature relation in pure bending of beams with symmetric cross-section- Bending stress, Shear stress- Cases of combined stresses- Concept of strain energy- Strain energy due to axial loading- Strain energy due to shear loading- Strain energy due to torsion- Modulus of toughness and resilience- Strain energy and complementary strain energy for simple structural elements Practice

- 1. Determine Young's modulus-non-uniform bending
- 2. Determine Young's Modulus-Uniform Bending
- 3. Mini Project

 Learning
 1. Mahendra K Verma, Introduction to Mechanics, Universities Press (India) Pvt. Ltd., 2016

 Resources
 2.J. L. Meriam, Engineering Mechanics – Dynamics, 7th edition, Vol. 2, Wiley Publishers, 2012

3.J. P. Den Hartog, Mechanics, Dover Publications Inc., 1961

4.E.P. Popov, Engineering Mechanics of Solids, Prentice Hall India Learning Private Limited; 2nd edition, 2002.

Learning Assessment	-			Contraction of the	1.0						
		C- I Contraction	Continuous Lea		Summativa						
	Bloom's Level of <mark>Thinking</mark>	CLA-1 A	Formative verage of unit test (50%)	Life	Long Learning CLA-2 (10%)	Fina (40	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%		2 N. O. M.	10%	20%	-				
Level 2	Understand	20%	1 1 1 N 1	· ·	30%	20%	-				
Level 3	Apply	30%	1201000	1 St. P.	20%	30%	-				
Level 4	Analyze	30%	· ·		40%	30%	-				
Level 5	Evaluate		·			-	-				
Level 6	Create	-	-	-		-	-				
	Total		100 %		100 %		100 %				

**Course Designers** 

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. D.K. Aswal, National Physical Laboratory, dkaswal@nplindia.org	1. Prof. V. Subramanian, IITM, Chennai, manianvs@iitm.ac.in	1. Dr.K.D.Nisha, SRMIST
		2. Dr.R.Annie Sujatha, SRMIST

B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-2(Revised-July2023)-First Year Syllabi-Control Copy

18 Hour

46

Course	21CYB101J	Course			CHEMISTRY		Course	В				BA	SIC	SCIE	NCE	S				L	T	P	C
Coue		Name					category		-											3	I	2	5
Pre-requ Cours	uisite <i>Nil</i> ses			Co- requisite Courses	Nil		Progre Cour	ssive ses	Nil														
Course O	ffering Department	Chemis	stry		Data Book	/ Codes / Standards	Nil																
Course 1	Learning Rational	le (CLR):	The purpo	ose of learning th	nis course is to:	TI M	dis					Prog	ram	Outc	omes	s (PC	))				F	Progra	am
CLR-1 :	Exploit the periodic water quality parar	c properties of neters	of elements for	bulk property m	anipulation towards techno	ological advancemen	t and interpret		1	2	3	4	5	6	7	8	9	10	11	12	01	Speci [:] utcom	fic 1es
CLR-2 :	Address concepts strength and redox	related to elect potentials of	ectrochemistry, f aqu <mark>eous solu</mark>	such as corrosiention	on, using thermodynamic	principles and measu	re the acidic			1	1				lity								
CLR-3 :	Employ various org acidic strength and	ganic reaction	ns <mark>towards th</mark> e e of aqueous s	design of fine cl solution	hemical and drug molecul	es for industries and i	measure the		edge		nt of	ons of		ociety	tainabi		Nork		nce				
CLR-4 :	Brief outline, reacti	ion types a <mark>nd</mark>	l applications of	of polymers and	determine average molect	ular weight of the poly	vmer		lowle	SIS	mer	igati	sage	s pu	Sus		am /	~	Fina	ing			
CLR-5 :	Properties, surface aqueous solution	e characteriza	ation and appli	cations of advan	ced engineering materials	s and measure the ac	idic strength of		ering Kr	I Analys	develops	t invest proble	Tool U	ineer a	ment &		al & Te	nicatior	Mgt. & I	g Learr			
				Annual Contraction		Same?	1000		inee	blem	ign/	nduc	dem	eng	iron	S	vidu	nmu	ject	Lon	<u>-1</u>	)-2	-3
Course (	Outcomes (CO):		At the end	l of this course, l	learners will be able to:				Eng	Prof	Des	Con	Moc	The	Env	Ethi	Indi	Con	Proj	Life	PSC	PSC	PSC
CO-1:	Rationalize bulk pro	perties u <mark>sing</mark>	periodic prope	erties of element	s, evaluate water quality p	arameters like hardn	ess and alkalin	ity	3	-	3	2	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Utilize the concepts and redox potentials	of therm <mark>odyn</mark> of aque <mark>ous</mark> s	namics in unde solution	rstanding therm	odynamically driven chem	nical reactions, detern	nine acidic strei	ngth	3	3	3		-	-	-	-	-	-	-	-	-	-	-
CO-3:	Perceive the importa acidic strength and o	ance of s <mark>terec</mark> conducta <mark>nce</mark> (	ochemistry in s of aqueous so	synthesizing orga olution	anic molecules applied in _l	pharmaceutical indus	tries, determine	9	-	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Utilize the concepts polymer	of polym <mark>er p</mark> r	rocessing for v	various technolog	gical applications, determi	ne average molecula	r weight of the		3	-	3	3	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Analyze the importal aqueous solution	nce of adv <mark>an</mark> d	ced processin	g techniques tow	vards engineering applicat	tions and measure the	e acidic strengt	h of	3	ł	3	-	3	-	-	-	-	-	-	-	-	-	-

#### Unit-1 : Periodic properties

18 Hour

18 Hour

Coordination numbers and geometries - Crystal field theory - Octahedral & Tetrahedral complexes - Optical & magnetic properties of transition metal complexes - Isomerism in transitional metal compounds - Effective nuclear charge, penetration of orbitals - variations of orbital energies of atoms in the periodic table - Electronic configurations, atomic and ionic sizes - ionization energies, electron affinity and electronegativity - Hard soft acids and bases

Practice:

- 1. Determination of the amount of sodium carbonate and sodium hydroxide in a mixture by titration
- 2. Determination of hardness (Ca2+) of water using EDTA Complexometry method.

# Unit-2 : Use of free energy in chemical equilibria

Thermodynamic functions: Energy, Entropy and free energy - Estimation of entropy & free energies - Free energy and emf. Cell potentials - The Nemst equation and applications - Acid base, oxidation reduction - Solubility equilibria - Corrosion - Free energy of a corrosion reaction - Pourbaix diagram Salient Features and phase diagram for Iron Practice:

1. Determination of strength of an acid by Conductometry.

2. Determination of ferrous ion using potassium dichromate by Potentiometric titration

Unit-3: Stereochemistr	y and Organic reactions
------------------------	-------------------------

Representations of 3 dimensional structures - structural isomers and stereoisomers - configurations and symmetry and chirality - enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis - Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings - Synthesis of a commonly used drug molecule. Practice:

- 1. Estimation of amount of chloride content of a water sample.
- 2. Determination of the strength of a mixture of acetic acid and hydrochloric acid by Conductometry

#### Unit-4 : Polymers

Introduction to concept of macromolecules - Tacticity - Classification of Polymers - Thermoplastics, Thermosets and Elastomers - Types of Polymerization - Important addition and condensation polymers – synthesis and properties – Polypropylene, polystyrene, PVC, Teflon, Nylon, PET, Polyurethane and Synthetic rubber, Conducting polymers – introduction, types – n and p doping, examples (polyacetylene and P3HT), applications Practice:

1. Determination of molecular weight of polymer by viscosity average method.

# Unit-5: Advanced Engineering Materials

Mechanical properties of solid – stress-strain relationship - Tensile strength, Hardness, Fatigue, Impact strength, Creep – Composite materials - introduction - Types of composites - Fibre Reinforced Composites. Particle Reinforced Composites. Metal Matrix Composites. Ceramic Matrix Composites. Examples and applications. Surface Characterisation techniques - XRD and XPS. Practice:

1. Determination of strength of an acid using pH meter.

Learning Resources	<ol> <li>B. H. Mahan, R. J. Meyers, University Chemistry, 4th ed., Pearson publishers, 200.</li> <li>M. J. Sienko, R. A. Plane, Chemistry: Principles and Applications, 3rd ed., McGraw publishers, 1980</li> <li>B. L. Tembe, Kamaluddin, M. S. Krishnan, Engineering Chemistry (NPTEL Web-bc http://nptel.ac.in/downloads/122101001/</li> </ol>	<ol> <li>Peter W. Atkins, Julio de Paula, James Keeler, Physical Chemistry, 11th ed., Oxford publishers, 2021</li> <li>K. P. C. Vollhardt, N. E. Schore, Organic Chemistry: Structure and Function 7thed., Freeman, 2014</li> <li>W. D. Callister, D. G. Rethwisch, Materials Science and Engineering: An Introduction, 8th ed., Wiley, 2009</li> <li>7. J. C. Kuriacose, J. Rajaram, Chemistry in Engineering and Technology, Tata McGraw-Hill Education 1984</li> </ol>
-----------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Learning Assessment					Contraction of the second		
			Continuous Le	arning Assessment (CLA)			Cummotivo
	Bloom's Level of Thinking	CLA-1 A	Formative verage of unit test (50%)	Life	e Long Learning CLA-2 (10%)	Fina (40	al Examination % weightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	10%		· ·	20%	10%	-
Level 2	Understand	30%		11. The second s	20%	30%	-
Level 3	Apply	30%			20%	30%	-
Level 4	Analyze	30%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	· · ·	40%	30%	-
Level 5	Evaluate	(- AA)	L'ANNE MER	· · · ·		-	-
Level 6	Create	Ser.	· · · · · · · · · · · · · · · · · · ·			-	-
	Total		100 %		100 %		100 %

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Ravikiran Allada, Head R&D, Analytical, Novugen Pharma, Malaysia, ravianalytical@gmail.com	1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in	1. Prof. M. Arthanareeswari, SRMIST
2. Dr. Sudarshan Mahapatra, General Manager, Encube Ethicals Pvt. Ltd., Mumbai, sudarshan.m@encubeethicals.com	2. Prof. Kanishka Biswas, JNCASR Bengaluru, kanishka@jncasr.ac.in	2. Dr. K. Ananthanarayanan, SRMIST

B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-2(Revised-July2023)-First Year Syllabi-Control Copy

18 Hour

18 Hour



Pre-requisite Courses       Progressive Course       Progre	Course Code	21CYM101T	Course Name	ENVIF	RONMENTAL SCIENCE	(	Course Category	М				NON	I CRED	TI				L 1	T 0	P 0	C 0
Course Learning Rationale (CLR):       The purpose of learning this course is to:       Program Outcomes (PO)       Program Outcomes (PO)<	Pre-requ Course Course Of	isite es <i>Nil</i> fering Department	Chemis	Co- requisite Courses	Nil Data Book / Code:	s / Standards	Progre Cour Nil	essive rses	Nil												
Clark 1:       Clark 1:       Acquire knowledge on various causes, effects and control measures of soil, thermal and radiation pollution         ClR 1:       Acquire knowledge on various causes, effects and control measures of soil, thermal and radiation pollution         ClR 2:       Acquire knowledge on various causes, effects and control measures of soil, thermal and radiation pollution         ClR 3:       Acquire knowledge on various causes, effects and control measures of soil, thermal and radiation pollution         ClR 4:       Identify sources, disposal and treatment methods of soid waste management         Clar 5:       Identify sources, disposal and treatment methods of biomedical waste management         Course Outcomes (CO):       At the end of this course, learners will be able to:         Course Outcomes, (EO):       At the end of this course, learners will be able to:         Course Outcomes, (CO):       At the end of this course, learners will be able to:         Course Outcomes, (CO):       At the end of this course, learners will be able to:         Course Outcomes, (CO):       At the end of this course, learners will be able to:         Course Outcomes, (CO):       At the end of this course, learners will be able to:         Course Outcomes, (CO):       At the end of this course, learners will be able to:         Course Outcomes, (CO):       At the end of this course, learners will be able to:         Course Explain the processes involved in waste water treatment and inve	Course I	earning Rational	e (CLR):	The purpose of learning th	his course is to:						Pr	ogram	Outco	mes (F	20)				P	rograr	n
Cline 2:       Acquire knowledge on various causes, effects and control measures of soil, thermal and radiation pollution       Image: Cline 2:       Image: Cl	CI R-1 ·	Acquire knowledge	e on various c	auses, effects and control me	easures of environmental air and v	water pollution			1	2	3 4	5	6	7 8	9	10	11	12	S	Specifi	С
CLR3:       Acquire knowledge on various process involved in the treatment of wastewater         CLR3:       Acquire knowledge on various process involved in the treatment of wastewater         CLR4:       Identify sources, disposal and treatment methods of solid waste management         CLR5:       Identify sources, disposal and treatment methods of solid waste management         Course Outcomes (CO):       At the end of this course, learners will be able to:         Course Outcomes (CO):       At the end of this course, learners will be able to:         Course Outcomes (CO):       At the end of this course, learners will be able to:         Course Outcomes (CO):       At the end of this course, learners will be able to:         Co-1:       Analyze the sources, effects and control measures of environmental air pollution         Co-2:       Analyze causes, effects and control measures, of soil, thermal and radiation pollution         Co-3:       Explain the processes involved in waste water treatment and investigate the impact in local areas       -       3       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       - <td>CLR-2 ·</td> <td>Acquire knowledge</td> <td>on various c</td> <td>auses, effects and control me</td> <td>easures of soil, thermal and radiat</td> <td>tion pollution</td> <td>_</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>, 0</td> <td>-</td> <td>10</td> <td>11</td> <td>12</td> <td>OL</td> <td>Itcome</td> <td>S</td>	CLR-2 ·	Acquire knowledge	on various c	auses, effects and control me	easures of soil, thermal and radiat	tion pollution	_							, 0	-	10	11	12	OL	Itcome	S
Clinical       Identify sources, disposal and treatment methods of solid waste management       Identify sources, disposal and treatment methods of biomedical waste management         Clinical       Identify sources, disposal and treatment methods of biomedical waste management       Identify sources, disposal and treatment methods of biomedical waste management       Identify sources, disposal and treatment methods of biomedical waste management         Course       COURS       At the end of this course, learners will be able to:       Identify sources, disposal and treatment methods of work waster is environmental air pollution       3       3       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       <	CLR-3 ·	Acquire knowledge	on various p	rocess involved in the treatme	ent of wastewater	SWR			dge	tof	o suo		ociety		Vork		g				
CLR-5:       Identify sources, disposal and treatment methods of biomedical waste management       View       View <t< td=""><td>CLR-4</td><td>Identify sources, di</td><td>isposal and tr</td><td>eatment methods of solid was</td><td>ste management</td><td></td><td></td><td></td><td>lwor</td><td>sis</td><td>igatic</td><td>sage</td><td>s put</td><td></td><td>am V</td><td>_</td><td>Finar</td><td>ning</td><td></td><td></td><td></td></t<>	CLR-4	Identify sources, di	isposal and tr	eatment methods of solid was	ste management				lwor	sis	igatic	sage	s put		am V	_	Finar	ning			
Course Outcomes (CO):       At the end of this course, learners will be able to:       Image: Course Outcomes (CO):       At the end of this course, learners will be able to:         C0-1:       Analyze the sources, effects and control measures of environmental air pollution       3       3       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -	CLR-5 :	Identify sources, di	isposal and tr	eatment methods of biomedic	cal waste management				ering Kr	n Analy develor	t invest	X proble	gineer a	ahility	ial & Te	Inication	Mgt. &	ng Lean			
Construction       3       3       -       -       3       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       - <t< td=""><td>Course</td><td>Jutcomes (CO):</td><td>_</td><td>At the end of this course</td><td>learners will be able to:</td><td>1.1</td><td></td><td>_</td><td>ngine</td><td>robler esian</td><td>onduc</td><td>omple loderr</td><td>he en</td><td>thics</td><td>dividu</td><td>ommu</td><td>roject</td><td>ffe Loi</td><td>SO-1</td><td>SO-2</td><td>SO-3</td></t<>	Course	Jutcomes (CO):	_	At the end of this course	learners will be able to:	1.1		_	ngine	robler esian	onduc	omple loderr	he en	thics	dividu	ommu	roject	ffe Loi	SO-1	SO-2	SO-3
CO-2:       Analyze causes, effects and control measures, of soil, thermal and radiation pollution       3       3       -       -       3       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       - <td>CO-1:</td> <td>Analyze the sources</td> <td>, effects and</td> <td>control measures of environm</td> <td>nental air pollution</td> <td>ALC: NO.</td> <td></td> <td></td> <td>3</td> <td>3</td> <td><u> <u> </u> <u></u></u></td> <td>ō ≥ -</td> <td></td> <td>3 -</td> <td>-</td> <td>-</td> <td>-</td> <td></td> <td><u> </u></td> <td><u> </u></td> <td><u> </u></td>	CO-1:	Analyze the sources	, effects and	control measures of environm	nental air pollution	ALC: NO.			3	3	<u> <u> </u> <u></u></u>	ō ≥ -		3 -	-	-	-		<u> </u>	<u> </u>	<u> </u>
CO-3:       Explain the processes involved in waste water treatment and investigate the cause of a local polluted site       -       3       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -<	CO-2:	Analyze causes, effe	ects and contr	rol measures ,of soil, thermal	and radiation pollution	5129-	12.22		3	3			-	3 -	-	-	-	-	-	-	-
CO-4: Illustrate the treatment methods involved in solid waste management and investigate the impact in local areas - 3 3 3 3	CO-3.	Explain the processe	es involv <mark>ed in</mark>	waste water treatment and in	vestigate the cause of a local pol	lluted site	1.1	1.5	-	3		1.	-	3 -	3	-	-	-	-	-	-
CO-5: Illustrate the treatment methods involved in biomedical waste management and investigate the impact in local areas - 3 3 <td>CO-4:</td> <td>Illustrate the treatme</td> <td>ent methods in</td> <td>volved in solid waste manage</td> <td>ement and investigate the impact</td> <td>t in local areas</td> <td>5.00</td> <td>-</td> <td></td> <td>3</td> <td></td> <td></td> <td>-</td> <td>3 -</td> <td>3</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td>	CO-4:	Illustrate the treatme	ent methods in	volved in solid waste manage	ement and investigate the impact	t in local areas	5.00	-		3			-	3 -	3	-	-	-	-	-	-
Unit-1 : Environmental Segments, Air and Water Pollution       3 Hour         Environmental segments Structure of atmosphere - Composition of atmosphere - Air Pollution Sources - Effects – acid rain, ozone layer depletion and greenhouse effect Control measures of air pollution - Sources, effects and control measures of Water pollution       3 Hour         Unit-2 : Soil, Thermal and Radiation Pollution       3 Hour         Determination of BOD and COD - Determination of TDS and trace metals - Sources, effects and control measures of Soil pollution - Sources, effects and control measures of Thermal pollution - Sources and effects of Radiation pollution - Control measures of Radiation pollution       3 Hour         Unit-3 : Waste Water Treatment       3 Hour         Waste water treatment - Introduction - Primary treatment - Secondary treatment - Tertiary treatment - Activity: Visit to a local polluted Urban/Rural/Industrial/Agricultural site       3 Hour         Solid waste management       3 Hour         Solid waste management       3 Hour         Solid waste management       - Disposal methods, Open dumping, Engineered land filling, Composting, Incineration - Activity: Visit a hospital to understand the biomedical waste management - Treatment and disposal methods - Activity: Visit a hospital to understand the biomedical waste management.	CO-5:	Illustrate the treatme	ent meth <mark>ods i</mark> r	nvolved in biomedical waste n	nanagement and investigate the i	impact in local are	as	10	-	3	-	-	-	3 -	3	-	-	-	-	-	-
Environmental segments Structure of atmosphere - Composition of atmosphere - Air Pollution Sources - Effects - acid rain, ozone layer depletion and greenhouse effect Control measures of air pollution - Sources, effects and control measures of Water pollution Unit-2 : Soil, Thermal and Radiation Pollution Determination of BOD and COD - Determination of TDS and trace metals - Sources, effects and control measures of Soil pollution - Sources, effects and control measures of Radiation pollution - Sources and effects of Radiation pollution - Control measures of Radiation pollution Unit-3: Waste Water Treatment Unit-3: Waste Water Treatment Unit-4 : Solid Waste Management Solid waste management - Types - Effects - Process of waste management - Disposal methods, Open dumping, Engineered land filling, Composting, Incineration - Activity: Visit a hospital to understand the biomedical waste management - Treatment and disposal methods - Activity: Visit a hospital to understand the biomedical waste management.	Unit-1 : En	vironmental Seame	ents. Air and	Water Pollution			Co.	4.0	-		-									3 H	our
Control measures of Water pollution       3 Hour         Unit-2 : Soil, Thermal and Radiation Pollution       3 Hour         Determination of BOD and COD - Determination of TDS and trace metals - Sources, effects and control measures of Soil pollution - Sources, effects and control measures of Radiation pollution - Sources and effects of Radiation pollution         Unit-3: Waste Water Treatment       3 Hour         Waste water treatment - Introduction - Primary treatment - Secondary treatment - Tertiary treatment - Activity: Visit to a local polluted Urban/Rural/Industrial/Agricultural site       3 Hour         Volt-4 : Solid Waste Management       3 Hour         Solid waste management - Types - Effects - Process of waste management - Disposal methods, Open dumping, Engineered land filling, Composting, Incineration - Activity: Monitoring solid waste management in local areas         Unit-5: Biomedical Waste Management       3 Hour         Biomedical Waste Management - Definition and Effects - Categories of biomedical waste - Process of biomedical waste management - Treatment and disposal methods - Activity: Visit a hospital to understand the biomedical waste management.	Environme	ntal segments Struct	ure of atmosp	here - Composition of atmosp	ohere - Air Pollution Sources - Effe	fects <mark>– acid</mark> rain, o	zone layer	depleti	on and g	greenho	use effe	ct Cor	ntr <mark>ol me</mark>	asures	s of ai	r pollut	ion -	Source	s, eff	ects a	nd
Determination of BOD and COD - Determination of TDS and trace metals - Sources, effects and control measures of Soil pollution - Sources, effects and control measures of Radiation pollution - Sources and effects of Radiation pollution - Control measures of Radiation pollution Unit-3: Waste Water Treatment Waste Water Treatment - Introduction - Primary treatment - Secondary treatment - Tertiary treatment - Activity: Visit to a local polluted Urban/Rural/Industrial/Agricultural site Unit-4 : Solid Waste Management Solid waste management - Types - Effects - Process of waste management - Disposal methods, Open dumping, Engineered land filling, Composting, Incineration - Activity: Monitoring solid waste management in local areas Unit-5: Biomedical Waste Management Biomedical Waste Management - Definition and Effects - Categories of biomedical waste - Process of biomedical waste management - Treatment and disposal methods - Activity: Visit a hospital to understand the biomedical waste management.	control mea	asures of Water pollu	tion liation Pollut	lion		11.				-	-	_		_						3 11	our
pollution - Control measures of Radiation pollution Unit-3: Waste Water Treatment Unit-3: Waste Water Treatment Unit-4: Solid Waste Management Solid Waste Management - Types - Effects - Process of waste management - Disposal methods, Open dumping, Engineered land filling, Composting, Incineration - Activity: Monitoring solid waste management in local areas Unit-5: Biomedical Waste Management Biomedical Waste Management- Definition and Effects - Categories of biomedical waste - Process of biomedical waste management - Treatment and disposal methods - Activity: Visit a hospital to understand the biomedical waste management.	Determinat	tion of BOD and COD	) - Determinat	ion of TDS and trace metals -	- Sources. effects and control mea	asures of Soil poll	ution - Sou	rces. ei	ffects ar	d contr	ol measi	ires o	f Therm	al poll	ution ·	- Sourc	ces ar	nd effe	cts of	Radia	tion
Unit-3: Waste Water Treatment       3 Hour         Waste water treatment - Introduction - Primary treatment - Secondary treatment - Tertiary treatment - Activity: Visit to a local polluted Urban/Rural/Industrial/Agricultural site       3 Hour         Unit-4 : Solid Waste Management       3 Hour         Solid waste management - Types - Effects - Process of waste management - Disposal methods, Open dumping, Engineered land filling, Composting, Incineration - Activity: Monitoring solid waste management in local areas         Unit-5: Biomedical Waste Management       3 Hour         Biomedical Waste Management - Definition and Effects - Categories of biomedical waste - Process of biomedical waste management - Treatment and disposal methods - Activity: Visit a hospital to understand the biomedical waste management.	pollution - (	Control measures of I	Radiation poll	ution				,													
Waste water treatment - Introduction - Primary treatment - Secondary treatment - Tertiary treatment - Activity: Visit to a local polluted Urban/Rural/Industrial/Agricultural site Unit-4 : Solid Waste Management Solid waste management - Types - Effects - Process of waste management - Disposal methods, Open dumping, Engineered land filling, Composting, Incineration - Activity: Monitoring solid waste management in local areas Unit-5: Biomedical Waste Management Biomedical Waste Management- Definition and Effects - Categories of biomedical waste - Process of biomedical waste management - Treatment and disposal methods - Activity: Visit a hospital to understand the biomedical waste management.	Unit-3: Wa	nste Water Treatmen	nt	1	a part of the second se	and the second second				1.1										3 H	our
Unit-4 : Solid Waste Management       3 Hour         Solid waste management - Types – Effects - Process of waste management - Disposal methods, Open dumping, Engineered land filling, Composting, Incineration - Activity: Monitoring solid waste management in local areas         Unit-5: Biomedical Waste Management       3 Hour         Biomedical Waste Management - Definition and Effects - Categories of biomedical waste - Process of biomedical waste management - Treatment and disposal methods - Activity: Visit a hospital to understand the biomedical waste management.	Waste wate	er treatment - Introdu	ction - Primar	y tre <mark>atment - S</mark> econdary treat	tment - Tertiary treatment - Activit	ty: Visit to a local p	olluted Urb	ban/Ru	ral/Indus	strial/Ag	ricultura	site									
Solid waste management - Types – Effects - Process of waste management - Disposal methods, Open dumping, Engineered land filling, Composting, Incineration - Activity: Monitoring solid waste management in local areas Unit-5: Biomedical Waste Management Biomedical Waste Management- Definition and Effects - Categories of biomedical waste - Process of biomedical waste management - Treatment and disposal methods - Activity: Visit a hospital to understand the biomedical waste management.	Unit-4 : So	olid Waste Managem	ient					0												<u>3 H</u>	our
Biomedical Waste Management- Definition and Effects - Categories of biomedical waste - Process of biomedical waste management - Treatment and disposal methods - Activity: Visit a hospital to understand the biomedical waste management.	Solid Wast	e management - Typ	es – Effects - nagement	Process of waste manageme	ent - Disposal methods, Open dur	nping, Engineered	i land filling	i, Comp	oosting,	Incinera	ation - Ad	ctivity:	Monito	ring so	olid wa	aste ma	anage	ement i	n Ioca	<u>וו area</u> ג בו	S
waste management.	Biomedical	l Waste Management	- Definition ar	nd Effects - Categories of bior	medical waste - Process of biome	edical waste mana	aement - T	reatme	nt and o	lisposa	method	s - Aci	tivitv [.] Vi	isit a h	ospita	l to un	derst	and the	hior	<u>зп</u> nedica	J
	waste man	agement.	2				90on	. e admo	ne and a		method			0.001	oopna	. to un			2.011		

Learning Resources	1. Erach Bharucha, Textbook of Environmental Studies for Undergraduate Courses, 2nd ed., UGC 2. Kamaraj. P, Arthanareeswari. M, Environmental Science–Challenges and Changes, 6th ed., Sudhandhira Publications, 2013	<ol> <li>R.Jeyalakshmi, Principles of Environmental Science, Devi publications, 2nd ed., 2008.</li> <li>Helen P Kavitha, Principles of Environmental Science, Shine Publications and Distributors, 1st Edition, 2013</li> </ol>
-----------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

-			С	ontinuous Learning A	ssessment (CLA	)					
Bloom's Level of Thinking		Formative CLA-1 (40%)		Life long learning CLA-2 (40%)		Su	mmative (20%)	Final Examination (0% weightage)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	20%	1	20%	1.00	20%	-	- 1	-		
Level 2	Understand	20%		20%	A second	20%	-	-	-		
Level 3	Apply	30%		30%	-	10%		-	-		
Level 4	Analyze	30%		30%		30%		-	-		
Level 5	Evaluate			1000	and the second	20%	-		-		
Level 6	Create	-	1000	Sections'	211-12	St. And St.		-	-		
	Total	1	00 %	10	0 %		100%		-		

Course Designers	A STATE OF A	The second se
Experts from Industry	Experts from Higher Technical Institutions	Inter <mark>nal Exper</mark> ts
1. Dr. Ravikiran Allada, Head R&D, Analytical, Novugen Pharma, Malaysia, ravianalytical@gmail.com	1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in	1. Prof. M. Arthanareeswari, SRMIST
2. Dr. Sudarshan Mahapatra, General M <mark>anager, E</mark> ncube Ethicals Pvt. Ltd., Mumbai, sudarshan.m@encubeethicals.com	2. Prof. Kanishka Biswas, JNCASR Bengaluru, kanishka@jncasr.ac.in	2. Dr. K. K. R. Datta, SRMIST



Course	21LEM101T	Course		Course	М	NON CREDIT	L	Т	Р	С
Code		Name	CONSTITUTION OF INDIA	Category			1	0	0	0

Pre-requisite	Co- requisite	Progressive
Courses Nil	Courses Nil	Courses Nil
Course Offering Department	English and Foreign Languages	Data Book / Codes / Standards Nil

Course	Learning Rationale (CLR): The purpose of learning this course is to:	1			Prog	gram	Outcor	mes (F	PO)				Pr	ogra	m
CLR-1 :	Understand the basics of Constitution of India – meaning, nature, fundamental right and duties.	1	2	3	4	5	6	7 8	9	10	11	12	SI out	tcom	ic ies
CLR-2 :	Explain the parliamentary system of the government and the relationship between the governments		4	1	of		ty		v						
CLR-3 :	Detail the powers and functions of Central government	ledge		ent of	tions	e	socie		Worl		ance	_			
CLR-4 :	Detail the powers and functions of State government	Now	ysis	opme	stigat	Usag	and	5	eam	Б	k Fina	rning			
CLR-5 :	Create an awareness in learners about the kinds of local administrations, Election Commission and Political Dynamics		em Anal	n/devel	uct inve	m Tool	ngineer	inahility	tual & T	nunicati	t Mgt. 8	ong Lea	-		~
Course	Outcomes (CO): At the end of this course, learners will be able to:	Engin	Proble	Desig	Condi	Mode	The e	Susta Fthice	Individ	Comn	Projec	Life Li	-OS4	PSO-:	PSO-3
CO-1:	Define the meaning and nature of constitution of India, its fundamental rights and duties.	1	1	-	-	-	2		-	-	-	3	-	-	-
CO-2:	Demonstrate the powers of President, Vice President, Prime Minister, the process of Parliamentary System and the relation between the governments		5	-	-	-	2		-	-	-	3	-	-	-
CO-3:	Analyze the powers of State Legislature and Inter-state relation		1	-	-	-	3		-	-	-	3	-	-	-
CO-4:	Incorporate the system of Grassroot Democracy		-	-		-	3		-	-	-	3	-	-	-
CO-5:	Compile the power and process of Election Commission and Political Dynamics	- No.	-			-	3		-	-	-	3	-	-	-

Unit-1 : Constitutional Framework	3 Hour
Historical Background, Salient Features of the Constitution, Preamble, Union and its Territory, Citizenship, Fundamental Rights, Fundamental Duties, Amendment of the Constitution, Systems of Government	-
Unit-2 : Union Government	3 Hour
President, Vice-President, Prime Minister, Union Council of Ministers, Parliament, Parliamentary Committees, Centre-State Relationships, Union Judiciary - Supreme Court of India	
Unit-3: State Administration	3 Hour
Governor, Chief Minister, State Council of Ministers, State Legislature, Inter-State Relationships, State Judiciary - High court.	
Unit-4 : Urban and Local Administration	3 Hour
District's Administration Head, Mayor, Chairman, Elected Representatives, Panchayat Raj, Municipalities, Municipal Corporation	-
Unit-5: Election Provisions and Emergency Provisions	3 Hour
Election Commission of India- Composition, Powers and Functions and Electoral Process, Anti-Defection Law, Types of Emergency-Grounds, Procedure, Duration and Effects	

Learning Resources	1. M Laxmikanth, Indian Polity, Mc Graw Hill Publications, 2019.	2. D D Basu, Introduction to the Constitution of India. Lexis Nexis, 2020.
-----------------------	------------------------------------------------------------------	----------------------------------------------------------------------------

			Coi	ntinuous Learning A	ssessment (CLA	)			Cummotivo
	Bloom's Level of Thinking	For CLA-1 Aver (2	mative age of unit test 20%)	Life Long CLA (60	Learning A-2 – )%)	Sur	mmative (20%)	Fi (	inal Examination (0% weightage)
		Theory	Practice	Theory	Practice	Theory	<b>Practice</b>	Theory	Practice
Level 1	Remember			-				-	-
Level 2	Understand	100%	· · ·	100%		100%	1.	-	-
Level 3	Apply		A		200			-	-
Level 4	Analyze					-		- 18	-
Level 5	Evaluate			Come Sector			-		-
Level 6	Create			1000		-	1. 2. 4	-	-
-	Total	1	00 %	100	0%		100%		-

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Y. S. Kiran Kumar, Robert Bosch <mark>, Bangalo</mark> re	. 1. Dr. S. Soundiraraj, Professor and Head, Dept.of English, College of Engineering, Anna University Guindy Campus, Chennai	1. Dr. P. Tamilarasan, SRMIST
	2. Dr. J. Mangayakarasi, Head, Dept.of English, Ehiraj College for woman, chennai	2. Mr. G. Sugumar, SRMIST



Course Code	21LEM102T	Course Name	UHV-I:	UNIVERSAL	HUMAN VA	ALUES <mark>– INTRO</mark> I	DUCTION	Course	e M					NON	CREI	DIT					L 1	T 0	P C 0 0
Pre-requ Cours	iisite <i>Nil</i> es			Co- requisite Courses	Nil			Pro	ogressive Courses	Nil													
Course Of	ffering Department	EFL-Valı	Je Education C	Cell		Data Book / C	Codes / Standards	ls Nil															
						- Andrew	1	- 1 · ·	-	-												D-	
Course Le	arning Rationale (CLR	R):	The purpose	e of learning th	nis course is	s to:			<u> </u>				Prog	gram (	Outco	mes	(PO)					Pro Sr	ogram
CLR-1 :	understand what va	alue education	and per <mark>sonal</mark>	values is.	1	N. Same				1	2	3	4	5	6	7	8	9	10 1	11	12	out	comes
CLR-2 :	Connect the learner	rs to see the n	eed for develo	<mark>ping</mark> a holistic	perspective	e of life.	100			e		ч <b>—</b>	of		ety			¥					
CLR-3 :	Strengthen self-refle	ection		~	× 1		1.000	ä		/ledg		ent o	tions	ge	soci			Mo		ance	-		
CLR-4 :	Develop more confi	idence and <mark>cor</mark>	<mark>mmitment</mark> to u	nderstand, lea	arn and act a	accordingly		74 S		< now	lysis	opme	stiga	Usaç	and	ð .		eam	ы	& Fin	aminę		
CLR-5 :	Sensitize the stude	nt about th <mark>e so</mark>	<mark>cope of</mark> life – in	dividual, famil	ly (inter-per	sonal relationship	o), society and na	ature/existend	ce	ineering I	olem Ana	ign/devel tions	duct inve plex prob	em Tool	engineer	ainahilitv	8	vidual & 1	imunicati	ect Mgt. 8	Long Lea	-1	
Course Ou	ıtcomes (CO):		At the end o	f this course, I	learners will	ll be able to:	1	1000	1	Engi	Prot	Desisolu	Con	Mod	The	Sust	Ethic	lindiv	Corr	Proj	Life	PSC	PSC
CO-1:	Analyze the significat and education	nce of value in	puts provided	in formal educ	cation along	y with skills and d	levelop a broader	r perspective	about life		÷	-	1	-	-	-	3	-	-	-	3	-	
CO-2:	Formulate their aspir	ations a <mark>nd cor</mark>	<mark>1ce</mark> rns at differ	en <mark>t levels of l</mark> i	ving, and th	ne way to fulfil the	em in a sustainabl	le manner.		-	-	-		-	-	2	3	2	-	-	3	-	
CO-3:	Evaluate their curren	t state o <mark>f unde</mark>	erstanding and	living, and mo	odel a healtl	hy lifestyle	5.540	21.23		-	-	-		-	-	-	3	2	-	-	3	-	
CO-4:	Examine the issues of grateful towards pare	of home <mark>sickne</mark> ents, tea <mark>chers,</mark>	ess, interaction	s with seniors	on the car	npus, peer pressu	ure with better un	nderstanding	and feel	-	÷	-		-	-	-	3	2	-	-	3	-	
CO-5:	Develop more confid	lence an <mark>d com</mark>	mitment for va	lue-based livir	ng in family,	, society and natu	ure	11000	1	-	-	-	1	-	2	3	3	-	-	-	3	-	
Unit-1: Int	roduction to Value E	ducation	1		te ete			<u> ( 1990</u>	<u>e</u> .	-			~										3 Hour
Definition a Society, N	and Understanding of ation. Fixing one's goa	Value Educatio als - Basic hum	on - Objectives	s of Value Edu s - Role of UH	ication - Ne V in educati	ed for inculcation	n of Values – Self nolistic perspectiv	f exploration: /e	Aspiration	s and	Conce	erns, In	dividua	l acad	demio	, care	eer, E	Expec	ctation	s of fa	amily,	peers	,
Unit-2: Ha	rmony in the Human	Being - Unde	erstanding Or	neself								18											3 Hour
Definition of Understan activities o	of 'Self' (person) - Und ding Harmony in Self f the Self. Understand	lerstanding Hu : Self Confide ling Harmony i	i <mark>man being</mark> as ance - Self Dis in Human Bein	the Co-exister cipline – Self g Self with the	nce of the S assessmer Body: Self	Self and the Body. nt - peer pressur f-Regulation healt	re, time managen th issues, healthy	ment, anger, / diet, healthy	stress, pe lifestyle,	rsona Nurtur	lity de ing the	velopm Body.	ient, se	elf- im	prove	ement	, Una	derst	anding	the	chara	cteris	tics and
Unit-3: Ha	rmony in the Family				1.1.1.1.	L'ALS.	1.2.1.11	12	1.111	11													3 Hour
Harmony i feelings in	n the Family - Harmon relationship : Affection	ny in relations n, Care, guidar	hip - Values in nce, Reverenc	n Human-to-H e, Gratitude, G	'uman Relat Glory, Love	tionship - Feeling	g of Relationship	- Exploring	Feeling of	Trust	(Found	dation	value),	Resp	ect a	s a ri	ght e	valua	ation, c	other	natur	ally ad	ceptable
Unit-4: Ha	rmony in Society																						3 Hour
Understan Exchange∙	ding Harmony in Soc Storage - Scope: Harr	ciety: Participa mony from Far	ation in Societ mily Order to V	ty – <mark>Understa</mark> Vorld Family C	a <mark>nding Hum</mark> Drder – Univ	nan Goal - Dime <mark>versa</mark> l Human Orc	ensions (Systems der	s) of Humar	n Order: E	Educat	tion-Sa	anskar,	Health	h-Self	regu	lation	, Pro	oduct	ion-W	ork, .	Justice	e-Pres	servation,
Unit-5: Ha	rmony in the Nature/	Existence				The second s																	3 Hour
Understan Holistic Pe	ding Harmony in the N ception of Harmony in	lature – Classi n Existence. S	ification of Unit elf-Evaluation	ts into Four on and sharing	ders - Interc	connectedness ar	nd mutual fulfilme	ent - Realizin	g Co-exist	ence a	at All L	evels v	vith Na	ture -	Unde	erstan	ding	units	, Spac	e, Si	ubmer	gence	- The

₋earning Resources	<ol> <li>Gaur R.R., Sangal R., Baga Professional Ethics, Excel B</li> <li>http://uhv.org.in/uhv1notes</li> </ol>	ria G.P., 2019 (2nd F ooks, New Delhi.	Revised Edition), A Fe	oundation Course	in Human Values a	and			
Learning Asses	sment :								
	Bloom's Level of Thinking	Fo CLA-1 Ave	Con prmative prage of unit test (0%)	ntinuous Learning . Life Lon CL	Assessment (CLA g Learning A-2 – 0%)	) Su	mmative (0%)	 Fii (l	Summative nal Examination 0% weightage)
		Theory	Practice	Theory	Practice	Theory	<b>Practice</b>	Theory	Practice
Level 1	Remember		-	-	-	-		-	-
Level 2	Understand		· · · /		-		10	-	-
Level 3	Apply		1 . 14	1121-14	-	-	-	-	-
Level 4	Analyze	1 - C			and the second	-	-	-	-
Level 5	Evaluate	-		1.12 Later 1	A	-		-	-
Level 6	Create	S	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		State of the second	-	Card and a second s	-	-
	Total			1. Y	10000				-
			1.1.1.1	A REAL PROPERTY.	414 - 74	1.25	1		

Course Designers	1 mar 1		100	
Experts from Industry		Experts from Higher Technical Institutions	and the second	Internal Experts
1.		1	100	Dr.P.Supraja, SRMIST
		2		



