ACADEMIC CURRICULA

UNDERGRADUATE/ INTEGRATED POST GRADUATE DEGREE PROGRAMMES

(With exit option of Diploma)

(Choice Based Flexible Credit System)

Regulations 2021

Volume – 2
(Syllabi for First Year 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

Contents (Volume-2)

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 Code	21LEH101T	Course Name	COMMUNICATIVE ENGLISH	Course Category	H	HUMANITIES	L	T	P	C
							2	1	0	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive 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:*
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*
CLR-2 :	*enable the students to efficiently use English for accessing scientific and technical knowledge*
CLR-3 :	*introduce the students the methods of using efficiently English in gaining knowledge through the internet and the vice versa. To make them understand the importance of acceptable online behaviors and the factors behind multiplicity in media projections of an event*
CLR-4 :	*improve the learners' employability related communication skills and thereby equipping themselves for the increased opportunities for employment.*
CLR-5 :	*equip the learners with the appropriate business vocabulary by introducing them to the nuances of business communication*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*demonstrate the various types, modes, channels and barriers of communication, focusing on LSRW skills and put this awareness into effective use.*									*2*	*3*		-
CO-2:	*incorporate the meanings of technical terms in a scientific text and explain the manufacturing process and interpret data*									*2*	*3*		-
CO-3:	*analyze digital platforms not only to acquire information from e-sources for developing research skills, analytical skills and problem-solving skills, but also to create e-content following the etiquettes of social media.*									*2*	*3*		-
CO-4:	*develop an understanding of the employability skills and how to develop them, which will gradually help them in their career exploration process.*									*2*	*3*		-
CO-5:	*apply nuances of business communication effectively*									*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, Précis 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	**9 Hour**
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.
Unit-3- English in Digital World **9 Hour**
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 **9 Hour**
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 **9 Hour**
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 - Enquiry & complaint letter- Proposal writing- writing Advertisement- caption and slogan Poster-Brochure-Voices , Tenses, Direct and Indirect, Connectives- Concord and Comparative forms

Learning Resources	*1. Swan, Michael. Practical English Usage. OUP, 1995.* *2. Kumar Sanjay and Pushpa Lata. Communication Skills. OUP, 2011.* *3. Scientific English: A Guide for Scientists and Other Professionals, 3rd Edition Paperback – Import, 16 June 2011*	*4. Graduate Attributes, Learning and Employability (English, Electronic book text, Hager Paul J)* *5. Great Business English - Phrases, Verbs and Vocabulary for Speaking Fluent English by Hilary F. Moore Mba · 2013*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life-Long Learning CLA-2 (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*10%*	-	*10%*	-	*10%*	-
Level 2	*Understand*	*10%*	-	*10%*	-	*10%*	-
Level 3	*Apply*	*20%*	-	*20%*	-	*20%*	-
Level 4	*Analyze*	*20%*	-	*20%*	-	*20%*	-
Level 5	*Evaluate*	*20%*	-	*20%*	-	*20%*	-
Level 6	*Create*	*20%*	-	*20%*	-	*20%*	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal 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.*
2. Ms. Steffi Pearl Vinodhini, LIC Financial Advisor, Chennai. Steffipearl8@gmail.com	*2. Dr. S. Vijayakumar, B.S. Abdur Rahman Crescent Institute of Science and Technology, Chennai. vijayakumar@cresent.education*	*2. Dr. M.M. Umamaheshwari, SRMIST.*

Course Code	21LEH102T	Course Name	CHINESE	Course Category	H	HUMANITIES	L	T	P	C
							2	1	0	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive 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:*
CLR-1 :	*Recall Chinese Pinyin, tones, scripts and greetings.*
CLR-2 :	*Construct simple affirmative, negative, interrogative sentences with Chinese grammar. Apply numbers translate time and date in Chinese*
CLR-3 :	*Apply basic grammar asking about nationality, direction, location.*
CLR-4 :	*Translate sentences with more vocabulary knowledge.*
CLR-5 :	*Apply construction and few frequently used words framing sentences; acquire knowledge about Chinese festival and city.*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Write Chinese Romanization , Outline of China and the Chinese speaking countries, basic characters, Greetings*	-	-	-	-	-	-	-	-	-	3	-	3
CO-2:	*Construct basic conversations with simple sentences, counting numbers, Greet each other, express time and date in Chinese.*	-	-	-	-	-	-	-	-	-	3	-	3
CO-3:	*Create WH words make interrogative sentence, translate sentences into Chinese.*	-	-	-	-	-	-	-	-	-	3	-	3
CO-4:	*Develop the knowledge of various Chinese grammar and vocabulary and introduce own self.*	-	-	-	-	-	-	-	-	-	3	-	3
CO-5:	*Implement knowledge about Chinese festivals and culture, adapt conversational skills*	-	-	-	-	-	-	-	-	-	3	-	3

Unit-1 - **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 很, negative sentence with adjectives - adverb 也 - Interrogative particle吗 and呢, application & Usages - Possessive/ Structural Particle的, Writing Chinese characters - basic conversation related to greetings - Writing greetings in characters with proper stoke order

Unit-2- **9 Hour**

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

Unit-3- **9 Hour**

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.

Unit-4 – **9 Hour**

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**
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.

Learning Resources	*1. New Practical Chinese Reader Textbook - 1.*	

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*40%*	-	*40%*	-	*40%*	-
Level 2	*Understand*	*30%*	-	*30%*	-	*30%*	-
Level 3	*Apply*	*30%*	-	*30%*	-	*30%*	-
Level 4	*Analyze*	-	-	-	-	-	-
Level 5	*Evaluate*	-	-	-	-	-	-
Level 6	*Create*	-	-	-	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

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 Code	21LEH103T	Course Name	FRENCH	Course Category	H	HUMANITIES	L	T	P	C
							2	1	0	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive 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:*
CLR-1 :	*Extend the knowledge in the French Language using basic grammar, Self-introduction and Greetings.*
CLR-2 :	*Illustrate lexicon related to adjectives, prepositions, possessives Adjectives, using 1st group verbs.*
CLR-3 :	*Construct phrases using 2nd group verbs, pronominal verbs, future tense and time, framing questions with Interrogative words.*
CLR-4 :	*Make use of 3rd group verbs, demonstrative adjectives and vocabularies related to clothing.*
CLR-5 :	*Utilize the adverbs related to alimentation, partitive articles and negation.*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*develop a dialogue by using French greetings, expressions and self- Introduction.*	-	-	-	-	-	-	-	-	-	3	-	3
CO-2:	*create the map and find directions.*	-	-	-	-	-	-	-	-	-	3	-	3
CO-3:	*write simple routine tasks using reflexive verbs.*	-	-	-	-	-	-	-	-	-	3	-	3
CO-4:	*compile paragraph to describe a person with adjectives, colours and clothing.*	-	-	-	-	-	-	-	-	-	3	-	3
CO-5:	*apply adverbs of quantity related to food in sentences.*	-	-	-	-	-	-	-	-	-	3	-	3

Unit-1 - : *L'alphabet* **9 Hour**

Les accents - Les salutations - Les pronoms sujets - Les verbes : être, avoir, s'appeler, habiter - Se présenter / Présenter quelqu'un - S'informer sur qqn - Les articles indéfinis - communiquer en classe - Les nombres de 0 à 69 - Les jours - Les mois - Des portraits de pays francophones - Les articles définis - Les pronoms toniques - Demander poliment - Répondre poliment.

Unit-2- **9 Hour**

Les nombres de 70 à 1000 - Le 1er groupe verbe - Les verbes venir et aller - les professions - les couleurs - Les pays - la nationalité - Le genre des adjectifs - les nombre des adjectifs - Les prépositions de lieu (1) - Décrire son voisin - Décrire votre profession - La description physique - Les adjectifs possessifs (sing. / pl.) - Les orientations - les monuments - la monnaie - La famille

Unit-3- **9 Hour**

Les mots interrogatifs - Les verbes : Vouloir, pouvoir, devoir - les verbes pronominaux - Les 2eme groupes verbes - Faire une enquête - Les goûts des autres - Les temps libres et les loisirs - Parler de ses loisirs - Exprimer ses goûts / préférence - Exprimer une envie - Activité quotidienne - Le futur proche - L'heure - Demander / dire l'heure - Le système éducatif en France.

Unit-4 – **9 Hour**

Les adjectifs démonstratifs - le saisons - Les verbes : sortir, partir - Les 3eme groupes verbes - Proposer une sortie à qqn - Proposer à qqn de faire quelque chose - Apprécier qqn - Ne pas apprécier qqn - Les vêtements - Les adverbes de fréquence - Les adverbes de temps - Décrire une tenue - Décrire les accessoires - la mode en France - Demander le prix - Faire des courses.

Unit-5– **9 Hour**

Les articles partitifs (du..) et les quantités - Les verbes (er, ger, yer, cer) - Les adverbes de quantité - le pronom "en" de quantité - Les expressions de quantité - L'Impératif - Les habitudes alimentaires - la négation - Ecrire une recette - commander au restaurant - Donner son appréciation - S'exprimer à table - Les Fêtes en France.

Learning Resources	1. *SAISONS 1 - Didier – 2017* 2. *BIENVENUE - Course Book in French - Department of EFL, SRMIST - 2017.*	

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*40%*	-	*40%*	-	*40%*	-
Level 2	*Understand*	*30%*	-	*30%*	-	*30%*	-
Level 3	*Apply*	*30%*	-	*30%*	-	*30%*	-
Level 4	*Analyze*	-	-	-	-	-	-
Level 5	*Evaluate*	-	-	-	-	-	-
Level 6	*Create*	-	-	-	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

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. Eric Perrotel Attaché de coopération pour le français - Zone Sud Institut français en Inde - Embassy of France in India, Bureau de France - 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. *Mr. J. Sabastian Satish,* SRMIST
		3. *Dr. Walter Hugh Parker,* .SRMIST,

Course Code	21LEH104T	Course Name	GERMAN	Course Category	H	HUMANITIES	L	T	P	C
							2	1	0	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive 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:*
CLR-1 :	*Help students learn about the country, its culture, basic grammar elements such as greetings, self - introduction, alphabet and numbers.*
CLR-2 :	*Familiarize the basic sentence structure with corresponding verb conjugations.*
CLR-3 :	*Introduce nominative elements and directions.*
CLR-4 :	*Introduce accusative and time elements.*
CLR-5 :	*Prioritize using modal verbs, separable verbs and possessive pronouns in real - time conversation.*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*demonstrate the features of culture, geography, greeting and self - introduction.*	-	-	-	-	-	-	-	-	-	3	-	3
CO-2:	*construct simple sentences with personal pronouns and corresponding verb conjugations.*	-	-	-	-	-	-	-	-	-	3	-	3
CO-3:	*develop sentences with nominative elements and directions.*	-	-	-	-	-	-	-	-	-	3	-	3
CO-4:	*create conversational sentences using accusative and time elements.*	-	-	-	-	-	-	-	-	-	3	-	3
CO-5:	*express thoughts in sentences using modal verbs, separable verbs and possessive pronouns in real - time conversation.*	-	-	-	-	-	-	-	-	-	3	-	3

Unit-1 :	**9 Hour**
Begrüßungen und Verabschiedungswörter, Sich vorstellen - Name, Zahlen (bis 100), Länder und Sprachen, Wohnort, Berufe, Hobbys, Verb Konjugationen - kommen, wohnen, leben, heißen, sein und sprechen, Buchstabieren, Telefonnummer und E - Mail - Adresse nennen, Bundesländer und Hauptstädte, W - Fragen - Wer, Wie, Wie alt, Was, Woher, Wo, Welche Warum, Tage, Monate, Jahreszeiten, Zeitangaben am, im, Grundsätzliche Redewendungen.	
Unit-2 :	**9 Hour**
Personal Pronomen im Nominativ, Konjugation - Regelmäßige Verben und Unregelmäßige Verben ausführlich lernen, Zahlen bis eine Million, Satzbau formulieren - Aussage Satz, Ja / Nein Frage Satz und W - Frage Satz, Formular ausfüllen, Grundsätzliche Redewendungen.	
Unit-3:	**9 Hour**
Wortschatz lernen - Plätze und Gebäude, Verkehrsmittel, Schulsachen, Technik und Geräte benennen, Adjektiv - Gegenteile, Nominativ - Bestimmter Artikel der, die, das, Unbestimmter Artikel ein, eine, ein, Negation kein, keine, kein, Nach dem Weg fragen und einen Weg beschreiben - links, rechts, geradeaus und die Himmelrichtungen, Ordinal Zahlen lernen, einen Text verstehen und antworten.	
Unit-4 :	**9 Hour**
Lebensmittel - Über Essen und Getränke sprechen, Einkauf planen, Über preise wissen, Akkusative Bestimmter Artikel den, die, das, Unbestimmter Artikel einen, eine, ein, Negation keinen, keine, kein, Verben mit Akkusativ, W Fragen - Wen, Wie viel, Wohin, Wann, Wie oft, Wie viele, Wie lange, Die Uhrzeit verstehen und nennen - Singular und Plural, Texte verstehen und antworten.	
Unit-5:	**9 Hour**
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 Resources	*Netzwerk A1.1 Neu, Klett, München*	

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*40%*	-	*40%*	-	*40%*	-
Level 2	*Understand*	*40%*	-	*40%*	-	*40%*	-
Level 3	*Apply*	*20%*	-	*20%*	-	*20%*	-
Level 4	*Analyze*	-	-	-	-	-	-
Level 5	*Evaluate*	-	-	-	-	-	-
Level 6	*Create*	-	-	-	-	-	-
	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, Dean of Academics Affairs & Head, PG and Research, Dept. of English, Ethiraj College for Woman, Chennai.	2. *Mr. G. Sugumar,* SRMIST.
		3. *Ms. Bhuvana Udhaykumar,* SRMIST.

Course Code	21LEH105T	Course Name	JAPANESE	Course Category	H	HUMANITIES	L	T	P	C
							2	1	0	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive 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:*
CLR-1 :	*Explain basics concept and facts of Japanese language.*
CLR-2 :	*Compare demonstrative pronouns to ask information.*
CLR-3 :	*Select different verbs, demonstrative pronouns for place*
CLR-4 :	*Outline Japanese etiquette by using vocabularies related to daily activities and time.*
CLR-5 :	*Explain diverse food habits of Japanese.*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Write Japanese alphabet pronunciation, greetings, self - introduction*	-	-	-	-	-	-	-	-	-	3	-	3
CO-2:	*Apply the class activity through conversation with other students*	-	-	-	-	-	-	-	-	-	3	-	3
CO-3:	*Analyze directions using different group of verbs*	-	-	-	-	-	-	-	-	-	3	-	3
CO-4:	*Develop knowledge in about festivals and culture. Summarize everyday conversations.*	-	-	-	-	-	-	-	-	-	3	-	3
CO-5:	*Demonstrate the food habits of Japanese and others*	-	-	-	-	-	-	-	-	-	3	-	3

Unit-1 : **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 : **9 Hour**

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: **9 Hour**

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. Kanji - otoko, onna, ko, hito etc.
Unit-4 : **9 Hour**
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: **9 Hour**
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

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*40%*	-	*40%*	-	*40%*	-
Level 2	*Understand*	*30%*	-	*30%*	-	*30%*	-
Level 3	*Apply*	*30%*	-	*30%*	-	*30%*	-
Level 4	*Analyze*	-	-	-	-	-	-
Level 5	*Evaluate*	-	-	-	-	-	-
Level 6	*Create*	-	-	-	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

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. Korogi Yu, DGM, Renault Nissan, Japan.*	*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. *Ms. P.R. REKHAA, SRMIST.*
		3. *Ms. V. SUNDRAVALLI, SRMIST.*

Course Code	21LEH106T	Course Name	KOREAN	Course Category	H	HUMANITIES	L	T	P	C
							2	1	0	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive 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:*
CLR-1 :	*Spell, pronounce, and demonstrate the Korean script, and to define oneself and other people in the language. Get to know about Korea, its culture, and its language.*
CLR-2 :	*Illustrate sentence ending expressions, Numbers, Shopping and Teaching money*
CLR-3 :	*Construct phrases using action verbs for present and Past daily life activities*
CLR-4 :	*Tell time, to socialize: make appointments, phone calls*
CLR-5 :	*Determine expressing abilities, hopes, intentions, requests*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Write words by using Korean script - Self Introduction, Greetings in Korean*	-	-	-	-	-	-	-	-	-	3	-	3
CO-2:	*Demonstrate Number and money terms, managing daily life activities in Korean*	-	-	-	-	-	-	-	-	-	3	-	3
CO-3:	*Develop simple daily life tasks using Verb conjugation in Present and Past*	-	-	-	-	-	-	-	-	-	3	-	3
CO-4:	*Construct time, to socialize make appointments, phone call etiquettes*	-	-	-	-	-	-	-	-	-	3	-	3
CO-5:	*Express the expressions related to the daily life activities*	-	-	-	-	-	-	-	-	-	3	-	3

Unit-1 :	**9 Hour**
Introduction to Korea and Korean (한글소개, 한국 소개) - Single vowel (단모음) - Double vowels & basic consonants (이중모음과 자음) - Double consonants & syllables (쌍 자음과 음절) - Batchim & syllables (받침과 음절) - New vocabulary (Nationality & Occupation) - Self-Introduction - Greetings.	
Unit-2 :	**9 Hour**
Grammar point: Topic marking particles(은/는) - Sentence ending expressions (이에요/예요) - Formal sentence ending expressions (ㅂ니다/습니다, ㅂ니까/습니까) - Teaching Number System (Sino Korean Numbers) - New vocabulary (counter noun) - Grammar point - 있다/없다 - Subject marking particle: 이/ 가 - Interrogative words (뭐, 언제, 누구, 어디), Object marking particle (을, 를) - Location marking particle (에/에서) - Particles Noun (와/과, N(이)랑, Noun 하고, N의).	
Unit-3:	**9 Hour**
Conjugation of a Verb - Present tense (아요/어요), Past tense (았/었, 날씨) weather new vocabulary (season & weather) - Progressive tense - vb. 고있다, Particles (N도,N만, N(으)로, N(이)나, N쯤) - Negative expressions - Word negation (안 - adj. / vb. (아요/어요))..	
Unit-4 :	**9 Hour**
Time system - Days of the week - Months of a year - Conjugation of a Verb in Future Tense (으)ㄹ거예요 - Listening and contrast - adj. / vb. 고 - vb. 지만, N보다,N마다 - Confirming Information - adj. / vb. 지요, Irregular	

verbs ㄷ	
Unit-5:	**9 Hour**
Ability & possibility (vb. (으)ㄹ수있다/없다) - obligations/permissions vb. (으) 세요, vb. 지마세요 - Making requests vb. 아/어주세요 - Expressions of hope vb. 고싶다 - Asking opinions and making suggestions vb. (으)ㄹ까요? - Discovery and surprise adj. vb. 네요.	

