Faculty of Engineering and Technology

CURRICULUM, PRE-REQUISITES/ CO-REQUISITES CHART, AND SYLLABUS FOR B.TECH.

UNDER CHOICE BASED FLEXIBLE CREDIT SYSTEM

REGULATIONS 2015

(For students admitted from 2015-16 onwards)

Specialization	:	**COMPUTER SCIENCE AND ENGINEERING**
Offering Department	:	**COMPUTER SCIENCE AND ENGINEERING**

Placed in the 32nd Academic Council Meeting held on 23rd July 2016

STUDENT OUTCOMES

The curriculum and syllabus for B.Tech programs (2013) conform to outcome based teaching learning process. In general, ELEVEN STUDENT OUTCOMES (a-k) have been identified and the curriculum and syllabus have been structured in such a way that each of the courses meets one or more of these outcomes. Student outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program. Further each course in the program spells out clear instructional objectives which are mapped to the student outcomes.

The student outcomes are:

(a) an ability to apply knowledge of mathematics, science, and engineering

(b) an ability to design and conduct experiments, as well as to analyze and interpret data

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(d) an ability to function on multidisciplinary teams

(e) an ability to identify, formulate, and solve engineering problems

(f) an understanding of professional and ethical responsibility

(g) an ability to communicate effectively

(h) the broad education necessary to understand the impact of engineering solutions in global, economic, environmental, and societal context

(i) a recognition of the need for, and an ability to engage in life-long learning

(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

C-D-I-O INITIATIVE

The CDIO Initiative (CDIO is a trademarked initialism for **Conceive** — **Design — Implement — Operate**) is an innovative educational framework for producing the next generation of engineers. The framework provides students with an education stressing engineering fundamentals set in the context of Conceiving — Designing — Implementing — Operating real-world systems and products. Throughout the world, CDIO Initiative collaborators have adopted CDIO as the framework of their curricular planning and outcome-based assessment.

In the syllabus, every topic has been classified under one or more of C-D-I-O so that students and faculty alike are clear about the scope of learning to take place under each one of the topics.

SYMBOLS AND ABBREVIATIONS

B	--	Courses under Basic Science and Mathematics
BT	--	Biotechnology Courses
C-D-I-O	--	Conceive-Design-Implement-Operate
CS	--	Computer Science and Engineering Courses
CY	--	Chemistry Courses
Dept.	--	Department of Computer Science and Engineering
E with course code	--	Elective Courses
E	--	Courses under Engineering Sciences
EC	--	Electronics and Communication Engineering Courses
EE	--	Electrical and Electronics Engineering Courses
G	--	Courses under Arts and Humanities
IOs	--	Instructional Objectives
IT	-	Information Technology Courses
L	--	Laboratory / Project / Industrial Training Courses
LE	--	Language Courses
L-T-P-C	--	L- Lecture Hours Per Week T- Tutorial Hours Per Week P- Practical Hours Per Week C- Credits for a Course
M	--	Courses with Multi Disciplinary Content
MA	--	Mathematics Courses
ME	--	Mechanical Engineering Courses
NC	--	NCC- National Cadet Corps
NS	--	NSS – National Service Scheme
P	--	Professional Core Courses
PD	--	Personality Development Courses
PY	--	Physics Courses
SE	-	Software Engineering Courses
SO/SOs	--	Student Outcomes (a-k)
SP	--	NSO- National Sports Organization
YG	--	Yoga Course

FACULTY OF ENGINEERING AND TECHNOLOGY,
SRM INSTITUTE OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B.TECH COMPUTER SCIENCE AND ENGINEERING
Curriculum
CHOICE BASED FLEXIBLE CREDIT SYSTEM (CBFCS)
(Under Regulations 2015 (For students admitted from 2015-16 onwards)

Semester - I						
Category	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
Arts & Humanities-G	15LE101	English	2	0	0	2
	15PD101	Soft Skills - I	1	1	0	1
		Total	3	1	0	3
Basic Sciences-B	15MA101	Calculus And Solid Geometry	3	1	0	4
	15PY101	Physics	3	0	0	3
	15PY101L	Physics Laboratory	0	0	2	1
	15CY101	Chemistry	3	0	0	3
	15CY101L	Chemistry Laboratory	0	0	2	1
	15BT101	Biology For Engineers	2	0	0	2
		Total	11	1	4	14
Engineering Sciences -E	15CE101	Basic Civil Engineering	2	0	0	2
	15EE101	Basic Electrical Engineering	2	0	0	2
	15ME105L	Engineering Graphics	1	0	4	3
	15CS101L	Programming Laboratory	1	0	2	2
		Total	6	0	6	9
			20	**2**	**10**	**26**
		Contact hours	**32**			

Semester - II

Category	Course Code	Course Title	L	T	P	C
Arts & Humanities-G	15LE102	Value Education	2	0	0	2
	15PD102	Soft Skills - II	1	1	0	1
	15NC101	NCC- National Cadet Corps	0	0	1	1
	15NS101	NSS- National Service Scheme				
	15SP101	NSO- National Sports Organization				
	15YG101	Yoga				
		Total	3	1	1	4
Basic Sciences - B	15MA102	Advanced Calculus And Complex Analysis	3	1	0	4
	15PY102L	Materials Science	2	0	2	3
	15CY102	Principles Of Environmental Science	2	0	0	2
		Total	7	1	2	9
Engineering Sciences -E	15ME101	Basic Mechanical Engineering	2	0	0	2
	15EC101	Basic Electronics Engineering	2	0	0	2
	15IT101L	Computer Hardware and Troubleshooting Laboratory	0	0	3	2
		Total	4	0	3	6
Professional - Core -P	15IT102	Program Design And Development	3	0	0	3
	15IT102L	Program Design And Development Laboratory	0	0	2	1
		Total	3	0	2	4
			17	**2**	**8**	**23**
		Contact hours	**27**			

Semester - III						
Category	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
Arts & Humanities-G	15LE201E	German Language I	2	0	0	2
	15LE202E	French Language I				
	15LE203E	Japanese Language I				
	15LE204E	Korean Language I				
	15LE205E	Chinese Language I				
	15PD201	Quantitative Aptitude & Logical Reasoning –I	1	1	0	1
		Total	3	1	0	3
Basic Sciences - B	15MA201	Transforms And Boundary Value Problems	4	0	0	4
		Total	4	0	0	4
Engineering Sciences -E	15EE208	Electron Devices and Circuits	3	0	0	3
		Total	3	0	0	3
Professional - Core -P	15CS202	Digital System Design	3	0	0	3
	15CS201J	Data Structures	3	0	2	4
	15SE201J	Object Oriented Programming Using C++	3	0	2	4
	15CS203	Computer System Architecture	3	0	0	3
		Total	12	0	4	14
			22	**1**	**4**	**24**
		Total contact hours	**27**			

Semester – IV

Category	Course Code	Course Title	L	T	P	C
Arts & Humanities-G	15LE207E	German Language II	2	0	0	2
	15LE208E	French Language II				
	15LE209E	Japanese Language II				
	15LE210E	Korean Language II				
	15LE211E	Chinese Language II				
	15PD202	Verbal Aptitude	1	1	0	1
		Total	3	1	0	3
Basic Sciences - B	15MA207	Probability And Queuing Theory	4	0	0	4
		Total	4	0	0	4
Engineering Sciences -E	15EE232	Electrical Engineering And Control Systems	3	0	0	3
		Total	3	0	0	3
Professional - Core -P	15SE205J	Programming In Java	3	0	2	4
	15CS204J	Algorithm Design And Analysis	3	0	2	4
	15CS205J	Microprocessors And Microcontrollers	3	0	2	4
	15SE203	Object Oriented Analysis And Design	2	2	0	3
		Total	11	2	6	15
			21	**3**	**6**	**25**
		Total Contact hours	**30**			

Semester - V

Category	Course Code	Course Title	L	T	P	C

Arts & Humanities-G	15PD301	Communication & Reasoning Skills	1	1	0	1
		Total	1	1	0	1
Basic Sciences - B	15MA302	Discrete Mathematics	4	0	0	4
		Total	4	0	0	4
Professional - Core -P	15CS302J	Operating Systems	3	0	2	4
	15CS301	Theory Of Computation	3	0	0	3
	15IT303J	Computer Networks	3	0	2	4
		Total	9	0	4	11
Prof - Electives - P		**Dept Elective-I**	**3**	**0**	**0**	**3**
		Dept Elective-II	**3**	**0**	**0**	**3**
		Total	6	0	0	6
Project / Seminar / Internship-P	15CS375L / 15CS380L / 15CS385L / 15CS490L	Minor Project I / Seminar I / MOOCs I / Industrial Module I	0	0	3	2
	15CS390L	Industrial Training	0	0	3	2
		Total	0	0	6	4
			20	**1**	**10**	**26**
		Total Contact hours	**31**			

Semester - VI						
Category	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**

Arts & Humanities-G	15PD302	Quantitative Aptitude & Logical Reasoning –II	1	1	0	1
		Total	1	1	0	1
Professional - Core -P	15CS314J	Compiler Design	3	0	2	4
	15SE202	Software Engineering Principles	3	0	0	3
	15IT302J	Database Management Systems	3	0	2	4
	15CS303M	Multi Disciplinary Design	3	0	0	3
		Total	12	0	4	14
Prof - Electives -P		Dept Elective-III	3	0	0	3
		Dept Elective-IV	3	0	0	3
		Total	6	0	0	6
Project / Seminar / Internship-P	15CS376L / 15CS381L / 15CS386L / 15CS491L	Minor Project II / Seminar II / MOOCs II / Industrial Module II	0	0	3	2
		Total	0	0	3	2
Open Electives		Open Elective I As per list / as taken by the student	3	0	0	3
		Total	3	0	0	3
			22	**1**	**7**	**26**
		Total contact hours	**30**			

Semester- VII

Category	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
		Total	0	0	0	0
Professional - Core -P	15IT304J	Web Programming	3	0	2	4
	15CS401	Artificial Intelligence	3	0	0	3
	15SE204	Professional Ethics And Software Economics	2	0	0	2
		Total	8	0	2	9
Prof - Electives -P		**Dept Elective-V**	**3**	**0**	**0**	**3**
		Dept Elective-VI	**3**	**0**	**0**	**3**
		Total	6	0	0	6
Open Electives		Open Elective II As per list / as taken by the student	3	0	0	3
		Total	3	0	0	3
			17	**0**	**2**	**18**
		Total contact hours	**19**			

Semester - VIII						
Category	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
		Total	0	0	0	0
Project / Seminar / Internship-P	15CS496L	Major Project	0	0	24	12
		Total	0	0	24	12
			0	**0**	**24**	**12**
		Total contact hours	**24**			

LIST OF DEPARTMENTAL ELECTIVES

List of subjects for Dept Elective - I and Dept Elective - II

COURSE CODE	Course Title	L	T	P	C
15CS320E	Computational Logic	3	0	0	3
15SE321E	Principles Of Programming Languages	3	0	0	3
15CS322E	Neuro Fuzzy And Genetic Programming	3	0	0	3
15CS323E	Distributed Computing	3	0	0	3
15IT345E	Linux Internals	3	0	0	3
15SE334E	Advanced Java Programming	2	2	0	3
15SE329E	Visual Programming	2	2	0	3
15IT322E	Python Programming	2	2	0	3
15SE328E	Programming In PHP	2	2	0	3
15IT323E	Game Programming	2	2	0	3
15IT324E	Mobile Application Development	2	2	0	3
15SE322E	E-Commerce	3	0	0	3
15CS324E	Machine Learning	3	0	0	3
15CS325E	Digital Image Processing	3	0	0	3
15CS326E	Visualization Techniques	3	0	0	3
15CS327E	Cellular Automata	3	0	0	3
15CS328E	Virtual Reality	3	0	0	3
15CS329E	Geographical Information Systems	3	0	0	3
15EC252	Principles Of Communication Systems	3	0	0	3
15EC323E	Embedded System Design	3	0	0	3

List of subjects for Dept Elective - III and Dept Elective - IV

COURSE CODE	Course Title	L	T	P	C
15CS330E	Human Computer Interface	3	0	0	3
15CS331E	Data Mining And Analytics	3	0	0	3
15IT326E	Cloud Computing	3	0	0	3
15CS332E	Wireless Sensor Networks	3	0	0	3
15IT327E	Cryptography	3	0	0	3
15IT362E	Information Storage And Management	3	0	0	3
15SE333E	Pervasive Computing	3	0	0	3
15IT328E	Parallel Programming Using OpenCL	3	0	0	3
15CS333E	Biometrics	3	0	0	3
15IT330E	Text Mining	3	0	0	3
15IT331E	Computer Graphics	2	2	0	3
15IT332E	Software Testing	3	0	0	3
15CS334E	Network Programming	3	0	0	3
15SE327E	Distributed Operating Systems	3	0	0	3
15CS335E	Computer Forensics	3	0	0	3
15CS336E	Network Routing Algorithms	3	0	0	3
15CS337E	High Performance Computing	3	0	0	3
15EC353	Digital Signal Processing Techniques	3	0	0	3
15CS338E	Database Security And Privacy	3	0	0	3
15MA317E	Optimization Techniques	3	0	0	3

List of subjects for Dept Elective - V and Dept Elective - VI					
COURSE CODE	**Course Title**	**L**	**T**	**P**	**C**
15CS421E	Natural Language Processing	3	0	0	3
15CS422E	Knowledge Based Decision Support Systems	3	0	0	3
15IT422E	Internet Of Things	2	2	0	3
15CS423E	Software Defined Networks	3	0	0	3
15SE323E	Design Patterns	3	0	0	3
15IT424E	Business Intelligence And Analytics	3	0	0	3
15CS424E	Semantic Web	3	0	0	3
15SE427E	Wireless And Mobile Communication	3	0	0	3
15IT426E	Parallel Architectures And Algorithms	3	0	0	3
15CS425E	Service Oriented Architecture	3	0	0	3
15CS426E	Pattern Recognition Techniques	3	0	0	3
15CS427E	Nature Inspired Computing Techniques	3	0	0	3
15CS428E	Optical Networks	3	0	0	3
15CS429E	Computational Linguistics	3	0	0	3
15CS430E	Bio Informatics	3	0	0	3
15IT423E	Data Science and Big Data Analytics	2	2	0	3
15CS432E	Data Centric Networks	3	0	0	3
15CS433E	Network Design And Management	3	0	0	3
15CS434E	Network Security	3	0	0	3
15EC352E	Introduction to VLSI Design	3	0	0	3

Summary of credits										
Category	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**Total**	**%**
G	**3**	**4**	**3**	**3**	**1**	**1**	**0**	**0**	**15**	**8.33%**
B	**14**	**9**	**4**	**4**	**4**	**0**	**0**	**0**	**35**	**19.44%**
E	**9**	**6**	**3**	**3**	**0**	**0**	**0**	**0**	**21**	**11.67%**
P	**0**	**4**	**14**	**15**	**15**	**16**	**9**	**12**	**85**	**47.22%**
Open Elective	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**0**	**6**	**3.33%**
Departmental Elective	**0**	**0**	**0**	**0**	**6**	**6**	**6**	**0**	**18**	**10.00%**
Total	**26**	**23**	**24**	**25**	**26**	**26**	**18**	**12**	**180**	**100**

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[illegible]		Year 1												Year 2											
		[illegible]						[illegible]						[illegible]						[illegible]					
[illegible]	[illegible]	Course Code	Course Title	L	T	P	C	Course Code	Course Title	L	T	P	C	Course Code	Course Title	L	T	P	C	Course Code	Course Title	L	T	P	C
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Year 3												**Year 4**											
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Course Code	**Course Title**	**L**	**T**	**P**	**C**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
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	Dept Elective I				[illegible]		Dept Elective III	[illegible]	[illegible]	[illegible]	[illegible]		Dept Elective V	[illegible]	[illegible]	[illegible]	[illegible]						
	Dept Elective II				[illegible]		Dept Elective IV	[illegible]	[illegible]	[illegible]	[illegible]		Dept Elective VI	[illegible]	[illegible]	[illegible]	[illegible]						
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B.Tech Computer Science and Engineering (Regulations 2019)

List of Electives for Third Year

COURSE CODE	Course Title	L	T	P	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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COURSES OFFERED TO OTHER DEPARTMENTS

Course Code	Course Title	L	T	P	C	Offered to
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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B.Tech Computer Science and Engineering (Regulations 2019)

List of Electives for Third Year

COURSE CODE	Course Title	L	T	P	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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B.Tech Computer Science and Engineering (Regulations 2019)

List of Electives for Fourth Year

COURSE CODE	Course Title	L	T	P	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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B.Tech - Computer Science and Engineering
For Students admitted from 2015 onwards
Prerequisites and Co requisites Courses

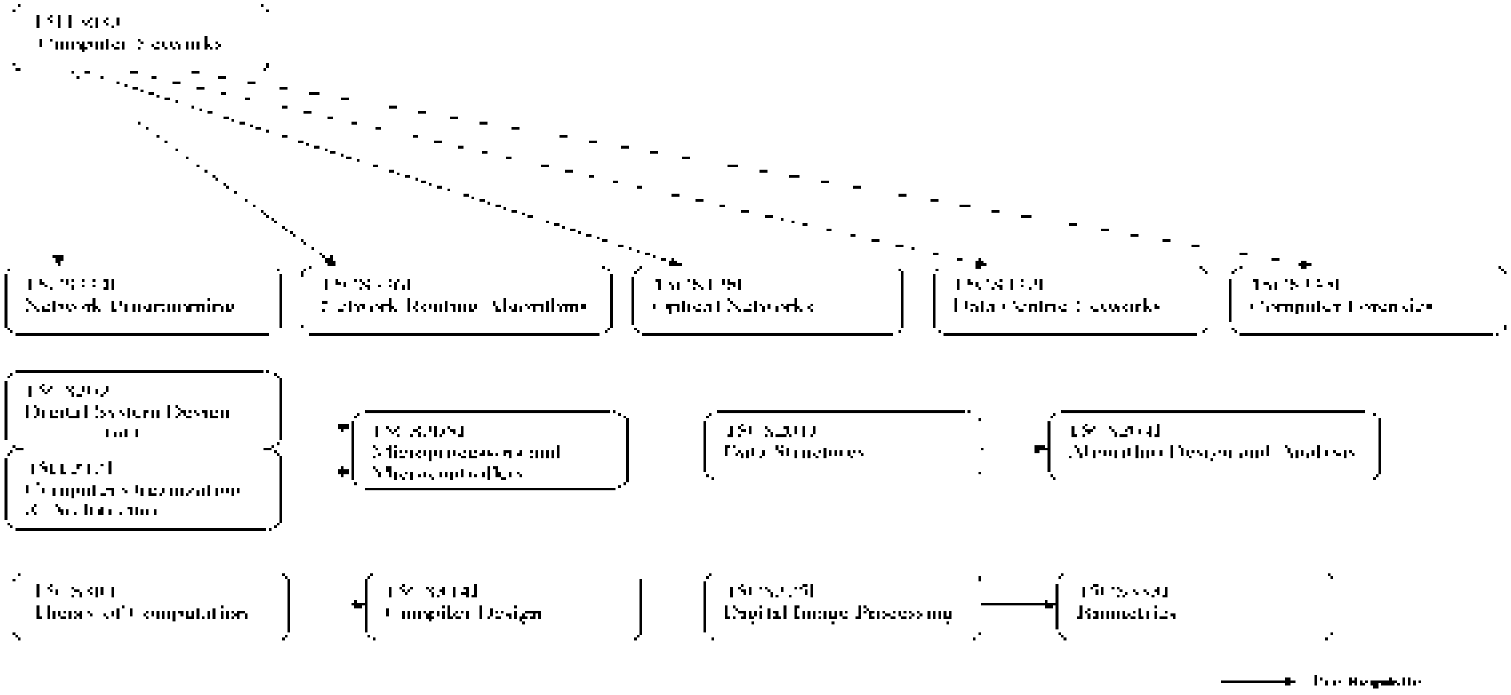
Course Code	Course Title	Prerequisite course	Co requisite courses
15CS205J	Microprocessors and Microcontrollers	15CS202 / 15IT212J	Nil
15CS204J	Algorithm Design and Analysis	15CS201J	Nil
15CS314J	Compiler Design	15CS301	Nil
15CS333E	Biometrics	15CS325E	Nil
15CS334E	Network Programming	15IT303J	Nil
15CS336E	Network Routing Algorithms	15IT303J	Nil
15CS428E	Optical Networks	15IT303J	Nil
15CS432E	Data Centric Networks	15IT303J	Nil
15CS335E	Computer Forensics	15IT303J	Nil

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B-Tech Computer Science and Engineering

For Students admitted from 2015 onwards

PRE-REQUISITES AND CO-RE-REQUISITES FLOWCHART



15LE101	ENGLISH		L	T	P	C
			2	0	0	2
Co-requisite:	NIL					
Prerequisite:	Nil					
Course Category	G	General				
Course designed by	Department of English & Foreign Languages					
Approval	-- Academic Council Meeting -- , 2016					

PURPOSE	To enhance the systemic and specific knowledge and skills of the learners in the use of English language by improving their ability to listen, speak, read and write							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	strengthen their lexical, syntactical and logical competencies	g						
2.	comprehend, speak and write on technical topics	g						
3.	fine tune their skills required to join an organization and move forward	g						
4.	be sensitive to the nuances of English language by enriching their critical and creative thinking	g						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	Introduction – Communication and Language Skills	**2**	**g**	4	1
Unit I - INVENTIONS		**6**			
1	Grammar and Vocabulary – Tense and Concord	2	g	1,2	1
2	Listening and Speaking – Common errors in Pronunciation (Individual sounds); Process description (Describing the working of a machine, and the manufacturing process)	1	g	1,2	1
3	Writing – Interpretation of data (Flow chart, Bar chart)	2	g	1,2	1,2
4	Reading -- (Reading Comprehension -- Answering	1	g	1,3	1,2
Unit II –- ECOLOGY		**6**			
1	Grammar and Vocabulary – Error Analysis – Synonyms and Antonyms, Parallelisms	1	g	1	1
2	Listening and Speaking - Conducting Meetings	2	g	1,3	1
3	Writing – Notice, Agenda, Minutes , letters to the editor via email : Email etiquette	2	g	3,4	1,2
4	Reading Comprehension – Summarizing and Note-making	1	g	3	1,2
Unit III- SPACE		**5**			
1	Grammar and Vocabulary – tense and concord; word formation	1	g	1	1
2	Listening and Speaking – Distinction between native and Indian English (Speeches by TED and Kalam) – accent, use of vocabulary and rendering;	**1**	g	1,4	1
3	Writing – Definitions and Essay writing	**2**	g	3,4	1,4
4	Reading Comprehension – Predicting the content	1	g	3,4	1
UNIT IV– CAREERS		**6**			
1	Grammar and Vocabulary –Homonyms and Homophones A. Writing Applying for job, cover letter and resume D. Reading, etymology (roots, idioms and phrases),	1	g	1	1,3
2	Listening and Speaking – Group Discussion	2	g	3	1,2,3
3	Writing Applying for job, cover letter and resume	**2**	g	3,4	1,2,3
4	Reading, etymology (roots, idioms and phrases),	**1**	g	1,4	1,3
UNIT V - RESEARCH		**5**			
1	Grammar and Vocabulary – Using technical terms, Analogies	1	g	1,4	1,3
2	Listening and Speaking -- Presentation techniques (Speech by the learner)	2	g	3,4	1,3
3	Writing – Project Proposal	1	g	3,4	1,3
4	Reading Comprehension -- Referencing Skills for Academic Report Writing (Research Methodology – Various methods of collecting data) Writing a report based on IEEE Handbook	1	g	1,3	1,3,4
	Total Contact Hours	**30**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOK**
1	*English for Engineers*. Dr.K.Anbazhagan, Dr.B.Cauveri&Dr.M.P.Devika, Cengage Publications. 2016.
2	Dhanavel, S.P. *English and Communication Skills for Students of Science and Engineering***.** Units 1-5. Chennai: Orient, Blackswan Ltd., 2009.
3	Raman, Meenakshi and SangeethaSharama **.** *Technical Communication-Principles and Practice*. Oxford University Press. 2009.
4	Day, R A. *Scientific English: A Guide for Scientists and Other Professionals***.** 2nd ed. Hyderabad: Universities Press, 2000

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	**Quiz**	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
						End semester examination Weightage :	**50%**

15PD101	**SOFT SKILLS - I**		**L**	**T**	**P**	**C**
			1	**1**	**0**	**1**
Co-requisite:	NIL					
Prerequisite:	NIL					
Course Category	G	General				
Course designed by	Career Development Centre					
Approval	-- Academic Council Meeting -- , 2016					

PURPOSE	To enhance holistic development of students and improve their employability skills.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1	Acquire inter personal skills and be an effective goal oriented team player	d						
2.	Develop professionalism with idealistic, practical and moral values.	f						
3.	Acquire communication and problem solving skills.	g						
4.	Re-engineer their attitude and understand its influence on behavior.	i						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	Unit I – Self Analysis	**4**			
1	Introduction, Who am I?	1	C, I	2, 4	1, 2, 6, 7
2	SWOT analysis, Detailed self introspection	1	C, I	2, 4	1, 2, 7
3	Johari window, Knowing the unknown can bring self confidence and self esteem	2	C, I	2, 4	1, 2, 7
	Unit II – Creativity	**8**			
4	Out of the box thinking, Possibility of innovation	2	C, I, O	2, 3	1
5	Creative thinking and Lateral thinking, Torrance test of creative thinking	3	C, I, O	2, 3	1
6	Creativity challenge	3	O	2, 3	1, 7

	Unit III – Attitude	**6**			
7	Factors influencing attitude, Influence of attitude on behavior, Thumb impression activity	2	C	1,2, 4	1, 2, 3, 4
8	Challenges and lessons from attitude, Synergy between knowledge, skill and attitude	2	C, D	1,2, 4	1, 2, 3, 4
9.	Personal, social and professional etiquette.	2	C, D, I	1, 2, 4	2, 4, 7
	Unit IV – Motivation	**4**			
10	Motivational factors, I am good at, Self image	1	C	2, 4	1, 2
11	Self talk, Tapping and tuning inner voice, Self motivation	1	C, I	2, 4	1, 2
12	Intrinsic and extrinsic motivators	2	C, D, I	2, 4	1, 2
	Unit V – Goal setting	**8**			
13	Wish list, SMART goals, Short, long, life time goals, Goal tree	2	C, D, I	1, 2	1, 2
14	Goal poster, Blueprint for success, 5W1H	2	C, D, I	1, 2	1, 2
15	Time management, Value of time, Test your Time management skill	2	C, D, I	1, 2	1, 2
16	Weekly planner, TODO list, Prioritizing work, Time management matrix	2	C, D, I	1, 2	1, 2, 7
	Total contact hours	30			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	SOFT SKILLS, 2015, Career Development Centre, Green Pearl Publications.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	Covey Sean, *Seven Habits of Highly Effective Teens*, New York, Fireside Publishers, 1998.
3.	Carnegie Dale, *How to win Friends and Influence People*, New York: Simon & Schuster, 1998.
4.	Thomas A Harris, *I am ok, You are ok* , New York-Harper and Row, 1972.
5.	Daniel Coleman, *Emotional Intelligence*, Bantam Book, 2006.
6.	Carnegie Dale, *How to stop worrying and start living*, New York: Simon & Schuster, 1985.
7.	http://empower.srmuniv.ac.in (online LMS)

Course nature				**Fully internal**		
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Activities	Extempore	LMS	Participation	**Total**
	Weightage	**30%**	**25%**	**35%**	**10%**	**100%**

15MA101	**CALCULUS AND SOLID GEOMETRY**		**L**	**T**	**P**	**C**
			3	**1**	**0**	**4**
Co-requisite:	NA					
Prerequisite:	NA					
Data Book / Codes/Standards						
Course Category	B	CORE	MATHEMATICS			
Course designed by	Department of Mathematics					

Approval	-- Academic Council Meeting -- , 2016

PURPOSE	To acquire analytical ability on solving Calculus and Solid Geometry problems as applied to the respective all branches of Engineering.		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1.	Apply advanced matrix knowledge to Engineering problems.	a	e
2.	Equip themselves familiar with functions of several variables.	a	e
3.	Familiarize with the applications of ordinary differential equations	a	e
4.	Improve their ability in solving geometrical applications of differential calculus problems.	a	e
5.	Expose to the concept of three dimensional analytical geometry.	a	e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: MATRICES	**12**			
1.	Characteristic equation	1	C,I	1	1-7
2.	Eigen values and Eigen vectors of a real matrix	2	C,I	1	1-7
3.	Properties of Eigen values	2	C,I	1	1,3,4,6
4.	Cayley – Hamilton theorem orthogonal reduction of a symmetric matrix to diagonal form	2	C,I	1	1,3,4,6
5.	Orthogonal matrices	1	C,I	1	1,3,4
6.	Reduction of quadratic form to canonical form	2	C,I	1	1,3,4,6
7.	Quadratic form to canonical form by orthogonal transformations.	2	C,I	1	1,3
	UNIT II: FUNCTIONS OF SEVERAL VARIABLES	**12**			
8.	Function of two variables – Partial derivatives	2	C,I	2	1,3,4,6
9.	Total differential	2	C,I	2	1,3,4,6
10.	Taylor’s expansion	2	C,I	2	1,3
11.	Maxima and Minima	2	C,I	2	1,3,4,6
12.	Constrained Maxima and Minima by Lagrangian Multiplier	2	C,I	2	1,3,
13.	Jacobians	2	C,I	2	1-7
	UNIT III: ORDINARY DIFFERENTIAL EQUATIONS	**12**			
14.	Linear equations of second order with constant and variable coefficients	2	C,I	3	2,5,7

15.	Homogeneous equation of Euler type	2	C,I	3	2,5,7,1
16.	Homogeneous equation of Legendre’s Type	2			
17.	Equations reducible to homogeneous form	2	C,I	3	2,5,7
18.	Variation of parameters	2	C,I	3	1,2
19.	Simultaneous first order with constant co-efficient.	2	C,I	3	1,2
	UNIT IV: GEOMETRICAL APPLICATIONS OF DIFFERENTIAL	**12**			
20.	Curvature – Cartesian coordinates	2	C,I	4	7
21.	Curvature – polar coordinates	2	C,I	4	7
22.	Circle of curvature	2	C,I	4	1
23.	Centre of curvature	2	C,I	4	7
24.	Evolutes	2	C,I	4	4,5
25.	Envelopes	2	C,I	4	7
	UNIT V: THREE DIMENSIONAL ANALYTICAL GEOMETRY	**12**			
26.	Equation of a sphere – Plane section of a sphere	2	C,I	5	3,4
27.	Tangent Plane – Orthogonal spheres	2	C,I	5	3,4
28.	Equation of a cone	2	C,I	5	4
29.	Right circular cone	2	C,I	5	3,4
30.	Equation of a cylinder	2	C,I	5	2,3
31.	Right circular cylinder.	2	C,I	5	3,4
	Total contact hours	60			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Kreyszig.E, “*Advanced Engineering Mathematics*”, John Wiley & Sons. Singapore, 10th edition, 2012.
2.	K.Ganesan, Sundarammal Kesavan, K.S.Ganapathy Subramanian &V.Srinivasan, “*Engineering Mathematics*”,Gamma publications, Revised Edition, 2013.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 42nd

	Edition,2012.
4.	Veerajan. T, “*Engineering Mathematics I*”, Tata McGraw Hill Publishing Co, New Delhi, 5th edition, 2006.
5.	Kandasamy P etal. “*Engineering Mathematics*”, Vol.I (4th revised edition), S.Chand &Co., New Delhi, 2000.
6.	Narayanan S., Manicavachagom Pillay T.K., Ramanaiah G., “*Advanced Mathematics for Engineering students*”, Volume I (2nd edition), S.Viswanathan Printers and Publishers, 1992.
7.	Venkataraman M.K., “*Engineering Mathematics*” – First Year (2nd edition), National Publishing Co., Chennai, 2000.

Course nature					**Theory**		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50 %**

15PY101	**Physics**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	B	BASIC SCIENCES			
Course designed by	Department of Physics and Nanotechnology				
Approval	-- Academic Council Meeting -- , 2016				

	The purpose of this course is to provide an understanding of physical concepts and

Purpose	underlying various engineering and technological applications. In addition, the course is expected to develop scientific temperament and analytical skill in students, to enable them logically tackle complex engineering problems in their chosen area of application.							
Instructional Objectives		**Student Outcomes**						
At the end of the course, student will be able								
1.	To understand the general scientific concepts required for technology	a						
2.	To apply the Physics concepts in solving engineering problems	e						
3.	To educate scientifically the new developments in engineering and technology	k						
4.	To emphasize the significance of Green technology through Physics principles	c						

Session	Description of Topic (Theory)	Contact hours	C-D-I-O	IOs	Reference
Unit I: Mechanical Properties of Solids and Acoustics		**9**			
1.	**Mechanical Properties of Solids :** Stress-strain relationship - Hooke's law - Torsional Pendulum - Young's modulus by cantilever	1	C,D	1	1,2,3
2.	Uniform and non-uniform bending -Stress-strain diagram for various engineering materials	1	C,D	1	1,2,3
3.	Ductile and brittle materials - Mechanical properties of Engineering materials - Tensile strength, Hardness	1	C	1	1,2,3
4.	Mechanical properties of Engineering materials - Fatigue, Impact strength, Creep - Fracture -Types of fracture (Elementary ideas)	1	C	1	1,2,3
5.	**Acoustics:** Intensity - Loudness - Absorption coefficient and its determination	1	C,D	1	1,2,4
6.	Reverberation - Reverberation time - Factors affecting acoustics of buildings and their remedies	1	C	1	1,2,4
7.	Sources and impacts of noise - Sound level meter - Strategies on controlling noise pollution	1	C	1	1,2,4
8.	Ultrasonic waves and properties - Methods of Ultrasonic production (Magnetostriction and Piezoelectric)	1	C	1	1,2,4
9.	Applications of Ultrasonics in Engineering and medicine	1	C	1	1,2,4
Unit II: Electromagnetic Waves, Circuits and Applications		**8**			
10.	Del operator - grad, div, curl and their physical significances - displacement current	1	C,D	2	1,2,6
11.	Maxwell's equations (derivation)	1	C,D	2	1,2,6
12.	Wave equation for electromagnetic waves	1	C	2	1,2,6
13.	Propagation in free space -Poynting theorem	1	C,D	2	1,2,6
14.	Characteristic of Transverse electric and magnetic waves -Skin depth	1	C,D	2	1,2,6
15.	Rectangular and circular waveguides	1	C,D	2	1,2,6
16.	High powered vacuum-based cavity magnetrons	1	C	2	1,2,6
17.	Applications including radars, microwave oven and lighting systems	1	C	2	1,2,6
Unit III: Lasers and Fiber Optics		**9**			
18.	**Laser:** Characteristics of Lasers - Einstein's coefficients and their relations -	1	C,D	3	1,2,5

	Lasing action				
19.	Working principle and components of CO_2 Laser, Nd-YAG Laser	1	C	3	1,2,5
20.	Semiconductor diode Laser- Excimer Laser and Free electron Laser	1	C	3	1,2,5
21.	Applications in Remote sensing - Holography	1	C	3	1,2,5
22.	Optical switching -Mechanism of Laser cooling and trapping	1	C	3	1,2,5
23.	**Fiber Optics:** Principle of Optical fiber - Acceptance angle and acceptance cone	1	C	3	1,2
24.	Numerical aperture - V-number	1	C,D	3	1,2
25.	Types of optical fibers (Material, Refractive index and mode) -Photonic crystal fibers	1	C	3	1,2
26.	Fiber optic communication - Fiber optic sensors	1	C	3	1,2

Unit IV: Quantum Mechanics and Crystal Physics		**8**			
27.	**Quantum mechanics:** Inadequacies of Classical Mechanics - Duality nature of electromagnetic radiation	1	C,D	1	1,2,7
28.	De Broglie hypothesis for matter waves - Heisenberg’s uncertainty principle - Schrödinger’s wave equation	1	C,D	1	1,2,7
29.	Particle confinement in 1D box (Infinite Square well potential)	1	C,D	1	1,2,7
30.	**Crystal Physics:** Crystal directions - Planes and Miller indices	1	C	1	1,2,8
31.	Symmetry elements - Quasi crystals	1	C	1	1,2,8
32.	Diamond and HCP crystal structure - Packing factor -Reciprocal lattice	1	C,D	1	1,2,8
33.	Diffraction of X-rays by crystal planes - Laue method and powder method	1	C	1	1,2,8
34.	Imperfections in crystals	1	C	1	1,2,8
Unit V: Green Energy Physics		**8**			
35.	Introduction to Green energy - **Solar energy:** Energy conversion by photovoltaic principle - Solar cells	1	C	4	1,9
36.	**Wind energy:** Basic components and principle of wind energy conversion systems	1	C	4	1,9
37.	**Ocean energy:** Wave energy - Wave energy conversion devices	1	C	4	1,9
38.	Tidal energy - single and double basin tidal power plants - Ocean Thermal Electric Conversion (OTEC)	1	C	4	1,9
39.	**Geothermal energy:** Geothermal sources (hydrothermal, geo-pressurized hot dry rocks, magma)	1	C	4	1,9
40.	**Biomass:** Biomass and bio-fuels - bio-energies from wastages	1	C	4	1,9
41.	**Fuel cells**: H_2O_2	1	C	4	1,9
42.	**Futuristic Energy:** Hydrogen - Methane Hydrates - Carbon capture and storage (CCS)	1	C	4	1,9
Assessment		**3**			
43.	Cycle Test I	1	--	-	
44.	Cycle Test II	2	-	-	-
	Total contact hours	45			

Learning Resources	
Sl.	**Text Books**

No.	
1.	Thiruvadigal.J. D, Ponnusamy .S, Sudha.D and Krishnamohan .M, "Physics for Technologists", Vibrant Publication, Chennai, 2015
2.	Dattu R.Joshi, “*Engineering Physics*”, Tata McGraw- Hill, New Delhi, 2010
Reference Books/Other Reading Material	
3.	WoleSoboyejo,*"Mechanical Properties of Engineered Materials"*, Marcel Dekker Inc" 2003
4.	Frank Fahy, *"Foundations of Engineering Acoustics"*, Elsevier Academic Press, 2005
5.	Alberto Son"*Lasers and their applications*", Gordon and Breach Science Publishers Ltd., 1976
6.	David J. Griffiths, *“Introduction to electrodynamics"*, 3rd Edition, Prentice Hall, 1999
7.	Leonard.I. Schiff, "*Quantum Mechanics*", 3rd Edition, Tata McGraw Hill' 2010
8.	Charles Kittel, *"Introduction to Solid State Physics"*, Wiley India Pvt.Ltd,7th Edition ,2007
9.	Godfrey Boyle,*“Renewable Energy: Power sustainable future"*, 2nd Edition, Oxford University Press. UK. 2004

Course nature							**Theory**
Assessment Method – Theory Component (Weightage 50%)							
In-semester	Assessment tool	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	Total
	Weightage	10%	15%	15%	5%	5%	50%
End semester examination Weightage :							50%

15PY101L	**Physics Laboratory**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	B	BASIC SCIENCES			
Course designed by	Department of Physics and Nanotechnology				
Approval	-- Academic Council Meeting -- , 2016				

Course nature						**Practical**
Assessment Method – Practical Internal Component (Weightage 100%)						
In-semester	Assessment tool	Experiments	Record	MCQ/Quiz/ Viva Voce	Model examination	Total
	Weightage	40%	**5%**	**5%**	10%	60%
End semester examination Weightage :						40%

Purpose	The purpose of this course is to develop scientific temper in experimental techniques and to reinforce the physics concepts among the engineering students.

Instructional Objectives		**Student Outcomes**						
At the end of the course, student will be able to								
1.	Gain knowledge in the scientific methods and learn the process of measuring different Physical variables	a						
2.	Develop the skills in arranging and handling different measuring instruments	e						
3.	Get familiarized with experimental errors in various physical measurements and to plan / suggest on how the contributions could be made of the same order, so as to minimize the errors.	b						

Sl. No.	**Description of Experiments**	**Contact hours**	**C-D I-O**	**IOs**	**Reference**
1.	Determination of Young's modulus of materials - Uniform bending.	2	I,O	1,2,3	1,2,3
2.	Determination of Rigidity modulus of a given material – Torsion pendulum	2	I,O	1,2,3	1,2,3
3.	Determination of dispersive power of a prism – Spectrometer	2	I,O	1,2,3	1,2,3
4.	Determination of laser parameters – divergence and wavelength for a given laser source –laser grating/ Particle size determination using laser	2	I,O	1,2,3	1,2,3
5	Study of attenuation and propagation characteristics of optical fiber cable	2	I,O	1,2,3	1,2,3
6	Calibration of voltmeter / ammeter using potentiometer	2	I,O	1,2,3	1,2,4
7	Construction and study of IC regulation properties of a given power supply	2	I,O	1,2,3	1,2,4
8	Study of V-I and V-R characteristics of a solar cell	2	I,O	1,2,3	1,2,4
9	Mini Project – Concept based Demonstration	2	I,O	1,2,3	-
	Total contact hours (inclusive of Demo and Repeat Class)	**30**			

Learning Resources	
Sl. No.	**Text Books**
1.	Thiruvadigal.J. D, Ponnusamy .S, Sudha.D and Krishnamohan .M, "Physics for Technologists", SSS Publication, Chennai, 2015
2.	Shukla R.K and Anchal Srivastava, “Practical Physics”, 1st Edition, New Age International (P) Ltd, New Delhi, 2006
Reference Books/Other Reading Material	
3.	Souires G.L., “Practical Physics:, 4th Edition, Cambridge University, UK, 2001.
4.	Chattopadhyay D, Rakshit P. C and Saha B, “*An Advanced Course in Practical Physics*”, 2nd Edition., Books & Allied Ltd., Calcutta, 1990.