Course Code	21PDM101L	Course Name		PROFESSIO	NAL SKILL	S AND PRACTICES	C	Course ategory	М					NON	CRE	DIT					L 0	T 0	P 2	C 0
Pre-requi Course Course Off	site s <i>Nil</i> ering Department	Career	Developme	Co- requisite Courses nt Center	Nil	Data Book / Codes / S	Standards	Progre Cour Nil	essive rses	Nil														
Course L	earning Rational	e (CLR):	The pur	pose of learning t	his course i	s to:		6.71					Prog	gram	Outc	ome	s (PC	D)				Pr	ogran	n
CLR-1 :	Analyze 'self', iden	tify profession	nal behavior	r and apply creating	ve ideas					1	2	3	4	5	6	7	8	9	10	11	12	S	pecific tcome	ະ S
CLR-2 :	Enhance necessar	y critical think	king <mark>skills th</mark>	<mark>at helps</mark> in resolvi	ing problem	S				-		t	ions	Ð										-
CLR-3 :	Adopt success hab	its and develo	lop p <mark>eople s</mark>	kills	1	1.655	<b>N</b> 144				ysis	pme	stigat oblen	Jsag	and	~		eam	Ľ		ming			
CLR-4 :	Enhance holistic de	evelopment of	of s <mark>tudents</mark> a	nd improve their	employabilit	y skills	1997			edae	em Anal	n/develo utions	uct inves	n Tool (	ngineer v	nability		lual & T	nunicatio	t Mgt. 8	ong Lea	_	0	~
Course C	Outcomes (CO):	-	At the e	nd of this course,	learners wi	ll be able to:	1			Engine Snowl	Proble	Design of solu	Condu	Moder	The el	En virc	Ethics	ndivic Mork	Comr	² rojec	_ife Lo	, -OSc	S-OS	S-OS
CO-1:	Develop professiona	lism and <mark>disc</mark>	<mark>cover t</mark> he cre	eative self			100	1.1		-	-	-	-	-	-	-	3	3	-	-	3	-	-	-
CO-2:	Apply best practices	and app <mark>roacl</mark>	ches to resol	lve problems effe	ctively	1 1 1 C M	10.00	1.5		-	-	-	3	-	-	-	-	3	2	-	3	-	-	-
CO-3:	Acquire inter person	al skills <mark>and b</mark>	b <mark>e an</mark> effecti	ve goal-oriented t	eam player	345 SAN	10210	1.1.1.1	1	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-
CO-4:	Apply behavior chan	ging ele <mark>ment</mark> s	<mark>ts to</mark> constru	ct professionalism	n in behavic	or		1.5		-	-	-	10.00	-	-	-	3	-	2	-	3	-	-	-
Unit-1 :							1.0	14.			1		-										10 H	our
Orientation ribbon cerei	to the course – IKIG. mony	AI – SW <mark>OT</mark> ai	analysis – JC	DHARI window – I	DISC profile	- Personal branding – Pr	ofile building -	Video Prof	ile Attit	ude re	engin	eering	– Chal	lengii	ng th	e seli	f – E	Etique	ette & g	groom	ning - G	Gratitu	de – E	3lue
Unit-2 :				2.	-Center																		10 H	our
Creativity &	Innovations – SCAN	IPER – De <mark>sig</mark>	<mark>gn Thin</mark> king	– Mind Mapping -	- Creativity	Challenge Decision Makir	n <mark>g – 6 Thinking</mark>	Hats – Pr	oblem	Solvin	ng skill	s – Fisl	h bone	Theo	ory								40.11	
Unit-3: Interperson	al skills – Think win x	win attitude -	– Expectati	on Management -	- Emotional	Intelligence Collaborative	Skills – Team	work – Net	tworkin	g - Le	aders	hip - Co	onflict I	/ana	geme	ent –	Арр	roach	ies – C	Case S	Study		10 H	our
Learning Resources	1. Covey Sean, 2. Thomas A Ha 3. Carol Dweck,	Seven Habits arris, I am ok, Mindset, The	ts <mark>of Highly (</mark> , You are ok e New Psyc	Effective Teens, I , New York-Harpe hology of Succes	New York, F er and Row, s, Random	ireside Publishers, 1998 1972 House Pub. 2006	4. Héctor 5. Kenneti 6. Angela 7. James	García,Fra h Blanchar Duckworth Clear, Ator	ncesc d, The n,Grit, V mic Ha	Miralle One I Vhy p bits, F	es, Ikių Minute assior Randoi	gai: The Manag and re m Hous	e Japai ger, Ha silienc se,202	nese irperc e are 1	secre collins the s	et to a s, 20 secre	a lon )14 ets to	g and succ	l happ cess, V	y life, /ermil	Pengu ion, 20	iin Bo 17	oks, 2	2017

Learning Assessment									
			Ca	ntinuous Learning	Assessment (CLA	)			
	Bloom's Level of Thinking	Fo	rmative CLA-1 30%)	For CL (3	mative .A-2 – 30%)	SL	ımmative (40%)	Fir (C	nal Examination 0% weightage)
		Theory	Practice	Theory	Practice	The <mark>ory</mark>	<b>Practice</b>	Theory	Practice
Level 1	Remember		15%		10%		10%		-
Level 2	Understand		<mark>15</mark> %		10%		<mark>10%</mark>	-	-
Level 3	Apply		20%	-	20%		20%	-	-
Level 4	Analyze		20%	-	20%	1.1	20%	-	-
Level 5	Evaluate		15%		20%		20%	-	-
Level 6	Create	1	15%	10.55	20%	2 >-	20%	-	-
	Total	1	00 %	10	00 %		100%		-

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Ms. Sudha Mahadevan, Career Launc <mark>her, sudh</mark> a.m@careerlauncher.com	1. Mr. Nishith Sinha, dueNorth India Academics LLP, nsinha.alexander@gmail.com	1. Mr. P. Priyanand, SRMIST
2. Mr Ajay Zenner, Career Launcher, aja <mark>y.z@car</mark> eerlauncher.com	2. Dr.Dinesh Khattar, Delhi University, dinesh.khattar31@gmail.com	2. Mrs. M. Kavitha,, SRMIST



Course Code	21PDM102L	Course Name		GE	ENERAL APTITUDE		Course Category	М				NON (	CREDI	Т				L 0	T 0	P 2	C 0
Pre-requ Cours Course O	uisite les <i>Nil</i> ffering Department	Career	Co C Development Cer	- requisite courses nter	Nil Data Book / Code	es / Standards	Progres Cours Nil	ssive ses	Vil												
Course l	Learning Rational	le (CLR):	The purpose of	of learning th	nis course is to:		6.71				Prog	gram C	Dutcon	nes (l	PO)				P	rogra	ım
CLR-1 :	Recapitulate funda	mental math	ematical concepts	and skills, h	oone grammar skills to write error	r-free sentences.		7	1 2	3	4	5	6 7	7 8	3 9	10	11	12	01	Specif utcom	ic ies
CLR-2 :	Sharpen logical rea	asoning throu	ugh skillful concept	ualization, r	nurture passion for enriching voca	abulary.		-	-	nt	ions ns	е									
CLR-3 :	Identification of rela	ationships be	etwe <mark>en words</mark> base	d on their fu	inction, usage and characteristic	S.		1	ysis	amq	stigat	Jsag			eam	E	~	ming			
CLR-4 :	Acquire the right ki	nowledge, ski	ill and aptitude to f	ace an <mark>y</mark> cor	npetitive examination.		2	Darina	ledae em Anal	n/develo	uct inves	rn Tool I		inahilitv	dual & T	nunicatio	ot Mgt. 8 Ce	ong Lea	1	2	e
Course	Outcomes (CO):		At the end of t	his course,	learners will be able to:				Proble	Desig	Cond	Mode	Shrief Chvird	Susta	ndivid	Comn	Proje(	ife L	-OSc	-OSC	-SO-
CO-1:	Build a strong base approaches.	in the fundam	nental mathematic	al concepts,	vocabulary and grammar knowle	edge through me	thodical					-		-	3	3	-	3	-	-	-
CO-2:	Identify the approach	hes and <mark>strat</mark>	<mark>egies</mark> to solve prol	plems with s	peed and accuracy.	Detter	1.00			-	1	-			3	3	-	3	-	-	-
CO-3:	Enhance lexical skill Collectively solve pr	's throug <mark>h sys</mark> oblems i <mark>n te</mark> a	stematic applicatio	n of concep	ts and careful analysis of style, s	syntax, semantics	and logic,	10		-	0	-		-	3	3	-	3	-	-	-
CO-4:	Gain appropriate ski	ills to su <mark>ccee</mark> d	<mark>d in p</mark> reliminary se	lection proc	ess for recruitment.	18.2.5	12/202			-	-	-		-	3	3	-	3	-	-	-
						1.1	Sec.	12													<u> </u>
Unit-1 :						-	C. S.	1 A			-									10 F	lour
Synonyms	s – Antonyms - Simple	Equations –	Age Problems – F	Ration Propo	ortion & Variation - Average	1	1.11.12	-		1.0	-									<del></del>	
Unit-2 :			1		Contraction of the second					1.11										10 F	lour
Sentence	Completion– Spotting	Error - Perce	<mark>entage –</mark> Profit and	l loss - Simp	ble and Compound Interest	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			_	-	-										
Unit-3:				10 A A		1111														<u>10 F</u>	lour
Reading C	Comprehension – Wor	d Analogy - L	Linear Arrangemen	t – Circular	Arrangement – Selection and Dis	stribution - Blood	Relations - D	Direction	sense	100											-
	1. Nishit K. Sinf	ia, The Pears	so <mark>n Guide to</mark> Quar	titative Apti	tude and Data Interpretation for t	he CAT 4. Nor	man Lewis, H	How to F	Read Bet	er and	Faster,	Goyal	, <mark>4th</mark> E	ditior	1						

Learning 2. Dinesh Khattar-The Pearson Guide to QUANTITATIVE APTITUDE for competitive examinations 5. Franklin GRE Word List, 3861 GRE Words, Franklin Vocab System, 2014W	/iley's GMAT Reading
Resources 3. Charles Harrington Elstor, Verbal Advantage: Ten Easy Steps to a Powerful Vocabulary, Random Comprehension Grail, Wiley, 2016	
House Reference, 2002 6. Manhattan Prep GRE : Reading Comprehension and Essays, 5th Edition	

Learning Assessmen	nt												
			Co	ontinuous Learning	Assessment (CLA	l)							
	Bloom's Level of Thinking	Fo CLA-1 Ave	ormative prage of unit test (30%)	For CL (3	mative A-2 – 80%)	SL	immative (40%)	Final Examination (0% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember		40%		40%		40%	-	-				
Level 2	Understand		40%	a second second	40%		40%	-	-				
Level 3	Apply		10%	-	10%	1.	10%	-	-				
Level 4	Analyze	-	10%	-	10%	1.1	10%	-	-				
Level 5	Evaluate						-	-	-				
Level 6	Create		A - 0		-	10 million	- A -	-	-				
	Total		100 %	1(	00 %		100%		-				
	64	21	-	SR-SA			in the						

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.Pratap Iyer, Study Abroad Mentors <mark>,pratap.iy</mark> er30@gmail.com	1. Mr Nishith Sinha, dueNorth India Academics LLP, nsinha.alexander@gmail.com	1. Dr. P. Madhusoodhanan, SRMIST
2. Mr Ajay Zenner, Career Launcher, ajay.z@careerlauncher.com	2. Dr.Dinesh Khattar, Delhi University, dinesh.khattar31@gmail.com	2. Dr Jayapragash J, SRMIST
		3 Dr M Snehalatha SRMIST



Course	21GNM101L	Course	PHYSICAL AND MENTAL HEALTH USING YOGA	Course	М	NON CREDIT	L	Т	Ρ	С
Code		Name	the second se	Category			0	0	2	0

Pre-requisite		Co- requisite		Progres	sive	9
Courses Nil		Courses	Nil	Cours	es	Nil
Course Offering Department	Center For YOGA			Data Book / Codes / Standards Nil		

Course	Learning Rationale (CLR):	The purpose of learning this course is to:		Program Outcomes (PO)											Program		
CLR-1 :	Utilize rich Indian heritage and kn	owledge for self-healing and self-protection from diseases	1	2	3	4	5	6	7	8 9	10	11	12	OL OL	specif utcom	IC IES	
CLR-2 :	Application of meditation techniqu	es to balance emotions, state of mind and body equip attain happiness.		1		of		ty									
CLR-3 :	Intellectually develop oneself by i	lentifying oneness with divine state merging with absolute space.	edore	2	nt of	ions	е	socie		Worl		ance					
CLR-4 :	Social transformations towards m	<mark>eaningful</mark> and purposeful humanity through the morality of the both the self and the soci	ety.	ysis	bme	stigat	Usag	and	X	eam	E E	Fina	ming				
CLR-5 :	Spiritual enlightenment of self by	purifying the body, mind and soul to attain the blissful stage.	ring k	Anal	develo	inve	Tool	ineer	ment	L & L	licati	Mgt. 8	g Lea				
			inee in	blem	sign/c	nduct	dem	eng	rironr stains	lcs vidus	Inmu	ject I	Lon	<u>-</u> -	0-2	0-3	
Course	Outcomes (CO):	At the end of this course, learners will be able to:	L L	Po Po	Des	Sol	Mo	The			S I	PG D	Life	PSC	PSC	PSC	
CO-1:	Identify Indian heritage, culture. Ide	ntify key anatomical structures in the human body and basic exercises for the same	1	-	-	3	-	2	- 3	2 3	3	-	3	-	-	-	
CO-2:	Apply yoga meditation practices for	emotional development and wellbeing	3	-	-	3	3	-	-	- 3	3	-	3	-	-	-	
00.0			0			0				0	0		0				

CO-3.	identity educational and intenectual development methods using tive sense realization and transformation	3	-	-	3	-	-	-	-	3	3	-	3	-	-	-
CO-4:	Demonstrate human values and emotions through thorough understanding about life, naturopathy and food habits	3	1	2	3	3	-	-	-	3	3	-	3	-	-	-
CO-5:	Impact self and society by peaceful coexistence with self-introspection and balanced diet charts	3	3	2	3	-	3	3	3	3	3	-	3	-	-	-

### Unit-1 : Physical Development

6 Hour

6 Hour

6 Hour

Indian Heritage & Culture, Concept of Yoga, Objectives, Science & Art of Yoga, Classification, Misconceptions, History of Yoga, Women and Yoga Practice- Meditation (Self Realization), Relaxation - Importance of Guru in Yoga, Purusharthas, Yogic Anatomy – Naadi's, Chakra's and Pancha Koshas, Human anatomy Scientific view - Yogic creation of Universe, Nature of Soul and Prakriti, Understanding the Mind, Disease and Causes, Food Habits. Exercises: Hands, Legs, Neuro-Muscular breathing, Eye, Ears, Nostrils, kidney, brain- Digestive tract, stomach, lungs, spine, hip, neck. Pressure points in our body.

Practice1: Standing exercise, Surya Namaskar

Practice2: Surya Namaskar, Sitting Exercises

Practice3: Prone & Supine posture Exercises

# Unit-2 : Emotional Development

Brain Functions, Bio-Magnetism, Cognitive Mind - Emotional The 3 levels of Consciousness and the Importance of Subconscious mind - Meditation (Five Sense Realization), Relaxation - Brain and its Functions, Bio Magnetism and its operation. Bio Magnetic Operation and Food Transformation - The 5 states of Mind and Brain waves- Meditation (mooladhara) & Relaxation - Asanas (Postures) for Body Structure: Full Body Structure Maintenance -Standing, Sitting, Prone & Supine Posture, Benefits of asanas Practices

Practice4: Surva Namaskar, Standing asanas

Practice5: Surya Namaskar, Sitting asanas

Practice6: Surya Namaskar, Prone & Supine posture Asanas

# Unit-3: Concentration Development

Current Challenges and sensory Overload, Need for better attention and awareness - Methods to improve Self Awareness and Concentration- Meditation (Five Sense Realization), Relaxation- Mind Taming Techniques, Nature of Divine states- Transformation of universe, living beings- Meditation (Agna) – Relaxation- Exercises: Intellectual development Brain Crown Centre (Thuriyam) Meditation- Five Senses Breath based Meditation Practices

Practice7: Yoga for Youthfulness (Kayakalpah Yoga
Practice8: Dynamic poses Yoga, Pranayama
Practice9: , Mudhras, Self-introspection Practice (Thought Analysis)
Unit-4 :Social Development 6 Ho
Introduction: Social Intelligence- Cultural values, Ethics & Morality- Service to Humanity, Self-Introspection- Yogic Ethics [Yama and Niyama]- Six Bad temperaments and Overcoming actions- Yoga Mudhras, Meditation
(Santhi) & Relaxation- Therapy for Social Development: Gestures Yoga (Mudhras) – Body locks (Bhandhas)- Indian Medical System: Naturopathy, Food, Nutrition, Diet Chart for Youthfulness
Practices
Practice10: Kayakalpha, Bhandas, Meditation (Crown)
Practice11: Stay poses Yoga, Krisya Yoga
Practice12: Balancing Asanas
Unit-5:Spiritual Development 6 Ho
Spiritual Connect & Yoga: Self-Realization, Self-Awareness, Self-Actualization, Self-Motivation - Methods for Self-Realization: Karma, Bakthi, Janana and Raja Yoga- Meditation (Nine centre) & Relaxation- The Science of Cause and Effect: Karmic Theory. Internal Cleanliness- Self-Actualization and Maslows theory of Self Actualization- Meditation, Introspection, Sublimination- Spirituality for Stress Management(yoga break by ayush)- Yoga Practices for blissful existence, advance asanas. Practices
Practice 13: Management of Physical problems (Yoga therapy)
Practice14: Project Submission
1.       B.K.S.Iyengar, Light on yoga, 2006.         5.       Vivekananda Kenthria Prkasan Trust, Yogam, 2006.

	1.	B.K.S.Iyengar,Ligh <mark>t on yoga</mark> ,2006.	5.	Vivekananda Kenthria Prkasan Trust, Yogam, 2006.
Loomina	2.	T.K.V.Desikachar, Heart of Yoga, Inner Traditions Bear and Company, 2003.	6.	Swami muktibodhananda, Hatha yoga Prathipika, Bihar School of Yoga 1985.
Descurrage	3.	Swami Ramdev Ji Yog Its Philosophy and Practice, 2008.	7.	Swami Satyananda Saraswati, Asana Pranayama Mudra Bandha, Bihar School of Yoga, 1993
Resources	4.	Yogiraj Vethathiri Maharishi, Yoga for Modern Age, Tenth edition, Vethathiri Publications,	8.	Dr. Asana Andiappan, Thirumoolar's Astanga Yoga, International Yoga Academy, 2017
		2007		

Learning Assessment	•				-	1			
g,			Cor	ntinuous Learning As	ssessment (CLA)	1.7			
	Bloom's Level of Thinking	Form CL (30	native A-1 0%)	Form CLA (30	ative and the A-2 %)	Su	mmative (40%)	Final (0%	l Examination 5 weightage)
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	1	20%		20%		20%		-
Level 2	Understand	1.0	20%		20%		20%	-	-
Level 3	Apply	1.10	30%		30%		30%	- 1	-
Level 4	Analyze		30%	S	30%	-	30%	-	-
Level 5	Evaluate	-/ -/ -/	11.11.11					-	-
Level 6	Create	100	· · · · · · · · · · · · · · · · · · ·		· · .			-	-
	Total	10	0%	100	)%		100%		-

Course Designers			
Professional Experts	Exp	erts from Higher Technical Institutions	Internal Experts
1.Dr s. Lakshmiganthan ,Assistant professor., MDINY., AYUSH., slk.pt@rediffmail.com	1.	Dr. N. Perumal, Director, Vision for Wisdom, Aliyar, visionacademy@vethathiri.edu.in.	1. Dr.V.Parthiban, SRMIST
2 .Dr. Manimekalai Narayanan, Sri Ramachandra Faculty of allied Health Sciences. m.manimekalai@sriramachandra.edu.in	2.	Shri.S. Sivakeerthi, Sr. Strategist APSEL Technologies, siva@apseltech.com	2. Dr.V.Nithyananthan, SRMIST

Course Code	21GNM102L	Course Name		NATION	AL SERVICE S	CHEME	Cou Cate	urse M egory				1	NON (	CRED	IT				L 0	T 0	P C 2 0
Pre-requ Cours	isite es <i>Nil</i>		Co- r Coı	equisite Irses	Nil			Progressive Courses	Nil												
Course Of	fering Department	NSS Cell	1		Da	ata Book / Codes / Standa	ards I	Vil													
Course I	earning Rational	e (CLR):	The purpose of l	earning this	course is to:	al and	the second	211				Proc	ram (	Dutcor	nes (F	20)				Pr	ogram
CLR-1 :	Understand themse	elves in relation	to their communit	y y				10	1	2	3	4	5	6	7 8	9	10	11	12	S	pecific
CLR-2 :	Develop among the	emselves a sens	se <mark>of social and</mark> ci	vic respons	ibility		_		1	1 .		4		>			-			ou	COILES
CLR-3 :	Utilize their knowle	dge in finding pr	ractical solution to	individual a	and community	problems	12		adge		ıt of	o suc		ociet		Vork		JCe			
CLR-4 :	Develop competen	ce required for g	group-living and si	haring of re	sponsibilities		1.44		nowle	/SiS	pmer	tigati ems	Jsage	and s		am /	ç	Fina	ning		
CLR-5 :	Acquire leadership	qualities and de	emocratic attitude	-		1.5.5.5	100	1	ering K	1 Anal)	develo s	t inves x probl	Tool	gineer a	ahilitv	al & Te	nicatio	Mgt. &	ıg Lear		
Course (	Dutcomes (CO):	_	At the end of this	course lea	arners will be a	ble to:	-		inginee	roblen	besign/	conduction	lodem	he enc	thics	ndividu	ommu	roject	ife Lor	SO-1	SO-2 SO-3
CO-1:	realize themselves in	n relation to theil	<mark>r communit</mark> y				1000	1	-	-	-	-	-	3	3 -	3	-	-	-	-	<u></u>
CO-2:	Develop among then	nselves <mark>a sense</mark>	of social and civi	c responsib	oility	COLORS NO	Sec.	1.2.7	-	-	-	-	-	3	3 -	3	-	-		-	
CO-3:	find practical solutior	n to indi <mark>vidual ar</mark>	nd community pro	blems			1.1	Sec.5	-		-	1.0	-	3	3 -	3	-	-	-	-	
CO-4:	Develop competence	e requir <mark>ed for gr</mark>	oup-living and sha	aring of res	ponsibilities	1 S 4 1 1 1 1	1.1				-	-	-	3	3 -	3	-	-	-	-	
CO-5:	develop leadership o	qualities <mark>and der</mark>	nocratic attitude	100	1000		100	-		-	-	-	-	3	3 -	3	-	-	-	-	
Unit-1 : In	troduction to NSS		-					-	-			-									6 Hour
Basic cond	epts –Profile –Aims –	-Objective <mark>s –Syr</mark>	<mark>mbo</mark> l –Motto –Stru	i <mark>cture –</mark> Reg	gular Activities -	-Special Camping Progra	mme –Natio	nal Days and	l Celeb	ration	s.										
Unit-2 : Ma	an Making		100								1										6 Hour
Personality	/ Development –Lead	ership Training		1	_		_		_	_	-		_								611.000
Unit-3: Co	Structure and Compo	ent poition Commu	nity based issues	Nood for	awaranaan Do	volopmontal Programma			-	-	9-										6 Hour
Volunteer	Empowerment:		mily based issues	-neeu ior	awareness –De	evelopmental Flogramme	3.														
Women's I	Emancipation –Forma	tion of Youth Cl	u <mark>bs –Self–H</mark> elp G	roups –You	ith and Develop	oment															
Unit-4 :So	cial Issues													_		_, ,					6 Hour
Media Infili Relief -An	tration – Human Right ti Atomic Movement –	ts Education –Co Drought Relief -	onsumer Awarene -Refugees Servic	ess –HIV/Al es.	IDS –Role of NS	SS in Eradicating Child La	abour –Envir	ronmental lss	ues –N	lationa	al Integr	ration- I	Blood	Dona	tion –	Flood	Relief	–First	Aid –E	arthq	Jake
Unit-5:Su	stainable Developme	ent																			6 Hour
Rain Wate	r Harvesting –Watersl	hed Managemei	nt –Health and Hy	giene –Alte	ernative Medicin	nal Systems –Yoga –Men	tal and Phys	sical Health- A	Adoptic	n of V	/illage.										

,
---

earning Assessme.	ent		Co	ontinuous Learning As	sessment (CLA	)					
	Bloom's Level of Thinking	Formative CLA-1 (30%)		Formative CLA-2 (30%)		Su	m <mark>mative</mark> (40%)	Final Examination (0% weightage)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember		20%	- the second	20%	-	20%	-	-		
Level 2	Understand		20%	and the second	20%	-	20%		-		
Level 3	Apply	1	30%		30%		30%		-		
Level 4	Analyze		30%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	30%	-	30%		-		
Level 5	Evaluate	A		States and the		-	and the second	-	-		
Level 6	Create					-	-	-	-		
	Total	100 %		100 %			100%		-		
		-	1. S. S. S. S.	1000 Barris		C 1255					

Course Designers		100 C
Professional Experts	Experts from Higher Technical Institutions	Internal Experts
		1. Dr.T.Rajasekaran, SRMIST



Course Code	21GNM103L	Course Name	NATIO	NATIONAL CADET CORPS Course Category						NON	CRED	IT				L 0	T 0	P 2	C 0
Pre-requ Course	isite es <i>Nil</i>		Co- requisite Courses	Nil	Progre Cour	ssive ses	Nil												
Course Of	fering Department	NCC	Cell	Data Book / Codes /	Standards Nil														
Course I	earning Rationa	ale (CLR):	The purpose of learning this	s course is to:	and in				Prog	gram (	Outcor	nes (F	PO)				P	rogra	im Fe
CLR-1 :	Understand the h	istory, aims a	nd objectiv <mark>e of NCC</mark>			1	1 2	3	4	5	6	7 8	9	10	11	12	0	itcom	
CLR-2 :	Understand abou	t armed force	s and <mark>various entries</mark>	1	1		0		of		ety		×						00
CLR-3 :	Know about Drill a	and various p	hysi <mark>cal training</mark>				edg	nt of	suo	Ð	socie		Wor		ance				
CLR-4 :	: Understand about weapons using in NCC						Knowl	opme	stigat	Usag	s and		Feam	ю	& Fina	aming			
CLR-5 :	Know about socia	l awareness	program conducting by NCC	200 C 100	and the second se		Ana	eve	inve	100	neel	hilih	8	licat	Agt.	) Le			
	1		2.2.1		Contraction of the		neer	gn/d	duct	em .	engi	sina S	idua	mur	ect N	Lonç	T	Ŷ	က္
Course (	Dutcomes (CO):		At the end of this course, le	arners will be able to:	10000		Engi Prob	Desi	Con	Mod	The	Ethic	Indiv	Corr	Proj	Life	PSO	PSO	PSO
CO-1:	known the history,	aims and <mark>obje</mark>	ective of NCC					-	1	-	3	- 3	3	-	-	-	-	-	-
CO-2:	Apply to armed forces through various entries						-	-	-	-	3	- 3	3	-	-	-	-	-	-
CO-3:	Perform the Drill and various physical training							-	1	-	3	- 3	3	-	-	-	-	-	-
CO-4:	Use the weapons using in N <mark>CC</mark>						-	-	-	-	3	- 3	3	-	-	-	-	-	-
CO-5:	Conduct the social awarene <mark>ss programs</mark>							-	-	-	3	- 3	3	-	-	-	-	-	-
r			and the second			1 L	1000												
Unit-1 :								10	-									<u>6 F</u>	lour
Introduction	n to NCC-Aims, Obj	ective, and Si	tructure Of NCC-History and Pre	sent of NCC-Duties of NCC Cadet	-NCC Camps: Types and	Conduc	t		-										
Unit-2 : Armod For	cos Entrios into va	rious armod f	incos Polico, and Paramilitary fo	areas (Pracodura of SSP) Nation	I Integration and importan	no Po	No of NCC	during	00000	andu	ortimo	Var	ious V	Vare fo	waht	Wor h	oroog	01	iour
Init-3	Les - Lintiles into va	nous anneu i		inces (Frocedure of SSD) - Nationa	a meyralion and importar			, uunny	peace		arunne	- vai	ious v	vais it	uynı,	vvai II	erues	61	lour
Physicals (	Various Types of Pl	nvsical Activit	ies). Obstacle Training - History (	of Drill - Types of Drill and Rules o	f Drill - Various Drills (Cere	emonial	Drill, Foo	t Drill. R	iffle Dr	ill) - C	omma	nds of	f Drill						ioui
Unit-4 :		i jeredi i tearra					21111,1 00			, .	o mina							6 ł	lour
Weapon Ti	raining - Introduction	to .22 and S	LR, Handling of Riffles, Firing - F	Range Procedure and Theory of G	roup - Case Studies - Adv	enture,	General A	warene	ss, ano	l Knov	vledge	ļ.							
Unit-5:				ALC: NO. 12	DEAP. F													6	lour
Personality	Development (Con	nmunication.	Empathy, Critical and creative th	inking) - Leadership (Motivation, M	loral Values. Honor Code)	- Turno	out and Tr	aits - He	alth an	d Hvo	iiene -	Socia	l Worl	k and a	aware	ness			
--																			

Learning Assessmen	t								
			Co	ntinuous Learning A	Assessment (CLA	)			
	Bloom's Level of Thinking	Fo	rmative CLA-1 (30%)	Forr CL (3	native "A-2 0%)	Su	mmative (40%)	Fin (0	al Examination % weightage)
		Theory	Practice	Theory	Practice	Theory	Practice 14	Theory	Practice
Level 1	Remember		20%		20%		20%	-	-
Level 2	Understand		20%	10000	20%		20%	-	-
Level 3	Apply		30%	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	30%	-	30%	-	-
Level 4	Analyze	N	30%		30%	-	30%	-	-
Level 5	Evaluate			1. 1. A.	2-1-1-1	-	1.00	-	-
Level 6	Create	2.00		1.1	1	-	-	-	-
	Total		100 %		100 %		100%		-
				C. 00.002		122	1 7		

Course Designers	a star bush when I want	
Professional Experts	Experts from Higher Technical Institutions	Internal Experts
	the second	 1. Mr.P. Jegan, SRMIST





Course	21CSS101J	Course		Course	S	ENGINEERIN
Code		Name	PROGRAMIMING FOR PROBLEM SOLVING	Category		

Pre-requisite	Nil		Co- requisite	Nil		Progressive	Nil
Courses			Courses			Courses	
Course Offering Department		Computer Science	e and Engi <mark>neering</mark>		Data Book / Codes / Standards	Nil	a designed and the second s

Course 1	Learning Rationale (CLR): The purpose of learning this course is to:				Prog	yram (
CLR-1 :	Think and evolve with a logic to construct an algorithm and pseudocode that can be converted into a program	1	2	3	4	5
CLR-2 :	Utilize the appropriate operators and control statements to solve engineering problems	dge		of	SU	
CLR-3 :	Store and retrieve data in a single and multidimensional array	wlea	S	nent	latio ems	age
CLR-4 :	Create custom designed functions to perform repetitive tasks in any application	Knc	alysi	lopr	estig	I Us
CLR-5 :	Create basic Abstract Data Types with python	ring	Ana	deve	inve lex p	Too
0		ginee	oblem	sign/c	nduct	odern

Course (	Dutcomes (CO): At the end of this course, learners will be able to:	Ш	Pro	De	of Co	β	ЧL
CO-1:	Solve problems through comp <mark>uter prog</mark> ramming. Express the basic data types and variables in C	2	3	-	-	-	
CO-2:	Use appropriate data types in simple data processing applications. To create programs using the concept of arrays.	2	3	-	-	-	
CO-3:	Create string processing applications with single and multi-dimensional arrays.	2	3	-	-	-	
CO-4:	Create user defined functions with required operations. To implement pointers in applications with dynamic memory requirements.	2	3	-	-	- 1	
CO-5:	Create programs using the python data types, loops, control statements for problem solving	2	3	-	-	-	

# Unit-1 :

Evolution of Programming & Languages - Problem solving through programming - Writing algorithms & Pseudo code - Single line and multiline comments - Introduction to statements. Variables and identifiers, Constants, Keywords - Values, Names, Scope, Binding, Storage Classes - Numeric Data types: integer, floating point Non-Numeric Date expression, Increment and decrement operator - Comma, Arrow and Assignment operator, Bitwise and Size-of operator - Arithmetic, Relational and logical Operators - Condit, with pre / post increment operator

# Unit-2 :

Conditional Control -Statements :Simple if, if...else - Conditional Statements : else if and nested if - Conditional Statements : Switch case - Un-conditional Control Statements. Statements: for, while, do.while - Looping Control Statements: nested for, nested while - Introduction to Arrays -One Dimensional (1D) Array Declaration and initialization - Acc Array Programs – 1D - Initializing and Accessing 2D Array, Array Programs – 2D - Pointer and address-of operators -Pointer Declaration and dereferencing, Void Pointers, Null Unit-3:

String Basics - String Declaration and Initialization - String Functions: gets(), puts(), getchar(),putchar(), printf() - Built-inString Functions: atoi, strlen, strcat, strcmp -String Functions on Strings - Function prototype declaration, function definition - Actual and formal parameters - Function with and without Arguments - Function - Function Pointers.

# Unit-4 :

Python: Introduction to Python - Introduction to Google Colab - Basic Data Types: Integers, Floating Points, Boolean types - Working with String functions - Working with Input, Comments/ Error Handling - Conditional & Looping Statements : If, for, while statements - Working with List structures - Working with Tuples data structures - Working with String functions - Working with Statements - Working with List structures - Working with Tuples data structures - Working with String functions - Working with String with String with String functions - Working with String with String functions - Working with String with St

Unit-5:

Creating NumPy Array -Numpy Indexing - Numpy Array attributes - Slicing using Numpy - Descriptive Statistics in Numpy: Percentile - Variance in Numpy -Introduction to Pand - Simple Operations with Data frames - Querying from Data Frames -Applying Functions to Data frames - Comparison between Numpy and Pandas - Speed Testing between N

Practice		
Practice 1: Input, Output Statements, Variables		
Practice 2: Data types & Operators-I		
Practice 3: Data types & Operators-II		
Practice 4: Control Statements (Branching, Looping)		
Practice 5: Arrays		
Practice 6: Arrays with Pointers		
Practice 7: Strings	and the state of t	
Practice 8: Functions		
Practice 9 : Arrays and Functions		
Practice 10: Input, Output in Python		
Practice 11: Python data structures		
Practice 12: Arrays in Python		
Practice 13: Operations with Numpy		
Practice 14: Operations with Pandas		
Practice 15: case study: Data science with Numpy, Pandas	The second state of the se	

Learning       2. Head First C: A Brain-Friendly Guide, By David Griffiths, Dawn Griffiths, Oreilly. [Chapters 2 to 4]       3. Let Us C, Fifth Edition, Yashavant P. Kanetkar, BPB publications. [Chapters 1 to 6, 8 to 9]       4. Problem Solving & Programming Concepts, Maureen Sprankle, Jim Hubbard, Prentice Hall, Ninth Edition.       6. https://www.tutorialspoint.com/python/index.htm         8. Python Datascience Handbook, Oreilly.Jake VanderPlas, 2017.[Cl         9. https://www.stutorialspoint.com/python/index.htm         10. https://www.uttorialspoint.com/python/index.htm         10. https://www.w3schools.com/python/
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Learning Assessmen	t 👘		121 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2						
		and the second se	Continuous Learn	ning Assessment (CLA)	Street Street Street	0	mmotivo		
	Bloom's Level of Thinking	Fc CLA-1 Ave	ormative erage of unit test (45%)	Life L CL4	ong Learning A-2 –Practice (15%)	Final Examination (40% weightage)			
		Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	20%		-	15%	15%	-		
Level 2	Understand	20%		-	15%	15%	-		
Level 3	Apply	20%			20%	20%	-		
Level 4	Analyze	20%			20%	20%	-		
Level 5	Evaluate	10%	1 1 1 2		15%	15%	-		
Level 6	Create	10%	THOMAS (		15%	15%	-		
	Total	100	100 %	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	100 %		100 %		

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sainarayanan Gopalakrishnan, HCL Technologies, sai.jgk@gmail.com	1. Prof. Janakiram D, IIT Madras, djram@iitm.ac.in	1. Dr. E.Poovammal, SRMIST
2. Dr. Sricharan Srinivasan, Wipro Technologies, sricharanms@gmail.com		2. Dr. B. Amutha, SRMIST
		3.Dr. Rajeev Sukumaran, SRMIST

Course Code	21EES101T	Course Name	E	ELECTRICAL AND	se S ory			E	ENGIN	EERII	NG S	CIEN	CES			L 3	T 1	P 0	C 4			
Pre-req Cours	uisite <i>Nil</i> ses			Co- requisite Course <mark>s</mark>	Nil		P	rogressive Courses	Nil													
Course C	Offering Department	t Electr	rical and Electr	ronics Engineering	Dai	ta Book / Codes / Standa	ards Ni	I														
Course	Learning Ration	ale (CLR):	The purp	o <mark>ose of learn</mark> ing this	s course is to:	Server 1	100	20				Prog	ram (	Outco	mes (	PO)				F	rogra	im
CLR-1 :	Outline the conce	epts and theor	rem of DC and	<mark>I AC ele</mark> ctric circuit	S			1.0	1	2	3	4	5	6	7 8	9	10	11	12	01	Specif utcom	ic ies
CLR-2 :	Gain knowledge	on analog and	d digita <mark>l electro</mark>	onics	~ /				0			of		ety		×						
CLR-3 :	Familiarize the c	oncept of DC	/ AC <mark>machines</mark>	s and drives	1	1.12	S		ledge		ent of	ions	e	socie		Worl		ance				
CLR-4 :	Illustrate the wor	king of differe	nt s <mark>ensors a</mark> nd	d transducers	1	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	1.1.5	_	Now	ysis	pme	stigat lems	Usag	and	ð	eam	ч	Fina	rning			
CLR-5 :	Acquire the know	vledge on Pow	v <mark>er Engine</mark> erin	ng 👘	-	Constant of	-	the second	ering k	1 Anal	develo	t inve x prob	Tool	gineer	ahility	al & T	nicati	Mgt. 8	ig Lea			
Course	Outcomes (CO)	:	At the en	nd of this course, le	arners will be <mark>ab</mark>	le to:	-		Engine	roblen	Design/	Conduc	Modern	The en		ndividu	Commu	Project	-ife Lor	SO-1	SO-2	-SO-3
CO-1:	Examine the funda	amentals of <mark>D</mark>	C and AC elec	ctric circuits		1		225	3	2	-	-	-	-		-	-	-	-	-	-	-
CO-2:	Apply the analog a	and digital <mark>elec</mark>	<mark>ctronic</mark> s to real	l time problem		C 245.0	ter.	10.0	3	2	-	-	-	-		-	-	-	-	-	-	-
CO-3:	Describe the work	ing princip <mark>le o</mark>	o <mark>f mac</mark> hines an	nd interpret its appli	ication to drives	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1	C. Carlo	3	1	-	-	-	-		-	-	-	-	-	-	-
CO-4:	Summarize the wo	orking of v <mark>ario</mark>	<mark>us se</mark> nsors an	d transducers		1 C 1 C 1		-	3	-	-		-	-		-	-	-	-	-	-	-
CO-5:	Disseminate the la	ntest trend <mark>s in</mark>	power engine	ering and its applic	ation to electric	vehicle	1.00	-	3	-		-	-	-		-	-	-	-	-	-	-
Unit-1:	Electric Circuits		-			-	18	1.5	<del>(</del>		1 24	1		P							12 ŀ	lour
Introduction Theorem.	on to basic terminolo	igies in DC cir	rcuit, Kirchhoff	's Current law, Kirc	hhoff's21EE Vol	tage law, Mesh Current /	Analysis, Nod	al Voltage A	Analysi	s, The	venin's	Theore	em, M	laxim	um po	wer tr	ansfer	Theor	rem, S	uperp	ositio	n

Basic terminologies of AC - RMS and Average value of halfwave and Full wave alternating quantity, Fundamentals of single-phase AC circuits- Analysis of R-L, R-C, R-L-C series circuits- Fundamentals of three phase AC system, Three-Phase Winding Connections, Relationship of Line and Phase Voltages, and Currents in a Delta and Star-connected System.

Practice on Theorems, Halfwave, Full wave bridge rectifier circuits

## Unit-2 : Electronics

Overview of Semiconductors, Diodes and Transistors, Introduction to JFET and MOSFET, Construction and working of power devices-SCR, BJT, MOSFET, IGBT -Switching Characteristics of SCR- Types of power converters-Natural and forced commutation, Linear voltage Regulator, SMPS.

Realize the logic expression using basic logic gates, Combinational logic design-Sum of Product form (SOP) and Product of Sum (POS) form, Minterm and Maxterm, Kamaugh Map (K-Map) representation of logical functions, Two variables K-Map, Three variables K-Map, Four variables K-Map. Introduction to FPGA.