Learning Resources	1. *Seo gang Korean서강 new 한국어 1A - Student book* 2. *Korean Grammar in Use : Beginning to Early Intermediate* 3. *Seo gang Korean 서강 new 한국어 1A Workbook*	

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*40%*	-	*40%*	-	*40%*	-
Level 2	*Understand*	*30%*	-	*30%*	-	*30%*	-
Level 3	*Apply*	*30%*	-	*30%*	-	*30%*	-
Level 4	*Analyze*	-	-	-	-	-	-
Level 5	*Evaluate*	-	-	-	-	-	-
Level 6	*Create*	-	-	-	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

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. 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, Chennai.*	*2. Ms. M. Ratna kumari, SRMIST.*

Course Code	21LEH107T	Course Name	SPANISH	Course Category	H	HUMANITIES	L	T	P	C
							2	1	0	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive 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:*
CLR-1 :	*show the students about the language and to select the usage of Grammar, Self - introduction and greetings.*
CLR-2 :	*extend the knowledge, how to introduce oneself, to ask and give information about others and express simple conversations.*
CLR-3 :	*utilise the adjectives, to ask and give directions, and an overview of general conversations.*
CLR-4 :	*identify and to develop the ability to read, understand and initiate sentence formation.*
CLR-5 :	*maximise the basic conversational skills.*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*demonstrate the culture, geography, greetings and introducing themselves.*	-	-	-	-	-	-	-	-	-	3	-	3
CO-2:	*create the dialogue between learners in the use of grammar and vocabulary.*	-	-	-	-	-	-	-	-	-	3	-	3
CO-3:	*develop a map to find the directions by using vocabularies*	-	-	-	-	-	-	-	-	-	3	-	3
CO-4:	*incorporate a paragraph related to shopping and daily routine.*	-	-	-	-	-	-	-	-	-	3	-	3
CO-5:	*construct the sentence using various grammar tenses to improve the conversational skills.*	-	-	-	-	-	-	-	-	-	3	-	3

Unit-1 : **9 Hour**

El Abecedario, a Saludar y a despedirnos - Las nacionalidades, las profesiones y sobre las palabras - Los Números 1 - 100 - La Presentación - El Vocabulario - hablar - Pronombre Personal - Días de la semana y meses - Sobre temporadas en España y otros países - Artículos definidos - Usos de los verbos auxiliares - Los verbos ser, tener y llamarse - Sobre tu familia.

Unit-2 : **9 Hour**

Artículos Indefinidos - Los Números 1000 y Vocabulario - a expresar intenciones - Negación y traducción - Números telefónicos - Direcciones cardinales y medios de transporte - Preguntar por direcciones y describir un camino - El Vocabulario - Escuchar: Escribe los números - El presente de Indicativo (verbos terminados en - ar, - er, - ir - conjugación de - AR verbos regulares - Formando oraciones en tiempo presente - El Ejercicio - conjugación de - ER, - IR verbos regulares - Algunos Usos de a, con, de, por y para - Oraciones de ejemplo para y por - Tipos de colores y el articulo determinado - Describe tu clase o colegio en español.

Unit-3: **9 Hour**

Ser y Estar - Números ordinales y días - a expresar existencia - El Vocabulario - Diferenciación entre ser y estar con oraciones de ejemplo - Ejercicio de escucha - A hablar de Ubicación - El Ejercicio - conjugación de - AR verbos Irregulares - Leyendo la comprensión y respondiendo las preguntas - a hablar de Clima - Ejercicios: conjugaciones de verbos - algunos usos de hay - oraciones de ejemplo para hay - El Ejercicio - Escuchar - El Superlativo - Explicar: un/una/unas/unos y oraciones - Explicar: mucho/mucha/muchos/muchas y oraciones - Preguntas: qué /cuál /cuáles /cuantos /cuántas /dónde y cómo.

Unit-4 : **9 Hour**

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/la/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 Resources	**Aula 1**	

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	40%	-	40%	-
Level 2	Understand	30%	-	30%	-	30%	-
Level 3	Apply	30%	-	30%	-	30%	-
Level 4	Analyze	-	-	-	-	-	-
Level 5	Evaluate	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-
	Total	100 %		100 %		100 %	

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.*
	2. Dr. J. Mangayakarasi, Head, PG and Research, Dept.of English,Ethiraj College for Woman, Chennai.	***2.** Mr. J. Sabastian Satish,* SRMIST.
		3. Dr. Walter Hugh Parker, SRMIST

Course Code	21GNH101J	Course Name	PHILOSOPHY OF ENGINEERING	Course Category	H	HUMANITIES	L	T	P	C
							1	0	2	2

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	---	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Inspire a holistic overview of engineering*
CLR-2 :	*Enlighten the methods and methodologies for building ontologies for systems engineering*
CLR-3 :	*Acquaint with engineering knowledge, building engineering knowledge and value of engineering*
CLR-4 :	*Upskill the engineering design process in aspects of conceive, design, implement and operate methodology*
CLR-5 :	*Instill the role of engineers in society, code of ethics and socio-politics of technology and engineering*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Analyze the relation between Arts, Mathematics, Science, Technology and Engineering and desired attributes of an engineer*	1	-	-	3	-	1	-	1	3	3	-	3
CO-2:	*Build ontologies for systems engineering using concept/mind mapping techniques*	3	-	-	3	3	-	-	-	3	3	-	3
CO-3:	*Analyze the knowledge base in engineering, distinctive features of engineering design and RIASEC model*	3	-	-	3	-	-	-	-	3	3	-	3
CO-4:	*Illustrate the engineering design process for the given application, analyze the requirements of CDIO engineers*	3	1	3	3	3	-	-	-	3	3	-	3
CO-5:	*Evaluate designs on their environmental and societal aspects and do organizational analysis on profession engineering organizations*	3	3	3	3	-	3	3	3	3	3	-	3

Unit-1 : Introduction to Philosophy of Engineering	**9 Hour**
Define Engineering - History of Engineering Development - Practice 1: Compare Prehistory, Medieval and Present Engineering Development - Relation between Arts, Mathematics, Science, Technology and Engineering - STEAM Pyramid - Practice 2: STEAM Pyramid Analysis: Is Art Context Necessary? - Desired Attributes of an Engineer - Engineering Habits of Mind - Practice 3: Case Study on Attributes of an Engineer.	
Unit-2 : Ontology of Engineering	**9 Hour**
Ontology - Reference Ontology and Application Ontology - Practice 4: Reference Ontology using Concept/Mind Mapping - Suites of Ontology Modules - Functions and Capabilities - Practice 5: Engineering Application Ontology using Concept/Mind Mapping - Product Life Cycle - Commodities, Services and Infrastructure - Practice 6: Product Life Cycle Ontology using Concept/Mind Mapping	
Unit-3: Epistemology of Engineering	**9 Hour**
Relations between Science, Technology and Engineering - Questions on Philosophy of Engineering - Practice 7: Analyze the nature, contents and complexity of the knowledge base in engineering Four Dimensions of Engineering - RIASEC Model - Practice 8: Case Study on RIASEC Theory of Career Choice - Epistemology of Engineering Design - Rigour, Creativity and Change in Engineering - Practice 9: Analyze Distinctive Features of Epistemology of Engineering Design	
Unit-4 : Methodology of Engineering	**9 Hour**
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	**9 Hour**
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 Resources	1. *Louis L. Bucciarelli, Engineering Philosophy, Illustrated, DUP Satellite, 2007* 2. *Gregory Bassett, Philosophical Perspectives of Engineering and Technology Literacy, I, Original writing Ltd, 2014* 3. *Philosophy of Engineering, Volume I, 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 Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (45%)		*Life Long Learning CLA-2 – Practice (15%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*20%*	-	-	*15%*	*20%*	-
Level 2	*Understand*	*20%*	-	-	*15%*	*20%*	-
Level 3	*Apply*	*20%*	-	-	*20%*	*20%*	-
Level 4	*Analyze*	*20%*	-	-	*20%*	*20%*	-
Level 5	*Evaluate*	*10%*	-	-	*15%*	*10%*	-
Level 6	*Create*	*10%*	-	-	*15%*	*10%*	-
	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*

Course Code	21MGH101T	Course Name	FUNDAMENTALS OF ECONOMICS	Course Category	H	HUMANITIES	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Faculty of Management*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Understand the fundamentals of economic principles*
CLR-2 :	*Gain knowledge of demand and supply analysis in business environment*
CLR-3 :	*Study various theories of production, costs and revenue*
CLR-4 :	*Illustrate key characteristics and consequences of different forms of markets*
CLR-5 :	*Equip the learners with macro-economic tools for business analysis*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Apply economic concepts in rational allocation of resources*	-	-	-	3	-	-	3	3	2	2	-	-
CO-2:	*Assess the demand and supply analysis in business environment*	2	-	3	3	-	-	3	3	-	-	2	-
CO-3:	*Analyze the relationship between production, cost and price for effective decision making*	3	3	2	3	-	-	-	-	-	2	2	-
CO-4:	*Assess the different competitive environment in which the firm operates*	-	3	-	-	-	-	-	2	2	2	-	-
CO-5:	*Identify potential market opportunities based on macro-economic indicators*	-	2	-	2	2	-	2	-	-	3	2	-

Unit-1 :Introduction	**9 Hour**
Meaning-Definitions of Economics - Nature & Scope of Economics – Subject Matter of Economics – Branches of Economics – Relevance of Economics in Engineering. Utility analysis, Marginal Theory of utilities and Equi-Marginal theory of utility	
Unit-2 : Demand and Supply Function	**9 Hour**
Meaning of demand - Demand theory and objectives- Demand analysis - Demand schedule - Demand Curve - Laws of Demand - Elasticity of Demand -Types and Measurement - Indifference curves analysis - Laws of Supply - Elasticity of Supply - Consumer Equilibrium - Consumer Surplus	
Unit-3: Theory of Production, Cost and Revenue	**9 Hour**
Production: Firm as an Agent of Production- Factors of production - Concept of Production Function- Law of Variable Proportions - Isoquants- Returns to Scale- Economies & Diseconomies of Scale. Costs & Revenue: Costs in the Short Run- Costs in the Long Run- Profit Maximization and Cost Minimization- Equilibrium of the Firm- Technical/Technological Change- Concept of Revenue: Total, Average and Marginal Revenue.	
Unit-4 : Market Analysis	**9 Hour**
Perfect competition – Short Run and Long Run- Equilibrium of the Firm and Industry - Price and Output Determination – Supply Curve- Monopoly – Short run and Long run Equilibrium- Price Discrimination – Monopolistic Competition – General and Chamberlin Approaches to Equilibrium- Equilibrium of the Firm and Group with Product Differentiation and Selling Costs- Excess Capacity under Monopolistic and Imperfect Competition- Criticism of Monopolistic Competition- Oligopoly	
Unit-5: Money, Banking and Trade	**9 Hour**
Money- nature and functions – Inflation and Deflation – Kinds of Banking – commercial banks – Central banking – Credit instrument - Monetary Policy – International trade – Balance of trade and Balance of Payments – taxation – Direct and Indirect taxes – GST- Impact and Incidence of tax- Concept of National Income – Features with reference to developing countries.	

Learning Resources	1. P.L. Mehta, "Managerial Economics- Analysis, Problems & Cases", Sultan Chand & Sons, 21st Edition, 2019 2. J.P. Mishra, "Business Economics", Sahitya Bhavan Publications, Agra, 2022 3. P.M. Salwan, Priyanka Jindal, "Business Economics – Second Edition", TAXMANN, 2022 4. C.M.Chaudhary, "Business Economics", RBSA Publishers, 13th Edition, 2016.	4. Zahid A khan: Engineering Economy, "Engineering Economy", Dorling Kindersley, 2012 5. Francis Cherunilam, "Business Environment", Himalaya Publishing House, Mumbai - 04, 25th Edition, 2017. 6. Panneer Selvam, R, "Engineering Economics", Second Edition, PHI Learning Private Limited, New Delhi, 2013 7. Nick Wilkinson, "Managerial Economics, Problem-Solving in a Digital World – Second edition", Cambridge University Press, 2022

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 (10%)			
		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%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers

Experts from Industry	Experts from 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 Code	21MGH102T	Course Name	FUNDAMENTALS OF MANAGEMENT	Course Category	H	HUMANITIES	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Faculty of Management*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Acquire knowledge about the historical evaluation and the fundamental concepts of Management*
CLR-2 :	*Develop an understanding of planning, Decision making tools and techniques.*
CLR-3 :	*Evolve practical application of organizing and the staffing function.*
CLR-4 :	*Enable the learners to practice to be an effective leader and motivational concepts in an organization*
CLR-5 :	*Exercise controlling techniques in an organization for measuring organizational performance and managerial actions.*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Understand the concepts related to management and current practice of Management*	-	-	-	-	2	-	-	-	-	-	2	2
CO-2:	*Use the techniques and tools of planning and make prudent decisions*	2	2	3	2	1	-	-	-	-	-	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	-	-
CO-5:	*Apply controlling techniques in business.*	-	3	3	2	2	-	2	-	-	-	3	2

Unit-1:	**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-Pre-scientific 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	
Unit-2 :	**9 Hour**
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:	**9 Hour**
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- Training-performance appraisal	
Unit-4:	**9 Hour**
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:	**9 Hour**
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. *William/ Tripathi, MGMT - A south Asian Perspective, 1st edition, Cengage Learning, 2022* 2. *Dr.J.Jayasankar, Principles of Management, 1st edition, Margham Publications, 2021.* 3. *P.C Tripathi & P.N Reddy, Principles of Management, 4thedition, Tata McGraw Hill, 2021.*	4. *Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition.* 5. *L.M.Prasad, Principles and Practice of Management, 7ed, S.Chand Publishers, 2020Richard Daft, Principles of Management, 10th edition, Cengage Learning, 2021.* 6. *https://lecturenotes.in/subject/62/principles-of-management-pom* 7. *https://www.slideshare.net/ersmbalu/principles-of-management-lecture-notes*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 (10%)*			
		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%*	-	*10%*	-	*10%*	-
Level 6	*Create*	*10%*	-	*10%*	-	*10%*	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers		
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, Chennai. drrajan@gmail.com		*2. Dr.L Jayanthi, SRMIST*

Course Code	21MGH103T	Course Name	BASICS OF ACCOUNTING AND COSTING	Course Category	H	HUMANITIES	L	T	P	C
							2	1	0	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Faculty of Management*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Understand the fundamentals of Accounting*
CLR-2 :	*Gain knowledge on the basics and preparation of statutory financial statements*
CLR-3 :	*Learn to analyse the financial statements using ratios*
CLR-4 :	*Understand the importance of costing and the method of preparation of cost sheet*
CLR-5 :	*Study the technique of marginal costing and budgetary control*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Acquire the knowledge on foundations of accounting and accounting cycle*	2	-	-	-	-	-	3	2	-	-	-	3
CO-2:	*Acquire the ability to prepare statutory financial statements*	-	-	-	3	3	-	3	1	2	3	3	3
CO-3:	*Analyse the financial statements using ratios*	3	3	2	3	2	-	3	-	3	2	3	-
CO-4:	*Appreciate the concepts of Cost accounting systems*	2	-	3	-	-	2	-	2	-	1	3	3
CO-5:	*Apply the techniques of marginal costing and budgetary control*	-	3	2	2	3	2	2	-	2	3	2	2

Unit-1: **9 Hour**

Introduction to Accounting: Concepts and Conventions - Financial Statements: Significance, interpretation – Accounting process: steps in accounting cycle, Bookkeeping, Record Maintenance – Principles of Accounting: Basic Types of Accounts, Golden rules of Accounting – Journal Entry: sample problems – Ledger posting: sample problems – Trail Balance: sample problems – Computerized Books.

Unit-2 : **9 Hour**

Financial statements: Types, Significance, and Contents – Final Accounts: Preparation of Trading Account – problems with simple adjustments, Preparation of P&L account - problems with simple adjustments, Balance Sheet - problems with simple adjustments.

Unit-3: **9 Hour**

Ratio Analyses: Types, Significance and Characteristics – Benefits of Ratios – Calculation of Ratios: Profitability ratios: Gross Profit Ratio, Net Profit Ratio, ROI, ROE, ROA, EPS, PE ratio - Liquidity ratios: Current ratio, Quick ratio, Interval measure (NWC ratio) - Leverage ratios: Total Debt ratio, D/E ratio, Capital Equity ratio, Interest Coverage ratio -Turnover ratios: Inventory turnover ratio, Debtor turnover, Collection period, Assets turnover, WC turnover - Case Discussion.

Unit-4: **9 Hour**

Costing Systems – meaning of cost; Types of costs - Elements of Cost – Material, Labour and Overheads - Cost sheet – simple problem - Cost Behavior and Cost Allocation (theory) ; Overhead Allocation - Unit Costing, Process Costing – meaning, application - Job Costing – meaning, application ; Absorption Costing – meaning, application (only theory).

Unit-5: **9 Hour**

Marginal Costing - Cost Volume Profit (CVP) Analysis – uses, application; CVP chart - Simple problems in CVP analysis; ABC Analysis - Budgets – meaning, uses, types (only theory).