15CY101	CHEMISTRY	L	T	P	C
		3	0	0	3
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	B	Basic Sciences			
Course designed by	Department of Chemistry				
Approval	32nd Academic Council Meeting, 23rd July 2016				

PURPOSE	To enable the students to acquire knowledge in the principles of Chemistry for engineering applications							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand, analyse the quality of water and its treatment methods for domestic and industrial applications	a	b					
2.	Understand the classification of polymers, different types of polymerization, preparation, properties and applications of Industrially important polymers and FRPs.	a	b	e				
3.	Understand and apply phase rule in one and two component systems.	a	b	c				
4.	Equip with the knowledge on corrosion and its prevention.	a	b	k				
5.	Acquire knowledge on classification and selection of lubricants and adhesives and their applications.	a	b					
6.	Understand the principle and instrumentation of analytical techniques for industrial application.	a						

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
UNIT I - WATER TREATMENT		**9**			
1.	Water quality parameters: Physical, Chemical & Biological significance -Hardness – Introduction-Types of hardness-Units of hardness.	1	C	1	1-5
2.	Estimation of hardness - EDTA method	1	C,D	1	1-5
3.	Dissolved Oxygen-Determination by Winkler's method, Alkalinity determination	2	C,D	1	1-5
4.	Disadvantages of using hard water in boilers: Scale, sludge formation - disadvantages	1	C	1	1-5
5.	Prevention - treatment: Internal conditioning - phosphate, calgon and carbonate conditioning methods	1	C	1	1-5
6.	External: Zeolite, ion exchange methods	1	C	1	1-5
7.	Desalination - reverse osmosis and electro dialysis	1	C	1	1-5
8.	Domestic water treatment	1	C	1	1-5
UNIT II - POLYMERS AND REINFORCED PLASTICS		**9**			
9.	Classification of polymers	1	C	2	1-5
10.	Types of polymerization reactions-Addition-Condensation and Copolymerization	1	C	2	1-5
11.	Mechanism of addition polymerization: free radical, ionic and Ziegler - Natta	2	C,D	2	1-5
12.	Effect of structure on the properties of polymers - strength, plastic deformation, elasticity and crystallinity.	1	C	2	1-5
13.	Preparation and properties of important resins: Polyethylene, PVC, PMMA, Polyester, Teflon, Bakelite and Epoxy resins	2	C	2	1-5
14.	Compounding of plastics , moulding methods - injection, extrusion, compression and calendaring; Reinforced plastics - FRP – Carbon and Glass-applications	2	C	2	1-5

UNIT III - PHASE EQUILIBRIA, LUBRICANTS AND ADHESIVES		**9**			
15.	Phase rule: Statement - explanation of the terms involved	1	C	3	1-5
16.	One component system (water system only)	1	C,I	3	1-5
17.	Two component systems: Condensed phase rule - Thermal analysis	1	C	3	1-5
18.	Simple eutectic, Pb-Ag; compound formation, Zn-Mg.	2	C,I	3	1-5
19.	Lubricants: Classification –solid, semi-solid, liquid, emulsion	1	C	3	1-5
20.	Properties – selection of lubricants for different purposes	1	C	3	1-5
21.	Adhesives: classification-natural, synthetic, inorganic-Adhesive action - applications.	2	C	3	1-5
UNIT IV - CORROSION AND ITS CONTROL		**9**			
22.	Corrosion: Basic concepts - mechanism of chemical corrosion, Pilling Bed worth rule	1	C	4	1-5
23.	Mechanism of electrochemical corrosion- Types of Electrochemical corrosion - galvanic corrosion - differential aeration corrosion - pitting corrosion - stress corrosion – Measurement of corrosion (wt. loss method only)	2	C,D,I	4	1-5
24.	Factors influencing corrosion.	1	C	4	1-5
25.	Corrosion control: Cathodic protection - sacrificial anodic method - corrosion inhibitors	2	C,I	4	1-5
26.	Protective coatings: surface preparation for metallic coatings - electro plating (copper plating) and electroless plating (Nickel plating)	2	C,I	4	1-5
27.	Chemical conversion coatings - anodizing, phosphating& chromate coating	1	C,I	4	1-5
UNIT V: INSTRUMENTAL METHODS OF ANALYSIS		**9**			1-5
28.	Basic principles-instrumentation and applications of potentiometry.	3	C,I	5	1-5
29.	UV - visible spectroscopy	2	C,I	5	1-5
30.	Infrared spectroscopy	2	C,I	5	1-5
31.	Atomic absorption spectroscopy	1	C,I	5	1-5
32.	Flame Photometry	1	C,I	5	1-5
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Kamaraj.P&Arthanareeswari. M, “Applied Chemistry”,9thEdition, Sudhandhirapublications, 2012.
2.	R.Jeyalakshmi, ‘Engineering Chemistry, Devi Publications, 2nded., 2007.
REFERENCE BOOKS/OTHER READING MATERIAL	
3.	S.S.Dara, A Text book of Engineering Chemistry,10thEdition,S.Chand& Company Ltd.,

	NewDelhi,2003
4.	Jain.P.C and Monika Jain, "Engineering Chemistry", DanpatRai publishing company (P) Ltd, New Delhi, 2010.
5.	Helen P Kavitha, “A Text book of Engineering Chemistry”–Shine Publications, 2015.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15CY101L	CHEMISTRY LABORATORY	L	T	P	C
		0	0	2	1
Co-requisite:	15CY101				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	B Basic Sciences				
Course designed by	Department of Chemistry				
Approval	32nd Academic Council Meeting, 23rd July 2016				

PURPOSE	To develop skills in conducting experiments and to apply the principles of Chemistry in engineering							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Equip themselves with the basic concepts and analytical skills involved in the analyses.	a	b	k				

Sl. No.	Description of experiments	Contact hours	C-D-I-O	IOs	Reference
1.	Preparation of standard solutions	2	C	1	1
2.	Estimation of total, permanent and temporary hardness by EDTA method	2	C,I	1	1
3.	Conductometric titration - determination of strength of an acid	2	C,I	1	1
4.	Estimation of iron by potentiometry	2	C,I	1	1
5.	Determination of molecular weight of polymer by viscosity average method	2	C,I	1	1
6.	Determination of dissolved oxygen in a water sample by Winkler's method	2	C,I	1	1
7.	Determination of Na / K in water sample by Flame photometry (Demonstration)	2	C,I	1	1
8.	Estimation of Copper in ore	2	C,I	1	1
9.	Estimation of nickel in steel	2	C,I	1	1
10.	Determination of total alkalinity and acidity of a water sample	2	C,I	1	1
11.	Determination of rate of corrosion by weight loss method.	2	C,I	1	1
	Total contact hours	**30**			

LEARNING RESOURCES	
Sl. No.	**REFERENCES**
1.	P. Kamaraj& M. Arthanareeswari, Practical Chemistry (workbook), Sudhandira publications, 2013.

Course nature				**Practical**		
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Experiments	Record	MCQ/Quiz/Viva Voce	Model examination	**Total**
	Weightage	**40%**	**5%**	**5%**	**10%**	**60%**
					End semester examination Weightage :	**40%**

15BT101	**Biology for Engineers**	**L**	**T**	**P**	**C**
		2	0	0	2
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	B	BASIC SCIENCES	BIOTECHNOLOGY		
Course designed by	Department of Biotechnology				
Approval	32nd Academic Council Meeting - July 23, 2016				

PURPOSE	The purpose of this course is to provide a basic understanding of biological mechanisms of living organisms from the perspective of engineers. In addition, the course is expected to encourage engineering students to think about solving biological problems with engineering tools.				
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**			
At the end of the course, student will be able to					
1.	appreciate the basic organization of organisms and living being.	a			
2.	understand the machinery of the cell that is ultimately responsible for various daily activities.	a	b		
3.	acquire knowledge about biological problems that requires engineering expertise to solve them.			j	

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I-BASIC CELL BIOLOGY	**06**			
1.	Introduction to Biology	1	C	1	1
2.	The cell: the basic unit of life	1	C	1	1,3
3.	Expression of genetic information - protein structure and function	1	C	1	1,2
4.	Cell metabolism; Cells respond to their external environments	1	C	1	1,2,3
5.	Cells grow and reproduce	1	C	1	1,3
6.	Cellular differentiation	1	C	1	1,3
	UNIT II- BIOCHEMISTRY AND MOLECULAR ASPECTS OF LIFE	**05**			
7.	Biodiversity - Chemical bonds in Biochemistry; Biochemistry and Human biology	1	C	1,2	1,2
8.	Protein synthesis –DNA; RNA	1	C	2	1,2,3
9.	Transcription and translation factors play key roles in protein synthesis	1	C	2	1,2,3
10.	Differences between eukaryotic and prokaryotic protein Synthesis	1	C	2	1,2
11.	Stem cells and their applications	1	C	1,2	1,3
	UNIT III-ENZYMES AND INDUSTRIAL APPLICATIONS	**05**			
12.	Enzymes – significance, factors	1	C	2	1,2
13.	Mechanism and effective catalysis – proteases, carbonic anhydrase	1	C	2	1,2
14.	Restriction Enzymes; Nucleoside Monophosphate Kinases	1	C	2	1,2,3
15.	Photosynthesis and carbon fixation; Biological energy production	1	C	2	1,2
16.	Metabolism-anabolism and catabolism	1	C	2	1,2
	UNIT IV-MECHANOCHEMISTRY	**07**			
17.	Protein motors convert chemical energy into mechanical work	2	C	2,3	1,2
18.	ATP synthase structure	1	C	2,3	1,3
19.	The bacterial flagellar motor	1	C	2,3	1,3
20.	Cytoskeleton	1	C	2,3	1,2
21.	Biosensors - types, applications	1	C	2,3	1,4

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
22.	Bioremediation	1	C	2,3	1,5
	UNIT V-NERVOUS SYSTEM, IMMUNE SYSTEM AND CELL SIGNALING	**07**			
23.	Basics of nervous system and “neural networks"	2	C	3	1,6,7
24.	The cellular basis of immunity	1	C	3	1,6,7
25.	The functional properties and structure of antibodies	2	C	3	1,6
26.	T cell receptors and subclasses	1	C	3	1,6
27.	General principles of cell signaling	1	C	1,3	1,6,7
	Total contact hours			**30**	

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	ThyagaRajan.S., Selvamurugan. N., Rajesh.M.P., Nazeer.R.A., Richard W. Thilagaraj, Barathi.S., and Jaganthan.M.K., “*Biology for Engineers”*, Tata McGraw-Hill, New Delhi, 2012.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, “*Biochemistry”*, W.H. Freeman and Co. Ltd., 6th Ed., 2006.
3.	Robert Weaver, “*Molecular Biology”*, MCGraw-Hill, 5th Edition, 2012.
4.	Jon Cooper, “*Biosensors A Practical Approach”,* Bellwether Books, 2004.
5.	Martin Alexander, “*Biodegradation and Bioremediation”,* Academic Press, 1994.
6.	Kenneth Murphy, “*Janeway's Immunobiology”*, Garland Science; 8th edition, 2011.
7.	Eric R. Kandel, James H. Schwartz, Thomas M. Jessell, “*Principles of Neural Science”*, McGraw-Hill, 5th Edition, 2012.

Course nature			**Theory**			
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15CE101	**BASIC CIVIL ENGINEERING**		**L**	**T**	**P**	**C**
			2	**0**	**0**	**2**
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	NIL					
Course Category	E	ENGINEERING SCIENCES				
Course designed by	Department of Civil Engineering					
Approval	32nd Academic Council Meeting , 2016					

PURPOSE	To get exposed to the glimpses of Civil Engineering topics that are essential for an Engineer.	
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course, student will be able to		
1.	Know about different materials used in civil engineering structures in general	a
2.	Understand the engineering properties of material related to the design of civil engineering structural members	a
3.	Know about terms, definitions and uses related to multifarious building components.	a
4.	Learn the importance of surveying and the transportation systems	a
5.	Comprehend rudiments of engineering related to dams, water supply, and sewage disposal	a

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I- BUILDING MATERIALS	**6**			
1.	Introduction to Civil Engineering and Civil Engineering materials	1	C	1	1-3
2.	Composition, classifications, properties, and uses of stones	1	C	1	1-3
3.	Classification of rocks , quarrying , dressing , properties and uses	1	C	1	1-3
4.	Properties and uses of timber and ply wood	1	C	1	1-3
5.	Types, grades, properties and uses of cement and grade, designation, properties and uses of concrete	1	C	1	1-3
6.	Types of steel, mild, medium and hard, properties and uses and market forms	1	C	1	1-3
	UNIT II- MATERIAL PROPERTIES	**6**			
7.	Types of stresses and strains and Hook’s law	1	C	2	1-3
8.	Three modulii of elasticity and Poisson’s ratio and their interrelationship , simple problems	1	C, I	2	1-3
9.	Determination of centre of gravity of plane areas	1	C, I	2	1-3
10.	Concept of Moment of inertia, parallel and perpendicular axis theorems and the concept of radius of gyration	1	C	2	1-3

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
11.	Determination of moment of inertias of rectangular, circular, I , T and channel sections	2	C, I	2	1-3
	UNIT III -BUILDING COMPONENTS	**6**			
12.	Factors to be considered for site selection for buildings	1	C	3	1-3
13.	Classification of buildings and their components	1	C	3	1-3
14.	cement concrete, marble terrazzo , ceramic tiled floorings including the names of popular commercial brands	2	C	3	1-3
15.	Requirements of roofing in buildings and corresponding classification of building roofs – RCC flat roofs and sheet roofings for pitched steel buildings.	2	C	3	1-3
	UNIT IV-SURVEYING AND TRANSPORTATION	**6**			
16.	Objectives, classification and principles of surveying	1	C	4	1-3
17.	Classification of transportation of and cross section and components of road	1	C	4	1-3
18.	Railway – cross section and components of permanent way and its functions	1	C	4	1-3
19.	Water way, docks and harbor their classifications and components.	2	C	4	1-3
20.	Components of bridge	1	C	4	1-3
	UNIT V- WATER SUPPLY AND SEWAGE DISPOSAL	**6**			
21.	Purpose of dams, types of dam, selection of site for the dams, and the cross section of gravity of dams	2	C	5	1-3
22.	Objectives of water supply, estimation of quantity of water, sources of water, standards of drinking water and distribution system	2	C	5	1-3
23.	Classification of sewage , technical terms and definitions, septic tank its components and functions.	2	C	5	1-3
Total contact hours		**30**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Raju .K.V.B, Ravichandran .P.T, “*Basics of Civil Engineering”*, Ayyappa Publications, Chennai, 2012.
2.	Rangwala .S.C,” *Engineering Material”s*, Charotar Publishing House, Anand, 2012.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain, “*Basic Civil Engineering*”, Laxmi Publications, First edition (2003), New Delhi

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15EE101	**Basic Electrical Engineering**		**L**	**T**	**P**	**C**
			2	**0**	**0**	**2**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	PROFESSIONAL CORE	CIRCUITS AND SYSTEMS			
Course designed by	Department of Electrical and Electronics Engineering					
Approval	32nd, Academic Council Meeting , 2016					

PURPOSE	This course provides comprehensive idea about circuit analysis, working principles of machines and common measuring instruments							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, the student will be able to								
1.	Understand the basic concepts of magnetic circuits, AC and DC circuits.	a	e					
2.	Gain knowledge about the working principle, construction, applications of DC, AC machines and measuring instruments.	a						
3.	Understand the fundamentals of wiring and earthing.	a						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
1.	**UNIT I : FUNDAMENTALS OF DC CIRCUITS**	**6**			
2.	Introduction to DC and AC circuits, Active and passive two terminal elements	1	C	1	1
3.	Ohms law, Voltage-Current relations for resistor, inductor, capacitor	1	C	1	1
4.	Kirchhoff's laws, Mesh analysis	2	C	1	1
5.	Nodal analysis	1	C	1	1
6.	Ideal sources –equivalent resistor, current division, voltage division	1	C	1	1
	UNIT II : MAGNETIC CIRCUITS	**6**			
7.	Introduction to magnetic circuits	1	C	1	1
8.	Simple magnetic circuits	2	C	1	1
9.	Faraday's laws	2	C	1	1
10.	Induced emf and inductances	1	C	1	1
	UNIT III : AC CIRCUITS	**6**			
11.	Sinusoids, Generation of AC, Average and RMS values, Form and peak factors	2	C	1	1
12.	Concept of phasor representation, J operator	1	C	1	1
13.	Analysis of R-L, R-C, R-L-C circuits	2	C	1	1
14.	Introduction to three phase systems - types of connections, relationship between line and phase values	1	C	1	1
	UNIT IV : ELECTRICAL MACHINES & MEASURING INSTRUMENTS	**6**			
15.	Working principle, construction and applications of DC machines	2	C	2	1
16.	Working principle, construction and applications of AC machines (1 - phase transformers, single phase induction motors: split phase, capacitor start and capacitor start and run motors)	2	C	2	1
17.	Basic principles and classification of instruments - Moving coil and moving iron instruments.	2	C	2	1
	UNIT V : ELECTRICAL SAFETY, WIRING AND INTRODUCTION TO POWER SYSTEM	**6**			
18.	Safety measures in electrical system- types of wiring	1	C	3	1
19.	Wiring accessories- staircase, fluorescent lamps and corridor wiring	2	C	3	1

20.	Basic principles of earthing-Types of earthing-Simple layout of generation, transmission and distribution of power	3	C	3	1
	Total contact hours	**30**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Dash.S.S, Subramani.C, Vijayakumar.K, ”*Basic Electrical Engineering*”, First edition,Vijay Nicole Imprints Pvt.Ltd,2013
REFERENCE BOOKS/OTHER READING MATERIAL	
2.	Smarajt Ghosh, “*Fundamentals of Electrical & Electronics Engineering*”, Second edition, PHI Learning, 2007
3.	Metha.V.K, Rohit Metha, “*Basic Electrical Engineering*”, Fifth edition, Chand. S & Co, 2012
4.	Kothari.D.P and Nagrath.I.J, “*Basic Electrical Engineering*”, Second edition, Tata McGraw - Hill, 2009
5.	Bhattacharya.S.K, “*Basic Electrical and Electronics Engineering”*, First edition, Pearson Education, 2011.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15ME105L	ENGINEERING GRAPHICS	L	T	P	C
		1	0	4	3
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	First Angle Projection is to be followed - Practice with Computer Aided Drafting tools, IS STANDARD				
Course Category	E	ENGINEERING SCIENCES			
Course designed by	Department of Mechanical Engineering				
Approval	-- Academic Council Meeting -- , 23rd July 2016				

PURPOSE	1. To draw and interpret various projections of 1D, 2D and 3D objects. 2. To prepare and interpret the drawings of buildings.							
INSTRUCTIONAL OBJECTIVES		**STUDENTOUTCOMES**						
At the end of the course, student will be able to familiarize with the								
1.	Construction of geometrical figures	g						
2.	Projection of 1D, 2D and 3D objects	g	k					
3.	Sectioning of solids and development of surfaces	g	k					
4.	Preparation and interpretation of building drawing	g	k					

Sl. No.	Description of experiments	Contact hours	C-D-I-O	IOs	Reference
1.	**Introduction to Engineering Graphics and Drafting tool** **Introduction to Engineering drawing** - Drawing instruments (including Mini drafter) - Lettering - Line type - Drawing standards and codes - Drawing sheet layout (Margins and Title block) **Introduction to Drafting package** - Graphical User Interface (GUI) – - Setting work area and Title block - Draw: Line, Arc, Circle - Modify: Erase, Offset, Move, Copy	2	C,D	1,2	1,2,3
	Manual Drafting - Drawing sheet layout - Alphabets of height 5 and 7 mm - Numerals 0 to 9 of height 5 and 7 mm - Drawing basic entities	1	C,D		
	Computer Aided Drafting - Draw the given figures using drafting package	2			
2.	**Review of Geometric construction & Introduction to modifying commands** **Geometric constructions:** - Dividing a line into ‘n’ parts - Bisecting an arc - Drawing an arc tangent to two straight lines - Construction of polygon **Introduction to Modify commands** - Demonstration of Modify commands in drafting package	2	C	1	1,2,3
	Manual Drafting - Geometric constructions	1	D		
	Computer Aided Drafting - Draw the given figures using drafting package	2			
3.	**Layers, Dimensioning, Hatching and Text** **Demonstration of commands** - Layers - Dimensions - Hatching - Text	2	C	2	1,2,3
	Computer Aided Drafting - Draw the given figures using drafting package	3	D		
4.	**Conic sections and Special curves** **Construction of Conic sections:**	2	C	1,2	1,2,3

Sl. No.	Description of experiments	Contact hours	C-D-I-O	IOs	Reference
	- Parabola : Tangent and Rectangle method - Ellipse: Oblong method and concentric circle method – - Hyperbola – Eccentricity method - Construction of special curves: - Cycloid - Spiral				
	Manual Drafting - Construction of conic sections and cycloid	2	D		
	Computer Aided Drafting - Draw the given figures using drafting package	1	D		
5.	**Introduction to orthographic projections:** - I, II, III and IV angle projections - Projection of Points in different quadrants - Projection of Lines: Inclined to one plane - Projection of planes - Conceptual free hand sketching	2	C	2,3	1,2,3
	Manual Drafting - Conceptual sketching - Projection of points, lines and planes	3	D		
6.	**Solids I** **Introduction to solids :** - Polyhedron - Prisms **Introduction to 3D Tools:** - Modeling	2	C	2	1,2,3
	Manual Drafting - Projection of solid	1	D		
	Computer Aided Drafting - Modeling of polyhedron and prisms - Generating orthographic views of solids	2	D		
7.	**Solids II** **Introduction to solids:** - Pyramids - Solids of revolution **Introduction to 3D Tools**: - Modeling	2	C	2	1,2,3
	Manual Drafting - Projection of solids	2	D		
	Computer Aided Drafting - Modeling of pyramids & solids of revolution and generating the orthographic views	1	D		
8.	**Solids – III** **Orthographic views** - Orthographic views of the given pictorial view / model - Demonstration of modeling of components using Extrude and Revolve - Boolean operations	2	C	2	1,2,3
	Manual Drafting – - Drawing orthographic views of machine components in grid sheet	1	D		
	Computer Aided Drafting - Modeling of simple machine components and generating its orthographic views	2	D		
9.	**Solids – IV** - Demonstration of modeling of components using Loft, Sweep, Helical sweep and Shell.	2	C	2	1,2,3
	Computer Aided Drafting - Modeling of components using Boolean operations and generating its orthographic views	3	D		
10.	**Section of Solids** **Introduction to Section of regular solids**	2	C	2,3	1,2,3

Sl. No.	**Description of experiments**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	- Section plane - Sectional view				
	Manual Drafting - Section of solids	2	D		
	Computer Aided Drafting - Modeling the regular solids and section it to obtain the sectional views	1	D		
11.	**Development of surfaces** - Introduction - Methods - Application	2	C	2,3	1,2,3
	Manual Drafting - Development of surfaces	3	D		
12.	**Building Drawing** - Components of a building - Conventional representation of building materials - Scale	2	C	4	1,2,3
	Computer Aided Drafting - Drawing the plan, elevation and sectional views of a building	3	D		
	Total contact hours	**60** **60**			

LEARNING RESOURCES	
Sl. No.	**REFERENCES**
1.	Bhatt, N.D., "*Elementary Engineering Drawing (First Angle Projection)*", Charotar Publishing Co., Anand, 1999.
2.	Bethune, J.D.,"*Engineering Graphics with AutoCAD 2013*", PHI Learning Private Limited, Delhi, 2013.
3.	Shah, M. B. and Rana, B. C., "*Engineering Drawing*", Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2005.
4.	Venugopal, K. and Prabhu Raja, V., "*Engineering Graphics*", Eighth Edition (Revised), New Age International Publishers, Chennai, 2007.
5.	Natarajan, K.V., "*A Text Book of Engineering Graphics*", 21st Edition, Dhanalakshmi Publishers, Chennai, 2012.
6.	Jeyapoovan, T., "*Engineering Drawing and Graphics using AutoCAD*", Vikas Publishing House Pvt. Ltd., New Delhi, 2010.
7.	Narayanan, K. L. and Kannaiah, P.,"*Engineering Graphics*", Scitech Publications, Chennai, 1999.

Course nature				**Practical**		
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	**Experiments**	**Record**	**MCQ/Quiz/Viva Voce**	**Model examination**	**Total**
	Weightage	**50%**	**-**	**-**	**10%**	**60%**
End semester examination Weightage :						**40%**

15CS101L	**Programming Laboratory**	**L**	**T**	**P**	**C**
		1	**0**	**2**	**2**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	P	Professional Core			
Course designed by	Department of Computer Science and Engineering				
Approval	32nd Academic Council Meeting , 23rd July, 2016				

PURPOSE	This Lab Course will enable the students to understand the fundamentals of programming and gain knowledge on using the preliminary constructs in solving simple applications

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able								
1.	Learn the fundamentals of programming and its environment	k						
2.	Ability to write programs using commands and functions	a						
3.	To be able to apply programming skills in their area of specialization	d						
4.	Learn to work with team members in developing mini projects	c						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	Students shall be given experiments covering the following topics: 1. Practicing the environment for programming to familiarize Workspace, Directory, Windows, Edit options, Help, Shortcuts etc. Simple exercises to familiarize Basic Commands. 2. Data types, Constants and Variables, operators, Input-output functions, reading and storing data, Assignment statements, Control Structures, Iterative statements 3. Vectors and Matrices, commands to operate on vectors and matrices, Matrix Manipulations, Arithmetic, Relational and Logical operations on Matrices. 4. Polynomial Evaluation, Roots of Polynomial, Arithmetic Operations on Polynomials. 5. Basic Graphics: 2D / 3D plots, Printing labels, Grid & Axes box, Text in plot, Bar and Pie chart, Histograms, Animation 6. Experiments in solving simple Engineering problems – To be decided by the Lab Course Coordinator. 7. Students shall be encouraged to form groups (Maximum 3) to do a mini Project covering the above mentioned topics.	Theory 15 Practical 30	D, I,O	1,2,3,4	
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl. No.	**REFERENCE BOOKS**
1.	www.scilab.org
2.	Rudra Pratap., “Getting started with MATLAB”, Oxford University Press, 2010.
3.	Bansal R.K, Goel A.K.,Sharma M.K., “MATLAB and its Applications in Engineering”, Pearson Education, 2012.

Course nature				**Practical**	
Assessment Method (Weightage 100%)					
In-semester	**Assessment tool**	Observation	Model Exam	Mini Project & Report	**Total**
	Weightage	**20%**	**15%**	**25%**	**60%**
				End semester examination Weightage :	**40%**

SEMESTER - II

15LE102	**VALUE EDUCATION**			**L**	**T**	**P**	**C**
				2	**0**	**0**	**2**
Co-requisite:	NIL						
Prerequisite:	Nil						
Course Category	G	General					
Course designed by	Department of English & Foreign Languages						
Approval	-- Academic Council Meeting -- , 2016						
PURPOSE	To ensure the emotional and spiritual enrichment of the individual on a personal, social and professional level, the impact of which will be realized over a period of time.						

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	perceive the strengths and weaknesses – that of oneself and others	f,i						
2.	understand/Infer the role of the Individual in Society	f,i						
3.	analyze situations and adapt accordingly in a humanistic manner	f,i						
4.	be aware of the importance of Engineering Ethics and the need to apply them in their professional lives	f,i						
5.	To Comprehend the role of aesthetic, moral and spiritual values	f,i						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
Unit I - INTRODUCTION		**2**			
1	Definition, Relevance, Types of values, changing concepts of values,.	1	f	1,2	1,2
2	values through various genres of literature.	1	f,i	1,2	1,2
INDIVIDUAL AND GROUP BEHAVIOUR		**8**			
1	Personal values – Self	3	i	1,2	1,2
2	Strengths (self-confidence, self-assessment, self-reliance, self-discipline, determination, self-restraint, contentment, humility, sympathy and compassion, gratitude, forgiveness)	3	i	1,2	1,2
3	Weaknesses (Influences -- Peer pressure, familial and societal expectations, media)	2	f,i	3,4	1,2
Unit III- SOCIETIES IN PROGRESS		**7**			
1	Definition of society; Units of society;	3	f,i	1	1
2	Communities – ancient and modern – Agents of change – Sense of survival, security, desire for comfort and ease sense of belonging	3	f,i	1,4	1
3	Social consciousness and responsibility	1		3,4	1
UNIT IV–ENGINEERING ETHICS		**8**			
1	Definition- Societies for engineers – Code of Ethics – Ethical Issues involved in cross border research --	4	f,i	3,4	1
2	Ethical and Unethical practices – case studies – situational decision making	4	f,i	3,4	1,2
UNIT V - SPIRITUAL VALUES		**5**			
1	What is religion? -- Role of religion	2	i	5	1
2	Misinterpretation of religion – moral policing – Consequences	2	i	5	1
3	Religion as spiritual quest – Aesthetics and religion	1	i	5	1
	Total Contact Hours	**30**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOK**
1.	Department of English and Foreign Languages SRM University. 2015 ***Rhythm of Life .*** SRMUniversity Publications
2.	**Values (**Collection of Essays), 1996. Published by : Sri Ramakrishna Math, Chennai-4.

Course nature							**Theory**
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	**Quiz**	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15PD102	**SOFT SKILLS - II**	**L**	**T**	**P**	**C**
		1	**1**	**0**	**1**
Co-requisite:	NIL				
Prerequisite:	Soft Skills - 1				
Course Category	G General				
Course designed by	Career Development Centre				
Approval	-- Academic Council Meeting -- , 2016				

PURPOSE	To enhance holistic development of students and improve their employability skills.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1	Acquire inter personal skills and be an effective goal oriented team player	d						
2.	Develop professionalism with idealistic, practical and moral values.	f						
3.	Acquire communication and problem solving skills.	g						
4.	Re-engineer their attitude and understand its influence on behavior.	i						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	Unit I – Interpersonal skills				
1	Gratitude, Being thankful, Secret of happiness, Satin ribbon activity	2	C, I	2	1, 2, 3, 4
2	Stages of dependence, Understanding the integration of leadership, networking and	2	C	1, 3, 4	1, 2, 3, 4
3	Assessing interpersonal skills, situation analysis	2	C, I	1, 3, 4	1, 2, 3, 4
4	Importance of teamwork, Teamwork activity	4	C, O	1, 3, 4	3, 4
	Unit II - Leadership				
5	Skills needed for a good leader, Types of leadership style	2	C	1-4	1, 3, 7

6	Assessment of leadership skills, Wheel of leadership	2	C, I	1-4	1, 3, 7

	Unit III – Stress management				
7	Causes of stress and its impact, Let it down, How to manage and de-stress,	2	C	4	1, 6
8	Circle of control, Daily life can be a stress buster, Stress activity	2	C	4	1, 6
9.	Emotional intelligence, Emotional quotient and intelligence quotient	2	C, I	1, 2, 4	1, 4, 5
10	Emotion scale, Managing emotions	2	C, I	1, 2, 4	1, 4, 5
	Unit IV – Conflict resolution				
11	Conflicts in human relations, Self assessment test for conflict management	1	C	1-4	1, 3, 4
12	Approaches to conflict resolution	1	C	1-4	1, 3, 4
13	Case study	2	C, I	1-4	1, 7
	Unit V – Decision making				
14	Importance of decision making, Impact of decision in life	1	C	1, 2, 3	1, 2, 6
15	Weighing positives and negatives	1	C, I	1, 2, 3	1, 2, 6
16	Process and practical way of decision making	2	C, D, I	1, 2, 3	1, 2
	Total contact hours	30			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	SOFT SKILLS, 2015, Career Development Centre, Green Pearl Publications.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	Covey Sean, *Seven Habits of Highly Effective Teens*, New York, Fireside Publishers, 1998.
3.	Carnegie Dale, *How to win Friends and Influence People*, New York: Simon & Schuster, 1998.
4.	Thomas A Harris, *I am ok, You are ok* , New York-Harper and Row, 1972.
5.	Daniel Coleman, *Emotional Intelligence*, Bantam Book, 2006.
6.	Carnegie Dale, *How to stop worrying and start living*, New York: Simon & Schuster, 1985.

7.	http://empower.srmuniv.ac.in (Online LMS)

Course nature			**Fully internal**			
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Activities	**Tech talk**	LMS	Participation	**Total**
	Weightage	**40%**	**25%**	**25%**	**10%**	**100%**

15MA102	**ADVANCED CALCULUS AND COMPLEX ANALYSIS**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**
Co-requisite:	NA				
Prerequisite:	15MA101				
Data Book / Codes/Standards	NA				
Course Category	B	CORE	MATHEMATICS		
Course designed by	Department of Mathematics				
Approval	-- Academic Council Meeting -- , 2016				

PURPOSE	To acquire analytical ability on solving Advanced Calculus and Complex Analysis problems as applied to the respective branches of Engineering.		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1	Apply multiple integrals knowledge to Engineering problems.	a	e
2.	Improve their ability in solving vector calculus problems.	a	e
3.	Equip themselves familiar with Laplace Transforms.	a	e
4.	Familiarize with the applications of analytic functions.	a	e
5.	Expose to the concept of complex integration.	a	e

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: MULTIPLE INTEGRALS	**12**			
1.	Evaluation of double integration in Cartesian and plane polar coordinates	2	C,I	1	1-7
2.	Evaluation of double integral by changing of order of integration	2	C, I	1	1,3,4,6
3.	Area as a double integral (Cartesian and polar)	2	C, I	1	1,3,4,6
4.	Triple integration in Cartesian coordinates	2	C, I	1	1,3,4,6
5.	Conversion from Cartesian to polar in double integrals	2	C, I	1	1,3,4,6
6.	Volume as a Triple Integral.	2	C, I	1	1,3,4,6
	UNIT II: VECTOR CALCULUS	**12**			
7.	Review of vectors in 2,3 dimensions ,Gradient, divergence, curl – Solenoidal and irrotational	2	C,I	2	1,3,4,6
8.	Vector identities (without proof) – Directional derivatives	2	C, I	2	1,3
9.	Line, surface and volume integrals	2	C, I	2	1,3

10.	Green's theorem (without proof),	2	C, I	2	1,3
11.	Gauss divergence theorem (without proof), verification and applications to cubes and parallelopipeds only	2	C, I	2	1,3
12.	Stoke's theorems (without proof) – Verification and applications to cubes and parallelopipeds only	2	C, I	2	1,3
	UNIT III: LAPLACE TRANSFORMS	**12**			
13.	Transforms of standard functions –properties – Transforms of	2	C,I	3	2,5,7
14.	Initial and final value theorems (without proof)	2	C, I	3	2,5,7,1
15.	Inverse Laplace transforms	2	C, I	3	2,5,7
16.	ILT using Convolution theorem -problems only	2	C, I	3	1,2
17.	LT of periodic functions -problems only	2	C, I	3	1,2
18.	Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficient only	2	C, I	3	1,2
	UNIT IV: ANALYTIC FUNCTIONS	**12**			3.6
19.	Definition of Analytic Function – Cauchy Riemann equations	2	C,I	4	7
20.	Properties of analytic function functions	2	C,I	4	1,2
21.	Determination of analytic function using – Milne-Thomson's method	2	C, I	4	1
22.	Conformal mappings: magnification and rotation	2	C,I	4	1,2
23.	Conformal mappings: inversion and reflection	2	C, I	4	4,5
24.	bilinear transformation	2	C, I	4	1,2
	UNIT V: COMPLEX INTEGRATION	**12**			
25.	Cauchy's integral theorem (without proof) –and its applications	2	C,I	5	3,4
26.	Cauchy's integral formulae	2	C,I	5	3,4
27.	Taylor's and Laurent's expansions with simple problems	2	C, I	5	4
28.	Singularities – Types of Poles and Residues	2	C,I	5	3,4
29.	Cauchy's residue theorem (without proof)-	2	C, I	5	2,3

30.	Contour integration: Unit circle, semicircular contour.	2	C, I	5	3,4
	Total contact hours	60			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Kreyszig.E, "*Advanced Engineering Mathematics*", John Wiley & Sons. Singapore, 10th edition, 2012.
2.	K.Ganesan, Sundarammal Kesavan, K.S.Ganapathy Subramanian &V.Srinivasan, "*Engineering Mathematics*",Gamma publications, Revised Edition, 2013.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 42nd Edition,2012.
4.	Veerajan. T, "*Engineering Mathematics I*", Tata McGraw Hill Publishing Co, New Delhi, 5th edition, 2006.
5.	Kandasamy P etal. "*Engineering Mathematics*", Vol.I (4th revised edition), S.Chand &Co., New Delhi, 2000.
6.	Narayanan S., Manicavachagom Pillay T.K., Ramanaiah G., "*Advanced Mathematics for Engineering students*", Volume I (2nd edition), S.Viswanathan Printers and Publishers, 1992.
7.	Venkataraman M.K., "*Engineering Mathematics*" – First Year (2nd edition), National Publishing Co., Chennai, 2000.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15PY102L	**Materials Science**		**L**	**T**	**P**	**C**
			2	**0**	**2**	**3**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	B	BASIC SCIENCES				
Course designed by	Department of Physics and Nanotechnology					
Approval	-- Academic Council Meeting -- , 2016					

Purpose	The course introduces several advanced concepts and topics in the rapidly evolving field of material science. Students are expected to develop comprehension of the subject and to gain scientific understanding regarding the choice and manipulation of materials for desired engineering applications.							
Instructional Objectives		**Student Outcomes**						
At the end of the course, student will be able								
1.	To acquire basic understanding of advanced materials, their functions and properties for technological applications	a						
2.	To emphasize the significance of materials selection in the design process	e						
3.	To understand the principal classes of bio-materials and their functionalities in modern medical science	k						
4.	To get familiarize with the new concepts of Nano Science and Technology	d						
5.	To educate the students in the basics of instrumentation, measurement, data acquisition, interpretation and analysis	b						

Session	**Description of Topic (Theory)**	**Contact hours**	**C-D I-O**	**IOs**	**Reference**
Unit I: Electronic and Photonic Materials		**6**			
1.	**Electronic Materials**: Fermi energy and Fermi - Dirac distribution function	1	C,D	1	1,2,3
2.	Variation of Fermi level with temperature in intrinsic and extrinsic semiconductors	1	C,D	1	1,2,3
3.	Hall effect - Dilute Magnetic Semiconductors (DMS) and their applications	1	C,D	1	1,2,3
4.	**Superconducting Materials**: Normal and High temperature superconductivity - Applications	1	C	1	1,2,3
5.	**Photonic Materials:** LED – LCD - Photo conducting materials	1	C	1	1,2,4
6.	Photo detectors (CCD) - Photonic crystals and applications - Elementary ideas of Non-linear optical materials and their applications	1	C	1	1,2,4,5
Unit II: Magnetic and Dielectric Materials		**5**			
7.	**Magnetic Materials:** Classification of magnetic materials based on spin - Hard and soft magnetic materials - Ferrites	1	C	1,2	1,2
8.	Garnets and magnetoplumbites -Magnetic bubbles and their applications - Magnetic thin films	1	C	1,2	1,2
9.	Spintronics and devices (Giant magneto resistance, Tunnel magneto resistance and Colossal magneto resistance). **Dielectric Materials:** Polarization mechanisms in dielectrics **Dielectric Materials:** Polarization mechanisms in dielectrics	1	C	1,2	1,2,3

10.	Frequency and temperature dependence of polarization mechanism - Dielectric loss - Dielectric waveguide	1	C	1,2	1,2,3
11.	Dielectric resonator antenna - Piezoelectric, pyroelectric and ferroelectric materials and their applications	1	C	1,2	1,2,3
Unit III: Modern Engineering and Biomaterials		**5**			
12.	**Modern Engineering Materials:** Smart materials - Shape memory alloys - Chromic materials - Thermo, Photo and Electro - Rheological fluids	1	C	1,3	1,3
13.	Metallic glasses - Advanced ceramics - Composites. **Bio-materials:** Classification of bio-materials (based on tissue response)	1	C	1,3	1,3
14.	Comparison of properties of some common biomaterials - Metallic implant materials - stainless steel, cobalt-based and titanium-based alloys	1	C	1,3	1,7
15.	Polymeric implant materials -Polyamides, polypropylene, Acrylic resins and Hydrogels	1	C	1,3	1,7,8
16.	Tissue replacement implants - Tissue engineering - Biosensor	1	C	1,3	1,7
Unit IV: Introduction To Nanoscience and Nanotechnology		**6**			
17.	Basic concepts of Nanoscience and Nanotechnology - Quantum wire - Quantum well - Quantum dot - fullerenes	1	C	4	1,9,10
18.	Graphene - Carbon nanotubes	1	C	4	1,9,10
19.	Material processing by chemical vapor deposition and physical vapor deposition	1	C	4	1,9,10
20.	Principle of SEM, TEM, AFM	1	C	4	1,9,10
21.	Scanning near-field optical microscopy (SNOM) - Scanning ion-conducting microscopy (SCIM)	1	C	4	1,9,10
22.	Potential uses of nanomaterials in electronics, robotics, computers, sensors, sports equipment, mobile electronic devices, vehicles and transportation- Medical applications of nanomaterials	1	C	4	1,9,10
Unit V: Materials Characterization		**5**			
23.	X-ray diffraction, Neutron diffraction	1	C	5	1,11
24.	Electron diffraction - X-ray fluorescence spectroscopy	1	C	5	1,11
25.	Fourier transform Infrared spectroscopy (FTIR) -Ultraviolet and visible spectroscopy (UV-Vis)	1	C	5	1,11
26.	Thermogravimetric Analysis (TGA)	1	C	5	1,11
27.	Differential Thermal Analysis (DTA) - Differential Scanning Calorimetry (DSC)	1	C	5	1,11
Assessment		**3**			
28.	Cycle Test I	1	-	-	
29.	Cycle Test II	2	-	-	-
	Total contact hours	30			

Sl. No.	**Description of experiments**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
1.	Determination of resistivity and band gap for a semiconductor material -Four probe method / Post-office box	2	I,O	5	1
2.	Determination of Hall coefficient for a semiconducting material	2	I,O	5	1
3.	To study V-I characteristics of a light dependent resistor (LDR)	2	I,O	5	1

4.	Determination of energy loss in a magnetic material - B-H curve	2	I,O	5	1
5.	Determination of paramagnetic susceptibility - Quincke's method	2	I,O	5	1
6.	Determination of dielectric constant for a given materia	2	I,O	5	1
7.	Calculation of lattice cell parameters - X-ray diffraction	2	I,O	5	1
8.	Measurement of glucose concentration - Electrochemical sensor	2	I,O	5	1
9.	Visit to Advanced Material Characterization Laboratory	2	I,O	5	-
	Total contact hours (Inclusive of Demo and Repeat Class)	30			

Learning Resources	
Sl. No.	**Text Books**
1.	Thiruvadigal, J. D., Ponnusamy, S., Kala C.P. and Krishnamohan, M., "*Materials Science"*, SSS Publication, Chennai, 2015.
2.	Rajendran, V. "*Materials Science*",Tata McGraw- Hill,New Delhi,2011.
	Reference Books/Other Reading Material
3.	Rolf E. Hummel, "*Electronic Properties of Materials"*, 4th Edition., Springer, New York, 2011
4.	Dennis W. Prather, "*Photonic Crystals: Theory, Applications, and Fabrication"*, John Wiley & Sons, Hoboken, 2009
5.	James R. Janesick, "*Scientific Charge-Coupled Devices",* Published by SPIE - The International Society for Optical Engineering, Bellingham, Washington, 2001
6.	David M. Pozar, "*Microwave Engineering*", 3rd Edition., John Wiley & Sons, 2005
7.	Silver F. and Dillion C., "*Biocompatibility: Interactions of Biological and Implantable Materials*", VCH Publishers, New York, 1989
8.	Severial Dumitriu, "*Polymeric Biomaterials*" Marcel Dekker Inc, CRC Press, Canada 2001
9.	Cao G., "*Nanostructures and Nanomaterials: Synthesis, Properties and Applications*", Imperial College Press, 2004
10.	Pradeep T., "*A Text Book of Nanoscience and Nanotechnology*", Tata McGraw Hill, New Delhi, 2012
11.	Sam Zhang, "*Materials Characterization Techniques*", CRC Press, 2008

Course nature				**Theory + Practical**			
Assessment Method – Theory Component (Weightage 50%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	Total
	Weightage	5%	7.5%	7.5%	2.5%	2.5%	25%
End semester examination Weightage :							25%

Assessment Method – Practical Component (Weightage 50%)						
In-semester	**Assessment tool**	Experiments	Record	MCQ/Quiz/Viva Voce	Model examination	Total
	Weightage	20%	2.5%	2.5%	5%	30%
End semester examination Weightage :						20%

15CY102	**PRINCIPLES OF ENVIRONMENTAL SCIENCE**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

Co-requisite:	NIL	
Prerequisite:	NIL	
Data Book / Codes/Standards	NIL	
Course Category	B	Basic Sciences
Course designed by	Department of Chemistry	
Approval	32nd Academic Council Meeting, 23rd July 2016	

PURPOSE	The course provides a comprehensive knowledge in environmental science, environmental issues and the management.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, students will be able to								
1.	Understand the importance of environmental education and ecosystem.	h	b					
2.	Know the sources, effects and control measures of environmental pollution.	e	j					
3.	Acquire knowledge on the treatment of wastewater and solid waste management.	h	i					
4.	Understand the importance of biodiversity, its threat, its conservation and appreciate the concept of interdependence.	f						
5.	Outline the national and international concern for environment for protecting the environment	c	j					

Session	**Description of Topic (Theory)**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I - ENVIRONMENTAL EDUCATION AND ECOSYSTEMS		**6**			
1.	Environmental education: Definition and objectives.	**1**	C	1	1-6
2.	Structure and function of an ecosystem.	3	C	1	1-6
3.	Ecological succession –primary and secondary succession.	1	C	1	1-6
4.	Ecological pyramids – pyramid of number, pyramid of energy and pyramid of biomass.	**1**	C	1	1-6
UNIT II - ENVIRONMENTAL POLLUTION		**6**			
5.	Environmental segments - Structure and composition of atmosphere	1	C	2	1-6
6.	Pollution – Air, water, soil , thermal and radiation	2	C	2	1-6
7.	Effects – acid rain, ozone layer depletion and greenhouse effect	1	C	2	1-6
8.	Control measures	1	C	2	1-6
9.	Determination of BOD,COD,TDS and trace metals	1	C	2	1-6
UNIT III - WASTE MANAGEMENT		**6**			
10.	Waste water treatment (general) – primary, secondary and tertiary stages	2	C	3	1-6
11.	Solid waste management: sources and effects of municipal waste	2	C	3	1-6
12.	Bio medical waste - process of waste management	2	C	3	1-6
UNIT IV - BIODIVERSITY AND ITS CONSERVATION		**6**			
13.	Introduction: definition - genetic, species and ecosystem diversity	1	C	4	1-6
14.	Bio diversity hot spots, Endangered and endemic species of India	**1**	C	4	1-6
15.	Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values	1	C	4	1-6
16.	Threats to biodiversity: habitat loss, poaching of wildlife	1	C	4	1-6
17.	Conservation of biodiversity: in-situ and ex-situ conservations.	2	C	4	1-6
UNIT V - ENVIRONMENTAL PROTECTION		**6**			
18.	National concern for environment: Important environmental protection acts in India – water, air (prevention and control of pollution) act, wild life conservation and forest act	2	C	5	1-6
19.	Functions of State and Central Pollution Control Boards	1	C	5	1-6
20.	International effort – key initiatives of Rio declaration, Vienna	3	C	5	1-6

	convention, Kyoto protocol and Johannesburg summit.				
	Total contact hours	**30**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Kamaraj.P&Arthanareeswari.M,“Environmental Science–Challenges and Changes”,4th Edition, SudhandhiraPublications, 2010.
2.	R.Jeyalakshmi, Principles of environmental science, Devi publications, 2nd ed., 2008.
3.	Kurian Joseph , R.Nagendran, ‘Essentials of Environmental Studies’, Pearson Education, 2nd ed.,2005
REFERENCE BOOKS/OTHER READING MATERIAL	
4.	De.A.K.,“EnvironmentalChemistry”,New Age International,New Delhi,1996.
5.	Helen P Kavitha,“Principles of Environmental Science”,Scitech Publications, 2nd Edition,2008.
6.	Sharma.B.K.andKaur,“Environmental Chemistry”,Goel Publishing House, Meerut, 1994.