Practice on realization of logical expression, combinational circuits, PCB design, soldering and testing

## Unit-3: Machines and Drives

Construction and working principle of DC machines- Construction and Working principle of a single-phase Transformer- Construction and working of three phase Induction motor, BLDC motor, PMSM, Stepper and Servo motor. Introduction to Electrical Drives-Block diagram explanation of chopper fed DC drives, Selection of drives for real time applications (cranes/EV/ Pumping applications) Practice on chopper applications, Demo on DC& AC machines

12 Hour

Basic principles Transducer- Co Introduction to Introduction to Practice on cap	s and classification of Instrument lassification- Capacitive and Ind Opto-electronics Devices, Light Bio sensor, Sensors for smart bu pacitive and inductive transducer	s- Moving Coil instrumer luctive transducers, Lin Dependent Resistor (L ilding. thermistor and LVDT u	nts, Moving Iron in ear Variable Diff DR), Photodiode sing virtual lab	nstruments, Digital Multime erential Transformer (LVD s, Phototransistors, Photov	ter, Digital storage Oscillos T), Thermistors, Thermoc oltaic cells (solar cells), C	cope. puple, Piezoelectric t ptocouplers, Liquid c	ransducer, crystal displa	Photoelectric transdu ay, Proximity sensor,	cer, Hall effect transducers. IR sensor, Pressure sensor,
Unit-5: Power	Engineering			CULL	A diana				12 Hour
Electrical suppl Introduction to Safety Measure Introduction to Practice sessio	ly system- simple layout of Gene smart grid. es in Electrical systems- Basic P renewable energy resources: So n on different types of wiring circ	eration, transmission and inciple and importance of lar Photovoltaic -Introdu uits and safety measure	I Distribution of p of Earthing- preca ction to energy st s	ower, Typical AC and DC nutions for Electric shock- s orage systems-overview of	power supply schemes, ov afety devices. battery, Fuel cell technolog	erview on substation gies- HEVs, PHEVs a	equipment v nd EVs – EV	with key diagram of 1 V Charging station	IkV/400 V indoor substation-
1.       Edward Hughes, John Hiley, Keith Brown, Ian McKenzie Smith, Hughes Electrical and Electronics Technology, Pearson Education, 12th ed., 2016       4.       Charles Alexander, Matthew Sadiku, Fundamentals of electrical circuits, McGraw-Hill Education, 2012         Learning       2.       S. K. Bhattacharya, Basic Electrical and Electronics Engineering, Pearson Education, 2011       4.       Charles Alexander, Matthew Sadiku, Fundamentals of electrical circuits, McGraw-Hill Education, 2012         Resources       3.       R. Muthusubramanian, S. Salivahanan, Basic Electrical and Electronics Engineering, Tata McGraw-Hill, 2012       5.       Morris M. Mano, Digital Design, 3rd ed., Pearson Education, 2011       6.									s, McGraw-Hill Education; Graw Hill, July 2017.
Learning As	sessment	and the second second				12 A A	-		
				Continuous Learnin	ig Assessment (CLA)			Sumi	mative
	Bloom' Level of Thi	nking	Form CLA-1 Avera (5)	native ige of unit test 0%)	Lite Lon C. (1	Life Long Learning CLA-2 (10%)			amination eightage)
		Theory	and the second	Practice	Theory	Practice	Th	e <mark>ory</mark>	Practice
Level	1 Remember		30%	and the second sec	30%	-	Sec. 1	30%	-
Level	2 Understand		30%		30%	- 5.0	~	<mark>30</mark> %	-
Level	3 Apply		20 %	-	20 %	- 20 %			-
Level	4 Analyze	1	20 %	- 1/2	20 %	20 % - 20 %			-
Level	5 Evaluate			-	-				-
Level	6 Create	6 2			-				-

Unit-4 : Transducers and Sensors

Course Designers	A DARASSAN DALASSAN	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. S. Paramasivam, Danfoss, Industries Pvt Ltd., paramsathya@yahoo.com	1.Dr. K. S. Swarup, IIT Madras, ksswarup@iitm.ac.in	1. Dr. A.Rathinam, SRMIST
2. Dr.Bhaskar Sahu, Schneider Electric Ltd, bhaskar.Sahu@se.com	2. Dr. S.Chandramohan, CEG, c_dramo@annauniv.edu	2. Dr. P.Eswaran, SRMIST

100 %

100 %

Total

100 %

Course Code	21MES101L Course BASIC CIVIL AND MECHANICAL WORKSHOP Course Catego	e S ry				ENGIN	EER	ING S	CIEN	CES	3			L 0	T 0	P 4	C 2
Pre-requ Cours	uisite Nil Co- requisite Nil Province Courses	ogressive Courses	Nil														
Course Of	ffering Department         Civil and Mechanical Engineering         Data Book / Codes / Standards         Nil																
Course I	Learning Rationale (CLR): The number of learning this course is to:					Proc	aram	Outo	mee		<u>))</u>				F	roora	m
	Practice machining and glass cutting shop floor trade		1	2	2	110	E		7		<u> </u>	10	11	10	Ś	Specif	ic
CLR-1.	Practice are 1 and wolding, and fitting and make new appendice appendice to various dimensions and tolerances	-	1	2	3	4	5	0	/	0	9	10	11	12	OL	utcom	es
CLR-2 :	Practice and & gas weiging, and nump and make new assemblies according to various dimensions and tolerances		ge		of	s of		siety			¥		e.			1	
CLR-3 :	Practice basic carpentry joints and sheet metal shop hoor practices.		wled		nent o	ation	ge	d soc			ч		nanc	þ		1	
CLR-4 :	Practice casting, moulding, & smithy trades		Kno	alysis	ndola	blem	I Use	er an	x x		Tear	tion	& Fi	arnir		1	
CLR-5 :	Practice and make G.I & P.V.C. plumbing trade		ering	n Ana	deve	t inv x pro	T ₀₀	ginee	men ahilit		al &	Inica	Mgt.	lg Le		1	
		5.6	gine	obler	sign	nduc	dem	e en	viron stain	lics	lividu	mm	oject	e Lor	0-1	-7 10	0-3
Course (	Outcomes (CO): At the end of this course, learners will be able to:		с П 2	Pre	B B	83	2	f		<u></u>	Pul	රි	Pro	د Life	PS	S S	PS
CO-1:	Machine in a rate. Drift using drifting machines. Cut grass. Create new components according to specifications	100	2	-	-	1	1	-	2		-	-	-	2	-		-
CO-2:	weid joints using arc & gas weiding. Fit pipes and fixtures. Make new assembly for given dimensions, and tolerances	1	3		-	-	1	-	3	-	-	-	-	2	-	-	-
CO-3:	Practice basic carpentry joints used in house hold furniture items, and sheet metal items used shop floor practices		3	ć.	-	100	1	-	3	-	-	-	-	2	-	-	-
CO-4:	Practice casting, moulding, & smithy trades	1	3		-	-	1	-	3	-	-	-	-	2	-		-
CO-5:	Make G.1 & P.V.C pipe line connections used in the plumbing trade	-	3		-	-	1	-	3	-	-	-	-	2	-		-
Unit-1 :	Machining Process	( Shut				1				_						12 F	lour
Machining machine t on a meta	g, Drilling, Tapping, Glass cutti <mark>ng - Mac</mark> hining: Basics of Machining Processes Equipment's - Tools and demonstration tool - Simple turning of cylindrica <mark>l surface</mark> on MS rod using lathe machine tool - Basics of drilling and tapping processes, al piece - Generate internal threa <mark>d on a met</mark> al piece. Basics of Glass cutting processes, - Equipment's Tools and demons	of machining Equipment's tration of pro	g to p s, too oducii	orodu Is - D ing ma	ce moc emons odels -	lels - S tration o Make g	imple of dri lass	e turni Iling a panel	ng of nd tap s for b	cylir ppin boxe	ndrica ng to _i əs	al surfa produc	ace c ce mo	on MS odels.	rod u - Ger	ising herate	lathe hole
Unit-2 : M	letal Joining Process			Ŭ	10	Ū										12 F	lour
Welding (A overlappin fitting prac	Arc and Gas) and fitting - Basics of <mark>Metal Arc</mark> welding operations, Equipment's - Tools and demonstration of producing m ig on one another using arc welding <mark>process</mark> Basics of gas welding operations, Equipment's, - Tools and demonstratio tice, tools and method - of producing m <mark>odels - Too</mark> ls and demonstration of producing models - Step fitting of two metal pla	nodels - Butt n of produci n <mark>tes u</mark> sing fit	t joint ing m ting to	of two	o meta - MIG	l plates welding	s usin g of r	ng arc netal	weldi plates	ng p ; - T	oroce IG w	ss - La elding	ap joi of m	int of t etal pl	wo m ates	etal p - Basi	ilates ics of
Unit-3: Ca	arpentry and Sheet metal				1											12 F	lour
Basics of Basics of S geometrics	Carpentry operations, Equipment's - Tools <mark>and demonst</mark> ration of producing models - Cross halving joint of two wooden µ Sheet metal operations, Equipment's - Tools <mark>and demonst</mark> ration of producing sheet metal models - To make Rectangular al shapes in Sheet metal operations - Equipment's, tools and demonstration of producing models - To make geometrical s	pieces at pe r shaped tra hape like fru	erpeno y usii istum	dicula ng GI 1, C <mark>on</mark>	r direc sheet <mark>e an</mark> d l	tion - To - To ma Prism u	o ma ake b ising	ke du igger G.I sh	ster fi size s ieet	rom 3000	wood op usi	den pie ing Gl	ece u shee	ising o t Ba	arpe sics (	ntry to of diffe	ools erent
Unit-4 : F	Foundry and Smithy															12 H	lour
Casting, m injection m - Basics of	noulding and smithy - Basics of Casting, processes, Equipment's - Tools and demonstration of producing models - To noulding and processes, Equipment's, - Tools and demonstration of producing models - To make plastic models using inje f Smithy processes, Equipment's, - Tools and demonstration of producing models - To forge chisel from MS rod using blac	make the m ection mould <mark>k smithy</mark>	iould ling o	using f simp	stepp ble part	ed flang - To m	ge - 1 nake j	To ma plastic	ake the c mode	e m els ι	ould using	using injecti	stepp ion m	oed fla iouldin	nge g of s	· Basi simple	ics of e part

Unit-5: Plumbi	ing	12 Hour								
Plumbing (G.I and P.V.C) - Basics of Plumbing practices for G.I and P.V.C Tools and demonstration of producing models - Plumbing of bathroom/ kitchen fittings using G.I. fittings - Plumbing of bathroc										
G.I. fittings - PVC Plumbing of bathroom/ kitchen fittings using P.V.C. fittings - Tools and demonstration of producing models - Plumbing of bathroom/ kitchen fittings using P.V.C. fittings - Plumbing of bathroom/										
using P.V.C. fit	tings - Basics of Plumbing practices for G.I pipe - lines an <mark>d fittings for pumps and machine</mark> s - Equ	ipment's, tools and demonstration of producing models Plumbing of pipe lines and fitting for Pumps using G.I								
fittings										
	1. Jeyachandran K., Natarajan S. & Balasubramanian S., A Primer on Engineering Practices	5. Kannaiah P. & Narayana K.L., Manual on Workshop Practice, Scitech Publications, 1999.								
	Laboratory, Anuradha Publications, 2007	6. Hajra Choudhury S.K., Hajra Choudhury A.K., Nirjhar Roy S.K., Elements of Workshop Technology, Vol.I &								
Learning	2. Jeyapoovan T., Saravanapandian M. & Pranitha S., Engineering Practices Lab Manual,	Vol.II 2010, Media promoters and publishers private limited, Mumbai.								
Resources	Vikas Publishing House Pvt.Ltd, 2006.	7. Rao P.N., Manufacturing Technology, Vol. I & Vol. II, Tata McGrawHill,2017.								
	3. Bawa H.S., Workshop Practice, Tata McGraw, 2007.	8. Gopal T.V, Kumar. T, Murali. G, A first course on workshop practice – Theory, Practice and Work Book,								
	4. Rajendra Prasad A. & Sarma P.M.M.S., Workshop Practice, Sree Sai Publication, 2002.	Suma Publications, Chennai, 2005.								

	t				1995	N.C.				
Learning Assessme		<b>F (</b>	-	Continuous L	earning Assessment (CL	4)	-			
Bloom's Level of Th <mark>inking</mark>		CLA-1 A	Verage of first cycle experiments (30%)	CLA-2 Aver ex	rage of second cycle (periments (30%)	Practi (40	cal Examination % weightage)	Final (0%	Immative Examination weightage)	
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	
Level 1	Remember		20%	1 C C C C C C C C C C C C C C C C C C C	20%	Constant and	20%	-	-	
Level 2	Understand	-	20%	1 Star 5 1	20%		20%	-	-	
Level 3	Apply	-	30%		30%		30%	-	-	
Level 4	Analyze	· ·	30%	0.00	30%		30%	-	-	
Level 5	Evaluate		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Circle M				-	-	
Level 6	Create	-	and the second s	-		1. 1 and 1.		-	-	
	Total 100 %				100 %		100%	0 %		

Course Designers	Part I		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
1.Dr. R. Kalimuthu, ISRO, Trivandrum	1. Dr. Ramkumar P, IIT Madras, ramkumar@iitm.ac.in	1. Mr. A. Thirugnanam, SRMIST	
2.Dr. A. Velayutham, DRDO, Chennai	2. Dr. Sourav Rakshit, IIT Madras, srakshit@iitm.ac.in	2. Dr. S. Prabhu, SRMIST	



Course Code	21MES102L	Course Name	ENGINEERI	Course Category	S			ENGIN	EERI	NG SC	CIENC	ES			L 0	T 0	P C 4 2	-		
Pre-requis	site Nil		Co- requisite	Nil		Progre	ssive Nil													]
Course Offe	ering Department	Mechanic	cal Engineering		Data Book / Codes / Standards	Nil														
Course Le	earning Rational	e (CLR):	The purp <mark>ose of learn</mark> ing t	his course	is to:	A. 1				Prog	gram (	Outcor	nes (P	0)				Pro	gram	7
CLR-1 :	Utilize engineering	graphic fundar	nentals. Apply the same to	draw engin	eering curves and projection of objection	ets.	1	2	3	4	5	6	7 8	9	10	11	12	Sp	comes	
CLR-2 :	Draw the projectior	n of solids like p	oris <mark>ms, cylinder,</mark> pyramids a	nd cone.						of		N.								]

The engineer and society Engineering Knowledge ndividual & Team Work Conduct investigations Design/development of olutions Project Mgt. & Finance fodem Tool Usage ife Long Learning Problem Analysis CLR-4 : Create the development of surfaces and construction of building drawing. Communication nvironment & CLR-5 : Develop the assemblies of 3D parts and create 2D drawings from the assembly. 2-02 SO-1 Ethics Ś At the end of this course, learners will be able to: Course Outcomes (CO): 2 3 3 -CO-1: Construct the geometrical curves, projection of points, lines and planes. 1 2 -CO-2: Develop the orthographic projection of solids. 2 3 -3 2 2 3 3 CO-3: Construct the projection of combination and section of solids. CO-4. Construct the development of surfaces and projection of buildings. 2 -. 3 3 2 -CO-5: Develop solid modelling, assembly of parts and extraction of 2D drawings. 2 3 3 2 . . -

## Unit-1 : Proiection

CLR-3 :

12 Hour

Principles, Standards, Conventions - Angle Projection, Symbols, Dimensions - 2D Geometric Constructions - 2D Geometric Constructions - Conic Curves ellipse by eccentricity method - Conic Curves ellipse by eccentricity method - Cvcloids, Epicycloids - Hypocycloid - Involute of a Square, Circle - Spirals -Introduction to perspective projection with terminologies and concepts - Orthographic multiview and isometric projection - Perspective projection of a point, line - Perspective projection of a planes, solids - Orthographic multiview of point, line - Orthographic multiview of planes, solids - Isometric projection of a point, line - Isometric projection of planes, solids -Isometric to orthographic multiview sketching - Orthographic multiview to isometric sketch - Orthographic multiview projection of lines inclined to both planes - Orthographic multiview projection of planes. auxiliary projection - Projection of lines inclined to both the planes - true length, true inclinations, traces of lines - Projection of lines inclined to both the planes - true length, true inclinations, traces of lines shortest distance between a point and a plane - Shortest distance between two lines -shortest distance between point and plane - shortest distance between point and plane

#### Unit-2 : Projection of solids using CAD software

Model the projection of combined solids, section of solids.

12 Hour

Introducing CAD Software, layers, - dimensions, tolerance, annotations - Create, modify, customize, print using CAD - Demo: Menu, Toolbars, Drawing Area, Dialog box, windows, Shortcut menus - Command Line, Status Bar, Different zoom methods. Create. Select. Erase objects - Draw straight lines, rectangle, polar, absolute, relative - Orthographic constraints. Ortho ON, snap to objects manually, automatically - drawing lines, arcs, circles, polygons, create, edit, use layers, extend lines - Dimensioning objects, annotations - Demo: drawing page, print, units/ scale/ limits settings, standards for dimensioning - ISO, ANSI Std. dimensioning, tolerancing - Projection of solid prisms and cylinders - inclined to both the planes - change of position method, reference line - method / auxiliary projections, - Projection of solid prisms and cylinders - inclined to both the planes - Change of position method - Projection of solid prisms and cylinders inclined to both the planes

Reference line method - Auxiliary projections - Auxiliary projections - Viewing isometric and perspective views, shaded, wire-frame models - Obligue prismatic solids and its projections - Projection of solid pyramids and cones inclined to both the planes - change of position method and reference line method / auxiliary projections, - Projection of solid pyramids and cones inclined to both the planes - Change of position method - Projection of solid pyramids and cones inclined to both the planes - Change of reference line method - Auxiliary projections - Auxiliary projections - Viewing isometric and perspective views, shaded, wire-frame models - Obligue pyramidal solids and projections

### Unit-3: Projections of combination of solids

Combinations of solids, Constructive Solid Geometry(CSG), Boolean operations - Creating combination of solids, isometric, perspective views, shaded, wire-frame - Constructive Solid Geometry, Boolean operations, Creating combination of solids - isometric, perspective, shaded, wire-frame - Constructive Solid Geometry, Boolean operations, Creating combination of solids - isometric, perspective, shaded, wire-frame - Constructive Solid Geometry, Boolean operations, Creating combination of solids - isometric, perspective, shaded, wire-frame - Constructive Solid Geometry, Boolean operations, Creating combination of solids - isometric, perspective, shaded, wire-frame - Constructive Solid Geometry, Boolean operations, Creating combination of solids - isometric, perspective, shaded, wire-frame - Section of right regular solid with axis perpendicular to one principal planes and cutting plane perpendicular to any one - principle plane true shape of the section - Section of right regular to any one - principal planes and - cutting plane perpendicular to any one of the section - Section of solids with axis inclined to both the planes and cutting plane perpendicular to any one principal plane of the section - Section of solids with axis inclined to both the planes and cutting plane perpendicular to any one principal plane of the section - Section al plan elevation, and sectional side-view of Building/ dwelling, include windows, doors, fixtures, etc. - Sectional plan elevation, and sectional side-view of Building/ dwelling, include windows, doors, fixtures, etc. - Sectional plan elevation, and sectional side-view of Building/ dwelling, include windows, doors, fixtures, etc. - Sectional plan elevation, and sectional side-view of Building/ dwelling, include windows, doors, fixtures, etc. - Sectional plan elevation, and sectional side-view of Building/ dwelling, include windows, doors, fixtures, etc.

## Unit-4: Part Modeling and Drawing

3D modelling, parametric, non- parametric, parts of CSG, surface, wireframe, shaded-Rendered models, background, shadows, multi-view, isometric, perspective views - 3D modelling, parametric, non- parametric, parts of CSG, surface, wireframe, shaded - Rendered models, background, shadows, multi-view, isometric, perspective views - Viewing models in multi-view, isometric, and perspective views - Modelling industrial part drawings - Modelling industrial part drawings -Design new components as a team - Design new components as a team - 3D Part to 2D Drawings geometric - dimensioning and tolerancing annotations - generating 2D from 3D models, printing drawings, generating sectional views - Geometric dimensioning and tolerancing annotations - Generating 2D drawings from 3D models

Generating sectional views - Generating sectional views - Printing drawings to printer or as .pdf - Printing drawings to printer or as .pdf - Development of surfaces: un-cut, & cut right / oblique regular solids Simple position with cutting planes perpendicular to any one principal plane - Development of surfaces: un-cut, & cut right / oblique regular solids Simple position with cutting planes perpendicular to any one principal plane - Development of surfaces: un-cut, & cut right / oblique regular solids - Simple position with cutting planes perpendicular to any one principal plane - Development of surface-development of surface-development - Design of real time surface-development Design of real time surface-development - Design of r

## Unit-5: Assembly Modeling and Drawing

Part/ component model creation for assembly-. Study of various widely used assembly of parts like flanged joint, universal joint etc. -Creation of parametric parts for assembly - non- parametric parts for assembly - non- parametric parts for assembly - non- parametric parts for assembly - creation of parametric parts for assembly - non- parametric parts for assembly - non- parametric parts for assembly - simple assembly - non- parametric parts for assembly - simple assembly - simple assembly - simple assembly of parts, - associated part and assembly a

Assembly Drawings: exploded view with assembly annotations part details -Printing assembly drawings to printer and as pdf -Exploded view with assembly annotations -part details -Exploded view with assembly annotations -part details - Printing assembly drawings - Printing assembly drawings

Learning Resources	<ol> <li>Bhatt, N.D., Engineering Drawing (First Angle Projection),53rd ed., Charotar Publishing House, 2017</li> <li>Bethunc, J., Engineering Graphics with AutoCAD 2017, Pearson Education, 2016</li> <li>Khristofor Artemyevich Arustamov, Problems in projective geometry, MIR Publishers, Moscow, 1972</li> <li>Natarajan, K.V., A Text Book of Engineering Graphics, 21st Edition, Dhanalakshmi Pub., 2012</li> <li>Shah. M. B.,Rana, B. C, Engineering Drawing, Pearson Education, Pvt. Ltd., 2005</li> </ol>	<ol> <li>Jeyapoovan. T., Engineering Drawing and Graphics using AutoCAD, Vikas Pub. House, 2015</li> <li>Narayanan, K. L., Kannaiah, V., Engineering Graphics, Scitech Publications, 2010</li> <li>Luzzader, Warren J., Duff John M., Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Prentice Hall of India Pvt. Ltd., 2005.</li> <li>Mohammad Dastbaz, Chris Gorse, Alice Moncaster (eds.), Building Information Modelling, Building Performance, Design and Smart Construction, Springer 2017 User Manual of Respective CAD Softwares</li> </ol>
-----------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

12 Hour

12 Hour

$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Learning Assessme	nt													
Bloom's Level of Thinking       CLA-1 Average of first cycle experiments (30%)       CLA-2 Average of second cycle experiments (30%)       Practical Examination (40% weightage)       Guinnetwe Final Examination (0% weightage)         Level 1       Remember       -       20%       -       20%       -       Practice       Theory       Practice         Level 2       Understand       -       20%       -       20%       -       20%       -       -         Level 3       Apply       -       30%       -       30%       -       -       -         Level 4       Analyze       -       30%       -       30%       -       -       -         Level 5       Evaluate       -       -       -       -       -       -       -         Level 6       Create       -       -       -       -       -       -       -				Continuous Learning Assessment (CLA)											
TheoryPracticeTheoryPracticeTheoryPracticeTheoryPracticeLevel 1Remember-20%-20%-20%Level 2Understand-20%-20%-20%Level 3Apply-30%-30%-30%Level 4Analyze-30%-30%30%Level 5EvaluateLevel 6Create0%-0%		Bloom's Level of Thinking	CLA-1 A	Average of fi <mark>rst cycle</mark> experiments (30%)	CLA-2 Ave	erage of second cycle experiments (30%)	Practi (40)	cal Examination % weightage)	Final (0%	Examination weightage)					
Level 1         Remember         -         20%         -         20%         -         20%         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -			Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice					
Level 2         Understand         -         20%         -         20%         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -	Level 1	Remember		20%		20%	- L	20%	-	-					
Level 3         Apply         -         30%         -         30%         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -	Level 2	Understand		20%		20%		20%	-	-					
Level 4         Analyze         -         30%         -         30%         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -	Level 3	Apply	-	30%	-	30%	1000	30%	-	-					
Level 5         Evaluate         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -	Level 4	Analyze	-	30%		30%	1.	<mark>30%</mark>	-	-					
Level 6 Create	Level 5	Evaluate		1 N	10.00				-	-					
	Level 6	Create		1.1	and the second	S 16 10	N. 19.1		-	-					
100% 0%		Total		100 %	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	100 %		100%		0%					

Course Designers		Sec. Sec.
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.Dr. R. Kalimuthu, ISRO,	1. Dr. Ramkumar P, IIT Madras, ramkumar@iitm.ac.in	1. Mr. D. Kumaran, SRMIST
2.Dr. A. Velayutham, DRDO,	2. Dr. Sourav Rakshit, IIT Madras, srakshit@iitm.ac.in	2. Mr. S. Balamurugan, SRMIST

Note: For all B.Tech Programmes othe<mark>r than C</mark>ivil, Mechanical, Automobile, Aerospace and Mechatronics, the entire course would be conducted using CAD Software only. * This syllabus for the students admitted in the AY 2021-22 and 2022-23 only



Course Code	urse ode       21MES102L       Course Name       ENGINEERING GRAPHICS AND DESIGN#       Course Category       S       ENGINEERING SCIENCES       L       T         0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0 </th <th>T 0</th> <th>P (</th> <th>C 2</th>								T 0	P (	C 2														
Pre-requis	site N s	il			Co- requisite Courses	Nil	CIE	VO	Progress Course	sive es	Nil														
Course Off	ering D	epartment	Mec	hanical En	gineering	Da	ata Book / Codes / St	tandards	Nil	-															
Course L	earnin	Ration	ale (CLR)	: The	purpose of learning thi	s course is to:	-		-	٦F	1			Prog	ram (	Dutco	omes	s (PC	))				P	rogram	
CLR-1	Utilize	the engine	ering graph	ics fundam	entals. Apply the same	to draw geome	try and curves				1	2	3	4	5	6	7	8	9	10	11	12	S	pecific	_
CLR-2	Draw t	he projectio	on of points.	lines and	planes			-					-	-	5	•	,	0	-	10		12	ou	tcomes	<u>i</u>
CLR-3	Produc	e the proie	ection of sol	ids like pris	m. cvlinder. pvramid ar	nd cone and sec	ctioned solids	100			dge		tot	ins of		ociety			/ork		ge				
CLR-A ·	Create	the isome	tric and pers	spective pr	oiection and develop th	e surfaces		1	100		owle .	SIS	men	gatic ms	sage	nd sc			am V	_	-inar	ing			
	Develo	n the com	hination of s	olide usinc	n primitives and features	<u>,</u>		-			g Kn	nalys	/elop	vesti oble	ol U	er al	nt &		š Te	ation	t. & F	.eam			
CLR-0 :	Develo				phillines and realarce	,	-		100		eerin	A Ma	n/de/	uct in ex pı	n To	ngine	nme nahi		lual {	Junic	t Mg	ng L	_		~
Course ()	hitcom	es(CO)		At ti	he end of this course. le	amers will he a	ble to:		1.1.1	-	ngin	Lobie	olutic	ond	lode	he el	nviro	thics	Idivic	omn	rojec	ife Lo	ò	SO'S	25
CO-1:	Constru	ct the 2D g	eometrica <mark>l i</mark>	igures and	special curves		510 10.	1000	100		1	-	-	-	3	-	- -	-	-	2	-	-	-		<u> </u>
CO-2	Demons	trate the p	rojection of	points, line	s and planes	100.00		1 m	1.24		2	-	-		3	-	-	-	-	3	-	-	-		-
CO 2:	Constru	ct the orthc	araphic pro	iection of r	equiar and sectioned section	olids					2	-	-		3	-	-	-	-	3	-	-	-		_
CO-3.	Croato t	ho develor	mont of sur	faces and	isometric projection		I the second	100	-		2	_		-	3		_	_	_	3	_		-	_	
CO- <del>4</del> . CO-5:	create c	ombination	of solids		isometric projection		1	1.1	31.5		2	-	-	-	3	-	-	-	-	3	-	-	-	-	-
						Colais					_				. <del>.</del> .										
Unit-1 : I	ntroduc	tion to En	gineering g	r <mark>aphics</mark> a	nd Design									-										12 Ho	ur
Engineering	graphic	s principle	es and stan	dards - Si	gnificance of design ar	nd drawing – In	troduction to drafti <mark>ng</mark>	g Software – Dra	aw, modify	y and	dimens	sion t	oolbar	s- 2D	geon	netric	cal co	onstr	uctio	1 – Co	onic s	ection	s – E	llipse a	Ind
Unit-2 · Ort	hoaran	hic proiec	tion of poir	ts lines a	nd plane surface						-	-	1	-										12 Ho	ur
Drinoinlos	f proioo	tion Type	o of project	ion First of	and plane carriece	ningtion Drain	ation of points in four	auadranta Dr	ningtion of	otroio	ht line i	nolin	nd to o	no pla		ad bo	th n	rinoin	ol pl	one hu	rotot	ina lina	mot	had	
Projection of	of plane	surfaces in	iclined to or	e principal	plane	ojecuon – Proje		quaurants – Pro	Djection of	Straty	nit iine i	nciine	<del>j</del> u lo 0	ne pia	ille al		un pi	incip	ai pic	ane by	TUldli	ny iine	; meu	100 -	
Unit-3: Pro	jection	of solids a	nd Section	of solids		223.1	AR AND	W. Cha		1.1	1.1	L)												12 Ho	ur
Significance	e of proj	ection of so	olids – Ortho	ographic pr	rojection of simple solid	s - Projection of	polyhedrons and soli	ids of revolution	– Inclined	l to on	e princi	pal pl	lane ar	nd par	allel t	o oth	ner by	y cha	ange	of pos	ition n	nethod	l. Sec	tion of	
solids – Se	ction pla	ne perpen	dicular to or	ie plane ar	nd p <mark>arallel or incline</mark> d to	other plane				_	-														
Unit-4: De	velopm	ent of surf	'aces, Isom	etric proje	ection																			12 Ho	ur
Developm	ent of la obiects	teral surfac	ces of simpl -	e solids - p Pe	olyhedrons and solids of erspective	of revolution- Pr	inciples of isometric p f polyhedrons	projection and is and	ometric vie	ew – l solids	sometri	c vie	w from		orth	ogra _l	phic n hv	visu	al rav	view / meth	s 0 od (D	f simp emon:	le stratio	n)	
Unit-5: Con	nbinatio	on of Solid	ls			-j= 5	<i>polynearcino</i>	unu		20							~ ~ )							12 Ho	ur
Principles of	f constru	ictive solid	geometry -	Boolean c	perations – Combinatio	on of simple soli	ds usin <mark>g Boolean ope</mark>	erations – Extru	de, revolve	e <mark>, sw</mark> e	ep, loft	and s	shell fe	atures	5 – M	odeli	ng of	' sim	ole pi	roduct	s usin	g feat	ıres		
												_			_			_					_		_

Learning Resources	<ol> <li>Venugopal, K. and V. Prabhu Raja. Engineering Drawing and Graphics + AutoCAD. New Age International (P) Limited, 2005</li> <li>Narayana, K. L. and P. Kannaiah. Textbook on Engineering Drawing. Scitech Publications, 2011.</li> <li>Gopalakrishna, K. R. Engineering Drawing. Subas Publications, 2010.</li> <li>Bhatt, N. D. and V. M. Panchal. Engineering Drawing. Charotar Publishing house, 2012.</li> </ol>	5 Jeyapoovan. T., Engineering Drawing and Graphics using AutoCAD, Vikas Pub. House, 2015. 6. Natarajan, K. V. A text book of Engineering Drawing Graphics. Dhanalakshmi Publishers, Chennai, 2008. Dhananjay AJolhe. Engineering Graphics McGraw-Hill Publishing Company, Ltd, 2009.
Learning As	sessment	

	Bloom's Level of Thinking	CLA-1 A e	Examination weightage)	Summative Final Examination (0% weightage) Theory Practice					
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	30%	1 - A -	20%	Call 7. 1 -	20%	-	30%	-
Level 2	Understand	30%		40%		40%	-	30%	-
Level 3	Apply	40%		40%	1.00	40%	-	40%	-
Level 4	Analyze	in the second se			10 C 10 C 10 C 10 C		-	-	-
Level 5	Evaluate		- 1	1.1.1	1.77			-	-
Level 6	Create			10.00 30.0	1	-	3 .	-	-
	Total		100 %	Course V	100 %		100%		0%

Course Designers	The second s	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. N. Babu, CVRDE, DRDO, Avadi, babu.n.cvrde@gov.in	1. Dr. Shankar Krishnapillai, IIT Madras, skris@iitm.ac.in	Dr. V. Magesh, SRM IST, KTR
2. Mr. Parameswaran, Nokia, Chennai, p <mark>arameswa</mark> ran.s@nokia.com	2. Dr. Raju Abraham, NIOT, Chennai, abraham@niot.res.in	Mr. S. Arun Prasath, SRM IST, KTR

# This syllabus for the students admitted from the AY 2023-24 onwards



Course Code	21MES101T	Course Name	ENGINEERING	S			E	NGINI	ERIN	GSC	IENCI	ES			L 3	T 1	P 0	C 4		
Pre-requ Course Course Of	isite Nil es Fering Department	Mecha	Co- requisite Nil Courses Nil nical Engineering	Data Book / Codes / Standards	Progres Cours Nil	ssive ses	Nil													
Course I	earning Rational	e (CLR):	The purpose of learning this course	e is to:	1.1					Prog	ram C	utcon	nes (P	0)				Р	rogra	n
CLR-1 :	CLR-1 :         Apply static equilibrium problems in engineering and its applications										5	6 7	8	9	10	11	12	S ou	peciti itcom	c es
CLR-2 :	Apply theory of dry	friction in Me	echanical Engineering applications			<u>.</u>	0			of		ty		~						
CLR-3 :	Apply the concept	of centroid ar	nd <mark>moment of</mark> inertia in engineering pro	blems and its applications			ledge	1	ent of	tions	e	socie		Worl		ance	-			
CLR-4 :	Analyze problems	on kinematic	s and kinetics of particles		1.2		<pre>vow</pre>	lysis	opme	stiga	Usaç	& &		eam	uo	& Fin	arning			
CLR-5 :	Analyze problems	on kinematic	s and kinetics of rigid bodies	A STATISTICS	1.1		ering I	m Ana	/devel	ct inve ex prob	1 Tool	Igineer	vility	ual & T	unicati	: Mgt. 8	ng Lea			
Course (	Dutcomes (CO):		At the end of this course, learners v	will be able to:	-		Engine	Proble	Design	Condu	Moden	The en Envirol	<u>Sustair</u> Ethics	Individ	Comm	Project	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Solve statically deter	rminate <mark>equil</mark>	ibrium problems in Engineering	Construction of the second			3	3	-	1	-		-	-	-	-	-	-	-	-
CO-2:	Solve problems relat	ted to dr <mark>y fric</mark>	tion and analyze trusses	COLOR CONSTRUCTO	1.1.2.	1	3	3	-	-	-		-	-	-	-	-	-	-	-
CO-3:	Determine centroid a	and mom <mark>ent</mark>	of inertia for composite objects	the second second	N. 512	1.5	3	3	-	10	-		-	-	-	-	-	-	-	-
CO-4:	Perform kinematic a	nalysis o <mark>f pa</mark> i	r <mark>ticle</mark> s with rectilinear, curvilinear motior	ns and solve dynamic equilibrium proble	ems in particle	S	3	3	-	-	-		-	-	-	-	-	-	-	-
CO-5:	Perform kinematic al in rigid bodies	lems	3	3	-		-		-	-	-	-	-	-	-	-				

### Unit-1 : Statics of Particles and Rigid Bodies

Introduction to Mechanics, classification of mechanics - Fundamental concepts and principles of engineering mechanics - Concurrent forces in a plane, Coplanar forces - Vector approach on addition, subtraction of forces -Resolution of forces - Resultant of several concurrent forces in plane (vector approach) – Equilibrium of particles, Free body diagram, Forces in planes, Lami's theorem - Forces in space: resultant of concurrent forces in space. Principle of transmissibility - Moment of a force. Varianon's Theorem and its applications - Reduction of system of forces into single force and couple system - Resultant of non-concurrent forces in plane - Types of supports and reactions - Equilibrium of rigid bodies in two dimensions.

## Unit-2 : Analysis of Friction and Trusses

Friction and its types. Laws of Friction, coefficient of friction - Angle of Friction, Angle of repose, limiting friction - Equilibrium of a block resting on a rough inclined plane - Range of force required to maintain equilibrium of block on rough inclined plane – Dry Friction – wedge friction – Ladder friction - Belt friction - flat and V-belts, Ratio of belt tensions - Screw friction - screw jack - Terminology in screws, self-locking of screw - Effort, Mechanical advantage of a screw jack- problems on simple screw jack, Trusses - Simple Trusses - Analysis of Trusses - Method of joints- Method of sections.

## Unit-3: Centroid and Moment of Inertia

Centroids of lines, areas, and volumes - Determination of centroids of line, area and volume by integration - Determination of centroids of composite lines, areas and volume - Theorem of Pappus-Guldinus - Second moment or Moment of inertia of an area- Determination of moment of inertia of area by integration - Radius of gyration - Parallel and perpendicular axis theorems - Mass moment of inertia of plate, prism, cylinder, cone and sphere.

#### Unit-4 : Dynamics of Particles

Rectilinear motion –Curvilinear motion –Normal and tangential components of acceleration- Radial and transverse components of acceleration -Newton's second law of motion – D'Alembert's principle- Principle of work and energy – Applications - Conservative forces-Principle of impulse and momentum – Impulsive motion - Impact of elastic bodies – Direct central-Obligue central impact.