Learning Resources	*1. Robert N Anthony, David Hawkins, Kenneth Merchant, Accounting: Texts and Cases, McGraw-Hill, 13th Edition, 2017* *2. Dr. Narayana Swamy, Financial Accounting for Managers, Tata McGraw Hill, 2021 edition* *3. Eugene F. Brigham and Joel F. Houston, Fundamentals of Financial Management, 14th Edition, Cengage Learning India Pvt. Ltd., 2021.*	*4. S.P. Jain and K.L. Narang, Cost Accounting: Principles and Practice, Paperback, Kalyani Publishers, 2014* *5. Case Study Materials: To be distributed for class discussion* *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 read a Balance Sheet*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 (10%)*			
		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%*	-	*10%*	-	*10%*	-
Level 6	*Create*	*10%*	-	*10%*	-	*10%*	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers		
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		

ACADEMIC CURRICULA

Basic 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

Course Code	21BTB102T	Course Name	INTRODUCTION TO COMPUTATIONAL BIOLOGY	Course Category	B	BASIC SCIENCES	L	T	P	C
							2	0	0	2

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Biotechnology*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Explain the cell structure and function from its organization*
CLR-2 :	*Define the molecular and biochemical basis of an organism and the impact of human genome project*
CLR-3 :	*Discuss protein structure and its prediction*
CLR-4 :	*Acquire knowledge of neurons and workings of the brain*
CLR-5 :	*Impart the knowledge of immune system and prediction of vaccines*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Correlate cell growth, reproduction, and differentiation*	-	-	-	1	-	-	-	-	-	-	-	-
CO-2:	*Categorize the concepts and principles of biochemistry and relate their application in genomics*	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*	3	2	2	1	3	-	-	-	-	-	-	-
CO-5:	*Integrate the immune system and its workings to predict vaccine candidates*	3	-	2	2	3	-	-	-	-	-	-	-

Unit-1 : Cell and evolution	**6 Hour**
Cell theory, Whitaker's kingdom classification, cell organelles, and their functions, homeostasis, Replication and cell Division, tissue differentiation, stem cells and their applications, genetic algorithms.	
Unit-2 : Basics in biochemistry	**6 Hour**
Structure and functions of carbohydrates, lipids, proteins, enzymes, DNA, RNA, and hormones. The human genome project, genomics, Sequence databases, BLAST tool.	
Unit-3: Structure biology	**6 Hour**
Protein synthesis, Secondary structure of the protein, Structure and function, Structural databases, protein visualizing tools, Secondary structure prediction algorithms	
Unit-4 : Neurobiology	**6 Hour**
Basic of Neurons, glial cells, Brain and its parts, Artificial neural networks, concepts, and differences with biological neural networks. – uses of ANN, machine learning, and data mining in biology	
Unit-5: Immunobiology	**6 Hour**
Elements of the immune system, Types of the immune response, Active and passive immunity, Immunoinformatics, epitope prediction tools	

Learning Resources	
	1. *Thyagarajan S, N.Selvamurugan, R.A.Nazeeret.al., Biology for engineers McGraw Hill Education. 2012*
	2. *Parish, and Twyman, Instant notes, Bioinformatics, Westhead (1st edition), Bios Scientific Publishers Ltd., 2003*
	3. *Norman Lewis, Gabi Nindl Waite, Lee R. Waite et.al., Applied Cell and Molecular Biology for Engineers. McGraw-Hill Education. 2007*
	4. *Teresa K. Attwood, David Parry-Smith, Introduction to Bioinformatics, Pearson Education,2001*
	5. *Zvelebil, Marketa J., and Jeremy O. Baum. Understanding Bioinformatics. Garland Science, 2007*

Learning Assessment							
	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		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*	-	-	*10%*	-	-	-
Level 6	*Create*	-	-	*5%*	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

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. 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	21BTB103T	Course Name	BIOLOGY	Course Category	B	BASIC SCIENCES	L	T	P	C
							2	0	0	2

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Biotechnology*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Describe the cell structure and function and its organization*
CLR-2 :	*Explain the molecular and biochemical basis of an organism*
CLR-3 :	*Acquire knowledge of microbial implications in disease and in health*
CLR-4 :	*Define biosensors and its environmental and clinical applications*
CLR-5 :	*Acquire knowledge of mechanical motors within the cell and biologically nontoxic biomaterials*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Explain cell growth, replication, reproduction, and differentiation with the potential of stem cells*	2	-	-	-	-	-	-	-	-	-	-	-
CO-2:	*Integrate the concepts and principles of biochemistry in health*	2	-	-	-	-	-	-	-	-	-	-	-
CO-3:	*Relate microbes and their usefulness in human health and industrialization*	2	3	-	-	-	-	-	-	-	-	-	-
CO-4:	*Apply the knowledge on biosensors and molecular motor in applications of human health and the environment*	3	2	2	-	-	-	-	-	-	-	-	-
CO-5:	*Elaborate biomaterials with applications in biomimetics*	3	-	2	-	-	-	-	-	-	-	-	-

Unit-1 : Cell: Basic Unit of Life	**6 Hour**
Organelles of cells, cell cycle, Cell division and differentiation, Stem cells - types and applications	
Unit-2 : Macromolecules and Metabolism	**6 Hour**
Structure of carbohydrates, lipids, proteins, enzymes, DNA, and RNA. Metabolism of glucose, amino acids, and Fatty acid; Photosynthesis	
Unit-3: Microbiology in Human Life	**6 Hour**
Medical Microbiology: Pathogenic microorganisms: Bacteria and Virus; Antibiotics; Vaccines; Environmental Microbiology; Industrial Microbiology	
Unit-4 : Basics of Biosensors and Molecular Motors	***6 Hour***
Types of Biosensors, components of biosensors, and medical applications of biosensors. Linear motors: actin and myosin, rotatory motors: flagella motor and ATPase	
Unit-5: Basics of Biomaterial and its Applications	**6 Hour**
Properties of biomaterials, types of biomaterials, biomimetics in dental and bone applications	

Learning Resources	1. *Thyagarajan S, N.Selvamurugan, MP Rajesh, RA.Nazeer Richard W Thilagaraj, S Barathi, MK Jaganathan ., Biology for engineers McGraw Hill Education. 2012* 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 Microbiology, Tata McGraw-Hill, 2019*	

Learning Assessment							
	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		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*	-	-	*10%*	-	-	-
Level 6	*Create*	-	-	*5%*	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

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	21BTB104T	Course Name	BIOLOGY: HUMAN PHYSIOLOGY AND ANATOMY	Course Category	B	BASIC SCIENCES	L	T	P	C
							2	0	0	2

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Biotechnology*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Understand basic human body functions and life processes*
CLR-2 :	*Familiarize the concepts of cardiac and nervous systems*
CLR-3 :	*Gain knowledge about functions of respiratory and musculoskeletal systems*
CLR-4 :	*Explain the structure and functions of digestive systems and excretory systems*
CLR-5 :	*Attain the knowledge about ear, eye and endocrine systems*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Explain the human body functions and life processes*	*3*	-	-	-	-	-	-	-	-	-	-	-
CO-2:	*Analyze the phenomena taking place in the cardiovascular and nervous system*	*2*	-	-	-	-	-	-	-	-	-	-	-
CO-3:	*Explain the process taking place in the respiratory musculoskeletal system*	*3*	*2*	-	-	-	-	-	-	-	-	-	-
CO-4:	*Elaborate the structure and function of digestive and excretory systems*	*2*	-	-	-	-	-	-	-	-	-	-	-
CO-5:	*Summarize the structure and function of vision, auditory and endocrine glands*	*3*	*2*	-	-	-	-	-	-	-	-	-	-

Unit-1 : Cell and Circulatory System	**6 Hour**
The function of the cell, Membrane, resting potential of a cell, Action potential of a cell, Phases of action potential, Propagation of action potentials, The Goldman-Hodgkin-Katz equation, Blood cell - composition, origin of WBC Blood cell - composition, the origin of platelet, Types of blood groups, Estimation of blood components	
Unit-2 : Cardiovascular System and Nervous System	**6 Hour**
Blood vessels – Artery, capillary and vein, Heart structure, Cardiac cycle, Cardiac cycle - graphs, Cardiac output, Coronary circulation, Nervous system, Organization of the brain, spinal cord, Structure, and function of nerve the , Action potential of the neuron, Reflex action	
Unit-3: Respiratory System and Musculo Skeletal System	**6 Hour**
Lungs-in detail, Ventilator volumes – Adult human spirogram, Mechanics of breathing, Control of ventilation, Mechanism of gas exchange, Muscles – Skeletal muscle, Physiology of muscle contractions, Sliding bridge theory, Structural function of joints, Types of joints	
***Unit-4 :* Digestive System and Excretory System**	***6 Hour***
Salivary glands – Saliva, Tongue – Taste, GI tract, Digestion at the stomach, Digestion at the intestines, Accessory organs of Digestion, Function of bile, gall bladder, pancreas, Mechanism of urine formation, Urine reflex, Structure and function of skin, sweat gland, Temperature regulation	
Unit-5: Sensory Organs and Endocrine Glands	**6 Hour**
The optic nerve, optic chiasm, optic tract, Vision pathway, Structure and function of ear, Auditory pathway, Endocrine Glans-Overall functions, Pituitary glands, Parathyroid glands, Adrenal glands, Homeostasis of Glucose in the body, Homeostasis of calcium in the body	

Learning Resources	
	1. *Sarada Subramanyam, K. Madhavan Kutty and H.D. Singh, "Textbook of human physiology", S.Chand & Company, 5th edition, 2014.*
	2. *Ranganathan T.S., "Textbook of human anatomy", S.Chand & Co. Ltd., Delhi, 5th edition, 2014.*
	3. *Tobin, C.E., "Basic human anatomy", McGraw-Hill Publishing Co. Ltd., Delhi, 2nd edition, 1997.*
	4. *J. Gibson, "Modern physiology and anatomy for nurses", Blackwell SC Publishing, 2nd edition, 1981.*
	5. *Arthur. C. Guyton, John E Hall, "Textbook of medical physiology", W.B. Saunders Company, 11th edition, 2000*

Learning Assessment							
	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		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*	-	-	*10%*	-	-	-
Level 6	*Create*	-	-	*5%*	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

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. 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 Code	21BTB105T	Course Name	CELL BIOLOGY	Course Category	B	BASIC SCIENCES	L	T	P	C
							2	0	0	2

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Biotechnology*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Provide the basic concepts and understanding of cell structure and function*
CLR-2 :	*Explain the different strategies of the organization of organelles*
CLR-3 :	*Familiarize the concepts of structural and functional orientation in eukaryotes*
CLR-4 :	*Serve as a platform to study the molecular mechanism of cellular transport*
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:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Explicate the fundamentals of cell biology.*	2	-	3	-	-	-	-	-	-	-	-	-
CO-2:	*Relate cell structures and functions*	-	-	3	3	-	-	-	-	-	-	-	-
CO-3:	*Explain the basis of cell structure and its function in cell development and death.*	-	-	-	3	2	-	-	-	-	-	-	-
CO-4:	*Describe the steps involved in cell-cell signaling in mammalian cell systems.*	-	-	3	3	-	-	-	-	-	-	-	-
CO-5:	*Critique the fundamentals and relate with the advances in the various areas of diagnostic and therapeutic applications of cells*	-	3	-	3	-	-	-	-	-	-	-	-

Unit-1 : An Overview of Cells and Cell Research	**6 Hour**
Origin and evolution of cells, Origin of Prokaryotes, Eukaryotes and Development of multicellular organisms; Cells as experimental models; Tools of cell biology, Molecular composition of cells, Cell membrane	
Unit-2 : Cell, Structure and Function–I	**6 Hour**
Nucleus, Endoplasmic reticulum, Golgi apparatus, Lysosomes, Mitochondria, Chloroplasts and Peroxisomes	
Unit-3: Cell, Structure and Function–II	**6 Hour**
Cytoskeleton: Actin and myosin filaments, Intermediate filaments and Microtubules; Transport of molecule; Cell-cell interactions: Adhesion junctions, tight junctions, gap junctions	
Unit-4 : Cell Signaling	***6 Hour***
General principles of cell signaling-Modes of cell-cell signaling, Pathways of intracellular signal transduction-function of cell surface receptors; GPCR pathway, MAPK pathway	
Unit-5: Cell Regulation	**6 Hour**
Cell division, Cell cycle and its regulation; Mitosis, Meiosis; Cell death: Necrosis, Apoptosis; Cancer-Introduction to cancer, types of cancer, Epithelial cell cancer; Stem cells and its therapeutic applications.	

Learning Resources	
	1. Channarayappa, "Cell biology," Universities Press, 2010.
	2. Rastogi, S.C, "Cell biology," New Age International Publishers, 2005.
	3. Thyagarajan S, N.Selvamurugan, MP Rajesh, RA.Nazeer Richard W Thilagaraj, S Barathi, MK Jaganathan ., Biology for engineers McGraw Hill Education. 2012"Biology for Engineers " 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 Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 (10%)			
		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	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

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. 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	Course Name	CALCULUS AND LINEAR ALGEBRA	Course Category	B	BASIC SCIENCES	L	T	P	C
							3	1	0	4

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Mathematics*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Apply the concept of Matrices in problems of Science and Engineering*
CLR-2 :	*Utilize Taylor series, Maxima minima, composite function and Jacobian in solving various Engineering problems*
CLR-3 :	*Apply the concept of Differential Equations in problems of Science and Engineering*
CLR-4 :	*Utilize the concepts of radius of curvature, evolute, envelope in problems of Science and Engineering*
CLR-5 :	*Apply the Sequences and Series concepts in Science and Engineering*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Apply the concepts of Matrices to find Eigenvalues and Eigen Vectors problems solving in Science and Engineering*	3	3	-	-	-	-	-	-	-	-	-	-
CO-2:	*Apply Maxima and Minima, Jacobian, and Taylor series to solve problems in Science and Engineering*	3	3	-	-	-	-	-	-	-	-	-	-
CO-3:	*Solve the different types Differential Equations in Science and Engineering applications*	3	3	-	-	-	-	-	-	-	-	-	-
CO-4:	*Identify Radius, Centre, envelope and Circle of curvature and apply them in Science and Engineering*	3	3	-	-	-	-	-	-	-	-	-	-
CO-5:	*Identify convergence and divergence of series using different tests in Engineering applications*	3	3	-	-	-	-	-	-	-	-	-	-

Unit-1 : Matrices	**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	**12 Hour**
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	**12 Hour**
Linear equations of second order with constant coefficients when PI=0 or exponential - Linear equations of second order with constant coefficients when PI=sinax or cos ax - Linear equations of second order with constant coefficients when PI=polynomial Linear equations of second order with constant coefficients when PI=exponential with sinax or Cosax - Linear equations of second order with constant coefficients when PI= exponential with polynomial - Linear equations of second order with constant coefficients when PI=polynomial with sinhax or coshax - Linear equations of second order variable coefficients - Linear equations of second order variable coefficients - Homogeneous equation of Euler type - Homogeneous equation of Legendre's Type - Homogeneous equation of Legendre's Type - Equations reducible to homogeneous form - Equations reducible to homogeneous form - Variation of parameters - Variation of parameters - Simultaneous first order with constant co-efficient. - Simultaneous first order with constant co-efficient. - Simultaneous first order with constant co-efficient.	
Unit-4 : Differential Calculus and Beta Gamma Functions	**12 Hour**
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	**12 Hour**
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. *Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.* 2. *B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.* 3. *Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008*	4. *Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010* 5. *G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson,Reprint, 2002* 6. *N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		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*	-	-	-	-	-	-
	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.in*	2. *Dr. N. Balaji, SRMIST*

Course Code	21MAB102T	Course Name	ADVANCED CALCULUS AND COMPLEX ANALYSIS	Course Category	B	BASIC SCIENCES	L	T	P	C
							3	1	0	4

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Mathematics*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Determine the Double and triple Integral and apply then in problems in Science and Engineering.*
CLR-2 :	*Gain knowledge in interpretation of vector differentiation and vector integration which relates line integral, Green's, Stoke's and Gauss divergent theorem.*
CLR-3 :	*Identify the techniques of Laplace Transforms and inverse transform and extend them in the problems of Science and Engineering*
CLR-4 :	*Construct the analytic function, discuss conformal mapping and bilinear transformation in Engineering Problems*
CLR-5 :	*Evaluate complex integrals and power series using various theorems*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
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 techniques in solving Engineering problems*	3	3	-	-	-	-	-	-	-	-	-	-
CO-4:	*Utilize complex integrals and power series in solving engineering problems*	3	3	-	-	-	-	-	-	-	-	-	-
CO-5:	*Gain knowledge in evaluating improper integrals using Residue theorem involving problems in Science and Engineering*	3	3	-	-	-	-	-	-	-	-	-	-

Unit-1 : Integral Calculus	**12 Hour**
Evaluation of double integration Cartesian and plane polar coordinates - Evaluation of double integration of plane polar coordinates. Evaluation of double integral by changing of order of integration - Evaluation of double integral by changing of order of integration -Area as a double integral (Cartesian) - Area as a double integral (polar) - Triple integration in Cartesian coordinates -Conversion from Cartesian to polar in double integrals - Conversion from Cartesian to polar in double integrals -Triple integration in Cartesian coordinates -Area of triple Integral.	
Unit-2 : Vector Calculus	**12 Hour**
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 applications to parallelepiped. -Stoke's theorems (without proof) – Verification Stoke's theorems (without proof) – Applications to cubes - Stoke's theorems (without proof) – Applications to parallelepiped only.	
Unit-3: Laplace Transform	**12 Hour**
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 - Inverse Laplace transforms using partial fractions - Inverse Laplace transforms sing Partial fractions -Inverse Laplace transforms section shifting theorem - LT using Convolution theorem -problems only - LT using Convolution theorem -problems only -ILT using Convolution theorem -problems only -Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficient only -Solution of Integral equation and integral equation involving convolution type	
Unit-4 : Analytic Functions	**12 Hour**
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: inversion -Conformal mappings: reflection - Conformal mappings: reflection bilinear transformation - Cauchy's integral theorem (without proof) -Cauchy's integral theorem applications	

Unit-5: Complex Integration	**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: Unit circle. -Contour integration: semicircular contour. -Contour integration: semicircular contour.	