<table>
<tr><td colspan="5"><b>Course nature</b></td><td colspan="3"><b>Theory</b></td></tr>
<tr><td colspan="8"><b>Assessment Method – Theory Component (Weightage 100%)</b></td></tr>
<tr><td rowspan="2"><b>In-semester</b></td><td><b>Assessment tool</b></td><td>Cycle test I</td><td>Cycle test II</td><td>Cycle Test III</td><td>Surprise Test</td><td>Quiz</td><td><b>Total</b></td></tr>
<tr><td><b>Weightage</b></td><td><b>10%</b></td><td><b>15%</b></td><td><b>15%</b></td><td><b>5%</b></td><td><b>5%</b></td><td><b>50%</b></td></tr>
<tr><td colspan="7"><b>End semester examination Weightage :</b></td><td><b>50%</b></td></tr>
</table>

15ME101	**BASIC MECHANICAL ENGINEERING**		**L**	**T**	**P**	**C**
			2	**0**	**0**	**2**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	E	ENGINEERING SCIENCES				
Course designed by	Department of Mechanical Engineering					
Approval	Academic Council Meeting , 23rd July 2016					

PURPOSE	To familiarize the students with the basics of Mechanical Engineering.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student should be able to understand								
1.	Basic machine elements	a	e					
2.	Sources of Energy and Power Generation	a	e					
3.	Various manufacturing processes	a	e					

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I- MACHINE ELEMENTS	**6**			
1.	Springs: Helical and leaf springs, Classification, Terms, Materials	1	C	1	1
2.	Springs in series and parallel, Importance of the combination of springs, Applications of springs, numerical in springs	1	C, D	1	1
3.	Cams: Types of cams and followers , Classification, Based on Input / Output Motion, Follower configuration, Follower arrangement and Cam shape	1	C	1	1
4.	Cam profile, Cam nomenclature, Application, Motion of the follower	1	C	1	1
5.	Power Transmission , Gears terminology, Spur , Helical ,Bevel gears and gear trains applications	1	C	1	1
6.	Belt drives, Types of belt drives, Belt materials and Applications, problems on open and cross belt drives, Chain drives, Comparison of gear, belt drives and chain drives	1	C, D	1	1
	UNIT II – ENERGY SOURCES	6			
7.	Renewable and Nonrenewable Sources, Characteristics, types, Advantages and disadvantages	1	C	2	3
8.	Solar thermal systems and tower power generation, Solar photovoltaic system	1	C	2	3
9.	Wind energy, Horizontal axis wind turbines, Vertical axis wind turbines, advantages and disadvantages	1	C	2	3
10.	Geothermal energy, Indian geothermal sources, advantages and disadvantages	1	C	2	3
11.	Ocean energy, ocean thermal energy conversion	1	C	2	3
12.	Tidal energy , Single pool tidal energy conversion system	1	C	2	3
	UNIT III - POWER GENERATION	**6**			
13.	Power Generation: external and internal combustion engines	1	C	2	3
14.	Classification of engines, Engine operations: 2 stroke & 4 stroke, Comparison of SI & CI engines	1	C	2	3
15.	Overview of fuels, Applications, Numerical–internal combustion engines	1	C,D	2	3
16.	Thermal Power Plants: layouts, element/component description, advantages, disadvantages, applications	1	C	2	3
17.	Hydro power plants : layouts, element/component description, advantages, disadvantages, applications	1	C	2	3

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
18.	Nuclear power plant :layouts, element/component description, advantages, disadvantages, applications, Element/component description of boiling water reactor and pressurized water reactor	1	C	2	3
	UNIT IV: MANUFACTURING PROCESSES I	**6**			
19.	Sheet metal work : Introduction, equipment, Tools, accessories	1	C	3	2
20.	Sheet metal Various processes	1	C	3	2
21.	Sheet metal application, advantages and disadvantages.	1	C	3	2
22.	Welding : Types, Equipment, Tools and accessories, Techniques employed	1	C	3	2
23.	Applications of gas and arc welding , gas cutting	1	C	3	2
24.	Brazing and soldering, Advantages and disadvantages	1	C	3	2
	UNIT V: MANUFACTURING PROCESSES II	**6**			
25.	Lathe Practice: Types, Description of main components	1	C	3	2
26.	Lathe Cutting tools and Work holding devices ,basic operations	1	C	3	2
27.	Numerical on lathe operations	1	C, D	3	2
28.	Drilling Practice : Introduction, Types, Description, Drilling Tools	1	C	3	2
29.	Drilling operations, special operations on drilling machines, drill holding devices	1	C	3	2
30.	Numerical on drilling operations	1	C, D	3	2
	Total contact hours*	**30**			

*Excluding assessment hours

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Merhyle F. Spotts , Terry E. Shoup " *Design of Machine Elements*", Pearson; 8th Edition, 2003
2.	SeropeKalpakjian, Steven Schmid," *Manufacturing Processes for Engineering Materials*", Pearson, 2016
3.	Drbal, Larry F. Boston, Patricia G. Westra, Kayla L. Black, Veatch, "*Power Plant Engineering*", Kluwer Academic Pub., 1995
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Andy Walker, "*Solar Energy*", John Wiley & Sons, 2013
5.	John G. Edwards, "*Lathe Operation and Maintenance*", Carl HanserVerlag GmbH & Co, 2003.
6.	EfstathiosE.Stathis, Michaelides, "*Alternative Energy Sources*", Springer, 2012
7.	Kumar. T, Leenus Jesu Martin and Murali. G, "*Basic Mechanical Engineering*", Suma Publications, Chennai, 2007.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	**Cycle Test I**	**Cycle Test II**	**Cycle Test III**	**Surprise Test**	**Quiz**	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
						End semester examination Weightage :	**50%**

15EC101	**Basic Electronics Engineering**	**L**	**T**	**P**	**C**

		2	0	0	2
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	**P**	**Professional Core**	**Electronics**		
Course designed by	Department of ECE				
Approval	30th Academic Council Meeting, 24th March, 2016				

Purpose	This course provides comprehensive idea about working principle, operation and characteristics of electronic devices, transducers, Digital Electronics and Communication Systems.

Instructional Objectives At the end of the course, the learners will be able to gain knowledge about the		**Student Outcomes**		
		H	**M**	**L**
1.	Fundamentals of semiconductor, electronic components/devices, optoelectronic devices and transducers	a		
2.	Principles of digital electronics	e		
3.	Principles of various communication systems	a	e	

H: High correlation, **M:** Medium correlation, **L:** Low correlation

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	Unit-I: Semiconductor Devices	**9**			
1	Overview of Semiconductors, PN junction diode	1	C	1	1
2	Zener diode	1	C	1	1
3	Diode circuits: rectifiers (bridge-type only)	1	C,D	1	1
4	Filters	1	C	1	1
5	Clippers and Clampers	1	C	1	1
6	BJT construction, operation, characteristics (CB,CC,CE configurations) and uses	2	C	1	1
7	JFET and MOSFET construction, operation, characteristics (CS configuration) and uses.	2	C	1	1
	Unit – II : Optoelectronic Devices	**4**			
10	Photoconductive cell - photovoltaic cell - solar cell	1	C	1	1
11	Photodiode - phototransistor	1	C	1	1
12	LED - infrared emitters	1	C	1	1
13	LCD - optocouplers	1	C	1	1
	Unit-III: Transducers	**4**			
14	Basic requirements of transducers - classification of transducers - passive transducers: capacitive, inductive	1	C	1	1
15	LVDT, potentiometric, strain gauge	1	C	1	1
16	Thermistor, Hall-Effect Transducer	1	C	1	1
17	Active transducers- piezoelectric, photoelectric and thermocouple	1	C	1	1
	Unit - IV:Digital Electronics	**7**			

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
18	Number systems	2	C,D	2	1
19	Binary codes – Binary Arithmetic	1	C,D	2	1
20	Logic gates	1	C,D	2	1
21	Boolean algebra, laws and theorems	1	C,D	2	1
22	Simplification of Boolean expressions	1	C,D	2	1
23	Implementation of Boolean expressions using logic gates Standard forms of Boolean expression	1	C,D	2	1
	Unit- V: Communication Systems	**6**			
24	Block diagram of a basic communication system, Frequency spectrum, Need for modulation, Methods of modulation	1	C	3	1
25	principles of AM, FM, pulse analog and pulse digital modulation	2	C	3	1
26	AM/FM transmitters and receivers(block diagram description only)	1	C	3	1
27	Satellite Communication,Radar systems	1	C	3	1
28	Data transmission and MODEM	1	C	3	1
	Total contact hours	**30**			

Learning resources (Text books / other reading materials)	
1.	R. Muthusubramanian, S. Salivahanan, *“Basic Electrical and Electronics Engineering”*, Tata McGraw-Hill Education, Reprint 2012.
2.	B. Somanathan Nair, S.R. Deepa, “*Basic Electronics”,* I.K. International Pvt. Ltd., 2009.
3.	Thomas L. Floyd, *“Electronic Devices”,* Pearson Education, 9th Edition, 2011.
4.	R.K. Rajput, *“Basic Electrical and Electronics Engineering”*, Laxmi Publications, First Edition, 2007.

Course nature		**Theory**					
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15IT101L	Computer Hardware And Troubleshooting Laboratory	L	T	P	C

			0	0	3	2
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL CORE				
Course designed by	Department of Information Technology					
Approval	32nd Academic Council Meeting , 23rdJuly 2016					

PURPOSE	This course is designed to enable the students to get a detailed knowledge of all the hardware components that make up a computer and to understand the different interfaces required for connecting these hardware devices.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	To understand the components on the motherboard	k						
2.	To perform system administration tasks	i						
3.	To understand different storage media	k						
4.	To understand system related problems and methods of troubleshooting	k						

Sl. No.	**Description of experiments**	**Contact Hours**	**C-D-I-O**	**IOs**	**Reference**
1	Study and identification of standard desktop personal computer.	3	C	1	1
2.	Understanding of Motherboard and its interfacing components	3	C	1	1
3.	Install and configure computer drivers and system components.	3	D	2	1
4.	Disk formatting, partitioning and Disk operating system commands	6	I,O	3	1
5.	Install, upgrade and configure Windows operating systems.	3	I,O	2	1
6.	Remote desktop connections and file sharing.	3	I,O	3	1
7.	Identify, install and manage network connections Configuring IP address and Domain name system	6	I,O	2	1
8.	Install, upgrade and configure Linux operating systems.	3	I,O	2	1
9.	Installation Antivirus and configure the antivirus.	4	I,O	2	1
10.	Installation of printer and scanner software.	3	I,O	2	1
11.	Disassembly and Reassembly of hardware.	4	I,O	2	1
12.	Troubleshooting and Managing Systems	4	I,O	2	1
	TOTAL CONTACT HOURS	45*			

LEARNING RESOURCES	
1.	Laboratory Manual
2.	Craig Zacker& John Rourke, “The Complete Reference:PC hardware”, New Delhi, Tata McGraw-Hill, 2001, ISBN-13: 978-0072125160
3.	Mike Meyers, “Introduction to PC Hardware and Troubleshooting”, New Delhi, Tata McGraw-Hill, 2003, ISBN-13: 978-0072226324
4.	B.Govindarajulu, “IBM PC and Clones hardware trouble shooting and maintenance”, New Delhi, 2002, Tata McGraw-Hill, ISBN-13: 978-0070482869

Course nature				**Practical**		
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Experiments	Record /observation	MCQ/Quiz/Viva Voce	Model examination	**Total**
	Weightage	**40%**	**5%**	**5%**	**10%**	**60%**
					End semester examination Weightage :	**40%**

15ITI02	**Program Design And Development**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	P	PROFESSIONAL CORE			
Course designed by	Department of Information Technology				
Approval	32nd Academic Council Meeting , 23rdJuly 2016				

PURPOSE	Knowledge of problem solving and programming concepts are essential for those who develop applications for users. Hence, to provide the required knowledge, this course imparts basic knowledge in C Programming along with the concepts of design and development of programs using C.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Apply logic and solve problems using computers	a						
2.	Understand the basic components and structure of a C program	c						
3.	Develop proficiency in basic programming skills	i						

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I : INTRODUCTION TO PROBLEM SOLVING AND PROGRAMMING		**6**			
1.	Creative thinking and problem solving skills ;Visualization and Memory	1	C	1	1
2.	Problem Solving Concepts ; Problem Solving in everyday life; Types of Problems	1	C	1	1
3.	Problem solving Concept for Computers; Algorithms and Flowcharts	2	C,D	1	1
4.	Programming Concepts; Preprocessing, Compilation, Assembling and Linking	2	C	1	1
UNIT II : OVERVIEW OF C		**9**			
5.	Structure of C program, constants, variables, Data types	1	C	2	2
6.	Operators ; Evaluation of Expressions; Precedence of Operators and associativity	1	C	2	2
7.	Mathematical Functions and Managing I/O operations	2	C	2	2
8.	Decision making and branching structures ;IF statement and its variants, Switch statement ;break statement	2	C,I	3	2
9.	Decision making and Looping structures ; For loop, While statement, do while statement; Continue statement	3	C,I	3	2
UNIT III : FUNCTIONS		**9**			
10.	User defined functions and its elements; Function call ; Function definition	2	C,I	3	2
11.	Return values and its types	1	C,I	3	2
12.	Types of functions	2	C,I	3	2
13.	Scope and Visibility of variables in functions	2	C,I	3	2
14.	Calling functions within other functions ;Recursion	2	C,I	3	2
UNIT IV : ARRAYS, STRUCTURES AND UNIONS		**10**			
15.	Arrays: Single Dimension , Multi-dimension, Dynamic Arrays	2	C,I	3	2
16.	Character arrays and strings	2	C,I	3	2
17.	String handling functions	1	C,I	3	2
18.	Structures and Unions ; Defining a Structure, Declaring Structure Objects, Array of Structures, Nested Structures	3	C,I	3	2
19.	Functions and Structures	2	C,I	3	2
UNIT V : POINTERS		**11**			
20.	Pointers and Indirection, Defining a Pointer Variable, Pointers in Expressions	2	C,I	3	2

21.	Operations Pointers : Arithmetic Operations , Relational Operations	2	C,I	3	2
22.	Array of Pointers : character strings	2	C,I	3	2
23.	Passing Pointers to functions	2	C,I	3	2
24.	Pointers to structures	2	C,I	3	2
25.	Shell Programming : Basics	1	C,I		
	TOTAL CONTACT HOURS	45*			

LEARNING RESOURCES	
1.	Maureen Sprankle, “Problem Solving and Programming Concepts”, 7th Edition, Pearson, 2011, ISBN-10: 0-13-249264-4, ISBN-13: 978-0-13-249264-5
2.	E.Balagurusamy, “Programming in ANSI C”, 5th Edition, Tata McGrawHill, 2011, ISBN-13: 978-0-07-068182-8, ISBN-10: 0-07-068182-1
3.	Y.P. Kanetkar, “Let us C”, 8th Edition, BPB Publications, 2008, ISBN-13: 978-1934015254, ISBN-10:1934015253
4.	Steve Oualline, “ Practical C Programming”, O’Reilly Publishers, 2011, ISBN-13: 978-1-565-92306-5
5.	Byron Gottfried, “Programming with C”, 2nd Edition, Schaum’s Outline Series, 2000, ISBN -10: 0071367993, ISBN-13: 9780071367998

<table>
<tr><th colspan="4">Course nature</th><th colspan="4">Theory</th></tr>
<tr><th colspan="8">Assessment Method (Weightage 100%)</th></tr>
<tr><td rowspan="2"><b>In-semester</b></td><td><b>Assessment tool</b></td><td>Cycle test I</td><td>Cycle test II</td><td>Cycle Test III</td><td>Surprise Test</td><td>Quiz</td><td><b>Total</b></td></tr>
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<tr><td colspan="7"><b>End semester examination Weightage :</b></td><td><b>50%</b></td></tr>
</table>

* - Excluding Assessment Hours

15IT102L	**Program Design And Development Laboratory**	**L**	**T**	**P**	**C**
		0	**0**	**2**	1
Co-requisite:	15IT102 - Program Design and Development				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Information Technology				
Approval	32nd Academic Council Meeting, 23rdJuly 2016				

PURPOSE	To develop skills in designing and developing programs using C language

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Apply problem solving skills and logic to solve problems using computers	a						
2.	Understand the basic components and structure of a C program	c						
3.	Develop proficiency in basic programming skills	i						

Sl. No.	**Description of experiments**	**Contact Hours**	**C-D-I-O**	**IOs**	**Reference**
1.	Study of Unix commands	2	C	1	1
2.	Programs using I/O functions	2	C,I	2	1
3.	Programs using decision making and branching statements	2	C,I	3	1
4.	Programs using decision making and looping statements	2	C,I	3	1
5.	Programs with arrays : Single dimensional, Multidimensional	2	C,I	3	1
6.	Programs using user-defined functions , Definition of arguments	2	C,I	3	1
7.	Programs using recursions	2	C,I	3	1
8.	Programs with strings , Function with strings as arguments	2	C,I	3	1
9.	Programs using structures ,Unions and as arguments in functions	2	C,I	3	1
10.	Programs using pointers ; Simple Programs	2	C,I	3	1
11.	Programs using pointers as parameters to functions	2	C,I	3	1
12.	Programs using pointers and Arrays	2	C,I	3	1
13.	Programs using pointers and structures	3	C,I	3	1
14.	Programs with Function pointers	3	C,I	3	1
	TOTAL CONTACT HOURS	30*			

LEARNING RESOURCES	
1.	Laboratory Manual

Course nature				**Practical**		
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Experiments	Record	MCQ/Quiz/Viva Voce	Model examination	**Total**
	Weightage	**40%**	**5%**	**5%**	**10%**	**60%**
					End semester examination Weightage :	**40%**

* - Excluding Assessment Hours

SEMESTER – III

15LE201E	***GERMAN LANGUAGE - I***		**L**	**T**	**P**	**C**
			2	**0**	**0**	**2**
Co-requisite:	NIL					
Prerequisite:	NIL					
Course Category	G	General				
Course designed by	Department of English & Foreign Languages					
Approval	-- Academic Council Meeting -- , 2016					

PURPOSE	Germany offers infinite opportunities for students of engineering for higher studies, research and employment in Germany. B.Tech Students are offered German Language I during their second year. Knowledge of the language will be helpful for the students to adjust themselves when they go for higher studies							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	To introduce the language, phonetics and the special characters in German language	g						
2.	To introduce German culture & traditions to the students.	g						
3.	By the end of Phase – I, the students will be able to introduce themselves and initiate a conversation.	g						
4.	We endeavor to develop the ability among the students to read and understand small texts written in German.	g						
5.	To enable the students to elementary conversational skills	g						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
Unit I – Wichtige Sprachhandlungen		6			
1	Phonetics – Sich begrüßen	1	g	1,2	1
2	Sich und andere vorstellen formell / informell	1	g	1	1,6
3	Zahlen von 1 bis 1 Milliarde - verstehen & sprechen	1	g	1	1
4	regelmäßige Verben im Präsens - “sein” und “haben”	2	g	1,4	1,2
5	Personalpronomen im Nominativ	1	g	1,4	1,2
Unit II – Wichtige Sprachhandlungen		6		g	
1	Telefon Nummern verstehen und sprechen	1	g	2,4	1
2	Uhrzeiten verstehen und sagen Verneinung “nicht und kein” (formell und informell)	1	g	3	1
3	Wortstellung – Aussagesatz – W-Frage	1	g	3,4	1,2
4	Satzfrage (Ja/Nein Frage) Nomen buchstabieren	1	g	3,4	1,2,6
5	notieren bestimmter und unbestimmter Artikel	1	g	4	1,2
6	Negativartikel im Nom. & Akkusativ	1	g	3,4	1,2
Unit III – Wichtige Sprachhandlungen		6		g	
1	Tageszeiten verstehen und über Termine sprechen	1	g	3	1
2	Verabredungen verstehen und Aufgaben im Haushalt verstehen	1	g	1	1
3.	Genitiv bei Personennamen	1	g	1,3,4	1,2
4	Personalpronomen im Akkusativ	1	g	3	1,2
5	W-Fragen “wie, wer, wohin,wo, was usw	1	g	3,4	1,2,6
6	Modalverben im Präsens “können, müssen, möchten”	1	g	3,4	1,2
Unit IV –Wichtige Sprachhandlungen		6		g	
1	Sich austauschen	1	g	2,4	2
2	was man kann, muss – Bezeichnungen Lebensmittel	1	g	3	1
3	Mengenangaben verstehen	1	g	3,4	1,2,6
4	Preise verstehen und Einkaufzettel schreiben	1	g	3,4	1,2
5	Wortstellung in Sätzen mit Modalverben Konnektor ”und” – “noch”- kein - mehr	1	g	4	1,2
6	wie viel, wie viele, wie alt, wie lange” –Possessivartikel im Nominativ	1	g	3,4	1,2

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
Unit V - Wichtige Sprachhandlungen		6		g	
1	Freizeitanzeigen verstehen	1	g	2,4	1,6
2	Hobbys und Sportarten Anzeigen für Freizeitpartner schreiben bzw	1	g	3	1,2
3	Verben mit Vokalwechsel im Präsens	1	g	3,5	1,2
4	Modalverben im Präsens " dürfen, wollen und mögen	1	g	3,4,5	1,2
5	"haben und sein" im Präteritum	1	g	4	1,2
6	regelmäßige Verben im Perfekt – Konnektoren "denn, oder, aber	1	g	3,4,5	1,2
	Total Contact Hours	**30**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOK**
1.	German for Beginners, SRM University
REFERENCE BOOKS/OTHER READING MATERIAL	
2.	Studio d A1. Deutsch als Fremdsprache with CD. (Kursbuch und Sprachtraining)
MATERIAL FOR FURTHER READING:	
3.	Sometimes we use CDs for practicing of Native speaking.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	**Cycle test I**	**Cycle test II**	**Cycle Test III**	**Surprise Test**	**Quiz**	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15LE202E	**FRENCH LANGUAGE - 1**		**L**	**T**	**P**	**C**
			2	**0**	**0**	**2**
Co-requisite:	NIL					
Prerequisite:	NIL					
Course Category	G	General				
Course designed by	Department of English and Foreign Languages					
Approval	-- Academic Council Meeting -- , 2016					

PURPOSE	To enable the student learners understand on a basic level how French as a foreign language functions aimed at the four language competences- reading, writing, listening and speaking.						
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**					
At the end of the semester, the course helps							
1. To enable students improve their grammatical competence.		g					
2. To enhance their listening skills.		g					
3. To enhance their lexical competence		g					
4. To help the students introduce themselves and focus on their communication skills		g					

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
UNIT I – L'ALPHABET FRANCAIS, LES ACCENTS ET LES PHONETIQUES		**4**			
1	La francophonie – démystifier le français	1	g	3	1, 4
2	Comment se présenter, les accents – é, è, ê, ç, ë, l'apostrophe et trait d'union phonétique	1	g	2	1, 2
3	L'alphabet Lexique	1	g	2,3	1, 2, 3
4	Les mots transparents en sciences et technologie et quelques prénoms français.	1	g	3	1
UNIT II – SE PRESENTER ET LES SALUTATIONS		**5**			
5	Le tutoiement et le vouvoiement – la politesse ''à la française"	1	g	1,2	1,2
6	Comment saluer et accueillir quelqu'un puis comment identifier et nommer une personne	1	g	1,3,4	1,3
7	Le verbe être au présent	1	g	1	1,3,4
8	Les articles indéfinis	1	g	1,2	1,4
9	La politesse, les salutations et la famille	1	g	1, 3,4	1,3
UNIT III – LES ARTICLES ET LES PREPOSITIONS		**5**			
10	Comment se présenter et présenter quelqu'un puis aborder une personne et remplir un formulaire,	2	g	1,4	1, 3,4
11	Les pronoms personnels, le féminin et le masculin, les prépositions de lieu	2	g	1,3	1, 4
12	Les articles définis la liaison obligatoire et l'accent	1	g	1,3,4	1,2,3
UNIT IV – LES ADJECTIFS, LA NEGATION		**8**			
13	Comment demander des nouvelles et parler de soi- dire son âge et comment poser des questions simples.	2	g	2,3	1, 2
14	Les pronoms toniques puis l'interrogation la voyelle nasale les chiffres de 0 a 1000, les ordinaux, parler de ses activités et de ses loisirs et de ses goûts. les verbes faire et savoir, la négation	2	g	3,4	1, 2
15	les adjectifs possessifs et le partitif.	2	g	1,3	1, 2
16	Le verbe avoir et les verbes du premier groupe au présent, les adjectifs possessifs	2	g	1,3	2,3
UNIT V – L'ORIENTATION		**8**			
17	Se repérer sur un plan objectifs, comment s'excuser et comprendre un mail puis comment demander son chemin et indiquer une direction et décrire son logement, et "il y a "Phonétique, l'intonation lexique ,	3	g	2,3,4	1, 2,3
18	Le verbe aller au présent, les prépositions de lieu	3	g	1, 2,3	1, 2

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
19	Le logement et la ville, les verbes de direction	2	g	3	1, 2, 4
	Total Contact Hours	**30**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Tech French (for Science and Technology)
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	French for dummies. Wiley publishing co. Inc., USA.
3.	French made easy , Goyal publishers
4.	Version Originale, Goyal publishers

Course nature							**Theory**
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	**Cycle test I**	**Cycle test II**	**Cycle Test III**	**Surprise Test**	**Quiz**	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15LE203E	**JAPANESE LANGUAGE–I**		**L**	**T**	**P**	**C**
			2	**0**	**0**	**2**
Co-requisite:	NIL					
Prerequisite:	NIL					
Course Category	G	General				
Course designed by	Japanese faculty of EFL dept					
Approval	-- Academic Council Meeting -- , 2016					

PURPOSE	To enable students achieve a basic exposure on Japan, Japanese language and culture. To acquire basic conversational skill in the language.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	read and write the Hiragana Japanese script and a few basic kanji.	g						
2.	converse in Japanese at a basic level	g						
3.	know about Japan and Japanese culture	g						
4.	have a better opportunity for employability by companies who have association with Japan.	g						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
Unit I – Hiragana Script		**8**			
1	Chart 1 – 46 syllables	4	g	1	1, 2
2	Chart 2 – ten-ten letters and chart 3 – combination letters.	2	g	1	1, 2
3	Double consonants and vowel elongation	2	g	1	1, 2
Unit II – Self Introduction and Greetings		**8**			
4	Self introduction and greetings	2	g	2, 3	1
5	Asking about someone and introducing someone	2	g	2, 3	1
6	Numbers, days of the week and months of the year	2	g	2, 3	1
7	Land, language and culture	2	g	3	1
Unit III – Demonstrative Pronouns		**5**			
8	Telling the time	2	g	2	1
9	asking the price	1	g	2	1
10.	seasons	1	g	2	1
11	Kanji introduction	1	g	1	1
Unit IV – Adjectives		**5**			
12	Introduction to i-ending and na-ending adjectives.	2	g	2, 3	1
13	Colours	1	g	2, 3	1
14	Locations	2	g	2, 3	1
Unit V – Counters		**4**			
15	Some basic counters used in daily life.	2	g	2, 3, 4	1
16	Family – plain and polite forms.	2	g	2, 3, 4	1
	Total Contact Hours	**30**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	A basic course in Japanese, SRM University
REFERENCE BOOKS/OTHER READING MATERIAL	
2.	Japanese for dummies. Wiley publishing co. Inc., USA.
3.	Kana workbook, Japan foundation
4.	Shoho-I, Japan foundation
5.	www.learnjapaneseatsrm.blogspot.in

Course nature					**Theory**		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	**Cycle test I**	**Cycle test II**	**Cycle Test III**	**Surprise Test**	**Quiz**	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
						End semester examination Weightage :	**50%**

15LE204E	**KOREAN LANGUAGE–I**		**L**	**T**	**P**	**C**
			2	**0**	**0**	**2**
Co-requisite:	NIL					
Prerequisite:	NIL					
Course Category	G	General				
Course designed by	Korean faculty of EFL dept					
Approval	-- Academic Council Meeting -- , 2016					

PURPOSE	To enable students achieve a basic exposure on Korea, Korean language and culture. To acquire basic conversational skill in the language.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	understand scripts from the text book	g						
2.	make the students acquire basic conversational skill	g						
3.	enable students to know about Korean culture	g						
4.	create an advantageous situation for the students to have better opportunity for employability by companies who have association with Korea	g						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
Unit I – INTRODUCTION TO KOREAN LANGUAGE		**9**			
1	Introduction to Hangeul- Consonants and Vowels	5	g	1	1, 2
2	Reading,Writing, Listening - Hangeul 1	4	g	1	1, 2
Unit II – GREETING		**6**		g	
4	Expressions related to greetings	1	g	2, 3	1
5	Introducing yourself– About myself (name, nationality, occupation, etc.)	1	g	2, 3	1
6	Vocabulary – Occupations	1	g	2, 3	1
7	Reading, Writing, Listening - Hangeul 2	3	g	1, 3	1
Unit III – INTRODUCTIONS		**6**			
8	Introducing another person – obtaining personal information	1	g	2, 3	1
9	introducing two people to each other	1	g	2, 3	1
10.	Exchanging personal information	1	g	2, 3	1
11	Reading, Writing, Listening - Hangeul 3	3	g	1, 3	1
Unit IV – RESTAURANT		**6**			
12	Ordering at a restaurant – Ordering food as directed, Asking for more	2	g	2, 3, 4	1
13	Vocabulary – food and tableware	1	g	2, 3, 4	1
14	Reading, Writing, Listening - Hangeul 4	3	g	1, 3	1
Unit V – NUMBERS		**3**			
15	Numbers and Counting units	1	g	2, 3, 4	1
16	Reading, Writing, Listening - Hangeul 5	2	g	2, 3, 4	1
	Total contact hours	**30**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Seoul National University, *Active Korean 1*, MOONJINMEDIA, 2006.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	THE NATIONAL INSTITUTE OF THE KOREAN LANGUAGE, *King Sejong Korean 1*, THE NATIONAL INSTITUTE OF THE KOREAN LANGUAGE, 2013.
3.	THE NATIONAL INSTITUTE OF THE KOREAN LANGUAGE, *Korean Grammar for Foreigners 1, 2*, COMMUNICATIONBOOKS, 2005.
4.	Cho H. R. etal., Master Korean basic 1-1, Darakwon, 2013.
5.	Ahn J. M. et al.,Korean grammar in use beginning, Darakwon, 2010

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	**Cycle test I**	**Cycle test II**	**Cycle Test III**	**Surprise Test**	**Quiz**	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
						End semester examination Weightage :	**50%**

15LE205E	**CHINESE LANGUAGE - I**		**L**	**T**	**P**	**C**
			2	**0**	**0**	**2**
Co-requisite:	NIL					
Prerequisite:	NIL					
Course Category	G	General				
Course designed by	Chinese faculty by EFL department					
Approval	-- Academic Council Meeting -- , 2016					

PURPOSE	To acquire phonetics knowledge and simple communication skills with simple Chinese characters for beginners with no knowledge of Chinese.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	To help students to acquire the phonetics knowledge.	g						
2.	To help the students learn the Chinese scripts.	g						
3.	To make the students acquire the basic conversational skill in Chinese.	g						
4.	To enable students to know about China and Chinese culture.	g						
5.	To create an advantageous situation for the students to have better opportunity for employability by companies in association with China/ Chinese market.	g						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
Unit I –PRONOUNCIATIONS AND TONES		**8**			
1	Introduction of China and Chinese languages	1	g	4	1
2	Tables of combination of initials and finals in Putonghua(Mandarin)	4	g	1	1
3	Introduction of syllables and tones	3	g	1,3	1
Unit II–BASIC STROKES AND GREETINGS		**3**			
4	Introduction of Chinese characters	1	g	2	1
5	The eight basic strokes of characters	1	g	2	1
6	Chinese characters with proper stoke orders- Basic greetings	1	g	2.3	1
Unit III–GRAMMAR AND BASIC CONVERSATIONS		**8**			
7	PronounsFraming simple sentences	2	g	2,3.5	1
8	Making sentences in S-V-O patterns- nces in past tense	3	g	2,3,5	1
9.	Framming basic interrogativesentence- Practice basic conversations with mini dialogues- Making sentences	3	g	2,3,5	1
Unit IV – DAILY USING VOCABULARY		**7**			
10	Numbers counting in Chinese language with characters- -Family relations-	3	g	2,3	1
11	Weekdays- month- Date-Time	1	g	2,3	1
12	Chinese currency and monitory systems- Direction s – 北，南，东，西	3	g	2,3	1
Unit V – BASIC KNOWLEDGE ABOUT CHINA		**4**			
13	Seasons in Chinese,major cities of china,famous festivals of China	4	g	4	1
	Total Contact Hours	**30**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	New Practical Chinese Readers Textbook (1) - Beijing Language and cultural university press

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	**Cycle test I**	**Cycle test II**	**Cycle Test III**	**Surprise Test**	**Quiz**	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15PD201	**QUANTITATIVE APTITUDE AND LOGICAL REASONING I**		**L**	**T**	**P**	**C**
			1	**1**	**0**	1
Co-requisite:	NIL					
Prerequisite:	Soft Skills-2					
Data Book / Codes/Standards	NIL					
Course Category	G	GENERAL				
Course designed by	Career Development Centre					
Approval	-- Academic Council Meeting -- , 2016					

PURPOSE	To give the right knowledge, skill and aptitude to face any competitive examination.

	INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**						
	At the end of the course, student will be able to							
1	build a strong base in the fundamental mathematical concepts	a						
2.	grasp the approaches and strategies to solve problems with speed and accuracy	e						
3.	gain appropriate skills to succeed in preliminary selection process for recruitment	i						
4.	collectively solve problems in teams & group.	d						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: PURE ARITHMETIC-I	**6**			
1.	Types of numbers, Divisibility tests	1	C-I-O	1-	1-5,8-11
2.	LCM and GCD	1	C-I-O	1-	1-5,8-11
3.	Unit digit, Number of zeroes, Factorial notation	1	C-I-O	1-	1-5,8-11
4.	Square root, Cube roots, Remainder concepts	1	C-I-O	1-	1-5,8-11

5.	Identities	1	C-I-O	1-	1-5,8-11
6.	Fractions and Decimals, surds	1	C-I-O	1-	1-5,8-11
	UNIT II: COMMERCIAL ARITHMETIC-1	**6**			
7.	Percentage Intro	1	C-I-O	1-	1-5,8-11
8.	Percentage Problems	1	C-I-O	1-	1-5,8-11
9.	Profit and Loss	1	C-I-O	1-	1-5,8-11
10.	Discount	1	C-I-O	1-	1-5,8-11
11.	Simple Interest	1	C-I-O	1-	1-5,8-11
12.	Compound Interest, Installments	1	C-I-O	1-	1-5,8-11
	UNIT III: ALGEBRA I	**6**			
13.	Logarithms Intro	1	C-I-O	1-	1-5,8-11
14.	Logarithms Rules	1	C-I-O	1-	1-5,8-11
15.	Linear Equations	1	C-I-O	1-	1-5,8-11
16.	Ages	1	C-I-O	1-	1-5,8-11
17.	Quadratic Equations and In-equations	1	C-I-O	1-	1-5,8-11
18.	Surprise Test I	1			
	UNIT IV: MODERN MATHEMATICS I	**6**			
19.	Permutations	1	C-I-O	1-	1-5,8-11
20.	Permutations	1	C-I-O	1-	1-5,8-11
21.	Combination	1	C-I-O	1-	1-5,8-11
22.	Combination	1	C-I-O	1-	1-5,8-11
23.	Probability	1	C-I-O	1-	1-5,8-11
24.	Probability	1	C-I-O	1-	1-5,8-11
	UNIT V: REASONING	**6**			
25.	Logical Reasoning – Blood relations, Directions, Cubes	1	C-I-O	1-	6-11
26.	Logical Reasoning – Coding and Decoding	1	C-I-O	1-	6-11
27.	Information Ordering - Arrangements	1	C-I-O	1-	6-11
28.	Information Ordering - Analogy, Math operations	1	C-I-O	1-	6-11
29.	Analytical Reasoning	1	C-I-O	1-	6-11
30.	Surprise test II	1			
	Total contact hours	30			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOK**
1	Dinesh Khattar-The Pearson Guide to QUANTITATIVE APTITUDE for competitive examinations**.**
	REFERENCE BOOKS
2	The Pearson Guide to Quantitative Aptitude and Data Interpretation for the CAT, by Nishit K Sinha
3	Dr. Agarwal.R.S – *Quantitative Aptitude for Competitive Examinations,* S.Chand &Company Limited 2011
4	Abhijit Guha*, Quantitative Aptitude for Competitive Examinations,* Tata McGraw Hill, 3rd Edition*,* 2011
5	Arun Sharma-Quantitative aptitude for CAT, Tata McGraw Hill
6	Edgar Thrope, *Test Of Reasoning for Competitive Examinations,* Tata McGraw Hill, 4th Edition, 2012
7	Dr. Agarwal.R.S – *A modern approach to non-verbal reasoning,* S.Chand &Company Limited 2011
	ON-LINE RESOURCES
8	www.indiabix.com
9	www.lofoya.com
10	www.careerbless.com
11	www.achieversforce.com

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**10%**	**20%**	**5%**	**5%**	**50%**

End semester examination Weightage :	**50%**

15MA201	**TRANSFORMS AND BOUNDARY VALUE PROBLEMS**	**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**
Co-requisite:	NOT APPLICABLE				
Prerequisite:	15MA102(or)15MA205B				
Data Book / Codes/Standards	NOT APPLICABLE				
Course Category	B	CORE	MATHEMATICS		
Course designed by	Department of Mathematics				
Approval	-- Academic Council Meeting -- , 2016				

PURPOSE	To acquire analytical ability in solving boundary value problems and transform techniques.		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1.	To know to formulate and solve partial differential equations	a	E
2.	To have thorough knowledge in Fourier series	a	E
3.	To be familiar with applications of partial differential equations	a	E
4.	To gain good knowledge in the application of Fourier transform	a	E
5.	To learn about Z- transforms and its applications	a	E

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: PARTIAL DIFFERENTIAL EQUATIONS	**14**	C,I	1	1-8
1.	Formation of partial differential equation by eliminating arbitrary constants	1	C,I	1	1-8
2.	Formation of partial differential equation by eliminating arbitrary functions	1	C,I	1	1-8
3.	Formation of partial differential equation by eliminating arbitrary functions of the form $\phi(u,v)=0$	2	C,I	1	1-8
4.	Solution of standard types of first order equations	2	C,I	1	1-8
5.	Reducible to standard type	2	C,I	1	1-8
6.	Lagrange's linear equation: Method of grouping, method of multipliers	2	C,I	1	1-8
7.	Linear Homogeneous partial differential equations of second and higher order with	2	C,I	1	1-8
8.	Linear Homogeneous partial differential equations of second and higher order with	2	C,I	1	1-8
	UNIT II: FOURIER SERIES	**14**			

9.	Introduction of Fourier series -Dirichlet’s conditions for existence of Fourier Series	1	C,I	2	1-8
10.	Fourier series –related problems	2	C,I	2	1-8
11.	Fourier series –related problems	2	C,I	2	1-8
12.	Half Range sine series-related problems	2	C,I	2	1-8
13.	Half Range Cosine series-related problems	2	C,I	2	1-8
14.	Parseval’s Identity(without proof)-related problems	2	C,I	2	1-8
15.	Harmonic Analysis for finding fundamental harmonic	1	C,I	2	1-8
16.	Harmonic Analysis for finding second and third harmonic	2	C,I	2	1-8
	UNIT III: ONE DIMENSIONAL WAVE & HEAT EQUATION	**12**			
17.	Classification of partial differential equations. Method of separation of variables. One dimensional Wave Equation and its possible	2	C,I	3	1-8
18.	Initial and Boundary value Problems with zero velocity – related problems	2	C,I	3	1-8
19.	Initial and Boundary value Problems with Nonzero velocity- related problems	2	C,I	3	1-8
20.	One dimensional heat equation and its possible solutions	2	C,I	3	1-8
21.	Steady state conditions and zero boundary conditions- related problems	2	C,I	3	1-8
22.	Steady state conditions and Non-zero boundary conditions- related problems	2	C,I	3	1-8
	UNIT IV: FOURIER TRANSFORMS	**10**			
23.	Fourier Transforms- problems	2	C,I	4	1-8
24.	Properties of Fourier transforms-problems	2	C,I	4	1-8
25.	Fourier Sine and Cosine Transforms - problems	1	C,I	4	1-8
26.	Properties of Fourier sine & cosine Transforms-problems	2	C,I	4	1-8
27.	Convolution Theorem	1	C,I	4	1-8
28.	Parseval’s Identity for Fourier transform and Fourier sine & cosine transforms	2	C,I	4	1-8
	UNIT V: Z-TRANFORMS AND DIFFERENCE EQUATIONS	**10**			
29.	Z-transform, its elementary properties	1	C,I	5	1-8
30.	Inverse Z-transform, related problems, long division method	2	C,I	5	1-8
31.	Inverse Z-transform - residue theorem method	1	C,I	5	1-8

32.	Convolution theorem (without proof)-applications	1	C,I	5	1-8
33.	Convolution theorem (without proof)-applications	2	C,I	5	1-8
34.	Solution of linear difference equations with constant coefficients using Z-transform	1	C,I	5	1-8
35.	Solution of linear difference equations with constant coefficients using Z-transform	2	C,I	5	1-8
	Total contact hours	**60**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Kreyszig.E, "*Advanced Engineering Mathematics*", 10th edition, John Wiley & Sons. Singapore,2012.
2.	Grewal B.S, "*Higher Engg Maths*", Khanna Publications, 42nd Edition, 2012.
3.	Kandasamy, P., etal., Engineering Mathematics, Vol. II & Vol. III (4th revised edition), S.Chand & Co., New Delhi, 2000
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Sivaramakrishna Das P. and Vijayakumari.C, A text book of Engineering Mathematics III, Viji's Academy,2010
5.	Narayanan. S., Manickavachagom Pillay. T . and Ramanaiah, G., *Advanced Mathematics for Engineering students*, Volume II & III (2nd edition), S,Viswanathan Printers and Publishers, 1992
6.	Venkataraman, M,K., *Engineering Mathematics* - Vol.III - A & B (13th edition), National Publishing Co., Chennai, 1998.
7.	Sankara Rao, "*Introduction to Partial Differential Equations*", 2nd Edition, PHI Learning Pvt. Ltd., 2006.
8.	Veerarajan, T., '*Engineering mathematics*', Tata McGraw-Hill (Education) India Pvt.Ltd, 2006.