B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-2(Revised-July2023)-First Year Syllabi-Control Copy

78

12 Hour

# 12 Hour

12 Hour

Unit-5: Dynamics of Rigid bodies 12	Hour
Introduction to Kinematics of rigid bodies - Translation and rotation of rigid bodies - Fixed axis rotation – determination of angular displacement, velocity and acceleration, General plane motion – Absolute and Relative velo	city in
plane motion - Instantaneous center of rotation in plane motion – Kinetics of rigid bodies, Angular momentum – Kinetics of rigid bodies by Newton's second law - Principle of work and energy.	-

Learning Resources	<ol> <li>Ferdinand.P. Beer. E, Russell Johnston Jr., David Mazurek, Philip J Cornwell, Vector Mechanics for Engineers: Statics and Dynamics, McGraw - Hill, 10th ed., 2013</li> <li>Meriam J.L and Kraige L.G., Engineering Mechanics, Volume I - statics, Volume II - dynamics, John Wiley &amp; Sons, 7th ed., 2012</li> </ol>	<ol> <li>Russel C Hibler, Engineering Mechanics: Statics, Dynamics, Pearson,14th ed., 2015</li> <li>Shames.I.H, Krishna Mohana Rao.G, Engineering Mechanics (Statics and Dynamics), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), 4th ed., 2006</li> <li>Timoshenko, Young, Engineering Mechanics, Tata Mc-Graw Hill, 5th ed., 2013</li> </ol>
-----------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Continuous Learnin	g Assessment (CLA)			ummativa
	Bloom's Level of Th <mark>inking</mark>	CLA-1 A	Formative verage of unit test (50%)	Life	Long Learning CLA-2 (10%)	Fina (40'	l Examinative / Examination % weightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20 %		20 %		20 %	-
Level 2	Understand	20%		20%		20%	-
Level 3	Apply	30 %	A CONTRACTOR	30 %		30 %	-
Level 4	Analyze	30%		30%	Cost I d	<u>30%</u>	-
Level 5	Evaluate		1 State 1	Cherry Color		-	-
Level 6	Create			and the second	5 · · · ·	-	-
	Total		100 %		100 %		100 %

Course Designers			
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
1. Dr. Anand Gurupatham, Renault Nissan, Chennai	1. Dr. Arulprakash, Professor, IIT Madras	1. Dr. P. Nandakumar, SRMIST	
2. Dr. Saravanan, Mahindra & Mahindra, Chennai	2. Dr. Raju Abraham, NIOT, Chennai	2. Mr. A.Vinoth. SRMIST	



Course Code	21ASS101T	course ategory	S			I	ENGIN	EERI	NG	SCIE	NCE	S			L 3	T 0	P 0	C 3						
Pre-requi	isite <i>Nil</i> es	Aaroon	Co- Co	requisite ourse <mark>s</mark>	Nil	Paals / Cadaa / Stan	dordo	Progre	essive rses	Nil														
Course O	tering Department	Aerospa	ace Engineering		Data I	BOOK / Codes / Stan	dards	INII	_															
Course l	Learning Rational	le (CLR):	The purpose of	learning this	course is to:	A	1						Prog	gram (	Outo	ome	s (PC	J)				Pr	ograi	m
CLR-1 :	Apply the concept	of static equil	librium of <mark>particles a</mark>	and rigid bodi	es.	-	-			1	2	3	4	5	6	7	8	9	10	11	12	S	pecifi tcom	c es
CLR-2 :	Apply the concept	of centroid an	nd mo <mark>ment of iner</mark> tia	a about differe	ent axes on static	structures			-				of		ty									
CLR-3 :	Apply the concept	of the dynami	nics of particles	~	1	1.12.5.3	95			edge	1	nt of	suoi	Ð	socie			Work		ince				
CLR-4 :	Apply the concept	of the dynami	ni <mark>cs of rigid</mark> bodies.	1	1	1.1.1.1.1.1	1.1			(now	ysis	pme	stigat	Usag	and	ంచ		eam	Ľ	Fina	rning			
CLR-5 :	Solve problems re	lated to space	<mark>e mechan</mark> ics.	27	-		- 36			leering h	em Anal	jn/develo	uct inve: lex prob	em Tool	engineer	onment in ability	6	dual & T	nunicati	ct Mgt. 8	ong Lea	5	5	ę
Course (	Dutcomes (CO):		At the end of th	is course, lea	arners will be able	to:	100	5.57		Engir	Probl	Desig	Cond	Mode	The e	Envin Susta	Ethics	ndivi	Comr	^o roje	-ife L	-OSc	-So	- So
CO-1:	Determine the force	es under s <mark>tatic</mark>	<mark>c equil</mark> ibrium			1. C. S. S. S.			1	3	2	-	1	-	-	-	-	-	-	-	1	-	-	-
CO-2:	Calculate the centro	oids and <mark>deter</mark> i	r <mark>mine</mark> moment of ine	ertia	and the	CASN.	Contra d	1.18	1	3	3	-	-	-	-	-	-	-	-	-	1	-	-	-
CO-3:	Determine the force	es acting <mark>on pa</mark>	<mark>articl</mark> e for kinetics a	nd kinematics	3		- 24	1.5.2	14	3	2	-	1	-	-	-	-	-	-	-	1	-	-	-
CO-4:	Determine the force	es acting <mark>on rig</mark>	gid body for kinetics	and kinemat	tics	5 - 1 - N		1		3	2	-	-	-	-	-	-	-	-	-	1	-	-	-
CO-5:	Solve the problems	of orbital mec	chanics and projecti	le motions	-	Street, Street, St.	1	10.0	6	3	3	-	-	-	-	-	-	-	-	-	1	-	-	-
Unit-1: Sta	atics of Particles	-	-				100		<u>Au</u>	-			-				-						9 H	our
Fundamen	tals of mechanics - F	Forces on parti	ticles - Resolution a	nd Resultant	of forces - Princip	le of Transmissibility	<mark>/ - F</mark> orces ii	i space - I	Momer	nt of fo	orce - N	arigno.	n's the	orem	- Eq	uival	ent s	ysten	n of fo	rces -	Free b	ody d	iagra	m -
Types of s	upports and Equilibriu	um of rigid boo	dies in two dimensi	ons – Statica	lly determinate and	d indeterminate stru	ctures.					-					_						0.11	
Determina	tion of centroids by in	tearation - ce	ntroids of lines are	as and volum	nes - Determinatio	n of moment of inert	tia hy integ	ation Par	allol ar	nd Poi	nondia	ular av	is than	rome	- Po	lar m	omo	ant of	inortia	- Ma	ss mor	nont c	эп of ino	our
Unit-3: Dy	namics of Particles				les - Delemination	in or moment of mert	ia by integr	auon, r ar	anerai		penuic	uiai ax	13 11100	UCIII3	-10		IOIIIC		incitia	- 1010	55 1101		9 H	our
Rectilinear	motion: Uniform i s. Newton's second l	motion and law – D' Aleml	Uniformly accele bert's principle - Pr	erated motion inciple of wor	n - Rectangular c rk and energy, prir	components of veloc nciple of impulse and	city. Curvili d momentu	near Motio n.	on-Noi	rmal a	and tar	igentia	comp	onent	ts -	Radia	al ar	id tra	nsver	se co	mpone	ents. (	Cylinc	Irical
Unit-4 : D	namics of Rigid bo	odies			<u></u>				11	1.11		1						-					9 H	our
Kinematics	s of rigid bodies: Fixe	d axis rotation	n - Gene <mark>ral plane M</mark> dv	otion-Absolut	te and Relative vel	locity in plane motion	n - Instanta	neous cer	nter of	rotatio	on in pl	ane mo	tion - I	Princij	ple c	of wor	rk an	d ene	ergy, F	Princip	le of in	npulse	) and	
Unit-5: Ap	plications in Space	Mechanics	-,																				9 H	our
Angular m Motion, Tra	omentum of a particle	e- Rate Of cha under a centra	ange of angular m <mark>o</mark> l al force: Application	mentum - New to space me	wton's Law of Grav chanics	vitation – Kepler's La	aw of motic	n - Conse	ervatior	n of ar	ngular i	momen	tum, c	onser	vatic	on of o	ener	gy, Sj	bace I	Mecha	anics –	Centr	al Fo	rce

1. Ferdinand P. Beer, E. Russell Johnston Jr., David Mazurek, Philip J Cornwell, "Vector         Learning         Resources         2. Shames, I.H., and Krishna Mohana Rao, G., "Engineering Mechanics (Statics and Dynamics)", Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), 2006.	3 NPTEL Engineering Mechanics Lectures by IIT Guwahati 'https://nptel.ac.in/courses/112103109/
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------

Sec. 1

Learning Assessme	nt		a table to be	1			
			Continuous Learnir	g Assessment (CLA)			ummotivo
	Bloom's Level of Thinking	CLA-1 A	Formative verage of unit test (50%)	Life	Long Learning CLA-2 – (10%)	Fina (40)	I Examinative K weightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20 %		20 %		20 %	-
Level 2	Understand	20%		20%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	20%	-
Level 3	Apply	60 %		60 %		60 %	-
Level 4	Analyze	2				-	-
Level 5	Evaluate			1000			-
Level 6	Create	- · ·	Concerning and			-	-
	Total		100 %	4	100 %		100 %

Co	urse Designers	William Andrew Market 🕅 🗮 👘			
Exp	perts from Industry	Experts from Higher Technical Institutions	Inter	rn <mark>al</mark> E	xperts
1.	Dr. R. Krishnamurthy, Group Director, Design Group, DRDL- DRDO, Hyderabad, rkmurthy@drdl.drdo.in	1. Dr. K. M. Parammasivam, Professor, Department of Aerospace Engineering MIT Campus, Anna University, Chennai, Indiamparams@mitindia.edu		1.	Mr.K.B.Ravichandrakumar ,SRMIST
2.	Dr. A Sakthivel, Scientist 'G', Regional Director RCMA (Helicopters), CEMILAC, DRDO, Bengaluru	2.Dr.S. Nadaraja pillai, Professor, Department of Mechanical Engineering, Sastra university Thanjavur, nadarajapillai@mech.sastra.edu		2.	Mr. K.lynthezhuthon, SRMIST



Course Code	21	AUS101L	C	ourse Name	)			AR	TIFA	CT DI	ISSEC	CTION	I LABOF	RATO	DRY			C	Cours atego	se ory	S				EN	NGIN	EER	ING	SCI	ENC	ΞS				L 0	T 0	P 2	C 1
Pre-requi Course Course Off	site A s fering D	lil Department		Auto	mobil	e Engi	neerii	Co-r Cou	equis Irses	ite	Nil		Data i	Book /	/ Code	es / Sta	andaro	ls	Pr (	ogres Cours	sive es	Nil																
																			10																			
Course L	earnin	g Rational	le (O	CLR)	:	The p	ourpos	se of l	əarnir.	<mark>g thi</mark> s	s cour	rse is t	to:		1.1											Prog	gram	Out	com	es (P	0)					P	rogra	im
CLR-1 :	Identif	fy the commo	only	used t	ools ir	n a hou	u <mark>seh</mark> o	ld and	l its us	sages	s.			-					-		2	1	2	3		4	5	6	7	8	9	1	0	11	12	01	Specif utcom	ic ies
CLR-2 :	Identif	fy the parts in	nag	iven n	nachir	ie.				4	15	-	1													of		ty										
CLR-3 :	Invest	igate the fund	ctior	is of th	ne cor	n <mark>pone</mark> r	n <mark>t</mark>		3			7			12	53		ä.,				ledge		ent of		tions	e	socie			Work	:		ance	5			
CLR-4 :	Devel	op the ability	to d	isman	tle stu	idy and	d asse	əmble	the g	iven r	machii	ine.										Non	ysis	bmdc	;	stiga lems	Usaç	and	<u>مع</u>		eam		u	Εi	rninç			
CLR-4 : Develop the ability to dismantie study and assemble the given machine. CLR-5 : Identify the commonly used tools in a household and its usages.												ering k	m Anal	/develo	us.	ct inve: ex prob	n Tool	Igineer	nment	vilitu	ual & T		unicatio	t Mgt. 8	ng Lea													
Course C	Outcon	nes (CO):				At the	end	of this	cour	se. le	erners	s will k	be able	e to:		-	-					Engine	Proble	Design	solutio	Condu	Noden	The er	Enviro	Ethics	ndivid			Project	-ife Lo	SO-1	2-02	SO-3
CO-1:	Describ	e the function	ns o	f the c	ommo	only us	ed to	ols in	a hou	sehol	ld and	l its us	sages.	17.7	10	0.5	100	100		2.5		3	3	-		-	-	-	-	-	-		-	-	3	-	-	-
CO-2:	Illustrat	e the proced	ure f	or d <mark>isi</mark>	nantli	ng the	giver	ı ma <mark>c</mark> l	nine					11	3.4	53		127	1.2.	1		3	3	-			-	-	-	-	-		-	-	3	-	-	-
CO-3:	Examin	e the compo	nent	s fo <mark>r f</mark>	ailure		-	1	10						1.1	1		-		1.5	1	2	3	-		-	-	-	-	-	-		-	-	3	-	-	-
CO-4:	Demon	strate the pro	oced	ure <mark>fo</mark>	r giver	n mach	nine	2,7		-			-	121			-	-	2.5			3	3	-			-	-	-	-	-		-	-	3	-	-	-
CO-5:	Describ	e the functio	ns o	f the c	ommo	only us	ed to	ols in	a hou	sehol	ld and	l its us	sages.	181								3	3	-			-	-	-	-	-		-	-	3	-	-	-
Practice 1:	Studv o	f common too	ols a	nd sp	ecial t	ools		-		÷		19						-	E.		÷	-		-		-				-								]
Practice 2:	Disman	tle the bicvcle	e. st	udv of	worki	na par	ts and	d Asse	emble	the c	aiven t	bicvcle	e			ų									ę.	-				-								
Due ette e 2.	D:	4 04 . d							1.:							-								-	-													
Practice 3.	Disman	lie Sludy and	IASS	semple	e une g	given s	sewing	Jiviac	nine	_	<u> </u>					14																						
Practice 4:	Disman	tle Study and	l Ass	semble	e the g	given D	Drilling	Macl	nine		1					1.5							1	14														
Practice 5:	Disman	tle Study and	l Ass	semble	e the <mark>g</mark>	given tv	wo sti	oke e	ngine	6	1							12					-	ω.														
Practice 6:	Disman	tle Study and	l Ass	semble	e the F	kick sta	arter n	necha	nism (	of the	e giver	n two :	stroke e	engine	9																							
Practice 7:	Disman	tle Study and	l Ass	semble	e the g	given w	vet gr	inding	mach	nine.					-					1.1		1																
Practice 8:	Disman	tle Study and	l Ass	semble	e the g	given n	nixer g	g <mark>rin</mark> diı	n <mark>g m</mark> a	<u>chine</u>	э.																			-				-				
Practice 9:	Disman	tle Study and	l Ass	semble	e the g	given w	vashir	ng ma	chine																					-				-				
Practice 10	: Disma	ntle Study an	nd As	ssemb	le the	given	Ceilir	ng fan																														

Learning	1. V. Ganesan, Internal Combustion Engines, Tata McGraw-Hill Education. 2004.	3. B. L. Theraja "Fundamentals of Electrical Engineering and Electronics", S. Chand, 1997
Resources	2. Karen E. Kunkel "The Complete Sewing Machine Handbook " Sterling, 1999	4. Bosch service manual for corded drills

Learning Assessment											
				Continuous L	earning Assessment (CLA	4)					
	Bloom's Level of Thinking		verage of first cycle experiments (30%)	CLA-2 Aver e>	rage of second cycle xperiments (30%)	Practic (409	cal Examination % weightage)	Final Examination (0% weightage)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	-	20%		20%	1.1.	20%	-	-		
Level 2	Understand	-	20%	-	20%		20%	-	-		
Level 3	Apply		30%	A Second	30%	and the second second	30%	-	-		
Level 4	Analyze		30%	100 million (1997)	30%		<mark>30%</mark>	-	-		
Level 5	Evaluate	-	- 1	1	A Designation of the second			-	-		
Level 6	Create	-		1. 1. 1. 1. 1.	1.2			-	-		
	Total	in the second	100 %		100 %		100%		0%		
				The Pola Com	107224		-				

Course Designers	A MARCH COLLECTION AND A DOMESTIC OF THE PARTY	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Ramakrishnan Ekambaram, Robe <mark>rt Bosch,</mark> Coimbatore.	1. Dr. K. Arunachalam, MIT, Chrompet, karunachalam@mitindia.edu	1. Mr. M. Palanivendhan, SRMIST
2. Mr.GovardhanaGiri, ATALON Product Centre PVT LTD giri@atalon.in.	2. Dr. M. Parthasarathy, Vel Tech, nparthasarathy@veltech.edu.in	2. Dr. R. Rajendran. SRMIST



Course Code	21AIS101J	Cou Na	urse me		FOL	INDATI	ON OF I	DATA ANAL	YSIS		Ca	ourse tegory	S	S ENGINEERING SCIENCES L T 2 0									P 2	C 3				
Pre-requi	isite <i>Nil</i> es				Co- requ Course	isite s	Nil	101	CN		0	Progre Cour	essive rses	Nil														
Course Of	fering Departmer	nt A	Artificial Inte	elligence				Data Bo	ook / Codes	/ Standard	ds	Nil																
Course I	earning Ration	nale (CI	LR): 7	The purp	ose of learr	ning this	s course	is to:						Z	1		Pro	gram	Out	com	es (P	0)		1		F	rogra Speci	am fic
CLR-1 :	Introduce a rang	e of topic	s and conc	c <mark>epts</mark> rela	ted to data	and da	ata analy	sis process.	-				Contra da	1	2	3	4	5	6	7	8	9	10	11	12	Ol	utcom	ies
CLR-2 :	Understand the	basic dat	a structu <mark>res</mark>	<mark>s involve</mark> i	d in python	to perfo	orm expl	loratory data	analysis	1.194	1			Ð		-	ď		≥t<	•		¥						
CLR-3 :	Apply EDA for d	lifferent fil	e form <mark>ats.</mark>											ledg		ento	tions	e	soci			Wor		ance	_			
CLR-4 :	Understands da	ta visualiz	zatio <mark>n using</mark>	<mark>g pyt</mark> hon	-			2.4	1.00	100	1			Now	ysis	pme	stigat	Usad	and	<u>م</u>		eam	Б	Fina	ming			
CLR-5 :	Provides an exp	osure to	basi <mark>c mach</mark>	<mark>hin</mark> e learn	ing techn <mark>i</mark> q	ues to s	solve rea	al world probi	olems		100			ering k	n Anal	/develo	ot inves	Tool	aineer	ment	nahility	al & T	unicatio	Mgt. 8	ng Lea			
0		<u></u>								L Gibrar		-	1	gine	oblei	sign	npu	den	e en	viror	nics	divid	mm	oject	e Lo	0-1	30-2	<u>0</u> -3
Course C	Jutcomes (CO	): 	A data and	At the en	a of this col	urse, lea	arners w	VIII DE ADIE TO:	):		100	1.1	-	З	2 Pr		3 8 8	3 2	Ē	<u>ш</u>	7 世	ŭ -	<u></u>	P_	<u>.</u>	ĥ	ď	8
00-1:	Understand differ	ent types	or data and	a starts n	orking in p	ython e	nvironm	lent	-	47 i	1	1000	1	2	2	1		_			_	_		_	2	-	-	-
CO-2:	Understand vario	us data si	tructures in	volved in	python and	d perfor	rm explo	ratory data a	analysis		1		-	3	2			-	-	-	-	-	-	-	3	-	-	-
CO-3:	Apply the concep	ts of EDA	i <mark>n various</mark>	datasets	_	14. s	1.2.		12.00	1.1		L	10	-	2	-	-	-	3	1	-	-	-	-	3	-	-	-
CO-4:	Formulate and us	e approp	riate visuali	lization te	chniques fo	or their o	data		_				1	2	2	1	-	-	-	-	-	-	-	-	3	-	-	-
CO-5:	Formulate and us	e approp	riate model	ls of data	analysis to	solve h	hidden si	solutions to bi	usiness-rela	ated challe	nges	-		-	-	-	2	-	3	3	-	-	-	-	3	-	-	-
Unit-1 :					5			The second		17.	2																12 I	lour
An Introduc Understand Python 2 a	ction to Data Ana ling the nature of nd Python 3 - Pyth	lysis - Da Data - L ion Packa	ata A <mark>nalysis</mark> Data – Infor age Index -	is - Know rmation; IDEs for	ledge dom Information python - So	ains of – Knor cipy: Nu	[:] Data Al wledge - impy- Pa	nalyst: Comp - Types of D andas, Matpl	puter Scien Data - Data / Iotlib	ce, Mathe Analy <mark>s</mark> is F	matics, a Process -	and statis Quantita	stics - ative D	Mach Iata A	ine Le nalysi	earning s - Qu	i & Al, alitative	Prof Dat	essic a Ar	onal i nalysi	fields is - P	of A Pythor	pplica 1 – Th	tion - e Pro	Introd gramn	uctior ning L	1 to E .angu	)ata - age -
Unit-2 :						1	51			1						1											12 I	lour
Numpy Lib Indexing, si indexes - C	rary: Numpy Instal licing and iterating )perations betwee	lation - N - Conditi n data str	darray, Cre ons and Bo uctures - Fi	e <mark>ate</mark> an ai polean an Function a	ray and Ty <mark>rays - Shap</mark> pplication a	pes of o e and a and map	data - Ba array ma oping - S	asic Operatio anipulation - \ Sorting and ra	ons: Arithme Vectorizatior anking - Cor	tic Operat n, structure rrelation ar	ors, Matr ed arrays nd covari	ix Produc - Panda ance - "N	ct, Incr Is librai Iot a n	emen ry: Ins umbei	t and tallati r" Data	Decrer on - Int a - Hie	nent O roducti ra <mark>rchic</mark>	perat on to al Ind	ors - Pan dexin	Univ das i g an	/ersai data : d levi	l Fund struct eling	ctions, ures -	Aggre Other	egate I functi	=uncti onalit	ions - ies oi	า
Unit-3:						4			_	_				11													12 I	lour
String Pane Discretizati study on da	das: Reading data on and binning: D ata preprocessing	from csv, etecting a	xml, text a nd filtering	and html i outliers -	files - Writir Permutatio	ng data Ion – ran	in CSV, ndom sai	Html, Excel, ampling - Strir	, files - Json ng manipula	data - HD ation - Reg	F5 forma ular expr	t - Data j essions -	orepara - Data	ation - Aggre	- Con gation	catena 1- Grou	ting - D p by -	ata ti Hiera	ransi irchio	forma cal gr	ation- roupii	Rem ng - A	loving dvand	duplic ed da	ates – ta agg	Map regat	ping - ion - (	Case
Unit-4 :																											12 I	lour
Data visual Histograms	ization with matple - Pie charts - Cor	otlib librar ntour plots	y - Matplotl s - Polar ch	ilib – Insta narts - Mp	allation and lot 3D tool	archite (it: 3D s	cture - P surfaces	² yplot, plotting - Scatter plot	ng window - ots and bar c	Using Kwa <mark>harts in 3L</mark>	args and <mark>D - Multi-</mark>	adding e panel plo	lement ot	ts to tl	he cha	art - Sa	ving ch	arts ·	- Har	ndling	g data	a valu	ies - I	ine cl	harts -	Bar c	harts	_

## Unit-5:

Machine Learning with sci-kit learn - sci-kit learn library - Machine Learning - Supervised learning with sci-kit learn - Linear Regression - Logistic Regression - K-Nearest Neighbor classifier - Support Vector Machines - Support Vector Classification - Nonlinear SVC - Support Vector Regression

# Practice

Practice 1: Introduction to Python – Installing Python and Jupyter, Importing Libraries
2 Writing Python Code – Input and Output statements, Mathematical calculations, and indentation
3 For loop and If statements
A Numpy Beading and writing array data on files (hinany files and tabular data)
o. Exploratory Data Analysis with Pandas
7. Reading and writing data
8. Data cleaning
9. Data aggregation using python
10. Installing matplotlib and implementing line and adding elements to the charts
11. Implementing bar charts, histogram and pie charts
12. Implementing multi-panel plots
13. Binary classification using (Logistic Regression)
14. Classification using kNN
15. Implement SVM classifier

Learning Resources	1. Fabio Nelli, Python D <mark>ata Anal</mark> ytics with Pandas, Numpy and matplotlib (Second edition), Apress 2021. 2. Wes McKinney, Pyth <mark>on for Da</mark> ta Analysis, 2nd Edition, O'Reilly Media, Inc. , 2012 (https://learning.oreilly.c <mark>om/librar</mark> y/view/python-for-data/9781491957653/)		1(	
Learning As	resement			

<b>y</b>			Continuous Le	arning Assessment (CLA)						
	Bloom's Level of Thinking	CLA-1 A	Formative verage of unit test (45%)	Life	Long Learning LA-2 –Practice (15%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%	2	-	15%	15%	-			
Level 2	Understand	20%		-	15%	15%	-			
Level 3	Apply	20%	1. 1. T. 1.	and the second s	20%	20%	-			
Level 4	Analyze	20%	1 1 1 1 1 1 1		20%	20%	-			
Level 5	Evaluate	10%			15%	15%	-			
Level 6	Create	10%			15%	15%	-			
	Total		100 %		100 %		100 %			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. Senthilnathan, Co-founder, Tenzai, Bangalore	Dr. E. Sivasankar, Assistant Professor, Department of CSE, NIT, Trichy	Dr. A. Alice Nithya, School of Computing, SRMIST

B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-2(Revised-July2023)-First Year Syllabi-Control Copy



Course Code	e 21BTC101T	Course Name		BIOCHEMISTRY		Course Category	С			PROF	ESSI	ONA	L COF	RE			L 3	T 0	P 0	C 3
Pre-req Cour	uisite <i>Nil</i> ses		Co- requisite Courses	Nil	STON 2	Progre	ssive <i>Nil</i> ses													
Course C	Offering Department	Biotech	nology	Da	ta Book / Codes / Standards	Nil	11.02													
Course	Learning Rational	le (CLR):	The purpose of learning the pu	his course is to:						Prog	gram (	Outco	omes (	PO)				F	rogra	m
CLR-1 :	Explain the structu	re and functio	ons of biomolecules	1		-	1	2	3	4	5	6	7 8	9	10	11	12	0	Specif utcom	IC Ies
CLR-2 :	Define the metabo	lism, bioenerg	getic <mark>s and phot</mark> osynthesis	5	1.000		0	1		of		ety		×						
CLR-3 :	Explain the carboh	nydrate met <mark>ab</mark>	ool <mark>ism and ho</mark> rmonal regulatio	n			ledo		ento	tions	ge	socie		Wor		ance	_			
CLR-4 :	Acquire knowledge	e of the metal	p <mark>olism of p</mark> roteins and amino a	acids	And the second		Anow	lysis	opme	stiga	Usaç	and	ຮູ	[eam	U	& Fin	aminç			
CLR-5 :	Explain mechanisr	n of lipid m <mark>eta</mark>	abolism and associated hormo	ones				m Ana	n/devel	ct inve ex prot	n Tool	ngineer	nmem	ual & T	unicati	t Mgt. 8	ng Lee			
Course	Outcomes (CO):		At the end of this course,	learners will be at	le to:		Engine	Proble	Design	Condu	Moder	The er	Suistai Ethiog	Individ	Comm	Projec	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Describe the structu	ire and f <mark>unctio</mark>	ons of biomolecules		a cure with	350	3	-	-	3	-	-		-	-	-	-	-	3	-
CO-2:	Conclude the conce	pts of m <mark>etabo</mark>	olism, bioenergetics and photo	osynthesis	A ANGLE H	a faile	3		3	-	-	-		-	-	-	-	2	-	-
CO-3:	Explain the concept	s in met <mark>abolis</mark>	<mark>sm of</mark> carbohydrates and horm	nonal regulation	1.00	13/20	3		-	3	3	-		-	-	-	-	-	2	-
CO-4:	Describe the metab	olism of <mark>prote</mark>	ins and removal of nitrogen	1. 2. 1. 1.	Selected and the second	1	3	3		3	-	-		-	-	-	-	-	-	2
CO-5:	Summarize the lipid	and nuc <mark>leic a</mark>	acid metabolism		I the second second	IF AT	3	2	-	-	-	-		-	-	-	-	-	3	-
Unit-1 :	Introduction to Bio	chemistry	20	Contraction of the second						-									91	lour

#### Unit-1 : Introduction to Biochemistry

History of Biochemistry, Chemical bonds, pH and Buffers. Introduction to Carbohydrates - Classification – Monosaccharaides, Oligosaccharides and Polysaccharides - structure and functions. Glycoproteins and lectins. Protein composition and structures – Introduction – structure, classification, functions. Amino acids – classification, structure and functions. Enzymes – Basic concepts and regulations. Lipids and Cell membrane – Introduction – classification, structure and functions. DNA and RNA - structure and functions

### Unit-2 : Introduction To Metabolism, Bioenergetics And Photosynthesis

Metabolism – Basic concepts and design. Bioenergetics – Introduction - High energy compounds, Biological oxidation - Electron transport chain, Oxidative phospholyration, Chemiosmotic theory - Shuttle pathways – Glycerol phosphate Shuttle, Malate aspartate Shuttle. Photosynthesis - Light and Dark reactions.

## Unit-3: Carbohydrate Metabolism

Carbohydrate metabolism - Glycolysis - Citric acid cycle – Gluconeogenesis - Glycogen metabolism – Glycogenesis – Hormonal regulations - Muscle use of Glycogen - Blood glucose levels regulation by Insulin.

### Unit-4 : Protein Turnover and Amino Acids Metabolism

Protein turnover - Introduction - Degraded to amino acids - Removal of Nitrogen - Regulation - Metabolism of amino acids - Transamination - Deamination - decarboxylation - Metabolism of ammonia - Urea cycle Biosynthesis of amino acids – Feedback Inhibition Regulations.

## Unit-5: Fatty Acid and Nucleic Acids Metabolisms

Fatty acid metabolism - Introduction - Hormones signal the release of fatty acids from adipose tissue - Fatty acid oxidation - Ketone bodies & Ketogenesis - Biosynthesis of Fatty acids - Eicosanoids - Cholesterol Biosynthesis -Lipoproteins. Nucleic acid metabolism – Introduction – Biosynthesis and Degradation of Purine and Pyrimidine.

9 Hour

9 Hour

9 Hour

Learning	<ol> <li>JeremyM.Berg, JohnL. Tymoczko, GregoryJ.Gatto, LubertStryer, "Biochemistry", 9thEdition, 2019</li> <li>Donald Voet, Judith G. Voet, Charlotte W. Pratt," Fundamentals of Biochemistry: Life at the</li></ol>	3.U.Satyanarayanaand, U.Chakrapani, "Biochemistry", 4thEdition,ElsevierIndia,2013.
Resources	Molecular Level", 5thEdition, JohnWiley &Sons Inc., 2016	4. DavidL.Nelson,MichaelM.Cox, "LehningerPrinciplesofBiochemistry",7th Edition, W.H.Freemen &Co.,2017

Learning Assessmer	nt		1	Carlos						
		- Summative								
	Bloom's Level of Thinking	CLA-1 A	Formative verage of unit test (50%)	Life	Long Learning CLA-2 (10%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	<u>Theory</u>	Practice			
Level 1	Remember	15 %		15%		15%	-			
Level 2	Understand	25%		20%		25%	-			
Level 3	Apply	30 %	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	25%		30%	-			
Level 4	Analyze	30%		25%		30%	-			
Level 5	Evaluate	S		10%		-	-			
Level 6	Create			5%		-	-			
	Total		100 %		100 %		100 %			
		A		40.00	300 in 1-					

Course Designers									
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts							
1. Dr. C. N. Ramchand, Saksin Life sciences, ramchand@saksinlife.com	1. Dr. K Subramaniam, IITM Chennai, subbu@iitm.ac.in	1. Dr. S. Subhashini, SRM IST							
2. Dr. S. Sam Gunasekar, Orchid Pharma Ltd.,sam@orchidpharma.com	2. Dr. R. B. Narayanan, Anna university, arbeen09@gmail.com	2. Dr. R. Pachaiappan, SRM IST							



Course Code	21BMC101J	Course Name		BIOM	IEDICAL SENSOR	S	Course Category	С			PROF	ESSI	ONAL	COR	E			L 2	T 0	P 2	C 3
Pre-requ Cours Course O	iisite Nil es ffering Department	Biomedi	ical Engineering	o- requisite Courses	Nil Data	Book / Codes / Standards	Progre Cour	essive Ni rses	1												
Course l	Learning Rational	le (CLR):	The p <mark>urpose</mark>	of learning thi	s course is to:				A		Prog	ram (	Outcor	nes (F	20)				P	rograi	m
CLR-1 :	Describe the basic	s of measuren	nent s <mark>ystem</mark>	1	× /			1	2	3	4	5	6	7 8	9	10	11	12	- S	specifi utcom	ic Ies
CLR-2 :	Demonstrate the w	vorking princip	les <mark>of temper</mark> ati	ure transducers	1	1.281.5 100			1		of		ty								
CLR-3 :	Exemplify the oper	ating principle	s <mark>of pressur</mark> e tr	ansducers		1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	1.20	adda		nt of	ous	d)	socie		Work		nce				
CLR-4 :	Elucidate the opera	ation of magne	etic sensors	~		A. I. T. Labor		Iwou	ysis	pme	stigati ems	Jsag	and		eam	E	, Fina	ming			
CLR-5 :	Compile the princip	oles of opti <mark>cal</mark>	transducers	21				ering k	n Anal	develo	t inves x probl	Tool (	gineer ment 8	ahilitv	lal & T	inicatio	Mgt. 8	ng Lea			
Course (	Outcomes (CO):		At the end o	f this course le	arners will he able	to:	0	ndine	robler	esign	onduc	lodern	he en	thics	Idividu	ommu	roject	fe Lor	S0-1	S0-2	SO-3
CO-1:	Analyze the perform	ance of a mea	asurement syste	em e e e e e e e e e e e e e e e e e e			11156	1	1		-	2	<u>-</u> ш	<u>о</u> ш	<u>  -</u>	-	-	3	-	-	-
CO-2:	Develop a system to	) determ <mark>ine te</mark> r	mperature of a r	medium	100	1000	1 10	2		-	2	-	-		-	-	-	3	-	-	-
CO-3:	Implement a system	i to mea <mark>sure p</mark>	o <mark>res</mark> sure	- E	10.14.95	2012	100	1	-	2	-	-	-		-	-	-	3	-	-	-
CO-4:	Execute a displacen	nent sen <mark>sor</mark>			Contraction of	211 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 State 1	1	-	-	-	2	-		-	-	-	3	-	-	-
CO-5:	Propose an optical	transduc <mark>er sys</mark>	<mark>stem</mark> to determin	ne various mea	isurand		and the second	1	- 1	-		-	-		-	-	-	3	-	-	-
Unit-1 :	Measurement Syste	əm	- 5		Col.		1000				-		-							12 H	lour
Measurem Instrument Practice:	ent system- Function , Functional elements 1. Study at 2. Measure 3. Measure	al elements of of a Medical bout the function ment of voltage ment of curre	of an Instrumen Instrument, salie onal block of Me ge using analog nt using analog	t - Measureme ent features of asurement sys and digital Vol and digital Am	nt terminologies Medical Instrument stem. 'tmeters. meters.	Classification of Instrum s.	ents- types of l	Instrument	s, Instru	iments	used to	o disp	lay ele	etrica	l para	meters	s, Adv	<i>rantag</i>	es of	Electi	ronic
Unit-2 : Te	emperature Transdu	cers			1	$V \to T W$										·		·		12 H	lour
Transduce principles- Practice:	rs- Block diagram- T Characteristics- Appl 1. Character	ypes- RTD- C lications. eristics of RTE	Construction and	l operating prir	iciples, Application	s - Thermistor- Construc	tion and operati	ing princip	les- Chi	aracteri	stics- A	pplica	ations-	- The	)rmoco	ouple-	Consi	truction	n and	opera	ating

- 2. Characteristics of thermistor
- 3. Characteristics of thermocouple

Unit-3: Pressure	e and	I Magnetic Transducers		12 Hour
Strain Gauge: P	Princip	les, Construction and Working, Load cell: Construction and Working, Capacitive transducer- Construction and Wo	<mark>orkin</mark> g, Piezo	pelectric transducer: Construction and Working, LVDT- Construction and
Working.				
Practic	e:			
	1.	Characteristics of – LVDT.		
	2.	Characteristics of Strain gauge.		
	3.	Characteristics of Piezoelectric transducer.		
Unit-4 : Optical	Tran	sducers		12 Hour
Photodiodes- Wo	orking	g principles- phototransistor- Worki <mark>ng principles</mark> - LDR- Working principles, Photovoltaic cell- Working principles, Chara	cteristics of F	Photodiode.
Practic	e:			
	1.	Characteristics of LDR		5 Y
	2.	Characteristics of Phototransistor.		
Unit-5: Medical	Appl	ications Of Sensors	1	12 Hour
Pulse oximetry-	Work	ing principle, Applicatio <mark>ns, Heart ra</mark> te sensor- Construction and Working principle, Blood pressure sensor- Working prir	nciple, IR ser	nsors- Working principle and Applications,
Practic	e:			
	1.	Study of Pulse oximeter.		
	2.	Measurement of Heart rate.		
	3.	Measurement of Blood pressure		
			Par	
		1. Sawhney A.K, "A Course in electrical and electronic measurements and instrumentation", Dhanpat Rai	4.	U.A. Bakshi, A.V. Bakshi, "Measurements and instrumentation",
Learning		& Co (P) Ltd, Educational and Technical Publishers, 19th Revised edition 2011, Reprint 2014.	1.0	Technical Publications, 3rd revised edition, 2010
Resources		2. Patranabis D, "Sensors and transducers", PHI, 2nd edition, 2004	5.	Paras N, Prasad, "Introduction to biophotonics", John Wiley & Sons, 1st
		3. Murty DVS, "Transducer and instrumentation", PHI, 2nd edition, 2010.	2.11	edition, 2003

Loarning Accore ----

	Bloom's Level of Thinking Th Remember Understand Apply		Continuous Le	earning Assessment (CLA			Summotivo
	Bloom's Level of Thinking	CLA-1 A	Formative Average of unit test (45%)	1 5 6 6	ife Long Learning CLA-2 –Practice (15%)	Fina (40	al Examination % weightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%		-	20%	20%	-
Level 2	Understand	20%			123	20%	-
Level 3	Apply	30%		-	40%	20%	-
Level 4	Analyze	30%	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.			20%	-
Level 5	Evaluate	2000	1 1 1 1 1 1 1	I I I I I I I I I	40%	10%	-
Level 6	Create		The survey of the survey	· · · ·		10%	-
	Total		100 %		100 %		100 %

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. Anbuselvan T, General Manager – Sales, Wipro GE Healthcare Pvt. Ltd., Tamil Nadu, Srilanka & Maldives	Dr. S. Poonguzhali, Professor, Centre for Medical Electronics, Anna University	Dr.D.Kathirvelu, SRMIST

Course Code	21CEC101T	Course Name	BUILDING MATERIA	LS IN THE BUILT ENVIRONMENT	C Ca	ourse C itegory	C PROFESSIONAL CORE L T 3 0						P 0	C 3						
Pre-requ Course	iisite <i>Nil</i> es		Co- requisite Course <mark>s</mark>	Nil		Progressive Courses	Nil													
Course Of	ffering Department	Civil Engin	eering	Data Book / Codes / Standa	rds	Nil														
Course I	Learning Rational	le (CLR):	The purpose of learning this	course is to:	200					Prog	gram	Outco	mes (	PO)				P	rograi	m
CLR-1 :	Study different ma	terials used in civ	ril engi <mark>neering structu</mark> res.	NV -		10	1	2	3	4	5	6	7 8	3 9	10	11	12	S	specifi	C es
CLR-2 :	Understand the bu	ilding finishing m	aterials, application of ferro o	cement and insulating materials.			1			of		≳		1.						
CLR-3 :	Learn the masonry	/ building, transpo	o <mark>rt and term</mark> ite treatment.				edge	1	nt of	ous	d)	societ		Work		nce				
CLR-4 :	Know the various e	ecofriendly b <mark>uildir</mark>	ng materials.	A	1.1		now	ysis	pme	stigat lems	Jsag	ands	5	eam	Ľ	, Fina	rning			
CLR-5 :	Explore energy effi	icient buildin <mark>gs a</mark> i	nd cost-effective construction	n techniques.	1		ing k	Anal	evelo	inves	Tool	neer	hility	1 & T	licatio	Agt. 8	g Lea			
			1.1.1		1	al tal	gineer	blem	sign/d	Induct	lem .	engi	taina	vidua	nmur	ject N	Lonç		0-2	0.3
Course (	Outcomes (CO):		At the end of this course, lea	arners will be able to:	107	03.C.	Enç	Pro	Des	Son	Moc	The		Indi	Š	Pro	Life	PS(	PSC	PSC
CO-1:	1: Apply the acquired knowledge on building materials and products for construction.				1.23	3	-	-	1	-	-	3 -	-	-	-	-	-	-	-	
CO-2:	Identify various build	ding finis <mark>hing mat</mark>	erials and ferro cement appl	ications for the building construction.	251	1.1.1	3		-	-	-	2		-	-	-	-	-	-	-
CO-3:	Apply the knowledge	e on the <mark>masonry</mark>	<mark>r,</mark> building transport and the t	termite treatment.			3	-	-	1-01	2	-	-   -	-	-	-	-	-	-	-
CO-4:	Disseminate the know	owledge <mark>on vario</mark> u	us eco friendly building mate	rials			3	ł	-		-	3			-	-	-	-	-	-
CO-5:	Recognize the energ	gy efficie <mark>nt buildir</mark>	ngs and cost-effective constr	ruction techniques	1	Sec. 1	3		- 1	in the second	-	-	3 -	<u> -</u>	-	-	-	-	-	-
Unit-1 :	Building Materials		-		1	100	-		1 -	-									9 H	our
Introductio	n to Civil Engineering	and Civil Engine	ering materials - Compositio	on, classifications, properties and uses of	stones - (	Classification o	frocks	s, quar	ying, d	ressing	g, pro	perties	and	uses -	Prope	rties a	and use	es of t	imber	and
plywood - Llnit-2 · Fil	Types, properties and inishing and Protect	tive Materials	and lime, Types of steel, mil	a, medium and nard, properties of floor a	and wall til	ies and thermai	Insula	ating m	ateriais	i.									٥H	
Finishing N	Materials: Glass, Alurr	ninium, Plastics, I	Paints, Varnishes, Distempe	r - Waterproofing - Damp Proofing Maten	ials - Ferro	ocement and its	s appli	cation	- Sound	d insula	ation -	mate	rials a	and me	ethods	– Fire	proof	mater	rials –	Fire
alarms.																				
Unit-3: Co	mponents of Buildin	ng and Treatm <mark>e</mark> i	nt nt					-	<u>.</u>										<u>9 H</u>	our
Partition wa	all and Cavity wall - C	composite mason	n <mark>ry – Doors –</mark> Windows – Vei	ntilators – Stairs – Lift – Ramps – Escala	tors - Anti	termite treatme	ent												0.11	
Construction	co-rriencity materials	<b>s</b> , availahla huildin	na materials - Soil Elv ash	Ferrocement Lime Fibres Stone dust	Red mi	id Gynsum A	ltornat	a Wor	d Pol	mor_A		E Col	h and	Ram	mad a	arth I	liaht c	lav S	9 H	our Rale
Bamboo, A	Agro-Industrial waste,	Structural proper	rties of alternate building ma	terials, Composite materials, Artificial ag	gregates s	substitutes for r	atural	conse	rvation		000	_, 001	, and	rtann	nou o	<i></i>	_igint 0	uy, O		Juio,
Unit-5: Mo	odern Techniques	· ·																	9 H	our
Introductio	n to Green Buildings-	Definition, Impor	tance - Building envelope -	Problems in existing buildings - Energy u	se in build	dings - Principle	of en	ergy ei	fficient l	building	g - Gr	eenho	use g	as em	ission	s and	indoor	air po	llutior	1-
Green con	struction materials - V	ventilation and all	r conaitioning - Green buildir	ng assessment system – Cost-effective c	onstructio	n techniques.														

	1. Punmia. B.C., Ashok Kumar Jain, Arun Kumar Jain, Building Construction, Laxmi Publishing	4. K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and
Learning	(P).Ltd., New Delhi-2, 2012.	Technologies. New Age International, 2007.
Resources	2. Bhavikatti.S.S., Building Materials, Vikas Publishing House.Pvt. Ltd., New Delhi, 2012.	5. Energy Conservation Building Code, 2017, Bureau of Energy Efficiency, Ministry of Power, Government of
	3. Rangwala .S.C," Engineering Material"s, Charotar Publishing House, Anand, 2012.	India.