Learning Resources	1. *Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.* 2. *B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.* 3. *Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008*	4. *Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010* 5. *G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson,Reprint, 2002* 6. *N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		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*	-	-	-	-	-	-
	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.in	*2. Dr. N. Balaji, SRMIST*

Course Code	21PYB101J	Course Name	PHYSICS: ELECTROMAGNETIC THEORY, QUANTUM MECHANICS, WAVES AND OPTICS	Course Category	B	BASIC SCIENCES	L	T	P	C
							3	1	2	5

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Physics and Nanotechnology*	**Data Book / Codes/Standards**	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Identify the applications of electric field on materials*
CLR-2 :	*Identify the applications of magnetic field on materials*
CLR-3 :	*Identify the significance of quantum theory*
CLR-4 :	*Create insights to the concepts of optical effects*
CLR-5 :	*Analyze the working principle of lasers and optical fibers*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Express the significance of electrostatic fields*	*3*	*3*	-	-	-	-	-	-	-	-	-	-
CO-2:	*Analyze electromagnetic induction*	*3*	*3*	-	-	-	-	-	-	-	-	-	-
CO-3:	*Apply quantum mechanics to basic physical problems*	*3*	-	-	*3*	-	-	-	-	-	-	-	-
CO-4:	*Apply ray propagation and optical effects*	*3*	*3*	-	-	-	-	-	-	-	-	-	-
CO-5:	*Understand the types of lasers, structure and propagation properties of optical fiber and analyse its applications*	*3*	*3*	*3*	-	-	-	-	-	-	-	-	-

Unit-1: Electromagnetism and Dielectrics **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- 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 **18 Hour**

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*
2. *Calibrate Voltmeter using Potentiometer*
3. *Determine magnetic susceptibility-Quincke's method*

Unit-3:Quantum Mechanics **18 Hour**

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-Particle in a 1 D box-Normalizations-Concept of harmonic oscillator-Quantum harmonic oscillator

Practice

1. *Determine Planck's Constant*
2. *Study of I-V characteristics of a light dependent resistor (LDR)*

Unit-4: Wave Optics **18 Hour**

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 grating-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 Extraordinary 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 Hour**
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-Essential 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* *2. Study of attenuation and propagation characteristic-optical fiber* *3. Mini project*

Learning Resources	*1. David Jeffery Griffiths, Introduction to Electrodynamics, Revised edition, Pearson, 2013* *2. AjoyGhatak, Optics, Tata McGraw Hill Education, 5th edition, 2012*	*3. David Halliday, Fundamentals of Physics, 7th edition, John Wiley & Sons Australia, Ltd, 2004* *4. Eisberg and Resnick, Quantum Physics: Of Atoms, Molecules, Solids, Nuclei and Particles, 2nd Edition, 1985*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 (10%)			
		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%	-	-	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. 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	21PYB102J	Course Name	SEMICONDUCTOR PHYSICS AND COMPUTATIONAL METHODS	Course Category	B	BASIC SCIENCES	L	T	P	C
							3	1	2	5

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Physics and Nano Technology*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Introduce band gap and Fermi level in semiconductors and how to compute those properties*
CLR-2 :	*Explain the concept of carrier transport mechanism in p-n and metal semiconductor junction*
CLR-3 :	*Provide an insight on semiconductor optical transitions and photovoltaic effect*
CLR-4 :	*Procure knowledge of electrical and optical measurements in semiconductor and to instigate the concepts of TCAD*
CLR-5 :	*Develop necessary skills for low dimensional semiconductor material processing and characterization and to introduce the basic of machine learning in image processing*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Understand and compute energy band in solids and electron occupation probability*	*3*	-	-	-	-	-	-	-	-	-	-	-
CO-2:	*Understand and analyze the working of optoelectronic devices*	*3*	-	-	-	-	-	-	-	-	-	-	-
CO-3:	*Apply the knowledge to the development of new and novel optoelectronic devices*	-	-	*3*	-	-	-	-	-	-	-	-	-
CO-4:	*Understand the working mechanism of electrical and optical measurements and gain the fundamentals of TCAD*	*3*	-	-	-	-	-	-	-	-	-	-	-
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 **18 Hour**

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 **18 Hour**

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 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 **18 Hour**

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.*

Unit-4 : Electrical And Optical Measurements **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 **18 Hour**

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-CVD-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.*

Learning Resources	*1. J.Singh, "Semiconductor Optoelectronics": Physics and Technology, McGraw-Hill Inc. 1995.* *2. B. E. A. Saleh and M. C. Teich, "Fundamentals of Photonics", John Wiley & Sons, Inc., 2007.* *3. S. M. Sze, "Semiconductor Devices" Physics and Technology, Wiley 2008.* *4. A. Yariv and P. Yeh, Photonics:" Optical Electronics in Modern Communications", Oxford University Press, New York 2007.*	*5. Computational Materials Science: An Introduction by June Gunn Lee, Chapter 7, Page 227- 230 (Quantum Espresso)and Page 300-307 (VASP)* *6. Finite Element Method GouriDhatt, Emmanuel Lefrançois, Gilbert Touzot, Wiley Publication, ISBN: 978-1-848-21368-5*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 (10%)			
		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%	-	-	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. 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.S. Saurab Ghosh S, SRMIST*

Course Code	21PYB104J	Course Name	PHYSICS: MECHANICS	Course Category	B	BASIC SCIENCES	L	T	P	C
							3	1	2	5

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Physics and Nanotechnology*	**Data Book / Codes/Standards**	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Utilize the principles pertaining to vector mechanics and basics of vibrations to structural engineering.*
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*
CLR-3 :	*Apply knowledge of statics to determine the forces and moments in truss structures*
CLR-4 :	*Comprehend the failure of structures by identifying the principal stresses and strains*
CLR-5 :	*Analyze the bending types and torsion in structural members*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Identify the principle of mechanics and vibrations*	3	3	-	-	-	-	-	-	-	-	-	-
CO-2:	*Understand the rigid body mechanics in 2D and 3D*	3	3	-	-	-	-	-	-	-	-	-	-
CO-3:	*Apply the knowledge of free body diagram to establish equations of equilibrium to determine the internal forces in simple truss structures*	3	-	-	3	-	-	-	-	-	-	-	-
CO-4:	*Analyze the principal stresses and principal planes to understand the failure of materials.*	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 beams*	3	3	3	-	-	-	-	-	-	-	-	-

Unit-1: Vector Algebra and Vibrations **18 Hour**

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 **18 Hour**

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 law- Describing rigid body motion-(Euler's equation of motion)- Precession of a body- Precession of a spinning top- Introduction to three-dimensional rigid body motion- Distinction from two-dimensional motion- Two- dimensional 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

Practice

4. *Determine acceleration due to gravity-Compound bar pendulum*
5. *Determine spring constant-Expansion of a helical spring*
6. *Determine the coefficient of Static friction*

Unit-3: Equilibrium and Stability of Rigid Structures **18 Hour**

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-

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 **18 Hour**

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 **18 Hour**

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 Resources	*1.Mahendra K Verma, Introduction to Mechanics, Universities Press (India) Pvt. Ltd., 2016* *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

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 (10%)			
		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%	-	-	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

Course Code	21CYB101J	Course Name	CHEMISTRY	Course Category	B	BASIC SCIENCES	L	T	P	C
							3	1	2	5

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Chemistry*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Exploit the periodic properties of elements for bulk property manipulation towards technological advancement and interpret water quality parameters*
CLR-2 :	*Address concepts related to electrochemistry, such as corrosion, using thermodynamic principles and measure the acidic strength and redox potentials of aqueous solution*
CLR-3 :	*Employ various organic reactions towards the design of fine chemical and drug molecules for industries and measure the acidic strength and conductance of aqueous solution*
CLR-4 :	*Brief outline, reaction types and applications of polymers and determine average molecular weight of the polymer*
CLR-5 :	*Properties, surface characterization and applications of advanced engineering materials and measure the acidic strength of aqueous solution*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Rationalize bulk properties using periodic properties of elements, evaluate water quality parameters like hardness and alkalinity*	3	-	3	2	-	-	-	-	-	-	-	-
CO-2:	*Utilize the concepts of thermodynamics in understanding thermodynamically driven chemical reactions, determine acidic strength and redox potentials of aqueous solution*	3	3	3	-	-	-	-	-	-	-	-	-
CO-3:	*Perceive the importance of stereochemistry in synthesizing organic molecules applied in pharmaceutical industries, determine acidic strength and conductance of aqueous solution*	-	3	3	2	-	-	-	-	-	-	-	-
CO-4:	*Utilize the concepts of polymer processing for various technological applications, determine average molecular weight of the polymer*	3	-	3	3	-	-	-	-	-	-	-	-
CO-5:	*Analyze the importance of advanced processing techniques towards engineering applications and measure the acidic strength of aqueous solution*	3	-	3	-	3	-	-	-	-	-	-	-

Unit-1 : Periodic properties **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 **18 Hour**

Thermodynamic functions: Energy, Entropy and free energy - Estimation of entropy & free energies - Free energy and emf. Cell potentials - The Nernst 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: Stereochemistry and Organic reactions **18 Hour**

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 **18 Hour**
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 **18 Hour**
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	*1. B. H. Mahan, R. J. Meyers, University Chemistry, 4th ed., Pearson publishers, 2009.* *2. M. J. Sienko, R. A. Plane, Chemistry: Principles and Applications, 3rd ed., McGraw-Hill publishers, 1980* *3. B. L. Tembe, Kamaluddin, M. S. Krishnan, Engineering Chemistry (NPTEL Web-book) http://nptel.ac.in/downloads/122101001/*	*4. Peter W. Atkins, Julio de Paula, James Keeler, Physical Chemistry, 11th ed., Oxford publishers, 2021* *5. K. P. C. Vollhardt, N. E. Schore, Organic Chemistry: Structure and Function 7thed., Freeman, 2014* *6. W. D. Callister, D. G. Rethwisch, Materials Science and Engineering: An Introduction, 8th ed., Wiley, 2009* *7. 7. J. C. Kuriacose, J. Rajaram, Chemistry in Engineering and Technology, Tata McGraw-Hill Education, 1984*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	10%	-	-	20%	10%	-
Level 2	Understand	30%	-	-	20%	30%	-
Level 3	Apply	30%	-	-	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. 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*

ACADEMIC CURRICULA

Non Credit Courses (M)

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	21CYM101T	Course Name	ENVIRONMENTAL SCIENCE	Course Category	M	NON CREDIT	L	T	P	C
							1	0	0	0

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Chemistry*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Acquire knowledge on various causes, effects and control measures of environmental air and water pollution*
CLR-2 :	*Acquire knowledge on various causes, effects and control measures of soil, thermal and radiation pollution*
CLR-3 :	*Acquire knowledge on various process involved in the treatment of wastewater*
CLR-4 :	*Identify sources, disposal and treatment methods of solid waste management*
CLR-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:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Analyze the sources, effects and control measures of environmental air pollution*	*3*	*3*	-	-	-	-	*3*	-	-	-	-	-
CO-2:	*Analyze causes, effects and control measures ,of soil, thermal and radiation pollution*	*3*	*3*	-	-	-	-	*3*	-	-	-	-	-
CO-3:	*Explain the processes involved in waste water treatment and investigate the cause of a local polluted site*	-	*3*	-	-	-	-	*3*	-	*3*	-	-	-
CO-4:	*Illustrate the treatment methods involved in solid waste management and investigate the impact in local areas*	-	*3*	-	-	-	-	*3*	-	*3*	-	-	-
CO-5:	*Illustrate the treatment methods involved in biomedical waste management and investigate the impact in local areas*	-	*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	
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	
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	
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.	

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*	*3. R.Jeyalakshmi, Principles of Environmental Science, Devi publications, 2nd ed., 2008.* *4. Helen P Kavitha, Principles of Environmental Science, Shine Publications and Distributors, 1st Edition, 2013*

Learning Assessment									
	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*						*Final Examination (0% weightage)*	
		Formative CLA-1 (40%)		*Life long learning CLA-2 (40%)*		*Summative (20%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*20%*	-	*20%*	-	*20%*	-	-	-
Level 2	*Understand*	*20%*	-	*20%*	-	*20%*	-	-	-
Level 3	*Apply*	*30%*	-	*30%*	-	*10%*	-	-	-
Level 4	*Analyze*	*30%*	-	*30%*	-	*30%*	-	-	-
Level 5	*Evaluate*	-	-	-	-	*20%*	-	-	-
Level 6	*Create*	-	-	-	-	-	-	-	-
	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. K. R. Datta, SRMIST*

Course Code	21LEM101T	Course Name	CONSTITUTION OF INDIA	Course Category	M	NON CREDIT	L	T	P	C
							1	0	0	0

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive 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:*
CLR-1 :	*Understand the basics of Constitution of India – meaning, nature, fundamental right and duties.*
CLR-2 :	*Explain the parliamentary system of the government and the relationship between the governments*
CLR-3 :	*Detail the powers and functions of Central government*
CLR-4 :	*Detail the powers and functions of State government*
CLR-5 :	*Create an awareness in learners about the kinds of local administrations, Election Commission and Political Dynamics*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Define the meaning and nature of constitution of India, its fundamental rights and duties.*	-	-	-	-	-	2	-	-	-	-	-	3
CO-2:	*Demonstrate the powers of President, Vice President, Prime Minister, the process of Parliamentary System and the relation between the governments*	-	-	-	-	-	2	-	-	-	-	-	3
CO-3:	*Analyze the powers of State Legislature and Inter-state relation*	-	-	-	-	-	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*	-	-	-	-	-	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.*	

Learning Assessment									
	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*						*Summative Final Examination (0% weightage)*	
		Formative CLA-1 Average of unit test (20%)		*Life Long Learning CLA-2 – (60%)*		*Summative (20%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	-	-	-	-	-	-	-	-
Level 2	*Understand*	*100%*	-	*100%*	-	*100%*	-	-	-
Level 3	*Apply*	-	-	-	-	-	-	-	-
Level 4	*Analyze*	-	-	-	-	-	-	-	-
Level 5	*Evaluate*	-	-	-	-	-	-	-	-
Level 6	*Create*	-	-	-	-	-	-	-	-
	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. 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, Dept.of English, Ehiraj College for woman, chennai	*2. Mr. G. Sugumar, SRMIST*

Course Code	21PDM101L	Course Name	PROFESSIONAL SKILLS AND PRACTICES	Course Category	M	NON CREDIT	L	T	P	C
							0	0	2	0

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Career Development Center*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Evaluate and analyze 'self '*
CLR-2 :	*Identify professional behavior and apply creative ideas*
CLR-3 :	*Adopt success habits and develop people skills*
CLR-4 :	*Become efficient in communication and problem-solving*
CLR-5 :	*Enhance necessary critical thinking skills that helps in solving problems amongst groups*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Analyze productive and successful habits*	-	-	-	-	-	-	-	-	*3*	-	-	*3*
CO-2:	*Develop professionalism and discover the creative self*	-	-	-	-	-	-	-	-	*3*	*3*	-	*3*
CO-3:	*Acquire inter personal skills and be an effective goal-oriented team player*	-	-	-	-	-	-	-	-	*3*	*3*	-	*3*
CO-4:	*Realize the importance of communication within a team*	-	-	-	-	-	-	-	-	*3*	*3*	-	*3*
CO-5:	*Acquire communication and problem-solving skills.*	-	-	-	-	-	-	-	-	*3*	-	-	*3*

Unit-1 :	**6 Hour**
Orientation to the course – IKIGAI – SWOT analysis – JOHARI window – DISC profile - Personal branding – Profile building	
Unit-2 :	**6 Hour**
Attitude reengineering – Challenging the self – Kubler Ross concept – Etiquette & grooming Creativity & Innovations – SCAMPER – Design Thinking – Mind Mapping – Creativity Challenge	
Unit-3:	**6 Hour**
Interpersonal skills – Think win x win attitude – Expectation Management – Emotional Intelligence *Collaborative Skills – Teamwork – Networking - Leadership – Time management*	
Unit-4 :	***6 Hour***
Decision Making – 6 Thinking Hats – Problem Solving skills – Fish bone Theory *Conflict Management – Approaches – Brainstorming vs Painstorming – Group Discussions – Case Study*	
Unit-5:	**6 Hour**
Video Profile – Extempore – Gratitude – Blue ribbon ceremony	

Learning Resources	*1. Covey Sean, Seven Habits of Highly Effective Teens, New York, Fireside Publishers, 1998* *2. Thomas A Harris, I am ok, You are ok, New York-Harper and Row, 1972* *3. Carol Dweck, Mindset, The New Psychology of Success, Random House Pub. 2006*	*4. Héctor García,Francesc Miralles, Ikigai: The Japanese secret to a long and happy life, Penguin Books, 2017* *5. Kenneth Blanchard, The One Minute Manager, Harpercollins, 2014* *6. Angela Duckworth,Grit, Why passion and resilience are the secrets to success, Vermilion, 2017* *7. James Clear, Atomic Habits, Random House,2021*

Learning Assessment									
	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*						*Final Examination (0% weightage)*	
		Formative CLA-1 (30%)		*Formative CLA-2 – (30%)*		*Summative (40%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	-	*15%*	-	*10%*	-	*10%*	-	-
Level 2	*Understand*	-	*15%*	-	*10%*	-	*10%*	-	-
Level 3	*Apply*	-	*20%*	-	*20%*	-	*20%*	-	-
Level 4	*Analyze*	-	*20%*	-	*20%*	-	*20%*	-	-
Level 5	*Evaluate*	-	*15%*	-	*20%*	-	*20%*	-	-
Level 6	*Create*	-	*15%*	-	*20%*	-	*20%*	-	-
	Total	*100 %*		*100 %*		*100%*		-	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Ms. Sudha Mahadevan, Career Launcher, sudha.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, ajay.z@careerlauncher.com	*2. Dr.Dinesh Khattar, Delhi University, dinesh.khattar31@gmail.com*	*2. Mrs. M. Kavitha,, SRMIST*

Course Code	21PDM102L	Course Name	GENERAL APTITUDE	Course Category	M	NON CREDIT	L	T	P	C
							0	0	2	0

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Career Development Center*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Recapitulate fundamental mathematical concepts and skills*
CLR-2 :	*Hone grammar skills to write error-free sentences*
CLR-3 :	*Sharpen logical reasoning through skillful conceptualization,*
CLR-4 :	*Identification of relationships between words based on their function, usage and characteristics*
CLR-5 :	*Nurture passion for enriching vocabulary*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Build a strong base in the fundamental mathematical concepts*	-	*3*	-	-	-	-	-	-	*3*	-	-	*2*
CO-2:	*Identify the approaches and strategies to solve problems with speed and accuracy*	-	-	-	-	-	-	-	-	*3*	-	-	*3*
CO-3:	*Enhance lexical skills through systematic application of concepts and careful analysis of style, syntax, semantics and logic*	-	-	-	-	-	-	-	-	*3*	*3*	-	*3*
CO-4:	*Collectively solve problems in teams and groups*	-	*3*	-	-	-	-	-	-	*3*	*3*	-	*2*
CO-5:	*Build vocabulary and grammar through methodical approaches*	-	-	-	-	-	-	-	-	*3*	*3*	-	*3*