Course nature	**Theory**

Assessment Method (Weightage 100%)

In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15EE208	**Electron Devices And Circuits**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	NIL					
Prerequisite:	15EC101					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL CORE	ELECTRONICS			
Course designed by	Department of Electrical and Electronics Engineering					
Approval	32nd Academic Council Meeting, 2016					

PURPOSE	To familiarize the students with the design, analyze and application of electronic devices.							
INSTRUCTIONAL OBJECTIVES.		**STUDENT OUTCOMES**						
At the end of the course, the student will be able to								
1.	Familiarize with the electronic devices and its applications.	a						
2.	Understand the concepts of frequency response of amplifiers and different types of feedback	a	c	e				
3.	Gain knowledge about the design and analysis of multi-vibrators, oscillators and wave shaping circuits	a						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I : SEMICONDUCTOR DEVICES AND ITS APPLICATIONS	**8**			
1.	Construction and Characteristics of DIAC, TRIAC, GTO, HEMT	2	C	1	1,7
2.	LED, LCD characteristics, Tunnel diode, Schottky diode.	2	C	1	3,4
3.	MOS as a charge transferring device-CCD,BBD	1	C	1	2
4.	Analysis and Performance of L, C, LC,CLC filters ,series and shunt regulators	2	C	1	3
5.	Switched mode power supply	1	C	1	3
	UNIT II : SMALL SIGNAL ANALYSIS	**10**			
6.	Operating point of a BJT - Biasing circuits for BJT- Bias stability- Thermal runaway - Use of a heat sink	2	C	2	3
7.	JFET – Biasing a JFET and MOSFET	2	C	2	3
8.	CE,CB,CC amplifier, Hybrid model-Evaluation of H- parameters - Cascade – Darlington connection	2	C	2	3
9.	Small signal equivalent circuits-Miller’s theorem- boot-strapping	2	C	2	4
10.	Small signal model – CS and CD amplifiers-problems	2	C	2	3
	UNIT III : LARGE SIGNAL AMPLIFIERS	**9**			
11.	Classification of large signal amplifiers, Distortion in amplifiers	1	C	2	6
12.	Frequency response of different coupling schemes	2	C	2	3,7
13.	Determining efficiency of Class A amplifiers, Class B amplifier, push-pull amplifier	2	C	2	3
14.	Class C-Single , Double-stagger tuned amplifiers-neutralization methods, Class D amplifier – Class S amplifier -	2	C	2	3
15.	MOSFET power amplifier -Differential amplifiers: DC and AC analysis-CMRR.	2	C	2	3,5
	UNIT IV : FEED BACK AMPLIFIERS AND OSCILLATORS	**10**			

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
16.	Feedback amplifiers – Barkhausen criterion-Stability –Distortion	2	C	2	2,7
17.	Current - Voltage, series / shunt feedback amplifiers	3	C	2	3,7,8
18.	Design and analysis of RC phase-shift oscillator.	1	C,D	3	3,4
19.	Design and analysis - Wien-bridge oscillator, Hartely oscillator.	2	C,D	3	3,4
20.	Design and analysis of Colpitt's oscillator and Crystal oscillators.	1	C	3	3
21.	Working - Franklin, Armstrong and Twin T oscillators.	1	C	3	3,4
	UNIT V – WAVE SHAPING CIRCUITS	**8**			
22.	RC wave shaping circuits- Clampers and Clippers	1	C	3	3
23.	RC, RL-Integrator and Differentiator circuits-Storage, Delay and Calculation of Transistor Switching Times	1	C	3	5
24.	Speed-up Capacitor -Voltage Multiplier	1	C	3	5
25.	Multivibrators – Astable, Monostable	2	C	3	3
26.	Bistable - Analysis of performance parameters of multivibrators	1	C	3	3
27.	Schmitt trigger -UJT relaxation oscillators-Blocking Oscillators	1	C	3	3
28.	Time base circuits – Voltage-Time base circuit, Current-Time base circuit	1	C	3	3
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Jacob. Millman, Christos C.Halkias, "*Electronic Devices and Circuits*", Tata McGraw Hill Publishing Limited, New Delhi, 2010.
2.	Floyd, "*Electronic Devices*", Pearson Education Ltd", New Delhi, 2012
REFERENCE BOOKS/OTHER READING MATERIAL	
3.	Sedha.R.S, "*A Text Book of Applied Electronics*", Sultan Chand Publishers, 2008..
4.	Theodre F.Bogart,Jeffrey S.Beasley , Guilermo Rico,"*Electronic Devices and Circuits*", Pearson education ltd, New Delhi,2013
5.	Malvino, "*Electronic Principles*", Tata McGraw Hill, 6th edition, 2006.
6.	Boylestad & Nashelsky, "*Electronic Devices and Circuit Theory*", Prentice Hall of India (P) Ltd., Eighth edition, 2003.
7.	Gupta.J.B, "*Electron Devices and Circuits*"- S.K.Kataria & Sons, 2012
8.	David A Bell, "*Electronic Devices and Circuits*", 5th edition, 2008, Oxford University Press India

Course nature		**Theory**					
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
						End semester examination Weightage :	**50%**

15CS202	**Digital System Design**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	P	Professional Core			
Course designed by	Department of Computer Science and Engineering				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE	To understand the basics of Boolean algebra and the operation of logic components, combinational, sequential circuits and VHDL.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Apply the principles of Boolean algebra to manipulate and minimize logic expressions.	a						
2.	Apply two-level logic functions with AND, OR, NAND, NOR and XOR gates	a						
3.	Use K-maps and table method to minimize and optimize two-level logic functions up to 5 variables.	a	b					
4.	Design combinational circuits using decoders, ROM and transmission gates.	a	b					
5.	Design finite state machines using various types of flip-flops and combinational circuits with prescribed functionality	a	b					
6.	Use the VHDL language for representation of digital signals	a						

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
UNIT I: Introduction to Number Systems and Boolean Algebra		**9**			
1.	Digital and Analog Basic Concepts, Some history of Digital Systems	1	C	1	1
2.	Introduction to number systems , Binary numbers , Number Base Conversion	1	C	1	1,2,3,4
3.	Complement Codes, Binary Arithmetic , Binary codes: BCD, Weighted codes -2421,8421,gray code	3	C	1	1,2,3,4
4.	Binary Logic functions, Boolean Algebra, Theorems and Properties of Boolean Algebra	4	C	1,2	1,2,3,4
UNIT II: Minimization techniques in digital Logic		**9**			
5.	Canonical forms, Generation of Switching Equations from Truth Table	2	C	1,2	1,2,3,4
6.	K-map(Karnaugh map) 2 ,3,4 and 5 variables, K map with Don’t care terms	3	C	3	1,2
7.	Quine Mc-Cluskey minimization technique, Quine Mc-Cluskey using Don’t Care Terms	3	C	3	1,2
8.	Mixed logic Combinational circuits	1	C,D	4	1,2
UNIT III: Design of Combinational Logic Circuits		**9**			
9.	Introduction to Combinational Circuits, Analysis and Design Procedure	1	C	4	1,2
10.	Binary Adder, Subtractor, Carry Look Ahead Generator, Decimal Adder, Binary Multiplier	4	C,D	4	1,2,3,4
11.	Decoder, Encoder, Priority Encoder, Digital Multiplexer, Magnitude Comparator	4	C,D	4	1,2,3,4
UNIT IV: Synchronous Sequential Circuits		**10**			
12.	Flip-flops- SR,D,JK,T	2	C	5	1,2
13.	Analysis of Synchronous Sequential Circuit	1	C	5	1,2
14.	State Reduction and Assignment	1	D,I	5	1,2
15.	Design of Synchronous Sequential Circuit: Sequence Detector for	2	D,I	5	1,2,3,4

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	D,JK,T flip-flops				
16.	BCD Counter, Registers: Shift Registers, Analysis of Asynchronous Sequential Circuit: Transition Table, Flow Table	4	D,I	5	1,2,3,4
UNIT V: Hardware Description Language		**8**			
17.	Introduction to HDL: Module Declaration, Gate delays, Boolean Expressions, User Defined Primitives	2	C	6	2,5,6
18.	HDL models for Combinational Circuits: Gate Level Modeling, Data Flow , Behavioral Modeling	3	D,I	6	2,5,6
19.	HDL flow Behavioral Sequential Circuits: HDL Models for Flip-Flops and Latches	3	D,I	6	2,5,6

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	John . M. Yarbrough,” Digital Logic: Applications and Design”, Cengage Learning, Reprint, 2009
2.	M.Morris Mano, Michael D. Ciletti ,”Digital Design with an Introduction to the verilog HDL”, Pearson Publications, Fifth edition, 2014.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Roth , Kinney,”Fundamentals of Logic Design”, Cengage Learning, 7th edition, 2015
4.	Donald D. Givone, “ Digital Principles and Design”, McGraw Hill Education (India) Pvt. Ltd,2013
5.	Richard S. Sandige, Michael L Sandige, “ Fundamentals of Digital and Computer Design with VHDL”, McGraw Hill, 2014
6.	Stephen Brown, Zvonko Vranesic, “Fundamentals of Digital Logic with Verilog Design”,Second Edition, McGraw Hill, 2015.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS201J	**Data Structures**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	P Professional Core				
Course designed by	Department of Computer Science and Engineering				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE	Data structure is a particular way of storing and organizing information in a computer so that it can be better processed. This course introduces different kind of data structures like stack, queue, linked list, tree and graph suitable for different kinds of applications. Specific data structures are most important for many efficient algorithms.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand analysis of algorithm and its time complexity	a	b					
2.	Be familiar with and implement the Linked list data structure	a	b	c				
3.	Be familiar with and implement the Stack and Queue data structure	a	b	c				
4.	Have a comprehensive knowledge of Trees and their implementations	a	b	c				
5.	Learn advanced data structures like Graphs and their implementation, hash tables and Hashing methods	a	b	c				

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: INTRODUCTION TO DATA STRUCTURES		**6**			
1.	Introduction : Basic terminology - Data structures – Data structure operations	1	C	1	1
2.	ADT – Algorithms: Complexity, Time – Space trade off	1	C	1	1
3.	Mathematical notations and functions	1	C	1	1
4.	Asymptotic notations – Linear and Binary search	1	C,I	1	1
5.	Asymptotic notations – Bubble sort	1	C,I	1	1
6.	Asymptotic notations -Insertion sort	1	C,I	1	1
UNIT II: ARRAYS AND LIST		**9**			
7.	Array : Operations on Arrays, Applications of Arrays	1	C,I	2	1,2,3
8.	Multidimensional Arrays : Sparse Matrix	2	C	2	1,2,3
9.	Linked List : Insertion, Deletion and Search, Cursor based implementation	2	C,I	2	1,2
10.	Polynomial Arithmetic	1	C,I	2	1,2
11.	Circular Linked List – Applications – Josephus Problem	1	C, I	2	1,2
12.	Doubly linked list: Insertion, Deletion and Search	2	C,I	2	1,2
UNIT III: STACK AND QUEUE		**9**			
13.	Stack: Array implementation, Linked list implementation	1	C	3	1,2
14.	Applications of Stack – Infix to Postfix – Evaluation of Postfix	2	C,I	3	1,2
15.	Application of Stack – Balancing symbols – Nested function calls	1	C,I	3	1,2
16.	Recursion – Towers of Hanoi	1	C,I	3	1,2
17.	Queue – Array implementation , Linked List implementation	1	C,I	3	1,2
18.	Circular Queue	1	C	3	1,2
19.	Applications of Queue – Priority queue – Double ended queue	2	C	3	1
UNIT IV: TREES		**11**			
20.	General trees – Terminology – Representation of trees – Tree traversal	1	C,D,I	4	1,2
21.	Binary tree – Representation – Expression tree – Binary tree traversal, Threaded Binary Tree	1	C,D,I	4	1,2
22.	Binary Search Tree – Construction - Searching , Deletion	2	C,D,I	4	1,2
23.	AVL trees – Rotation, Insertion	2	C,D,I	4	1,2
24.	B-Trees, construction, searching, deletion	2	C,D,I	4	1,2
25.	Splay trees	1	C	4	1,2

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
26.	Red-Black Trees	2	C	4	1,2
UNIT V: GRAPHS AND HASH TABLES		**10**			
27.	Graph Terminology, Graph Traversal, Topological sorting	1	C,D,I	5	1,2,4
28.	Minimum spanning tree – Prims - Kruskals	2	C,D,I	5	1,2,3
29.	Network flow problem	1	C	5	1,2,4
30.	Shortest Path Algorithm: Dijkstra	2	C,D,I	5	1,2,3
31.	Graph Search: Depth First Search, Breadth First Search	1	C,D,I	5	1,2
32.	Hashing: Hash functions, Collision avoidance, Separate chaining	1	C,D,I	5	1,2
33.	Open addressing: Linear probing, Quadratic Probing, Double hashing, Rehashing, Extensible Hashing	2	C	5	1,2
	Total contact hours	**45***			

Session	Description of the Experiments	Contact hours	C-D-I-O	IOs	Reference
1.	Implementation of Sorting, searching	4	D,I	1	1,2,3,4,5
2.	Implementation of Linked List (Singly , Doubly, Circular)	4	D,I	2	1,2,3,4,5
3.	Implementation of stack using array, linked list	4	D,I	2	1,2,3,4,5
4.	Implementation of queue using array, linked list	4	D,I	2	1,2,3,4,5
5.	Applications of stack, queue	4	D,I	3	1,2,3,4,5
6.	Binary Tree Traversal , Binary Search Tree Implementation	4	D,I	4	1,2,3,4,5
7.	Minimum Spanning Tree	4	D,I	5	1,2,3,4,5
8.	Shortest path algorithm using Dijkstra	3	D,I	5	1,2,3,4,5
	Total Contact Hours	30*			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Seymour Lipschutz, “Data Structures with C”, McGraw Hill Education, Special Indian Edition, 2014.
2.	R.F.Gilberg, B.A.Forouzan, “Data Structures”, Second Edition, Thomson India Edition, 2005.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	A.V.Aho, J.E Hopcroft and J.D.Ullman, “Data structures and Algorithms”, Pearson Education, First Edition Reprint 2003.
4.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2011.
5.	ReemaThareja, “Data Structures Using C”, Oxford Higher Education , First Edition, 2011

Course nature				**Theory + Practical**			
Assessment Method – Theory Component (Weightage 50%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

Assessment Method – Practical Component (Weightage 50%)						
In-semester	**Assessment tool**	Experiments	Record	MCQ/Quiz/Viva Voce	Model examination	**Total**
	Weightage	**40%**	**5%**	**5%**	**10%**	**60%**
End semester examination Weightage :						**40%**

* Excluding Assessment Hours

15SE201J	**Object Oriented Programming Using C++**		**L**	**T**	**P**	**C**
			3	**0**	**2**	**4**
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL CORE				
Course designed by	Department of Software Engineering					
Approval	32nd Academic Council Meeting, 23rd July, 2016					

PURPOSE	Real world is full of objects and problems can be best solved using object oriented approach. The pioneer programming language to implement object oriented features is C++. This course aims at building object oriented skills through programming in C++.								
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**							
At the end of the course, student will be able to									
1.	Apply the basic object oriented features	a	c						
2.	Develop Generic programming skills	a	c						
3.	Apply appropriate data structures and solve complex problems by applying the skills acquired so far	a	b	i					
4.	Design problem into classes and develop a full working code	a	c						
5.	Develop programs using Streams, files, templates and handle exceptions	a	c	i					

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: INTRODUCTION TO OBJECT-ORIENTED PROGRAMMING	**10**			
1.	Need of Object-Oriented Programming - Comparison of procedural programming and Object-Oriented Programming	1	C	1	1
2.	Characteristics of Object-Oriented Languages	1	C	1	1
3.	C++ Programming Basics: Basic Program Construction	1	C	1	1
4.	Data Types, Variables, Constants	1	C	1	1
5.	Type Conversion, Operators, Library Functions	1	C	1	1
6.	Loops and Decisions, Structures	2	C	1,2	1
7.	Functions – Simple Functions, Passing arguments, Returning values, Reference Arguments	1	C	1,2	1
8.	Recursion, Inline Functions, Default Arguments Storage Classes	1	C	1,2	1
9.	Arrays – Strings	1	C	1,2	1
	UNIT II: FEATURES OF OBJECT-ORIENTED PROGRAMMING	**11**			
10.	Introduction to Classes and Objects	1	C	1	1,2,3
11.	Constructors and its types, Destructors	1	C,I	1,2	1,2,3
12.	Passing Objects as Function arguments and Returning Objects from Functions	1	C,I	1,3,4	1,2,3
13.	Operator Overloading	1	C,I	1,2	1,2,3
14.	Inheritance	2	C,I	1,3,4	1,2,3
15.	Overloading Member Functions	1	C,I	1,2	1,2,3
16.	Pointers	2	C,I	1,3,4	1,2,3
17.	Virtual Functions – Friend Functions, Static Functions	2	C,I	1,2	1,2
	UNIT III: STREAMS AND FILES	**7**			
18.	Streams: Classes and Errors	1	C	5	1,3,4
19.	Disk File I/O with Streams	1	C,I	5	1,3,4
20.	Files: File Pointers, Error handling in File I/O, File I/O with member Functions	3	C,I	3,5	1,3,4
21.	Overloading the extraction and Insertion Operators	1	C,I	5	1,3,4

22.	Multi File Programs	1	C,I	5	1,3,4
	UNIT IV: TEMPLATES, EXCEPTIONS	**7**			
23.	Templates – Function templates, Class templates	2	C	5	1,3,4
24.	Exceptions: Need of Exceptions, keywords, Simple and Multiple Exceptions	3	C,I	5	1,3,4
25.	Re-throwing Exception and Exception Specifications, Custom Exception	2	C,I	5	1,3,4
	UNIT V: STANDARD TEMPLATE LIBRARY	**10**			
26.	Introduction to STL: Containers, Algorithms, iterators - potential problems with STL	2	C,I	5	1
27.	Algorithms: find(), count(), sort(),search(),merge()	1	C,I	5	1
28.	Function Objects: for_each() , transform()	1	C,I	5	1
29.	Sequence Containers: vectors, Lists, Deques	2	C,,I	3,5	1
30.	Iterators and specialized iterators	1	C,I	5	1
31.	Associative Containers: Sets and Multisets Maps and multimaps	2	C,I	3,5	1
32.	Storing User-Defined Objects – Function Objects	1	C	5	1
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Robert Lafore, “Object-Oriented Programming in C++”, 4th edition, SAMS Publishing, 2008
2.	Deitel, “C++ How to Program”, 6th edition, PHI publication, 2008
3.	R. Subburaj, “Object Oriented Programming With C++ ”, Vikas Publishing House, New Delhi, Revised Edition, 2013.
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	E.Balaguruswamy “Object Oriented Programming with C++”, 6th edition, Tata McGraw Hill Education, 2015
5.	Joyce Farrell, “Object Oriented Programming”, 4th edition, Cengage learning, 2009
6.	Nicolai M. Jossutis, “Object-Oriented Programming in C++”, Wiley Publications, 2002
7.	BjarneStroustrup ,”The C++ Programming Language”, 4th Edition, Addison Wesley, 2015
8.	Stanley Lippman, JoseeLajoie, Barbara E. Moo ,”C++ Primer”, 5th Edition, Addison Wesley, 2015

S. No.	**Description of Experiments**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
Each student is assigned with an application in Session 1. Students have to complete the below listed experiments with respect to the assigned application.					
1.	Identifying appropriate data types, variables and simple programs to understand the basic program structure	2	C,D,I	1	1-8
2.	Programs for control structures and loops	2	C,D,I	1	1-8
3.	Simple Programs to construct a class structure with methods and arguments	2	C,D,I	1,2	1-8
4.	Programs to develop their skills on Inheritance	2	C,D,I	1,4	1-8
5.	Programs to improve their skills on polymorphism	2	C,D,I	1,4	1-8
6.	Programs to construct Functions, Inline functions, and Virtual functions	4	C,D,I	1,4	1-8
7.	Develop a complete logic for the assigned application including all the concepts done so far	4	C,D,I	3,4	1-8
8.	Programs to improve the skills on reading and storing from and to files	2	C,D,I	5	1-8
9.	Programs for manipulating pointers	4	C,D,I	1,2,4	1-8
10.	Programs to construct templates and handle exceptions	2	C,D,I	5	1-8
11.	Programs to construct a STL for Sequential containers and iterators	2	C,D,I	5	1-8
12.	Programs to construct a STL for Associative containers	2	C,D,I	5	1-8
	Total Contact Hours	**30**			

<table>
<tr><td colspan="5">**Course nature**</td><td colspan="3">**Theory + Practical**</td></tr>
<tr><td colspan="8">**Assessment Method – Theory Component (Weightage 50%)**</td></tr>
<tr><td rowspan="2">**In-semester**</td><td>**Assessment tool**</td><td>Cycle test I</td><td>Cycle test II</td><td>Cycle Test III</td><td>Surprise Test</td><td>Quiz</td><td>**Total**</td></tr>
<tr><td>**Weightage**</td><td>**10%**</td><td>**15%**</td><td>**15%**</td><td>**5%**</td><td>**5%**</td><td>**50%**</td></tr>
<tr><td colspan="7">**End semester examination Weightage :**</td><td>**50%**</td></tr>
<tr><td colspan="7"></td><td></td></tr>
<tr><td colspan="8">**Assessment Method – Practical Component (Weightage 50%)**</td></tr>
<tr><td rowspan="2">**In-semester**</td><td>**Assessment tool**</td><td>Experiments</td><td>Record</td><td>MCQ/Quiz/Viva Voce</td><td colspan="2">Model examination</td><td>**Total**</td></tr>
<tr><td>**Weightage**</td><td>**40%**</td><td>**5%**</td><td>**5%**</td><td colspan="2">**10%**</td><td>**60%**</td></tr>
<tr><td colspan="7">**End semester examination Weightage :**</td><td>**40%**</td></tr>
</table>

15CS203	**Computer System Architecture**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	P Professional Core				
Course designed by	Department of Computer Science and Engineering				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE	To study the basic structure of a digital computer and the organization of the Arithmetic and Logical unit, the Memory unit, Control unit and I/O unit.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	To study basic structures and functions of Control Unit, Memory unit, Storage devices and Input/output organization in a computer system.	a						
2.	To understand the representations of signed and unsigned numbers and arithmetic algorithms such as addition, subtraction, multiplication and division.	a	b					
3.	To learn the concepts of various instruction set architectures (ISA), addressing modes to understand the concepts of pipelining and superscalar execution.	d						
4.	To understand the various classes of instruction types such as data movement, arithmetic, logical and flow control and to study the various control unit design.	a	b	c				
5.	To identify the various memory technologies and memory hierarchies found in a computer and to describe the various ways of organizing cache memory and appreciate the cost-performance tradeoffs.	a	b					
6.	To understand how interrupts are used to implement I/O control and data transfers and to identify various types of buses in a computer system and understand how devices compete for a bus and are granted access to the system bus.	a	b	c				

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: BASIC STRUCTURE OF COMPUTERS		**8**			
1.	Computer Types, Functional units, Basic operational concepts , Bus structures	1	C	1, 6	1,2,4
2.	Memory locations and addresses, Memory operations	1	C	1,5	1
3.	Instruction and instruction sequencing, Assembly language, Addressing modes, Basic I/O operations	3	C,D,I	3,4,6	1,2,4
4.	Evolution of Parallel computers, System Attributes to Performance	2	C	1	7
5.	Multiprocessors and Multicomputers	1	C	1	4,5,7
UNIT II: ARITHMETIC UNIT		**9**			
6.	Addition and subtraction of signed numbers, Design of fast adders	2	C,D,I	1,2	1,6
7.	Multiplication of positive numbers, Signed operand multiplication	2	C,D,I	2	1,6
8.	Fast multiplication-Bit pair recoding of Multipliers, Carry Save Addition of summands	2	C,D,I	2	1,6
9.	Integer division- Restoring Division, Non Restoring Division	2	D,I	2	1,6
10.	Floating point numbers and its operations	1	D,I	2	1,4
UNIT III: BASIC PROCESSING UNIT		**11**			
11.	Fundamental concepts, Execution of a complete instruction, Multiple bus organization	2	C	1,3	1,2,8
12.	Hardwired control	1	D,I	1,4	1,2,4,6
13.	Micro programmed control	2	D,I	1,4	1,2,4,6
14.	Pipelining- Basic concepts, Data hazards, Instruction hazards,	3	C,D,I	3,4	1,5,8
15.	Pipelining- Influence on Instruction sets, Datapath and control considerations	2	C	3,6	1,9
16.	Superscalar Operation	1	C	3	1,7
UNIT IV: MEMORY UNIT		**8**			
17.	Basic concepts of memory system, Semiconductor RAMs, ROMs	3	C,D	1,5	1,2,9

Session	Description of Topic	Contact hours	C- D- I- O	IOs	Reference
	Speed, size and cost				
18.	Cache memories, Performance consideration	2	C,D	5	1,3,4,5
19.	Virtual memory	1	C,D	1,5	1,3,5
20.	Memory Management requirements	1	C	5	1
21.	Secondary storage	1	C	5	1,2,4
UNIT V: INPUT – OUTPUT ORGANIZATION		**9**			
22.	Introduction to Data transfer techniques, Bus Interface – UART, Interfacing UART to Microprocessor Unit	3	C,I	1,6	2
23.	Programmed IO, Interrupt driven IO, Direct Memory Access	2	C	1,6	1,2,4
24.	I/O Interrupt, I/O channel/Processor	2	C,I	1,6	1,2
25.	Interconnection Standards – PCI Bus, SCSI, USB, Firewire, SATA, SAS, PCI Express	2	C	6	1,8
	Total contact hours	**45***			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Carl Hamacher, Zvonko Vranesic, Safwat Zaky, “Computer Organization”, McGraw-Hill, Fifth Edition, Reprint, 2015.
2.	Pal Chaudhuri,”Computer Organization and Design”,PHI Pvt, Third Edition,2008.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Ghosh T. K., “Computer Organization and Architecture”, Tata McGraw-Hill, Third Edition, 2011.
4.	William Stallings, “Computer Organization and Architecture – Designing for Performance”, Pearson Education, Tenth Edition, 2015.
5.	Behrooz Parahami, “Computer Architecture”, Oxford University Press, Eighth Impression, 2015.
6.	John P. Hayes, “Computer Architecture and Organization”, McGraw Hill, Third Edition, 2015.
7.	Kai Hwang & Naresh Jotwani,”Advanced Computer Architecture”, McGraw Hill, Third Edition, 2016.
8.	Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian,“Computer Organization and Embedded Systems”, McGraw-Hill, Sixth Edition, 2012.
9.	P.V.S. Rao,”Computer System Architecture”, PHI Learning Pvt Ltd, 2011

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

SEMESTER - IV

15LE207E	***GERMAN LANGUAGE - II***		**L**	**T**	**P**	**C**
			2	**0**	**0**	**2**
Co-requisite:	NIL					
Prerequisite:	GERMAN LANGUAGE I					
Course Category	G	General				
Course designed by	Department of English & Foreign Languages					
Approval	-- Academic Council Meeting -- , 2016					

PURPOSE	The Engineering students continue to learn German language in Phase II. As already stated, the students will obtain extra profile in the field of employment opportunities in addition to their Engineering degree.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	to enable the students to read, understand technical literature, read german newspapers & short stories and also to write short notes	g						
2.	by introduction of modal verbs and perfect tense in grammar, the students will definitely be able to converse well in german.	g						
3.	developing easy conversation, writing e-mails and letters in conventional german language	g						
4.	dativ präpositionen , wechsel präpositionen , konnektoren , partizip perfekt, akkusativ verben , dativ verben und modal verben.	g						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
Unit I – Wichtige Sprachhandlungen		**6**			
1	Wiederholung	1	g	1,2	1,2
2	Modal Verben	1	g	1,2	1,2
3	Trennbar verben	2	g	1,2	1,2
4	Wortschatz	2	g	3	1,2
Unit II – Wichtige Sprachhandlungen		**6**			
1	Dativ Präpositionen	2	g	2,4	1
2	Wohin-Wann- Wielange	1	g	2	1
3	Untrennbare Verben	1	g	2,4	1
4	Possessiv Artikel	2	g	3,4	1,2
Unit III – Wichtige Sprachhandlungen		**6**			
1	Akkusativ verbs	2	g	3,4	1,2
2	Partizip Perfekt	3	g	3,4	1,2
3.	Wortschatz	1	g	3	1,2
Unit IV –Wichtige Sprachhandlungen		**6**			
1	Dativ verbs	1	g	3,4	1,2
2	Akkusativ prepositions	1	g	2,4	1
3	Personal pronomen – Dativ	1	g	2,4	1
4	Konnektoren(aber,und,oder,denn,sondern)	1	g	2,4	1,2,3
5	Nom , Akku&dativpronomen	2	g	2,4	1
Unit V - Wichtige Sprachhandlungen		**6**			
1	Dativ prepositions	1	g	2,4	1
2	DativArtikelmitnomen	1	g	4	1
3	Das Prateritum	1	g	4	1
4	Wechselpreposition(an, auf, hinter, neben, in, über, unter, vor, zwischen	1	g	3,4	1,2
5	Dialoge	1	g	2,3	1,2
6	PrufungenGesprach	1	g	1,2,3,4	1,2
	Total Contact Hours	**30**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOK**
1.	German for Beginners, SRM University
REFERENCE BOOKS/OTHER READING MATERIAL	
2.	Studio d A1. Deutsch als Fremdsprache with CD.(Kursbuch und Sprachtraining)
MATERIAL FOR FURTHER READING:	
3.	Sometimes we use CDs for practicing of Native speaking.

Course nature					**Theory**		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	**Cycle test I**	**Cycle test II**	**Cycle Test III**	**Surprise Test**	**Quiz**	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
						End semester examination Weightage :	**50%**

15LE208E	**FRENCH LANGUAGE - II**		**L**	**T**	**P**	**C**
			2	**0**	**0**	**2**
Co-requisite:	NIL					
Prerequisite:	French - I					
Course Category	G	General				
Course designed by	Department of English and Foreign Languages					
Approval	-- Academic Council Meeting -- , 2016					

PURPOSE	Language skills coupled with technical skills enables the French students in career orientation. An advanced level of the language helps the students get to know to access information on the internet and to send and receive mails and are in a position to communicate effectively with any French speaker

INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**						
At the end of the semester, the course helps							
1. Consolidate the knowledge of French grammar with examples provided from different angles: from present day literature, day to day conversation.	g						
2. Improve their oral and written skills through practice.	g						
3. The learner acquires the concept of general French for everyday interactions	g						
4. The student get to know the particularities of French culture and life style	g						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I – L'HEURE, LES PREPOSITIONS DE TEMPS		**8**			
1	Le calendrier universitaire français. scientifiques.	2	g	3	1, 4
2	Comprendre et présenter un emploi du temps et comment dire l'heure, puis s'informer sur les horaires	2	g	2	1, 2
3	Le deuxième groupe des verbes comme finir et les prépositions de temps.	2	g	1,2,3	1, 2, 3
4	Les jours de la semaine, les mois de l'année, les matières, l'heure, les spécialités	2	g	3	1,4
UNIT II – LES ADJECTIFS ET LES NATIONALITES		**8**			
5	Les noms de scientifiques célèbres. les adjectifs de nationalité et le féminin et le masculin des noms de métiers scientifiques.	3	g	1,2	1,2,3
6	Les noms de pays, les nationalités, les métiers scientifiques, proposer et accepter une sortie et un rendez-vous	3	g	1,3	1,3
7	Le futur proche, les adjectifs démonstratifs.	2	g	1,4	1,3,4
UNIT III – LES ARTICLES PARTITIFS		**6**			
8	Les habitudes alimentaires et la cuisine française.	2	g	1,4	1, 3,4
9	Comment faire les courses et commander au restaurant, exprimer ses besoins, comprendre une étiquette et demander le prix,	2	g	1,3,4	1, 4
10	Les verbes manger et boire au présent et l'article partitif.	2	g	2,4	1,4
UNIT IV – LES VERBES ET LES VERBES PRONOMINAUX		**4**			
11	Les fêtes et les jours fériés français**.**	2	g	3,4	1, 2
12	Les prépositions de lieu et les verbes pronominaux.	2	g	2,3,4	1, 2
UNIT V – LA NOMINALISATION		**4**			
13	Comment exprimer un souhait professionnel		g	2,4	1, 2
14	Formuler un projet, la nominalisation		g	1, 2,3	1, 2
	Total Contact Hours	**30**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Tech French (for Science and Technology)

	REFERENCE BOOKS/OTHER READING MATERIAL
2.	French for dummies. Wiley publishing co. Inc., USA.
3.	French made easy , Goyal publishers
4.	Version Originale, Goyal publishers

<table>
<tr><th colspan="5">Course nature</th><th colspan="3">Theory</th></tr>
<tr><td colspan="8"><b>Assessment Method (Weightage 100%)</b></td></tr>
<tr><td rowspan="2"><b>In-semester</b></td><td><b>Assessment tool</b></td><td><b>Cycle test I</b></td><td><b>Cycle test II</b></td><td><b>Cycle Test III</b></td><td><b>Surprise Test</b></td><td><b>Quiz</b></td><td><b>Total</b></td></tr>
<tr><td><b>Weightage</b></td><td><b>10%</b></td><td><b>15%</b></td><td><b>15%</b></td><td><b>5%</b></td><td><b>5%</b></td><td><b>50%</b></td></tr>
<tr><td colspan="7"><b>End semester examination Weightage :</b></td><td><b>50%</b></td></tr>
</table>

15LE209E	**JAPANESE LANGUAGE–II**		**L**	**T**	**P**	**C**
			2	**0**	**0**	**2**
Co-requisite:	NIL					
Prerequisite:	Japanese language-I					
Course Category	G	General				
Course designed by	Japanese faculty of EFL dept					
Approval	-- Academic Council Meeting -- , 2016					

PURPOSE	To enable students to learn a little advanced grammar in order to improve their conversational ability in Japanese.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	read and write the Katakana Japanese script and a few more kanji.	g						
2.	improve their conversational skill in Japanese	g						
3.	know about Japan and Japanese culture	g						
4.	have a better opportunity for employability by companies who have association with Japan	g						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
Unit I – Katakana Script		**8**			
1	Chart 1 – 46 syllables	4	g	1	1, 2
2	Chart 2 – ten-ten letters and chart 3 – combination letters.	2	g	1	1, 2
3	Double consonants and vowel elongation	2	g	1	1, 2
Unit II – Verbs and Associated Particles		**8**			
4	Commonly used verbs and their associated particles.	2	g	2, 3	1
5	Verbs indicating destination, time and objects.	2	g	2, 3	1
6	Verbs in past tense	2	g	2, 3	1
7	Common expressions used in daily life	1	g	2, 3, 4	1
8	Kanji for verbs	1	g	2, 3, 4	1
Unit III – Adjectives		**6**			
9	Introduction to i-ending and na-ending adjectives	2	g	2, 3, 4	1
10	Non-past and present, affirmative and negative forms	2	g	2, 3, 4	1
11	Combining two adjectives and contrasting adjectives (use of ~kute, de and ga)	2	g	2, 3, 4	1
Unit IV – Invitation		**4**			
12	Use of ~masenka and ~mashou.	2	g	2, 3, 4	1
13	Kanji – time and people related	2	g	2, 3, 4	1
Unit V – Verb Forms		**4**			
14	Use of ~te form and ~tai form	2	g	2, 3, 4	1
15	Kanji – ookii, chiisai, gaku and go (language)	2	g	2, 3, 4	1
	Total Contact Hours	**30**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	A basic course in Japanese, SRM University
REFERENCE BOOKS/OTHER READING MATERIAL	
2.	Japanese for dummies. Wiley publishing co. Inc., USA.
3.	Kana workbook, Japan foundation
4.	Shoho-I, Japan foundation
5.	www.learnjapaneseatsrm.blogspot.in

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	**Cycle test I**	**Cycle test II**	**Cycle Test III**	**Surprise Test**	**Quiz**	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15LE210E	**KOREAN LANGUAGE–II**		**L**	**T**	**P**	**C**
			2	**0**	**0**	**2**
Co-requisite:	NIL					
Prerequisite:	Korean Language-I					
Course Category	G	General				
Course designed by	Korean faculty of EFL dept					
Approval	-- Academic Council Meeting -- , 2016					

PURPOSE	To enable students achieve a basic exposure on Korea, Korean language and culture. To acquire basic conversational skill in the language.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	understand scripts from the text book	g						
2.	make the students acquire basic conversational skill	g						
3.	enable students to know about Korean culture	g						
4.	enable students to buy items at a store and talk about daily schedules	g						
5.	create an advantageous situation for the students to have better opportunity for employability by companies who have association with Korea	g						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
Unit I – DESCRIBING THINGS		**6**			
1.	Review of Vowels and Consonants	2	g	1	1, 2
2.	Asking if someone has an item - Asking the name of things with demonstratives	2	g	1	1, 2
3.	Basic Conversation and Listening	2	g	1	1,2
Unit II – SHOPPING		**9**			
4.	Asking prices – Selling and Buying items at a store	3	g	2, 3	1
5.	Vocabulary - Basic verb, Basic adjective, noun “place”	3	g	2, 3	1
6.	Korean culture “money”	3	g	2, 3	1
Unit III – DAILY LIFE		**6**			
7.	Talking about daily life - Expressing movement	2	g	2, 3	1
8.	Talking about daily life -Expressing negation	2	g	2, 3	1
9.	Basic Conversation and Listening – Describing a person or a thing	2	g	2, 3	1
Unit IV – INTERROGATIVE		**6**			
10.	Getting information about someone – One’s likes and dislikes, About my friends	2	g	2, 3, 4	1
11.	Linking two sentences	2	g	2, 3, 4	1
12.	Basic Conversation and Listening	2	g	1, 3	1
Unit V – TIME		**3**			
13.	Telling time - Expressing days of the week	1	g	2, 3, 4	1
14.	Basic Conversation and Listening – Expressing days of the week	2	g	2, 3, 4	1
	Total Contact Hours	**30**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Seoul National University, *Active Korean 1*, MOONJINMEDIA, 2006.
REFERENCE BOOKS/OTHER READING MATERIAL	
2.	THE NATIONAL INSTITUTE OF THE KOREAN LANGUAGE, *King Sejong Korean 1*, THE NATIONAL INSTITUTE OF THE KOREAN LANGUAGE, 2013.
3.	THE NATIONAL INSTITUTE OF THE KOREAN LANGUAGE, *Korean Grammar for Foreigners 1, 2,* COMMUNICATIONBOOKS, 2005.
4.	Cho H. R. etal., Master Korean basic 1-1, Darakwon, 2013.
5.	Ahn J. M. et al.,Korean grammar in use beginning, Darakwon, 2010

Course nature					Theory		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	**Cycle test I**	**Cycle test II**	**Cycle Test III**	**Surprise Test**	**Quiz**	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15LE211E	**CHINESE LANGUAGE -II**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**
Co-requisite:	NIL				
Prerequisite:	NIL				
Course Category	G	General			
Course designed by	Chinese faculty by EFL department				
Approval	-- Academic Council Meeting -- , 2016				