Learning Assessmer	nt		1-1-1							
			Continuous Learnin	ng Assessment (CLA)		· · · · · · · · · · · · · · · · · · ·	ummotivo			
	Bloom's Level of Thinking	F CLA-1 A	Formative verage of unit test (50%)	Life	Long Learning CLA-2 (10%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20 %		20 %	10 CONT. 10 CONT.	20 %	-			
Level 2	Understand	20%		20%		20%	-			
Level 3	Apply	30 %	and the state of the state	30 %		30 %	-			
Level 4	Analyze	30%		30%	1000	30%	-			
Level 5	Evaluate	No. 1/ - 1		A CONTRACT OF			-			
Level 6	Create	· ·	12 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.7		-	-			
	Total		100 %		100 %		100 %			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Inter <mark>nal Exper</mark> ts
1. Er. K. Jayasankar, Senior Vice President, Ultra Tech Cement Limited, Mumbai	1. Dr. R. Senthil, Professor, Anna University, Chennai	1. Dr. P.T. Ravichandran, SRMIST
2. Dr. P. Manoharan, Regional Executive Engineer, Madurai, Municipal Administration.	2. Dr. R. Baskar, Professor, Annamalai University, Chidambaram	2. Dr. N. Pannirselvam, SRMIST



B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-2(Revised-July2023)-First Year Syllabi-Control Copy

Course Code	21CHC101J	Course Name	PHYSICAL AND	ANALYTICAL CHEMISTRY	Course Category	C	PROFESSIONAL CORE						2 0 2			C 3			
Pre-requ Cours Course Ot	lisite <i>Nil</i> es ffering Department	Chemica	Co- requisite / Courses / al Engineering	lil Data Book / Codes / Standa	Progressiv Courses ards Nil	re Nil													
Course I	Learning Rational	e (CLR):	The purp <mark>ose of learning</mark> this c	ourse is to:	1000				Prog	ram (	Dutcon	nes (F	PO)				Pi	rogra	m
CLR-1 :	Describe the ideal	and non-ideal	behavior of liquids; learn colligat	ive properties and their applications	- C	1	2	3	4	5	6 7	7 8	9	10	11	12	S ou	pecifi itcom	c es
CLR-2 :	Explain the concep	ts of chemical	l equ <mark>ilibrium and</mark> the effect of var	ious factors on equilibrium constant					of		ety		×						
CLR-3 :	Compare the difference in behavior of different states of matter essential for separation operations						1	nt of	ions	e	socie		Worl		ance				
CLR-4 :	Describe the prope	erties and ap <mark>pl</mark>	i <mark>cations of c</mark> olloids; Understand t	he kinetics of photochemical reactions	17- 1	mow	ysis	bme	stigat lems	Jsag	and		eam	Ľ	, Fine	rning			
CLR-5 :	Explain the principl	les of analytica	<mark>al instrum</mark> ents along with their lin	nitations	S. 199	ering K	Anal	develc	t inves k probl	Tool	gineer ment d	ahilitv	al & T	nicatic	Mgt. 8	ig Lea			
			1 2 3 M		(Construction)	ginee	blem	sign/	npley	dem	enç ironi	ics i	ividu	nmu	ject l	i Lon	<u>-</u> -	0-2	0.3
Course (	Outcomes (CO):		At the end of this course, lear	ners will be able to:	10000	Enç	Pro	De	Cor	Mol	En L	ET SI	Indi	Cor	Pro	Life	PS(	PS(	PS
CO-1:	Analyze ideal and no	on-ideal <mark>behav</mark>	<mark>vior o</mark> f fluids and define the collig	ative properties		3	-	-	1	-		-	-	-	-	-	-	-	-
CO-2:	Evaluate the signific	ance of <mark>Gibbs</mark>	<mark>' free</mark> energy and equilibrium cor	stants	the for the	3	2	-	-	-	- ·	· -	-	-	-	-	-	-	-
CO-3:	Apply Gibbs' phase	rule and <mark>draw</mark>	<mark>the</mark> phase diagram of one- and t	hree-component systems	- N. S. 24	3		1	100	-		-	-	-	-	-	-	-	-
CO-4:	Analyze the properti	es of co <mark>lloids a</mark>	and photochemical reactions	A STATE AND A STATE	1000	2	-	-	3	-		-	-	-	-	-	-	-	-
CO-5:	Implement the appro	opriate a <mark>nalytic</mark>	<mark>cal t</mark> echnique for various types of	chemical compounds	and the second	2	-	-	3	-		-	-	-	-	-	-	-	-

# Unit-1 : Properties of Solutions

12 Hour Introduction to solutions, Raoult's law-Vapour pressures of ideal and non-ideal solutions - Deviations from ideality of Type II, Type II and Type III solutions - Completely miscible binary solutions: Vapor pressure-Composition and Boiling point-Composition curves of Type II, and Type III solutions - Fractional distillation of binary liquid systems, The Lever rule - Distillation of immiscible liquids, Steam distillation - Partially miscible liquids, Critical solution temperature, Phenol-water system, Solutions of gases in liquids: Factors influencing solubility of a gas, Henry's law - Colligative Properties - Relative lowering of vapour pressure, Osmosis and osmotic pressure, Elevation in boiling point, Depression in freezing point, Determination of molecular weight from colligative properties, Effect of association/dissociation on colligative properties

Practice 1: Determine the critical solution temperature (CST) of phenol-water system

Practice 2: Determine the molecular weight of an unknown compound by Rast method

## Unit-2 : Chemical Equilibrium

Introduction to Chemical equilibria - Gibbs' free energy and Chemical potential - Free energy of a spontaneous reaction - Law of mass action - Law of chemical equilibrium - Thermodynamic derivation of the law of chemical equilibrium - Problems on Gibbs' free energy - Significance of equilibrium constant - Equilibrium constants : Kp. Kc.and, Kx - Relationship between Kp. Kc.and, Kx - Temperature dependence of Equilibrium constant - Van't Hoff Equation - Pressure dependence of equilibrium constants - Problems on equilibrium constants - Le Chatelier's Principle - Effect of change in concentration, temperature, and pressure - Le Chatelier's principle and physical equilibria Practice 1: Determine the strength of the given acid mixture by conductometric titration

Practice 2: Determine the rate constant of acid catalyzed hydrolysis of an ester

# Unit-3: Phase Equilibrium

Introduction to Phase equilibria - Component, phase and degrees of freedom - Conditions for equilibrium between phases - Derivation of Gibbs' phase rule - Representation of one component systems using phase diagrams -One component systems - water system, CO2 system, sulphur system - Three component systems - Triangular phase diagram - Three component system: acetic acid-chloroform-water system, Two salts and water system. The Nernst distribution law and distribution co-efficient. Conditions for the validity of the distribution law - Association of the solute in one of the solvents - Dissociation of the solute in one of the solvents - Applications of Nernst distribution law - Problems on Nernst distribution law

12 Hour

Practice1: Phase diagram of three component system Practice 2: Determine the partition co-efficient of benzoic acid between benzene and water

## Unit-4 : Colloids and Photochemistry

## 12 Hour

12 Hour

Introduction to Colloids - General properties of colloids: Tyndall effect and Brownian movement - Electrical properties of colloids: electrical double layer, Zeta potential - Electrokinetic properties of colloids: electrophoresis and electro-osmosis - Gels and emulsions - Applications of colloids - Introduction to Photochemistry - Laws of photochemistry - Quantum yield - Photochemical reactions - Photochemical rate law - Determination of quantum yields - Problems on Beer Lambert's law - Problems on quantum yield - Kinetics of hydrogen-chlorine reaction: Mechanism and Derivation - Kinetics of hydrogen-bromine reaction: Mechanism and Derivation

Practice 1: Estimation of sulphate by nephelometry

Practice 2: Determine the amount of reducing sugar by DNS method

## Unit-5: Instrumental Methods of Analysis

Instrumental Methods of Analysis - Accuracy, precision, common errors (system/manual) - Calibration curves - Classification of instrumental methods - spectroscopy, electrochemical and chromatography - Electro-magnetic (EM) spectrum, Interaction of EM radiation with matter - Generalities of optical methods (light source/ monochromator / sample introduction / detector / signal generator) - Principle, Instrumentation, Working, Applications, and Limitations of analytical techniques - UV – Vis spectroscopy - Infra-red spectroscopy - Atomic absorption spectroscopy - Chromatographic techniques: General principle - Column chromatography - Paper chromatography - Thin layer chromatography - Gas chromatography - High Performance Liquid Chromatography - Open-ended problems on choice and usage of analytical instruments - Open-ended problems on choice and usage of analytical instruments - Open-ended problems on choice and usage of analytical instruments - Open-ended problems on choice and usage of analytical instruments - Open-ended problems on choice and usage of analytical instruments - Open-ended problems on choice and usage of analytical instruments - Open-ended problems on choice and usage of analytical instruments - Open-ended problems on choice and usage of analytical instruments - Open-ended problems on choice and usage of analytical instruments - Open-ended problems on choice and usage of analytical instruments - Open-ended problems on choice and usage of analytical instruments - Open-ended problems on choice and usage of analytical instruments

Practice 1: Estimate amount of iron present in a sample using UV-Vis spectrophotometer

Practice 2: Determine the amount of fatty acid methyl ester using gas chromatography

Learning Resources	<ol> <li>B. R. Puri, L. R. Sharma and Madan S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 47th Ed, 2015</li> <li>Arun Bahl, B. S. Bahl, and G. D. Tuli, Essentials of Physical Chemistry, S. Chand &amp; Company Ltd., 2009.</li> </ol>	3. Douglas A. Skoog , F. James Holler, and Timothy A. Nieman. "Principles of Instrumental Analysis, Thomson Learning Inc., Toronto, 1998
Learning As	ssessment	
	Continuous Learning Assessme	ent (CLA)

			Continuous Le		Summotivo					
	Bloom's Level of Thinking	CLA-1 A	Formative verage of unit test (45%)		ife Long Learning CLA-2 –Practice (15%)	Fin (40	al Examination % weightage)			
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%	-	-	20%	20%	-			
Level 2	Understand	20%	-	-	20%	20%	-			
Level 3	Apply	30%		11 Table -	30%	30%	-			
Level 4	Analyze	30%		· · · ·	30%	30%	-			
Level 5	Evaluate		1000	The second se		- 1	-			
Level 6	Create	7.000	1 376 3 35	I THE R.		- 1	-			
	Total	1968	100 %		100 %	100 %				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. A. Subramaniam, PESCO Beam Environmental Solutions Pvt. Ltd	1. Dr. Lima Rose Miranda, Anna University	1. Dr. K. Deepa, SRMIST
		2. Dr. S. Prabhakar, SRMIST

Course Code	21CSC101T	Course Name	OBJECT ORIENTED	D DESIGN AND PROGRAMMING	Course Category	С				PROF	ESS	IONAI	LCO	RE			2	T 1	P 0	C 3
Pre-requ Cours Course O	uisite Nil es ffering Department	Сотри	Co- requisite Courses Iter Science and Engineering	Nil Data Book / Codes / Standards	Progre Cour Nil	essive ses	Nil													
Course 1	Learning Rationa	ale (CLR):	The purpose of learning this	s course is to:	1.1					Prog	aram	Outco	mes	(PO)				F	Progra	am
CLR-1 :	Programs using c	bject-oriented	approach and design methodol	logies for real-time application development			1	2	3	4	5	6	7	8 9	) 1	0 11	12		Specit	fic
CLR-2 :	Method overloadi	ing and operat	or ove <mark>rloading for</mark> real-time appl	lication development programs						of		y								100
CLR-3 :	Inline, friend and	virtual functior	ns and create application develo	pp <mark>ment</mark> programs			edge		nt of	ous c		ociet		Morb		DCe				
CLR-4 :	Exceptional hand	ling and colled	ctions for real-time object-oriente	ed programming applications	1		nowl	/SiS	bmei	tigati ems	Jsage	and s	×			Fina	ning			
CLR-5 :	Model the System	n using Unified	d Modelling approach using diffe	erent diagrams			eering K	em Analy	n/develo	uct inves ex probl	m Tool L	ngineer a	inahility	, T o louit		t Mat. &	ong Lear	-		
Course	Outcomes (CO):		At the end of this course, lea	earners will be able to:	1.5		Engin	roble	Desig	Condi	lode	he e		-thics			ife L	-OS	-OS	So
CO-1:	Create programs u	sing object-on	ented approach and design met	thodologies			-	2	2	-	2	-	-			-	3	-	-	-
CO-2:	Construct program	s using m <mark>etho</mark>	d overloading and operator over	rloading	-1.2.2		-	2	2	-	2	-	-			-	3	-	-	-
CO-3:	Create programs u	sing inline <mark>, frie</mark>	end and virtual functions, constru	uct programs using standard templates	4. 8.9	10	-	2	2	-	2	-	-			-	3	-	-	-
CO-4: CO-5:	Construct program Create Models of ti	s using excep he system usii	tional handling and collections ng UML Diagrams				-	2 2	2	-	2	-	-			-	3 3	-	-	-
Unit-1 : Object-Ori	Introduction to OC	OPS - Features of	C++ - I/O Operations, Data Type	es, Variables-Static, Constants-Pointers-Typ	e Conversions -	- Condit	tional	and lo	ooping	statem	ents -	- Arra	ys - C	;++ 1 ⁻	1 feat	ıres - (	Class a	nd Ob	9   ojects,	Hour
Unit-2 : M	ethods and Polymo	prphism	iners, methous- one Diagrams	initioduction - Ose Case Diagram - Class Di	ayrann.		-	7		i.									91	Hour
Constructo Collaborat	ors- Types of constru ion Diagram - Exam	ictors - Static ple Diagram	constructor and Copy constructo	or -Destructor - Polymorphism: Constructor o	verloading - Me	thod Ov	verloa	ading (	Operato	or Over	loadii	ng - U	ML Ir	terac	tion D	iagram	is -Seq	uence	; Diag	ram -
Unit-3: Inl	heritance	U																	91	Hour
Inheritance Chart Diac	e – Types -Single an aram - UML Activity I	nd Multiple Inh Diagram	eritan <mark>ce - Multil</mark> evel Inheritance	- Hierarchical Inheritance - Hybrid Inheritance	ce - Advanced F	unction	ns - In	line, F	riend-	Virtual	- Pur	e Virtu	ial fui	nction	- Abs	stract c	lass - l	IML S	itate	
Unit-4 : G	eneric Programmin	ig	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	MATT THE FIRST OF	1	100		TT	-										91	Hour
Generic - Component	Templates - Functio	n templates - enlovment Dia	Class Templates - Exceptional I gram	Handling: try and catch - Multilevel exception	nal - throw and	throws	- fina	ally - L	Jser de	fined e	xcepi	tional	- Dyr	amic	Mode	ling: P	ackage	Diag	ram -	UML
Unit-5: St	andard Template L	ibrary	gram																91	Hour
STL: Cont find(), cou	ainers: Sequence an nt(), sort() - Algorithr	nd Associative ms: search(), r	Container - Sequenc <mark>e Containe</mark> nerge(), for_each(), transform()	er: Vector, List, Deque, Array, Stack - Associ	ative Containers	s: Map,	Multii	map -	Iterator	and S	pecia	lized i	terato	or - Fi	inctio	ns of ite	erator -	Algor	ithms	:

	1.Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Object-Oriented Analysis and Design with	A Pohot Lafora, Object Oriented Programming in CLL, 4th ed. SAMS Publishing 2009
Learning	Applications, 3rd ed., Addison-Wesley, May 2007	<ol> <li>Robert Lable, Object-Oriented Programming in C++, 4th ed., SAMS Publishing, 2006</li> <li>Ali Bahrami, Object Oriented Systems Development", McGraw Hill, 2004</li> </ol>
Resources	2. Reema Thareja, Object Oriented Programming with C++, 1st ed., Oxford University Press, 2015	6. Craig Larmen, Applying UML and Patterns, 3rd ed., Prentice Hall, 2004
	3. Sourav Sahay, Object Oriented Programming with C++, 2nd ed., Oxford University Press, 2017	

Learning Assessmen	t			C 1 2 2			
			Continuous Learnii	ng Assessment (CLA)			ummative
	Bloom's Level of Thinking	CLA-1 A	Formative verage of unit test (50%)	Life I	Long Learning CLA-2 – (10%)	Final (409	l Examination 6 weightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	Contraction of the second	20%	1.	20%	-
Level 2	Understand	20%		20%		20%	-
Level 3	Apply	30%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	30%		30%	-
Level 4	Analyze	30%		30%		30%	-
Level 5	Evaluate	S	Contraction of the second				-
Level 6	Create	· · · ·		and the second		-	-
	Total		100 %	1977 - C - 1	100 %		100 %
		A		Carrier Street	and the		

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Sagar Sahani, Amadeus Software Labs, Bangalore, hello.sagarsahni@gmail.com	1.Prof. R. Golda Brunet, GCE,Salem, goldabrunet@gcessalem.edu.in	1. Mr.C.Arun, SRMIST
2. Mr. Janmajay Singh, Fuji Xerox R&D, Japan, janmajaysingh14@gmail.com		2. Mrs.C.G.Anupama, SRMIST



B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-2(Revised-July2023)-First Year Syllabi-Control Copy

Course Code	21EEC101J	Course Name	ELECTRIC CIRCU	IITS	Course Category	С	C PROFESSIONAL CORE							L T P 2 0 2		P 2	C 3		
Pre-requ Cours Course Of	isite Nil es ffering Department	Electrical and	Co- requisite Nil Courses Electronics Engineering D	ata Book / Codes / Standards	Progres Cours Nil	ssive Nil ses													
Course I	Learning Rational	e (CLR): The	e purpose of learning this course is to:						Progra	am Oi	utcom	es (PC	C)				Pi	rogra	m
CLR-1 : Solve real-time DC circuits using mesh, nodal analysis and network reduction							2	3	4	5 (	5 7	8	9	10	11	12	S ou	pecifi tcom	ic les
CLR-2 :	Explain the solution	n to AC circuits in <mark>clu</mark>	ding series and parallel resonance	1000			1		of		ary		×						
CLR-3 :	Understand netwo	rk theorems and app	ly them to DC and AC circuits	- 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0	1	ledge		entof	tions	9	SOCIE		Wor		ance	-			
CLR-4 :	Study the circuits a	at transient condition	and analyze the coupled circuits	And the state	57	Now	ysis	opme	stiga	Usac	& and		eam	ы	k Fin	ming			
CLR-5 :	Examine three pha	nse circuits <mark>and two p</mark>	oort networks				m Anal	ns ns	ct inve ex prob	n Tool	igineer nment	Dability	ual & T	unicati	t Mgt. 8	ng Lea			
Course (	Outcomes (CO):	At t	he end of this course, learners will be a	able to:		Engine	Proble	Design	Condu	Moder	Enviro	Ethics	Individ	Comm	Projec	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Analyze problems of	n DC cir <mark>cuits using</mark> n	nesh and nodal analysis	the Auge William	100	3	3	-		-		-	2	-	-	-	2	-	-
CO-2:	Solve AC circuits inc	cluding s <mark>eries and</mark> pa	arallel resonance		a faile	3	3	-	-			-	2	-	-	-	1	-	-
CO-3:	Apply network theor	ems to a <mark>nalyze D</mark> C a	and AC circuits		1320	3	3	-	-			-	2	-	-	-	1	-	-
CO-4:	Examine DC and AC	C circuits <mark> under tra</mark> ns	ient conditions	a state of the second	1.14	3	3	-		-		-	2	-	-	-	2	-	-
CO-5:	Analyze three phase	e circuits <mark>and two</mark> pol	t networks	Contrast of the best	-	3	3	-	-	-   -		-	2	-	-	-	2	-	-

## Unit-1 : DC Circuits

Active and passive elements. Two terminal circuit - Types of sources, Combination of Sources, Source transformation - Network reduction techniques- Star-Delta transformation -Mesh and Nodal analysis of DC circuits with dependent sources.

Laboratory Practice: Mesh analysis and Nodal analysis-Simulation and hardware

Unit-2 : AC Circuits

Introduction to AC circuits - Steady state analysis of RL, RC, RLC series, parallel and compound circuits- Series resonance and parallel resonance circuits - Mesh analysis and Nodal analysis for AC circuits with independent sources.

Laboratory Practice: RL, RC, RLC series and parallel circuits -Simulation and hardware

Unit-3: Network Theorems

Superposition theorem. Thevenin's theorem, Norton's theorem and Maximum power transfer theorem for AC circuits-Reciprocity theorem, Millman's theorem, Compensation theorem and Tellegen's theorem for DC circuits. Laboratory Practice: Practice on theorems-Simulation and hardware 12 Hour

# Unit-4: Transient Analysis and Coupled Circuits

Transients in RL circuit with DC and AC excitation, Transients in RC circuit with DC and AC excitation-Analysis of coupled circuits -Analysis of single tuned circuits. Laboratory Practice: Time domain of RL and RC transient circuit - Simulation

## Unit-5: Three-Phase Circuits and Two Port Networks

Analysis of balanced and unbalanced three phase circuits-Measurement of three phase power and power factor using two wattmeter method- Analysis of two port networks: Z, Y, h, g, ABCD and inverse ABCD parameters. Laboratory Practice: Three phase power and power factor measurement for R and RL loads, Determination of hybrid parameters- Simulation and hardware

B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-2(Revised-July2023)-First Year Syllabi-Control Copy

12 Hour

12 Hour

12 Hour

		1 Sudhakar A Shvammohan S Palli Circuits and Networks: Analysis and Synthesis
Ι.		5th ed., McGraw Hill Education I, 2017
	Learning	2. William II. Hast, Iash E. Kammarky, Jamia D. Dhilling, Stayon M. Durkin, Environment
Ь	n ő	2. William H. Hayt, Jack E. Kemmeny, Jamie D. Phillips, Steven M. Durbin , Engineering
1	Resources	circuit analysis, 9th ed., McGraw Hill, 2020
		3. Jegatheesan R, Analysis of Electric Circuits, McGraw Hill, 2014

- 4. John Bird, Electric circuit theory and technology, 6th ed., Routledge, 2017
- 5. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-071j-introduction-to-electronics-signals-and-measurement-spring-2006/lecture-notes/

	Bloom's Level of Thinking	CLA-1 A	Formative verage of unit test (45%)	Ing Assessment (CLA) Life CL	Long Learning A-2 –Practice (15%)	Summative Final Examination (40% weightage)			
		Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	20%	and the second second		20%	20%	-		
Level 2	Understand	20 %			20 %	20 %	-		
Level 3	Apply	30 %		A	30 %	30 %	-		
Level 4	Analyze	30%	172 B 14 A 14		30%	30%	-		
Level 5	Evaluate	-		· · · ·	Cast I.	-	-		
Level 6	Create	· · ·	ALC: CALS N	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		-	-		
	Total		100 %		100 %		100 %		

Course Designers	and the second sec	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. S. Paramasivam, Danfoss, Industries Pvt Ltd., paramsathya@yahoo.com	1. Dr. K. S. Swarup, IIT Madras, ksswarup@iitm.ac.in	1. Dr. K.Vijayakumar, SRMIST
2. Dr.BhaskarSahu, Schneider Electric Ltd, bhaskar.sahu@se.com	2. Dr. S.Chandramohan, CEG, c_dramo@annauniv.edu	2. Dr. C.S.Boopathi, SRMIST



Course Code	21ECC101J	Course Name	Inse ELECTRONIC SYSTEM AND PCB DESIGN Course C PROFESSIONAL CORE							L 2	T 0	P 2	C 3					
Pre-requ Course Course Of	isite <i>Nil</i> es ffering Department	Electro	Co- requisite Nil Courses And Communication Engineering Data Book / Codes / Standards	Progressive Courses	Nil													
Course I	Learning Rational	le (CLR):	The purpose of learning this course is to:		7	7		Prog	jram C	utcor	nes (P	90)				P	rogra	m
CLR-1: Explore the basics of semiconductors and semiconductor devices						2	3	4	5	6	7 8	9	10	11	12		Specif utcom	ic ies
CLR-2 :	Study of special se	emiconductor	d <mark>evices and f</mark> abrication techniques	1.00	0	1		of		ity		×						
CLR-3 :	Identify the applica	tions of devic	es in circuit and measuring instruments	- 10	ledge		nt of	ions	е	socie		Wor		ance				ļ
CLR-4 :	Create insights to	the conce <mark>pts o</mark>	of PCB design and rules		Now	ysis	pme	stigat	Jsag	and		eam	E	, Fina	ming			
CLR-5 :	Analyze the desigr	n concept <mark>of P</mark>	CB design for different applications	1.1	ring k	Anal	levelo	inves	Tool	nent	hilitv	al & T	nicatio	Agt. 8	g Lea			
				10 10 10 10	inee	olem	ign/d tions	duct	lem .	engl	taina	vidua	Jmur	ect N	Long	-1	-2	ကို
Course (	Outcomes (CO):		At the end of this course, learners will be able to:	1.11	Eng	Prol	Des solu	Con	Moc	Env Env	Ethi	Indi	Con	Proj	Life	PSC	PSC	PSC
CO-1:	Understand the prop	perties o <mark>f sem</mark>	iconductor materials and devices		3	2	-	-	-	-	-   -	-	-	-	-	-	-	-
CO-2:	Analyze working pri	nciple an <mark>d cha</mark>	aracteristics of special semiconductor devices	1032.44	3	2	-		3			-	-	-	-	-	-	-
CO-3:	Design basic electro	onic circu <mark>its ar</mark>	d familiar with working principles of instruments	State of the	3	3	1	-	3	-		-	-	-	-	-	-	-
CO-4:	Apply the concept a	nd rules <mark>for P</mark>	CB design	in the second	3	3	-	-	3	-		-	-	-	-	-	-	-
CO-5:	Implement the desig	ın rules f <mark>or va</mark>	rious PCB design applications	a subscription of the	3	-	3	-	3			-	-	-	-	-	-	-

Unit-1 :

# 12 Hour

Classifications of Semiconductor, Doping in Semiconductors, Conductivity of semiconductors, Energy Distribution and fermi level, Carrier Concentration in intrinsic semiconductor and Mass-Action Law, Problem Solving techniques, Drift and Diffusion Current, Einstein Relationship for semiconductors, Basic PN junction and applications, Bipolar junction transistor and MOSFETs, Challenges for Nano MOSFETs (Scaling Issues), SOI MOSFET and Double gate MOSFET (Working Principle), FinFET and IGFET (Basic Concept)

Practice: Study of electron devices and electronic components- Passive electronic components, Study of electronic components- active devices, analog and digital integrated circuits (IC), Study of testing and measuring Instruments: Logic analyzer, spectrum analyzer, IC tester (Analog and Digital), LCR meters Unit-2 :

# 12 Hour

12 Hour

Introduction to power electronics, applications and role of power electronics, Introduction to power semiconductor devices, Operating characteristics of Power Diodes, Gunn Diode, Schottky Diode, IMPATT Diode, Introduction to Thyristor, PNPN Diode, Silicon Control Rectifier (SCR), Thyristor Rating, Physics of Power BJT and Switching Characteristics, Physics of Power MOSFET and Characteristics, Monolithic Fabrication Process, Fabrication of Monolithic Diode, Fabrication of monolithic capacitors and resistors

Practice: Study on diodes using CAD tools, Design and analysis of RL and RC time constants using schematic in CAD tool, Design and analysis of RLC circuits using schematic in CAD tool

Unit-3:

Basic Building block of power supply and its requirements, Rectifiers (Half Wave and Full Wave), Rectifier circuits using SCR, Voltage Regulators (Line regulation and Load regulation) and problem solving, Switched Mode Power Supply (SMPS), Classifications of SMPS, Advantages and comparison, Wave Shaping Circuits, Multivibrators (Astable, Monostable and Bistable), Ammeter, Digital voltmeter, Digital multimeter, Cathode Ray Oscilloscope (CRO), Spectrum Analyzer, Energy Meter, Power meter and distortion meter (block diagram and working principle).

Unit-4 :

12 Hour Concept of PCB Design, Components of a PCB, Classifications and manufacturing of PCB, Layout planning and Design block diagram, Importance of PCB Design, Mechanical Design of PCB, Types of Boards, Mounting Techniques, Stress analysis, Electrical Design Consideration of PCB, Rules for Component Placement in PCB, Rules for Power supply and Ground, Connections layout, Component Assembly in PCB Practice: PCB Layout Design of single digit pulse counter using PCB design tool, PCB Layout Design - of RL, RC and RLC circuits Unit-5:

12 Hour

Environmental Factors on PCB Design, Cooling and Packaging of PCB, Layout Design of PCB and Checklist, Design rules for analog PCB, Design rules for digital PCB, Problems in Digital PCB (reflections, cross-talk, signal noise and interference), PCB Design for high frequency circuits, PCB Design for fast pulse circuits, PCB Design for microwave circuits Practice: Mini Project - Circuit Schematic, PCB Layout Design, manufacturing, Assembly of components and testing (Open choice on any application circuit).

	1. Simon Sze, Ming-Kwei Lee," Semiconductor Devices, Physics and Technology" 3rd edition,	3. Raghbir Singh Khandpur, Printed Circuit Boards: Design, Fabrication, and Assembly, McGraw Hill
Learning	John Wiley & Sons, Inc, 2015.	Education; 1st edition (1 July 2017)
Resources	2. S. Salivahanan, N Suresh Kumar, "Electronic Device and Circuits" 3rd edition, McGraw-Hill	4. Ned Mohan, T. M. Undeland, W. P. Robbin, "Power Electronics: Converters, Applications, and Design"
	Education, 2012	Wiley; Third edition (1 January 2007)

Learning Assessmen	it	1 m 1								
		S	Continuous Learn	ing Assessment (CLA)			Pummativa			
	Bloom's Level of Thinking	CLA-1 A	Formative verage of unit test (45%)	CL	A-2 –Practice (15%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Th <mark>eory</mark>	Practice			
Level 1	Remember	30%	the second second		20%	30%	-			
Level 2	Understand 🛛 👘	30%	- 10 M M	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	30%	30%	-			
Level 3	Apply 🚽	40%		-	40%	40%	-			
Level 4	Analyze				10%	-	-			
Level 5	Evaluate			CHERKER ST		- 11	-			
Level 6	Create				1.0	- 10	-			
	Total		100 %		100 %		100 %			

Course Designers																									
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts																							
1. Mr. Mohan, Embedded 360, Chennai	1. Dr. Venkatesan, Sr. Scientist, NIOT, Chennai	1. Dr. Soumyaranjan Routray, SRMIST																							
2. Mr. Sai Vineeth, ML Silicon Architect, Google Cloud TPU, USA	2. Dr. S. A. Akbar, Chief Scientist, CEERI Pilani	2. Dr. P. Eswaran, SRMIST																							
Course Code	21ECC112J	Course Name			SYSTEMS	S PROGR	AMMING			Course Category	С				PRO	FESS	IONAL	COR	E			L 3	T 0	P 2	C 4
----------------------------------------------------------	----------------------------------------------------------------------------------------------------	-------------------------------------------------------------------	---------------------------------------------------------	----------------------------------------------	------------------------------------------	-----------------------------------------------------	---------------------------------------------------------------	---------------------------	------------------------	------------------------	---------------------	------------------	----------------	--------------------	---------------------------------	----------------	--------------------	------------	--------	---------	--------	--------	------------	--------	---------
Pre-requ Course Course Of	isite Nil es fering Department	Electror	nics and Co	Co- requ Course mmunicatior	i <b>isite</b> Nii s n Engineeri	il ing	Data Book / Code	es / Standar	nrds	Prog Co Nil	ressive urses	Nil													
								1.1		1000	_														
Course I	earning Rational	le (CLR):	The purp	pose of lear	<mark>hing this co</mark>	ourse is to	):								Prog	gram	Outcon	nes (F	PO)				F	Progra	ım د
CLR-1 :	Explore system so	ftware implerr	nentation <mark>an</mark>	<mark>d languag</mark> e ;	processors	\$					-01	1	2	3	4	5	6 7	7 8	9	10	11	12	0	utcom	nes
CLR-2 :	Acquire a fundame	ental understa	andin <mark>g of the</mark>	input/outpu	t data man	agement,	, arrays in C++, fur	nctions, clas	asses ai	nd threads	5	0			of		ť		~						
CLR-3 :	Provide the knowle	edge of basic	da <mark>ta structu</mark>	<mark>re</mark> s and thei	r implemen	ntations		1000	5			ledge	1	ent of	ions	е	socie		Worl		ance	-			
CLR-4 :	Know the design a	nd implement	tat <mark>ion of li</mark> nk	er and loade	ərs.			12.63				Now	ysis	pme	stigat	Usag	and		eam	E	Fina	rning			
CLR-5 :	Make proper use o	of system soft	ware implem	nentation too	ols	1	12.53	A STATE	136			ring k	Anal	levelo	inve	Tool	ineer nent	hility	al & T	nicatio	Agt. 8	g Lea			
				1			100			and to		ginee	blem	sign/c	nduct	dem	eng /ironr	ics ics	ividua	Inmu	ject N	Lon	<u>-</u> -	0-2	0-3
Course (	Dutcomes (CO):		At the er	nd of this co	urse, learne	ers will be	e able to:		10			ц	Pro	Des	Co	Moc	En The	S E	Ind	Š	Po	Life	PS(	PS(	PS(
CO-1:	Understand the exec	cution pr <mark>oces</mark> :	<mark>s of H</mark> igh Le	vel Languag	e program	IS		10.00			24	2	-	3	1	-		· -	-	-	-	-	-	-	-
CO-2:	Develop C++ progra	ams usin <mark>g clas</mark>	<mark>sses,</mark> inherita	ance, <mark>fun</mark> ctio	ons and thr	reads	10 SW	53.302	1.1	$ \cdot  \geq  \cdot $	1	-	2	3	-	-		-	-	-	-	-	-	-	-
CO-3:	Develop small applic	cation pr <mark>ogra</mark> r	<mark>ms u</mark> sing ba	sic dat <mark>a s</mark> tru	cture conce	epts						-	1	-	2	3			-	-	-	-	-	-	-
CO-4:	Compare various sy	stem so <mark>ftware</mark>	<mark>e like</mark> linkers	and loaders	s related to	o the giver	n system			100		2		3	-	•		•	-	-	-	-	-	-	-
CO-5:	Distinguish the feat	ures of s <mark>yster</mark>	m software 1	like compile	rs, interpre	eters and o	debuggers related	d to the give	en syste	em	14	2	-	3	1	-	-   -		-	-	-	-	-	-	-
IInit-1 · M	ulti-Paradiam Proar	ammina		-		-			-	Ep	-	-			-	-								15 F	Hour
C++ name	spaces, references, e	exceptions, ne	ew/delete, C	++ classes (	& inheritand	ce, C++ t€	emplates, polymor	rphism, C++	+ functi	ons and la	mbdas,	C++ i	hread	s	-									101	IUUI
Practice: D	evelop and practice (	C++ applicatio	on programs	s using class	es, inherita	ance, func	ctions and threads.	S.	<u>e</u>							_									
Unit-2 : Ba	sic Data Structures						<u></u>					_		01										15 H	lour
Practice: D	ary search trees, bina Nevelop and practice a	ary heaps, Tat application pro	bles: lookup o <mark>grams us</mark> in	) tables, has in basic data	h tables, G structures	iraphs: DF s like trees	FS, BFS, shortest j s tables stacks ar	path, minim nd graphs	num sp	anning tre	es, Que	eues, S	Stacks	, Stand	lard C+	+ Libi	raries:	stl, bo	ost						
Unit-3: Ov	erview of System So	oftware and I	La <mark>nguage F</mark>	Processor	- otraotaroo	/ 1110 11000		na grapno	1.0					1										15 H	lour
Software H Programm Practice: D	lierarchy, Systems Pr ing Languages and La evelop simple progra	rogramming, I anguage Proc oms in C++ for	Machine Structure cessors, Lar	ucture, Inter iguage Proc ing symbol t	faces, Addi essing Act	ress Spac tivities, Pro basic dat	ce, Computer Lang ogram Execution, ta structures	guages, Too Symbol Tal	ools, Life ables, P	e Cycle of rogrammi	a Sourd ng langi	ce Pro uage (	gram, Gramn	Levels nars, So	of S <mark>ys</mark> canning	tem S g and	oftware Parsing	ə, g							
Unit-4 : Li	nkers and Loaders		. inipiciticita	ng ojmoort	unio denig	buore uut	a chactaree			_		3.4												15 F	Hour
Introduction	n to linkers, Relocatio	on and Linking ader	g Concept, L	Design of a L	<mark>.inke</mark> r, Intro	oduction to	o Loaders, Differer	ent Loading	Schem	es, Seque	ential an	d Dire	ect Loa	iders, C	Compile	-and-	Go Loa	aders,	Linke	ers v/s	Loade	ərs			
Unit-5: So	ftware Programming	g Tools																						15 H	Hour
Introduction Interpreters Debuggers Practice: D	n to compilers, Worki s: Benefits of Interpre :: Types of Errors, De evelop a program for	ng of compile etation, Overv bugging Proc lexical analys	ers, Types of view of Interp cedures, Cla rser	Compilers, pretation, Th ssification o	Data struct le Java Lar f Debugger	t <mark>ures u</mark> sec nguage Er rs, Dynam	d in compilers. nvironment, Java V nic / Interactive De	Virtual Maci ebugger	chine.																