Unit-1 :	**6 Hour**
Synonyms – Antonyms -Tenses – Voices – Simple Equations – Age Problems – Ration Proportion & Variation	
Unit-2 :	**6 Hour**
Sentence Arrangement – Commonly Confusing Words – Linear Arrangement – Circular Arrangement – Selection and Distribution	
Unit-3:	**6 Hour**
Percentage – Profit and loss – Closest Meaning – Word Analogy – Types of Sentences – Phrasal Verbs	
Unit-4 :	***6 Hour***
Simple and Compound Interest – Blood Relations – Odd Words – Question Tags – Conditional Clauses	
Unit-5:	**6 Hour**
Direction sense – Average – Conditional Clauses – Reading Comprehension	

Learning Resources	*1. Nishit K. Sinha, The Pearson Guide to Quantitative Aptitude and Data Interpretation for the CAT* *2. Dinesh Khattar-The Pearson Guide to QUANTITATIVE APTITUDE for competitive examinations* *3. Charles Harrington Elstor, Verbal Advantage: Ten Easy Steps to a Powerful Vocabulary, Random House Reference, 2002*	*4. Norman Lewis, How to Read Better and Faster, Goyal, 4th Edition* *5. Franklin GRE Word List, 3861 GRE Words, Franklin Vocab System, 2014Wiley's GMAT Reading Comprehension Grail, Wiley, 2016* *6. Manhattan Prep GRE : Reading Comprehension and Essays, 5th Edition*

Learning Assessment									
	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*						*Final Examination (0% weightage)*	
		Formative CLA-1 Average of unit test (30%)		*Formative CLA-2 – (30%)*		*Summative (40%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	-	*40%*	-	*40%*	-	*40%*	-	-
Level 2	*Understand*	-	*40%*	-	*40%*	-	*40%*	-	-
Level 3	*Apply*	-	*10%*	-	*10%*	-	*10%*	-	-
Level 4	*Analyze*	-	*10%*	-	*10%*	-	*10%*	-	-
Level 5	*Evaluate*	-	-	-	-	-	-	-	-
Level 6	*Create*	-	-	-	-	-	-	-	-
	Total	*100 %*		*100 %*		*100%*		-	

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 Jayapragash J, SRMIST*
		3. Dr. M. Snehalatha, SRMIST

Course Code	21GNM101L	Course Name	PHYSICAL AND MENTAL HEALTH USING YOGA	Course Category	M	NON CREDIT	L	T	P	C
							0	0	2	0

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Center For YOGA*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Utilize rich Indian heritage and knowledge for self-healing and self-protection from diseases*
CLR-2 :	*Application of meditation techniques to balance emotions, state of mind and body equip attain happiness.*
CLR-3 :	*Intellectually develop oneself by identifying oneness with divine state merging with absolute space.*
CLR-4 :	*Social transformations towards meaningful and purposeful humanity through the morality of the both the self and the society.*
CLR-5 :	*Spiritual enlightenment of self by purifying the body, mind and soul to attain the blissful stage.*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Identify Indian heritage, culture. Identify key anatomical structures in the human body and basic exercises for the same*	*1*	*-*	*-*	*3*	*-*	*2*	*-*	*2*	*3*	*3*	*-*	*3*
CO-2:	*Apply yoga meditation practices for emotional development and wellbeing*	*3*	*-*	*-*	*3*	*3*	*-*	*-*	*-*	*3*	*3*	*-*	*3*
CO-3:	*Identify educational and intellectual development methods using five 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**

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.

Practices

Practice1: Standing exercise, Surya Namaskar

Practice2: Surya Namaskar, Sitting Exercises

Practice3: Prone & Supine posture Exercises

Unit-2 : Emotional Development **6 Hour**

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: Surya Namaskar, Standing asanas

Practice5: Surya Namaskar, Sitting asanas

Practice6: Surya Namaskar, Prone & Supine posture Asanas

Unit-3: Concentration Development **6 Hour**

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 Hour**
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 Hour**
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* *Practice13: Management of Physical problems (Yoga therapy)* *Practice14: Project Submission*

Learning Resources	1. *B.K.S.Iyengar,Light on yoga,2006.* 2. *T.K.V.Desikachar, Heart of Yoga, Inner Traditions Bear and Company, 2003.* 3. *Swami Ramdev Ji Yog Its Philosophy and Practice, 2008.* 4. *Yogiraj Vethathiri Maharishi, Yoga for Modern Age, Tenth edition, Vethathiri Publications, 2007*	5. *Vivekananda Kenthria Prkasan Trust, Yogam, 2006.* 6. *Swami muktibodhananda, Hatha yoga Prathipika, Bihar School of Yoga 1985.* 7. *Swami Satyananda Saraswati, Asana Pranayama Mudra Bandha, Bihar School of Yoga, 1993* 8. *Dr. Asana Andiappan, Thirumoolar's Astanga Yoga, International Yoga Academy, 2017*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)						Final Examination (0% weightage)	
		Formative CLA-1 (30%)		Formative CLA-2 (30%)		Summative (40%)			
		Theory	Practice	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	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100%		-	

Course Designers

Professional Experts	Experts 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*

ACADEMIC CURRICULA

Engineering Science Courses (S)

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	21CSS101J	Course Name	PROGRAMMING FOR PROBLEM SOLVING	Course Category	S	ENGINEERING SCIENCES	L	T	P	C
							3	0	2	4

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Computer Science and Engineering*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Think and evolve with a logic to construct an algorithm and pseudocode that can be converted into a program*
CLR-2 :	*Utilize the appropriate operators and control statements to solve engineering problems*
CLR-3 :	*Store and retrieve data in a single and multidimensional array*
CLR-4 :	*Create custom designed functions to perform repetitive tasks in any application*
CLR-5 :	*Create basic Abstract Data Types with python*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Solve problems through computer programming. Express the basic data types and variables in C*	2	3	-	-	-	-	-	-	-	-	-	2
CO-2:	*Use appropriate data types in simple data processing applications. To create programs using the concept of arrays.*	2	3	-	-	-	-	-	-	-	-	-	2
CO-3:	*Create string processing applications with single and multi-dimensional arrays.*	2	3	-	-	-	-	-	-	-	-	-	2
CO-4:	*Create user defined functions with required operations. To implement pointers in applications with dynamic memory requirements.*	2	3	-	-	-	-	-	-	-	-	-	2
CO-5:	*Create programs using the python data types, loops, control statements for problem solving*	2	3	-	-	-	-	-	-	-	-	-	2

Unit-1 :	**15 Hour**
Evolution of Programming & Languages - Problem solving through programming - Writing algorithms & Pseudo code - Single line and multiline comments - Introduction to C: Structure of the C program - Input and output statements. Variables and identifiers, Constants, Keywords - Values, Names, Scope, Binding, Storage Classes - Numeric Data types: integer, floating point Non-Numeric Data types: char and string - L value and R value in expression, Increment and decrement operator - Comma, Arrow and Assignment operator, Bitwise and Size-of operator - Arithmetic, Relational and logical Operators - Condition Operators, Operator Precedence - Expressions with pre / post increment operator	
Unit-2 :	**15 Hour**
Conditional Control -Statements :Simple if, if...else - Conditional Statements : else if and nested if - Conditional Statements : Switch case - Un-conditional Control Statements : break, continue, goto - Looping Control Statements: for, while, do.while - Looping Control Statements: nested for, nested while - Introduction to Arrays -One Dimensional (1D) Array Declaration and initialization - Accessing, Indexing and operations with 1D Arrays - Array Programs – 1D - Initializing and Accessing 2D Array, Array Programs – 2D - Pointer and address-of operators -Pointer Declaration and dereferencing, Void Pointers, Null pointers Pointer based Array manipulation	
Unit-3:	**15 Hour**
String Basics - String Declaration and Initialization - String Functions: gets(), puts(), getchar(),putchar(), printf() - Built-inString Functions: atoi, strlen, strcat, strcmp -String Functions: sprint, sscanf, strrev, strcpy, strstr, strtok - Operations on Strings - Function prototype declaration, function definition - Actual and formal parameters - Function with and without Arguments - Function with and without return values - Call by Value, Call by Reference - Passing Array to Function - Passing Array elements to Function - Function Pointers.	
Unit-4 :	**15 Hour**
Python: Introduction to Python - Introduction to Google Colab - Basic Data Types: Integers, Floating Points, Boolean types - Working with String functions - Working with Input, Output functions - Python-Single and Multi line Comments/ Error Handling - Conditional & Looping Statements : If, for, while statements - Working with List structures - Working with Tuples data structures - Working with Sets - Working with Dictionaries - Introduction to Python Libraries - Introduction to Numpy - High Dimensional Arrays	
Unit-5:	**15 Hour**
Creating NumPy Array -Numpy Indexing - Numpy Array attributes - Slicing using Numpy - Descriptive Statistics in Numpy: Percentile - Variance in Numpy -Introduction to Pandas - Creating Series Objects, Data Frame Objects - Simple Operations with Data frames - Querying from Data Frames -Applying Functions to Data frames - Comparison between Numpy and Pandas - Speed Testing between Numpy and Pandas - Other Python Libraries	

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* *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*

Learning Resources	1. *Programming in C, E.Balagurusamy,Mc Graw Hill, Eighth Edition.2019. [chapters 1 to 6 & 8 To 11]* 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. [Chapters 1 to 7]*	5. *https://www.tutorialspoint.com/cprogramming/index.htm* *6. https://www.geeksforgeeks.org/c-programming-language/* *7. Python Datascience Handbook, Oreilly,Jake VanderPlas, 2017.[Chapters 2 &3]* *8. Python For Beginners, Timothy C.Needham,2019. [Chapters 1 to 4]* *9. https://www.tutorialspoint.com/python/index.htm* *10. https://www.w3schools.com/python/*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (45%)		*Life Long Learning CLA-2 –Practice (15%)*			
		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%*	-	-	*15%*	*15%*	-
Level 6	*Create*	*10%*	-	-	*15%*	*15%*	-
	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. 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	ELECTRICAL AND ELECTRONICS ENGINEERING	Course Category	S	ENGINEERING SCIENCES	L	T	P	C
							3	1	0	4

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Electrical and Electronics Engineering*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Outline the concepts and theorem of DC and AC electric circuits*
CLR-2 :	*Gain knowledge on analog and digital electronics*
CLR-3 :	*Familiarize the concept of DC / AC machines and drives*
CLR-4 :	*Illustrate the working of different sensors and transducers*
CLR-5 :	*Acquire the knowledge on Power Engineering*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Examine the fundamentals of DC and AC electric circuits*	*3*	*2*	-	-	-	-	-	-	-	-	-	-
CO-2:	*Apply the analog and digital electronics to real time problem*	*3*	*2*	-	-	-	-	-	-	-	-	-	-
CO-3:	*Describe the working principle of machines and interpret its application to drives*	*3*	-	-	-	-	-	-	-	-	-	-	-
CO-4:	*Summarize the working of various sensors and transducers*	*3*	-	-	-	-	-	-	-	-	-	-	-
CO-5:	*Disseminate the latest trends in power engineering and its application to electric vehicle*	*3*	-	-	-	-	-	-	-	-	-	-	-

Unit-1: Electric Circuits **12 Hour**

Introduction to basic terminologies in DC circuit, Kirchhoff's Current law, Kirchhoff's21EE Voltage law, Mesh Current Analysis, Nodal Voltage Analysis, Thevenin's Theorem, Maximum power transfer Theorem, Superposition Theorem.
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 **12 Hour**

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, Karnaugh 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 **12 Hour**

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

Unit-4 : Transducers and Sensors **12 Hour**

Basic principles and classification of Instruments- Moving Coil instruments, Moving Iron instruments, Digital Multimeter, Digital storage Oscilloscope.
Transducer- Classification- Capacitive and Inductive transducers, Linear Variable Differential Transformer (LVDT), Thermistors, Thermocouple, Piezoelectric transducer, Photoelectric transducer, Hall effect transducers. Introduction to Opto-electronics Devices, Light Dependent Resistor (LDR), Photodiodes, Phototransistors, Photovoltaic cells (solar cells), Optocouplers, Liquid crystal display, Proximity sensor, IR sensor, Pressure sensor, Introduction to Bio sensor, Sensors for smart building.

Practice on capacitive and inductive transducer, thermistor and LVDT using virtual lab
Unit-5: Power Engineering **12 Hour**
Electrical supply system- simple layout of Generation, transmission and Distribution of power, Typical AC and DC power supply schemes, overview on substation equipment with key diagram of 11kV/400 V indoor substation- Introduction to smart grid. *Safety Measures in Electrical systems- Basic Principle and importance of Earthing- precautions for Electric shock- safety devices.* *Introduction to renewable energy resources: Solar Photovoltaic -Introduction to energy storage systems-overview of battery, Fuel cell technologies- HEVs, PHEVs and EVs – EV Charging station* *Practice session on different types of wiring circuits and safety measures*

Learning Resources	1. *Edward Hughes, John Hiley, Keith Brown, Ian McKenzie Smith, Hughes Electrical and Electronics Technology, Pearson Education, 12th ed., 2016* 2. *S. K. Bhattacharya, Basic Electrical and Electronics Engineering, Pearson Education, 2011* 3. *R. Muthusubramanian, S. Salivahanan, Basic Electrical and Electronics Engineering, Tata McGraw-Hill, 2012*	4. *Charles Alexander, Matthew Sadiku, Fundamentals of electrical circuits, McGraw-Hill Education; 5th ed., 2012* 5. *Morris M. Mano, Digital Design, 3rd ed.,Pearson Education, 2011* 6. *Ernest Doebelin, Dhanesh Manik, Measurement systems, Fourth Edition,McGraw Hill, July 2017.*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*30%*	-	*30%*	-	*30%*	-
Level 2	*Understand*	*30%*	-	*30%*	-	*30%*	-
Level 3	*Apply*	*20 %*	-	*20 %*	-	*20 %*	-
Level 4	*Analyze*	*20 %*	-	*20 %*	-	*20 %*	-
Level 5	*Evaluate*	-	-	-	-	-	-
Level 6	*Create*	-	-	-	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

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*

Course Code	21MES101L	Course Name	BASIC CIVIL AND MECHANICAL WORKSHOP	Course Category	S	ENGINEERING SCIENCES	L	T	P	C
							0	0	4	2

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Civil and Mechanical Engineering*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Practice machining and glass cutting shop floor trade*
CLR-2 :	*Practice arc & gas welding, and fitting and make new assemblies according to various dimensions and tolerances*
CLR-3 :	*Practice basic carpentry joints and sheet metal shop floor practices.*
CLR-4 :	*Practice casting, moulding, & smithy trades*
CLR-5 :	*Practice and make G.I & P.V.C. plumbing trade*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Machine in a lathe. Drill using drilling machines. Cut glass. Create new components according to specifications*	*3*	-	-	-	*1*	-	*3*	-	-	-	-	*2*
CO-2:	*Weld joints using arc & gas welding. Fit pipes and fixtures. Make new assembly for given dimensions, and tolerances*	*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*	-	-	-	*1*	-	*3*	-	-	-	-	*2*
CO-4:	*Practice casting, moulding, & smithy trades*	*3*	-	-	-	*1*	-	*3*	-	-	-	-	*2*
CO-5:	*Make G.I & P.V.C pipe line connections used in the plumbing trade*	*3*	-	-	-	*1*	-	*3*	-	-	-	-	*2*

Unit-1 : Machining Process **12 Hour**

Machining, Drilling, Tapping, Glass cutting - Machining: Basics of Machining Processes Equipment's - Tools and demonstration of machining to produce models - Simple turning of cylindrical surface on MS rod using lathe machine tool - Simple turning of cylindrical surface on MS rod using lathe machine tool - Basics of drilling and tapping processes, Equipment's, tools - Demonstration of drilling and tapping to produce models. - Generate hole on a metal piece - Generate internal thread on a metal piece. Basics of Glass cutting processes, - Equipment's.- Tools and demonstration of producing models - Make glass panels for boxes

Unit-2 : Metal Joining Process **12 Hour**

Welding (Arc and Gas) and fitting - Basics of Metal Arc welding operations, Equipment's - Tools and demonstration of producing models - Butt joint of two metal plates using arc welding process - Lap joint of two metal plates overlapping on one another using arc welding process. - Basics of gas welding operations, Equipment's, - Tools and demonstration of producing models - MIG welding of metal plates - TIG welding of metal plates - Basics of fitting practice, tools and method - of producing models - Tools and demonstration of producing models - Step fitting of two metal plates using fitting tools

Unit-3: Carpentry and Sheet metal **12 Hour**

Basics of Carpentry operations, Equipment's - Tools and demonstration of producing models - Cross halving joint of two wooden pieces at perpendicular direction - To make duster from wooden piece using carpentry tools.- Basics of Sheet metal operations, Equipment's - Tools and demonstration of producing sheet metal models - To make Rectangular shaped tray using GI sheet - To make bigger size scoop using GI sheet. - Basics of different geometrical shapes in Sheet metal operations - Equipment's, tools and demonstration of producing models - To make geometrical shape like frustum, Cone and Prism using G.I sheet

Unit-4 : Foundry and Smithy **12 Hour**

Casting, moulding and smithy - Basics of Casting, processes, Equipment's - Tools and demonstration of producing models - To make the mould using stepped flange - To make the mould using stepped flange - Basics of injection moulding and processes, Equipment's, - Tools and demonstration of producing models - To make plastic models using injection moulding of simple part - To make plastic models using injection moulding of simple part - Basics of Smithy processes, Equipment's, - Tools and demonstration of producing models - To forge chisel from MS rod using black smithy

Unit-5: Plumbing **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 bathroom/ kitchen fittings using 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/ kitchen fittings using P.V.C. fittings - Basics of Plumbing practices for G.I pipe - lines and fittings for pumps and machines - Equipment's, tools and demonstration of producing models. - Plumbing of pipe lines and fitting for Pumps using G.I fittings