PURPOSE	To acquire communication and writing skills for beginners with basic knowledge of Chinese							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	make the students improve their Chinese conversational skills, character writing skills and language knowledge.	g						
2.	help students extend their Chinese grammar and vocabulary.	g						
3.	enable students to improve their knowledge about China and Chinese culture.	g						
4.	improve their employability by companies associated with China/ Chinese market.	g						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
Unit I –INTRODUCING ONESELF		**3**			
1.	Introducing people to each other, conversations	2	g	1,2	1
2.	Self-introduction-introducing oneself	1	g	1	1
Unit II–DAILY USING CONVERSATIONS		**10**		g	
3.	Receiving a guest	2	g	1,2,3,4	1
4.	Question and answer about nationality-Question and answers about places	2	g	1,2,4	1
5.	Expressing apology -Question and answer about time-Making proposal-Expressing affirmation/ negation	2	g	2,3	1
6.	Telling age-Making requests	2	g	2,3	1
7.	Question and answer about postcodes and telephone number	2	g	1,2,3	1
Unit III–GRAMMAR		**8**		g	
8.	Interrogative questions	2	g	2,3.5	1
9.	Sentence with a verbal and an adjectival predicate- Verbal measure words-Optative verbs	2	g	2,3,5	1
10.	Making sentences in future tense- Usage of (还是,但是，可，以后，以前，后来，每,，如果)-	2	g	2,3,5	1
11.	Usage of the basic verbs and adjectives, sentence with a nominal predicate, sentence with a subject verbconstruction as its predicate	2	g		1
Unit IV – DAILY USING VOCABULARY		**7**		g	
12.	Colours - Different kinds of professions -	2	g	2	1
13.	Name of the places- Vegetables and fruits	2	g	2	1
14.	Body parts- Sports	3	g	2	1
Unit V – CONSTRUCTIONS		**2**		g	
15.	Introduction and application of few frequently used constructions in Chinese Language like跟。。。一样, 是。。。的,从。。。到,正在。。。呢,除了。。。以外。	2	g	2,3	1
	Total Contact Hours	**30**			

LEARNING RESOURCES

Sl. No.	TEXT BOOKS
1.	New Practical Chinese Readers Textbook (1) - Beijing Language and cultural university press

Course nature					**Theory**		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	**Cycle test I**	**Cycle test II**	**Cycle Test III**	**Surprise Test**	**Quiz**	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15PD202	**VERBAL APTITUDE**			**L**	**T**	**P**	**C**
				1	**1**	**0**	**1**
Co-requisite:	NIL						
Prerequisite:	Quantitative Aptitude and Logical Reasoning - I						
Data Book / Codes/Standards	Nil						
Course Category	G	GENERAL	VERBAL APTITUDE				
Course designed by	Career Development Centre						
Approval	----- Academic Council Meeting -------------------, 2016						

PURPOSE	To impart knowledge and equip with skills and aptitude that will enable learners ace competitive exams and placement tests with speed and precision.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, the student will be able to								
1.	Enhance lexical skills through systematic application of concepts and careful analysis of style, usage, syntax, semantics and logic	g	i					
2.	Build vocabulary through methodical approaches and nurture passion for learning new words	g	i					
3.	Sharpen logical reasoning through skilful conceptualization, identification of relationships between words based on their function, usage and characteristics	i						
4.	Hone critical thinking skills by analyzing the arguments with explicit and implicit premises to validate the author’s point of view	i						
5.	Inculcate problem solving and decision making skills through case studies on work ethics, decision making, organizational behavior	d	f	g	j			

Sl. No.	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: CRITICAL REASONING -I	**4**			
1.	Overview of the syllabus, Introduction to Different Parts of an Argument in Reasoning	1	C	3,	1,2
2.	Assumption of an Argument	1	C,I,O	3	1,2
3.	Strengthening of an Argument	1	C,I,O	3	1,2
4.	Weakening of an Argument	1	C,I,O	3	1,2
	UNIT II: VOCABULARY ENRICHMENT	**6**			
5.	Synonyms	2	I,O	2	1,3,4,5
6.	Antonyms	1	I.O	2	1.3.4.5
7.	Odd Words	1	C,I	2	1,7,8
8.	Idioms and Phrasal Verbs	1	C,I,O	2	1,13
9.	Same Word-Different Parts of Speech	1			
	UNIT III: VERBAL REASONING	**6**			
10.	Word Analogy	2	C,D,I,O	2	1,7,8
11.	Sentence Completion & Text Completion	2	I,O	2	1,9,10,17
12.	Sentence Equivalence	2	I,O	2	1,9,10,17
	UNIT IV: ERROR ANALYSIS	**6**			
13.	Identification of Error/s	2	I,O	1	1,7,8
14.	Sentence Correction	4	I,O	1	1,6
	UNIT V: PARA JUMBLE	**4**			
15.	Logical Rearrangement of Sentences	4	C,D,I	3	1,7,14,16
	UNIT VI: PROBLEM SOLVING SKILLS	**4**			
16.	Case Study	4	C,I,O	5	15
	Total contact hours	30			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Verbal Aptitude :A Quantum Leap to Empowerment
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	Manhattan GMAT - Critical Reasoning GMAT Strategy Guide, 12th Edition
3.	Charles Harrington Elstor, Verbal Advantage: Ten Easy Steps to a Powerful Vocabulary, Large Print, September 2000.
4.	Norman Lewis, Word Power Made Easy, WR Goyal Publications, 2011
5.	GRE Word List 3861 – GRE Words for High Verbal Score, 2016 Edition
6.	Manhattan GMAT Sentence Correction Guide, 5th Edition
7.	R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning. S.Chand Publications, 2010
8.	Thorpe Edgar and Thorpe Showich, Objective English. Pearson Education, 2012
9.	GRE Text Completion and Sentence Equivalence Practice Questions, Vibrant Publishers, USA, 2013
10.	Green Sharon Weiner M.A & Wolf Ira K.Barron's New GRE, 19th Edition. Barron's Educational Series, Inc, 2011.
11.	Manhattan Prep GRE : Reading Comprehension and Essays, 5th Edition
12.	Sujith Kumar, Reading Comprehension for the CAT, Pearson
13.	Sam Phillips, 3000 Idioms and Phrases (English Improvement for Success), Goodwills Publications, 2014
14.	Sharma Arun, Verbal Ability and Reading Comprehension for the CAT, Mc.Graw Hill Publication, 2014
15.	Ellet William. The Case Study Handbook : How to Read, Discuss and Write Persuasively About Cases
16.	Nishit K Sinha, VARC for the CAT, 3rd Edition, Pearson Publication, 2015
17.	The Official Guide to the GRE-General Revised Test, 2nd Edition, Mc Graw Hill Publication

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15MA207	PROBABILITY AND QUEUEING THEORY	L	T	P	C
		4	0	0	4

Co-requisite:	NOT APPLICABALE		
Prerequisite:	15 MA102 (or) 15MA205B		
Data Book / Codes/Standards	STATISTICAL TABLES		
Course Category	B	CORE	MATHEMATICS
Course designed by	Department of Mathematics		
Approval	-- Academic Council Meeting -- , 2016		

PURPOSE	To acquire analytical ability in solving mathematical problems as applied to the respective branches of engineering		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1.	Be through with probability concepts	a	e
2.	To acquire knowledge on Probability Distributions	a	e
3.	Get exposed to the testing of hypothesis using distributions	a	e
4.	Gain strong knowledge inn principles of Queueing theory	a	e
5.	Get exposed to Discrete time Markov chain	a	e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: RANDOM VARIABLES	**14**			
1.	Review of probability concepts, Types of Events, Axioms, Conditional probability, Multiplication theorem, Applications.	2	C,I	1	1-5
2.	Discrete and continuous Random Variables – Discrete case, Probability Mass function, Cumulative distribution function, Applications	2	C,I	1	1-5
3.	Characteristics of random variables – Continuous case, Probability density function, Cumulative distribution function, Applications	2	C,I	1	1-5
4.	Expectation, Variance.	2	C,I	1	1-5
5.	Higher Order Moments	2	C,I	1	1-5
6.	Moment Generating Function, Functions of Random Variable (One dimensional only)	2	C,I	1	1-5
7.	Chebychev’s Inequality – (Statement only). Applications of Chebychev’s Inequality	2	C,I	1	1-5
	UNIT II: THEORETICAL DISTRIBUTIONS	**12**			

8.	Discrete Probability distribution: Binomial distribution – MGF, Mean, Variance, Applications of Binomial distribution, Fitting a Binomial distribution	2	C,I	2	1-5
9.	Poisson distribution – MGF, Mean, Variance, Applications of Poisson distribution, Fitting a Poisson distribution	2	C,I	2	1-5
10.	Geometric distribution – MGF, Mean, Variance, Memoryless Property , Applications of Geometric distribution	2	C,I	2	1-5
11.	Continuous Probability Distributions: Uniform distribution – MGF, Mean, Variance & Applications	1	C,I	2	1-5
12.	Exponential Distribution - MGF, Mean, Variance, Memoryless Property Applications of Exponential distribution	2	C,I	2	1-5
13.	Normal distribution – Mean, Variance	1	C,I	2	1-5
14.	Standard Normal distribution and Applications of Normal distribution	2	C,I	2	1-5
	UNIT-III - TESTING OF HYPOTHESIS	**14**			
15.	Introduction to Sampling Distributions, Population and Sample, Null Hypothesis and Alternative Hypothesis, Single and Two Tailed Test	2	C,I	3	1-5
16.	Testing of Hypothesis, Level of Significance, Critical Region, Procedure for Testing of Hypothesis	1	C,I	3	1-5
17.	Large Sample Test- Test For Single Proportion, Two Sample Proportions	2	C,I	3	1-5
18.	Large Sample Test- Test For Single Mean, Two Sample Means	2	C,I	3	1-5
19.	Small Sample Tests – ‘t’ Test For a Single Mean	1	C,I	3	1-5
20.	‘t’ Test For The Difference Of Means, Paired ‘t’ Test	2	C,I	3	1-5
21.	F Test – Test of Significance of The Difference Between Two Population Variances	2	C,I	3	1-5
22.	Chi Square Test For Goodness of Fit, Independence of Attributes	2	C,I	3	1-5
	UNIT-IV : QUEUEING THEORY	**10**			
23.	Introduction to Markovian queueing models	2	C,I	4	1-5
24.	Single Server Model with Infinite system capacity, Characteristics of the Model (M/M/1) : (∞/FIFO)	2	C,I	4	1-5
25.	Problems on Model (M/M/1) : (∞/FIFO)	2	C,I	4	1-5
26.	Single Server Model with Finite System Capacity, Characteristics of the Model (M/M/1) : (K/FIFO)	2	C,I	4	1-5

27.	Problems on Model (M/M/1) : (K/FIFO)	2	C,I	4	1-5
	UNIT-V : MARKOV CHAINS	**10**			
28.	Introduction to Stochastic process, Markov process, Markov chain one step & n-step Transition Probability.	2	C,I	5	1-5
29.	TPM and Applications	1	C,I	5	1-5
30.	Chapman Kolmogorov theorem (Statement only), Applications on Chapman Kolmogorov	1	C,I	5	1-5
31.	Transition probability	2	C,I	5	1-5
32.	Transition probability - Applications	1	C,I	5	1-5
33.	Classification of states of a Markov chain	2	C,I	5	1-5
34.	Classification of states of a Markov chain – Applications	1	C,I	5	1-5
	Total contact hours	60			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Veerarajan T., Probability, Statistics and Random Processes, Tata McGraw Hill,1st Reprint 2004.
2.	S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 9th extensively revised edition, Sultan Chand & Sons, 1999.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Trivedi K S, “ Probability and Statistics with reliability, Queueing and Computer Science Applications”, Prentice Hall of India, New Delhi, 1984
4.	Gross.D and Harris.C.M. “Fundamentals of Queuing theory”, John Wiley and Sons, 1985.
5.	Allen.A.O., “Probability Statistics and Queuing theory”, Academic Press, 1981.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15EE232	**Electrical Engineering And Control Systems**			**L**	**T**	**P**	**C**
				3	**0**	**0**	**3**
Co-requisite:	NIL						
Prerequisite:	NIL						
Data Book / Codes/Standards	NIL						
Course Category	P	PROFESSIONAL CORE	ELECTRICAL MACHINES				
Course designed by	Department of Electrical and Electronics Engineering						
Approval	32nd Academic Council Meeting , 2016						

PURPOSE	To give students, a fair knowledge on the working of various electrical machines and to provide sound knowledge in the basic concepts of control theory.								
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**							
At the end of the course, the student will be able to									
1.	To understand the concepts of circuits.	a							
2.	To acquire in depth knowledge of operation, construction and characteristics of DC machines, single phase induction motor and some special machines.	a	c						
3.	To provide adequate knowledge in the time response of systems and steady state error analysis.	a							
4.	To study the stability in frequency domain	a							

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
1.	**UNIT I: ELECTRIC CIRCUITS (DC Circuits)**	09			
2.	Dependent and independent sources	1	C	1	1
3.	Thevenin’s theorem - Norton’s theorem	2	C	1	1
4.	Superposition - Maximum power transfer	1	C	1	1
5.	Graph of a network - Trees	2	C	1	1
6.	Chords and branches	1	C	1	1
7.	Tie-set and cut-set of a graph	2	C	1	1
	UNIT II: DC MACHINES (Qualitative Treatment only)	09			
8.	Constructional details and operating principle of D.C. generators	2	C	2	3
9.	Emf equation	2	C	2	3
10.	DC Generator Characteristic	1	C	2	3
11.	Principle of operation of D.C. motors	2	C	2	3
12.	DC motor Characteristic - Starting.	2	C	2	3
	UNIT III: AC MACHINES (Qualitative Treatment only)	09			
13.	Single-phase induction motor - double field revolving theory	2	C	2	1,3
14.	Constructional details of three phase induction motor	2	C	2	1,3
15.	Principles of single phase transformers - EMF equation.	2	C	2	1,3
16.	Servomotors - Stepper motor	1	C	2	1,3
17.	Universal motor - Applications	2	C	2	1,3
	UNIT IV: MATHEMATICAL MODELS OF PHYSICAL SYSTEMS	09			
18.	Definition and classification of system - terminology and structure of feedback control theory	2	C	3	2,4
19.	Differential equation of physical systems - hydraulic and pneumatic systems Steady state errors - error constants	2	C	3	2,4

20.	Block diagram algebra - Signal flow graphs	2	C	3	2,4
21.	Time response of first and second order system	1	C	3	2,4
22.	Stability by Routh-Harwitz criterion -Simple problems.	2	C	3	2,4
	UNIT V: TRANSFER FUNCTION and STATE VARIABLE ANALYSIS	09			
23.	Time Response analysis of II order system - Frequency response	2	C	4	2,4
24.	Bode plots	2	C	4	2,4
25.	Stability in frequency domain using Nyquist stability criterion	2	C	4	2,4
26.	Concept of state variable - State models for linear and continuous time systems.	3	C	4	2,4
	Total hours	**45**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Deshpande M.V, “Electrical Machines”, PHI Learning Private Limited, New Delhi, 2015.
2.	Nagrath I J and Gopal.M., “Control Systems Engineering”, Anshan Pub, 2013.
REFERENCE BOOKS	
3.	Nagarath.I.J, and Kothari.D.P, “Electrical Machines”, Tata McGraw Hill Publishing Company, New Delhi, 2nd edition, 2008.
4.	Katsuhiko Ogata, “Modern Control Engineering”-fifth edition, Prentice Hall of India Private Ltd, New Delhi, 2014.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	**Cycle test I**	**Cycle test II**	**Cycle Test III**	**Surprise Test**	**Quiz**	**Total**
	Weightage	10%	15%	15%	5%	5%	50%
End semester examination Weightage :							50%

15SE205J	**Programming In JAVA**		**L**	**T**	**P**	**C**
			3	**0**	**2**	**4**
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL CORE				
Course designed by	Department of Software Engineering					
Approval	32nd Academic Council Meeting, 23rd July, 2016					

PURPOSE	Java is a mature and solidly engineered programming language that is extensively built on object oriented programming concepts. Its in-built security and safety features together support for advanced programming tasks like networking, database connectivity, rich web applications, and mobile applications. This course is designed around the fundamental concepts of Java that enable the students to design and build more complex Java applications.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Acquaint themselves with the fundamental concepts and programming environment.	l						
2.	Design classes and efficiently use the IO streams	c						
3.	Implement object oriented concepts like inheritance, reusability, and encapsulation.	i						
4.	Apply custom exceptions and employ concurrency.	b						
5.	Exploit the power of advanced data structures and basic GUI design.	i						

Session	**Description of Topic (Theory)**	**Contact hours**	**C-D - I-O**	**IOs**	**Reference**
	UNIT I: FUNDAMENTALS OF JAVA TECHNOLOGY AND PROGRAMMING	**6**			
1.	Java platform features, Java technologies-JSR, JCP.	1	C	1	1,2
2.	Data types, Key words, Scoping rules	2	C	1	1,2
3.	Automatic Type Conversion , Type Casting and Arrays	1	C	1	1,2
4.	Operators Precedence & Associativity, Expression. Flow control, new featuresfrom Java5 to Java 7	1	C	1	1,2
5.	Enhanced for loop, switch statements, handling Strings, Entry Point for Java Programs	1	C	1	1,2
	UNIT II: CLASSES, OBJECTS AND STREAMS	**12**			
6.	Class fundamentals: Declaring objects, Assigning object reference variable, Methods & Method Signatures, Method retuning Values, Method with parameters, Variable arguments in Java 5	2	D	2	1,2
7.	I/O Basics: Byte stream& Character Stream, Getting user input: Reading console input & Writing console output, Reading and Writing files-new file system API NIO2	2	C	2	3
8.	Constructors: Default Constructor, Parameterized constructor. this keyword, Garbage Collector, finalize() method, Overloading methods and constructors	2	C	2	3
9.	Using object as parameters, returning object in methods, recursion, Access control, static and final keyword	2	C	2	3
10.	Nested and Inner classes , Command Line argument	2	D	2	3
11.	String and String Buffer class, Java Bean standards, Naming conventions	2	D	2	3

	UNIT III: INFORMATION HIDING & REUSABILITY	**9**			
12.	Inheritance basics. Using super, Method Overriding. Constructor call. Dynamic method dispatch	3	D	3	4
13.	Abstract class, Using final with inheritance, Default Package. Path & Class Path EnvironmentVariables	2	D	3	4
14.	Package level access ,Importing Packages, Interface: Multiple Inheritance in Java	2	D	3	4
15.	Extending interface, Wrapper Class, Auto Boxing	2	D	3	4
	UNIT IV: EXCEPTION , CONCURRENCY, ENUMERATION AND ANNOTATIONS	**9**			
16.	Exception handling mechanism. new look try/catch mechanism in Java 7	2	C	4	3
17.	Thread class & Runnable Interface. Inter Thread Communication, Synchronization of threads using Synchronized keyword and lock method	2	I	4	3
18.	Thread pool and Executors framework, Futures and callable, Fork-Join in Java. Deadlock conditions	2	I	4	3
19.	Enumeration in Java 5 - usage. Annotations: basics of annotation.	1	C	4	3
20.	The Annotated element Interface. Using Default Values, Marker Annotations. Single-Member Annotations. The Built-In Annotations-Some Restrictions.	2	I	4	3
	UNIT V: GENERICS , COLLECTIONS FRAME WORK AND GUI PROGRAMMING	**9**			
21.	Generics: Basics , Generics and type safety	2	I	5	4
22.	Collections Interfaces – Collection, Set, List, Queue, Collections Classes – Array List, Hash Set, Tree Set. Accessing a Collection via Iterators. Map Interfaces. Map Classes – Abstract Map, Hash Map, Tree Map	2	I	5	4
23.	Introduction to Swing, MVC Connection, Containers – Jframe, JDialog, JPanel,JRootPane, JLayeredPane	2	I	5	4
24.	Placing components into containers, Event Handling, Components – Jbutton, JLabel, JTextField, JComboBox, JList, JTable, JTabbedPane	3	I	5	4
	Total contact hours			**45**	

Sl. No.	Description of experiments	Contact hours	C-D-I-O	IOs	Reference
1.	Program to implement Operators,Flow Controls concepts	3	I	1	1-5
2.	Program to implement Classes, Constructors, Overloading and Access Control	3	I	2	1-5
3.	Program using Nested & Inner Classes, Static and Final	3	I	2	1-5
4.	Program using File Streams and IO Streams	3	I	2	1-5
5.	Program to implement Strings, String Buffer Concept	3	I	2	1-5
6.	Program using Interfaces, Abstract Classes	3	I	3	1-5
7.	Program to implements Exceptions Concepts	3	I	4	1-5
8.	Program using Threads	3	I	4	1-5
9.	Program using Collections, Generics concepts	3	I	5	1-5
10.	Program to implement Swing Application	3	I	5	1-5
	Total contact hours	30			

LEARNING RESOURCES

Sl. No. TEXT BOOKS

1. Herbert Schildt, “The Complete Reference (Fully updated for jdk7)”, Oracle press Ninth Edition,2014.

REFERENCE BOOKS/OTHER READING MATERIAL

2. Cay S. Horstmann, “Core Java Volume –I Fundamentals”, Prentice Hall , 10th Edition, 2015.
3. Deitel&Deitel, “Java How to Program”, Prentice Hall, 10th Edition, 2016.
4. Herbert Schildt ,“Java: A Beginner's Guide”, Sixth Edition, Oracle Press, 2014.
5. https://docs.oracle.com/javase/tutorial

<table>
<tr><td colspan="5"><b>Course nature</b></td><td colspan="3"><b>Theory + Practical</b></td></tr>
<tr><td colspan="8"><b>Assessment Method – Theory Component (Weightage 50%)</b></td></tr>
<tr><td rowspan="2"><b>In-semester</b></td><td><b>Assessment tool</b></td><td>Cycle test I</td><td>Cycle test II</td><td>Cycle Test III</td><td>Surprise Test</td><td>Quiz</td><td><b>Total</b></td></tr>
<tr><td><b>Weightage</b></td><td><b>10%</b></td><td><b>15%</b></td><td><b>15%</b></td><td><b>5%</b></td><td><b>5%</b></td><td><b>50%</b></td></tr>
<tr><td colspan="7"><b>End semester examination Weightage :</b></td><td><b>50%</b></td></tr>
<tr><td colspan="7"></td><td></td></tr>
<tr><td colspan="8"><b>Assessment Method – Practical Component (Weightage 50%)</b></td></tr>
<tr><td rowspan="2"><b>In-semester</b></td><td><b>Assessment tool</b></td><td>Experiments</td><td>Record</td><td>MCQ/Quiz/Viva Voce</td><td colspan="2">Model examination</td><td><b>Total</b></td></tr>
<tr><td><b>Weightage</b></td><td><b>40%</b></td><td><b>5%</b></td><td><b>5%</b></td><td colspan="2"><b>10%</b></td><td><b>60%</b></td></tr>
<tr><td colspan="7"><b>End semester examination Weightage :</b></td><td><b>40%</b></td></tr>
</table>

15CS204J	**Algorithm Design and Analysis**		**L**	**T**	**P**	**C**
			3	**0**	**2**	**4**
Co-requisite:	Nil					
Prerequisite:	15CS201J					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Core				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	To acquire the ability of applying various algorithmic concepts for all domains and efficient interpretation of real life problems.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Apply Mathematical concepts and notations to define a problem	a						
2.	Apply divide and conquer method to solve a problem	b						
3.	Ability to solve a real life problems with these algorithmic techniques	j						
4.	Familiarize the concept of multidisciplinary functions	d						
5.	Interpret data using NP problems and applications of various algorithms to solve real life problems	b	j					

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**References**
UNIT I: INTRODUCTION TO ALGORITM DESIGN		**10**			
1.	Introduction, Fundamentals of algorithm(Line count, operation count)	1	C	1	2,3,6
2.	Algorithm Design Techniques (Approaches, Design Paradigms)	1	C	1	1,2,3,6
3.	Designing an algorithm and its Analysis(Best ,Worst & Average case)	2	C,D	1,3	1,2,3,6
4.	Asymptotic Notations (◯ , Ω, Θ) based on Orders of Growth	1	C,I	1	1,2,3,6
5.	Mathematical Analysis - Induction	1	C	1	3,4
6.	Recurrence Relation - Substitution method	1	C	1	3,2
7.	Recurrence Relation - Recursion method	2	C	1	2,3
8.	Recurrence Relation - Master's Theorem	1	C	1	2
UNIT II: DIVIDE AND CONQUER		**8**			
9.	Introduction, Binary Search	1	D,I	2	1,3
10.	Merge sort and its algorithm analysis	1	C,D	2	1,3
11.	Quick sort and its algorithm analysis	2	D,I	2	1,3
12.	Strassen's Matrix multiplication	1	C	2	1,3
13.	Finding Maximum and minimum	1	D,I	2,3	1,3
14.	Algorithm for finding closest pair	1	C,I	2	3,5
15.	Convex Hull Problem	1	C	2	1,3
UNIT III: GREEDY AND DYNAMIC PROGRAMMING		**9**			
16.	Introduction - Greedy- Huffman Coding	1	C	3	1
17.	Greedy - Knapsack Problem	1	C,D,I	3	1,3
18.	Greedy - Minimum Spanning Tree(Kruskals Algorithm)	2	C,D,I	3	1,3
19.	Introduction - Dynamic Programming - 0/1 Knapsack Problem	1	C,D	3	1,3
20.	Dynamic Programming - 0/1 Knapsack Problem	1	C	3	1,3
21.	Dynamic Programming- Travelling Salesman Problem	1	C,D	3	1,3
22.	Dynamic Programming- Multistage Graph- Forward path and backward path	2	C,D,I	3	1
UNIT IV: BACK TRACKING		**9**			
23.	Introduction - NXN Queen's Problem	1	C	4	1,2
24.	NXN Queen's Problem	1	D,I	4	1,2
25.	Sum Of Subsets	1	D,I	4	1,3
26.	Graph Coloring	2	D,I	3,4	1

Session	Description of Topic	Contact hours	C-D-I-O	IOs	References
27.	Hamiltonian's Circuit	1	C	3,4	1
28.	Travelling Salesman Problem	2	C	3,4	1,3
29.	Generating Permutation	1	C	1	2,4
UNIT V: BRANCH BOUND AND RANDOMIZED ALGORITHM		**9**			
30.	Branch and bound - 0/1 Knapsack	1	D,I	4	1,3
31.	Branch and Bound - Travelling Sales man Problem	1	C,I	3,4	1,3
32.	Randomized algorithm- Hiring Problem	1	C,I	3,4	2
33.	Randomized algorithm- Matrix Chain Multiplication	1	C,I	3,4	1,2
34.	Randomized Quick Sort	1	C	4	2
35.	Introduction to PN problems	1	C	5	5
36.	Introduction to NP problems	1	C	5	5
37.	NP Complete	2	C	5	4,5
Total Contact Hours		**45***			

Session	Description of the Experiments	Contact hours	C-D-I-O	IOs	References
Divide and conquer Technique		**10**			
1.	Binary Search	2	I	2	1,3,6
2.	Quick Sort	2	C,I	2	1,3,6
3.	Merge sort	2	I	2	1,3,6
4.	Min Max Problem	4	I	2	1,3,6
Greedy and Dynamic Programming Technique		**14**			
5.	Knapsack Problem	2	C	3	1,3,5,6
6.	Huffman Coding	4	C,I	3	1,3,5,6
7.	Minimum Spanning Tree(Kruskal Algorithm)	4	C,I	3	1,3,6
8.	Multistage Graph (Forward path & Backward path)	4	C,I	3	1,6
Backtracking Technique		**4**			
9.	NXN Queens problem	2	C,I	4	1
10.	Graph Coloring	2	C,I	3,4	1
Randomized Algorithm		**2**			
11.	Hiring Problem	2	I	5	2
Total Contact Hours		**30***			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Ellis Horowitz, Sartajsahni, Sanguthevar, Rajesekaran, *"Fundamentals of Computer Algorithms"*, Galgotia Publication Pvt. Ltd., Reprint, 2010.
2.	Thomas H Cormen, Charles E Leiserson, Ronald L Revest, Clifford Stein, "*Introduction to Algorithms" 3^{rd} Edition*, The MIT Press Cambridge, Massachusetts London, England, 2014
3.	S.Sridhar, "Design and Analysis of Algorithms", Oxford University Press, 2015
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Richard Johnson Baugh, Marcus Schaefer,*"Algorithms",* Pearson education, 2004
5.	Mark Allen Weiss, *"Data Structures and Algorithm Analysis in C"*, 2^{nd} Edition, Pearson Education, Inc., 2006
6.	Rajesh K Shukla, *"Analysis and Design of Algorithms-A Beginner's Approach",* Wiley publisher ,2015

Course nature						**Theory + Practical**	
Assessment Method – Theory Component (Weightage 50%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

Assessment Method – Practical Component (Weightage 50%)						
In-semester	**Assessment tool**	Experiments	Record	MCQ/Quiz/Viva Voce	Model examination	**Total**
	Weightage	**40%**	**5%**	**5%**	**10%**	**60%**
End semester examination Weightage :						**40%**

* Excluding Assessment Hours

15CS205J	**Microprocessors And Microcontrollers**		**L**	**T**	**P**	**C**
			3	**0**	**2**	**4**
Co-requisite:	Nil					
Prerequisite:	15CS202 (or) 15IT212J					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Core				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	The purpose of this course is to develop Assembly Language Programs and build a Microprocessor based system for various applications.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	To learn the basics of 8086 Microprocessor to Pentium-core Microprocessor and their functions	a	b					
2.	To understand and implement the 8086 family Assembly Language Programming	a	c					
3.	To explore the I/O interfacing and advanced Microprocessors	a	c					
4.	Expose to the functional architecture of 8051 and its basic programming using C	a	c					

Session	**Description of Topic (Theory)**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: INTRODUCTION TO MICROPROCESSOR AND FAMILY		**8**			
1.	Introduction –Microprocessors and Microcontrollers-its computational functionality and importance - overview of syllabus	1	C	1,4	1-5
2.	8086 architecture and Historical background	2	C,D	1,2	1,2
3.	The Microprocessor–Based Personal Computer Systems	1	C	1	1
4.	Internal Microprocessor Architecture	2	C,D	1,2	1
5.	Real mode memory Addressing–Protected mode Memory Addressing	2	C	1,2	1
UNIT II: 8086 Family Assembly Language Programming		**10**			
6.	Machine language instruction format-Addressing modes-Data addressing	1	C	2	1,2
7.	Program memory and stack addressing modes	2	C	2	1
8.	Instruction Set: Data Movement Instructions	2	C	2	1
9.	Arithmetic and Logic Instructions	2	C	2	1
10.	Program control Instructions	2	C	2	1
11.	Assembler Directives of 8086	1	C	2	1
UNIT III: PROGRAMMING CONCEPTS		**10**			
12.	Using Assembly Language with C/C++ for 16-Bit DOS Applications and 32-Bit Applications	4	C	2	1
13.	Modular Programming	2	C	2	1
14.	Using the Keyboard and Video Display	2	C,D	2,3	1
15.	Data Conversions–Example Programs: Binary to ASCII- ASCII to Binary	2	C	2	1
UNIT IV: I/O INTERFACE & ADVANCED MICROPROCESSORS		**9**			
16.	Introduction to I/O Interface	1	C	2,3	1
17.	Programmable Peripheral Interface architecture- modes	2	C	2,3	1
18.	Basic DMA Operations- 8237 DMA Controller architecture--software commands	2	C,D	2,3	1,2
19.	Disk Memory Systems	1	C	2,3	1
20.	Introduction to Pentium - Pentium Pro Microprocessor-Pentium II-Pentium III- Pentium-IV & Core2	3	C	1,2	1
UNIT V: ARCHITECTURE AND PROGRAMMING 8051		**8**			
21.	Architecture of 8051-Signal Descriptions-Registered- Program Status Word	2	C,D	4	2,3,5

Session	Description of Topic (Theory)	Contact hours	C-D-I-O	IOs	Reference
22.	Memory and I/O Addressing-Addressing modes- Instruction set	2	C	4	2,3,5
23.	Timer/Counter-Serial-Interrupt	2	C	4	2,3,5
24.	Basic Programming	2	C	4	2,6
	Total contact hours	**45***			

Sl. No.	Description of experiments	Contac t hours	C-D-I-O	IOs	Reference
Assembly Language Programs Using TASM/MASM					
1	Program involving Arithmetic Instructions on 16 bit data i. Addition & Subtraction ii. Multiplication & Division iii. Factorial of a given number	6	C,I	2	1-4
2	Program involving Data Transfer Instructions on 16 bit data i. Byte and Word data transfer in different addressing modes ii. Block Data Transfer	2	I	2	1-4
3	Program involving Bit Manipulation Instructions on 16 bit data - Given data is positive or negative	2	I	2	1-4
4	Implementation of Bubble Sort Algorithm	2	I	2	1-4
5	Program involving String Instructions on 16 bit data i. Reverse a given string and check whether it is a palindrome ii. String Display using Display Interrupt (Read your name from the keyboard and displays it at a specified location on the screen after the message "What is your name?" You must clear the entire screen before display)	4	I	2	1-4
6.	Time display using Interrupt (Read the current time from the system and display it in the standard format on the screen)	4	C,I	2,3	1-4
Basic 8051 programming using C					
7	Port Programming	4	C,I	4	2,6
8	Timer-Counter Programming	2	I	4	2,6
9	Serial Programming	2	I	4	2,6
10	Interrupt Programming	2	I	4	2,6
	Total contact hours	**30***			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Barry B. Brey**, "**THE *INTEL Microprocessors-Architecture, Programming and Interfacin**g***", 8th Edition, Pearson, 2012.(Units I-IV)
2.	A.K.Ray and K.M. Bhurchandi, "*Advanced Microprocessor and Peripherals*" Tata McGraw Hill, 3rd Edition, 2013(Unit-5).
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	N.Senthilkumar, M.Saravanan, S,Jeevanathan, "Microprocessors and Microcontrollers", Oxford University Press, 2011
4.	Kenneth J Ayala, "The 8086 Microprocessor: Programming and Interfacing the PC", Cengage Learning, Reprint 2014
5.	Kenneth J Ayala, "The 8051 Microcontroller", 3rd edition, Cengage Learning, Reprint 2014..
6.	Muhammed Ali Mazidi, Janice GillispleMaidi, Rolin.D. McKinlay, "The 8051 Microcontroller and Embedded Systems, Using Assembly and C", Second edition, Pearson Prentice Hall, 2015.

<table>
<tr><td colspan="5"><b>Course nature</b></td><td colspan="3"><b>Theory + Practical</b></td></tr>
<tr><td colspan="8"><b>Assessment Method – Theory Component (Weightage 50%)</b></td></tr>
<tr><td rowspan="2"><b>In-semester</b></td><td><b>Assessment tool</b></td><td>Cycle test I</td><td>Cycle test II</td><td>Cycle Test III</td><td>Surprise Test</td><td>Quiz</td><td><b>Total</b></td></tr>
<tr><td><b>Weightage</b></td><td><b>10%</b></td><td><b>15%</b></td><td><b>15%</b></td><td><b>5%</b></td><td><b>5%</b></td><td><b>50%</b></td></tr>
<tr><td colspan="7"><b>End semester examination Weightage :</b></td><td><b>50%</b></td></tr>
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<tr><td colspan="7"><b>End semester examination Weightage :</b></td><td><b>40%</b></td></tr>
</table>

* Excluding Assessment Hours

5SE203	**Object Oriented Analysis And Design**	**L**	**T**	**P**	**C**
		2	**2**	**0**	**3**
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Software Engineering				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE	The purpose of the course is to practice popular technical approach for analyzing, designing an application, system, or business by applying the object-oriented paradigm and visual modeling throughout the development life cycles to foster better stakeholder communication and product quality.

	INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand the basics object model for System development.	j						
2.	Apply the various modeling techniques using UML approach.	b						
3.	About building high quality system for different real world issues.	c						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: INTRODUCTION	**6**			
1.	Complexity in Traditional Systems	1	C	1	1,3,4
2.	The Object Model	2	C	1	1,3,4
3.	Classes and Objects	2	C	1	1,3,4
4.	Classification	1	C	1	1,3,4
	UNIT II: STATIC MODELING	**6**			
5.	What is UML?	1	C	2	2,3,4
6.	Use Case Diagram	2	C,D	2,3	2,3,4
7.	Domain Models	1	C,D	2,3	2,3,4
8.	UML Class Diagram	2	C,D	2,3	1,3,4
	UNIT III: DYNAMIC MODELING	**6**			
9.	Interaction and Package Diagram	2	C,D	2,3	2,3,4
10.	Activity Diagrams and Modeling	1	C,D	2,3	1,3,4
11.	State Machine Diagram and Modeling	1	C,D	2,3	1,3,4
12.	UML Component Diagram	1	C,D	2,3	1,3,4
13.	UML Deployment Diagram	2	C,D	2,3	1,3,4
	UNIT IV: GoF DESIGN PATTERNS	**6**			
14.	Object Design	1	C	1	2
15.	What are Patterns?	1	C	1	2
16.	Applying GoF Design Patterns	2	C,D	2	2
17.	Design Persistence Framework	2	C	2,3	2
	UNIT V: APPLICATIONS	**6**			
18.	Satellite Based Navigation	1	D,I	2,3	1
19.	Traffic Management	1	D,I	2,3	1
20.	Crypt Analysis	2	D,I	2,3	1
21.	Weather Monitoring Station	1	D,I	2,3	1
22.	Vacation Tracking System	1	D,I	2,3	1
	Total contact hours	**30**			

Sl.	**Description of Tutorials**	**Contact**	**C-D-**	**IOs**	**Reference**

No.		hours	I-O		
1	Implementation of Use Case Diagram	3	C,D,I	1,2,3	2,3,4
2	Implementation of Class Diagram	4	C,D,I	2,3	1,3,4
3	Implementation of Interactions Diagram	2	C,D,I	2,3	2,3,4
4	Implementation of State Machine Diagram	2	C,D,I	2,3	1,3,4
5	Implementation of Activity Diagram	2	C,D,I	2,3	1,3,4
6	Implementation of Component Diagram	3	C,D,I	2,3	1,3,4
7	Implementation of Deployment Diagram	2	C,D,I	2,3	1,3,4
8	Generate Skeleton code of Class Diagram for your Mini-Project	4	D,I	1,2,3	3
9	Implement the generated code using C++/Java Applications	4	C,D,I	1,2,3	3
10	Perform Test Case and Test Plan for implemented Mini-Project	4	C,D	3	4
	Total contact hours	30			

Note: Each Student is assigned with a mini project for which implementation to be carried out

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Grady Booch, Robert A. Maksimchuk, Michael W. Engle,"Object-Oriented Analysis and Design with Applications" ,Addison-Wesley Professional; 3 edition (April 30, 2007)ISBN-13: 978-0201895513
2.	Craig Larmen, "Applying UML and Patterns", Prentice Hall; 3 edition (October 30, 2004)ISBN-13: 978-0131489066
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Brett McLaughlin,"Head First Object-Oriented Analysis and Design",O'Reilly Media; 1 edition (December 7, 2006)ISBN-13: 978-0596008673
4.	Ali Bahrami , "Object Oriented Systems Development", McGraw Hill Eduction, Indian Edition, 2004, ISBN-13:978-0-07-026512-7

Course nature				**Theory**	
Assessment Method – Theory Component (Weightage 50%)					
In-semester	**Assessment tool**	Cycle test I	Model Exam	Tutorial Project	**Total**
	Weightage	**10%**	**15%**	**25%**	**50%**
				End semester examination Weightage :	**50%**

SEMESTER - V

15PD301	**COMMUNICATION & REASONING SKILLS**		**L**	**T**	**P**	**C**
			1	**1**	**0**	**1**
Co-requisite:	NIL					
Prerequisite:	Verbal Aptitude					
Data Book / Codes/Standards	NA					
Course Category	G	GENERAL				
Course designed by	Department of Career Development Centre					
Approval	-- Academic Council Meeting ------------- , 2016					

PURPOSE	To inculcate professional values and improve employability skills. To enrich verbal reasoning ability for succeeding in competitive exams.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, students will be able to								
1.	Gain insights on building a winning CV (digital and LinkedIn profile) in alignment with the employers' expectations and creating an impressive self-introduction video	g						
2.	To sharpen critical thinking skills by analyzing complex arguments with explicit and implicit premises to validate the author's point of view	i						
3.	Actively participate in formal discussions and manifest their professional skills such as leadership, empathy, time management and assertiveness	d	g					
4.	Build confidence to encounter the real interview process through formal one-on-one assessment sessions with constructive feedback.	i	g					
5.	To develop comprehension and interpretation skills through speed reading and mind mapping techniques	i						
6.	To assess the logical correctness of texts through application of grammatical rules	g	i					

S. No.	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: CURRICULUM VITAE	**2**			
1.	Importance of building a winning CV,Orientation to placement preparation & Do's and Don'ts of CV/Inputs on LinkedIn profiling	1	C	1	8,9
2.	Preparation of an impressive CV	1	C,D,I,O	1	8,9
	UNIT II: GROUP DISCUSSION	**6**			
3.	What is GD? Why GD? Types Of GD, SPELT Topics, Do's & Don'ts of GD, Skills Assessed/Parameters, Knowledge, Body Language, Communication, Team Skills, Time management, Assertiveness	1	C	3	1,2
4.	Mock GD	1	I	3	
5.	GD Assessment	4	O	3	
	UNIT III: CRITICAL REASONING-II	**4**			
6.	Recap of Critical Reasoning Strategies	1	C	2	4
7.	Drawing conclusion of an Argument	1	C,I,O	2	4
8.	Inference of an Argument	1	C, I,O	2	4
9.	Summarizing and Evaluation of an Argument	1	C, I,O	2	4
	UNIT IV: VIDEO PROFILE	**2**			
10.	Instructions to present an appealing self introduction video – Sample video profile screening	1	C	1	10
11.	Presentation of self introduction video for assessment	1	C,D,I,O	1	10
	UNIT V: SYNTACTIC ANALYSIS	**2**			
12.	Determination of Correct Sentences	1	I, O	6	5
13.	Determination of Incorrect Sentences	1	I, O	6	5
	UNIT VI: COMPREHENSION SKILLS	**6**			
14.	Techniques of Active and Efficient Reading (Short and Long Passages)	2	C,D,I	5	6,7,8,9

15.	Analysis of Question Types	4	C,D,I	5	6,7,8,9

	UNIT VII: INTERVIEW SKILLS	**8**			
16.	What is a Structured Interview? Preliminary Preparation, Do's & Don'ts of an Interview, Sample Interview Video Projection	1	C	4	3
17.	Discussion of frequently asked questions in the interview	1	D,I	4	3
18.	Personal Interview Assessment with constructive feedback	6	O	4	
	Total contact hours	30			

LEARNING RESOURCES	
	REFERENCE BOOKS/WEBLINKS
1.	Anand Ganguly, *"Group Discussion for Admissions and Jobs"*, Pustak Mahal Publications.
2.	Gerald M. Phillips, Douglas J. Pedersen, *"Group Discussion: A Practical Guide to Participation and Leadership"*, Waveland Press
3.	Susan Hodgson, *"Brilliant Answers to Tough Interview Questions"*, Pearson Publications.
4.	Manhattan GMAT - Critical Reasoning GMAT Strategy Guide, 12th Edition
5.	Manhattan GMAT Sentence Correction Guide, 5th Edition
6.	Manhattan Prep GRE : Reading Comprehension and Essays, 5th Edition
7.	Nishit K Sinha, VARC for the CAT, 3rd Edition, Pearson Publication, 2015
8.	The Official Guide to the GRE-General Revised Test, 2nd Edition, Mc Graw Hill Publication
9.	Sujith Kumar, Reading Comprehension and Essays, 5th Edition
10.	https://www.quintcareers.com/curriculum-vitae/
11.	http://www.hongkiat.com/blog/professional-linkedin-profile/
12.	https://www.youtube.com/video resume/