Learning	1. System Programming by D M Dhamdhere McGraw Hill Education, 2011	<ol> <li>"Systems Programming", Srimanta Pal, Oxford University Press, 2011</li> <li>"Computer Systems – A Programmer's Perspective", Bryant and O'Hallaron. Third edition, Pearson India</li></ol>
Resources	2. "C++ Primer", Stanley Lippman, 5th Edition, Addison-Wesley Professional Publishers, 2012	Education Services Pyt. Itd., 2015

Learning Assessment											
		Continuous Learning Assessment (CLA)									
	Bloom's Level of Thinking	F CLA-1 A	Formative verage of unit test (45%)	CL	A-2 –Practic <mark>e</mark> (15%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%	-		10%	20%	-				
Level 2	Understand	20%			10%	20%	-				
Level 3	Apply	30%			30%	30%	-				
Level 4	Analyze	20%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	10 C - 10 C	30%	30%	-				
Level 5	Evaluate	10%	and the state of the		20%		-				
Level 6	Create					- 12	-				
	Total		100 %	Sec. Sec.	100 %		100 %				
			14 St. 19 St. 19	1. 1974 - 224	138 1 1 S - 1						

Course I	Designers	1 mar 1			
Experts f	rom Industry	and the second	Experts fr	om Higher Technical Institutions	Internal Experts
1.	Mr. Mohan, Embedded 360, <mark>Chennai</mark>	7	1.	Dr. R. Venkatesan, Sr. Scientist, NIOT, Chennai	1. Dr. S. Malarvizhi, SRMIST
2.	Mr. Sai Vineeth, ML Silicon Architect, Goo	gle Cloud TPU, USA	2.	Dr. S. A. Akbar, Chief Scientist, CEERI Pilani	2. Dr. M. S. Vasanthi, SRMIST



Course Code	21EIC101J	Course Name	SENSO	RS AND ACTUATORS	Ca	ourse tegory	С				PRO	FESS	IONAI	LCOR	RE			L 3	T 0	P (	C 4
Pre-requ Course	isite <i>Nil</i>		Co- requisite Courses	Nil		Progre	ssive	Nil													
Course Of	fering Department	Electr	ronics and Instrumentation Engin	neering Data Book / Codes / S	Standards	Nil															
				TEL AL																	
Course I	earning Rational	le (CLR):	The purpose of learning this	s course is to:							Prog	gram	Outco	mes (l	PO)				F	rogram	
CLR-1 :	Familiarize with dif	ferent types (	of the Sen <mark>sing physical</mark> quantity	and their basic principle and sensin	ng properties		1	1	2	3	4	5	6	7 8	3 9	10	11	12	OI.	utcomes	3
CLR-2 :	Introduce the con	struction and	l princi <mark>ple of Mecha</mark> nical, resistiv	ve, capacitive and Inductive sensors	5						of		ty								
CLR-3 :	Impart the basic pr	rinciples and	me <mark>chanism of</mark> Thermal, Magnet	tic, radiation, smart sensors	80%a			edge		nt of	ions	e	socie		Work		ance	ł			
CLR-4 :	Understand the ba	sic actuator p	o <mark>rinciples an</mark> d phenomenon on v	which it works	S. 1. 1			now	ysis	bme	stigat lems	Jsag	and	5	eam	E	، Fina	rning			
CLR-5 :	Provide the micro	sensor and a	ctuators working and construction	on mechanism	1.1	1		ring k	Anal	develo	inves	Tool	ineer	hility	al & T	nicatic	Agt. 8	g Lea			
					1000	10		ginee	blem	sign/d	nduct	dem	eng	tain;	vidua	nmu	ject I	Lon	D-1	0-2	n C
Course (	Dutcomes (CO):		At the end of this course, le	arners will be able to:		100		Enç	Pro	Solt	Sor	Mo	Ц Ц Ц		Ind L	Š	Pro	Life	PS(	DS DS	ろ ユ
CO-1:	Identify the transduc	ction- sen <mark>sing</mark>	<mark>g princ</mark> iples and label their chara	cteristics of measurement system		1.53		2	2	-	1	-	-		-	-	-	-	-		-
CO-2:	Classify different typ	be of sen <mark>sor l</mark>	based on their principles	14 14 CH 5			1	3	2	-	-	-	-		-	-	-	- 1	-	-   -	-
CO-3:	Recall the Selection	criteria, <mark>perf</mark>	ormance of different sensor bas	ed on their application	2 -	18.2	1	2	2	-	100	•	-		-	-	-	-	-		-
CO-4:	Outline the different	working prin	ciples of the actuators		1. 1. 1. 1. 1.			3	2	-	-	-	-		-	-	-	-	-		-
CO-5:	Associate the relation	on betwe <mark>en t</mark> ł	<mark>ne mi</mark> cro sensor and micro actua	ator in a system	1000		11	3	2	-	-	-	-		-	-	-	-	-		-
-						100	Sug				No.										
Unit-1 :Fu	ndamentals and Sei	nsor Cha <mark>rac</mark>	teristics							1.54	-									15 Ho	ur
Introduction	n on Sensor, transmi lechanical and Electr	tter and trans	sducer - Primary measuring elen	nents- Selection and characteristics tive sensors Capacitive sensor The	: Range, Sensit ermal sensors	ivity, Erro Magnetic	or, Line senso	earity, Irs and	resolu 1 smai	tions, r t sensc	epeata ors	ability,	accui	racy, b	ackla	sh, res	ponse	) time.	Class	sification	) of
Unit-2 : Cl	assification of Sens	or-l				nagriotio	0011001	no une	i omu	1 00/100	<i>.</i>									15 Ho	ur
Mechanica	l and Electromechan	ical sensor: <mark>L</mark>	Definition, principle of Sensing &	transduction, Classification, Resisti	ive Sensor : Pot	entiometr	ric type	e, Stra	in gau	ige , Ind	ductive	sens	or : R	eluctai	nce cł	nange	type , i	Mutua	l indu	ctance	-
change typ	e , transforms action	type, LVDT ,	, P <mark>roximity se</mark> nsor , Capacitive s	ensor :variable -area , variable -dist	tance type , Piez	oelectric	eleme	ent, U	Itrasol	nic sens	sor.										
Unit-3: Cla	ssification of Sens	or-II														-	<i>,</i>			15 Ho	ur
Thermal se thermoeled sensors, A	ensors: Material expa stric power : Radiation Architecture and indus	ansion type : n sensor - Ty strial applicat	Solid , <mark>liquid, Gas</mark> and vapor : R pes and characteristics and con ion	lesistance change type : RTD mater nparison LDR , Photovoltaic cells, p	rials , tip sensiti hoto diodes, Ma	/e & sterr agnetic Se	n sensi ensors	itive ty s: torq	/pe , I jue, Th	hermis iomson	tor: ma effect	aterial , hall	, shaj effect	be , ra . Sma	nge, rt sen	l hermi sors :	o emf Comp	sensoi onents	of sn	es , nart	
Unit-4: Ac	tuators			·				-												15 Ho	ur
Definitions,	types and selection	of actuators;	linear, rotary, Logical and cont	inuous actuators, Electrical Actuato	rs: electrical ac	tuating sy	/stems.	: solic	l state	switch	es, Sol	lenoia	s, ele	ctric n	notors	: AC- I	DC, st	epper	motor	s, synch	hro
Pneumatic	s and Hydraulic Actu	ators, Shape	memory alloys Actuator perform	nance criteria and selection																45 11-	
Unit-5: Mic	cro Sensor and Mici	ro actuators	nioro, actuator dovicas: clastrast	atio piezo registivo piezoclastria th	hormal magnet	o tranadi	ation	Floot	onio n	onition	oonoin	a oiro	uito ci	ad ala	otriacl	and ~	oohor	nicol ni	vino	15 HO	ur
witcro-sens	or. Enncipies and ex	аттріе апа п	nuru-autuator devices. electrost	auc, piezo-resistive, piezoelectric, tr	ienniai, magneti	c transau		Electr	unic p	USILION-	Sensin	y circ	uits al	in eie	Juncal	anu ff	ecnan	ingal UC	nse		

Practice:	
1.	The strain gauge characteristics.
2.	The characteristics and weight measurement by load cell
3.	The construction of LVDT and its use in displacement and thickness measurement.
4.	The characteristics of LDR,
5.	The Measurement and testing of different types of thermocouples.
6.	The voltage – intensity characteristics of a photo – transistor
7.	The ramp response characteristics of a filled in system thermometer.
8.	The step response characteristics of RTD.
9.	The step response characteristics of thermocouple.
10.	The Hall Effect Transducer
11.	To design LabVIEW Program for measurement of current, Voltage, PQ (power quality) factor
12.	To design LabVIEW Program for measurement of voltage to current conversion
13.	Characteristics of capacitive measurement systems
14.	Measurement using proximity sensors,
15.	Characteristics of a capacitive transducer

	1. Patranabis D, "Sensors and Transducers," Prentice Hall of India, 2nd Edition, PHI
	Publications, 2021
	2. Ernest O.Do <mark>ebelin , D</mark> hanesh N. Manik,Doebelin's Measurement Systems:, Tata
Learning	McGraw Hill <mark>, 7th Edit</mark> ion (SIE),2019
Resources	3. Robert H. Bishop, "Mechatronic Systems, Sensors, and Actuators: Fundamentals and
	Modeling"; The Mechatronics Handbook, Second Edition, 2017

4. A.K Sawhney. Puneet Sawhney A course in electrical and electronic measurements and instrumentation, Dhanpat Rai and Sons, 2012

5. Murthy DVS, "Transducers & Instrumentation", 2nd , edition, Prentice Hall of India, 2008

6. Clarence W. De Silva, Sensors and Actuators: Control System Instrumentation, University of British Columbia, Vancouver, Canada, CRC Press 2017

7. Neubert HKP, "Instrument Transducers" Oxford University Press 2nd edition. 1999

#### Learning Assessment

			Continuous Learn		Summative					
	Bloom's Level of Thinking	H CLA-1 A	Formative verage of unit test (45%)	Final Examination (40% weightage)						
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%		A Contraction of the local division of the l	30%	20%	-			
Level 2	Understand	20 %	1. 1. 1. 1. 1.	The second	20%	20 %	-			
Level 3	Apply	30 %	and the second sec	1.11 . 13	30%	30 %	-			
Level 4	Analyze	30%		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	20%	30%	-			
Level 5	Evaluate		-			-	-			
Level 6	Create		-	-	-	-	-			
	Total		100 %		100 %		100 %			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr.Vijesweran, MD, Vi MicroSystem Pvt., Ltd	Dr.K.Srinivasan, Associate Professor, NIT Trichy	Dr.A.Vimala Juliet, SRMIST

Course Code	21MHC101P	Course Name	ELEMENTS OF	MECHATRONICS SYSTEMS	Course         C         PROFESSIONAL CORE         L         T         P           Category         2         1         0									P 0	C 3				
Pre-requ Cours	uisite <i>Nil</i> ses		Co- requisite Course <mark>s</mark>	Nil	Progre	ssive Ni ses													
Course O	ffering Department	Mechatronic	s Engineering	Data Book / Codes / Stand	lards Nil														
Course l	Learning Rational	le (CLR): 7	The purpose of learning this	s course is to:	1.1.1				Prog	ram (	Outcor	nes (F	PO)				Р	rogra	Im
CLR-1 :	Understand the ba	asics of mechanica	l elements through relative	e motions		1	2	3	4	5	6	7 8	9	10	11	12	S	pecif	iC 1es
CLR-2 :	Comprehend the ty	ype of sensors and	d signal conditioning circuit	ts			1		f		٨								00
CLR-3 :	Acquire the knowle	edge of electrical a	ctuators and drives.	The second s	197	adde	>	it of	ous d		ociet		Nork		ЪСе				
CLR-4 :	Apply simple contr	rol strategies for op	pen loop and closed system	ns		- Inow	ysis	pmer	stigati ems	Jsage	and s		eam \	Ľ	: Final	rning			
CLR-5 :	Apprehend the bas	sics of data acquis	ition systems		3.4	erina K	n Anal	/develo	ct inves	Tool I	gineer iment 8	uahility	al & T	unicatio	Mgt. 8	ng Leai			
Course	Outcomes (CO):	A	At the end of this course, le	earners will be able to:		Fnaine	Probler	Design	Conduc	Moderr	The en	<mark>Ethics</mark>	Individu	Comm	Project	Life Loi	PSO-1	PSO-2	PSO-3
CO-1:	Build simple mechai	nisms wit <mark>h few de</mark> g	grees of freedom			3	3	-	3	-	-		-	-	-	-	-	-	-
CO-2:	Identify appropriate	sensors <mark>and the s</mark> t	uitable conditioning circuits	S	the first	3	3	-	-	-	-		-	-	-	-	-	-	-
CO-3:	Select actuators and	d the com <mark>patible d</mark> i	riving circuits		- A. S.S.	3	3	-	-	-	-		-	-	-	-	-	-	-
CO-4:	Construct simple co	ontrol sys <mark>tems</mark>	Contraction in the			3	3	-	1.0	-	-		-	-	-	-	-	-	-
CO-5:	Demonstrate a syste	em integ <mark>ration</mark>			and the second	3	3	-	-	-	-	-   -	-	-	-	-	-	-	-
Unit-1 :	Mechanical System	n			- E.S. 13	N.A		1.	-		-							91	lour
Degrees o	f Freedom – Joints ar	nd constraints – Ty	pes of mechanism- Transi	mission Elements – Aspects of mechanic	cal engineering desig	gn – Aspe	cts of M	anufact	uring pr	roces	S								
Unit-2 : Se	ensors and Signal C	Conditioning	and a start		-				-									9 F	lour
Basic spec	cification and measure	ement – typ <mark>es of P</mark>	Physical parameters – Type	es of sensory signals – Signal con <mark>ditionir</mark>	ng circuits – Signal d	ecoding -	sensor	calibrati	ion										
Unit-3: A	ctuators and Drives		1.6.1	and the second sec				19										9 H	lour
Electrical /	Actuators (AC and DC	C) – Fluid powe <mark>r ac</mark>	<mark>ctuators</mark> – Basic specification	ons of linear and rotary actuators – Spec	cial purpose actuator	s – Electri	cal driv	es – Flu	id powe	er driv	/es								
Unit-4 : E	mbedded Control		1 C -	and the second s	100 m			Q										9 H	lour
Introductio Accuracy -	on to Control Systems – parallelization – Cor	s – Open loop an <mark>d</mark> ncept of programm	l <mark>closed lo</mark> op systems – C ling , Algorithm and coding	DN OFF control – proportional control –	Basics of computing	hardware	э – Тур	es of co	omputin	ng hai	rdware	– Re	al tim	e beha	ivior –	- Time	Perfo	ormar	псе –
Unit-5:So	ftware Stack and Int	tegration	<u>,</u>															9 F	lour
User Inter	face – Data acquisitio	on and methods – S	Sampling and quantization	- Data processing - Basic algorithm imp	olementation – Motio	n control i	mpleme	entation	– Deve	lopm	ent pip	eline							

Note: The tutorial and free hours will be utilized to develop small mechatronics project prototypes (in groups/batches of students) which will provide real hands on experience to the students.

	1.	Devdas Shetty, Richard Kolk ."Mechatronics System Design", Cengage Learning, Inc; 2nd ed. Edition,2010	3.	W. Bolton, "Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering", Pearson, 6th edition, 2015.
Learning	2.	Kaltjob, Patrick O. J. "Control of mechatronic systems: model-driven design and implementation guidelines", John Wiley & Sons, Inc., 1st edition, 2020.	4.	Singh, Satya Bir, Ranjan, Prabhat, Vakhrushev, Alexander V., and Haghi, A. K. "Mechatronic systems design and solid materials: methods and practices", CRC Press, 1st edition, 2021
Resources	3.	De Silva, Clarence W., Khoshnoud, Farbod, Li, Maoqing, and Halgamuge, Saman K. "Mechatronics: fundamentals and applications", CRC Press, 1st edition, 2016	5.	Schmidt, Robert Munnig, "The design of high performance mechatronics : high-tech functionality by multidisciplinary system integration", Delft University Press, 3rd edition, 2020.
	4.	4. Robert H. Bishop, "The Mechatronics Handbook-Mechatronic systems, sensors and actuators", CRC Press, 2nd edition, 2007	P.	

Learning Assessment	t					1							
			Co	ntinuous Learning As	sessment (CLA	)	1						
	Bloom's Level of Th <mark>inking</mark>	Forr CLA-1 Avera (2	native age of unit test 0%)	Project Base CLA (605	d Learning I-2 %)	Report a	nd Viva Voce (20%)	Final Examination (0% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	40%		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		-		-	-				
Level 2	Understand	40%				-	-		-				
Level 3	Apply	20%		and the states of	20%	de strate	20%		-				
Level 4	Analyze		A started	100 B	30%	1.12	30%	-	-				
Level 5	Evaluate 🚽			140.102	30%		30%	-	-				
Level 6	Create	A 1000			20%	Sec 1	20%		-				
	Total	10	0 %	100	%	1	100%		-				
	-	-	Salar Salar	Print Piles	A State		1						

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Ganesh Ram, CTO, Tunga Systems, Chennai	and the second sec	1. Dr. R Senthilnathan, SRMIST
2. Mr. Mohammed Sagheer, Specialist, ZF Wabco, Chennai		2. Mr. Ranjith Pillai, SRMIST



Course Code	21NTC101T	Course Name	NANOSCIENCE AND NANOT	ECHNOLOGY	Course Category	С	C PROFESSIONAL CORE L 3							T 0	P 0	C 3			
Pre-requi Course	isite <i>Nil</i> es	Dhucios and N	Co- requisite Nil Courses	ata Book / Codes / Standards	Progre Cour	ssive Nil ses													
Course On	lering Department	Filysics and No		ala DOOK / COUES / Standards	INN														
Course L	earning Rational	e (CLR): The	purp <mark>ose of learn</mark> ing this course is to:	A COLORED	A. 17				Prog	ram C	)utcon	nes (P	0)				P	rogra	m
CLR-1 :	Acquire knowledge	on basics of nanosc	i <mark>ence, classe</mark> s of nanomaterials and th	eir size and dimensionality dep	pendence	1	2	3	4	5	6 7	7 8	9	10	11	12		itcom	ic ies
CLR-2 :	Obtain knowledge	on physical prope <mark>rtie</mark>	<mark>s of nanostructured materials and thei</mark>	size and dimensionality depen	ndence				of		ţ		~						
CLR-3 :	Understand the ph	ysics and chem <mark>istry-l</mark>	based experimental approaches to syn	thesize various types of nanon	naterials	edge	1	nt of	ions	е	socie		Wor		ance				
CLR-4 :	Gain knowledge or	n the basic principles	of characterization techniques at nanc	scale		now	ysis	bme	stigat lems	Jsag	and		eam	E	, Fina	rning			
CLR-5 :	Appreciate the pote	ential applic <mark>ations of</mark>	the nanotechnology	A STREET IS		ing K	Anal	evelo	inves prob	Tool	neer	hility	I & T	licatio	Agt. 8	g Lea			
					- and the	lineel	blem	ign/d	Iduct	lem .	engi	taina	vidua	umur	ect N	Lonç		0-2	0-3
Course C	Dutcomes (CO):	At th	he end of this course, learners will be a	ble to:	0750524	Eng	Po	Des	Con	Moc	Env He	Ethi	Indi	ő	Proj	Life	PSC	PSC	PSC
CO-1:	Analyze fundamenta	als of nan <mark>otechnolo</mark> gy	r, different classes of nanomaterials an	d their sizes and dimensions		3		2	5	-			-	-	-	-	-	-	-
CO-2:	Describe various phy	ysical pr <mark>operties o</mark> f n	anomaterials	1 S.	1.1.1	2	-	-	3	-			-	-	-	-	-	-	-
CO-3:	Apply chemical and	physica <mark>l methods</mark> to	synthesize and fabricate nanomaterial	5	1. 82	1.5	2	3	1	-			-	-	-	-	-	-	-
CO-4:	Distinguish various o	characte <mark>rization te</mark> chi	niques involved in nanotechnology	A CHART A	199		-	3	-	3			-	-	-	-	-	-	-
CO-5:	Identify the potential	ities of n <mark>anotechn</mark> olo	gy and a second s			2	-		3	-			-	-	-	-	-	-	-

#### Unit-1 : Basics of Nanoscience and Classification of Nanomaterials

Introduction to nanoscience - Moore's Law. Matter at different length scales: Nanosystems-classification based on length scale - Bulk, Quantum dots, guantum wells and guantum wires - Density of states in bulk, two, one and zero dimensions, Quantum confinement: exciton confinement in quantum dots. Surface to volume ratio - Fraction of surface atoms and surface energy. Carbon-based nano materials: Fullerenes. Carbon nanotubes and Graphene. Metal nanoparticles: Nanogold and nanosilver. Metal-oxide based nano materials. Nanocomposites

Unit-2 : Size-Dependent Physical Properties of Nanomaterials

Size dependent Mechanical properties of nanomaterials. Thermal properties of nanomaterials: melting point - size dependent thermal transport - Electronic properties of nanomaterials: size dependent terms transport - size dependent terms and the size dependent terms and terms Luttinger liquid behavior of electrons in 1D metals: Magnetic properties of nanomaterials: Single domain region – super paramagnetism - Langevin function. Optical properties: Size dependent light absorption and emission of quantum dots Red- and blue shift 9 Hour

Unit-3: Nanomaterials Synthesis Methods

Top-down and bottom-up approach for nanomaterials synthesis. Bottom-up approach: Chemical methods - metal nanoparticle synthesis by chemical reduction - Hydrothermal and solvothermal synthesis of nanoparticles-Photochemical synthesis – spray pyrolysis synthesis of nanoparticles. Fabrication of nanotubes, nanowires and nanorods: Vapor-liquid-solid (VLS) process. Physical Vapor Deposition: Thermal evaporation - DC/RF magnetron sputtering -Molecular beam epitaxy (MBE). Chemical vapor deposition (CVD) - Metal organic chemical vapor deposition (MOCVD). Top-down approach: Ball milling & Grinding – Nanofabrication: Concept of lithography- Photo and electron beam lithography.

Unit-4 : Characterization of Nanomaterials

X-ray diffractometometer (XRD) – Debye Scherrer method. Introduction to electron microscopy – Scanning electron microscope working principle - Field emission scanning electron microscope (FESEM) - Environmental scanning electron microscope (E- SEM) - High resolution transmission electron microscope (HRTEM). Scanning probe microscope (SPM): Atomic force microscope (AFM) - Scanning tunnelling microscopy (STM). Absorption spectroscopy - Photoluminescence spectroscopy, Magnetic measurements - Vibrating sample magnetometer (VSM).

9 Hour

9 Hour

9 Hour

Unit-5: Applications of Nanomaterials	9 Hour
Magnetic nanoparticles – Hyperthermia – Ferro fluids– Nanotechnology in memory. <u>Nanotechnology in Printed electronics – Na</u> Environment: Nanotechnology in improving environment - Catalytic application of nanoparticles. Sensors: Chemical sensors – i	anoinks. Role of nanotechnology in solar energy conversion. Nanotechnology in food storage. Biosensors. Nanomedicine - Nanobiotechnology - Nanotoxicology - Nanotechnology in cosmetics
1. T. Pradeep, A Textbook of Nanoscience and Nanotechnology, Tata McGraw Hill Education Pvt. Ltd., 2012         2. M. S. Ramachandra Rao and Shubra Singh, Nanoscience and Nanotechnology: Fundamentals to Frontiers, Wiley, 1st ed. 2013         3. Hari Singh Nalwa, Nanostructured Materials and Nanotechnology, Academic Press, 2008	<ol> <li>Edward L. Wolf, Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience. 2nd ed., Wiley-VCH, 2004</li> <li>Hans-Eckhardt Schaefer, Nanoscience: The Science of the Small in Physics, Engineering, Chemistry, Biology, and Medicine, Springer-Verlag Berlin Heidelberg, 1st Edition, 2010.</li> </ol>

Learning Assessmer	nt				1.1					
		Continuous Learning Assessment (CLA)								
	Bloom' <mark>s</mark> Level of <mark>Thinking</mark>	CLA-1 A	Formative verage of unit test (50%)	Life I	Long Learning CLA-2 (10%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20 %		20 %		<mark>20</mark> %	-			
Level 2	Understand	20%		20%		<mark>20</mark> %	-			
Level 3	Apply	30 %		30 %	Carl I.	30 %	-			
Level 4	Analyze	30%	1 Su51	30%		<u>30%</u>	-			
Level 5	Evaluate	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		The second	C	-	-			
Level 6	Create 🥒		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		21 2	-	-			
	Total		100 %		100 %		100 %			
		1 to 1 to 1	area a state of the state of th		C The State of Longer					

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sunil Varughese, CSIR-NIIST, s.varughese@niist.res.in	1. Prof. S. Balakumar, University of Madras, balakumar@unom.ac.in	1. Dr. E. Senthil Kumar, SRMIST
2. Dr. M. Krishna Surendra, Saint-Gobain Research, Chennai, krishna.muvvala@saint- gobain.com	2. Prof. M. S. Ramachandra Rao, IIT Madras, msrrao@iitm.ac.in	2. Dr. M. Navaneethan, SRMIST



Course Code       21NTC111T       Course Name       PHYSICS OF MATERIALS       Course Category       C       PROFESSIONAL CORE       L       T         3       0													IL CC	ORE	T 0	P 0	C 3							
Pre-requ Course	iisite <i>Nil</i> es			Co- Co	requisite ourse <mark>s</mark>	Nil		Progree	ssive ses	Nil														
Course Of	fering Depa	artment	Physic	s and Nanotechnol	ogy	Data Book / Cod	es / Standards	Nil																
Course I	Learning I	Rational	e (CLR):	The purpose of	<mark>f learn</mark> ing this	s course is to:		1.1					Prog	ram C	Outco	omes	(PO	)				Pr	ograr	m
CLR-1 :	Develop t	heoretica	l knowledge	in classica <mark>l mechar</mark>	nics (CM), qu	antum mechanics(QM) and so	olid state physics	(SSP)		1	2	3	4	5	6	7	8	9	10	11	12	out	pecifie tcome	c es
CLR-2 :	Develop s	kills on s	olving analyt	tical p <mark>roblems in C</mark> N	I, QM and SS	SP				0			of		ity			~						
CLR-3 : Acquire advanced knowledge in current understanding of CM, QM and SSP										ledge	1	ent of	tions	е	socie			Worl		ance	6			
CLR-4 :	Understa	nd Schroo	linger equati	ion and its application	ons in Materia	als Science	12.000	200		Know	lysis	opme	stiga	Usaç	and	×		Feam	on	& Fin	arninç			
CLR-4:       Orderstand Schrödinger equation and its applications in Materials Science         CLR-5:       Understand the crystal structure as basic building block of material and its properties										leering l	em Ana	In/devel	uct inve lex prob	m Tool	ngineer	onment	"	dual & J	nunicati	ct Mgt.	ong Lea	-	5	33
Course (	Outcomes	(CO):		At the end of th	nis course, lea	arners will be able to:	1000	1939		Engin	Probl	Desig	Cond	Mode	The e	Susta	Ethics	Indivi	Comr	Proje	Life L	PSO-	-SO-	-OS
CO-1:	Be familiar	with som	e eleme <mark>ntary</mark>	<mark>y phen</mark> omena and c	oncepts in pl	hysics				-	3	-	3	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Apply math	ematical	tools to <mark>expla</mark>	l <mark>ain ge</mark> neral properti	<mark>es</mark> like stress	s/strain/elasticity etc.	2.104	1.1.2	1	1	3	-	3	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Solve prob	lems in C	M, QM a <mark>nd S</mark>	SSP .	1.00		Sec. 11	1.55	1	-	3	-	3	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Apply the k	nowledge	e of qua <mark>ntum</mark>	<mark>n mec</mark> hanics for mat	erials science	e problems	1.1	100		-	3	-	3	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Calculate E	ensity of	states of cry	/stals	-			1964		-	3	-	3	-	-	-	-	-	-	-	-	-	-	-
Unit-1 :Cla	assical Mec	hanics	-	-				En si	Su.e				-										9 H	our
Mechanics of motion, SHM, Atwo	of a single Degree's of ood machine	particle, N freedom etc.	lechanics of and constrain	f system of particles ints, Calculus of Var	, Conservatic iations; Lagra	on of linear momentum, Conse ange's Equations; Hamilton's,	ervation of Angula principle, Hamilto	ar momentum, on's equations	, Mecha s of moti	nical ion, S	energ SHM, I	iy for a Equatio	particle n of m	e and otion,	a sy Appi	stem licatio	of pa ons c	article of Har	es, Ce nilton'	ntre c s equ	of mas ations	s and of mo	equa otion l	tion like
Unit-2 : Ge	eneral Prop	erties of	Matter		100							12											9 H	our
Combination Fundament them, Visco	on of two mu itals of vibra osity, Poiseu	itually per ion, force illi's form	pendicular s d oscillation, ula, Stoke's f	sim <mark>ple harm</mark> onic vib , Resonance, sharp formula, Surface tei	rations of sar ness of reso nsion, surface	ne frequency and different free nance, General Properties of I e energy, contact angle and its	quencies, Lissajo Matter, Elasticity, s determination.	us figures, Gr stress, strain,	ravitation , Young	n, Ac 's mo	celera dulus	tion du , bulk n	e to gra nodulu:	avity, s, she	Dete ar m	odulu	ation ıs, P	of ac oisso	celera n's rai	ation tio, R	due to elation	gravit betw	y, een	
Unit-3: Ba	sics of Qua	ntum Me	chanics		1	ALL MAY	SAME	12. 1	11.1	1.1													9 H	our
Basics of Davisson-(	Quantum M Germer expe	echanics, eriment. F	Planck's fo leisenberg U	ormula of black-boo Incertainty Principle	ly radiation, Wave Func	Photoelectric effect, Bohr ato tion. It.s Interpretation and No	om and quantization. Supe	tion of energy erposition of A	/ levels, molitud	de l es.	Brogli	e hypoi	thesis,	Elect	ron	doub	le-sli	it exp	erime	nt, C	ompto	n effe	ct,	
Unit-4 :Sc	hrodinger's	Equatio	n	, , , , , , , , , , , , , , , , , , , ,																			9 H	our
Dynamical	Variables a	s Operato	ors, Expectat	tion Values, Schrod	inger, Equation	on, Particle in a Box, Quantur	n Well, Potential I	Barrier, Hydro	gen ato	m, Ha	armon	ic Osci	llator, l	Electro	on in	perio	odic	poten	tial				<u></u>	
Unit-5:Lat	tice Structu	l attice t	anglational y	vectors and unit co	I Primitivo Is	attice cell Fundamental types	of lattices Millor	indicas Sim	nla crus	tal ct	ructur	as Hor	vagona		0 00	ck of	ructi		iamor	nd etr	ucturo	Cnv	<u>9 H</u>	our
symmetry,	Point group	s, Space	group, Recip	procal lattice, X-Ray	diffraction, E	Bragg's Law, Laue Equation	or ratilites, Willer		pie crys	iai si	uciul	<del>5</del> 3, 119)	ayuna	1 005	e µa	UN SL	uull	11 <del>0</del> , D	anor	10 511	uoluit	Ciys	iai	

	1.	Classical Mechanics, H. Goldstein, C. Poole and J. Fafko (Pearson Education Inc., 2002)	4.	Introduction to Quantum Mechanics, D J Griffiths, D F Schroeter (Cambridge University
Learning	2.	Classical Mechanics, Rana & Joag McGraw Hill Education, 2017)		Press, 3rd edition, 2021)
Resources	3.	Elements of Properties of Matter, D.S. Mathur (S. Chand, 2010)	5.	C.Kittel, Introduction to Solid State Physics, 8th Ed., J. Wiley and Sons, 2005.
			6.	C. Hu. Modern Semiconductor Devices for Integrated Circuits. Pearson, 2009

Learning Assessment				17.7							
			Continuous Learni	Summotivo							
	Bloom's Level of Thinking	CLA-1	Formative Average of unit test (50%)	Life L	ong Learning CLA-2 (10%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20 %		20 %		20 %	-				
Level 2	Understand	20%	1000	20%		20%	-				
Level 3	Apply	40 %		40 %		40 %	-				
Level 4	Analyze	20%		20%		20%	-				
Level 5	Evaluate				-	-	-				
Level 6	Create	-					-				
	Total		100 %		100 %		100 %				

Cours	se Designers		
Exper	ts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.	Dr. M. M. Krishna Surendra, Senior Research Engineer, Saint Gobain India Pvt. Ltd, Chennai	1. Prof Balakumar, Center for Nanoscience, University of Madras	1. Dr. Rudra Banerjee, SRMIST
2.	Dr. N Vijayan, National Physical Laboratory, nvijayan@nplindia.org	2.Prof. V. Subramanian, IITM, Chennai, manianvs@iitm.ac.in	2. Dr. Payel Bandyopadhyay, SRMIST



# ACADEMIC CURRICULA

Basic Science- Bridge Courses (For Lateral Entry Students)

**Regulations 2021** 



## SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Chengalpattu District 603203, Tamil Nadu, India

Course         21MAB205B         Course         MATHEMATICS           Code         Name         Mathematics         Mathematics							Cou Categ	rse Jory	В			E	BASIC	SCIEN	CES			L 3	- T 3 1	P 0	C 4
Pre-requi Course	isite es	Nil	Co- re Cour	quisite se <mark>s</mark>		Nil	P	rogres Cours	sive ses						Nil						
Course	Offering Departme	ent	Mathemat	ics		Data Book / Codes / Standa	ards							Nil							
Course Le	arning Rationale (	CLR):	The purpose of learning	ng this co	ourse is to	Mr. Barrens		1			Progr	am Ou	tcome	es (PO	)				P	rogra	m
CLR-1 :	Application of Ma	trices in p	roblems <mark>of science an</mark> d	engineerir	ng.	1	1	2	3	4	5	6	7	8	9	10	11	12	S	pecifi Itcom	ic ies
CLR-2 :	Utilize the concep	ots of radii	us of cu <mark>rvature, evo</mark> lute,	envelope	in problem	s of Science and Engineering.				1	34		ity								
CLR-3 :	CLR-3 : apply the concept of Taylor series, maxima minima, composite function, and Jacobian in problems science and engineering.								nt of	ons of	0	ociety	tainabi	-	Nork		nce				
CLR-4 :	CLR-4 : Construct the analytic function, discuss conformal mapping and bilinear transformation in engineer problems.							alysis	lopmer	estigati blems	l Usage	er and s	t & Sus		Team \	tion	& Fina	arning			
CLR-5 : gain knowledge in evaluation of double and triple integral and apply then in problems in engineering							ering	m Ani	/deve	<mark>ct</mark> inv	n Too	Iginee	nmen		ual &	unica	t Mgt.	ng Le			
Course Outcomes (CO): At the end of this course, learners will be able to:							Engine	Proble	Design	Condu	Aoder	The er	Enviro	Ethics	ndivid	Comm	Project	life Lo	SO-1	°SO-2	20-3
CO-1:	apply the knowled	lge of m <mark>a</mark> and engil	trices, eigenvalues and neering.	eigen vect	tors reduce	to quadratic form in problems	3	3	-	-	-	-		-	-	-	-	-	-	-	-
CO-2:	gain the knowledg	ge of Ra <mark>d</mark> and En <mark>gi</mark>	ius, Centre, envelope ar ineering.	nd Circle o	of curvature	and apply them in the problen	^{1S} 3	3	÷	-	-		1	-	-	-	-	-	-	-	-
CO-3:	Gain familiarity in the problems invo	the kno <mark>w</mark> Iving Scie	ledge of Maxima and Mi ence and Engineering.	inima, Jac	cobian, and	Taylor series and apply them	in 3	3		-	-			-	-	-	-	-	-	-	-
CO-4:	Utilize the analytic	c function	and bilinear transformation	tion Engin	neering prob	lems.	3	3	-	-	- 1	-	· -	-	-	-	-	-	-	-	-
CO-5:	Gain familiarity in	evaluatio	n <mark>of multi</mark> ple integrals.				3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Unit-1 - Ma	atrices		-		-	-				-	-			-						12	Hour
Characteria – Reductio	stic equation – Eige n of quadratic form	nvalues a to canoni	and E <mark>igenvecto</mark> rs of a re	al matrix – ransforma	- Properties	of Eigenvalues – Cayley Han	nilton the	orem -	- Ortho	gonal r	eductio	on of a	symme	etric m	atrix to	diagoi	nal forn	n – Orti	hogon	al ma	trices
Unit-2 - Di	fferential Calculus			anoronna		ALC MARKED	100			1.1		-								12	Hour
Radius of (	Curvature – Cartesi	an coordii	nates – Radius of Curva	ture – Pola	lar coordina	tes – Circle of curvature – Cer	tre of cu	rvature	e – Evo	lute of	standa	rd curv	es – E	nvelop	e of sta	andard	curves	5.			
Unit-3 - Fu	inctions of Severa	l Variable	es				-			-										12	Hour
Functions	of two variables – F	Partial der	ivatives – Total different	ial – Taylo	or's expansi	on with two variables up to thi	rd order	terms -	- Maxi	ma and	Minim	a – Col	nstrain	ed Ma	xima a	nd Min	ima by	Lagrai	ngian	Multip	lier
– Jacobian	is of three variables tegral Calculus	– Proper	ties of Jacobians - Prob	ems.																12	Hour
Evaluation (Cartesian)	of double integrati ) - Area as a double	on Carte: integral (	sian coordinates - Eval (Polar) - Triple integratio	uation of o	double_integ sian coordii	gration of polar coordinates - nates – Conversion from Carte	Evaluat sian to l	ion of Polar in	double doubl	integra e integr	al by c als.	hangin	g the	order d	of integ	ration	- Area	as a d	double	integ	gral

Unit-5 - Analy	tic Functi	ons	_	12 Hour									
Definition of A	Definition of Analytic Function – Cauchy-Riemann equations in Cartesian coordinates – Cauchy-Riemann equations in polar coordinates - Properties of analytic function – Determination of analytic function using												
Milne Thoms	on's meth	od – Mappings (Magnification, Rotation and Inversion) - Bilinear transformation - Col	<mark>formal m</mark>	apping.									
r													
	1.	Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.	4.	2010 Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Deini, 11th Reprint,									
Learning	2.	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition,	5.	G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint,									
Resources		2010.		2002									
	3.	Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New	6.	N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications,									
		Delhi,2008		Reprint, 2008.									

Learning Assessme	ent 🛛	A 1 1			and the second					
			Summativa							
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test )%)	Life-Long CL (10	g Learning .A-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%		20%		20%	-			
Level 2	Understand	20%	the course with	20%		<mark>2</mark> 0%	-			
Level 3	Apply	30%		30%	-	30%	-			
Level 4	Analyze	30%	1	30%		<mark>30</mark> %	-			
Level 5	Evaluate					-	-			
Level 6	Create	The same	-	100 Mar - 100 Mar		-	-			
	Total	10	0%	10	0%	10	0%			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
<ol> <li>Mr. Madhan Shanmugasundaram, Infosys Technologies, madshan@gmail.com</li> </ol>	1. Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	1. Dr. V. Subburayan, SRMIST
	2. Prof. K.C. Sivakumar, IIT Madras, kcskumar@iitm.ac.in	2. Dr. P. Godhandaraman, SRMIST

Course Code	21PYB105B Course ENGINEERING PHYSICS				Cours Catego	se ory	В			E	BASIC	SCIEN	CES			L 2	. T 2 0	P 0	C 2				
Pre-requis Courses	site s	Nil	(	Co- requisite Course <mark>s</mark>		-	Nil		Pr	ogres Cours	sive es						Nil						
Course C	Offering Departme	ent	Physics and	Nanotechnolog	у	Data Bo	ook / Codes	/ Standar	ls							Nil							
					1.00	-			-	-	1												
Course Lea	arning Rationale (	CLR): The	ne purpo <mark>se of l</mark>	<mark>learning</mark> this co	ourse is t	to:				1	10	1.1	Progr	am Ou	itcome	es (PO)	)				PI	ogran	n ^
CLR-1 :	Introduce to elect	ron theory an	nd Fe <mark>rmi level ir</mark>	n semiconducto	rs	100			1	2	3	4	5	6	7	8	9	10	11	12	ou	outcomes	
CLR-2 :	Explain the conce	ept of carrier ti	tran <mark>sport mech</mark>	anism	1.1	2	-	-	ge		of	s of	20	iety			ork		ē				
CLR-3 :	Identify the applic	ations of elec	ctr <mark>ic field in</mark> mat	terials	1		1999	7818	wled		lent	ation	ge	d soc			n We		nanc	b			
CLR-4 :	Understand the w	orking princip	<mark>ple of las</mark> ers an	nd optical fibers		16			Kno	alysis	lopr	estig	Use	r and	8		Tear	ion	& Fi	arnir			ı.
CLR-5 :	Utilize the princip	les pertaining	<mark>g to vec</mark> tor mecl	hanics			120.00		ering	n Ana	/deve	ct inv∈ x prol	T Tool	ginee	ment		. 8 ler	unicat	Mgt.	ng Le:			
Course Ou	tcomes (CO):	At	t the end of th	is course, lear	ners will	be able to:	R.		Ingine	roble	Design	Condui comple	Aoderr	he en	inviror	thics	Idivid	Comm	roject	ife Lo	SO-1	SO-2	SO-3
CO-1:	Identify the energ	v band in soli	lids and electro	n occupation pro	obability		1.2	144.	3	3	,		-	L.	<u>ш о</u>	-	-	-	-	-	-	-	-
CO-2:	Learning and ana	lvze the work	king of optoeled	ctronic devices		1	1000		3	3	12		-	-	-	-	-	-	-	-	-	-	-
CO-3:	Identify the effect	of electromad	anetic charge o	dvnamics		22.4.3	192		3	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Identify the applic	ations o <mark>f lase</mark>	ers and optical i	fiber	2.5	1000	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	100	3	3	-	-	-		-	-	-	-	-	-	-	-	-
CO-5:	Apply the concept	ts of vec <mark>tors a</mark>	and scalars to o	derive physical	laws				3		12	3	1	1	-	-	1	-	-	-	-	-	-
Unit-1 - Ele	ectron Theory and	l Quantum Pl	Physics		200	1.1		1						-			_					61	Hour
Electron the function- Se	eory of materials- chrodinger wave e E-k diagram-Direct	Classical free equation - tim	e electron the ne dependent-S	ory-postulates-S Schrodinger wa	Success a ve equati	and drawba ion - Time	acks of clas independent	sical free -Density c	electro f states	n theo -Ferm	ory-Qua ni level	antum ( Probat	concep bility of	ts - foccu	de-Brog pation-	glie wa Compu	ive eq Itationa	uation- al dete	Physic rminati	al sign on of L	ificand Band S	e of w Structu	vave ıre –
Unit-2 - Se	miconductors and	d Optoelectro	ro <mark>nic Devic</mark> es		11			-	-				1									61	Hour
Intrinsic ser	niconductor-Fermi Biasing concept in mics integrated circ	level on carri n p-n junctio	ier-concentratic on-Semiconduc light emitting d	on and temperat tor_materials_o liodes	ture in Int. of interes	rinsic Semi t for optoe	conductor-Ex electronic de	drinsic ser vices-Phot	nicondu ocurrer	ictors- nt in a	Fermi a P-N	level on junctio	carrie n diod	r-conc e-Ligh	entratio t emitt	on and ing die	tempe ode-Cl	erature assific	in extri ation o	insic se of Light	micon emitt	ductor ing di	s- p- iode-
Unit-3 - Ele	ectromagnetism a	nd Dielectric	cs							1.0												6 I	Hour
Electromag and its appl of polarizati	netism- Introductio lications-Concepts ion-Frequency and	n-Del, diverge of electric cu temperature	gence, curl and urrent-Laws of r	gradient operat magnetism ,Fara n polarization m	tions in ve aday's lav achanisn	ector calculu w-Ampere's m	us-Gauss-div s law, Biot –S	ergence a avart law-	nd Stok Maxwel	e's th I's equ	eorem- Jations	Electric -Maxwe	c field a ell's eq	and ele uation	ectrosta s in fre	tic pot e spac	ential i e- Pola	for a cl ar and	narge d Non Po	listribut olar die	ion-Ga lectric	iuss' la s -Typ	aw es
Unit-4 - La	sers and Fiber Op	tics																				6 I	Hour
Absorption component Materials, n	Absorption and emission processes-Einstein's theory of matter radiation - A and B coefficients-Characteristics of laser beams-Amplification of light by population inversion-Threshold population inversion-Essential components of laser system and pumping mechanisms-Nd: YAG laser-CO2 laser:-Application of laser – Holography-Optical fiber-physical structure-Total internal reflection-Classification of optical fibers - Materials, modes-Classification of optical fibers -Refractive index profile																						

#### Unit-5 - Principles of Vector Mechanics

Introduction to vector analysis-Scalar quantities & vector quantities-Transformation of scalars and vectors-Transformation of scalars and vectors under rotation transformation-Forces in nature-Newton's laws-Resonance-Applications of Resonance-Introduction to rigid body-Failure of materials-Concepts of fracture and yielding

		4.	David Halliday, Fundamentals of Physics, 12th Edition, JohnWileyLtd, 2021
	1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill	5.	Introduction to Mechanics, Mahendra K. Verma, University Press (India) Pvt. Ltd., 2016.
Learning	Inc.2019.	6.	Computational Materials Science: An Introduction by June Gunn Lee, Chapter 7, Page 227-
Resources	2. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley 2015.		230 (Quantum Espresso)and Page 300-307 (VASP)
	3. David Jeffery Griffiths, Introduction to Electrodynamics, Revised Edition, Pearson, 2013	7.	Finite Element Method GouriDhatt, Emmanuel Lefrançois, Gilbert Touzot, Wiley Publication,
			ISBN: 978-1-848-21368-5

Learning Assessm	ent	~ ~ ~								
			Continuous Learning	Assessment (CLA)		Sum	motivo			
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native age of unit test 0%)	Life-Long CL (10	y Learning A-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%	100 100 1000	20%		20%	-			
Level 2	Understand	20%	the state of the	20%		<mark>2</mark> 0%	-			
Level 3	Apply	30%		30%		30%	-			
Level 4	Analyze	30%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	30%	- W.	<mark>30</mark> %	-			
Level 5	Evaluate			1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.		-	-			
Level 6	Create	The second		Contraction of the		-	-			
	Total	10	0%	10	0 %	10	0%			
					1.5					

Course Designers		A REAL PROPERTY AND A REAL
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
<ol> <li>Dr. C. Vijayan, National Physical Laboratory, guptavinay@nplindia.org</li> </ol>	1. Prof. V. Subramanian, IITM, Chennai, vsubramanyan@iitm.ac.in	1. Dr. V <mark>. Ganesh</mark> , SRMIST
	<ol> <li>Prof. C. Venkateswaran, University of Madras, Chennai, cvenkateswaran@unom.ac.in</li> </ol>	2. Dr. B. Gunasekaran, SRMIST