Learning Resources	1. *Jeyachandran K., Natarajan S. & Balasubramanian S., A Primer on Engineering Practices Laboratory, Anuradha Publications, 2007* 2. *Jeyapoovan T., Saravanapandian M. & Pranitha S., Engineering Practices Lab Manual, Vikas Publishing House Pvt.Ltd, 2006.* 3. *Bawa H.S., Workshop Practice, Tata McGraw, 2007.* 4. *Rajendra Prasad A. & Sarma P.M.M.S., Workshop Practice, Sree Sai Publication, 2002.*	5. *Kannaiah P. & Narayana K.L., Manual on Workshop Practice, Scitech Publications, 1999.* 6. *Hajra Choudhury S.K., Hajra Choudhury A.K., Nirjhar Roy S.K., Elements of Workshop Technology, Vol.I & Vol.II 2010, Media promoters and publishers private limited, Mumbai.* 7. *Rao P.N., Manufacturing Technology, Vol. I & Vol. II, Tata McGrawHill,2017.* 8. *Gopal T.V, Kumar. T, Murali. G, A first course on workshop practice – Theory, Practice and Work Book, Suma Publications, Chennai, 2005.*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*						*Summative Final Examination (0% weightage)*	
		CLA-1 Average of first cycle experiments (30%)		*CLA-2 Average of second cycle experiments (30%)*		*Practical Examination (40% weightage)*			
		Theory	*Practice*	*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*	-	-	-			-	-	-
	Total	*100 %*		*100 %*		*100%*		*0 %*	

Course Designers		
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	ENGINEERING GRAPHICS AND DESIGN	Course Category	S	ENGINEERING SCIENCES	L	T	P	C
							0	0	4	2

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

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Utilize engineering graphic fundamentals. Apply the same to draw engineering curves and projection of objects.*
CLR-2 :	*Draw the projection of solids like prisms, cylinder, pyramids and cone.*
CLR-3 :	*Model the projection of combined solids, section of solids.*
CLR-4 :	*Create the development of surfaces and construction of building drawing.*
CLR-5 :	*Develop the assemblies of 3D parts and create 2D drawings from the assembly.*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Construct the geometrical curves, projection of points, lines and planes.*	*1*	-	-	-	*3*	-	-	-	-	*3*	-	*2*
CO-2:	*Develop the orthographic projection of solids.*	*2*	-	-	-	*3*	-	-	-	-	*3*	-	*2*
CO-3:	*Construct the projection of combination and section of solids.*	*2*	-	-	-	*3*	-	-	-	-	*3*	-	*2*
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 : Projection **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 - Cycloids, 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 inclined to 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 - Finding 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 **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 - Oblique 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 - Oblique pyramidal solids and projections

Unit-3: Projections of combination of solids **12 Hour**

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 -

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 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 solid with axis perpendicular to one principal planes and cutting plane perpendicular to any one - principle plane true shape of the section - Section of solids with axis inclined to both the planes and cutting plane perpendicular to any one principal plane only. - Sectional plan elevation, and sectional side-view of Building/ dwelling, include - windows, doors, fixtures, etc. - Building/ Dwelling drawing, Terminology, conventions, sectional plan and side-view of Building/ dwelling, include windows, -doors, fixtures, 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 **12 Hour**
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 - 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 - Geometric dimensioning and tolerancing annotations - Generating 2D drawings from 3D models - 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 - Design of real time surface-development Design of real time surface-development - Design of real time surface-development - Design of real time surface-development*
Unit-5: Assembly Modeling and Drawing **12 Hour**
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 - Creation of parametric parts for assembly - non- parametric parts for assembly - Creation of parametric parts for assembly -non- parametric parts for assembly - Creation of parametric parts for assembly - non- parametric parts for assembly - Simple assembly of parts,- associated part and assembly - Simple assembly of parts, - associated part and assembly - Simple assembly of parts, - associated part and assembly - Simple assembly of parts, - associated part and assembly - Simple assembly of parts,-associated part and assembly *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 -Exploded view with assembly annotations part details - Printing assembly drawings - Printing assembly drawings*

Learning Resources	1. *Bhatt, N.D., Engineering Drawing (First Angle Projection),53rd ed., Charotar Publishing House, 2017* 2. *Bethunc, J., Engineering Graphics with AutoCAD 2017, Pearson Education, 2016* 3. *Khristofor Artemyevich Arustamov, Problems in projective geometry, MIR Publishers, Moscow, 1972* 4. *Natarajan, K.V., A Text Book of Engineering Graphics, 21st Edition, Dhanalakshmi Pub., 2012* 5. *Shah. M. B.,Rana, B. C, Engineering Drawing, Pearson Education, Pvt. Ltd., 2005*	6. *Jeyapoovan. T., Engineering Drawing and Graphics using AutoCAD, Vikas Pub. House, 2015* 7. *Narayanan, K. L., Kannaiah, V., Engineering Graphics, Scitech Publications,2010* 8. *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.* 9. *Mohammad Dastbaz, Chris Gorse, Alice Moncaster (eds.), Building Information Modelling, Building Performance, Design and Smart Construction, Springer 2017* *User Manual of Respective CAD Softwares*

Learning Assessment									
	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*						*Summative Final Examination (0% weightage)*	
		CLA-1 Average of first cycle experiments (30%)		*CLA-2 Average of second cycle experiments (30%)*		*Practical Examination (40% weightage)*			
		Theory	*Practice*	*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*	-	-	-			-	-	-
	Total	*100 %*		*100 %*		*100%*		*0 %*	

Course Designers		
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 other than Civil, Mechanical, Automobile, Aerospace and Mechatronics, the entire course would be conducted using CAD Software only.

Course Code	21MES101T	Course Name	ENGINEERING MECHANICS	Course Category	S	ENGINEERING SCIENCES	L	T	P	C
							3	1	0	4

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

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Apply static equilibrium problems in engineering and its applications*
CLR-2 :	*Apply theory of dry friction in Mechanical Engineering applications*
CLR-3 :	*Apply the concept of centroid and moment of inertia in engineering problems and its applications*
CLR-4 :	*Analyze problems on kinematics and kinetics of particles*
CLR-5 :	*Analyze problems on kinematics and kinetics of rigid bodies*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Solve statically determinate equilibrium problems in Engineering*	3	3	-	-	-	-	-	-	-	-	-	-
CO-2:	*Solve problems related to dry friction and analyze trusses*	3	3	-	-	-	-	-	-	-	-	-	-
CO-3:	*Determine centroid and moment of inertia for composite objects*	3	3	-	-	-	-	-	-	-	-	-	-
CO-4:	*Perform kinematic analysis of particles with rectilinear, curvilinear motions and solve dynamic equilibrium problems in particles*	3	3	-	-	-	-	-	-	-	-	-	-
CO-5:	*Perform kinematic analysis of rigid bodies with translation, rotation, general plane motion and solve dynamic equilibrium problems in rigid bodies*	3	3	-	-	-	-	-	-	-	-	-	-

Unit-1 : Statics of Particles and Rigid Bodies	**12 Hour**
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, Varignon'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	**12 Hour**
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	**12 Hour**
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	**12 Hour**
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- Oblique central impact.	
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 velocity 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	*1. Ferdinand.P. Beer. E, Russell Johnston Jr., David Mazurek, Philip J Cornwell, Vector Mechanics for Engineers: Statics and Dynamics, McGraw - Hill, 10th ed., 2013* *2. Meriam J.L and Kraige L.G., Engineering Mechanics, Volume I - statics, Volume II - dynamics, John Wiley & Sons, 7th ed., 2012*	*3. Russel C Hibler, Engineering Mechanics: Statics, Dynamics, Pearson,14th ed., 2015* *4. Shames.I.H, Krishna Mohana Rao.G, Engineering Mechanics (Statics and Dynamics), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), 4th ed., 2006* *5. Timoshenko, Young, Engineering Mechanics, Tata Mc-Graw Hill, 5th ed., 2013*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 (10%)*			
		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*	-	-	-	-	-	-
	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 Name	APPLIED ENGINEERING MECHANICS	Course Category	S	ENGINEERING SCIENCES	L	T	P	C
							3	0	0	3

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

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Apply the concept of static equilibrium of particles and rigid bodies.*
CLR-2 :	*Apply the concept of centroid and moment of inertia about different axes on static structures*
CLR-3 :	*Apply the concept of the dynamics of particles*
CLR-4 :	*Apply the concept of the dynamics of rigid bodies.*
CLR-5 :	*Solve problems related to space mechanics.*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Determine the forces under static equilibrium*	3	2	-	-	-	-	-	-	-	-	-	*1*
CO-2:	*Calculate the centroids and determine moment of inertia*	3	3	-	-	-	-	-	-	-	-	-	*1*
CO-3:	*Determine the forces acting on particle for kinetics and kinematics*	3	2	-	-	-	-	-	-	-	-	-	*1*
CO-4:	*Determine the forces acting on rigid body for kinetics and kinematics*	3	2	-	-	-	-	-	-	-	-	-	*1*
CO-5:	*Solve the problems of orbital mechanics and projectile motions*	3	3	-	-	-	-	-	-	-	-	-	*1*

Unit-1: Statics of Particles	**9 Hour**
Fundamentals of mechanics - Forces on particles - Resolution and Resultant of forces - Principle of Transmissibility - Forces in space - Moment of force - Varignon's theorem - Equivalent system of forces -Free body diagram - Types of supports and Equilibrium of rigid bodies in two dimensions – Statically determinate and indeterminate structures.	
Unit-2 : Properties of Surfaces and Volumes	**9 Hour**
Determination of centroids by integration - centroids of lines, areas and volumes - Determination of moment of inertia by integration, Parallel and Perpendicular axis theorems - Polar moment of inertia - Mass moment of inertia..	
Unit-3: Dynamics of Particles	**9 Hour**
Rectilinear motion: Uniform motion and Uniformly accelerated motion - Rectangular components of velocity. Curvilinear Motion-Normal and tangential components - Radial and transverse components. Cylindrical coordinates, Newton's second law – D' Alembert's principle - Principle of work and energy, principle of impulse and momentum.	
Unit-4 : Dynamics of Rigid bodies	**9 Hour**
Kinematics of rigid bodies: Fixed axis rotation - General plane Motion-Absolute and Relative velocity in plane motion - Instantaneous center of rotation in plane motion - Principle of work and energy, Principle of impulse and momentum for the plane motion of a rigid body	
Unit-5: Applications in Space Mechanics	**9 Hour**
Angular momentum of a particle- Rate Of change of angular momentum - Newton's Law of Gravitation – Kepler's Law of motion - Conservation of angular momentum, conservation of energy, Space Mechanics – Central Force Motion, Trajectory of a particle under a central force: Application to space mechanics	

Learning Resources	*1. Ferdinand P. Beer, E. Russell Johnston Jr., David Mazurek, Philip J Cornwell, "Vector Mechanics for Engineers: Statics and Dynamics" , McGraw - Hill, New Delhi, Tenth Edition, 2013.* *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/'*

Learning Assessment							
	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*20 %*	-	*20 %*	-	*20 %*	-
Level 2	*Understand*	*20%*	-	*20%*	-	*20%*	-
Level 3	*Apply*	*60 %*	-	*60 %*	-	*60 %*	-
Level 4	*Analyze*	-	-	-	-	-	-
Level 5	*Evaluate*	-	-	-	-	-	-
Level 6	*Create*	-	-	-	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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.Iynthezhuthon, SRMIST*

Course Code	21AUS101L	Course Name	ARTIFACT DISSECTION LABORATORY	Course Category	S	ENGINEERING SCIENCES	L	T	P	C
							0	0	2	1

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

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Identify the commonly used tools in a household and its usages.*
CLR-2 :	*Identify the parts in a given machine.*
CLR-3 :	*Investigate the functions of the component*
CLR-4 :	*Develop the ability to dismantle study and assemble the given machine.*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Describe the functions of the commonly used tools in a household and its usages.*	*3*	*3*	-	-	-	-	-	-	-	-	-	*3*
CO-2:	*Illustrate the procedure for dismantling the given machine*	*3*	*3*	-	-	-	-	-	-	-	-	-	*3*
CO-3:	*Examine the components for failure*	*2*	*3*	-	-	-	-	-	-	-	-	-	*3*
CO-4:	*Demonstrate the procedure for given machine*	*3*	*3*	-	-	-	-	-	-	-	-	-	*3*

Practice 1: Study of common tools and special tools
Practice 2: Dismantle the bicycle, study of working parts and Assemble the given bicycle
Practice 3: Dismantle Study and Assemble the given Sewing Machine
Practice 4: Dismantle Study and Assemble the given Drilling Machine
Practice 5: Dismantle Study and Assemble the given two stroke engine
Practice 6: Dismantle Study and Assemble the kick starter mechanism of the given two stroke engine
Practice 7: Dismantle Study and Assemble the given wet grinding machine.
Practice 8: Dismantle Study and Assemble the given mixer grinding machine.
Practice 9: Dismantle Study and Assemble the given washing machine
Practice 10: Dismantle Study and Assemble the given Ceiling fan

Learning Resources	*1. V. Ganesan, Internal Combustion Engines, Tata McGraw-Hill Education. 2004.* *2. Karen E. Kunkel "The Complete Sewing Machine Handbook " Sterling, 1999*	*3. B. L. Theraja "Fundamentals of Electrical Engineering and Electronics", S. Chand, 1997* *4. Bosch service manual for corded drills*

Learning Assessment									
	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*						*Final Examination (0% weightage)*	
		CLA-1 Average of first cycle experiments (30%)		*CLA-2 Average of second cycle experiments (30%)*		*Practical Examination (40% weightage)*			
		Theory	*Practice*	*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*	-	-	-			-	-	-
	Total	*100 %*		*100 %*		*100%*		*0 %*	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Ramakrishnan Ekambaram, Robert Bosch, 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	Course Name	FOUNDATION OF DATA ANALYSIS	Course Category	S	ENGINEERING SCIENCES	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Artificial Intelligence*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Introduce a range of topics and concepts related to data and data analysis process.*
CLR-2 :	*Understand the basic data structures involved in python to perform exploratory data analysis*
CLR-3 :	*Apply EDA for different file formats.*
CLR-4 :	*Understands data visualization using python*
CLR-5 :	*Provides an exposure to basic machine learning techniques to solve real world problems*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Understand different types of data and starts working in python environment*	*3*	*2*	*1*	-	-	-	-	-	-	-	-	*3*
CO-2:	*Understand various data structures involved in python and perform exploratory data analysis*	*3*	*2*	*1*	-	-	-	-	-	-	-	-	*3*
CO-3:	*Apply the concepts of EDA in various datasets.*	-	*2*	-	-	-	*3*	*1*	-	-	-	-	*3*
CO-4:	*Formulate and use appropriate visualization techniques for their data*	*2*	*2*	*1*	-	-	-	-	-	-	-	-	*3*
CO-5:	*Formulate and use appropriate models of data analysis to solve hidden solutions to business-related challenges*	-	-	-	*2*	-	*3*	*3*	-	-	-	-	*3*

Unit-1 : **12 Hour**

An Introduction to Data Analysis - Data Analysis - Knowledge domains of Data Analyst: Computer Science, Mathematics, and statistics - Machine Learning & AI, Professional fields of Application - Introduction to Data - Understanding the nature of Data - Data – Information; Information – Knowledge - Types of Data - Data Analysis Process - Quantitative Data Analysis - Qualitative Data Analysis - Python – The Programming Language - Python 2 and Python 3 - Python Package Index - IDEs for python - Scipy: Numpy- Pandas, Matplotlib

Unit-2 : **12 Hour**

Numpy Library: Numpy Installation - Ndarray, Create an array and Types of data - Basic Operations: Arithmetic Operators, Matrix Product, Increment and Decrement Operators - Universal Functions, Aggregate Functions - Indexing, slicing and iterating - Conditions and Boolean arrays - Shape and array manipulation - Vectorization, structured arrays - Pandas library: Installation - Introduction to Pandas data structures - Other functionalities on indexes - Operations between data structures - Function application and mapping - Sorting and ranking - Correlation and covariance - "Not a number" Data - Hierarchical Indexing and leveling

Unit-3: **12 Hour**

String Pandas: Reading data from csv, xml, text and html files - Writing data in CSV, Html, Excel, files - Json data - HDF5 format - Data preparation – Concatenating - Data transformation- Removing duplicates – Mapping - Discretization and binning: Detecting and filtering outliers - Permutation – random sampling - String manipulation - Regular expressions - Data Aggregation- Group by - Hierarchical grouping - Advanced data aggregation - Case study on data preprocessing

Unit-4 : **12 Hour**

Data visualization with matplotlib library - Matplotlib – Installation and architecture - Pyplot, plotting window - Using Kwargs and adding elements to the chart - Saving charts - Handling data values - Line charts - Bar charts – Histograms - Pie charts - Contour plots - Polar charts - Mplot 3D toolkit: 3D surfaces - Scatter plots and bar charts in 3D - Multi-panel plot

Unit-5: **12 Hour**

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 *4. Numpy: Reading and writing array data on files (binary files and tabular data)* *5. Implementation of Pandas data structures* *6. 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 Data Analytics with Pandas, Numpy and matplotlib (Second edition), Apress 2021.* *2. Wes McKinney, Python for Data Analysis, 2nd Edition, O'Reilly Media, Inc. , 2012 (https://learning.oreilly.com/library/view/python-for-data/9781491957653/)*	

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (45%)		*Life Long Learning CLA-2 –Practice (15%)*			
		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%*	*-*	*-*	*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*

ACADEMIC CURRICULA

Professional Core Courses (C)

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	21BTC101T	Course Name	BIOCHEMISTRY	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Biotechnology*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Explain the structure and functions of biomolecules*
CLR-2 :	*Define the metabolism, bioenergetics and photosynthesis*
CLR-3 :	*Explain the carbohydrate metabolism and hormonal regulation*
CLR-4 :	*Acquire knowledge of the metabolism of proteins and amino acids*
CLR-5 :	*Explain mechanism of lipid metabolism and associated hormones*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Describe the structure and functions of biomolecules*	*3*	-	-	*3*	-	-	-	-	-	-	-	-
CO-2:	*Conclude the concepts of metabolism, bioenergetics and photosynthesis*	*3*	-	*3*	-	-	-	-	-	-	-	-	-
CO-3:	*Explain the concepts in metabolism of carbohydrates and hormonal regulation*	*3*	-	-	*3*	*3*	-	-	-	-	-	-	-
CO-4:	*Describe the metabolism of proteins and removal of nitrogen*	*3*	*3*		*3*	-	-	-	-	-	-	-	-
CO-5:	*Summarize the lipid and nucleic acid metabolism*	*3*	*2*	-	-	-	-	-	-	-	-	-	-

Unit-1 : Introduction to Biochemistry	**9 Hour**
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	**9 Hour**
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	**9 Hour**
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	**9 Hour**
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	**9 Hour**
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.	