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**10%**	**20%**	**5%**	**5%**	**50%**
						End semester examination Weightage :	**50%**

15MA302	**DISCRETE MATHEMATICS**		**L**	**T**	**P**	**C**
			4	**0**	**0**	**4**
Co-requisite:	NOT APPLICABLE					
Prerequisite:	15 MA102 (or) 15MA205B					
Data Book / Codes/Standards	NA					
Course Category	B	CORE	MATHEMATICS			
Course designed by	Department of Mathematics					
Approval	-- Academic Council Meeting -- , 2016					

PURPOSE	To acquire knowledge in discrete mathematical structures as applied to the respective branches of Engineering		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1	To understand logic and mathematical reasoning to count or enumerate objects in systematic way.	**a**	**e**
2	To understand set theory, relations and functions to read , understand and construct mathematical arguments.	**a**	**e**
3	To understand recurrence relation, generating functions and algebraic systems.	**a**	**e**
4	To understand how to apply the knowledge of graph theory to solve real world problems like minimum spanning tree - traversal of binary tree.	**a**	**e**
5	To understand the concept of lattices and Boolean algebra.	**a**	**e**

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I – MATHEMATICAL LOGIC:	**12**			
1.	Propositions and Logical operators - Truth tables and propositions generated by a set	1	C,I	1	1,2,9
2.	Equivalence and Implications of statements	2	C,I	1	1,2,9
3.	Tautologies of statements	1	C,I	1	1,2,9
4.	Direct proofs - Conditional conclusions	2	C,I	1	1,2,9
5.	Indirect proofs	1	C,I	1	1,2,9
6.	Problems bases on Mathematical Induction	1	C,I	1	1,2,9
7.	The existential and universal quantifiers	2	C,I	1	1,2,9
8.	Predicate calculus including theory of inference	2	C,I	1	1,2,9
	UNIT II – SET THEORY:	**12**			
9.	Laws of Set theory	1	C	2	1 ,2
10.	Partition of a set	1	C,I	2	1 ,2
11.	The duality principle	1	C,I	2	1 ,2
12.	Relations – Properties - Equivalence relation and partial order relation	2	C,I	2	1 ,2

13.	Poset - Graphs of relations - Hasse diagram	1	C,I	2	1 ,2
14.	Matrices of relations	2	C,I	2	1 ,2
15.	Closure operations on relations - Warshall's	2	C,I	2	1 ,2
16.	Functions, Combinatorics - Pigeonhole Principle – Generalized Pigeon hole principle	2	C,I	2	1 ,2
	UNIT III – RECURRENCE RELATION & ALGEBRAIC SYSTEMS:	**12**			
17.	Recurrence relations - Solving a recurrence relation – Homogeneous and Non-homogeneous Recurrence relations	2	C,I	3	1,2,9
18.	Formation of Recurrence relations obtained from solutions	1	C,I	3	1,2,9
19.	Generating functions, Solution of a recurrence relation using generating functions	1	C,I	3	1,2,9
20.	Groups – Axioms of groups	2	C,I	3	1,2,9
21.	Cyclic groups and their axioms	2	C,I	3	1,2,9
22.	subgroups and their axioms	1	C,I	3	1,2,9
23.	Cosets – Lagrange’s Theorem	2	C,I	3	1,2,9
24.	Normal subgroup, group homomorphism	1	C,I	3	1,2,9
	UNIT IV – GRAPH THEORY:	**12**			
25.	Basic concepts - Basic Definitions – Some	2	C,I	4	1,2,7
26.	Matrix Representation of Graphs	1	C,I	4	1,2,7
27.	Paths and circuits	2	C,I	4	1,2,7
28.	Eulerian and Hamiltonian Graphs	1	C,I	4	1,2,7
29.	Connected graphs	2	C,I	4	1,2,7
30.	Trees - Spanning Trees - Rooted trees	2	C,I	4	1,2,7
31.	Binary Trees, Kruskal's algorithm - Traversals of Binary trees	2	C,I	4	1,2,7
	UNIT V – LATTICES AND BOOLEAN	**12**			
32.	Lattices, properties of lattices	2	C,I	5	1,2,7
33.	Lattices as algebraic system	1	C,I	5	1,2,7
34.	Sub-lattices	1	C,I	5	1,2,7
35.	Lattices –Properties of Lattices	2	C,I	5	1,2,7
36.	Some special lattices	2	C,I	5	1,2,7
37.	Boolean algebra : Definition and Examples, Basic laws of Boolean Algebra	2	C,I	5	1,2,7
38.	Expression of Boolean function by algebraic method	2	C,I	5	1,2,7
	Total Contact Hours	**60**			

LEARNING RESOURCES:	
Sl. No.	**TEXT BOOKS**
1.	Alan Doerr and Kenneth Levasseur, "Applied Discrete Structures for Computer Science", Galgotia Publications (P) Ltd, 1992.
2.	Tremblay J. P. and Manohar R., Discrete Mathematical Structures with applications to Computer Science, Tata Mc Graw Hill Publishing Co., 35th edition,2008.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	V. Sundaresan, K.S. Ganapathy Subramanian and K. Ganesan, Discrete Mathematics, New Revised Edition, A. R. Publications, 2001
4.	Kolman and Busby, Discrete Mathematical Structures for Computer Science, Prentice Hall, 3rd edition,1997.
5.	Kenneth H.Rosen, Discrete Mathematics and its Application, Fifth edition, Tata McGraw-Hill Publishing company PVT .Ltd., New Delhi, 2003
6.	Lipschutz Seymour, Marc Lars Lipson, Discrete Mathematics, Mc Graw Hill Inc., 1992
7.	Narsing Deo, Graph Theory with applications to Engineering and Computer science, Prentice-Hall of India pvt. Ltd., New Delhi, 1987.
8.	C.L. Liu, Elements of Discrete Mathematics, 2nd Edition, McGraw Hill Publications, 1985.
9.	T.Veerarajan, Discrete Mathematics with Graph Theory and Combinatorics, Tata McGraw Hill, 2009.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15CS302J	**Operating Systems**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	P	Professional Core			
Course designed by	Department of Computer Science and Engineering				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE	To acquire analytical ability in solving mathematical problems as applied to the respective branches of Engineering.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand the structure and functions of OS	a						
2.	Learn about Processes and Threads	a	b					
3.	Understand and Implement the principles of concurrency Scheduling algorithms and Deadlocks and Implement them	a	b					
4.	Learn and Implement the different memory management schemes	a	b					
5.	Understand and Implement the different Input , Output and File management schemes	a	b					

Session	**Description of Topic (Theory)**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: INTRODUCTION		**9**			
1.	Computer System Overview-Basic Elements, Basic Linux commands.	2	C,I	1	2,6
2.	Instruction Execution, Memory Hierarchy	2	C	1	2
3.	Interrupts, Cache Memory, Direct Memory Access	2	C,D	1	2
4.	Operating system overview-objectives and functions	1	C,D	1	1,2
5.	Evolution of Operating System.	2	C	1	1,2
UNIT II: PROCESSES AND THREADS		**9**			
6.	Definition of process and Process Control Block	1	C,D	2	1,2,3,5
7.	Process States-Two state, Five state, Suspended Processes	2	C,D	2	1,2,3,5
8.	Process Description and Process Control	2	C	2	1,2,3,5
9.	Processes and Threads	2	C,D	2	1,3,5
10.	Types of Threads	1	C,D	2	1,2
11.	Windows 7 - Thread and SMP Management.	1	C,D,I	2	1
UNIT III: CONCURRENCY AND SCHEDULING		**9**			
12.	Principles of Concurrency	1	C	3	1,3,5
13.	Mutual Exclusion, Semaphores	2	C,D,I	3	1,3,5
14.	Monitors, Readers/Writers problem	1	C,D,I	3	1,3,5
15.	Principles of Deadlock	1	C	3	1,3,5
16.	Deadlocks – prevention- avoidance – detection	1	C,I	3	1,3,5
17.	Scheduling- Types of Scheduling	2	C,I	3	1,3,5
18.	Scheduling algorithms.	1	C,I	3	1,3,5
UNIT IV: MEMORY		**9**			
19.	Memory management requirements, Partitioning	1	C,D,I	4	1,3,5
20.	Paging and Segmentation	2	C,D,I	4	1,3,5
21.	Virtual memory - Hardware and control structures	1	C,D	4	1
22	Operating system software	3	C	4	1
23	Linux memory management,	1	D,I	4	1
24	Windows memory management.	1	D,I	4	1
UNIT V: INPUT/OUTPUT AND FILE SYSTEMS		**9**			
25	I/O management and disk scheduling – I/O devices, organization of I/O functions	2	C,D	5	1,3,5
26	OS design issues, I/O buffering	1	C,D	5	1,3,5
27	Disk scheduling,	1	D,I	5	1,3,5

Session	Description of Topic (Theory)	Contact hours	C-D-I-O	IOs	Reference
28	Disk cache	1	C	5	1,3,5
29	File management-Overview, Organization and Access	2	C,D,I	5	1,3,5
30	Directories, File sharing	1	C	5	1,3,5
31	Record Blocking, secondary storage management.	1	C,D	5	1,3,5
Total contact hours		**45***			

Sl. No.	Description of experiments	Contact hours	C-D-I-O	IOs	Reference
1.	Write programs using the following system calls of Linux operating system: Fork, exec, getpid, exit, wait, close, stat, opendir, readdir	2	D,I	1	6
2.	Write programs using the I/O system calls of Linux operating system (open, read, write,etc), ls, grep Commands	2	D,I	1	6
3.	Simulate the following CPU scheduling algorithms a. Round Robin b) SJF c) FCFS d) Priority	4	D,I	2	1,3,5
4.	Simulate file allocation strategies a). Sequential b) Indexed c) Linked	4	D,I	4	1
5.	Simulate Memory partitioning using MVT and MFT	2	D,I	4	1,3,5
6.	Implementation of Bankers Algorithm for Dead Lock Avoidance	2	D,I	3	1,3,5
7.	Simulate an Algorithm for Dead Lock Detection	2	D,I	3	1,3,5
8.	Simulate page replacement algorithms a. FIFO b) LRU c) LFU	4	D,I	4	1,3,5
9.	Simulate File Organization Techniques a. Single level directory b) Two level c) Hierarchical	2	D,I	5	1
10.	Simulate Paging Technique of memory management.	2	D,I	4	1,3,5
11.	Simulate Shared memory and IPC	2	D,I	4	1
12.	Implement Threading & Synchronization Applications	2	D,I	2	1
Total contact hours		**30***			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	William Stallings, “Operating Systems – internals and design principles”, Prentice Hall, 7thEdition, 2011.(Ch 1-9,11,12).
2.	William Stallings “Operating Systems – Internals and design principles”, Pearson Education, 5th Edition.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Andrew S. Tannenbaum & Albert S. Woodhull, “Operating System Design and Implementation”, Prentice Hall , 3rd Edition, 2006.
4.	Andrew S. Tannenbaum, “Modern Operating Systems”, Prentice Hall,3rd Edition,2007.
5.	Silberschatz, Peter Galvin, Greg gagne “Operating System Principles”, Wiley India,7th Edition, 2006.
6.	Unix Command Reference Guide

Course nature	**Theory + Practical**

Assessment Method – Theory Component (Weightage 50%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

Assessment Method – Practical Component (Weightage 50%)						
In-semester	**Assessment tool**	Experiments	Record	MCQ/Quiz/Viva Voce	Model examination	**Total**
	Weightage	**40%**	**5%**	**5%**	**10%**	**60%**
End semester examination Weightage :						**40%**

* Excluding Assessment Hours

15CS301	**Theory of Computation**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Core				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	The purpose of the course is to understand all basic concepts in theoretical Computer science.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	To understand and design various Computing models like Finite State Machine, Pushdown Automata, and Turing Machine.	a						
2.	To understand the various types of grammar and the corresponding languages	a						
3.	To understand Decidability and Undecidability of various problems	a						
4.	To understand the computational complexity of various problems	a						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**I O s**	**Reference**
UNIT I: FINITE AUTOMATA		**10**			
1.	Introduction: Basic Mathematical Notation and techniques	1	C	1	1,2,5
2.	Finite State systems, Basic Definitions, Finite Automaton : DFA	1	C,D	1	1,2
3.	Finite Automaton : NDFA, Finite Automaton with €- moves	1	C,D	1	1,5
4.	Regular Languages- Regular Expression	1	D	1,2	1,5
5.	Equivalence of NFA and DFA	1	C,D	1	1,2
6.	Equivalence of NDFA’s with and without €-moves	1	C,D	1	1,4
7.	Equivalence of finite Automaton and regular expressions	2	C,D	1,2	1,2,3
8.	Minimization of DFA	1	C,D	1	1,3
9.	Pumping Lemma for Regular sets, Problems based on Pumping Lemma	1	C	2	1
UNIT II: GRAMMARS		**8**			
10.	Grammar Introduction: Types of Grammar, Context Free Grammars and Languages	1	C	2	1
11.	Derivations, Ambiguity, Relationship between derivation and derivation trees	1	C	2	1,5
12.	Simplification of CFG: Elimination of Useless Symbols	1	C,D	2	1,5
13.	Simplification of CFG: Unit productions , Null productions	1	C,D	2	1,4
14.	Chomsky normal form	1	C	2	1,2,3
15.	Problems related to CNF	1	C,D	2	1,2,3
16.	Greiback Normal form	1	C	2	1,4,5
17.	Problems related to GNF	1	C,D	2	1,4,5
UNIT III: PUSHDOWN AUTOMATA		**9**			
18.	Pushdown Automata: Definitions Moves, Instantaneous descriptions	1	C	1	1,4
19.	Deterministic pushdown automata	1	C,D	1	1,5
20.	Problems related to DPDA	2	C,D	1	1,5
21.	Non - Deterministic pushdown automata	1	C,D	1	1,5
22.	Equivalence : Pushdown automata to CFL	1	C,D	1,2	1,3
23.	Equivalence : CFL to Pushdown automata	1	C,D	1,2	1,3
24.	Problems related to PDA to CFG and CFG to PDA	1	C,D	1,2	1,3,4
25.	Pumping lemma for CFL, Problems based on pumping Lemma	1	C	2	1
UNIT IV: TURING MACHINE		**9**			
26.	Turing Machines: Introduction, Formal definition of Turing machines, Instantaneous descriptions	1	C	1	1,2
27.	Turing Machine as Acceptors	1	C,D	1	1,2
28.	Problems related to Turing Machine as Acceptors	2	C,D	1	1,3
29.	Turing Machine for computing functions(Transducer)	3	C,D	1	1,4
30.	Turing Machine constructions	1	C	1	1,3

Session	Description of Topic	Contact hours	C-D-I-O	I O s	Reference
31.	Modifications of Turing Machines	1	C	1	1,3
UNIT V: COMPUTATIONAL COMPLEXITY		**9**			
32.	Undecidability :Basic definitions, Decidable problems	1	C	3	1,2,4
33.	Examples of undecidable problems	1	C	3	1,2,4
34.	Rice’s Theorem	1	C	3	2,3,5
35.	Undecidable problems about Turing Machine – Post’s Correspondence Problem	2	C,D	3	1,2
36.	Properties of Recursive and Recursively enumerable languages	1	C	3	2
37.	Introduction to Computational Complexity: Definitions, Time and Space complexity of TMs	1	C	4	2
38.	Complexity classes: Class P, Class NP	1	C	4	2,3
39.	Complexity classes: Introduction to NP-Hardness and NP-Completeness	1	C	4	2,3
Total contact hours		**45***			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Hopcroft J.E., Motwani R. and Ullman J.D, *“Introduction to Automata Theory, Languages and Computations”*, Second Edition, Pearson Education, 2008.
2.	Michael Sipser, “*Introduction to the Theory of Computation”* Cengage Learning, 2012.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	John.C.Martin, *“Introduction to Languages and the Theory of Computation*” McGraw-Hill Education, 01-May-2010.
4.	Kamala Krithivasan, Rama.R*,” Introduction to Formal Languages, Automata Theory and Computation*”, Pearson Education India, 01-Sep-2009.
5.	Peter Linz , “*An introduction to formal languages and automata*”, Jones & Bartlett Learning, 2001.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15IT303J	Computer Networks	L	T	P	C
		3	0	2	4
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	P PROESSIONAL CORE				
Course designed by	Department of Information Technology				
Approval	32nd Academic Council Meeting , 23rdJuly2016				

PURPOSE	This course provides a foundation to understand computer networks using layered architectures. It also helps students to understand the various network models, addressing concept, routing protocols and design aspects of computer networks. .							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand the evolution of computer networks using the layered network architecture.	b						
2.	Design computer networks using subnetting and routing concepts	c						
3.	Understand the various Medium Access Control techniques and also the characteristics of physical layer functionalities.	m						

Session	Description of Topic	Contact Hours	C-D-I-O	IOs	Reference
UNIT I : INTRODUCTION TO COMPUTER NETWORKS		**9**			
1.	Evolution of Computer Networks	1	C	1	1
2.	Classification of Computer Networks LAN,WAN,MAN	2	C	1	1
3.	Network Topology : BUS, STAR, RING, MESH -	2	C	1	1
4.	OSI Layered Architecture	2	C	1	1
5.	TCP/IP Model	2	C	1	1
UNIT II: IPV4 ADDRESSING ARCHITECTURE		**9**			
6.	IPv4 Public and Private Address	2	C	2	1
7.	Subnetting	3	C	2	1
8.	VLSM-CIDR	2	C	2	1
9.	Network Devices: Router, Switch, HUB, Bridge.	2	C	2	1
UNIT III: NETWORK LAYER PROTOCOLS		**9**			
10.	Static Routing	1	C	2	1
11.	Introduction to dynamic Routing Protocols	1	C	2	1
12.	RIP v1 and RIP v2,OSPF	3	C	2	1
13.	EIGRP	2	C	2	2
14.	BGP	2	C	2	1
UNIT IV: DATA LINK LAYER		**8**			
15.	Medium Access Control Techniques	1	C	3	1
16.	Random, Round Robin, Reservation, ALOHA	1	C	3	1
17.	Pure and Slotted, CSMA/CD	1	C	3	1
18.	CSMA/CA, Ethernet, Token Ring, Token Bus,	1	C	3	1
19.	ARQ 3 Types,	1	C	3	1
20.	Error Detection Codes, Parity Check, Checksum	2	C	3	1
21.	Error Correction Codes, Hamming codes	1	C	3	1
UNIT V: PHYSICAL LAYER CHARACTERISTICS		**10**			
22.	Physical Layer overview	2	C	3	1
23.	Latency, Bandwidth, Delay	1	C	3	1
24.	Wireless: 802.11	2	C	3	1
25.	Transmission Media : Twisted pair, Coaxial, Fibre	2	C	3	1
26.	802.15, 802.15.4	2	C	3	1
27.	802.16	1	C	3	1
	TOTAL CONTACT HOURS	45*			

Sl. No.	Description of Experiments	Contact	C-	IOs	Reference

		Hours	**D-I-O**		
1.	IP Addressing and subnetting (VLSM)	2	D,I	1-4	1,2
2.	LAN Configuration using straight through and cross over cables	2	D,I	3	2
3.	Basic Router Configuration (Creating Passwords, Configuring Interfaces)	2	I	1	2
4.	Static and Default Routing	4	I	1	2
5.	RIPv1	4	I	2	1,2
6.	RIPv2	2	I	2	1,2
7.	EIGRP Configuration, Bandwidth, and Adjacencies	4	I	2	2
8.	EIGRP Authentication and Timers	2	I	2	2
9.	Single-Area OSPF Link Costs and Interface	2	I	2	1,2
10.	Multi-Area OSPF with Stub Areas and Authentication	2	I	2	2
11.	Redistribution Between EIGRP and OSPF	2	I	2	2
12.	MODEL EXAMINATION	2			
	TOTAL CONTACT HOURS	30			

SI.No	**Learning Resources**
1.	Behrouz A. Forouzan, “Data Communications and Networking” 5th edition, July 1, 2010, ISBN: 9780073376226
2.	Todd Lammle, “CCNA Study Guide”, Edition7, Publication Date: April 5, 2011| ISB: 10:0470901071 ISBN:13: 9780470901076
3.	William Stallings, “Data and Computer Communications”, Edition 9, 2010.

Course nature				**Theory + Practical**			
Assessment Method – Theory Component (Weightage 50%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

Assessment Method – Practical Component (Weightage 50%)						
In-semester	**Assessment tool**	Experiments	Record	MCQ/Quiz/Viva Voce	Model examination	**Total**
	Weightage	**40%**	**5%**	**5%**	**10%**	**60%**
End semester examination Weightage :						**40%**

* - Excluding Assessment Hours

15CS375L	**Minor Project I**		**L**	**T**	**P**	**C**
			0	**0**	**3**	**2**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July, 2016					

PURPOSE	To obtain an hands-on experience in converting a small novel idea / technique into a working model / prototype involving multi-disciplinary skills and / or knowledge and working in at team.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able								
1.	To conceptualise a novel idea / technique into a product	c						
2.	To think in terms of multi-disciplinary environment		d					
3.	To understand the management techniques of implementing a project				k			
4.	To take on the challenges of teamwork, prepare a presentation in a professional manner, and document all aspects of design work.			g				

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	An Multidisciplinary project to be taken up by a team of maximum of ten students. Development of prototype product, a 3D model, simulation, blueprint for a larger project and any other development work are permitted. The contribution of the individuals in the project should be clearly brought out. A combined report is to be submitted. A presentation is to be made for the reviewers on the work done by the candidate.		C,D,I	1,2,3,4	
	Total contact hours				

Course nature			**Project – 100% internal continuous assessment**
Assessment Method (Weightage 100%)			
In-semester	**Assessment tool**	Refer the table	**Total**
	Weightage	Refer the table below	**100%**
End semester examination Weightage :			**0%**

Assessment components

Assessment component	**Expected outcome**	**Evaluators**	**Criteria or basis**	**Marks**
Project proposal (Review – I)	A short presentation to be delivered on: • A brief, descriptive project title (2-4 words). This is critical! • The 3 nearest competitors (existing solutions) and price. • Team members name, phone number, email, department/degree program, and year. • A description of the product opportunity that has been identified. To include: Documentation of the market need, shortcomings of existing competitive products, and definition of the target market and its size. • Proposed supervisor / guide	Panel of reviewers	Viability / feasibility of the project Extent of preliminary work done.	**0**
Review II	• Mission Statement / Techniques • Concept Sketches, Design Specifications / Modules & Techniques along with System architecture • Coding	Panel of reviewers	Originality, Multi-disciplinary component, clarity of idea and presentation, team work, handling Q&A.	**20**

Assessment component	**Expected outcome**	**Evaluators**	**Criteria or basis**	**Marks**
Review III	• Final Concept and Model / Algorithm/ Technique • Drawings, Plans / programme output • Financial Model / costing • Prototype / Coding • Final Presentation and Demonstration	Panel of reviewers	Originality, Multi-disciplinary component, clarity of idea and presentation, team work, handling Q&A.	**50**
Final technical Report	A good technical report	Supervisor / Guide	Regularity, systematic progress, extent of work and quality of work	**30**
			Total	**100**

15CS380L	**Seminar I**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**2**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	P Professional				
Course designed by	Department of Computer Science and Engineering				
Approval	32nd Academic Council Meeting , 23rd July, 2016				

PURPOSE	To inculcate the research culture among the students through literature reading, modelling a problem, analyzing and presenting.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able								
1.	To understand the research methodology adopted by various researchers	h	i	j				
2.	To mathematically model a problem, critically analyse it and adopt strategies to solve	b	c	e				
3.	To understand and present a well documented research	e	g					

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	Guidelines for conducting 15CS380L Seminar for B.Tech 1. Upon registering for the course the student must identify a sub-domain of the degree specialization that is of interest to the student and start collecting research papers as many as possible. 2. After collecting sufficient number of research papers the student must peruse all the papers, meet the course faculty and discuss on the salient aspects of each and every paper. 3. The course faculty, after discussion with the student will approve TWO research papers that is appropriate for presentation. 4. The student must collect additional relevant reference materials to supplement and compliment the two research papers and start preparing the presentation. 5. Each student must present a 15-minute presentation on each of the approved research paper to the panel of evaluators. 6. The presenter must present one research paper within the first half of the semester (6 weeks) and another research paper in the next half of the semester (6 weeks) as per the schedule. 7. All other students registered for the course will form the audience. 8. The audience as well as the evaluators will probe the student with appropriate questions and solicit response from the presenter. 9. The presentation will be evaluated against 7 to 8 assessment criteria by 4 to 5 evaluators. 10. The score obtained through the presentations of TWO research papers will be converted to appropriate percentage of marks. This course is 100% internal continuous assessment.		C,D	1,2,3,4	
Total contact hours		**30**			

Course nature			**100% internal continuous assessment.**	
Assessment Method (Weightage 100%)				
In-semester	**Assessment tool**	Presentation 1	Presentation 2	**Total**
	Weightage	**50%**	**50%**	**100%**
End semester examination Weightage :				**0%**

15CS385L	**MOOCs I**		**L**	**T**	**P**	**C**
			0	**0**	**3**	**2**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July, 2016					

PURPOSE	To offer students the opportunity to study with the world's best universities by integrating select MOOCs in a regular degree programme and providing students full credit transfer, as per university regulations, if they earn a "Verified / Completion Certificate" and take a proctored examination through a secure, physical testing center.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able								
1.	To apply the concepts, theories, laws, technologies learnt herein to provide engineering solutions.	f	h	i	j			

Course nature				**Online - 100% internal continuous assessment.**		
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Quiz	Assignment	Non-proctored / Unsupervised Tests	Proctored / Supervised Test	**Total**
	Weightage	**25%**	**25%**	**10%**	**40%**	**100%**
End semester examination Weightage :						**0%**

Registration process, Assessment and Credit Transfer:

1. Students can register for courses offered by approved global MOOCs platforms like edX, Coursera or Universities with which SRM partners specifically for MOOCs.
2. Annually, each department must officially announce, to the students as well as to the Controller of Examinations, the list of courses that will be recognized and accepted for credit transfer.
3. The department must also officially announce / appoint one or more faculty coordinator(s) for advising the students attached to them, monitoring their progress and assist the department in proctoring the tests, uploading the marks / grades, and collecting and submitting the graded certificate(s) to the CoE, within the stipulated timeframe.
4. Student who desires to pursue a course, from the above department-approved list, through MOOCs must register for that course during the course registration process of the Faculty of Engineering and Technology, SRMIST.
5. The maximum credit limits for course registration at SRM will include the MOOCs course registered.
6. The student must periodically submit the marks / grades obtained in various quizzes, assignments, tests etc immediately to the Faculty Advisor or the Course Coordinator for uploading in the university's academic module.
7. The student must take the final test as a Proctored / Supervised test in the university campus.
8. The student must submit the "Certificate of Completion" as well as the final overall Marks and / or Grade within the stipulated time for effecting the grade conversion and credit transfer, as per the regulations. It is solely the responsibility of the individual student to fulfil the above conditions to earn the credits.
9. The attendance for this course, for the purpose of awarding attendance grade, will be considered 100% , if the credits are transferred, after satisfying the above (1) to (7) norms; else if the credits are not transferred or transferable, the attendance will be considered as ZERO.

15CS490L	**Industrial Module I**			**L**	**T**	**P**	**C**
				0	**0**	**3**	**2**
Co-requisite:	Nil						
Prerequisite:	Nil						
Data Book / Codes/Standards	Nil						
Course Category	P	Professional					
Course designed by	Department of Computer Science and Engineering						
Approval	32nd Academic Council Meeting , 23rd July, 2016						

PURPOSE	To offer students the opportunity to interact with industries and learn the best practices adopted by them.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able								
1.	To obtain an insight into the current industrial trends and practices	h						
2.	To obtain an insight into the technologies adopted by industries	k						
3.	To obtain an insight into the technical problems encountered by the industries and the scope for providing solutions.	e						
4.	To network with industry	h						

Description of Topic	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
1. The department will identify and shortlist few emerging topics that are trending in industry. 2. The department will identify experts from industry who are willing to deliver modules on the shortlisted topics. 3. The identified expert will assist the department in formulating the course content to be delivered as a 30-hour module, prepare lectures notes, ppt, handouts and other learning materials. 4. The department will arrange to get the necessary approvals for offering the course, from the university's statutory academic bodies well before the actual offering. 5. The department must officially announce, to the students as well as to the Controller of Examinations, the list of courses that will be offered as industry module. 6. The department must also officially announce / appoint one or more faculty coordinator(s) for advising the students attached to them, monitoring their progress and assist the department in proctoring/supervising/assessment the quizzes, assignments, tests etc, uploading the marks, attendance etc, within the stipulated timeframe. 7. The Student who desires to pursue a course, from the above department-approved list, must register for that course during the course registration process of the Faculty of Engineering and Technology, SRMIST. 8. The maximum credit limits for course registration at SRM will include the Industry Module also. 9. All academic requirements of a professional course like minimum attendance, assessment methods, discipline etc will be applicable for this Industry Module. 10. The course will be conducted on week ends or beyond the college regular working hours.		C,D,I,O	1,2,3,4	
Total contact hours	**30**			

Course nature				**100% internal continuous assessment.**			
Assessment Method – Theory Component (Weightage 50%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage							**50%**

15CS390L	**Industrial Training**		**L**	**T**	**P**	**C**
			0	**0**	**3**	**2**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Core				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July, 2016					

PURPOSE	To provide short-term work experience in an Industry/ Company/ Organization							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able								
1.	To get an inside view of an industry and organization/company				j			
2.	To gain valuable skills and knowledge				j			
3.	To make professional connections and enhance networking	f	g					
4.	To get experience in a field to allow the student to make a career transition			i				

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	1. It is mandatory for every student to undergo this course. 2. Every student is expected to spend a minimum of 15-days in an Industry/ Company/ Organization, during the summer vacation. 3. The type of industry must be NOT below the Medium Scale category in his / her domain of the degree programme. 4. The student must submit the “Training Completion Certificate” issued by the industry / company / Organization as well as a technical report not exceeding 15 pages, within the stipulated time to be eligible for making a presentation before the committee constituted by the department. 5. The committee will then assess the student based on the report submitted and the presentation made. 6. Marks will be awarded out of maximum 100. 7. Appropriate grades will be assigned as per the regulations. 8. Only if a student gets a minimum of pass grade, appropriate credit will be transferred towards the degree requirements, as per the regulations. 9. It is solely the responsibility of the individual student to fulfill the above conditions to earn the credits. 10. The attendance for this course, for the purpose of awarding attendance grade, will be considered 100%, if the credits are transferred, after satisfying the above (1) to (8) norms; else if the credits are not transferred or transferable, the attendance will be considered as ZERO. 11. The committee must recommend redoing the course, if it collectively concludes, based on the assessment made from the report and presentations submitted by the student, that either the level of training received or the skill and / or knowledge gained is NOT satisfactory.		D, I,O	1,2,3,4	
	Total contact hours				

Course nature			**Training – 100% internal continuous assessment**
Assessment Method (Weightage 100%)			
In-semester	**Assessment tool**	**Presentation**	**Report**	**Total**
	Weightage	**80%**	**20%**	**100%**
End semester examination Weightage :				**0%**

SEMESTER – VI

15PD302	**QUANTITATIVE APTITUDE AND LOGICAL REASONING - II**	**L**	**T**	**P**	**C**
		1	**1**	**0**	1
Co-requisite:	NIL				
Prerequisite:	Communication and Reasoning Skills				
Data Book / Codes/Standards	NIL				
Course Category	G GENERAL				
Course designed by	Career Development Centre				
Approval	-- Academic Council Meeting -- , 2016				

PURPOSE	To give the right knowledge, skill and aptitude to face any competitive examination.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	build a strong base in the fundamental mathematical concepts	a						
2.	grasp the approaches and strategies to solve problems with speed and accuracy	e						
3.	gain appropriate skills to succeed in preliminary selection process for recruitment	i						
4.	collectively solve problems in teams & group.	d						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: PURE ARITHMETIC-II	**4**			
1	Arithmetic Progression	1	C-I-O	1-4	1-5,9-12
2	Geometric Progression, Harmonic progression	1	C-I-O	1-4	1-5,9-12
3	Sets	1	C-I-O	1-4	1-5,9-12
4	Functions	1	C-I-O	1-4	1-5,9-12

	UNIT II: COMMERCIAL ARITHMETIC-1I	**8**			
5	Clocks	1	C-I-O	1-4	1-5,9-12
6	Calendar	1	C-I-O	1-4	1-5,9-12
7	Ratio Proportion	1	C-I-O	1-4	1-5,9-12
8	Ratio Proportion	1	C-I-O	1-4	1-5,9-12
9	Mixtures & Solutions	1	C-I-O	1-4	1-5,9-12
10	Mixtures & Solutions	1	C-I-O	1-4	1-5,9-12
11	Average	1	C-I-O	1-4	1-5,9-12
12	Surprise Test-I	1			
	UNITIII: COMMERCIAL ARITHMETIC-1II	**6**			
13	Time, Speed, Distance	1	C-I-O	1-4	1-5,9-12
14	Time, Speed, Distance-Races	1	C-I-O	1-4	1-5,9-12
15	Problems on Trains	1	C-I-O	1-4	1-5,9-12
16	Boats & Streams	1	C-I-O	1-4	1-5,9-12
17	Time and work	1	C-I-O	1-4	1-5,9-12
18	Pipes and Cisterns	1	C-I-O	1-4	1-5,9-12
	UNIT IV: GEOMETRY	**6**			
19	Geometry I	1	C-I-O	1-4	1-5,9-12
20	Geometry II	1	C-I-O	1-4	1-5,9-12
21	Mensuration I	1	C-I-O	1-4	1-5,9-12
22	Mensuration II	1	C-I-O	1-4	1-5,9-12
23	Trigonometry I	1	C-I-O	1-4	1-5,9-12
24	Trigonometry II	1	C-I-O	1-4	1-5,9-12
	UNIT V: MODERN MATHEMATICS	**6**			
25	Data sufficiency I	1	C-I-O	1-4	1-12
26	Data sufficiency II	1	C-I-O	1-4	1-12
27	Data Interpretation I	1	C-I-O	1-4	7-12
28	Data Interpretation II	1	C-I-O	1-4	7-12
29	Data Interpretation III	1	C-I-O	1-4	7-12
30	Surprise Test II	1			

	Total contact hours	30

LEARNING RESOURCES	
Sl. No.	**TEXT BOOK**
1	Dinesh Khattar-The Pearson Guide to QUANTITATIVE APTITUDE for competitive examinations**.**
	REFERENCE BOOKS
2	The Pearson Guide to Quantitative Aptitude and Data Interpretation for the CAT, by Nishit K Sinha
3	Dr. Agarwal.R.S – *Quantitative Aptitude for Competitive Examinations,* S.Chand &Company Limited 2011
4	Abhijit Guha*, Quantitative Aptitude for Competitive Examinations,* Tata McGraw Hill, 3rd Edition*,* 2011
5	Arun Sharma-Quantitative aptitude for CAT, Tata McGraw Hill
6	Edgar Thrope, *Test Of Reasoning for Competitive Examinations,* Tata McGraw Hill, 4th Edition, 2012
7	The Pearson Guide to Data Interpretation and Logical Reasoning for the CAT (With CD) by Nishit K. Sinha Publisher: Pearson
8	How to Prepare for Data Interpretation for the CAT Common Admission Test by Arun Sharma Publisher: Tata McGraw-Hill
	ON-LINE RESOURCES
9	www.indiabix.com
10	www.lofoya.com
11	www.careerbless.com
12	www.achieversforce.com

Course nature	**Theory**

Assessment Method (Weightage 100%)

In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**10%**	**20%**	**5%**	**5%**	**50%**
						End semester examination Weightage :	**50%**

15CS314J	**Compiler Design**		**L**	**T**	**P**	**C**
			3	**0**	**2**	**4**
Co-requisite:	Nil					
Prerequisite:	15CS301					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Core				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	To acquire analytical ability in solving mathematical problems as applied to the respective branches of Engineering.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, the students would be able to								
1.	Learn the fundamentals of the Design of Compilers by applying mathematics and engineering principles	a						
2.	Design a system for parsing the sentences in a compiler grammar	c						
3.	Design a system to translate into various intermediate codes	c						
4.	Analyze the methods of implementing a Code Generator for compilers	a	c					
5.	Analyze and Design the methods of developing a Code Optimizer	a	c					

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: INTRODUCTION TO COMPILER & AUTOMATA		**9**			
1.	Compilers – Analysis of the source program	1	C	1	1,2
2.	Phases of a compiler – Cousins of the Compiler	1	C	1	1
3.	Grouping of Phases – Compiler construction tools	1	C	1	1
4.	Lexical Analysis – Role of Lexical Analyzer	1	C	1	1,2
5.	Input Buffering – Specification of Tokens- design of lexical analysis (LEX)	1	C,D	1	1
6.	Finite automation (deterministic & non deterministic) - Conversion of regular expression of NDFA – Thompson’s	2	C,D	1	1,2,3,4,5
7.	Conversion of NDFA to DFA- minimization of NDFA	1	C,D	1	1,2,3,4,5
8.	Derivation - parse tree - ambiguity	1	C	1	1,2,3,4,5
UNIT II: SYNTAX ANALYSIS – PARSING		**10**			
9.	Definition - role of parsers - top down parsing - bottom-up parsing	1	C	2	1,2
10.	Left recursion - left factoring - Handle pruning , Shift reduce parsing	1	C	2	1,2
11.	LEADING- TRAILING- Operator precedence parsing	1	C,D	2	2
12.	FIRST- FOLLOW	1	C	2	1,2,3,4,5
13.	Predictive parsing	1	C,D	2	1,2,3,4,5
14.	Recursive descent parsing	1	C,D	2	1
15.	LR parsing – LR (0) items - SLR parsing	2	C,D	2	1,2,3,4,5
16.	Canonical LR parsing	1	C,D	2	1,2
17.	LALR parsing	1	C,D	2	1,2
UNIT III: INTERMEDIATE CODE GENERATION		**9**			
18.	Intermediate Languages - prefix - postfix - Quadruple - triple - indirect triples	1	C	3	1,2,3,4,5
19.	Syntax tree- Evaluation of expression - three-address code	1	C	3	1,2
20.	Synthesized attributes – Inherited attributes	1	C	3	1,2
21.	Intermediate languages – Declarations	1	C,D	3	1,2
22.	Assignment Statements	1	C,D	3	1,2,3,4,5
23.	Boolean Expressions	2	C,D	3	1,2,3,4,5
24.	Case Statements	1	C,D	3	1
25.	Back patching – Procedure calls.	1	C,D	3	1
UNIT IV: CODE GENERATION		**9**			
26.	Issues in the design of code generator.	1	C,D	4	1
27.	The target machine – Runtime Storage management	2	C,D	4	1
28.	Basic Blocks and Flow Graphs	1	C	4	1,2,3,4,5

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
29.	Next-use Information – A simple Code generator	1	C,D	4	1
30.	DAG representation of Basic Blocks	1	C,D	4	1,2,3
31.	Peephole Optimization	1	C	4	1
32.	Cross Compiler – T diagrams	1	C,D	4	1
UNIT V: CODE OPTIMIZATION		**9**			
33.	Introduction– Principal Sources of Optimization	1	C	5	1
34.	Optimization of basic Blocks	1	C,D	5	1,2,3
35.	Loop Optimization	2	C,D	5	1,2,3
36.	Introduction to Global Data Flow Analysis –	1	C	5	1
37.	Runtime Environments – Source Language issues	1	C,D	5	1
38.	Storage Organization	1	C,D	5	1
39.	Storage Allocation strategies – Access to non-local names	1	C	5	1
40.	Parameter Passing.	1	C	5	1
Total contact hours		**45***			

Session	Description of the Experiments	Contact hours	C-D-I-O	IOs	Reference
1.	Converting a regular expression to NFA	2	D,I	1	1,2,3
2.	Conversion of Regular Expression to NFA	4	D,I	1	1,2,3
3.	Conversion of an NFA to DFA	4	D,I	1	1,2,3
4.	Computation of FIRST and FOLLOW sets	2	D,I	2	1,2,3
5.	Computation of Leading and Trailing Sets	2	D,I	2	1,2,3
6.	Construction of Predictive Parsing Table	2	D,I	2	1,2,3
7.	Construction of Recursive Descent Parsing	2	D,I	2	1,2,3
8.	Implementation of Shift Reduce Parsing	2	D,I	2	1,2,3
9.	Computation of LR(0) items	4	D,I	2	1,2,3
10.	Construction of DAG	2	D,I	4	1,2,3
11.	Intermediate code generation – Three Address Codes	2	D,I	3	1,2,3
12.	Intermediate code generation – Postfix, Prefix	2	D,I	3	1,2,3
	Total Contact Hours	**30***			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Alfred V Aho , Jeffery D Ullman , Ravi Sethi, " Compilers , Principles techniques and tools ", Pearson Education 2011
2.	S.Godfrey Winster,S.Aruna Devi,R.Sujatha,”Compiler Design”,Yesdee Publishing Pvt.Ltd, 2016
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	K.Muneeswaran , ,”Compiler Design”, Oxford Higher Education,Fourth edition 2015
4.	David Galles, “Modern Compiler Design”, Pearson Education, Reprint 2012.
5.	Raghavan V., “Principles of Compiler Design”, Tata McGraw Hill Education Pvt. Ltd., 2010.