6 Hour

Course Code	urse 21CYB102B Course CHEMISTRY Name				Course Category					E	BASIC	SCIEN	CES			L 2	. T 2 0	P 0	C 2	
Pre-requi	isite es	Nil	Co- requisite Courses	Nil		Pr	ogres Cours	sive es						Nil						
Course	Offering Departm	ent	Chemistry	Data Book / C	odes / Standard	ls						Per	riodic 1	able						
Course Le	arning Rationale	(CLR): 7	he purpos <mark>e of learning</mark> this c	ourse is to:		1	đ			Progr	am Ou	itcome	es (PO	)				Pi	rograi	
CLR-1 :	Exploit the period advancement	dic propertie	s of eleme <mark>nts for bul</mark> k property i	manipulation towards techno	ological	1	2	3	4	5	6	7	8	9	10	11	12	S ou	pecifi tcom	c es
CLR-2 :	Employ various of	organic reac	tion <mark>s towards the</mark> design of fine	chemical and drug molecule	s for industries		_	1		15		lity								
CLR-3 :	Get knowledge of methods for dom	on water qua nestic and in	lity <mark>paramete</mark> rs, methods to ana dustrial applications	lyze quality of water and trea	atment	edge		nt of	ons of	0	society	stainab <mark>i</mark>		Work		nce				
CLR-4 :	Address concept	ts related to	<mark>electroch</mark> emistry, such as corro	sion, using thermodynamic p	orinciples	Ivor	SiS	ame	igati	sage	s pu	Sus		am	_	Fina	jing		<mark>ا ا</mark>	ł
CLR-5 :	Employ various s properties	spectroscopi	c techniques in identifying the s	tructure and correlate it with	their	eering Kr	em Analy:	n/develop	uct invest ex proble	n Tool U	ngineer a	nment &		lual & Te	unicatior	t Mgt. &	ong Learr			~
Course Ou	utcomes (CO):		At the end of this course, lear	ners will be able to:	- N. 94	Engine	Proble	Design	Condu	Moder	The e	Enviro	Ethics	Indivic	Comm	Projec	Life Lo	PSO-`	PSO-2	PSO-3
CO-1:	Rationalize bulk	propertie <mark>s u</mark>	sing periodic properties of elem	ents		3		3	2	-	-	-	-	-	-	-	-	-	- 1	-
CO-2:	Perceive the imp	ortance <mark>of s</mark>	<mark>ynthe</mark> sizing organic molecules a	applied in pharmaceutical inc	dustries		2	3	2	-		-	-		-	-	-	-	-	-
CO-3:	Utilize the knowl	edge abo <mark>ut i</mark>	<mark>water</mark> technology for industrial p	urpose	100	2	2	2		-		-	-	-	-	-	-	- 1	-	-
CO-4:	Gaining the know	vledge in <mark>co</mark>	rrosion chemistry	ALC: NO.		2	-	2	2	-	240	-	-	-	-	-	-	-	- 1	-
CO-5:	Utilize the princip	oles of spe <mark>ct</mark>	<mark>roscop</mark> ic technique in analysing	the structure and properties	s of <mark>molecul</mark> es		2	2	-	2		-	-	-	-	-	-	-	-	-
Unit-1 – P	eriodic Properties	5							-	-	-	-							6	Hour
Introduction energies, e	n to Periodic table electron affinity and	- Effective i d electronega	nuclear charge, penetration of c ativity, Polarizability, oxidation s	orbitals, variations of s, p, d tates, Acids and bases: The	and <mark>f orbital ene</mark> ories	ergies d	of aton	ns in th	ne perio	odic tal	ole, Ele	ectroni	c confi	guratio	ns, ato	omic an	nd ionic	sizes,	ioniz	ation
Unit-2 - Or	rganic Reactions			L. LANK						199									6 /	Hour
Introductio	n to reactions invo	lving substit	ution, A <mark>ddition, Elim</mark> ination, Oxid	lation and Reduction reactio	ns, Cyclization,	Ring op	ening	reaction	ons, Syl	nthesis	s of a c	ommo	nly use	ed drug	n molec	ule				
Unit-3 - W	ater Treatment				1 1 1			-											61	Hour
Water qua	lity parameters, H g External: Zeolite	ardness of v process R	vater, Estimation of hardness, everse osmosis and electrodial	Scale, sludge formation – o sis Domestic water treatme	lisadvantages, F ent	Preventi	on - ti	reatme	nt, Inte	rnal co	onditio	ning –	phosp	hate a	nd carl	bon co	nditioni	ng, Ca	arbona	ate
Unit-4 - Co	orrosion	<i>process,</i> n			лц.														6/	Hour
Basic conc anodic me	cepts, Mechanism thod, Corrosion inf	of chemical nibitors, Elec	& electrochemical corrosion, P tro plating & Electroless plating	illing Bedworth rule, Types	of Electrochemic	cal corr	osion,	Facto	rs influe	encing	corros	ion, C	orrosio	n cont	rol: Ca	thodic	protect	ion - s	acrific	ial
Unit-5 - Sp	pectroscopy																		6 /	Hour
Basic princ Application	ciples, instrumenta ns of infrared spect	tion and app troscopy	lications of potentiometry, The	Nernst equation and application	tions, Principles,	Instru	nentat	tion an	d Applic	cations	of UV	' - visib	le spe	ctrosco	py, Pri	inciples	s, Instru	menta	tion a	nd

Learning Resources 1. Jain.P.C and Monika Jain, "Engineering Chemistry", Danpat Rai publishing company (P, Ltd, New Delhi, 2010. 2. P. Kamaraj and M. Arthanareeswari , "Applied Chemistry",9th Edition, Sudhandhira publications, 2012 3. Helen P .Kavitha, "Engineering Chemistry – I", Shine Publications and Distributors, 1st Edition, 2013. 4. R. Jeyalakshmi, Engineering Chemistry Devi Publication, 2nd Edition, 2015.	5. B. L. Tembe, Kamaluddin, M. S. Krishnan, Engineering Chemistry (NPTEL Web-book) 6. Peter W. Atkins, Julio de Paula, James Keeler, Physical Chemistry, 11th ed., Oxford publishers, 2018
------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

			Continuous Learning	Assessment (CLA)		Cum	motivo			
	Bloom's Level of Thin <mark>king</mark>	Form CLA-1 Avera (50	native ge of unit test 0%)	Life-Lon CL (1	g Learning LA-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	10%		20%		10%	-			
Level 2	Understand	30%		20%		30%	-			
Level 3	Apply	30%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	20%		30%	-			
Level 4	Analyze	30%	1. 1. C.	40%		<mark>3</mark> 0%	-			
Level 5	Evaluate		100 Cears 100	1 - 1 / · / . /	5 5 - 2	-	-			
Level 6	Create			and the second		-	-			
	Total	10	0%	10	0 %	100 %				

Course D	lesigners	100		2.42	
Experts f	rom Industry	Experts	from Higher Technical Institutions	st li	nternal Experts
1.	Dr. Ravikiran Allada, Head <mark>R&amp;D, An</mark> alytical, Novugen Pharma, Malaysia, ravianalyt <mark>ical@gm</mark> ail.com	1.	Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in		1. Prof. M. Arthanareeswari, SRMIST
2.	Dr. Sudarshan Mahapatra, Dr. Reddy' s Laboratories, smahapatra@drreddys.com	2.	Prof. Kanishka Biswas, JNCASR Bengaluru, kanishka@jncasr.ac.in		2. Dr. R. <mark>V. K. Man</mark> galam, SRMIST





## SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Chengalpattu District 603203, Tamil Nadu, India

# ACADEMIC CURRICULA

# UNDERGRADUATE/ INTEGRATED POST GRADUATE DEGREE PROGRAMMES (With exit option of Diploma)

(Choice Based Flexible Credit System)

**Regulations 2021** 

Volume – 3 (Syllabi for Higher Semester Mathematics Courses-All Programmes)



### SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Chengalpattu District 603203, Tamil Nadu, India



SRM INSTITUTE OF SCIENCE AND TECHNOLOGY Kattankulathur, Chengalpattu District 603203, Tamil Nadu, India

# Contents (Volume-3)

<u>No</u>		Syllabi for Higher Semester Mathematics Courses	<u>Page No</u>
1	21MAB201T	Transforms and Boundary Value Problems	2
2	21MAB202T	Numerical Methods	4
3	21MAB203T	Probability and Stochastic Processes	6
4	21MAB204T	Probability and Queueing Theory	8
5	21MAB206T	Numerical Methods and Analysis	10
6	21MAB209T	Transforms and Computational Techniques	12
7	21MAB210T	Statistical Modelling	14
8	21MAB301T	Probability and Statistics	16
9	21MAB302T	Discrete Mathematics	18
10	21MAB303T	Biostatistics for Biotechnologists	20
11	21MAB304T	Probability and Applied Statistics	22

1

Course Code	e 21MAB201T Course TRANSFORMS AND BOUNDARY VALUE PROBLEMS			Cours Catego	se ory	В			E	BASIC	SCIEN	CES			;	<u> </u>	P 0	C 4	
Pre-requis Courses	ite S	Nil	Co- requisite Courses	Nil	Pr	ogres Cours	sive es						Nil						
Course C	offering Departme	nt	Mathematics	Data Book / Codes / Standar	ds							Nil							
Course Lea	rning Rationale (	CLR): The	purpose of learning this course	is to:		1	1		Progra	m Ou	tcome	s (PO)	)				P	rogra	m
CLR-1 :	analyze partial diff problems	ferential equat	ions, and interpret the solutions rela	ted to PDE in engineering	1	2	3	4	5	6	7	8	9	10	11	11 12		Specific Outcomes	
CLR-2 :	compute the Fouri	ier series expa	a <mark>nsion and ex</mark> press the sine and cos	ine series	ge		of	s of	15	iety			ĸ		۵				
CLR-3 :	analyze one-dimei	nsional wa <mark>ve a</mark>	and heat equations using PDE and	Fourier series concepts	vledç		ento	tion:	ge	soc			oW r		ance	D			l
CLR-4 :	analyze Fourier tra	ansforms a <mark>nd</mark>	their properties	and the second second	Know	lysis	mdo	stiga	Usa	· and	৵		Fear	uo	& Fin	amin			i
CLR-5 :	analyze Z transfor	m for sol <mark>ving c</mark>	discrete-time Signal problems		leering	em Ana	in/devel	uct inve lex prot	m Tool	Ingineer	onment		dual & ⁻	nunicati	ct Mgt.	ong Lei	-	2	
Course Out	tcomes (CO):	Att	the end of this course, learners w	ill be able to:	Engin	Probl	Desig	Cond	Mode	The e	Envire Susta	Ethics	Indivi	Comr	Proje	Life L	-OSc	-OSc	-OSc
CO-1:	construct and solv	e partia <mark>l differ</mark>	ential equations using various techr	niques	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	explain the Fourie	r series <mark> expan</mark>	sion of a function in terms of sine a	nd cosine series	3	3	1	-	-	- 16	-	-	-	-	-	-	-	-	-
CO-3:	identify partial diffe	erential <mark>equations services and s Services and services </mark>	ons and utilize Fourier series techni	ques to solve one dimensional wave	3	3			-		-	-	-	-	-	-	-	-	-
CO-4:	apply Fourier trans	sforms <mark>techniq</mark>	ues in signal analysis		3	3	-		-	1	-	-	-	-	-	-	-	-	-
CO-5:	solve discrete-time	e signal <mark>proble</mark>	ems using Z transforms		3	3	-	-	- /	-	-	-	-	-	-	-	-	-	-
Unit-1 - Par	tial Differential Eq	quations	100						-	-			-					12	Hour
Formation of	f partial differential	I equations by	eliminating arbitrary constants & a	rbitrary functions- Solutions of stand	dard typ	es of i	first ord	ler part	ial diffe	rentia	l eq <mark>uat</mark>	<mark>ions –</mark>	Lagra	nge's l	inear e	quatio	n – Lir	near p	oartial
differential e	equations of second	d and highe <mark>r o</mark>	<mark>rder with</mark> constant coefficients of ho	mogeneous types.				$\mathcal{P}$											
Unit-2 - Fou	irier Series		<u></u>					-	44									12	Hour
Dirichlet's c	onditions – Genera	I Fourier serie	s – Odd and even functions - Half ra	ange sine and cosine series - Parsev	/al's ide	ntity –	Harmo	nic Ana	lysis									40	
Classificatio	n of second order	nartial differential	Equations	ation of variables - Solutions of on	o dimor	nsiona	wave	equatio	n - Or	ne din	nensior	nal eru	iation	of hea	t cond	uction	(Insul:	12 ated 6	nour daes
excluded) -	Steady state condi	tion with zero	boundary - Steady state condition w	ith non-zero boundary conditions	c unito	13101101	wave	cyuuu				iui cyc	Julion	or neu	Conu	uction	Insuic	neu e	Jugos
Unit-4 - Fou	rier Transforms																	12	Hour
Fourier tran	sform pair – Propei	rties -Fourier s	ine and cosine transforms – Prope	ties– Transforms of simple functions	: - Conv	olution	theore	em (with	out pro	oof) –	Parsev	al's ide	entity.						
Unit-5 - Tra	nstorms	7 tuon of ours -	Inverse 7 transforma Correct tim	the gram (without Droof) Orlinting	ofling	diffe			a uuitha -	a not-	nt aa - 1	Fielert	- unir -	7 440 -	of 0 110-			12	Hour
∠ - transform	iis – Properties of 2	∠ ıranstorms –	inverse z transforms – Convolution	Ineorem (without Proot) – Solution	ut iineai	anter	ence e	quation	s with c	onsta	nit coef	licients	s using	z-tran	storm				

	1.	Erwin kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2015.	5.	.N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi
Looming	2.	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2015.		Publications, New Delhi, 10th edition,2016.
Deseuress	3.	Veerarajan T., Transforms and Partial Differential Equations, Tata McGraw-Hill, New Delhi, 3rd	6.	Kandasamy P., etal. Engineering Mathematics, Vol.II & Vol.III (4th revised edition),
Resources		edition,2012.		S. Chand & Co., New Delhi,2000
	4.	Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 2010 3rd Edition		

		Sum	Summativo							
	Bloom's Level of Thinking	Forn CLA-1 Avera (50	native ge of unit test 0%)	Life-Long CL (1)	g Learning "A-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%		20%		20%	-			
Level 2	Understand	20%	the second second	20%		20%	-			
Level 3	Apply	30%		30%		30%	-			
Level 4	Analyze	30%		30%		30%	-			
Level 5	Evaluate		and the second			-	-			
Level 6	Create	-		1 I		-	-			
	Total	10	0%	10	0 %	10	0%			

Course Designers									
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts							
1. Mr. Madhan Shanmugasundaram, Infosys Technologies, madshan@gmail.com	1. Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	1. Dr. B.Vennila, SRMIST							
	2. Prof. K.C. Sivakumar, IIT Madras, kcskumar@iitm.ac.in								



Course Code	urse 21MAB202T Course NUMERICAL METHODS				Cour Categ	se ory	В	B BASIC SCIENCES L T P 3 1 0											C 4		
Pre-requis Courses	site s	Nil		Co- requisite Course <mark>s</mark>	-	Nil	P	rogres Cours	sive ses		Nil										
Course C	Offering Departm	ent	Ма	thematics	D	ata Book / Codes / Stand	dards							Nil							
					1.000		100	-	-												
Course Lea	arning Rationale	(CLR):	The purpose o	<mark>f learning</mark> this co	ourse is to:			67	100		Progr	am Oı	utcome	s (PO)	)				Pr	ograi	m io
CLR-1 : apply the numerical techniques for solutions of algebraic, transcendental and simultaneous equation							5 1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	c es
CLR-2 : understand the concept of interpolation for finding intermediate values of well-known data							θ		+	of	30	ety			¥						
CLR-3 : interpret the concept of numerical differentiation and integration in physical problems							ledg		ento	tions	e	soci		-	NoI		ance	0			ł
CLR-4 :	<b>R-4</b> : apply the numerical techniques for solutions of ordinary differential equations				Anow	lysis	opme	stiga	Usaç	and	৵		eam	ы	& Fin	arnin			ł		
CLR-5 :	<b><i>R-5</i></b> : apply the numerical techniques for solutions of partial differential equations			eering !	em Ana	In/devel	uct inve lex prob	ern Tool	engineer	onment ainability	6	dual & T	nunicati	ct Mgt. 8	ong Lea	-	2	e			
Course Ou	tcomes (CO):		At the end of t	his course, learn	ners will be al	ble to:	Engin	Proble	Desig	Cond	Mode	The e	Envire Susta	Ethics	ndivi	Comr	Proje	-ife L	-OSc	-OSc	- So
CO-1:	solve the numeri	cal soluti <mark>on</mark>	<mark>ns of alg</mark> ebraic, tr	ranscendental and	l simultaneou:	s equations	3	3	-	-	-		-	-	-	-	-	-	-	-	
CO-2:	apply finite different	ences co <mark>nc</mark>	cepts and variou:	s interpolation met	thods	A 100 C 1	3	3	12	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	utilize various nu engineering	merical <mark>me</mark>	ethods in numerio	cal differentiation a	and integratio	n-related problems in	3	3	1	-	-	-		-	-	-	-	-	-	-	-
CO-4:	identify and solve	e the nu <mark>me</mark>	erical solutions of	ordinary differenti	ial equations	Line and the	3	3	1	42	-	-	-	-	-	-	-	-	-	-	-
CO-5:	analyze the num	erical sol <mark>ut</mark>	<mark>tions of</mark> partial dit	ferential equations	S		3	3	an no	-	-	-	-		-	-	-	-	-	-	-
<b>Unit-1 - Nu</b> Solution of Gauss Seid	merical Solution nonlinear equatio lel method - Figen	<b>of Algebra</b> ns - False values of a	aic Equations	- Fixed point itera	ration method	- Newton Raphson meth	od - Solut	ion of	linear	system	of equ	ations	: Gaus	sian ei	liminat	ion me	thod -	Gauss	Jacok	<b>12</b> oi met	<b>Hour</b> hod -
Unit-2 - Cu	rve Fitting and In	terpolatio	on				-			-										12	Hour
Curve fitting	g – Method of leas	t squares -	– Interpolation: N	ewton's forward a	and backward	difference - Divided differ	ences – N	ewton	s divide	ed diffe	rence -	Lagra	ange's i	nterpo	lation -	- Invers	se inter	rpolatio	n.		
Unit-3 - Nu	merical Different	iation and	l Integration			$(R \land : I, R)$	1.1.1			1.1	1									12	Hour
Numerical c	differentiation by u	sing Newto	on's forw <mark>ard, bac</mark>	<mark>kward</mark> and divided	d differences -	Numerical integration by	trapezoida	al and	Simpso	on's 1/3	rd and	1 3/8th	rules.								
Unit-4 - Nu	merical Solution	of Ordina	ry Differential E	quation				. ,			,			,						12	Hour
Single step	methods: Taylor's	series me	Differential Eau	improved Euler me	ethoas, tourth	oraer Runge – Kutta met	noa – Mul	ustep i	method	s: Milne	e s prei	aictor	- correc	tor me	triod.					10	Hour
Finite differ	ence techniques	Solution of	f two dimensional	l Lanlace's equation	ons hy Liehm	ann's iterative process an	d Poisson	's eau	ations -	Soluti	on of o	ne din	nension	al hea	t enua	tion usi	ina Rer	nder Sc	hmidt	and (	Crank
Nicholson a	lifference scheme	s -Solution	of one dimensio	nal wave equation	1 by explicit so	heme.	u i 0100011	o oque		Jointh			101101011	anda	i oyua	.011 031	ng Dei		annat		<i>n</i> unit

		1.	S.S. Sastry, Introductory Methods of Numerical Analysis, Prentice - Hall of India	4.	Steven C.Chapra and Raymond P. Canale, "Numerical Methods for Engineers with
			Pvt Ltd, New Delhi, 2003.		Programming and Software Applications", McGraw-Hill, 2004.
Learn	ning	2.	M.K.Jain, SRK Iyengar and R.L.Jain, Numerical Methods for Scientific and	5.	B.S. Grewal, Numerical Methods in Engineering and Science, Khanna Publishers, 42nd
Reso	urces		Engineering Computation, Wiley Eastern Ltd., 4th edition, 2003.		edition, 2012.
		3.	F. B. Hildebrand, Introduction to Numerical Analysis (2nd edition), Dover	6.	D. R. Kincaid, E.W. Cheney, Numerical Analysis Mathematics of Scientific Computing, The
			Publications, 2013.	100	University of Texas at Austin. Brooks/Cole Publishing Company, 1991.

		1	Continuous Learning	Assessment (CLA)	*	Summotivo				
	Bloom's Level of Thinking	Form CLA-1 Avera (5)	g Learning _A-2 0%)	Final Ex. (40% w	amination eightage)					
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%	the same line	20%		20%	-			
Level 2	Understand	20%		20%	100	20%	-			
Level 3	Apply 📃	30%		30%		30%	-			
Level 4	Analyze	30%		30%		30%	-			
Level 5	Evaluate					-	-			
Level 6	Create		100 Co. 50 NO			-	-			
	Total	10	0%	10	0 %	10	0%			

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
<ol> <li>Mr. Madhan Shanmugasundaram, Infosys Technologies, madshan@gmail.com</li> </ol>	1. Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	1. Dr. V. Subburayan, SRMIST
	<ol><li>Prof. K.C. Sivakumar, IIT Madras, kcskumar@iitm.ac.in</li></ol>	2. Dr. R. Pe <mark>rumal, S</mark> RMIST



Course Code	21MAB203T Cou Nan	MAB203T Course PROBABILITY AND STOCHASTIC PROCESSES		Cours	se ory	В	BASIC SCIENCES L T P C 3 1 0 4								C 4				
Pre-requi	isite Nil		Co- requisite Courses	Nil	Pr	ogres Cours	sive es						Nil	1					
Course	Offering Department		Mathematics	Data Book / Codes / St.	andards	ards Nil													
Course Le	earning Rationale (CLR):	The purp	ose <mark>of learnin</mark> g this course	is to:		1			Progr	am Ou	utcome	s (PO)		1			Pi	rogra	m
CLR-1 :	Describe the applications	on discrete	and continuous random varia	ibles.	1	2	3	4	5	6	7	8	9	10	11	12	ou	tcom	es
CLR-2 :	Assess the applications of	of two-di <mark>mens</mark>	sional random variables.	U-strak	ge		of	s of	20	iety			rk		Ð				
CLR-3 :	Infer the various modes of	of conv <mark>ergenc</mark>	<mark>ce of</mark> random variables and th	neir limit theorems.	vled		ento	ation	ge	soc		-	٥W ۲		Jano	D			
CLR-4 :	Relate the specialized kr	owle <mark>dge in ra</mark>	andom processes in signals a	and systems.	Knov	Ilysis	mdo	stiga	Usa	r anc	~× _		Tean	U	& Fir	arnin			
CLR-5 :	Determine the application	ns o <mark>f spectra</mark> l	l density functions and linear	time-invariant systems	sering	em Ana	n/devel	ict inve ex prot	n Tool	nginee	nment		lual & ⁻	unicat	t Mgt.	ong Lei			~
Course O	utcomes (CO):	At the en	nd of this course, learners v	will be able to:	Engine	Proble	Design	Condu	Moder	The e	Enviro Sustai	Ethics	Indivic	Comm	Projec	Life Lo	PSO-`	PSO-2	PSO-3
CO-1:	Evaluate the characterist	i <mark>cs of disc</mark> rete	e and continuous random var	riables.	3	3	-	-	1	-	-	-	-	-	-	-	-	-	-
CO-2:	Explain the model and a	n <mark>alyze sy</mark> sten	ns using <mark>two</mark> -dimensional ran	dom variables.	3	3	1	-	-	-		-	-	-	-	-	-	-	-
CO-3:	Classify limit theorems a	<mark>nd evalu</mark> ate u	upper bounds using various ir	nequalities.	3	3	-	-	-	- 199	-	-	-	-	-	-	-	-	-
CO-4:	Analyze the characteristi	<mark>cs of ran</mark> dom	i processes.		3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Examine problems in spe	ectral density	functions and linear time-inv	ariant systems.	3	3	1.1	-	-	200	- 10	-	-	-	-	-	-	-	-
<b>Unit-1 - O</b> One-dimer	<b>ne-Dimensional random v</b> nsional random variable:	r <mark>ariable an</mark> d Discrete Cas	probability distributions se-Probability function, Cum	ulative Distribution Function,	continuous ra	ndom	varial	ble-Prol	oability	dens	ity fund	tion,	Cumul	ative o	listribu	tion fu	nction-	<b>12</b>	Hour erties,

Problems on one-dimensional random variable, Expectation, variance, Moments - raw and central moments, Binomial distribution –moments, Binomial distribution-Applications, Poisson distribution-moments, Poisson distribution-Applications, Exponential distribution-moments, Uniform Distribution-moments, Unifor

#### Unit-2 - Two-dimensional random variable and Correlation functions

Two-dimensional random variables-Discrete cases, Probability function of (X, Y) - Marginal probability distribution, Conditional probability distribution of (X, Y), Problems on discrete random variables, Continuous random variables – Joint PDF, Marginal Probability distributions, Conditional probability distribution of (X, Y), Problems on continuous two-dimensional random variables, Independent random variables, Cumulative distribution function-properties of F(x, y), Expected values of two-dimensional random variables, Covariance and correlation, Conditional expected values, Problems on uncorrelated random variables, Functions of two-dimensional random variables, Probability density functions of the type Z=XY, Probability density functions of the type Z=XY. Probability density functions of the type Z=XY. Application of two-dimensional random variables in engineering.

#### Unit-3 - Probability bounds and Central limit theorems

Limit theorems--Markov's inequality, Chebyshev's inequality without proof, Chebyshev's inequality - Applications, Chebyshev's inequality - Applications using Binomial distribution, Chebyshev's inequality-Applications using Exponential distribution, The weak law of large numbers, Central limit theorem without proof, Central limit theorem - Applications, Central limit theorem- Applications using Poisson random variables, Central limit theorem- Applications using Exponential random variables, The strong law of large numbers, The strong law of large numbers, One-sided Chebychev's inequality, Chernoff bounds, Chernoff bounds for the standard normal variate, Chernoff bounds for the Poisson random variate, Jenson's inequality, Applications of Central Limit Theorem in engineering.

#### 12 Hour

12 Hour

#### Unit-4 - Random processes and stationary processes

Random Processes-Introduction, Classification of random processes, Distribution of the process, Averages of the process, Stationary, SSS, WSS processes, Problems on stationary and SSS processes, Problems, Problems on WSS process, Autocorrelation function -properties, Proof of properties, Problems on autocorrelation function, Application of autocorrelation function, Cross-correlation-properties, Proof of properties, Problems on autocorrelation, Application of autocorrelation function, Cross-correlation-properties, Proof of properties, Proof of properties, Problems on autocorrelation function, Application of autocorrelation function, Cross-correlation-properties, Proof of properties, Proof of properties, Problems on autocorrelation function, Cross-correlation-properties, Proof of properties, Problems on autocorrelation function, Cross-correlation-properties, Proof of properties, Proof of properties, Problems on Cross-correlation function, Ergodicity, Mean ergodic process, Mean ergodic theorem, Applications of random process in engineering.

#### Unit-5 - Spectral density of random process and linear system with random inputs

12 Hour

12 Hour

Power spectral density function- properties, Proof of properties, Problems on power spectral density function, Problems on power spectral density function, Power density spectrum, Problems based on power density spectrum, Linear systems with random inputs, Representation of system in the form of convolution, Unit impulse response of the system, Properties, Applications of unit impulse function, Einstein Weiner-Khinchine Relationship, Cross-power density spectrum-problems, Cross-power density spectrum Cross-power density spectrum, Applications of power spectral density functions in engineering, Applications of power spectral density functions in engineering, Applications of power spectral density functions in engineering.

	1.	A. Papoulis, S. Unnikrishna Pillai, Probability, Random Variables and Stochastic	4.	S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons,
		Processes 4th Edition, Mcgraw Hill, 2002.		11th Edition, 2015.
Learning	2.	Henry Stark, Probability and Random Processes with Applications to Signal	5.	Jay L DeVore, Probability and Statistics for Engineering and the Sciences, 8th Edition,
Resources		Processing, Third Edition, Pearson 2004	100	Cengage Learning India Pvt. Ltd, 2012.
	3.	Sheldon Ross, A first course in Probability, Sixth Edition, 2011.	6.	T. Veerarajan, Probability, Statistics and Random Processes with Queueing Theory and
				Queueing Networks, 4th Edition, McGraw-Hill Education, New Delhi, 2015.

Learning Assessmer	nt 📃											
			Continuous Learning	Assessment (CLA)	27 A 6-	Summativa						
	Bloom's Level of Thinking	Form CLA-1 Avera (50	native age of unit test 0%)	Life-Long CL (10	g Learning "A-2 0%)	Final Examination (40% weightage)						
		Theory	Practice	Theory	Practice	<u>Th</u> eory	Practice					
Level 1	Remember	20%		20%		20%	-					
Level 2	Understand	20%		20%		<mark>2</mark> 0%	-					
Level 3	Apply	30%		30%	-	30%	-					
Level 4	Analyze	30%	-	30%		30%	-					
Level 5	Evaluate	2.5		-		-	-					
Level 6	Create	To Name		-	and the second second	-	-					
	Total	10	0%	10	0%	10	0%					

Course Designers	The SAUX STREET	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
<ol> <li>Mr. Madhan Shanmugasundaram, Infosys Technologies, madshan@gmail.com</li> </ol>	1. Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	1. Dr. V. Subburayan, SRMIST
	2. Prof. K.C. Sivakumar, IIT Madras, kcskumar@iitm.ac.in	2. Dr. G. Vijayalakshmi, SRMIST

Course Code	Irse 21MAB204T Course PROBABILITY AND QUEUEING THEORY							C	Cours atego	e ory	В			E	BASIC S	SCIEN	CES			L 3	. T 3 1	P 0	C 4
Pre-requisite Courses         Nil         Co- requisite Courses         Nil           Course Offering Department         Mathematics         Data Book / Codes / S										ogres Cours	sive es				Statis	stical 1	Nil Tables						
				nauromatio						1.0	1				otatio	, and an a	4.0.100					-	
Course Le	earning Rationale (	CLR):	The purpose	of learning thi	s course	is to:			Program Outcomes (PO)									P	rogran	m			
CLR-1 : Describe the properties of a random variable.									1	2	3	4	5	6	7	8	9	10	11	12	ິ ວບ	pecifi utcom/	c es
CLR-2 :	CLR-2 : Gain knowledge of discrete and continuous distributions.								ge	-	f	s of	1	iety			rk		a)		ļ		
CLR-3 :	R-3: Understand the basic concepts of two-dimensional random variables, correlation, and regression lines								vledç		ento	s	ge	soc			oW r		ance	D			
CLR-4 :	Interpret the system characteristics of queueing models.						1	Knov	lysis	mdo	stige	Usa	and	৵		ean	ы	& Fir	arnin				
CLR-5 : Create Markov chains and investigate stationary state distributions.						heering	em Ana	gn/devel	luct inve blex prot	ern Tool	engineer	onment ainability	s	idual & 7	nunicati	ct Mgt.	-ong Le	-	-2	က္			
Course O	utcomes (CO):		At the end o	of this course, I	earners w	vill be able to:	- Andres	197	Engir	Probl	Desig	Cond	Mode	The e	Envir Susta	Ethic	ndivi	Com	^o roje	_ife L	OSC.	Ś	Ś
CO-1:	Evaluate the chara engineering.	acteristics	s of discrete ar	nd continuous ra	ndom vari	iables and app	ly them in science	and	3	3	-	-	5.	1	-	-	-	-	-	-	-	-	-
CO-2:	Identify the randor	m varia <mark>ble</mark>	<mark>es and</mark> model t	them u <mark>si</mark> ng vario	us distribu	utions.			3	3		- 15		-	-	-		-	-	-	-	-	-
CO-3:	Infer results from	two dim <mark>er</mark>	<mark>nsional</mark> randon	n variab <mark>l</mark> es whic	h describe	e real life pheno	omenon.		3	3	1-1	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Examine the signi	ficant re <mark>s</mark>	ults of various	queueing mode	ls.	1.1.1			3	3		1.27	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Determine the trai	nsition p <mark>ro</mark>	<mark>obabilitie</mark> s and	classify the stat	es of the I	Markov chain.		1	3	3		-	-	-	-	-	-	-	-	-	-	-	-
Unit-1 - Ra	andom Variables	_		-		- AL	1	-					1	1	-		-					12	Hour
Probability generating	concepts - Discret	e and co chebychei	ontinuous rando ff's inequality -	om variables - I - Function of a ra	Probability andom vai	[,] distribution fu riable.	unction, Cumulativ	re distr	ibutio	n func	tion -	Momer	its - C	entral	and ra	w mor	nents,	Expec	tation	and va	riance	; - Mo	ment
Unit-2 - Theoretical Distributions Discrete distribution - Binomial distribution, Poisson distribution - MGF, Mean, Variance, Theoretical frequencies and applications – Continuous distribution - Exponential and normal distributions – MGF, Mean, Variance and applications																							
Unit-3 - Tv	vo-Dimensional Ra	ndom Va	ariables		201	ALC: NO																12	Hour
Joint distri	butions - Marginal a	nd conditi	ional distributio	o <mark>ns – Covarianc</mark> i	e – Correla	ation and linea	r regression – Cen	ntral lin	nit the	orem	(for inc	lepende	ent and	lident	ically di	stribut	ed ran	dom va	ariables	;)		- 40	
Queueina	ueueing Theory theorv – Characteris	stics of a	aueueina Mod	el – Kendal's no	tation – P	oisson aueues	s - (M/M/1): (∞/FIF	=O) Mo	del –	Svste	m cha	racteris	tics – A	Solida	tions -	(M/M/s	s): (∞/	FIFO)	Model	- Svste	m cha	aracter	ristics
– Applicati	ons - (M/M/1): (k/Fl	FO) Mode	el - System ch	aracteristics – A	pplications	S.	, , ,	.,	-	,							, , , ,	- / -					
Unit-5 - Ma	arkov Chain	in One	ston transition	probability matr	iv Choor	man Kolmogor	ov theorom Limit	ting pr	hahil	itios	Class	ification	of stat	os of	a Marke	webo	in					12	Hour
ινιαι κυν μι	JUESS - IVIAI KUV UIIA			ριουαυπική παιτ		nan Kumuyur		uny pro	Juavill	1100 -	Class	incation	ા ગાવા	53 UI (	a iviai Ku	v uld							

	1.	Sheldon Ross, A first course in probability, Pearson, 9th Edition, 2019.	4.	Arnold O. Allen, Probability, Statistics and Queueing Theory with Computer Science
	2.	S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand		Applications, Academic Press, 2nd Edition, 1990.
Learning		& Sons, 12th Edition, 2018.	5.	D. Gross, John F. Shortle, James M. Thompson, Carl M. Harris- Fundamentals of Queueing
Resources	3.	K. S Trivedi, Probability and Statistics with Reliability, Queuing and Computer	100	Theory, Wiley India Pvt. Ltd. 4th Edition, 2013.
		Science Applications, Prentice Hall of India, New Delhi, 2nd Edition, 2016.	6.	T. Veerarajan, Probability, Statistics and Random Processes with Queueing Theory and
				Queueing Networks, Tata McGraw-Hill, New Delhi, 4th Edition 2015

			Summotivo							
	Bloom's Level of Thinking	Forr. CLA-1 Avera (5)	native age of unit test 0%)	Life-Long CL (1	g Learning A-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%		20%		20%	-			
Level 2	Understand	20%		20%		20%	-			
Level 3	Apply	30%		30%		30%	-			
Level 4	Analyze	30%	11. 1. C. S. S. W.	30%		<mark>3</mark> 0%	-			
Level 5	Evaluate		100 Co. 10 M		- 11 - Taki	-	-			
Level 6	Create					-	-			
	Total	10	0%	10	0%	10	0 %			

Course Designers		-
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
<ol> <li>Mr. Madhan Shanmugasundaram, Infosys Technologies, madshan@gmail.com</li> </ol>	1. Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	1. Dr. V. Subburayan, SRMIST
54	2. Prof. K.C. Sivakumar, IIT Madras, kcskumar@iitm.ac.in	2. Dr. H. Merlyn Margaret, SRMIST



Course Code         21MAB206T         Course Name         NUMERICAL METHODS AND ANALYSIS						Cou Cate	rse Jory	В			I	BASIC	SCIEN	ICES			L 3	. T	P 0	C 4
Pre-requis Courses	site s	Nil	Co- requisi Courses	te	Nil	F	Progres Cours	ssive ses						Nil						
Course C	Offering Departme	ent	Mathematics		Data Book / Codes / Stan	dards							Nil							
Course Lea	arning Rationale	(CLR):	The purpos <mark>e of learnin</mark> g th	is course is	to:		1	1	2.1	Progr	am Ou	utcome	s (PO)	)				P	rogra	m
CLR-1 :	Understand the n	nethodolo	gies to solv <mark>e algebraic</mark> and tra	anscendental	equations.	1	2	3	4	5	6	7	8	9	10	11	12	5 01	pecifi itcom	c es
CLR-2: Gain knowledge on interpolating and extrapolating methods in various intervals in real life.						ge		of	s of	20	ciety			- Y		ē				
CLR-3 :	Understand the c	oncept of	numerical differentiation and	integration.		vled		ent	ation	ge	soc			۵W ۲		Janc	D			l
CLR-4 :	Solve initial and b	oundary	val <mark>ue proble</mark> ms in differential	equations usi	ing numerical methods.	You Y	lysis	opm	stige	Usa	and	<u>م</u>		-ean	и	& Fir	arnin			l
CLR-5 :	<b>P-5</b> : Solve initial and boundary value problems in partial differential equations using numerical methods.			sering	m Ana	n/devel	ct inve ex prot	n Tool	Igineer	nment nability		ual & 1	unicati	t Mgt. 8	ing Lea			-		
Course Ou	tcomes (CO):		At the end of this course,	learners will	l be able to:	Engine	Proble	Design	Condu	Moder	The er	Enviro Sustai	Ethics	Individ	Comm	Projec	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Obtain numerical	solutions	to algebraic and transcender	tal equations	ALC: CLASS V.S.	3	3	-	1.	5-1	-	-	-	-	-	-	-	-	-	-
CO-2:	Learn about vario	ous inter <mark>po</mark>	<mark>plating</mark> and extrapolating meth	ods.	通知 読みたけ	3	3	10	-	-	-	5	-	-	-	-	- 1	-	-	-
CO-3:	Compute numerio	cal differ <mark>e</mark>	ntiation and Integration.		22. O.V. 1	3	3	-	-	-	- 200	-	-		-	-	-	-	-	-
CO-4:	Interpret initial an	d final v <mark>al</mark>	<mark>ue prob</mark> lems in differential eq	uations.	1003	3	-3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Interpret initial an	d bound <mark>a</mark>	ry value problems in partial di	fferential equ	ations.	3	3	111	-	-	2	-	-	-	-	-		-	-	-
Unit-1 - Nu	merical solutions	of Algeb	raic and Transcendental Ec	uations							£								12	Hour
Numerical S	Solution of Algebra	ic and Tra	anscendental equation—Iterat	ion Method. I	Bisection Method. Method of Fa	lse Positi	on. Nev	wton-R	aphson	metho	d and	it's rate	of cor	nverae	nce: So	olvina S	Svstem	of Sir	nultan	eous
Linear Alge	braic Equations –	Gauss E	lim <mark>ination M</mark> ethod, Gauss Jor	don Method,	Jacobi Method, Gauss-Seidel M	lethod.	. , .							J.	,	5	,			
Unit-2 - Fin	nite Differences an	nd Interp	olatio <mark>n</mark>	100		-				1									12	Hour
Introduction	to Finite Differen	ces—Fon	ward and Backward Differend	ces, Relation	Between Operators, Differenc	es of a p	olynom	nial—Fa	actorial	Polyno	omial, I	Newton	's inte	rpolatio	on–Ne	wton's	forwar	d and	l Back	ward
Interpolation	n for Equal Interva merical Differenti	is; Divideo	Differences and Properties,	Interpolation	with Unequal Intervals— Newto	on's Divide	εα Diffe	erence	Interpol	ation, L	agran	ge's int	erpola	tion, In	iverse	Lagran	ge's int	terpola	ation. 12	Hour
Numerical I	Differentiation—Ne	wton's Fo	prward and Backward Differen	nce Formula	e to Compute First and Higher	Order De	erivativ	es, Nu	merical	Integra	ation-	Trapezo	oidal R	Rule, S	impsor	i's One	ə-Third	Rule,	Simp	son's
Three Eight	Rule. Applications	s of Trape	zoidal Rule, Applications of S	impson's On	e-Third Rule, Simpson's Three	Eight Rule	)			Ű										
Unit-4 - Nu	merical Solution	of Ordina	nry Differential Equations	Improved F	ularia Mathad Madified Fularia	mathad	Dunna	Kutta	Casana	Order	Math	ad Dum	ana Ku	-#- Fa	urth O	iday M	athoda	and the	<u>12</u>	Hour
convergence	es metrioù, Euler s :e.	s metrioa	and it's rate of convergence,	improved El	uier's metrioa, moainea Euler's	methoa,	Runge	-nulla	Second	-Order	Meth	oa, Rui	ige-ru	illa Fo	urtii Oi	aer m	этоа а	ina une	eir ord	ier oi
Unit-5 - Nu	merical solutions	of Partia	I Differential Equations																12	Hour
Classificatio	on of Second-Orde	er Partial	Differential Equations, Elliptic	Equations-F	inite Difference Scheme, Stand	lard Five	Point F	Finite D	Differenc	e Forn	nula, L	Diagona	I Five	Point	Finite I	Differe	ice For	mula,	Liebr	nan's
Iterative Pro	ocess, Solution of I	Laplace E	quations by Liebman's Iterati	/e process, S	solution of Poisson Equation, O	ne Dimens	sional H	arabo	lic Equa	ntion—	Bende	er-Schm	ndt Sci	neme,	Crank-	NIChol	son sch	ieme		