Learning Resources	*1. JeremyM.Berg,JohnL.Tymoczko,GregoryJ.Gatto,LubertStryer,"Biochemistry",9thEdition,2019* *2. Donald Voet, Judith G.Voet, Charlotte W. Pratt," Fundamentals of Biochemistry: Life at the Molecular Level", 5thEdition, JohnWiley &Sons Inc., 2016*	*3.U.Satyanarayanaand, U.Chakrapani,"Biochemistry",4thEdition,ElsevierIndia,2013.* *4. DavidL.Nelson,MichaelM.Cox,"LehningerPrinciplesofBiochemistry",7th Edition, W.H.Freemen &Co.,2017*

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 (10%)			
		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	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

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	BIOMEDICAL SENSORS	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							2	0	2	3

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

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Describe the basics of measurement system*
CLR-2 :	*Demonstrate the working principles of temperature transducers*
CLR-3 :	*Exemplify the operating principles of pressure transducers*
CLR-4 :	*Elucidate the operation of magnetic sensors*
CLR-5 :	*Compile the principles of optical transducers*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Analyze the performance of a measurement system*	*1*	*1*	-	-	-	-	-	-	-	-	-	*3*
CO-2:	*Develop a system to determine temperature of a medium*	*2*	-	-	*2*	-	-	-	-	-	-	-	*3*
CO-3:	*Implement a system to measure pressure*	*1*	-	*2*	-	-	-	-	-	-	-	-	*3*
CO-4:	*Execute a displacement sensor*	*1*	-	-	-	*2*	-	-	-	-	-	-	*3*
CO-5:	*Propose an optical transducer system to determine various measurand*	*1*	*1*	-	-	-	-	-	-	-	-	-	*3*

Unit-1 : Measurement System **12 Hour**

Measurement system- Functional elements of an Instrument - Measurement terminologies- - Classification of Instruments- types of Instruments, Instruments used to display electrical parameters, Advantages of Electronic Instrument, Functional elements of a Medical Instrument, salient features of Medical Instruments.

Practice:

1. *Study about the functional block of Measurement system.*
2. *Measurement of voltage using analog and digital Voltmeters.*
3. *Measurement of current using analog and digital Ammeters.*

Unit-2 : Temperature Transducers **12 Hour**

Transducers- Block diagram- Types- RTD- Construction and operating principles, Applications - Thermistor- Construction and operating principles- Characteristics- Applications- - Thermocouple- Construction and operating principles- Characteristics- Applications.

Practice:

1. *Characteristics of RTD,*
2. *Characteristics of thermistor*
3. *Characteristics of thermocouple*

Unit-3: Pressure and Magnetic Transducers **12 Hour**

Strain Gauge: Principles, Construction and Working, Load cell: Construction and Working, Capacitive transducer- Construction and Working, Piezoelectric transducer: Construction and Working, LVDT- Construction and Working.

Practice:

1. *Characteristics of – LVDT.*
2. *Characteristics of Strain gauge.*
3. *Characteristics of Piezoelectric transducer.*

Unit-4 : Optical Transducers	**12 Hour**
Photodiodes- Working principles- phototransistor- Working principles- LDR- Working principles, Photovoltaic cell- Working principles, Characteristics of Photodiode. *Practice:* *1. Characteristics of LDR* *2. Characteristics of Phototransistor.*	
Unit-5: Medical Applications Of Sensors	**12 Hour**
Pulse oximetry- Working principle, Applications, Heart rate sensor- Construction and Working principle, Blood pressure sensor- Working principle, IR sensors- Working principle and Applications, *Practice:* *1. Study of Pulse oximeter.* *2. Measurement of Heart rate.* *3. Measurement of Blood pressure*	

Learning Resources	*1. Sawhney A.K, "A Course in electrical and electronic measurements and instrumentation", Dhanpat Rai & Co (P) Ltd, Educational and Technical Publishers, 19th Revised edition 2011, Reprint 2014.* *2. Patranabis D, "Sensors and transducers", PHI, 2nd edition, 2004* *3. Murty DVS, "Transducer and instrumentation", PHI, 2nd edition, 2010.*	*4. U.A. Bakshi, A.V. Bakshi, "Measurements and instrumentation", Technical Publications, 3rd revised edition, 2010* *5. Paras N, Prasad, "Introduction to biophotonics", John Wiley & Sons, 1st edition, 2003*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (45%)		*Life Long Learning CLA-2 –Practice (15%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*20%*	-	-	20%	20%	-
Level 2	*Understand*	*20%*	-	-	-	20%	-
Level 3	*Apply*	*30%*	-	-	40%	20%	-
Level 4	*Analyze*	*30%*	-	-	-	20%	-
Level 5	*Evaluate*	-	-	-	40%	10%	-
Level 6	*Create*	-	-	-	-	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 MATERIALS IN THE BUILT ENVIRONMENT	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							3	0	0	3

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

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Study different materials used in civil engineering structures.*
CLR-2 :	*Understand the building finishing materials, application of ferro cement and insulating materials.*
CLR-3 :	*Learn the masonry building, transport and termite treatment.*
CLR-4 :	*Know the various ecofriendly building materials.*
CLR-5 :	*Explore energy efficient buildings and cost-effective construction techniques.*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Apply the acquired knowledge on building materials and products for construction.*	3	-	-	-	-	-	3	-	-	-	-	-
CO-2:	*Identify various building finishing materials and ferro cement applications for the building construction.*	3	--	-	-	-	2	-	-	-	-	-	-
CO-3:	*Apply the knowledge on the masonry, building transport and the termite treatment.*	3	-	-	-	2	-	-	-	-	-	-	-
CO-4:	*Disseminate the knowledge on various eco friendly building materials*	3	--	-	-	-	3	-	-	-	-	-	-
CO-5:	*Recognize the energy efficient buildings and cost-effective construction techniques*	3	--	-	-	-	-	3	-	-	-	-	-

Unit-1 : Building Materials	**9 Hour**
Introduction to Civil Engineering and Civil Engineering materials - Composition, classifications, properties and uses of stones - Classification of rocks, quarrying, dressing, properties and uses - Properties and uses of timber and plywood - Types, properties and uses of cement and lime, Types of steel, mild, medium and hard, properties of floor and wall tiles and thermal insulating materials.	
Unit-2 : Finishing and Protective Materials	**9 Hour**
Finishing Materials: Glass, Aluminium, Plastics, Paints, Varnishes, Distemper - Waterproofing - Damp Proofing Materials - Ferrocement and its application - Sound insulation - materials and methods – Fire proof materials – Fire alarms.	
Unit-3: Components of Building and Treatment	**9 Hour**
Partition wall and Cavity wall - Composite masonry – Doors – Windows – Ventilators – Stairs – Lift – Ramps – Escalators - Anti termite treatment	
Unit-4 : Eco-Friendly Materials	**9 Hour**
Construction materials: Locally available building materials - Soil, Fly ash, Ferrocement, Lime, Fibres, Stone dust, Red mud, Gypsum, Alternate Wood, Polymer-ADOBE, Cob and Rammed earth, Light clay, Straw-Bale, Bamboo, Agro-Industrial waste, Structural properties of alternate building materials, Composite materials, Artificial aggregates substitutes for natural conservation.	
Unit-5: Modern Techniques	**9 Hour**
Introduction to Green Buildings- Definition, Importance - Building envelope - Problems in existing buildings - Energy use in buildings - Principle of energy efficient building - Greenhouse gas emissions and indoor air pollution - Green construction materials - Ventilation and air conditioning - Green building assessment system – Cost-effective construction techniques.	

Learning Resources	*1. Punmia. B.C., Ashok Kumar Jain, Arun Kumar Jain, Building Construction, Laxmi Publishing (P).Ltd., New Delhi-2, 2012.* *2. Bhavikatti.S.S., Building Materials, Vikas Publishing House.Pvt. Ltd., New Delhi, 2012.* *3. Rangwala .S.C," Engineering Material"s, Charotar Publishing House, Anand, 2012.*	*4. K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and Technologies. New Age International, 2007.* *5. Energy Conservation Building Code, 2017, Bureau of Energy Efficiency, Ministry of Power, Government of India.*

Learning Assessment							
	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 (10%)*			
		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*	-	-	-	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

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. 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*

Course Code	21CHC101J	Course Name	PHYSICAL AND ANALYTICAL CHEMISTRY	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							3	0	2	4

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

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Describe the ideal and non-ideal behavior of liquids; learn colligative properties and their applications*
CLR-2 :	*Explain the concepts of chemical equilibrium and the effect of various factors on equilibrium constant*
CLR-3 :	*Compare the difference in behavior of different states of matter essential for separation operations*
CLR-4 :	*Describe the properties and applications of colloids; Understand the kinetics of photochemical reactions*
CLR-5 :	*Explain the principles of analytical instruments along with their limitations*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Analyze ideal and non-ideal behavior of fluids and define the colligative properties*	*3*	-	-	*1*	-	-	-	-	-	-	-	-
CO-2:	*Evaluate the significance of Gibbs' free energy and equilibrium constants*	*3*	*2*	-	-	-	-	-	-	-	-	-	-
CO-3:	*Apply Gibbs' phase rule and draw the phase diagram of one- and three-component systems*	*3*	-	*1*	-	-	-	-	-	-	-	-	-
CO-4:	*Analyze the properties of colloids and photochemical reactions*	*2*	-	-	*3*	-	-	-	-	-	-	-	-
CO-5:	*Implement the appropriate analytical technique for various types of chemical compounds*	*2*	-	-	*3*	-	-	-	-	-	-	-	-

Unit-1 : Properties of Solutions **15 Hour**

Introduction to solutions, Raoult's law-Vapour pressures of ideal and non-ideal solutions - Deviations from ideality of Type I, Type II and Type III solutions - Completely miscible binary solutions: Vapor pressure-Composition and Boiling point-Composition curves of Type I, 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 **15 Hour**

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 **15 Hour**

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, CO_2 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

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	**15 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	**15 Hour**
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 *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	*1.B. R. Puri, L. R. Sharma and Madan S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 47th Ed, 2015* *2. Arun Bahl, B. S. Bahl, and G. D. Tuli, Essentials of Physical Chemistry, S. Chand & Company Ltd., 2009.*	*3. Douglas A. Skoog , F. James Holler, and Timothy A. Nieman. "Principles of Instrumental Analysis, Thomson Learning Inc., Toronto, 1998*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (45%)		*Life Long Learning CLA-2 –Practice (15%)*			
		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*	-	-	-	-	-	-
	Total	*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 DESIGN AND PROGRAMMING	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							2	1	0	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Computer Science and Engineering*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Programs using object-oriented approach and design methodologies for real-time application development*
CLR-2 :	*Method overloading and operator overloading for real-time application development programs*
CLR-3 :	*Inline, friend and virtual functions and create application development programs*
CLR-4 :	*Exceptional handling and collections for real-time object-oriented programming applications*
CLR-5 :	*Model the System using Unified Modelling approach using different diagrams*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Create programs using object-oriented approach and design methodologies*	-	2	2	-	2	-	-	-	-	-	-	3
CO-2:	*Construct programs using method overloading and operator overloading*	-	2	2	-	2	-	-	-	-	-	-	3
CO-3:	*Create programs using inline, friend and virtual functions, construct programs using standard templates*	-	2	2	-	2	-	-	-	-	-	-	3
CO-4:	*Construct programs using exceptional handling and collections*	-	2	2	-	2	-	-	-	-	-	-	3
CO-5:	*Create Models of the system using UML Diagrams*	-	2	2	-	2	-	-	-	-	-	-	3

Unit-1 : Introduction to OOPS	**9 Hour**
Object-Oriented Programming - Features of C++ - I/O Operations, Data Types, Variables-Static, Constants-Pointers-Type Conversions – Conditional and looping statements – Arrays - C++ 11 features - Class and Objects, Abstraction and Encapsulation, Access Specifiers, Methods- UML Diagrams Introduction – Use Case Diagram - Class Diagram.	
Unit-2 : Methods and Polymorphism	**9 Hour**
Constructors- Types of constructors - Static constructor and Copy constructor -Destructor - Polymorphism: Constructor overloading - Method Overloading Operator Overloading - UML Interaction Diagrams -Sequence Diagram - Collaboration Diagram - Example Diagram	
Unit-3: Inheritance	**9 Hour**
Inheritance – Types -Single and Multiple Inheritance - Multilevel Inheritance - Hierarchical Inheritance - Hybrid Inheritance - Advanced Functions - Inline, Friend- Virtual - Pure Virtual function - Abstract class - UML State Chart Diagram - UML Activity Diagram	
Unit-4 : Generic Programming	**9 Hour**
Generic - Templates - Function templates - Class Templates - Exceptional Handling: try and catch - Multilevel exceptional - throw and throws - finally - User defined exceptional - Dynamic Modeling: Package Diagram - UML Component Diagram - UML Deployment Diagram	
Unit-5: Standard Template Library	**9 Hour**
STL: Containers: Sequence and Associative Container - Sequence Container: Vector, List, Deque, Array, Stack - Associative Containers: Map, Multimap - Iterator and Specialized iterator - Functions of iterator - Algorithms: find(), count(), sort() - Algorithms: search(), merge(), for_each(), transform()	

Learning Resources	*1.Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Object-Oriented Analysis and Design with Applications, 3rd ed., Addison-Wesley, May 2007* *2. Reema Thareja, Object Oriented Programming with C++, 1st ed., Oxford University Press, 2015* *3. Sourav Sahay, Object Oriented Programming with C++, 2nd ed., Oxford University Press, 2017*	*4. Robert Lafore, Object-Oriented Programming in C++, 4th ed., SAMS Publishing, 2008* *5. Ali Bahrami, Object Oriented Systems Development", McGraw Hill, 2004* *6. Craig Larmen, Applying UML and Patterns, 3rd ed., Prentice Hall, 2004*

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 – (10%)			
		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	-	-	-	-	-	-
	Total	100 %		100 %		100 %	

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

Course Code	21EEC101J	Course Name	ELECTRIC CIRCUITS	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Electrical and Electronics Engineering*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Solve real-time DC circuits using mesh, nodal analysis and network reduction*
CLR-2 :	*Explain the solution to AC circuits including series and parallel resonance*
CLR-3 :	*Understand network theorems and apply them to DC and AC circuits*
CLR-4 :	*Study the circuits at transient condition and analyze the coupled circuits*
CLR-5 :	*Examine three phase circuits and two port networks*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Analyze problems on DC circuits using mesh and nodal analysis*	*3*	*3*	-	-	-	-	-	-	*2*	-	-	-
CO-2:	*Solve AC circuits including series and parallel resonance*	*3*	*3*	-	-	-	-	-	-	*2*	-	-	-
CO-3:	*Apply network theorems to analyze DC and AC circuits*	*3*	*3*	-	-	-	-	-	-	*2*	-	-	-
CO-4:	*Examine DC and AC circuits under transient conditions*	*3*	*3*	-	-	-	-	-	-	*2*	-	-	-
CO-5:	*Analyze three phase circuits and two port networks*	*3*	*3*	-	-	-	-	-	-	*2*	-	-	-

Unit-1 : DC Circuits	**12 Hour**
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. *Practice: Practice on mesh analysis and nodal analysis-Simulation and hardware*	
Unit-2 : AC Circuits	**12 Hour**
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. *Practice: Practice on RL, RC, RLC series and parallel circuits -Simulation and hardware*	
Unit-3: Network Theorems	**12 Hour**
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. *Practice: Practice on theorems-Simulation and hardware*	
Unit-4 : Transient Analysis and Coupled circuits	**12 Hour**
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. *Practice: Practice on time domain of RL and RC transient circuit - Simulation*	
Unit-5: Three-Phase Circuits and Two Port Networks	**12 Hour**
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. *Practice: Practice on three phase power and power factor measurement for R and RL loads, Determination of hybrid parameters- Simulation and hardware*	

Learning Resources	1. *Sudhakar A, Shyammohan S. Palli, Circuits and Networks: Analysis and Synthesis, 5th ed., McGraw Hill Education I, 2017* 2. *William H. Hayt, Jack E. Kemmerly, Jamie D. Phillips, Steven M. Durbin , Engineering 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/*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (45%)		Life Long Learning CLA-2 –Practice (15%)			
		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	-	-	-	-	-	-
	Total	100 %		100 %		100 %	

Course Designers

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	ELECTRONIC SYSTEM AND PCB DESIGN	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							2	0	2	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Electronics and Communication Engineering	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Explore the basics of semiconductors and semiconductor devices
CLR-2 :	Study of special semiconductor devices and fabrication techniques
CLR-3 :	Identify the applications of devices in circuit and measuring instruments
CLR-4 :	Create insights to the concepts of PCB design and rules
CLR-5 :	Analyze the design concept of PCB design for different applications

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	Understand the properties of semiconductor materials and devices	3	2	-	-	-	-	-	-	-	-	-	-
CO-2:	Analyze working principle and characteristics of special semiconductor devices	3	2	-	-	3	-	-	-	-	-	-	-
CO-3:	Design basic electronic circuits and familiar with working principles of instruments	3	3	1	-	3	-	-	-	-	-	-	-
CO-4:	Apply the concept and rules for PCB design	3	3	-	-	3	-	-	-	-	-	-	-
CO-5:	Implement the design rules for various PCB design applications	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**

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: **12 Hour**

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)

Practice: Schematic and PCB Layout in CAD tool. Regulated power supply design.- Full wave rectifier circuit design with fixed voltage regulator, wave shaping circuits.