Course nature					**Theory + Practical**		
Assessment Method – Theory Component (Weightage 50%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

Assessment Method – Practical Component (Weightage 50%)						
In-semester	**Assessment tool**	Experiments	Record	MCQ/Quiz/Viva Voce	Model examination	**Total**
	Weightage	**40%**	**5%**	**5%**	**10%**	**60%**
End semester examination Weightage :						**40%**

* Excluding Assessment Hours

15SE202	**Software Engineering Principles**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL CORE				
Course designed by	Department of Software Engineering					
Approval	32nd Academic Council Meeting, 23rd July, 2016					

PURPOSE	The main purpose of this course is to impart knowledge on the basic principles of software engineering							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1	Understand the software life cycle models and software development process	a						
2	Elicit, analyze and specify software requirements through a productive working Relationship with project stakeholders	a	g					
3	Understand the importance of modeling and modeling languages	c	g					
4	Develop correct and robust software products	d	h					
5	Adaptation of Software maintenance and emerging trends in software engineering	d	j					

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: INTRODUCTION	**9**			
1	Software Engineering-Software Process- Generic process model	1	C	1	1
2	Process models	4	C	1	1
3	Agile development-Agile Process- Extreme Programming	2	C	1	1
4	Other Agile process models : Adaptive process models ,Scrum,Dynamic Systems Development Method and Crystal	2	C	1	1
	UNIT II: UNDERSTANDING REQUIREMENTS	**9**			
5	Principles that guide practice –Understanding requirements	3	C	1,2	1,3
6	Requirement Modeling : Scenarios, Information and Analysis classes	3	C,D	1,2,3	1,3
7	Requirements Analysis-Requirements Modeling Strategies	3	C	2,3,4	1,3
	UNIT III: DESIGN	**9**			
8	The design process - Design concepts	2	C,D	3	1
9	The design model –Architectural design-Software architecture	1	C	3	1
10	Component level design-user interface design	2	C,D	3	1
11	User Interface Design	2	C,D	3	1
12	Pattern oriented design-Web application design	2	C,D	3	1

	UNIT IV: SOFTWARE IMPLEMENTATION AND TESTING	**9**			
13	Modern Programming Language Features – Implementation Issues and Solutions	1	C	4	4
14	Structured coding Techniques-Coding Styles-Standards and Guidelines- Documentation Guidelines	2	C	4	4 ,2
15	Software Testing strategies on Conventional software ,Object oriented software and Web applications	3	C,D	4,5	1
16	Validation Testing- System Testing- Art of Debugging.	3	C,D	4,5	1
	UNIT V: SOFTWARE MAINTANENCE AND EMERGING TRENDS IN SOFTWARE ENGINEERING	**9**			
17	Software maintenance and Reengineering	4	C	4,5	1
18	Latest Trends: Technology evolution -Identifying Soft trends	2	C	4,5	1
19	Technology directions-Tools related trends	3	C	4,5	1
	Total contact hours	45			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1	Roger S Pressman, “Software Engineering – A Practitioner’s Approach”, 7th edition, Tata McGraw Hill Education, 2014.
2	Ian Somerville “Software Engineering”, 9th edition, Pearson Education, 2010.
	REFERENCE BOOKS/OTHER READING MATERIAL
3	Hans Van Vliet, “Software Engineering: Principles and Practices”, Wiley 2008.
4	Richard Fairley, “Software Engineering Concepts”, Tata McGraw Hill Education, 2008.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	**Cycle test I**	**Cycle test II**	**Cycle Test III**	**Surprise Test**	**Quiz**	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15IT302J	**Database Management Systems**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	P	Professional Core			
Course designed by	Department of Information Technology				
Approval	32nd Academic Council Meeting, 23rd July 2016				

PURPOSE	Designing database for different applications is an important area to focus. This course helps students to understand the limitations of file processing system and how a database management system overcomes the same. Learning various design tools and design techniques, along with a query language, makes a course on Database Management Systems complete and effective.							
Instructional Objectives		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand the fundamentals of Database Management Systems	c						
2.	Provide the proof for good database design after carefully eliminating certain problems inherent in Initial Database Design.	c						
3.	Design Logical Database Schema and Mapping it to implementation level schema through Database Language Features.	c	i					
4.	Understand the practical problems of Concurrency control and gain knowledge about failures and Recovery	c						
5.	Learn the different types of databases	c						

Session	**Description of Topic (Theory)**	**Contact Hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I : INTRODUCTION		**7**			
1.	File Processing System, Advantages of DBMS over File Processing System	1	C	1	1
2.	Data, Database, DBMS, Data model, Data Independence, Data Catalog	1	C	1	1
3.	DBMS Architecture and Data Abstraction, DBMS Languages	2	C	1	1
4.	DBMS System Structure	1	C	1	1
5.	ER Model: Objects, Attributes and its Type, Entity and Entity Set, Relationship & Relationship Set	2	C,D	1	1
UNIT II : DATABASE DESIGN AND QUERY PROCESSING		**9**			
6.	Design Issues in choosing attributes or entity set or relationship set	1	D	2	1
7.	Constraints	1	C	2	1
8.	Super Key, Candidate Keys, Primary Key	1	C	2	1
9.	ER Diagram Notations, Goals of ER Diagram, Weak Entity Set, ER Diagram Construction	2	C,D	2	1
10.	Tabular Representation of Various ER Schema	1	C,D	2	1,2
11.	Overview of Query Processing	1	C	2	1
12.	Relational Algebra: Fundamental operations; Views	2	C	2	1
UNIT III : STRUCTURED QUERY LANGUAGE		**11**			
13.	SQL: Overview, The Form of Basic SQL Query	1	C,I	3	1
14.	UNION, INTERSECT, and EXCEPT	2	C,I	3	1
15.	Nested Queries	2	C,I	3	1
16.	Aggregate Functions, Null Values	2	C,I	3	1
17.	Complex Integrity Constraints in SQL	2	C	3	1
18.	Embedded SQL, Integrity Constraints, Object Oriented Database, Object Relational Database	2	C	3	1,3
UNIT IV: FUNCTIONAL DEPENDENCIES AND NORMAL FORMS		**9**			
19.	Pitfalls in relational database, Decomposing bad schema, Need for Decomposition, Desirable Properties of Decomposition	2	C	3	1
20.	1NF, Super Key	1	C	3	1

21.	Functional dependency: Closure of Functional Dependency Set, Closure of Attribute Set, Minimal Functional Dependency Set	2	C	3	1
22.	2NF, BCNF, 3 NF, Denormalization	3	C	3	1
23.	Practical Database Design & Alternative Design techniques	1	C	3	1
UNIT V: TRANSACTION PROCESSING AND RECOVERY		**9**			
24.	File Structure: Overview of Physical Storage Media, Magnetic Disks	1	C	4	1
25.	RAID	2	C	4	1
26.	Transactions: Concurrency Control: Lock Based Protocols,	2	C	4	1
27.	Recovery System	2	C	4	1
28.	Introduction to Parallel and Distributed Databases, Spatial and multimedia databases.	2	C	5	1,3
	TOTAL CONTACT HOURS	45*			

Sl. No.	Description of experiments	Contact Hours	C-D-I-O	IOs	Reference
1.	Creating database, table	2	D,I	3	1,2,3,4,5
2.	Working with Data Manipulation commands	2	I	3	1,2,3,4,5
3.	Basic SELECT statements	2	I	3	1,2,3,4,5
4.	Advanced SELECT statements	2	I	3	1,2,3,4,5
5.	Integrity and Constraints	2	I	3	1,2,3,4,5
6.	Joining Tables	4	I	3	1,2,3,4,5
7.	SQL functions	2	I	3	1,2,3,4,5
8.	Sub queries	2	I	3	1,2,3,4,5
9.	Views	2	I	3	1,2,3,4,5
10.	Basics of PL/SQL	4	I	3	1,2,3,4,5
11.	Design and Develop applications	4	D,I	3	1,2,3,4,5
12.	MODEL EXAM	2			
	TOTAL CONTACT HOURS	30			

Sl. No.	Learning Resources
1.	Abraham Silberschatz, Henry F. Korth, S. Sudarshan, “Database System Concepts”, 6th Edition , 2010, McGraw-Hill, ISBN:0-07-352332-1
2.	Raghu Ramakrishnan, Johannes Gehrke, “Database Management System”, 3rd Edition, 2007, McGraw Hill, ISBN: 978-0072465631
3.	Elmasri and Navathe, “Fundamentals of Database System”, 6th Edition, 2010, Addison-Wesley Publishing, ISBN: 978-0136086208
4.	Date C.J, “An Introduction to Database”, 8th Edition , 2003, Addison-Wesley Pub Co, ISBN: 978-0321197849
5.	Peter rob, Carlos Coronel, “Database Systems – Design, Implementation, and Management”, 9th Edition, 2009, Thomson Learning, ISBN: 978-0538469685

<table>
<tr><td colspan="5"><b>Course nature</b></td><td colspan="3"><b>Theory + Practical</b></td></tr>
<tr><td colspan="8"><b>Assessment Method – Theory Component (Weightage 50%)</b></td></tr>
<tr><td rowspan="2"><b>In-semester</b></td><td><b>Assessment tool</b></td><td>Cycle test I</td><td>Cycle test II</td><td>Cycle Test III</td><td>Surprise Test</td><td>Quiz</td><td><b>Total</b></td></tr>
<tr><td><b>Weightage</b></td><td><b>10%</b></td><td><b>15%</b></td><td><b>15%</b></td><td><b>5%</b></td><td><b>5%</b></td><td><b>50%</b></td></tr>
<tr><td colspan="7"><b>End semester examination Weightage :</b></td><td><b>50%</b></td></tr>
<tr><td colspan="7"></td><td></td></tr>
<tr><td colspan="8"><b>Assessment Method – Practical Component (Weightage 50%)</b></td></tr>
<tr><td rowspan="2"><b>In-semester</b></td><td><b>Assessment tool</b></td><td>Experiments</td><td>Record</td><td colspan="2">MCQ/Quiz/Viva Voce</td><td>Model examination</td><td><b>Total</b></td></tr>
<tr><td><b>Weightage</b></td><td><b>40%</b></td><td><b>5%</b></td><td colspan="2"><b>5%</b></td><td><b>10%</b></td><td><b>60%</b></td></tr>
<tr><td colspan="7"><b>End semester examination Weightage :</b></td><td><b>40%</b></td></tr>
</table>

* - Excluding Assessment Hours

15CS303M	**Multi Disciplinary Design**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Core				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	Students of any specialization at an undergraduate level learn courses related to various sub-domains (Multi-disciplinary) of their specialization individually. They are not exposed to understanding how the various multi-disciplinary fields interact and integrate in real life situations. It is very common that an expert in a particular domain models and designs systems or products oblivious of the impact of other subsystems. This lack of multi-disciplinary thinking is very blatantly visible when the students take up their major project during their final year. This course aims to develop appropriate skills on systemic thinking on how to identify and formulate a problem, decompose the problem into smaller elements, conceptualize the design, evaluate the conceptual design by using scientific, engineering and managerial tools, select, analyze and interpret the data, consideration of safety, socio-politico- cultural, risks and hazards, disposal, regional and national laws, costing and financial model and undertake documentation and finally presentation.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able								
1.	To subdivide a complex system into smaller disciplinary models, manage their interfaces and reintegrate them into an overall system model	a	c	e	f	i	l	
2.	To rationalize a system architecture or product design problem by selecting appropriate design variables, parameters and constraints	a	c	e	f	i	l	
3.	To design for value and quantitatively assess the expected lifecycle cost of a new system or product	a	c	e	f	i	l	
4.	To take on the challenges of teamwork, prepare a presentation in a professional manner, and document all aspects of design work.	a	c	e	f	i	l	

Session	**Description of Topic**	**Contact hours**	**C-D- I-O**	**IOs**	**Reference**
1	Introduction: Facilitating Multidisciplinary Projects		C,D,I,O	1,2,3,4	1,2
2	Identifying and formulating a problem				
3	System Modelling				
4	Thinking perspectives: Decomposition–Composition Thinking Hierarchical Thinking, Organizational Thinking, Life-Cycle Thinking, Safety Thinking, Risk Thinking, Socio-politico-cultural thinking, Environment thinking				
5	Decomposing a system – Identifying the major sub-systems				
6	Mathematical Modeling and Governing equations for each sub systems				
7	Objectives, Constraints and Design Variables				
8	Conceptual Design				
9	Collaborative Design – Disciplinary teams satisfy the local constraints while trying to match the global constraints set by the project coordinator.				
10	Tools for modeling, designing, analysis, data interpretation, decision making etc				
11	Design Analysis, evaluation and selection				
12	Costing and Financial model				
13	Documentation, reviewing and presentation				
Total contact hours		**45**			

LEARNING RESOURCES	
Sl. No.	**REFERENCES**
1.	**Systems Design and Engineering: Facilitating Multidisciplinary Development Projects** G. Maarten Bonnema, Karel T. Veenvliet, Jan F. Broenink December 15, 2015, CRC Press ISBN

	9781498751261
2.	**Exploring Digital Design-Multi-Disciplinary Design Practices,** Ina Wagner , Tone Bratteteig , Dagny Stuedahl, Springer-Verlag London, 2010, ISSN:1431-1496 ***Additional references can be included by the respective departments based on the domain and / or theme.***

Course nature					**Predominantly Practice complimented by theory**	
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Review 1	Review 2	Review 3	Review 4	**Total**
	Weightage	**10%**	**25%**	**25%**	**40%**	**100%**
End semester examination Weightage :						**0%**

Pedagogy:

Theme or major/broad domains will be announced by the department every semester. Multi-disciplinary designs will be made by the students in groups (group size may be decided by the course coordinator), with the topic of interest falling within the theme or major/broad domains as announced by the department, applying any combinations of the disciplines in engineering. 3D modelling and / or simulation must be used to validate the design.

In a combination of lecture and hands-on experiences, students must be exposed to understand and analyze engineering designs (or products) and systems, their realization process and project management. Analysis of the design criteria for safety, ergonomics, environment, life cycle cost and sociological impact is to be covered. Periodic oral and written status reports are required. The course culminates in a comprehensive written report and oral presentation. If required guest lecturers from industry experts from the sub-domains may be arranged to provide an outside perspective and show how the system design is being handled by the industry. The Conceive Design Implement Operate (CDIO) principles must be taught to the students.

A full-scale fabrication is not within the purview /scope of this course. Of course this design, if scalable and approved by the department, can be extended as the major project work
This course is 100% internal continuous assessment.

15CS376L		**Minor Project II**	**L**	**T**	**P**	**C**
			0	**0**	**3**	**2**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July, 2016					

PURPOSE	To obtain an hands-on experience in converting a small novel idea / technique into a working model / prototype involving multi-disciplinary skills and / or knowledge and working in at team.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able								
1.	To conceptualize a novel idea / technique into a product	c						
2.	To think in terms of multi-disciplinary environment		d					
3.	To understand the management techniques of implementing a project				k			
4.	To take on the challenges of teamwork, prepare a presentation in a professional manner, and document all aspects of design work.			g				

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	An Multidisciplinary project to be taken up by a team of maximum of ten students. Development of prototype product, a 3D model, simulation, blueprint for a larger project and any other development work are permitted. The contribution of the individuals in the project should be clearly brought out. A combined report is to be submitted. A presentation is to be made for the reviewers on the work done by the candidate.		C,D,I	1,2,3,4	
	Total contact hours				

Course nature			**Project – 100% internal continuous assessment**
Assessment Method (Weightage 100%)			
In-semester	**Assessment tool**	Refer the table	**Total**
	Weightage	Refer the table below	**100%**
End semester examination Weightage :			**0%**

Assessment components

Assessment component	**Expected outcome**	**Evaluators**	**Criteria or basis**	**Marks**
Project proposal (Review – I)	A short presentation to be delivered on: • A brief, descriptive project title (2-4 words). This is critical! • The 3 nearest competitors (existing solutions) and price. • Team members name, phone number, email, department/degree program, and year. • A description of the product opportunity that has been identified. To include: Documentation of the market need, shortcomings of existing competitive products, and definition of the target market and its size. • Proposed supervisor / guide	Panel of reviewers	Viability / feasibility of the project Extent of preliminary work done.	**0**
Review II	• Mission Statement / Techniques • Concept Sketches, Design Specifications / Modules & Techniques along with System architecture • Coding	Panel of reviewers	Originality, Multi-disciplinary component, clarity of idea and presentation, team work, handling Q&A.	**20**

Assessment component	**Expected outcome**	**Evaluators**	**Criteria or basis**	**Marks**
Review III	• Final Concept and Model / Algorithm/ Technique • Drawings, Plans / programme output • Financial Model / costing • Prototype / Coding • Final Presentation and Demonstration	Panel of reviewers	Originality, Multi-disciplinary component, clarity of idea and presentation, team work, handling Q&A.	**50**
Final technical Report	A good technical report	Supervisor / Guide	Regularity, systematic progress, extent of work and quality of work	**30**
			Total	**100**

15CS381L	**Seminar II**		**L**	**T**	**P**	**C**
			0	**0**	**3**	**2**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July, 2016					

PURPOSE	To inculcate the research culture among the students through literature reading, modelling a problem, analyzing and presenting.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able								
1.	To understand the research methodology adopted by various researchers	h	i	j				
2.	To mathematically model a problem, critically analyze it and adopt strategies to solve	b	c	e				
3.	To understand and present a well documented research	e	g					

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	Guidelines for conducting 15CS381L Seminar for B.Tech 1. Upon registering for the course the student must identify a sub-domain of the degree specialization that is of interest to the student and start collecting research papers as many as possible. 2. After collecting sufficient number of research papers the student must peruse all the papers, meet the course faculty and discuss on the salient aspects of each and every paper. 3. The course faculty, after discussion with the student will approve TWO research papers that is appropriate for presentation. 4. The student must collect additional relevant reference materials to supplement and compliment the two research papers and start preparing the presentation. 5. Each student must present a 15-minute presentation on each of the approved research paper to the panel of evaluators. 6. The presenter must present one research paper within the first half of the semester (6 weeks) and another research paper in the next half of the semester (6 weeks) as per the schedule. 7. All other students registered for the course will form the audience. 8. The audience as well as the evaluators will probe the student with appropriate questions and solicit response from the presenter. 9. The presentation will be evaluated against 7 to 8 assessment criteria by 4 to 5 evaluators. 10. The score obtained through the presentations of TWO research papers will be converted to appropriate percentage of marks. This course is 100% internal continuous assessment.		C,D	1,2,3,4	
Total contact hours		**30**			

Course nature			**100% internal continuous assessment.**	
Assessment Method (Weightage 100%)				
In-semester	**Assessment tool**	Presentation 1	Presentation 2	**Total**
	Weightage	**50%**	**50%**	**100%**
End semester examination Weightage :				**0%**

15CS386L	MOOCs II	L	T	P	C
		0	0	3	2
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	P Professional				
Course designed by	Department of Computer Science and Engineering				
Approval	32nd Academic Council Meeting , 23rd July, 2016				

PURPOSE	To offer students the opportunity to study with the world's best universities by integrating select MOOCs in a regular degree programme and providing students full credit transfer, as per university regulations, if they earn a "Verified / Completion Certificate" and take a proctored examination through a secure, physical testing center.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able								
1.	To apply the concepts, theories, laws, technologies learnt herein to provide engineering solutions.	f	h	i	j			

Course nature				**Online - 100% internal continuous assessment.**		
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Quiz	Assignment	Non-proctored / Unsupervised Tests	Proctored / Supervised Test	**Total**
	Weightage	**25%**	**25%**	**10%**	**40%**	**100%**
End semester examination Weightage :						**0%**

Registration process, Assessment and Credit Transfer:

1. Students can register for courses offered by approved global MOOCs platforms like edX, Coursera or Universities with which SRM partners specifically for MOOCs.
2. Annually, each department must officially announce, to the students as well as to the Controller of Examinations, the list of courses that will be recognized and accepted for credit transfer.
3. The department must also officially announce / appoint one or more faculty coordinator(s) for advising the students attached to them, monitoring their progress and assist the department in proctoring the tests, uploading the marks / grades, and collecting and submitting the graded certificate(s) to the CoE, within the stipulated timeframe.
4. Student who desires to pursue a course, from the above department-approved list, through MOOCs must register for that course during the course registration process of the Faculty of Engineering and Technology, SRMIST.
5. The maximum credit limits for course registration at SRM will include the MOOCs course registered.
6. The student must periodically submit the marks / grades obtained in various quizzes, assignments, tests etc immediately to the Faculty Advisor or the Course Coordinator for uploading in the university's academic module.
7. The student must take the final test as a Proctored / Supervised test in the university campus.
8. The student must submit the "Certificate of Completion" as well as the final overall Marks and / or Grade within the stipulated time for effecting the grade conversion and credit transfer, as per the regulations. It is solely the responsibility of the individual student to fulfil the above conditions to earn the credits.
9. The attendance for this course, for the purpose of awarding attendance grade, will be considered 100% , if the credits are transferred, after satisfying the above (1) to (7) norms; else if the credits are not transferred or transferable, the attendance will be considered as ZERO.

15CS491L	**Industrial Module II**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**2**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	P Professional				
Course designed by	Department of Computer Science and Engineering				
Approval	32nd Academic Council Meeting , 23rd July, 2016				

PURPOSE	To offer students the opportunity to interact with industries and learn the best practices adopted by them.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able								
1.	To obtain an insight into the current industrial trends and practices	h						
2.	To obtain an insight into the technologies adopted by industries	k						
3.	To obtain an insight into the technical problems encountered by the industries and the scope for providing solutions.	e						
4.	To network with industry	h						

Description of Topic	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
1. The department will identify and shortlist few emerging topics that are trending in industry. 2. The department will identify experts from industry who are willing to deliver modules on the shortlisted topics. 3. The identified expert will assist the department in formulating the course content to be delivered as a 30-hour module, prepare lectures notes, ppt, handouts and other learning materials. 4. The department will arrange to get the necessary approvals for offering the course, from the university's statutory academic bodies well before the actual offering. 5. The department must officially announce, to the students as well as to the Controller of Examinations, the list of courses that will be offered as industry module. 6. The department must also officially announce / appoint one or more faculty coordinator(s) for advising the students attached to them, monitoring their progress and assist the department in proctoring/supervising/assessment the quizzes, assignments, tests etc, uploading the marks, attendance etc, within the stipulated timeframe. 7. The Student who desires to pursue a course, from the above department-approved list, must register for that course during the course registration process of the Faculty of Engineering and Technology, SRMIST. 8. The maximum credit limits for course registration at SRM will include the Industry Module also. 9. All academic requirements of a professional course like minimum attendance, assessment methods, discipline etc will be applicable for this Industry Module. 10. The course will be conducted on week ends or beyond the college regular working hours.		C,D,I,O	1,2,3,4	
Total contact hours	**30**			

Course nature				**100% internal continuous assessment.**			
Assessment Method – Theory Component (Weightage 50%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage							**50%**

SEMESTER - VII

15IT304J	**Web Programming**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**
Co-requisite:	NIL				
Prerequisite:	15SE205J Programming In Java				
Data Book / Codes/Standards	NIL				
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Information Technology				
Approval	32nd Academic Council Meeting ,23rdJuly2016				

PURPOSE	Web has become ubiquitous in nature. Organizations have integrated the Internet "seamlessly" into their information systems and the Web offers endless opportunity to do so. This course provides the basic concepts and techniques used to design, develop, and deploy web applications satisfying the requirements in terms of flexibility, availability and scalability.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1	Understand different internet Technologies, web 2.0 and create a basic website using HTML and Cascading Style Sheets	m	i					
2	Design a dynamic web page with validation using JavaScript objects and by applying different event handling mechanisms	j						
3	Design a server side program using Servlets and JSP	k	l					
4	Design a simple web page in PHP, and to present data in XML format.	k	l					
5	Get overviews of java specific web services architecture and to enable rich client presentation using AJAX.	j						

Session	**Description of Topic (Theory)**	**Contact Hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I : WEBSITES BASICS, HTML 5, CSS 3, WEB 2.0		**9**		1	1,2
1.	Understanding Internet , Difference between websites and web server, Internet technologies Overview	1	C	1	1,2
2.	Understanding websites and web servers: Understanding the difference between internet and intranet	1	C	1	1,2
3.	Web 2.0: Basics, RIA Rich Internet Applications , collaborations tools	1	C	1	1,2
4.	HTML and CSS: HTML 5.0	3	D,I	1	1,2
5.	XHTML, CSS 3	3	D,I	1	1,2
UNIT II : JAVASCRIPT		**9**			
6.	An introduction to JavaScript, JavaScript DOM Model	2	C	2	1,5
7.	Built-in objects, Date and Objects	3	D,I	2	1,5
8.	Regular Expressions , Exception Handling, Validation	2	I	2	1,5
9.	Event Handling , DHTML with JavaScript	2	D,I	2	1,5
UNIT III : SERVER SIDE PROGRAMMING		**9**			
10.	Java Servlet Architecture, Servlet Life Cycle , Form GET and POST actions, Session Handling , Understanding Cookies, Installing and Configuring Apache Tomcat Web Server	3	C,D,I	3	1
11.	Understanding Java Server Pages, JSP Standard Tag Library(JSTL)	3	C	3	1
12.	Creating HTML forms by embedding JSP code	3	D,I	3	1

UNIT IV : PHP and XML		**9**			
13.	An introduction to PHP, Using PHP, Variables, Program control	1	C	4	1,3,5
14.	Built-in functions, Connecting to Database , Using Cookies, Regular Expressions	2	D,I	4	1,3,5
15.	Basic XML, Document Type Definition, XML Schema	3	C	4	1,3,5
16.	DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM)	3	I	4	1,3,5
UNIT V : INTRODUCTION TO AJAX and WEB SERVICES		**9**			
17.	Introduction to Ajax , Ajax Client Server Architecture, XMLhttpRequest Object , Call Back Methods	3	C,D,I	5	1
18.	Introduction to Web Services, Java web services Basics, SOAP	2	C	5	1
19.	Creating, Publishing ,Testing and Describing a Web services(WSDL) , Consuming a web service	2	I	5	1
20.	Database Driven web service from an application	2	D,I	5	1
	TOTAL CONTACT HOURS	45*			

Sl. No.	**Description of experiments**	**Contact Hours**	**C-D-I-O**	**IOs**	**Reference**
1.	Create a simple webpage using HTML5 Semantic and Structural Elements	4	D,I	1	1,3,5
2.	Create a webpage using HTML5 Media Elements	2	D,I	1	1,3,5
3.	Add a Cascading Style sheet for designing the web page	2	D,I	1	1,3,5,
4.	Design a dynamic web page with validation using JavaScript	4	D,I	2	1,5
5.	Simple applications to demonstrate Servlets	2	D,I	3	1
6.	Simple applications using JSP and AJAX	4	D,I	3,5	1
7.	Design a simple online test web page in PHP	4	D,I	4	1,2,4
8.	Design simple application for accessing the data using XML	2	D,I	4	1,2,4
9.	Application for web services	4	D,I	5	1
10.	Model Exam	2			
	TOTAL CONTACT HOURS	30			

Sl. No.	**Learning Resources**
1.	Deitel, Deiteland Nieto, Internet and World Wide Web : How to Program, 5thEdition, 2012, Prentice Hall,. ISBN-13: 978-0-13-215100-9
2.	Stephen Wynkoop, Running a perfect website, QUE, 2ndEdition,2001. ISBN 13: 9780789709448
3.	Chris Bates, Web Programming : Building Intranet applications, 3rdEdition,2009, Wiley Publications,. ISBN 13: 9780470017753
4.	Jeffrey C. Jackson, “Web Technologies A computer Science Perspective”, 2011, Pearson, ISBN 9780133001976.
5.	www.W3Schools.com as on date: 18/04/2016

<table>
<tr><th colspan="4">Course nature</th><th colspan="4">Theory + Practical</th></tr>
<tr><th colspan="8">Assessment Method – Theory Component (Weightage 50%)</th></tr>
<tr><td rowspan="2"><b>In-semester</b></td><td><b>Assessment tool</b></td><td>Cycle test I</td><td>Cycle test II</td><td>Cycle Test III</td><td>Surprise Test</td><td>Quiz</td><td><b>Total</b></td></tr>
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</table>

* - Excluding Assessment Hours

15CS401	**Artificial Intelligence**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	P Professional Core				
Course designed by	Department of Computer Science and Engineering				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE	Introduce the concepts of Artificial Intelligence; Learn the methods of solving problems using Artificial Intelligence in Graph Playing, Natural Language Processing, Expert Systems and Machine Learning.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Identify problems that are amenable to solution by AI methods.	a	b					
2.	Identify appropriate AI methods to solve a given problem.	a	b					
3.	Formalize a given problem in the language/framework of different AI methods	a	b					
4.	Design and carry out an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports	a	b	c				

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: Introduction		**9**			
1.	Introduction to Artificial Intelligence-History of AI- AI Techniques	1	C	1	1,2,3,4
2.	Problem Solving with AI- AI models-Data Acquisition and Learning Aspects in AI	3	C	1	1,2,3,4
3.	Problem-Solving Process – Formulating Problems-Problem Types and Characteristics- Problem Analysis and Representation	3	C,D	1	1,2,3,4
4.	Performance Measuring-Problem Space and Search-Toy Problems- Real-world problems-Problem Reduction Methods	2	C,D	1	1,2,3,4
UNIT II: Heuristic Search Techniques		**9**			
5.	General Search algorithm – Uniformed Search Methods – BFS, Uniform Cost Search	2	C	2-4	1,2,3,4
6.	Depth First search , Depth Limited search (DLS), Iterative Deepening	2	C,D	2-4	1,2,3,4
7.	Informed Search-Introduction- Generate and Test, BFS, A* Search, Memory Bounded Heuristic Search.	3	C,D	2-4	1,2,3,4
8.	Local Search Algorithms and Optimization Problems – Hill climbing and Simulated Annealing	2	D,I	2-4	1,2,3,4
UNIT III: Knowledge and Reasoning		**9**			
9.	Knowledge Representation-Knowledge based Agents-The Wumpus World	2	C	3	1,2,3,4
10.	Logic-Propositional Logic-Predicate Logic-Unification and Lifting	3	C,D,I	3	1,2,3,4
11.	Representing Knowledge using Rules-Semantic Networks-Frame Systems	2	C,D	3	1,2,3,4
12.	Inference – Types of Reasoning	2	C	3	1,2,3,4
UNIT IV: Planning		**9**			
13.	Planning Problem – Simple Planning agent –Blocks world	2	C	4	1,2,3,4
14.	Goal Stack Planning-Means Ends Analysis- Planning as a State-space Search	2	D,I	4	1,2,3,4
15.	Partial Order Planning-Planning Graphs-Hierarchical Planning-Non- linear Planning -Conditional Planning-Reactive Planning	1	C,D,I	4	1,2,3,4
16.	Knowledge based Planning-Using Temporal Logic – Execution Monitoring and Re-planning-Continuous Planning-Multi-agent Planning-Job shop Scheduling Problem	2	C,D	4	1,2,3,4
17.	NLP-Introduction-Levels of NLP-Syntactic and Semantic analysis-Discourse and Pragmatic Processing-Information Retrieval-Information Extraction-Machine Translation-NLP and its Application	2	C,D,I	1-4	1,2,3,4,5
UNIT V: Game Playing		**9**			
18.	Introduction-Important Concepts of Game Theory	1	C	3-4	1,2,3

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
19.	Game Playing and Knowledge Structure-Game as a Search Problem	2	C, D	3-4	1,2,3
20.	Alpha-beta Pruning-Game Theory Problems Game Theory	3	C, D, I	3-4	1,2,3
21.	Expert System-Architecture- Knowledge acquisition-Rule based Expert System-Frame based and Fuzzy based expert system- Case study in AI Applications	3	C,D,I	1-4	1
Total contact hours		**45***			

LEARNING RESOURCES	
Sl. No.	
1.	Parag Kulkarni, Prachi Joshi, “Artificial Intelligence –Building Intelligent Systems ”PHI learning private Ltd, 2015
2.	Kevin Night and Elaine Rich, Nair B., “Artificial Intelligence (SIE)”, Mc Graw Hill- 2008.
3.	Stuart Russel and Peter Norvig “AI – A Modern Approach”, 2nd Edition, Pearson Education 2007.
4.	Deepak Khemani “Artificial Intelligence”, Tata Mc Graw Hill Education 2013.
5.	Akshar Bharati, Vineet Chaitanya, Rajeev Sangal, “Natural Language Processing: A Paninian Perspective”, Prentice Hall India Ltd.,New Delhi, 1996

Course nature					**Theory**		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15SE204	**Professional Ethics And Software Economics**		**L**	**T**	**P**	**C**
			2	**0**	**0**	**2**
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	Clark’s Table, IS : 456-2000					
Course Category	P	PROFESSIONAL CORE				
Course designed by	Department of Software Engineering					
Approval	32nd Academic Council Meeting, 23rd July, 2016					

PURPOSE	To exposure the aspects of professional ethics and software economics as an integral component of the undergraduate curriculum							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Gain knowledge, skills, and attitudes that software engineers must possess to practice software engineering professionally, responsibly, and ethically.	a	d	e	f			
2.	Develop professionals with idealistic, practical and moral values	c	d	f				
3.	Comprehend the role of professional societies and software engineering standards	a	d	f	h			
4.	Comprehend the basic fundamentals of software economics	c	h					
5.	*Comprehend* and be able to apply the key software engineering economic fundamentals to real-world software economic issues	c	h					

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT 1- GROUP DYNAMICS AND PYSCHOLOGY	**7**			
1.	Dynamics of working in teams and groups : Introduction to teams, Methods of Assessing and Evaluating Team Functioning	1	C	1	1
2.	Dealing with multicultural environments: Understanding Culture and Diversity-Understanding Cohesion and Collaboration	2	C	1	1
3.	Individual cognition : Improving Creativity and Innovation, Cognitive problem complexity	1	C	1	1
4.	Interacting with stakeholders-Dealing with uncertainty and ambiguity-Improving Problem Solving and Decision Making-presentation skills	3	C	1	1,4
	UNIT II- PROFESSIONALISM	**7**			
5.	Accreditation-certification-licensing	1	C	2	5
6.	Professionalism and Codes of ethics-Importance of Codes, Abuse of Codes, Limitations of Codes, Ethical Relativism, Justification of Codes	2	C	2	2
7.	Professional conduct: Professional Rights – Employee Rights.	1	C	2	2
8.	Professional Concerns: Introduction, Environmental Ethics, Computer Ethics	3	C	2	2
	UNIT III- ROLE OF PROFESSIONAL SOCIETIES AND SOFTWARE ENGINEERING STANDARDS	**6**			
9.	Nature and role of professional societies : Professional responsibilities	1	C	3	6
10.	Confidentiality and Proprietary Information,	1	C	3	6
11.	Conflict of Interest, Competitive bidding, whistle-blowing	2	C	3	6
12.	Nature and role of software engineering standard: Engineering standard, the standard of care, design standard, range of standard of practice.	2	C	3	3

	UNIT IV- SOFTWARE ECONOMICS	**6**			
13.	Introduction-Emphasis on Software Economics-Current status of software Economics	1	C	4	7
14.	Software Economics Road Map-Link Between software economics and policy,Software R&D Investment Policy Framework-Monitoring & Control for Dynamic Investment	2	C	4	7
15.	Improving Software Economics within an Enterprise-Modelling Costs, Benefits, and Value- Impact of Software Economics	2	C	4	7
16.	Employment Contracts-Legal Issues	1	C	4	7
	UNIT V- TRENDS IN SOFTWARE ECONOMICS	**4**			
17.	Case Study 1- Impact of Properly Licensed Software	2	C,O	5	8
18.	Case study 2: Current Growth and Impact of Software on Indian Economy	2	C,O	5	9
	Total Contact Hours		**30**		

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Timothy M. Franz by “*Group Dynamics and Team Interventions: Understanding and Improving Team Performance*”, Wiley Black-Well, April 2012
2.	Mike W.Martin, Ronald Schinzinger, ”*Introduction to Engineering Ethics* “2nd,Edition, Tata McGraw-Hill Higher Education,2009
3.	James .W. Moore ,"*Road Map to Software Engineering-Standards based Guide*" Wiley-IEEE Computer Society Press,2006.
	REFERENCE BOOKS/OTHER READING MATERIAL
4	Rio de Janeiro, "*Stake Holder Relationship Management*", 7th Project Management National Benchmarking Forum ,PMI Chapter, Nov. 2010.
5	Pierre Bourque, Richard E. Fairley,” SWEBOK V3.0 *Guide to the Software Engineering Body of Knowledg*,IEEE Computer Society, January 2014
6	Charles D Fleddermann, “*Engineering Ethics”, Prentice Hall, New Mexico*, 1999
7	Barry W. Boehm, Kevin J. *Sullivan "Software Economics: RoadMap*",1981.
8	INSEAD, Business School of the World, *"Competitive Advantage: Impact of Properly Licensed Software"*, 2013.
9	Dr. Rajesh Kumar Jhamb,"*Contribution of Software Industry in the Growth of Indian Economy in the Last Decade*", ZENITH International Journal of Business Economics & Management Research Vol.1 Issue 3, December 2011,

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15CS496L	**Major Project**		**L**	**T**	**P**	**C**
			0	**0**	**24**	**12**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Core				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting, 23rd July, 2016					

PURPOSE	The Major Project experience is the culminating academic endeavor of students who earn a degree in their Undergraduate Programs. The project provides students with the opportunity to explore a problem or issue of particular personal or professional interest and to address that problem or issue through focused study and applied research under the direction of a faculty member. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired in his/her academic program to real-world issues and problems. This final project affirms students' ability to think critically and creatively, to solve practical problems, to make reasoned and ethical decisions, and to communicate effectively.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able								
1.	To provide students with the opportunity to apply the knowledge and skills acquired in their courses to a specific problem or issue.	a	c		e	f		i
2.	To allow students to extend their academic experience into areas of personal interest, working with new ideas, issues, organizations, and individuals.	a	c		e	f		i
3.	To encourage students to think critically and creatively about academic, professional, or social issues and to further develop their analytical and ethical leadership skills necessary to address and help solve these issues.	a	c		e	f	h	i
4.	To provide students with the opportunity to refine research skills and demonstrate their proficiency in written and/or oral communication skills.	a	c		e	f	g	i
5.	To take on the challenges of teamwork, prepare a presentation in a professional manner, and document all aspects of design work.			d			g	

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	1. The Major project is a major component of our engineering curriculum: it is the culmination of the program of study enabling the students to showcase the knowledge and the skills they have acquired during the previous four years, design a product/service of significance, and solve an open-ended problem in engineering. 2. Each student must register to the project course related to his or her program 3. Major Project course consists of one semester and would be allowed to register only during the final year of study. 4. The Major Project may be initiated during the pre-final semester but will be assessed and credits transferred only during the last semester of study, upon completion of all other degree requirements. Generally the undergraduate major project is a team based one. 5. Each team in the major project course will consist of maximum of 5 students. 6. Each project will be assigned a faculty, who will act as the supervisor. 7. The project shall be driven by realistic constraints like that related to economic, environmental, social, political, ethical, health & safety, manufacturability and sustainability. 8. Each group must document and implement a management structure. Group leadership roles must be clearly identified including who has responsibility for monitoring project deliverables and group coordination.		C,D,I,O	1,2,3,4, 5	

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	9. A group project may be interdisciplinary, with students enrolled in different engineering degrees, or in Engineering plus other faculties such as Management, Medical and Health Sciences, Science and Humanities. 10. Each student team is expected to maintain a log book that would normally be used to serve as a record of the way in which the project progressed during the course of the session. 11. Salient points discussed at meetings with the supervisor (i.e., suggestions for further meetings, changes to experimental procedures) should be recorded by the student in order to provide a basis for subsequent work. 12. The logbook may be formally assessed; 13. The contribution of each individual team member will be clearly identified and the weightage of this component will be explicitly considered while assessing the work done. 14. A project report is to be submitted on the topic which will be evaluated during the final review. 15. Assessment components will be as spelt out in the regulations. 16. The department will announce a marking scheme for awarding marks for the different sections of the report. 17. The project report must possess substantial technical depth and require the students to exercise analytical, evaluation and design skills at the appropriate level.				
	Total contact hours				

Course nature			**Project – 100 % Internal continuous Assessment**		
Assessment Method (Weightage 100%)					
In-semester	**Assessment tool**	**Review 1**	**Review 2**	**Review 3**	**Total**
	Weightage	**10%**	**15%**	**20%**	**45%**
End semester examination	**Assessment Tool**	**Project Report**	**Viva Voce**		
	Weightage :	**25%**	**30%**		**55%**

ELECTIVES
Dept. Elective-I and Elective-II

15CS320E	**Computational Logic**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	P	Professional Elective			
Course designed by	Department of Computer Science and Engineering				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE	To study important concepts in Logic							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Provide main notions of Mathematical Logic	a						
2.	Learn Formal framework to construct logic arguments	e						
3.	Use deductive systems along with completeness	a						
4.	Learn about comprehensive introduction of the methods and techniques in Computational Logic	a	e					

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: PROPOSITIONAL LOGIC		**9**			
1.	Introduction, declarative sentences	1	C	1	1,2
2.	Syntax, Well formed formula, Induction and recursion, Satisfiability and Tautology	2	C	1	1
3.	Propositional connectives and boolean function, Semantics	2	C	1	1
4.	Computability and Decidability, CNF, Examples for conversion of CNF	3	C	1	1,2
5.	Boolean Satisfiability	1	C	1	1
UNIT II: PROPOSITIONAL LOGIC RULES		**8**			
6.	Natural Deduction , Examples, Problems	3	C	2,3	2,4
7.	Derived rules, Examples, Exercise Problems	3	C	2, 3	2,4
8.	Soundness theorem, Completeness theorem	2	C	3	2,4
UNIT III: FIRST ORDER LOGIC		**9**			
9.	Relations and predicates, Formulas, Interpretations	3	C	2,3	1,3
10.	Logical Equivalence, Semantic tableaux, Algorithm for semantic tableaux	4	C	2,3	1,3
11.	Soundness Theorem, Completeness Theorem	2	C	2,3	1,3
UNIT IV: FIRST ORDER LOGIC RESOLUTION		**9**			
12.	Ground resolution, Substitution, Unification Algorithm	3	C	4	1
13.	Correctness of unification Algorithm, Robinson's unification Algorithm	2	C	4	1
14.	General Resolution, Soundness of General Resolution, Completeness of General resolution	4	C	4	1
UNIT V: TEMPORAL LOGIC		**10**			
15.	Syntax and Semantics, Modal of time	2	C	3,4	1,3
16.	LTL, Semantic Tableaux	2	C	3,4	1, 2,3,5
17.	Binary Temporal Operators	1	C	3,4	1,3
18.	Branching Time Temporal Logic	2	C	3,4	1, 2,3
19.	BDD, OBDD	2	C,D	3,4	2,3
Total Contact Hours		**45***			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Mordechai Ben-Ari,"Mathematical Logic for Computer Science" ,III Edition,Springer ,2012

2.	Huth M and Ryan M ,” Logic in Computer Science : Modeling and Reasoning about systems”, Cambridge University Press, 2005
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Jean H. Gallier"Logic for Computer Science: Foundations of Automatic Theorem Proving", Second Edition, Dover Publications,2014
4.	I.M.Copi, D.Cohen, P.Jetli, M.Prabakar, “Introduction to Logic”, Pearson Education,2006
5.	Matt Kaufmann, Panagiotis Manolios, and J Strother Moore. Kluwer,"Computer-Aided Reasoning: An Approach.", Academic Publishers, June, 2000

Course nature				**Theory**			
Assessment Method – (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15SE321E	**Principles Of Programming Languages**		**L**	**T**	**P**	**C**
			3	**0**	**0**	3
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL ELECTIVE				
Course designed by	Department of Software Engineering					
Approval	32nd Academic Council Meeting, 23rd July, 2016					