	1.	Brian Bradie, A Friendly Introduction to Numerical Analysis. Pearson. (2006)	4.	F. B. Hildebrand Introduction to Numerical Analysis: (2nd edition). Dover, (2013).
	2.	D. R. Kincaid, E.W. Cheney, Numerical Analysis Mathematics of Scientific	5.	M. K. Jain, S. R. K. Iyengar & R. K. Jain, Numerical Methods for Scientific and Engineering
Learning		Computing, The University of Texas at Austin. Brooks/Cole Publishing Company,	200	Computation (6th edition). New Age International Publishers Publications. (2012).
Resources		(1991).	6.	P. Kandasamy, K. Thilagavathy & G. Gunawathy, Numerical Methods, S.Chand & Sons, 3rd
	3.	C. F. Gerald & P. O. Wheatley. Applied Numerical Analysis (7th edition), Pearson	N. L	Revised Edition, 2013.
		Education, India, (2008)	1.00	

			Continuous Learning	Assessment (CLA)		Cum	mativa			
	Bloom's Level of T <mark>hinking</mark>	Form CLA-1 Avera (5)	native ge of unit test	Life-Long CL (10	l Learning A-2 )%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%		20%	-	20%	-			
Level 2	Understand	20%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	20%		20%	-			
Level 3	Apply	30%		30%		30%	-			
Level 4	Analyze	30%	Section of the section of	30%		<mark>3</mark> 0%	-			
Level 5	Evaluate		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		-	-			
Level 6	Create	2 - W 1 - 1		「たちになきた」		- 11	-			
	Total		0%	10	0%	10	0%			

Course Designers	The second s	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
<ol> <li>Mr. Madhan Shanmugasundaram, Infosys Technologies, madshan@gmail.com</li> </ol>	1. Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	1. Dr. B. Vennila, SRMIST
	2. Prof. K.C. Sivakumar, IIT Madras, kcskumar@iitm.ac.in	2. Dr. Ab <mark>dul Haq, S</mark> RMIST



Course Code         21MAB209T         Course Name         TRANSFORMS AND COMPUTATIONAL TECHNIQUES						JES (	Cours Catego	se ory	В			I	BASIC	SCIEN	ICES			L 3	- T 3 1	P 0	C 4	
Pre-requis Course	site s	Nil		Co- requisite Course <mark>s</mark>		Nil		Pr	ogres Cours	sive es						Nil						
Course C	Offering Departme	ent		Mathematics		Data Book / Codes	s / Standard	5							Nil							
Course Lea	arning Rationale (	CLR):	The purpos	se <mark>of learnin</mark> g this o	course is to	):		4	1	1		Progr	am Oi	utcom	es (PO	)				P	rograi	m
CLR-1 :	Compute the Fou	rier serie	es expansion a	and express sine and	d cosine se	ries		1	2	3	4	5	6	7	8	9	10	11	12	ou	peciti itcom	C es
CLR-2 : Analyze Fourier Transforms and its properties and solve discrete-time signal problems using z transforms						Z				of	25	Ą	<b>bility</b>									
<b>CLR-3</b> : Construct and solve partial differential equations using various techniques., Identify partial differential equations and utilize Fourier series techniques to solve one dimensional wave and heat equations					ifferential ations	wledge		tent of	ations (	ge	d socie	ustaine		n Work		nance	þ					
CLR-4 : Apply the numerical techniques for solutions of ordinary differential equations							Kno	Ilysis	lopm	estig	nsa	r and	s S		Tear	.u	& Fi	arnir				
CLR-5 :	Apply the numeric	cal techn	iq <mark>ues for s</mark> olu	tions of partial differ	ential equat	ions		ering	m Ana	n/deve	et inve ex prot	n Tool	Iginee	nment		ual & .	unicat	t Mgt.	ng Le:			
Course Ou	tcomes (CO):		At the end	of this course, lea	rners w <mark>ill k</mark>	be able to:		Engine	Proble	Design	Condu	Moder	The er	Enviro	Ethics	Individ	Comm	Projec	Life Lo	PSO-1	PSO-2	PSO-3
CO-1:	Explain the Fourie	er series	expansion of	a function in terms o	of sine and	cosine series		3	3		-	-	-		-	-	-	-	-	-	-	-
CO-2:	Apply Fourier tran transforms	nsforms <mark>t</mark>	techniques in a	signal analysis, Solv	ve discrete-t	ime signal problems ι	using z	3	3	1	-	-	-	-	-		-	-	-	-	-	-
CO-3:	Identify partial diff and heat equatior	ferential 1s	equations and	l utilize Fourier serie	es technique	es to solve one dimen	sional wave	3	3	1	42	-			-	-	-	-	-	-	-	-
CO-4:	To solve the num	erical so	l <mark>utions of</mark> ordii	nary differential equa	ations		9	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-5:	To solve the num	erical so	lu <mark>tions of p</mark> arti	ial differential equati	ions	Let 1	1	3	3	-	-	-		1	-	-	-	-	-	-	-	-
Unit-1 - Fo	urier Series			2							-	-									12	Hour
Dirichlet's c	onditions – Fourier	r Series -	– Functions ha	aving arbitrary period	ds – Odd ar	nd even function - Hal	f range sine a	nd co	sine F	ourier	series -	Parse	val's i	dentity	– Harn	nonic A	Analysi	s.				
Unit-2 - Fo	urier Transforms	and Z Ti	ransfo <mark>rms</mark>		-	1.1.1.1	10 million		-			140					-				12	Hour
Fourier trar transforms	nsform pair –-Fouri – Convolution theo	ier sine a rem (wit	and cosine tra hout Proof) –	ansforms – Transfor Solution of linear difi	rms of simp ference eau	le functions - Convol ations with constant o	ution theoren	n (with sing Z-	out pi transf	roof) – form	Parsev	al's id	entity	- Z – t	ransfor	ms: Pi	ropertie	es of Z	transfo	orms –	Inver	rse Z
Unit-3 - Pa	rtial Differential E	quation	s and Their A	pplication	iononico equ			<u>9</u> –	d dirioi	0											12	Hour
Classification equation - (	on of second-order One dimensional ec	r partial quation o	differential eq	ua <mark>tions - Line</mark> ar Pa ction - Steady state o	ntial differe	ntial equations of sec vith zero boundarv	cond and hig	her or	der w	ith con	stant c	oefficie	ents of	homo	geneo	us type	e-Solut	ions of	one d	imens	ional	wave
Unit-4 - Nu	merical Solutions	of First	Order Ordin	ary Differential Equ	uations and	d Numerical Integrat	ion														12	Hour
Solutions of and Simpso	f first order simulta on's 3/8th rule.	neous d	lifferential equ	ations by Taylor's s	eries metho	od - Euler's method a	nd its applica	tions ·	- Rung	ge-Kutt	a meth	od of f	ourth	order (l	No pro	of) - Tı	rapezo	idal rul	e – Sin	npson	s one	third

 Unit-5 - Numerical Solutions of Partial Differential Equations
 12 Hour

 Classification of Second order PDE-Solutions of Elliptic Equations- Solutions of Laplace Equations by Liebmann's iterative process- Solutions of Poisson Equations- Solutions of Parabolic equations by Bender-Schmidt formula- Solutions of Parabolic equations of Hyperbolic equations by Explicit formula.

	1.	Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons,	5.	P. Kandasamy, et. al. Engineering Mathematics, Vol.II & Vol.III (4th revised edition), S. Chand &
		2015.		Co., New Delhi,2000
Looming	2.	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2015.	6.	P.Kandasamy et. al., Numerical Methods, S Chand & Co., New Delhi, 2003.
Learning	3.	B.V. Ramana, Higher Engineering Mathematics, 3rd Edition, Tata McGraw Hill New	7.	T. Veerarajan, Transforms and Partial Differential Equations, Tata McGraw-Hill, New Delhi, 3rd
Resources		Delhi, 2010.		edition,2012.
	4.	M.K. Venkataraman, Numerical Methods in Science and Engineering, National	8.	B.S. Grewal, Numerical Methods in Engineering and Science, Khanna Publishers, 42 nd editon,
		Publishing Co. 2005		2012.

Learning Assessm	ent										
		N 1	Continuous Learning		Summotivo						
	Bloom's Level o <mark>f Thinking</mark>	Forn CLA-1 Avera (50	native nge of unit test 0%)	Life-Long L CLA (109	Learning -2 %)	Final Examination (40% weightage)					
	-	Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%	Los Arriver Mart	20%		20%	-				
Level 2	Understand	20%		20%		<mark>20</mark> %	-				
Level 3	Apply	30%	1	30%		<mark>30</mark> %	-				
Level 4	Analyze	30%		30%		<mark>30</mark> %	-				
Level 5	Evaluate		-			-	-				
Level 6	Create					-	-				
	Total	10	0%	100	%	10	0 %				

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
<ol> <li>Mr. Madhan Shanmugasundaram, Infosys Technologies, madshan@gmail.com</li> </ol>	1. Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	1. Dr. V. Subburayan, SRMIST
	2. Prof. K.C. Sivakumar, IIT Madras, kcskumar@iitm.ac.in	2. Dr. N. B <mark>alaji, SRMI</mark> ST

Course Code	Course Code         21MAB210T         Course Name         STATISTICAL MODELLING			TICAL MODELLING	Ca Ca	ours atego	e ry	В			E	BASIC	SCIEN	CES			L 3	T	P 0	C 4		
Pre-requi Course	site s		Nil		Co- requisite Courses	Nil		Pro	ogres Cours	sive es						Nil						
Course	Offering D	epartme	nt	M	lathematics	Data Book / Codes / St	andards	Stat	tistical	l able												
Course Le	arning Rat	tionale ((	CLR):	The purpose	of learning this co	ourse is to:		-	1	1		Progr	am Oi	utcome	es (PO	)				Pi	rograr	m
CLR-1 :	Apply the	sampling	, g techniq	ues in engin <mark>eer</mark>	ring field.			1	2	3	4	5	6	7	8	9	10	11	12	S	pecifie	C es
CLR-2 :	Describe	the meas	sures of c	central <mark>tendenc</mark>	<mark>y an</mark> d measures of	dispersion.		Ð		4	of	2	ety			¥						
CLR-3 :	CLR-3 : Understand the basics and importance of estimate of statistical data.					ledg		ent o	tions	ge	soci		-	No		ance	-			ł		
CLR-4 : Describe the basics and importance of non-parametric methods in testing hypothesis.					Vou	lysis	opme	stiga Iems	Usaç	and	~X		eam	ы	š Fin	Inin			ł			
CLR-5 : Apply the procedure for Time series analysis and Forecasting.					sering h	em Ana	n/devel	ict inve ex prob	n Tool	ngineer	nment nability		ual & T	iunicati	t Mgt. 8	ong Lea			~			
Course Ou	itcomes (C	CO):		At the end of	this course, learn	ers will be able to:		Engine	Proble	Design solutio	Condu	Moder	The er	Enviro Sustai	Ethics	Individ	Comm	Projec	Life Lo	PSO-1	-OSd	-OS
CO-1:	Choose th	he approp	priate s <mark>ar</mark>	<mark>mpling t</mark> echniqu	ies.	A Street Auge W	4.1	3	3	-	-	-	-		-	-	-	-	-	-	-	
CO-2:	Compreh	end the b	basics of s	<mark>statistic</mark> s and si	tatistical methods	States and states		3	3	12	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Evaluate	statistica	l data u <mark>si</mark>	<mark>ing me</mark> thods of	estimation.	1. St. 65	1	3	3		-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Infer from	the non-	-param <mark>etr</mark>	ric methods.	_		1.0	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Illustrate engineeri	the time s ing.	series and	alysis and fored	casting and apply th	nem in the problems in science and	1	3	3	Ú.	-	-	1.5	-	-	-	-	-	-	-	-	-
Unit-1 - Sa	mpling Te	chnique	s				-					-	è		-	-					12	Hour
Random sa	ampling - S	ampling f	from finite	e <mark>and infinit</mark> e po	pulations - Estimat	es and standard error (sampling with	n replacen	nent a	and sa	mpling	withou	t repla	aceme	nt) - Sa	mpling	<mark>g di</mark> strit	oution o	of samp	ole mea	ın - str	atified	I
Unit-2 - In	roduction	to Statis	sampling stics	j and cluster sa	mpling.						-	-									12	Hour
Definition of	of Statistics	s - Basic	objective	es - Application	ns in various brand	ches of science with examples - C	ollection of	of Da	ta: Ini	ternal a	and ex	ernal	data,	primary	/ and	second	lary da	ta - P	opulatio	on and	d sam	ple -
Representa	ative sampl	le - Descr •	riptive Sta	atistics: Classifi	cation and tabulation	on of univariate data - graphical repr	esentation	n - Fre	equen	cy curv	es - De	scripti	ve me	asures	- cent	ral teno	dency a	and dis	persion		40	
Doint estim	timation ti ation - crite	neory an eria for de	a lesting	g Hypotnesis nates (unhiaseo	Iness consistency)	- Methods of estimation including m	aximum l	ikelihi	ood e	stimatio	on - Su	ficient	statis	tic: con	cent a	nd exa	mnles	compl	ete sufi	ficienc	<u>121</u> v and	their
application	in estimati	on - Test	of hypoth	hesis: concept a	and formulation - T	/pe I and Type II errors - Neyman Pe	earson ler	nma.	000 0	Juniau	in ou	noioin	otatio	uo. oon	oopru		mpioo,	oompi	oto oun	1010110	y ana	uion
Unit-4 - No	on-parame	tric Infer	ence			· · · · · ·															12 I	Hour
Compariso	n with para	metric in	ference -	Use of order st	tatistic <mark>s - Sign test</mark> -	Wilcoxon signed rank test - Mann-V	Vhitney te	st - R	Run te	st - Kol	mogora	ov-Smi	rnov t	est - Sp	bearma	n's an	d Kena	lall's te	st - Tol	erance	e regio	)n. Herre
Basics of T	ime Series	Analysis	s Analys and Fore	ecasting – Stati	ionary - ARIMA Mo	dels: Identification - Estimation and I	orecastir	na – A		ations t	o indus	trial pr	oblem	S.							121	TOUR

	1. Gun, M. K. Gupta and B.Dasgupta, Fundamentals of Statistics (Vol. I & Vol. II),
	World Press, 2016,
Learning	2. S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan
Resources	Chand & Sons, 11th Edition, 2015.
	3. M. Rajagopalan and P. Dhanavanthan, Statistical inference, PHI Learning
	Private Limited, New Delhi, 2012.

4.	I.R. Miller, J.E. Freund and R. Johnson, Probability and Statistics for Engineers, 4th Edition,
	PHI Learning Private Limited, New Delhi, 2015.
-	

S. C. Gupta and V. K. Kapoor, Fundamentals of Applied Statistics, 4th Revised Edition, Sultan Chand & Sons, 2019.
 Chris Chatfield, The Analysis of Time Series: An Introduction, Sixth edition, Chapman and Hall/CRC, 2004.

Learning Assessm	ent		The second	Contraction of the second						
		Sum	mativa							
	Bloom's Level of Thin <mark>king</mark>	oom's Formative CLA-1 Average of unit test (50%)			g Learning A-2 0%)	Final Examination (40% weightage)				
		Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	20%	And the state	20%		20%	-			
Level 2	Understand	20%		20%		20%	-			
Level 3	Apply 📃	30%		30%		30%	-			
Level 4	Analyze	30%	12 1 1 No. 10	30%		30%	-			
Level 5	Evaluate					-	-			
Level 6	Create		Construction of the second	the Aller of the second		-	-			
	Total		100 %		0%	100 %				
				1131150						

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Madhan Shanmugasundaram, Infosys Technologies, madshan@gmail.com	1. Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	1. Dr. V. Subburayan, SRMIST
	2. Prof. K.C. Sivakumar, IIT Madras, kcskumar@iitm.ac.in	2. Dr.R.Va <mark>radharaja</mark> n, SRMIST



Course	21MAB301T Course		Course	В	BASIC SCIENCES	L	Т	Ρ	С
Code	Name	PROBABILITY AND STATISTICS	Category			3	1	0	4

Pre-requisite			Co- requisite			Progressive	
Courses	Nil		Courses	Nil		Courses	Nil
Course Offering	J Department	Mathematics			Data Book / Codes / Standards	Statistical Table	

Course	Learning Rationale (CLR): The purpose of learning this course is to:	Program Outcomes (PO)				F	Program									
CLR-1 :	Apply the basic rules and theorems of probability theory and evaluate the expectation and variance using random variables.	1 2 3 4 5 6 7 8 9 10 11 12				12	outcomes									
CLR-2 :	Gain knowledge of theoretical distributions.				of		ty			~						
CLR-3 :	Understand how to develop Null and Alternate hypothesis and draw conclusions using hypothesis tests.	edge	1	nt of	ions	Θ	socie			Worl		ance				
CLR-4 :	R-4 : Apply the knowledge of regression lines and analysis of variance.				stigat	Usag	ands	<u>م</u>		eam	uc	Fina	ming			
CLR-5 :	Acquire knowledge to solve the problems of process control.	Anal Anal Investigation of the second		Agt. 8	dgt. 8 g Lea											
		ginee	blem	sign/c	nduct	dem	eng	vironr	S	vidua	nmu	ject I	Lon	D-1	0-2	-3 -3
Course	Outcomes (CO): At the end of this course, learners will be able to:	ШŬ	Pc	Des	Cor	Mo	The	Ц С	击	pul	Cor	Pro	Life	PS(	PS(	PSC
CO-1:	Implement the concepts of probability and random variables.	3	3	-	1	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Identify the random variables and model them using various distributions.	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Infer results by using hypoth <mark>esis testin</mark> g on large and small samples.	3	3	-	1	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Examine the regression lines and interpret the results in the analysis of variance.	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Utilize quality control techniques to solve real-world problems.	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-

#### Unit-1 : Probability and One-dimensional Random Variable

Probability concepts, Types of Events, Axioms and theorems - Conditional probability, Baye's theorem (without proof) - Applications of Baye's Theorem. Random variables – Discrete case and continuous case- Mathematical expectation, Variance – discrete case and continuous case - Raw Moments - Central Moments - Moment generating function (MGF) - discrete and continuous random variable.

#### Unit-2 : Theoretical Distributions

Discrete distributions – Introduction- Mean and Variance of Binomial Distribution- Fitting a Binomial distribution- MGF of Binomial Distribution- Poisson Distribution- Mean and Variance of Poisson Distribution- Fitting a Poisson distribution- MGF of Poisson Distribution- Geometric distribution- mean and variance, Memoryless property- Continuous distributions – Introduction- Uniform distribution – MGF, Mean and Variance- Exponential distribution - MGF, Mean and Variance- Exponential distribution - MGF, Mean and Variance, Memoryless property- Continuous distributions – Introduction- Uniform distribution – MGF, Mean and Variance- Exponential distribution - MGF, Mean and Variance distribution.

#### Unit-3: Testing of Hypothesis

Sampling Distributions – Type I and Type II errors- large sample test-Test of significance for single proportion- Test of significance for difference of proportions- Test of significance for single mean- Test of significance for difference of means- Small sample tests- Student's t- test for single mean- t- test for the difference of means- Fisher's F-test- Test of significance for two sample variances- Chi -square test for the goodness of fit- Chi-square test for the difference of means- Fisher's F-test- Test of significance for two sample variances- Chi -square test for the goodness of fit- Chi-square test for the independence of attributes.

#### Unit-4 : Correlation, Regression and ANOVA

Correlation and its Properties- Karl Pearson's coefficient of correlation- Spearman's rank correlation coefficient for repeated and non-repeated ranks- Linear Regression lines and Properties- Relation between correlation and regression coefficient- Introduction to Analysis of Variance (ANOVA) - One-way Classification – two-way classification.

Unit-5: Statistical Quality Control

Introduction – Process control – control charts for variables -  $\bar{X}$  and R,  $\bar{X}$  and S charts- control charts for attributes: p-chart, p-chart, c- chart and their applications in process control.

### 12 Hour

12 Hour

12 Hour

### 12 Hour

12 Hour

Learning Resources	<ol> <li>S. Ross, A First Course in Probability, 8th Ed., Pearson Education India, 2010.</li> <li>Johnson. R.A., Miller &amp; Freund's, Probability and Statistics for Engineers, 8th Edition, Prentice Hall India, 2011.</li> <li>Veerarajan T., Probability and Statistics, Tata McGraw-Hill, New Delhi, 2010.</li> </ol>	<ol> <li>Devore (JL), Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage Learning, 2012.</li> <li>S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand &amp; Sons, 11th Edition, 2015.</li> <li>Vijay K. Rohatgi., A.K. Md. Ensanes Saleh, An Introduction to Probability and Statistics, 2nd Edition, Wiley, 2008</li> </ol>

			Continuous Lear		Cummotive.				
	Bloom's Level of Thin <mark>king</mark>	CLA-1 A	Formative verage of unit test (50%)	Life	Long Learning CLA-2 – (10%)	Final Examination (40% weightage)			
		Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	20%		20%		20%	-		
Level 2	Understand	20%	Contraction of the local sectors of the local secto	20%		20%	-		
Level 3	Apply	30%		30%		30%	-		
Level 4	Analyze	30%		- 30%		30%	-		
Level 5	Evaluate		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1		-	-		
Level 6	Create				- Con 1 - 1 -		-		
	Total	and the second second	100 %		100 %		100 %		

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Inter <mark>nal Expe</mark> rts
1. Mr. Madhan Shanmugasundaram, Infosys Technologies, madshan@gmail.com	1. Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	1. Dr. B.Vennila, SRMIST
	2. Prof. K.C. Sivakumar, IIT Madras, kcskumar@iitm.ac.in	2. Dr.R.Varadharajan, SRMIST


Course	21MAB302T	Course		Course	В	BASIC SCIENCES	L	Т	Ρ	С	
Code		Name	DISCRETE MATHEMATICS	Category			3	1	0	4	

Pre-requisite			Co- requisite			Progressive	
Courses	Nil		Courses	Nil		Courses	Nil
<b>Course Offering</b>	Department	Mathematics			Data Book / Codes / Standards	Nil	

Course	Learning Rationale (CLR): The purpose of learning this course is to:				Pro	gram	Outo	come	s (PC	C)				F	Progra	am
CLR-1 :	Enhance the mathematical skills by applying the principles of sets and functions in storage, communication and processing data	the 1	2	3	4	5	6	7	8	9	10	11	12	0	Specit utcon	fic 1es
CLR-2 :	LR-2: Culminate in extensive use and application of counting strategies in enumeration of data						1	oility								
CLR-3 :	Apply the rules of inference theory to design electronic circuits and to verify computer programs	dae		tof	ins of		ociet)	ainat		/ork		e				
CLR-4 :	Apply the knowledge of algebraic structures and coding theory to solve problems on detection and correction of errors occurring in binary communication channels	Knowle	lysis	opmen	stigatio	Usage	r and so	& Sust		Feam W	ion	& Finan	arning			
CLR-5 :	CLR-5 : Acquire knowledge to solve problems in communication networks using graph models				uct inve	m To <mark>o</mark> l	ngineel	onment		dual & ⁻	nunicat	ct Mgt.	ong Le:	~	2	e
Course	Outcomes (CO): At the end of this course, learners will be able to:	Enain	Proble	Desig	Condi	Mode	The e	Enviro	Ethics	Individ	Comn	Proje	Life L	PSO-	PSO-	PSO
CO-1:	Apply the concepts of set theory and its operations in data structures and mathematical modelling languages	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Solve problems using counting techniques and understanding the basics of number theory	3	3	-	-	-	•	-	I	-	-	-	•	-	-	-
CO-3:	Comprehend and validate the logical arguments using concepts of inference theory	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Inculcate the curiosity for applying the concepts of algebraic structures to coding theory	3	3	-		-	-	-	-	-	-	-	-	-	- 1	-
CO-5:	Apply graph theory techniques to solve wide variety of real world problems	3	- 3	-	-	-	-	-	-	-	-	-	-	-	-	-

Unit-1 Set Theory	12 Hour
Sets - Operations on sets - Laws of set theory - Partition of a set - Cartesian product of sets - Relations - Properties - Equivalence relation and partial order relation - Poset - Graphs of relations - Digraphs	; - Hasse diagram ·
Closures of relations - Transitive closure and Warshall's algorithm - Functions - Types of functions - Composition of functions - Properties - Inverse of functions - Necessary and sufficient condition for e	xistence of inverse
function - Uniqueness of identity - Inverse of composition.	
Unit-2 -Combinatorics and Number Theory	12 Hour
Permutation and combination - Addition and product rules - Principle of inclusion and exclusion - Pigeon-hole principle and generalized pigeon-hole principle - Divisibility and prime numbers - Fundamental th	eorem of arithmetic
- Prime factorization - Division algorithm- Greatest common divisor - Properties - Euclid's algorithm - Least common multiple.	
Unit-3: Mathematical Logic	12 Hour

Propositions and logical operators - Truth tables - Converse, inverse and contrapositive - Tautology and contradiction - Equivalences - Implications - Laws of logic - Inference theory - Rules of inference - Direct method - CP rule - Inconsistency - Indirect method - Principle of mathematical induction.

#### Unit-4 : Algebraic Structures and Coding Theory

Groups - Permutation group - Cyclic group - Properties - Subgroup- Group homomorphism - Properties - Ring - Zero divisor - Integral domain- Field -Coding theory - Group code - Hamming codes - Error correction using matrices - Error correction - Decoding group codes.

Unit-5: Graph Theory

Definitions - Handshaking theorem - Some special graphs - Isomorphism of graphs - Paths, cycles and circuits - Connectivity in undirected graphs - Eulerian and Hamiltonian graphs - Matrix representation of graphs-Isomorphism using adjacency - Digraphs - Trees - Properties - Spanning tree - Kruskal's algorithm - Graph coloring - Chromatic number- Four color theorem (statement only).

B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-3 Mathematics courses-Syllabi-Control Copy

12 Hour

12 Hour

	1. H. Kenneth Rosen, Discrete Mathematics and its Application, Seventh edition, Tata
	McGraw-Hill Publishing company PVT. Ltd., New Delhi, 2012.
Learning	2. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with applications to
Resources	Computer Science, 35th edition, Tata McGraw Hill Publishing Co., 2008.
	3. Narsing Deo, Graph Theory with applications to Engineering and Computer science,
	Prentice-Hall of India pvt. Ltd., New Delhi, 2004

- C.L. Liu, Elements of Discrete Mathematics, 4th Edition, McGraw Higher ED, 2012.
   R.P. Grimaldi, Discrete and Combinatorial Mathematics: An Applied Introduction, 4th Edition, Pearson Education Asia, Delhi, 2007.
- 6. T. Veerarajan, Discrete Mathematics with Graph Theory and Combinatorics, Tata McGraw Hill, 2015.

			Continuous Lear		Summetive		
	Bloom's Level of Thin <mark>king</mark>	CLA-1	Formative Average of unit test (50%)	Life	Long Learning CLA-2 – (10%)	Fina (40	al Examinative % weightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	and the second se	20%		20%	-
Level 2	Understand	20%		20%		20%	-
Level 3	Apply	30%				30%	-
Level 4	Analyze	30%	12 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	30%	a start of the	30%	-
Level 5	Evaluate	-	and the second	Strate - Line Server	Constant of a	-	-
Level 6	Create			Street Street		-	-
	Total	10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	100 %	The second	100 %		100 %

Course Designers	Contraction of the second s	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Madhan Shanmugasundaram, Inf <mark>osys Tech</mark> nologies, madshan@gmail.com	1 Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	1. Dr. V. Subburayan, SRMIST
	2. Prof. K.C. Sivakumar, IIT Madras, kcskumar@iitm.ac.in	2. Dr. J. Sasikumar, SRMIST
		3. Dr. L. Shobana, SRMIST



B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-3 Mathematics courses-Syllabi-Control Copy

Course	21MAB303T	Course		Course	В	BASIC SCIENCES	L	Т	Ρ	С	l
Code		Name	BIOSTATISTICS FOR BIOTECHNOLOGISTS	Category			3	1	0	4	

 
 Pre-requisite Courses
 Co- requisite Courses
 Nil

 Course Offering Department
 Mathematics
 Data Book / Codes / Standards

Courses Nil
Standards Nil

Progressive

Course	e Learning Rationale (CLR): The purpose of learning this course is to:				Pro	gram	Out	come	s (P	0)				F	Progra	im
CLR-1 :	Gain knowledge in measures of central tendency, measures of dispersion, skewness and kurtosis through moments on statistical data	1	2	3	4	5	6	7	8	9	10	11	12	0	ric 1es	
CLR-2 :	Understand the importance of probability distributions such as Binomial, Poisson and Normal distributions to solve biotechnology related problems.			v	plex											
CLR-3 :	Learn how to formulate and test the hypothesis of single means and difference of means, single proportion and differen proportions for large samples and to understand the sample.	ce of		solutio	of com		ty	ability		~						
CLR-4 :	Gain knowledge on hypothetical tests about means and variances for small samples using the t test and F test, and app Chi-square test for goodness of fit and independence of attributes in biotechnological topics. Also, to have knowledge in ANOVA in biotechnology related topics.	bly the	lysis	onment of	stigations	Usage	r and socie	& Sustaine		Γeam Worł	ion	& Finance	arning			
CLR-5 :	R-5 : Gain knowledge in correlation and regression lines and the non-parametric tests in biotechnology.				uct inve	n Tool	ngineer	nment		lual & T	nunicati	t Mgt.	ong Lea	_		~
Course	e Outcomes (CO): At the end of this course, learners will be able to:		Proble	Decin	Condu	Model	The e	Envirc	Ethics	Indivic	Comr	Projec	Life Lo	PSO-	-OS4	PSO-3
CO-1:	Explain measures of central tendency and measures of dispersion.	3	3	-		-	-	-	-	-	-	-	-	-	-	-
CO-2:	Apply probability distributions applicable to biotechnology	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Examine the given problems relating to the large sample test of mean and difference of mean and Chi-square tests.	3	3	-	1000	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Infer from hypothesis tests by using the t-test, F- test, Chi-Square test and ANOVA.	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-5.	Evaluate problems on concepts of correlation, regression and non-parametric tests	3	2 3			-			_	-	-		_	-	- I	

#### Unit-1 : Measures on Statistical data

Introduction to discrete types of statistical data - Introduction to continuous types of statistical data- Measures of central tendency-Arithmetic mean, geometric mean, harmonic mean, median, mode - Measures of dispersion - Range, quartile deviation, mean deviation, median deviation, mode deviation and standard deviation- Coefficient of dispersion-Coefficient of variation – Raw moments and central moments and their relation. Measures of statistical data- Measures of dispersion-Coefficient of variation – Raw moments and central moments and their relation. Measures of skewness and kurtosis - Karl Pearson's coefficient of skewness, Bowley's coefficient of skewness.

Unit-2 : Probability

Introduction to probability concepts, random experiment, trail, events - Types of events: Impossible, Simple, Mutually Exclusive and Independent events (only definitions, properties- without proof)- Addition and Multiplication Theorems on probability- Total Probability theorem - Baye's Theorem (without proof) and its applications- Introduction to one-dimensional random variable and its types-Expectation(Mean), Variance, Moments and moment generating functions-Binomial Distribution, Poisson Distribution and Normal Distribution.

#### Unit-3: Large sample tests

Sampling Theory- Basic concepts- Population, Sample, Sampling distribution, population parameters and sample statistic- Testing of hypothesis, Null and Alternate hypothesis, Single-tailed and Two-tailed tests, Type-I and Type–II errors- Acceptance and Rejection Regions, Level of Significance, Degrees of freedom and Confidence limits – Large sample tests based on the normal distribution (Z-test)-Z-Test for single mean and for the difference of means, Z-Test for single proportion and difference of proportions

#### Unit-4 : Small sample tests

Small sample tests based on t- distribution- For single mean and for the difference of means – Paired t-test- F-test for equality of variances-The Chi-square test for goodness of fit and for Independence of attributes using a contingency table. One-way classifications- ANOVA, Two-way classifications- ANOVA.

B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-3 Mathematics courses-Syllabi-Control Copy

# 12 Hour

12 Hour

12 Hour

12 Hour

# 20

#### Unit-5: Correlation, Regression and Non-Parametric tests

12 Hour

Karl Pearson's coefficient of correlations - Spearman's rank correlation coefficient-Regression lines and its applications- Non-parametric tests – The sign test – The Wilcoxon signed –ranked test- Rank sum tests: The Man Whitney U test - The Kruskal Walis test.

	1.	Mario F. Triola, Elementary Statistics, Pearson, 13th edition, 2018.	4.	Richard I. Levin, David S. Rubin, Masood H. Siddiqui, S. Rastogi, Statistics for
	2.	Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and	1.1	Management, Pearson, 8th edition, 2017.
Learning		Scientists, Academic press, Sixth Edition, 2021.	5.	Bernard Rosner, Fundamentals of Biostatistics, Brooks/core, 8th edition, 2015.
Resources	3.	S.C.Gupta and V.K.Kapoor, Fundamentals of Mathematical Statistics, S.Chand &	6.	T. Veerarajan, Probability, Statistics and Random Processes with Queueing Theory and Queueing
		Co, Eleventh Edition, 2018.		Networks, 4th Edition, McGraw-Hill Education, New Delhi, 2015.

Learning Assessment											
		Cum	motivo								
	Bloom's Level of Thinking	F CLA-1 A	Formative verage of unit test (50%)	Life	Long Learning CLA-2 – (10%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%		20%		20%	-				
Level 2	Understand	20%		20%	Constant of a	<mark>20%</mark>	-				
Level 3	Apply	30%	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	30%		30%	-				
Level 4	Analyze 📃 📃	30%		30%		<u>30%</u>	-				
Level 5	Evaluate				2 I I I I I I I I I I I I I I I I I I I	-	-				
Level 6	Create					-	-				
	Total		100 %		100 %	1	00 %				
			and a second second	THE PART							

Course Designers			
Experts from Industry	Experts fr	om Higher Technical Institutions	Internal Experts
1. Mr. Madhan Shanmugasundaram, Infos <mark>ys Techn</mark> ologies, madshan@gmail.com	1.	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	1. Dr. V. Subburayan, SRMIST
	2.	Prof. K.C. Sivakumar, IIT Madras, kcskumar@iitm.ac.in	2. Dr.R.Senthamarai, SRMIST



B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-3 Mathematics courses-Syllabi-Control Copy

Course Code	21MAB304	. Cou Nan	rse ne	PROBABILITY AND APPLIED STATISTICS		Course Category	В				BA	SIC	SCIEI	NCE	S				L 3	T 1	P 0	C 4
Pre-req Cours Course C	uisite ses <i>Nil</i> Offering Departme	nt M	lathem	Co- requisite Courses Nil atics Data Book / Codes	/ Standards	Progr Cou Statistic	essive Irses cal Tab	Nil														
Course Learning Rationale (CLR): The purpose of learning this course is to:						Program Outcomes (PO)								Program		m						
CLR-1 : Apply the basic rules and theorems of probability theory such as Bayes' theorem to determine probabilities that help to solve engineering problems and to determine the expectation and variance of a random variable from its distribution.							1	2	3	4	5	6	7	8	9	10	11	12	S OL	Speci utcon	ic ies	
CLR-2 :	Appropriately of solve real-life	hoose, defi ngineering	ine and proble	t/or derive probability distributions such as the Binomial, Poisso ms.	n and Normal t	o model and	d			lutions				lity								
CLR-3 :	<i>R</i> -3 : Understand the principles of estimation theory and estimation techniques like a maximum-likelihood estimate.							neering Knowledge		of so	duct investigations of olex problems		iety	nabi		¥		m				
CLR-4 :	LR-4 : Learn the basic components of hypothesis testing and perform hypothesis tests on population means, variances and proportions.								sis	oment o		sage	nd soc	Sustai		am Wo	F	Finance	ing	÷	-2	
CLR-5: Understand how regression analysis can be used to develop an equation that estimates how two variables are related and how the analysis of variance procedure can be used to determine if means of more than two populations are equal.						how	em Analy		golavelop	em Tool U		engineer a	onment &	S	dual & Te	nunicatior	ct Mgt. &	ong Lean	ņ			
Course	Outcomes (CO	D):		At the end of this course, learners will be able to:	10 million (1990)	1.15	1.5	Engir	Probl	Desiç	Cond	Mode	The (	Envir	Ethic	ndivi	Com	^o roje	_ife L	OS ^c	OSc.	OSc
CO-1:	Pertain the know	ledge of pr	o <mark>bab</mark> ili	ty concepts to determine probabilities that help to solve enginee	ring problems	1999	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Gain familiarity in deriving probability distributions such as the Binomial, Poisson, Normal and apply them to the problems involving Science and Engineering.						1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Demonstrate competency in Consistency, efficiency and unbiasedness of estimators and method of maximum likelihood estimation.							3	3	16		-	-	-	-	-	-	-	-	-	-	-
CO-4:	Acquire knowled	ge in formu	ılating	and testing hypotheses about means, variances and proportion.	S.			3	3		-	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Apply the knowl	edge of Reg	gressio	<mark>n anal</mark> ysis, and ANOVA in real-life to problems in Science and I	E <mark>ngineering</mark> .			3	3		-	-	-	-	-	-	-	-	-	-	-	-
										15												
Unit-1 : P	Probability and O	e-dimensi	onal r	andom variable	No. 1				1												12	lour

Probability concepts- Conditional probability- Baye's theorem (without proof) - Applications of Baye's Theorem-Random variables – Discrete case and continuous case-Mathematical expectation –discrete case and continuous case-Raw moments- Central moments- Moment generating function(MGF)- discrete and continuous random variables.

#### Unit-2 : Theoretical Distributions

Discrete distributions – Introduction- Mean and variance of binomial distribution- Fitting a binomial distribution- MGF of binomial distribution- Poisson distribution- Mean and variance of Poisson distribution- Fitting a Poisson distribution- MGF of Poisson distribution- Geometric distribution- mean and variance, Memoryless property- Continuous distribution – Introduction- Uniform distribution – MGF, Mean and variance- Exponential distribution - MGF, Mean and variance- Exponential distribution - MGF, Mean and variance, Memoryless property- Continuous distribution – Introduction- Uniform distribution – MGF, Mean and variance- Exponential distribution - MGF, Mean and variance of Poisson distribution - MGF, Mean and variance- Exponential distribution - MGF, Mean and variance - Exponential distribution - MGF, Mean - Mach - M

#### Unit-3: Estimation theory

Introduction to estimation- Point estimation- Criteria for good estimates- Complete sufficiency and their application in estimation- Methods of estimation- Maximum likelihood estimation.

## Unit-4 : Testing of Hypothesis

Sampling Distributions – Type I and Type II errors- large sample test-Test of significance for single proportion- Test of significance for difference of proportions- Test of significance for single mean- Test of significance for difference of means- Small sample tests- Student's t- test for single mean- t- test for the difference of means- Fisher's F-test- Test of significance for two sample variances- Chi-square test for goodness of fit- Chi-square test for the independence of attributes.

12 Hour 12 Hour

12 Hour

### Unit-5: Correlation, Regression and ANOVA

And Personnelling

Correlation and its Properties- Karl Pearson's coefficient of correlation- Spearman's rank correlation coefficient for repeated and non-repeated ranks- Linear regression lines and Properties- Relation between correlation and regression coefficient- Introduction to - Analysis of Variance(ANOVA) – One-way classification- Two-way classification.

	1.	S. Ross, A First Course in Probability, 10th Ed., Pearson Education India, 2019.	4.	K.Vijay, A.K.Rohatgi, and Md. Ehsanes Saleh, An Introduction to Probability and Statistics, Third
	2.	R.A. Johnson, I.Miller & J.E.Freund's, Probability and Statistics for Engineers, 9th		Edition, Wiley india Pvt. Ltd, 2015.
Learning		Edition, Pearson's Education, New Delhi, 2016.	5.	Jay L DeVore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage
Resources	3.	A. Gun, M. K. Gupta and B.Dasgupta, Fundamentals of Statistics (Vol. I & Vol. II),		Learning India Pvt. Ltd, 2012.
		World Press, 2016.	6.	T. Veerarajan, Probability and Statistics, 3rd Edition, Tata McGraw-Hill, New Delhi, 2008.

Learning Assessment											
			Continuous Learnin	Summotivo							
	Bloom's Level of Thinking	Fo CLA-1 Ave	ormative erage of unit test (50%)	Life I	Long Learning CLA-2 – (10%)	Final Examination (40% weightage)					
		Theory	Practice	Theory	Practice	Theory	Practice				
Level 1	Remember	20%		20%		20%	-				
Level 2	Understand	20%		20%	5 10 - X-	<mark>20%</mark>	-				
Level 3	Apply 🚽	30%		30%	12 M	30%	-				
Level 4	Analyze	30%		30%		30%	-				
Level 5	Evaluate				2.4. 9	-	-				
Level 6	Create	Contraction of the	A Charles and Public			-	-				
Total			100 %	the second se	100 %	100 %					

Course Designers				
Experts from Industry	Experts fi	rom Higher Technical Institutions	Internal E	xperts
1. Mr. Madhan Shanmugasundaram, Infos <mark>ys Techn</mark> ologies, madshan@gmail.com	1.	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	1.	Dr. V. Subburayan, SRMIST
	1.	Prof. K.C. Sivakumar, IIT Madars, kcskumar@iitm.ac.in	2.	Dr. R. Varadharajan, SRMIST
	-		3.	Dr. B. Vijayakumar, SRMIST

B.Tech/M.Tech(Integrated) Programmes-Regulations 2021- Volume-3 Mathematics courses-Syllabi-Control Copy

12 Hour



# SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Chengalpattu District 603203, Tamil Nadu, India