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).*

Learning Resources	*1. Simon Sze, Ming-Kwei Lee," Semiconductor Devices, Physics and Technology" 3rd edition, John Wiley & Sons, Inc, 2015.* *2. S. Salivahanan, N Suresh Kumar, "Electronic Device and Circuits" 3rd edition, McGraw-Hill Education, 2012*	*3. Raghbir Singh Khandpur, Printed Circuit Boards: Design, Fabrication, and Assembly, McGraw Hill Education; 1st edition (1 July 2017)* *4. Ned Mohan, T. M. Undeland, W. P. Robbin, "Power Electronics: Converters, Applications, and Design" Wiley; Third edition (1 January 2007)*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (45%)		*CLA-2 –Practice (15%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*30%*	-	-	*20%*	*30%*	-
Level 2	*Understand*	*30%*	-	-	*30%*	*30%*	-
Level 3	*Apply*	*40%*	-	-	*40%*	*40%*	-
Level 4	*Analyze*	-	-	-	*10%*	-	-
Level 5	*Evaluate*	-	-	-	-	-	-
Level 6	*Create*	-	-	-	-	-	-
	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 PROGRAMMING	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							3	0	2	4

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Electronics and Communication Engineering*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Explore system software implementation and language processors*
CLR-2 :	*Acquire a fundamental understanding of the input/output data management, arrays in C++, functions, classes and threads*
CLR-3 :	*Provide the knowledge of basic data structures and their implementations*
CLR-4 :	*Know the design and implementation of linker and loaders.*
CLR-5 :	*Make proper use of system software implementation tools*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Understand the execution process of High Level Language programs*	2	-	3	-	-	-	-	-	-	-	-	-
CO-2:	*Develop C++ programs using classes, inheritance, functions and threads*	-	2	3	-	-	-	-	-	-	-	-	-
CO-3:	*Develop small application programs using basic data structure concepts*	-	-	-	2	3	-	-	-	-	-	-	-
CO-4:	*Compare various system software like linkers and loaders related to the given system*	2	-	3	-	-	-	-	-	-	-	-	-
CO-5:	*Distinguish the features of system software like compilers, interpreters and debuggers related to the given system*	2	-	3	-	-	-	-	-	-	-	-	-

Unit-1 : Multi-Paradigm Programming	**15 Hour**
C++ namespaces, references, exceptions, new/delete, C++ classes & inheritance, C++ templates, polymorphism, C++ functions and lambdas, C++ threads *Practice: Develop and practice C++ application programs using classes, inheritance, functions and threads.*	
Unit-2 : Basic Data Structures	**15 Hour**
Trees: Binary search trees, binary heaps, Tables: lookup tables, hash tables, Graphs: DFS, BFS, shortest path, minimum spanning trees, Queues, Stacks, Standard C++ Libraries: stl, boost *Practice: Develop and practice application programs using basic data structures like trees, tables, stacks and graphs*	
Unit-3: Overview of System Software and Language Processor	**15 Hour**
Software Hierarchy, Systems Programming, Machine Structure, Interfaces, Address Space, Computer Languages, Tools, Life Cycle of a Source Program, Levels of System Software, *Programming Languages and Language Processors, Language Processing Activities, Program Execution, Symbol Tables, Programming language Grammars, Scanning and Parsing* *Practice: Develop simple programs in C++ for implementing symbol table using basic data structures*	
Unit-4 : Linkers and Loaders	**15 Hour**
Introduction to linkers, Relocation and Linking Concept, Design of a Linker, Introduction to Loaders, Different Loading Schemes, Sequential and Direct Loaders, Compile-and-Go Loaders, Linkers v/s Loaders *Practice: Design of linker and loader*	
Unit-5: Software Programming Tools	**15 Hour**
Introduction to compilers, Working of compilers, Types of Compilers, Data structures used in compilers. *Interpreters: Benefits of Interpretation, Overview of Interpretation, The Java Language Environment, Java Virtual Machine.* *Debuggers: Types of Errors, Debugging Procedures, Classification of Debuggers, Dynamic / Interactive Debugger* *Practice: Develop a program for lexical analyser*	

Learning Resources	*1. System Programming by D M Dhamdhere McGraw Hill Education, 2011* *2. "C++ Primer", Stanley Lippman, 5th Edition, Addison-Wesley Professional Publishers, 2012*	*3. "Systems Programming", Srimanta Pal, Oxford University Press, 2011* *4. "Computer Systems – A Programmer's Perspective", Bryant and O'Hallaron. Third edition, Pearson India Education Services Pvt. ltd., 2015*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (45%)		*CLA-2 –Practice (15%)*			
		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%*	-	-	*30%*	*30%*	-
Level 5	*Evaluate*	*10%*	-	-	*20%*	-	-
Level 6	*Create*	-	-	-	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Mohan, Embedded 360, Chennai	*1. Dr. R. Venkatesan, Sr. Scientist, NIOT, Chennai*	*1. Dr. S. Malarvizhi, SRMIST*
2. Mr. Sai Vineeth, ML Silicon Architect, Google Cloud TPU, USA	*2. Dr. S. A. Akbar, Chief Scientist, CEERI Pilani*	*2. Dr. M. S. Vasanthi, SRMIST*

Course Code	21EIC101J	Course Name	SENSORS AND ACTUATORS	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							3	0	2	4

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Electronics and Instrumentation Engineering*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Familiarize with different types of the Sensing physical quantity and their basic principle and sensing properties*
CLR-2 :	*Introduce the construction and principle of Mechanical, resistive, capacitive and Inductive sensors*
CLR-3 :	*Impart the basic principles and mechanism of Thermal, Magnetic, radiation, smart sensors*
CLR-4 :	*Understand the basic actuator principles and phenomenon on which it works*
CLR-5 :	*Provide the micro sensor and actuators working and construction mechanism*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Identify the transduction- sensing principles and label their characteristics of measurement system*	2	2	-	-	-	-	-	-	-	-	-	-
CO-2:	*Classify different type of sensor based on their principles*	3	2	-	-	-	-	-	-	-	-	-	-
CO-3:	*Recall the Selection criteria, performance of different sensor based on their application*	2	2	-	-	-	-	-	-	-	-	-	-
CO-4:	*Outline the different working principles of the actuators*	3	2	-	-	-	-	-	-	-	-	-	-
CO-5:	*Associate the relation between the micro sensor and micro actuator in a system*	3	2	-	-	-	-	-	-	-	-	-	-

Unit-1 :Fundamentals and Sensor Characteristics **15 Hour**

Introduction on Sensor, transmitter and transducer - Primary measuring elements- Selection and characteristics: Range, Sensitivity, Error, Linearity, resolutions, repeatability, accuracy, backlash, response time. Classification of sensors: Mechanical and Electromechanical sensor, Resistive sensor, Inductive sensors, Capacitive sensor, Thermal sensors, Magnetic sensors and smart sensors.

Unit-2 : Classification of Sensor-I **15 Hour**

Mechanical and Electromechanical sensor: Definition, principle of Sensing & transduction, Classification, Resistive Sensor : Potentiometric type, Strain gauge , Inductive sensor : Reluctance change type , Mutual inductance change type , transforms action type, LVDT , Proximity sensor , Capacitive sensor :variable -area , variable -distance type , Piezoelectric element , Ultrasonic sensor.

Unit-3: Classification of Sensor-II **15 Hour**

Thermal sensors: Material expansion type : Solid ,liquid, Gas and vapor : Resistance change type : RTD materials , tip sensitive & stem sensitive type , Thermistor: material , shape , range, Thermo emf sensor : types , thermoelectric power : Radiation sensor - Types and characteristics and comparison LDR , Photovoltaic cells, photo diodes, Magnetic Sensors: torque, Thomson effect , hall effect. Smart sensors : Components of smart sensors , Architecture and industrial application

Unit-4: Actuators **15 Hour**

Definitions, types and selection of actuators; linear, rotary, Logical and continuous actuators, Electrical Actuators: electrical actuating systems: solid state switches, Solenoids, electric motors: AC- DC, stepper motors, synchro Pneumatics and Hydraulic Actuators, Shape memory alloys Actuator performance criteria and selection

Unit-5: Micro Sensor and Micro actuators **15 Hour**

Micro-sensor: Principles and example and micro-actuator devices: electrostatic, piezo-resistive, piezoelectric, thermal, magnetic transduction. Electronic position-sensing circuits and electrical and mechanical noise

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*

Learning Resources	1. *Patranabis D, "Sensors and Transducers," Prentice Hall of India, 2nd Edition, PHI Publications,2021* 2. *Ernest O.Doebelin , Dhanesh N. Manik,Doebelin's Measurement Systems:, Tata McGraw Hill, 7th Edition (SIE),2019* 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

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (45%)		Life Long Learning CLA-2 –Practice (15%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	-	30%	20%	-
Level 2	Understand	20 %	-	-	20%	20 %	-
Level 3	Apply	30 %	-	-	30%	30 %	-
Level 4	Analyze	30%	-	-	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 Category	C	PROFESSIONAL CORE	L	T	P	C
							2	1	0	3

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

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Understand the basics of mechanical elements through relative motions*
CLR-2 :	*Comprehend the type of sensors and signal conditioning circuits*
CLR-3 :	*Acquire the knowledge of electrical actuators and drives.*
CLR-4 :	*Apply simple control strategies for open loop and closed systems*
CLR-5 :	*Apprehend the basics of data acquisition systems*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Build simple mechanisms with few degrees of freedom*	3	3	-	-	-	-	-	-	-	-	-	-
CO-2:	*Identify appropriate sensors and the suitable conditioning circuits*	3	3	-	-	-	-	-	-	-	-	-	-
CO-3:	*Select actuators and the compatible driving circuits*	3	3	-	-	-	-	-	-	-	-	-	-
CO-4:	*Construct simple control systems*	3	3	-	-	-	-	-	-	-	-	-	-
CO-5:	*Demonstrate a system integration*	3	3	-	-	-	-	-	-	-	-	-	-

Unit-1 : Mechanical System	**9 Hour**
Degrees of Freedom – Joints and constraints – Types of mechanism- Transmission Elements – Aspects of mechanical engineering design – Aspects of Manufacturing process	
Unit-2 : Sensors and Signal Conditioning	**9 Hour**
Basic specification and measurement – types of Physical parameters – Types of sensory signals – Signal conditioning circuits – Signal decoding - sensor calibration	
Unit-3: Actuators and Drives	**9 Hour**
Electrical Actuators (AC and DC) – Fluid power actuators – Basic specifications of linear and rotary actuators – Special purpose actuators – Electrical drives – Fluid power drives	
Unit-4 : Embedded Control	**9 Hour**
Introduction to Control Systems – Open loop and closed loop systems – ON OFF control – proportional control – Basics of computing hardware – Types of computing hardware – Real time behavior – Time Performance – Accuracy – parallelization – Concept of programming , Algorithm and coding	
Unit-5:Software Stack and Integration	**9 Hour**
User Interface – Data acquisition and methods – Sampling and quantization – Data processing – Basic algorithm implementation – Motion control implementation – Development pipeline	

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.

Learning Resources	1. *Devdas Shetty, Richard Kolk .“Mechatronics System Design”, Cengage Learning, Inc; 2nd ed. Edition,2010* 2. *Kaltjob, Patrick O. J. “Control of mechatronic systems: model-driven design and implementation guidelines”, John Wiley & Sons, Inc., 1st edition, 2020.* 3. *De Silva, Clarence W., Khoshnoud, Farbod, Li, Maoqing, and Halgamuge, Saman K. “Mechatronics: fundamentals and applications”, CRC Press, 1st edition, 2016* 4. *4. Robert H. Bishop, “The Mechatronics Handbook-Mechatronic systems, sensors and actuators”, CRC Press, 2nd edition, 2007*	3. *W. Bolton, “Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering”, Pearson,6th edition, 2015.* 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* 5. *Schmidt, Robert Munnig , “The design of high performance mechatronics : high-tech functionality by multidisciplinary system integration”, Delft University Press, 3rd edition, 2020.*

Learning Assessment									
	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*						*Final Examination (0% weightage)*	
		Formative CLA-1 Average of unit test (20%)		*Project Based Learning CLA-2 (60%)*		*Report and Viva Voce (20%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*40%*	-	-	-	-	-	-	-
Level 2	*Understand*	*40%*	-	-	-	-	-	-	-
Level 3	*Apply*	*20%*	-	-	*20%*	-	*20%*	-	-
Level 4	*Analyze*	-	-	-	*30%*	-	*30%*	-	-
Level 5	*Evaluate*	-	-	-	*30%*	-	*30%*	-	-
Level 6	*Create*	-	-	-	*20%*	-	*20%*	-	-
	Total	*100 %*		*100 %*		*100%*		-	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Ganesh Ram, CTO, Tunga Systems, Chennai		*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 NANOTECHNOLOGY	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Physics and Nanotechnology*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Acquire knowledge on basics of nanoscience, classes of nanomaterials and their size and dimensionality dependence*
CLR-2 :	*Obtain knowledge on physical properties of nanostructured materials and their size and dimensionality dependence*
CLR-3 :	*Understand the physics and chemistry-based experimental approaches to synthesize various types of nanomaterials*
CLR-4 :	*Gain knowledge on the basic principles of characterization techniques at nanoscale*
CLR-5 :	*Appreciate the potential applications of the nanotechnology*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Analyze fundamentals of nanotechnology, different classes of nanomaterials and their sizes and dimensions*	*3*	-	*2*	-	-	-	-	-	-	-	-	-
CO-2:	*Describe various physical properties of nanomaterials*	*2*	-	-	*3*	-	-	-	-	-	-	-	-
CO-3:	*Apply chemical and physical methods to synthesize and fabricate nanomaterials*	-	*2*	*3*	-	-	-	-	-	-	-	-	-
CO-4:	*Distinguish various characterization techniques involved in nanotechnology*	-	-	*3*	-	*3*	-	-	-	-	-	-	-
CO-5:	*Identify the potentialities of nanotechnology*	*2*	-	-	*3*	-	-	-	-	-	-	-	-

Unit-1 : Basics of Nanoscience and Classification of Nanomaterials	**9 Hour**
Introduction to nanoscience - Moore's Law. Matter at different length scales: Nanosystems-classification based on length scale – Bulk, Quantum dots, quantum wells and quantum 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	**9 Hour**
Size dependent Mechanical properties of nanomaterials. Thermal properties of nanomaterials: melting point - size dependent thermal transport - Electronic properties of nanomaterials: size dependent electrical transport - 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	
Unit-3: Nanomaterials Synthesis Methods	**9 Hour**
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	**9 Hour**
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).	
Unit-5: Applications of Nanomaterials	**9 Hour**
Magnetic nanoparticles – Hyperthermia – Ferro fluids– Nanotechnology in memory. Nanotechnology in Printed electronics – Nanoinks. Role of nanotechnology in solar energy conversion. Nanotechnology in food storage. Environment: Nanotechnology in improving environment - Catalytic application of nanoparticles. Sensors: Chemical sensors – Biosensors. Nanomedicine - Nanobiotechnology - Nanotoxicology - Nanotechnology in cosmetics	

Learning Resources	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*	4. *Edward L. Wolf, Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience. 2nd ed., Wiley-VCH, 2004* 5. *Hans-Eckhardt Schaefer, Nanoscience: The Science of the Small in Physics, Engineering, Chemistry, Biology, and Medicine, Springer-Verlag Berlin Heidelberg, 1st Edition, 2010.*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 (10%)*			
		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*	-	-	-	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

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	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Physics and Nanotechnology*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Develop theoretical knowledge in classical mechanics (CM), quantum mechanics (QM) and solid state physics (SSP)*
CLR-2 :	*Develop skills on solving analytical problems in CM, QM and SSP*
CLR-3 :	*Understanding and Acquire knowledge of general properties of materials*
CLR-4 :	*Acquire advanced knowledge in current understanding of CM, QM and SSP*
CLR-5 :	*Understand Schrodinger equation and its applications in Materials Science*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
		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
CO-1:	*Be familiar with some elementary phenomena and concepts in physics*	*3*	-	*2*	-	-	-	-	-	-	-	-	-
CO-2:	*Master the technique of deriving and evaluating formulae for the equations of motion from degrees of freedom and constraints*	*2*	-	-	*3*	-	-	-	-	-	-	-	-
CO-3:	*Apply mathematical tools to explain general properties like stress/strain/elasticity etc.*	-	*2*	*3*	-	-	-	-	-	-	-	-	-
CO-4:	*Solve problems in CM, QM and SSP*	-	*3*	*3*	-	-	-	-	-	-	-	-	-
CO-5:	*Apply the knowledge of quantum mechanics for materials science problems*	*2*	-	-	*3*	-	-	-	-	-	-	-	-

Unit-1 : **9 Hour**

Mechanics of a single particle, Mechanics of system of particles, Conservation of linear momentum, Conservation of Angular momentum, Mechanical energy for a particle and a system of particles, Centre of mass and equation of motion, Degree's of freedom and constraints, Calculus of Variations; Lagrange's Equations; Hamilton's, principle, Hamilton's equations of motion, SHM, Equation of motion, Applications of Hamilton's equations of motion like SHM, Atwood machine etc.

Unit-2 : **9 Hour**

Combination of two mutually perpendicular simple harmonic vibrations of same frequency and different frequencies, Lissajous figures, Gravitation, Acceleration due to gravity, Determination of acceleration due to gravity, Fundamentals of vibration, forced oscillation, Resonance, sharpness of resonance, General Properties of Matter, Elasticity, stress, strain, Young's modulus, bulk modulus, shear modulus, Poisson's ratio, Relation between them, Viscocity, Poiseulli's formula, Stoke's formula, Surface tension, surface energy,contact angle and its determination.

Unit-3: **9 Hour**

Basics of Quantum Mechanics, Planck's formula of black-body radiation, Photoelectric effect, Bohr atom and quantization of energy levels, de Broglie hypothesis, Electron double-slit experiment, Compton effect, Davisson-Germer experiment, Heisenberg Uncertainty Principle, Wave Function, It,s Interpretation and Normalization, Superposition of Amplitudes.

Unit-4 : **9 Hour**

Dynamical Variables as Operators, Expectation Values, Schrodinger, Equation, Particle in a Box, Quantum Well, Potential Barrier, Hydrogen atom, Harmonic Oscillator, Electron in periodic potential

Unit-5: **9 Hour**

Crystal, Lattice, Basis, Lattice translational vectors and unit cell, Primitive lattice cell, Fundamental types of lattices, Miller indices, Simple crystal structures, Hexagonal close pack structure, Diamond structure, Crystal symmetry, Point groups, Space group, Reciprocal lattice, X-Ray diffraction, Bragg's Law, Laue Equation

Learning Resources	1. *Classical Mechanics, H. Goldstein, C. Poole and J. Fafko (Pearson Education Inc., 2002)* 2. *Classical Mechanics, Rana & Joag McGraw Hill Education, 2017)* 3. *Elements of Properties of Matter, D.S. Mathur (S. Chand, 2010)*	4. *Introduction to Quantum Mechanics, D J Griffiths, D F Schroeter (Cambridge University Press, 3rd edition, 2021)* 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

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
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Level 1	*Remember*	*15 %*	-	*15 %*	-	*15 %*	-
Level 2	*Understand*	*15%*	-	*15%*	-	*15%*	-
Level 3	*Apply*	*20 %*	-	*20 %*	-	*20 %*	-
Level 4	*Analyze*	*20%*	-	*20%*	-	*20%*	-
Level 5	*Evaluate*	*15%*	-	*15%*	-	*15%*	-
Level 6	*Create*	*15%*	-	*15%*	-	*15%*	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

Experts 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*

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

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

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