PURPOSE	The main purpose of this course is to describe syntax and semantics of programming languages.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Appreciate the basic and advanced feature of language built ins	i						
2.	Handle syntax and semantics of programming languages	b						
3.	Distinguish data, data types, and basic statements	i						
4.	Observe call-return architecture and ways of implementing them	b						
5.	Outline object-orientation, concurrency, and event handling in programming languages	k						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: Introduction to Programming Language	9			
1.	Concepts of Programming Languages	1	C,D	1	1
2.	Programming Domains	1	C	1	1
3.	Language evaluation Criteria-Language Categories	1	C	1	1
4.	Evolution of programming languages	1	C	1	1
5.	IBM 704 and Fortran	1	C,D	1	1
6.	Functional Programming LISP	1	C	1	1
7.	ALGOL60-COBOL-BASIC	1	C,D	1	1
8.	Prolog- C++ - Java - C#	2	C,D	1	1,5
	UNIT II: SYNTAX AND SEMANTICS	9			
9.	Describing syntax	1	C	2	1,2,5
10.	Context-free grammars ,attribute grammars	1	C	2	1,2,5
11.	Describing semantics	1	C	2	1,2,5
12.	Lexical analysis – parsing	2	C,I	2	1,2
13.	Recursive-decent	2	C,I	2	1
14.	Bottom-up parsing	2	C,D,I	2	1
	UNIT III: DATA TYPES, AND BASIC STATEMENTS	**9**			
15.	Names – variables – binding	2	C	3	1,3
16.	Scope – scope rules	1	C	3	1
17.	Primitive data types – strings – array types-record types-union types	2	C	3	1,3,4
18.	Arithmetic expressions – overloaded operators – type conversions – relational and boolean expressions	2	C,D,I	1,3	1,3
19.	Control structures – selection – iterations – branching statements	2	C,D	1,3	1,3
	UNIT IV: SUBPROGRAMS AND IMPLEMENTATIONS	**9**			
20.	Subprograms – design issues – local referencing	1	C	4	1
21.	Parameter passing – overloaded methods – generic methods	2	C,I	4	1
22.	design issues for functions	3	C,D,I	4	1

23.	Implementing simple subprograms – stack and dynamic local variables	2	C,I	4	1
24.	Nested subprograms – blocks – dynamic scoping	1	C,I	4	1
	UNIT V: OBJECT-ORIENTATION, CONCURRENCY, AND EVENT HANDLING	**9**			
25.	Object-orientation – design issues for OOP languages	1	C	3,5	1
26.	Implementation of object-oriented constructs	2	C,I	3,5	1
27.	Concurrency – semaphores – monitors	2	C,D,I	5	1
28.	Message passing – threads	2	C	3,5	1
29.	Exception handling-event handling	2	C	3,5	1
Total contact hours		45			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Robert W. Sebesta, “Concepts of Programming Languages”, Tenth Edition, Addison Wesley, 2012.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	Michael L. Scott, “Programming Language Pragmatics”, Third Edition, Morgan Kaufmann, 2013.
3.	“The Scheme programming language”, Fourth Edition, MIT Press, 2009.
4.	Jeffrey D. Ullman, “Elements of ML programming”, Second Edition, Prentice Hall, 1998
5.	Richard A. O'Keefe, “The craft of Prolog”, MIT Press, 2009.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15CS322E	**Neuro Fuzzy And Genetic Programming**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Elective				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	This course provides a way to understand the concepts of Neural Networks , Fuzzy Systems and Genetic Algorithms and its applications							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, students will be able to								
1.	Understand the fundamentals of Neural Networks	a						
2.	Learn the various topologies and learning algorithms of ANN	a	i					
3.	Understand the principles and fundamentals of Fuzzy Logic	a						
4.	Understand the Fuzzy Rule based systems	a	i					
5.	Understand the concepts and techniques of Genetic Algorithms	a	i					

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I FUNDAMENTALS OF ARTIFICIAL NEURAL NETWORKS AND SIMPLE MODELS		**8**			
1.	Biological and Artificial Neuron, History of ANN	1	C	1	1,2,4
2.	ANN architectures and Learning Algorithms	1	C	1	1,2,4
3.	Activation Functions, Bias Threshold and other parameters	1	C	1	1,2,4
4.	McCullosh Pitts model, Simulation of Logic Functions	1	C	1	1,2,4
5.	Perceptron Network, Hebbian network	1	C	1	1,2,4
6.	Linear Separability problem and solutions	1	C	1	1,2,4
7.	ADALINE and MADALINE networks	1	C	1	1,2,4
8.	Practice of Neural Network tool : Simple Logic functions, XOR problem,	1	C,I	1	1,2,4
UNIT II FEEDFORWARD NETWORK, PATTERN ASSOCIATION, UNSUPERVISED LEARNING		**10**			
9.	Delta Rule, Derivation of GDR	1	C	2	1,2,4
10.	Backpropagation Algorithm, Local Minima Problem	1	C	2	1,2,4
11.	Radial Basis Function	1	C	2	1,2,4
12.	Pattern Association, Auto Associative nets	1	C	2	1,2,4
13.	Hetero Associative nets	1	C	2	1,2,4
14.	Bidirectional Associative Memory	1	C	2	1,2,4
15.	Hopfield network	1	C	2	1,2,4
16.	Competitive networks: Maxnet, SOM	1	C	2	1,2,4
17.	Learning Vector Quantization, Adaptive Resonance Theory	1	C	2	1,2,4
18.	Practice of Neural Network tool : Delta rule, Associative memory, LVQ	1	C,I	2	1,2,4
UNIT III FUNDAMENTALS OF FUZZY LOGIC		**10**			
19.	Crisp sets, Fuzzy sets, Fuzzy membership functions	1	C	3	1,2,5
20.	Operations of Fuzzy sets, Fuzzy Relations, Operations	1	C	3	1,2,5
21.	Fuzzy Extension Principle	1	C	3	1,2,5
22.	Crisp Relations, Fuzzy relations, Properties, operations,	2	C	3	1,2,5
23.	Crisp Logic, Propositional Logic, Predicate Logic Rules of Inference	2	C,D	3	1,2,5
24.	Fuzzy Truth, Fuzzy Rules,	1	C	3	1,2,5
25.	Fuzzy Reasoning	1	C	3	1,2,5
26.	Practice of Fuzzy Logic tool: Fuzzy functions, operations	1	C,I	3	1,2,5
UNIT IV FUZZY RULE BASED AND INFERENCESYSTEMS		**8**			
27.	Fuzzification of Input Variables, Application of Fuzzy operations	1	C	4	1,5
28.	Evaluation of Fuzzy rules, Aggregation of output Fuzzy sets	1	C	4	1,2,5
29.	Rule based systems, Conventional programs vs Rule based systems	1	C	4	1,2,5
30.	Fuzzy Propositions	1	C	4	2,5

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
31.	Fuzzification and Defuzzification	1	C	4	1,2,5
32.	Fuzzy Controller : Air conditioner control, Cruise Controller	1	C	4	1
33.	Fuzzy Decision making	1	C	4	1,2
34.	Practice of Fuzzy Logic tool : Fuzzy controller design and applications	1	C,I	4	1,2
UNIT V CONCEPTS AND TECHNIQUES OF GENETIC ALGORITHMS		**9**			
35.	History of Evolutionary Computing, Genetic Algorithms, basic concepts	1	C	5	1,2,3,6
36.	GA Cycle , Fitness Function, Introduction to GA Operators	1	C	5	1,2,3,6
37.	Selection Operators, Crossover, Mutation Operations	2	C	5	1,2,3,6
38.	Schema Theorem, Example	1	C,D	5	1,2,3,6
39.	Classification of Genetic Algorithm	1	C	5	1,2,3
40.	Holland Classifier Systems	1	C	5	1,2,3
41.	Genetic Programming, Data Representation	1	C	5	1,2,3
42.	Application of Genetic Algorithm, Genetic Operators	1	C,D,I	5	1,2,3,6
Total contact hours		**45***			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Samir Roy, Udit Chakraborty, “Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms”, Pearson Education, 2013
2.	B.K.Tripathy, J.Anuradha,” Soft Computing”, Cengage Learning, 2015
3.	S.N.Sivanadam, S.N.Deepa,”Principles of Soft Computing, Wiley India Edition, 2007
4.	Laurene Fausett, "Fundamentals of Neural Networks, Architectures, Algorithms and Applications”, Pearson Education, 2008
	REFERENCE BOOKS/OTHER READING MATERIAL
5.	Timothy J. Ross , “Fuzzy Logic with Engineering Applications”, McGraw-Hill International Editions,1995
6.	David E. Goldberg, “Genetic Algorithms-In Search, optimization and Machine Learning”, Pearson Education

Course nature		**Theory**					
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS323E	**Distributed Computing**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	P	Professional Elective			
Course designed by	Department of Computer Science and Engineering				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE	To provide knowledge on principles and practice underlying in the design of distributed systems.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Layout foundations of Distributed Systems.	a						
2.	Get familiar with the idea of middleware and related issues	a						
3.	Understand in detail the system level and support required for distributed system	a						
4.	Understand the issues involved in studying data and cryptographic algorithms	a	e					
5.	Expose to the concept of design and implementation of distributed file systems	a	c					

Session	**Description of Topic**	**Contact hours**	**C- D- I- O**	**IOs**	**Reference**
UNIT I: INTRODUCTION		**7**			
1.	Introduction - overview of syllabus- Applications	1	C	1-5	1-3
2.	Examples of Distributed Systems	2	C	1	1
3.	Trends in Distributed Systems	2	C	1	1
4.	Focus on resource sharing	1	C	1	1
5.	Challenges	1	C	1	1
UNIT II: COMMUNICATION IN DISTRIBUTED SYSTEM		**9**			
6.	System Model– Physical model	1	C,D	2	1
7.	Architectural Model	1		2	1,3
8.	Fundamental Model	2	C,D	2	1
9.	Inter process Communication	1	C,D	2	1
10.	External data representation and Multicast communication	1	C,D	2	1
11.	API for internet protocols	1	C,D	2	1
12.	Network Virtualization: Overlay Networks	1	C,D	2	1
13.	Case Study: MPI	1	C,D	2	1
UNIT III: REMOTE METHOD INVOCATION AND OBJECTS		**10**			
14.	Remote Invocation – Introduction	1	C	3	1
15.	Request-reply protocols	1	C	3	1
16.	Remote procedure call	1	C	3	1
17.	Remote method invocation	1	C	3	1,2
18.	Design Issues	2	C,D	3	1
19.	Group communication - Publish-subscribe systems	2	C,D	3	1,3
20.	Shared memory approaches -Distributed objects	1	C	3	1,3
21.	Case study: CORBA	1	C	3	1
UNIT IV: SECURITY		**10**			
22.	Introduction- Overview of security techniques	1	C	4	1
23.	Cryptographic algorithms	3	C,I	4	1
24.	Digital Signatures	2	C,I	4	1
25.	Cryptography pragmatics	2	C	4	1
26.	case study: Kerberos	2	I	4	1
UNIT V: Distributed File System and Name Services		**9**			
27.	Distributed File Systems –Introduction	1	C	5	1
28.	File service architecture	2	C,D	5	1
29.	case study: Andrew File system	2	C	5	1
30.	Name Services- Introduction	1	C	5	1
31.	Name Services and Domain Name System	1	C	5	1
32.	Directory Services	1	C	5	1
33.	Case study:The X.500 Directory Service	1	C	5	1

Session	Description of Topic	Contact hours	C- D- I- O	IOs	Reference
Total Contact Hours		**45***			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems Concepts and Design” Fifth edition – 2011- Addison Wesley.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	Tanenbaum A.S., Van Steen M., “ Distributed Systems: Principles and Paradigms” , Pearson Education,2007.
3.	Liu M.L., “Distributed Computing, Principles and Applications”, Pearson and education,2004.

Course nature				**Theory**		
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15IT345E	Linux Internals	L	T	P	C
		3	0	0	3

Co-requisite:	NIL	
Prerequisite:	15IT314J- PRINCIPLES OF OPERATING SYSTEMS/ 15CS201J DATA STRUCTURES	
Data Book / Codes/Standards	NIL	
Course Category	P	PROFESSIONAL ELECTIVE
Course designed by	Department of Information Technology	
Approval	32nd Academic Council Meeting , 23rd July 2016	

PURPOSE	This course enables the student to understand the kernel- buffers and file representation, process control and scheduling and memory management policies in Unix.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand the kernel structure of Unix operating system	k						
2.	Understand the concepts of buffers and file system internal structures	j						
3.	Understand the concepts of process structure and process scheduling	j						
4.	Understand the concepts of kernel memory management policies	j						

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**	**Text Books**
	UNIT I : INTRODUCTION TO UNIX KERNEL	**6**			
1.	History and system structure , user perspective and operating system services	2	C	1	1
2.	Kernel architecture of Unix	1	D	1	1
3.	Unix system concepts	2	D,I	1	1
4.	Kernel data structure and system administration	1	C	1	1
	UNIT II : FILE REPRESENTATION INTERNALS AND SYSTEM CALLS	**11**			
5.	Introduction to file system algorithms and inodes	1	C	2	1
6.	Structure of a regular file: context of inode	1	C,D	2	1
7.	Directories and super blocks, path name to inode conversion	1	C	2	1
8.	Introduction to system calls and algorithms	2	C,D	2	1
9.	System calls: open and read, write and close.	3	C	2	1
10.	Mounting file systems, crossing mount point file paths, unmounting file systems and file system maintenance.	3	C	2	1
	UNIT III : KERNEL BUFFER CACHE	**6**			
11.	Buffer headers	1	C	2	1
12.	Structure of buffer pool	1	I	2	1
13.	Buffer retrieval scenarios	1	C,D	2	1
14.	Reading and writing disk blocks	1	C	2	1
15.	Buffer cache implementations and analysis	2	C,I,O	2	1
	UNIT IV: PROCESS STRUCTURE, SCHEDULING, CONTROL AND MEMORY MANAGEMENT	**13**			
16.	Structure of process**:** process states and transitions	1	C	3	1
17.	System memory layout	2	C,D,I	3	1
18.	Context of a process, introduction to process control and creation	2	C	3	1
19.	Signals	1	C,I	3	1
20.	System boot and init process, process scheduling	3	C	3	1
21.	Terminal drivers	1	C	3	1
22.	Memory management policies: swapping , memory management policies: demand paging	3	C,I	3	1
	UNIT V: MULTI PROCESS AND DISTRIBUTED UNIX SYSTEM	**9**			
23.	Introduction to multi process systems, master and slave processors	2	C	3	1
24.	Tunis system and performance, distributed Unix system : satellite processors	3	C	3	1

25.	Newcastle connection	2	C	3	1
26.	Transparent distributed file system, distributed file system : stub process	2	C	3	1
	TOTAL CONTACT HOURS	45*			

Sl. No.	LEARNING RESOURCES
1.	Maurice J.Bach, The Design of the UNIX Operating System, Pearson Education 1990. ISBN 13: 9780132017572.
2.	UreshVahalia, UNIX Internals: The New Frontiers, Pearson Education 2003, ISBN-13: 978-0131019089
3.	Behrouz A. Forouzan, UNIX and Shell Programming, Cengage Learning 2009, ISBN-13: 978-0534391553
4.	http://www.ee.surrey.ac.uk/Teaching/Unix/ as on Date 26 -04-2016
5.	http://www.cs.sfu.ca/~ggbaker/reference/unix/ as on Date 26 -04-2016
6.	http://www.tutorialspoint.com/unix/unix-getting-started.htm as on Date 26 -04-2016
7.	http://www.tutorialspoint.com/unix/unix-useful-commands.htm as on Date 26 -04-2016

Course nature					**Theory**		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
						End semester examination Weightage :	**50%**

* - Excluding Assessment Hours

15SE334E	**Advanced Java Programming**	**L**	**T**	**P**	**C**
		2	**2**	**0**	**3**
Co-requisite:	NIL				
Prerequisite:	15SE205J				
Data Book / Codes/Standards	NIL				
Course Category	P PROFESSIONAL ELECTIVE				
Course designed by	Department of Software Engineering				
Approval	32nd Academic Council Meeting, 23rd July, 2016				

PURPOSE	Having a hands on core java programming concepts, this course reviews advanced concepts in programming that motivate the students to build innovative applications. This course explores the skills required to develop J2EE enterprise applications using the Java programming language.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1	Design interactive applications with GUI Components such as Java FX.	d						
2	Make effective use of Java networking API to communicate between processes using network sockets	c						
3	Develop database applications using JDBC	c						
4	Designing Java Sever Pages and Java Servlet	i						
5	Understand Java Reflection API and XML DOM Parser related to Industry trends.	c						

Session	**Description of Topic (Theory)**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: JAVA GUI PROGRAMMING USING JAVA FX	**6**			
1	Basics of Java FX	1	C	1	1-5
2	Java FX and Containers	2	C	1	1-5
3	Frames, Layout Manager	1	C	1	1-5
4	Menus and Toolbars	1	C	1	1-5
5	Event Handling	1	C	1	1-5
6	Review of Unit I	1	C	1	1-5
	UNIT II: JAVA DATABASE CONCEPTS(JDBC 4)	**6**			
7	Database Architecture : Components of JDBC – Two Tier/ Three Tier Architecture Processing SQL Statements	1	D	3	1-5
8	Establish Connection : [Using Driver Manager class, Connection URLs], Types – Concurrency – Read column values from rows – Updating rows in a result set	1	D	3	1-5
9	Create a statement – Execute Query – Process Result Set, Reading from and modifying values in a Result Set	1	D	3	1-5
10	Handling SQL Exceptions : Contents of SQLException object , Retrieving warnings using SQLWarning object	1	D	3	1-5
11	Statements Creating Prepared Statement object – Assign values for Prepared Statement parameters	2	I	3	1-5
	UNIT III: JAVA NETWORKING	**6**			
12	URL: Creating and Parsing URL – URLConnection : Connecting to a URL	1	D	2	1-5
13	Reading from and Writing to aURLConnection.	1	C	2	1-5
14	Socket: Server Socket/Socket class	1	C	2	1-5
15	InetAddress. Datagram's: Writing a datagram client and server	1	C	2	1-5
16	Datagram Socket, Datagram Packet – Broadcasting tomultiple recipients	1	D	2	1-5
17	Multicast Socket-SSL and HTTPS in Java,RMI	1	D	2	1-5

	UNIT IV: JAVA SERVER SIDE TECHNOLOGIES	**6**			
18	Overview of JSP2.2 and Servlet 3.1	1	C	4	1-5
19	Creating dynamic WebPages using JSP and Servlet- Standard Tag Library	1	I	4	1-5
20	Database Access- XML Data	1	I	4	1-5
21	Java Beans - Custom Tags - Expression Language – Annotations	1	C	4	1-5
22	Filters-Event handling-Exception Handling - Asynchronous processing	1	I	4	1-5
23	Debugging - Security – Internationalization	1	C	4	1-5
	UNIT V: REFLEXTION API & JAVA XML	**6**			
24	Introduction to Java Reflextions API	1	I	5	1-5
25	Introspection	1	I	5	1-5
26	Dynamic Proxies	1	I	5	1-5
27	Dynamic class loading and reloading	1	I	5	1-5
28	Java XML: XML Processing	1	I	5	1-5
29	SAX and DOM Parser	1	I	5	1-5
	Total Hours		30		

Sl. No.	**Description of Tutorials**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
1.	Programs on Java FX basic components with containers and frames	3	I	1	1-5
2.	Programs on Java FX menu bars and tool bars	3	D	2	1-5
3.	Programs on TCP and UDP Socket	3	D	2	1-5
4.	Programs on Multicast Socket Applications	3	I	2	1-5
5.	Programs on Java RMI Concepts	3	I	2	1-5
6.	Programs on JDBC data base connectivity and normal execution of queries	3	D	3	1-5
7.	Programs on Result Set iteration and Prepared Statements	3	I	4	1-5
8.	Programs on designing pages using JSP	3	D	4	1-5
9.	Programs on MVC Based Web Applications	3	D	5	1-5
10.	Programs on SAX and DOM Parser.	3	I	5	1-5
	Total contact hours	30			

Sl. No.	**LEARNING RESOURCES**
1	Carl Dea, Mark Heckler, GerritGrunwald, José Pereda, Sean Phillips *“JavaFX 8: Introduction by Example” Apress* 2^{nd} *Edition 2014*
2	Kogent Learning Solutions Inc, “Java Server Programming Java EE 7 (J2EE 1.7), Black Book”, dreamtechpress 2015
3	Elliotte Rusty Harold,”Java Network Programming, 4th Edition Developing Networked Applications “O'Reilly Media, Final Release Date: October 2013
4	Paul Deital,HarveyDeital,”Java How to Program. “10^{th} Edition,2015
5	http://pdf.coreservlets.com/
6	https://docs.oracle.com/javase/tutorial

Course nature				**Theory**	
Assessment Method – Theory Component (Weightage 50%)					
In-semester	**Assessment tool**	**Cycle Test I**	**Cycle Test 2**	**Tutorial (Mini Project)**	**Total**
	Weightage	**10%**	**15%**	**25%**	**50%**
				End semester examination Weightage :	**50%**

15SE329E	**Visual Programming**	**L**	**T**	**P**	**C**
		2	**2**	**0**	**3**
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	P	PROFESSIONAL ELECTIVE			
Course designed by	Department of Software Engineering				
Approval	32nd Academic Council Meeting, 23rd July 2016				

PURPOSE	To acquire knowledge in windows and visual programming concepts							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand the basics of C# and .NET framework	a						
2.	Develop applications using object-oriented aspects of C#	a	b					
3.	Design Windows applications	a	b	e				
4.	Create Database applications using ActiveX Data Objects	a	b	e				
5.	Develop Web based applications	a	b	e				

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: INTRODUCTION TO C#	**7**			
1.	Introducing C# - Understanding .NET Framework	1	C	1	1
2.	Overview of C# - Literals – Variables Data Types – Operators – Constants - Expressions	1	C	1	1
3.	Program Control Statements: Branching, Looping	1	C,I	1	1
4.	Casting - Methods	1	C,I	1	1
5.	Arrays: Array Class, Array List	1	C,I	1	1
6.	Strings: String, String Builder	1	C,I	1	1
7.	Structures - Enumerations	1	C,I	1	1
	UNIT II: OBJECT ORIENTED ASPECTSOF C#	**6**			
8.	Class – Objects, Constructors – Types of Constructors	1	C	2	1,2
9.	Inheritance and its types	1	C,I	2	1,2
10.	Indexers and Properties	1	C	2	1,2
11.	Polymorphism – Operator and Method Overloading	1	C,I	2	1,2
12.	Interfaces, Abstract Class	1	C,I	2	1,2
13.	Event Handling, Errors and Exception Handling	1	C,I	2	1,2
	UNIT III: APPLICATION DEVELOPMENT ON .NET	**6**			
14.	Building Windows Application	1	C,I	3	2,3
15.	Creating Window Forms with Events and Controls	1	C,D,I	3	2,3
16.	Menu and Toolbar	1	C,I	3	2,3
17.	Delegates - Inheriting Window Forms	1	C,I	3	2,3
18.	SDI and MDI Application	1	C	3	2,3
19.	Dialog Box: Modal and Modeless	1	C,I	3	2,3
	UNIT IV: DATABASE APPLICATION ON .NET	**5**			
20.	Accessing data with ADO.NET: DataSet, Typed Dataset, Data Adapter	1	C,D,I	4	2,3
21.	Updating Database using Stored Procedures	1	C,I	4	2,3
22.	SQL Server with ADO.NET	1	C,D,I	4	2,3
23.	Handling Exceptions – Validating Controls	1	C,I	3	2,3
24.	Windows Application Configuration	1	C	3	2,3
	UNIT V: WEB BASED APPLICATION DEVELOPMENT ON .NET	**6**			
25.	Programming Web Application with Web Forms	1	C	5	2,5
26.	Introduction to ASP.NET, Working with XML and .NET	1	C,I	5	2,5
27.	Creating Virtual Directory and Web Application	1	C,D,I	5	2,5
28.	Session Management	1	C,D,I	5	2,5

29.	Web Services – web.config, Passing Datasets and Returning Datasets from Web Services	1	C,I	5	2,5
30.	Transaction Handling, Exception Handling – Returning Exceptions from SQL Server	1	C,I	5	2,5
	Total contact hours	30			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Herbert Schildt, “The Complete Reference: C# 4.0”, Tata McGraw Hill, 2012.
2.	Christian Nagel et al. “Professional C# 2012 with .NET 4.5”, Wiley India, 2012.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Andrew Troelsen , “Pro C# 2010 and the .NET 4 Platform, Fifth edition, APress, 2010.
4.	Ian Griffiths, Matthew Adams, Jesse Liberty, “Programming C# 4.0”, Sixth Edition, O’Reilly, 2010.
5.	Matthew MacDonald, “Beginning ASP.NET 4.5 in C#”, APress, 2012
6.	Stephen C. Perry, “Core C# and .NET”, Prentice Hall, 2005

S. No.	Description of Experiments	Contact hours	C-D-I-O	IOs	Reference
1.	Simple programs for implementing Control Structures	2	C,I	1	1-6
2.	Programs to implement Arrays, Structures and Strings	4	C,I	1	1-6
3.	Programs to implement console applications using • Properties • Inheritance • Interface • Polymorphism • Exception Handling	4	C,D,I	2	1-6
4.	Programs to implement Event and Delegates	2	C,I	3	1-6
5.	Programs to build windows applications using • MDI • Dialogs • Windows controls	4	C,D,I	3	1-6
6.	Program to access database with ADO.NET	2	C,D,I	4	1-6
7.	Program to implement Data binding controls	2	C,D,I	4	1-6
8.	Programs to implement ASP.Net Validation controls and handling exceptions	2	C,I	4	1-6
9.	Programs to implement a) Reading and Writing XML files b) XML Validation C) Database Table to XML and XML to Table Conversion	2	C,I	1,5	1-6
10.	Program to develop a Web service	2	C,D,I	5	1-6
11.	Program to implement Master and content pages	2	C,D,I	3,5	1-6
12.	Design a Web page using ASP.NET	2	C,D,I	3,4,5	1-6
	Total Contact Hours	**30**			

Course nature				**Theory + Practical**	
Assessment Method – Theory Component (Weightage 50%)					
In-semester	**Assessment tool**	Cycle test I	Cycle test II	**Tutorial Project**	**Total**
	Weightage	**10%**	**15%**	**25%**	**50%**
				End semester examination Weightage :	**50%**

15IT322E	Python Programming	L	T	P	C

			2	**2**	**0**	**3**
Co-requisite:	NIL					
Prerequisite:	15SE201J Object Oriented Programming Using C++					
Data Book / Codes/Standards	NIL					
Course Category	P	Professional Elective				
Course designed by	Department of Information Technology					
Approval	32nd Academic Council Meeting , 23rdJuly 2016					

PURPOSE	Python has evolved into a powerful high level language that implements a deliberately clear syntax and a highly coherent programming model. Python is more preferred for its features of portability, productivity and extensive support libraries and seamless integration with components coded in any other programming language. As an information technology undergraduate student, knowledge of Python is highly required for scientific computing and efficient software development.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Appreciate the basic and advanced features of core language built ins	i						
2.	Handle and control system/OS level features	c						
3.	Communicate using sockets, write client and server side scripts	c						
4.	Design and implement basic applications with database connectivity	i						

Session	**Description of Topic (Theory)**	**Contact Hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: CORE PYTHON : BASICS		**6**			
1.	Introduction to Python, Python Interpreter and its working, Syntax and Semantics	1	C	1	1
2.	Data Types, Assignments and Expressions, Control Flow Statements	2	C	1	1
3.	Sequences and Dictionaries	2	C	1	1
4.	Functions and lambda expressions	1	C	1	1
UNIT II: CORE PYTHON : ADVANCED FEATURES		**6**			
5.	Iterations and Comprehensions	1	C	1	1
6.	Handling text files	1	C	1	1,2
7.	Modules, Classes and OOP	2	D	1	1
8.	Exception Handling	1	D	1	1
9.	Strings and Regular Expressions	1	D	1	1,2
UNIT III: SYSTEM PROGRAMING		**7**			
10.	System tools : OS and Sys modules	2	C	2	2
11.	Directory Traversal tools	2	C	2	2
12.	Parallel System tools : threading and queue, Program Exits	3	C	2	2
UNIT IV: NETWORK AND WEB PROGRAMMING		**5**			
13.	Socket Programming : Handling Multiple Clients	1	C	3	2
14.	Client side scripting, urlib	1	C	3	2
15.	Server Side Scripting : CGI Scripts with User Interaction, Passing Parameters	3	C	3	2
UNIT V: GUI PROGRAMMING AND DATABASE CONNECTIVITY		**6**			
16.	Introduction to tkinter, Top Level Windows, Dialogs, Message and Entry	2	C	4	2
17.	Event Handling, Menus, Listboxes and Scrollbars, Text	2	C	4	2
18.	SQL Database interfaces with sqlite3 : Basic operations and table load scripts	2	C	4	2
	TOTAL CONTACT HOURS	30^*			
	TUTORIAL HOURS	30			

Sl.	**LEARNING RESOURCES**

No.	
1.	Mark Lutz ,"Learning Python", O Reily, 4thEdition, 2009, ISBN: 978-0-596-15806-4
2.	Mark Lutz ,"Programming Python ", O Reily, 4thEdition, 2010, ISBN 9780596158118
3.	Tim Hall and J-P Stacey ,"Python 3 for Absolute Beginners" , 2009, ISBN:9781430216322
4.	Magnus Lie Hetland , "Beginning Python: From Novice to Professional", 2nd Edition, 2009, ISBN:9781590599822

<table>
<tr><td colspan="5"><b>Course nature</b></td><td colspan="2"><b>Theory +Tutorial</b></td></tr>
<tr><td colspan="7"><b>Assessment Method (Weightage 100%)</b></td></tr>
<tr><td rowspan="2"><b>In-semester</b></td><td><b>Assessment tool</b></td><td>Cycle test I</td><td>Cycle test II</td><td>Cycle Test III</td><td>Tutorial</td><td><b>Total</b></td></tr>
<tr><td><b>Weightage</b></td><td><b>10%</b></td><td><b>10%</b></td><td><b>15%</b></td><td><b>15% [Experiments (10%) + Mini Project(5%)]</b></td><td><b>50%</b></td></tr>
<tr><td colspan="6"><b>End semester examination Weightage :</b></td><td><b>50%</b></td></tr>
</table>

* - Excluding Assessment Hours

15SE328E	**Programming In PHP**		**L**	**T**	**P**	**C**
			2	**2**	**0**	**3**
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL ELECTIVE				
Course designed by	Department of Software Engineering					
Approval	32nd Academic Council Meeting, 23rd July, 2016					

PURPOSE	PHP and MySQL are the emerging open source technology to construct web application. PHP provided with huge set of standard library and function which aids us to build and deploy application in repaid fashion. Delegate students a good practical knowledge of how to write successful HTML/PHP code utilizing a MySQL database

	INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Acquaint themselves with the fundamental concepts and programming environment of PHP.	a	e					
2.	Design classes and efficiently use PHP functions	b	c					
3.	Implement object oriented concepts like inheritance, reusability, and encapsulation.	c						
4.	Apply custom exceptions and employ concurrency.	a						
5.	Understand and Design the Database using MySQL.	a	k					

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: PHP FUNDAMENTALS	**07**			
1	PHP – Exploring the PHP Environment – HTML Embedding	1	C	1	1,5
2	Comments - Variables	1	C	1	1,5
3	Data types – Operators – PHP String functions	1	C	1	1,5
4	Controls Structures	1	C	1	1,5
5	Arrays – Types – Multi dimension array – Array functions	2	C,I	1	1,5
6	Functions in PHP	1	C,I	1	1,5
	UNIT II: PHP OO LANGUAGE	**06**			
7	Introduction – Object, Class, new Keyword, Constructor, Destructor	1	C,D	1,4	1
8	Accessing Methods and Properties Using the$this Variable	1	D	4	1
9	Class Constants, Cloning Objects, polymorphism	1	C	4	1
10	parent :: and self :: , instanceof Operator, Abstract method and Classes	1	C,D	4	1
11	Interfaces and Inheritance of Interfaces. Final methods, Overloading	1	D	3	1
12	Exception handling	1	C,D	4	1
	UNIT III: WEB PAGES WITH PHP	**06**			
13	Embedding into HTML, User Input, Safe Handling user Input	1	C	1,3	1
14	PHP Form, form processing	1	C	1	1
15	Working with Form Data, GET, POST, REQUEST	1	C	4	1
16	Reading Data in web Pages	1	C,I	4	1
17	Performing Data validation, required data, number , text	1	C,I	4	1
18	Cookies and Session in PHP`	1	C,D	4	1

	UNIT IV: WORKING WITH DATABASE	**06**			
19	MySQL, Creating Database and Table, CURD	2	C	4,5	1,2,3
20	JOIN, Aggregate Queries	1	C,I	2,4	1,2,3
21	Connecting to MySQL with PHP, Accessing and Updating Database with PHP	1	C,I	4	1,2,3
22	SQL injections	1	C	4	1,4
23	Prepared Statements	1	C	4	1
	UNIT V: ADVANCED CONCEPTS	**05**			
24	File Handling -Create, Open, read, write to files	1	C,I	4	1
25	Working with FTP in PHP	1	C,I	4	1
26	PHP mail functions, Advanced mail functions	1	C	2,3	1,4
27	Building and Formatting dates and times	1	C	2,5	1
28	PHP filters	1	C	2,5	1
Total contact hours		30			

Note: Students are given individual application, for that they have to do the case study specified in each unit.

DETAILS OF TUTORIALS

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IO**	**Reference**
1	Installing and Configuring XAMPP or WAMPP Web Server	2	O	1	1
2	Installing and Configuring MySQL Server	2	O	1	1
3	Case Study: For the given application, the students has to implement the classes and methods.	4	D,I	2,3	1
4	Case Study: Create and includes the necessary exception handling statements inside the applications	2	D,I	4	1
5	Case Study: Create the webpages for the application	4	D,I	2	1
6	Case Study: implement validation for the web pages using PHP Scripts	2	D,I	1	1
7	Case Study: Implement the Session and cookies to manage the user sessions	2	D,I	1	1
8	Case Study: Create the necessary database and tables for the given application	2	D,I	5	1
9	Case Study: Write the code to interface the database with the web application	2	D,I	5	1
10	Case Study: Implement the file handling to enable user to upload and download files	2	D,I	1	1
11	Case Study: Implement the graphing function using PHP Library	2	D,I	1	1
12	Case Study: Implement the mailing to enable the user to communicate	2	D,I	1	1
13	Case Study: implement the PHP filters in the application and deploy the same in XAMPP	2	D,I	1	1
Total Contact Hours		30			

LEARNING RESOURCES

Sl. No.	**TEXT BOOKS**
1.	Steven Holzner, “PHP: The Complete Reference”, Tata McGraw Hill Education, 1st Edition,2007.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	Luke Welling, Laura Thomson, “PHP and MySQL Web Development”, Pearson, 4th Edition, 2009.
3.	Larry Ullman, “PHP and MySQL for Dynamic Web Sites”, Prentice Hall, 4th Edition, 2016.
4.	George Schlossnagle,“Advanced PHP Programming”, First Edition, Sams Publishing, 2004.
5.	http://www.w3schools.com/php/

Course nature			**Theory**		
Assessment Method – Theory Component (Weightage 50%)					
In-semester	**Assessment tool**	**Cycle Test 2**	**Cycle Test 2**	**Mini Project**	**Total**
	Weightage	**10%**	**15%**	**25%**	**50%**
				End semester examination Weightage :	**50%**

15IT323E	**GAME PROGRAMMING**		**L**	**T**	**P**	**C**
			2	**2**	**0**	**3**
Co-requisite:	NIL					
Prerequisite:	15SE201J Object Oriented Programming Using C++					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL ELECTIVE				
Course designed by	Department of Information Technology					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	The purpose of this course is to provide 2D and 3D game programming skills for students.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand the principles of windows programming	m						
2.	Gain knowledge on DirectX programming	m						
3.	Make use of audio and input devices	i						
4.	Develop simple games in windows environment	i						

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: WINDOWS PROGRAMMING	**6**			
1.	Overview of windows programming	2	C	1	1
2.	Overview of DirectX, Basics of windows program	2	C	1	1
3.	Windows messaging and Event Handling, Real time Game Loop	2	C	1	1
	UNIT II: DIRECTX PROGRAMMING	**6**			
4.	Getting started with Direct 3D	1	C	2	1
5.	Surfaces and Bitmaps	2	C	2	1
6.	Drawing Animated, Transparent and Tiled Sprite	3	C,I	2	1
	UNIT III: DIRECTX AUDIO AND INPUT DEVICES	**6**			
7.	Using Direct Sound	2	C,I	3	1
8.	Testing Direct Sound	1	C,I	3	1
9.	Keyboard, Mouse	2	C,I	3	1
10.	Paddle Game	1	C,I	3	1
	UNIT IV:3D GRAPHICS AND 3D MODELS	**6**			
11.	Introducing to 3D Programming	1	C	4	1
12.	Textured cube demo	1	I	4	1
13.	Introducing Animator, Using Animator	2	C	4	1
14.	Creating car model	2	C,I	4	1
	UNIT V: 3D MODEL FILES AND GAME PROJECT	**6**			
15.	Converting 3D files	1	C	4	1
16.	Loading and Rendering a model file	2	C	4	1
17.	Playing the Game	1	I,O	4	1
18.	Creating the models, Bitmapped Font, Simple 3D collision detection	2	I,O	4	1
	TOTAL CONTACT HOURS	30*			
	TUTORIAL HOURS	30			

Sl. No.	**LEARNING RESOURCES**
1.	Jonathan S. Harbour, “*Beginning Game Programming”,* 3rd Edition, Course TechnologyPTR, 2009, ISBN:1-59200-585-3.
2.	David H. Eberly, “*3D Game Engine Design, Second Edition: A PracticalApproach to Real Time Computer Graphics*” , 2nd Edition, Morgan Kaufmann, 2006, ISBN:978-0122290633.
3.	JungHyun Han, “*3D Graphics for Game Programming*”, 1st Edition, Chapman andHall/CRC, 2011, ISBN:1439827370 9781439827376.
4.	Mike McShaffrfy, “*Game Coding Complete*”, 3rd Edition, Charles RiverMedia, 2009, ISBN:978-1584506805
5.	Ernest Adams and Andrew Rollings, “*Fundamentals of Game Design*”, 1st Edition, Prentice Hall, 2006, ISBN:978-0321643377

6.	Roger E. Pedersen, “*Game Design Foundations*”, 2nd Edition, Jones and BartlettLearning, 2009, ISBN:978-1598220346

Course nature					**Theory +Tutorial**	
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Tutorial	**Total**
	Weightage	**10%**	**10%**	**15%**	**15% [Experiments (10%) + Mini Project(5%)]**	**50%**
					End semester examination Weightage :	**50%**

* - Excluding Assessment Hours

15IT324E	**MOBILE APPLICATION DEVELOPMENT**	**L**	**T**	**P**	**C**
		2	**2**	**0**	**3**
Co-requisite:	NIL				
Prerequisite:	15SE205J Programming In Java				
Data Book / Codes/Standards	NIL				
Course Category	P	PROFESSIONAL ELECTIVE			
Course designed by	Department of Information Technology				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE		This course imparts the knowledge and skills necessary for developing mobile applications using the Android platform.						
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand the basics of Android devices and Platform.	i						
2.	Acquire knowledge on basic building blocks of Android programming required for App development.	k						
3.	Understand persistence Data storage mechanism in Android	j						
4.	Understand advanced application concepts like networking, Animations and Google Maps services etc.	j						
5.	Develop and publish Android applications in to Android Market	k						

Session	**Description of Topic (Theory)**	**Contact Hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: JAVA FX TECHNOLOGY FOR RICH CLIENT APPLICATIONS		**4**			
1.	**Introduction:** Introduction to mobile application development, trends, introduction to various platforms, introduction to smart phones	1	C	1	1,3,4
2.	**Android platform**: Android platform features and architecture, versions, comparison added features in each versions. ART(Android Runtime),ADB(Android Debug Bridge).	1	C	1	1,3,4
3.	**Development environment/IDE**: Android studio and its working environment, gradle build system, emulator setup	1	C	1	1,3,4
4.	**Application anatomy**: Application framework basics: resources layout, values, asset XML representation and generated R.Javafile ,Android manifest file. Creating a simple application.	1	C	2	1,3,4
UNIT II : ANDROID UI DESIGN		**7**			
5.	**GUI for Android**: Introduction to activities, activities life-cycle, Android v7 support library form API21 for lower version support	1	C,I	1	1,3,4
6.	**Intent** :intent object, intent filters ,adding categories, linking activities, user interface design components	2	C,I	1	1,3,4
7.	**Views and View Groups**: Basic views, picker views, adapter views, Menu, App Bar etc, basics of screen design; different layouts. App widgets. **Lollipop Material design**: new themes, new widgets, Card layouts. Recycler View	2	C,I	1	1,3,4
8.	**Fragments**: Introduction to activities, activities life-cycle.	2	C,I	1	1,3,4
UNIT III: DATA PERSISTENCE		**5**			
9.	**Different Data persistence schemes**: Shared preferences, File Handling, Managing data using SQLite database	3	C,I	3	1,3,4

10.	**Content providers**: user content provider, Android in build content providers.	2	C,I	2	1,3,4
UNIT IV: BACK GROUND RUNNING PROCESS, NETWORKING AND TELEPHONY SERVICES		**7**			
11.	**Services** :introduction to services – local service, remote service and binding the service, the communication between service and activity, Intent Service.	1	C,I	3	1,3,4
12.	**MultiThreading**: Handlers ,AsyncTask	2	C,I	3	1,3,4
13.	**Android network programming** :HttpUrlConnection, Connecting to REST-based and SOAP based Web services	2	C,I	3	1,3,4
14.	**Broad cast receivers:**LocalBroadcastManager, Dynamic broadcast receiver, System Broadcast. PendingIntent, Notifications	1	C,I	3	1,3,4
15.	**Telephony Manager**:Sending SMS and making calls.	1	C,I	3	1,3,4
UNIT V: ADVANCED APPLICATIONS		**7**			
16.	**Location based services**: Google maps V2 services using Google API,	1	C,I	4	1,3,4
17.	**Animations and Graphics:** Property Animation ,View Animations, Drawable Animations	1	C,I	4	1,3,4
18.	**Media and Camera API**: Working with video and audio inputs, camera API	1	C,I		1,3,4
19.	**Sensor programming**: Motion sensors, Position sensors, Environmental sensors.	2	C,I	4	2
20.	**Publishing Android Apps:** Guide lines, policies and process of uploading Apps to Google play	2	O	5	1,3,4
	TOTAL CONTACT HOURS	30*			
	TUTORIAL HOURS	30			

Sl. No.	**LEARNING RESOURCES**
1.	Dawn Griffiths, David Griffiths,*"Head First: Android Development" ,OReilly2015,ISBN*: 9781449362188
2.	Greg Milette,Adam Stroud,"PROFESSIONALAndroid™ Sensor Programming", John Wiley and Sons, Inc2012,ISBN/978111265055,9781280678943,978111227459
3.	Paul Deital,HarveyDeital, Alexander Wald, "Android 6 for Programmers ,App Driven approach",2015, Prentice Hall ,*ISBN*: 9780134289366
4.	http://developer.android.com/training/index.htmlas on Date 21.4.2016

Course nature				**Theory +Tutorial**		
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Tutorial	**Total**
	Weightage	**10%**	**10%**	**15%**	**15% [Experiments (10%) + Mini Project(5%)]**	**50%**
End semester examination Weightage :					**50%**	

* - Excluding Assessment Hours

15SE322E	**E-Commerce**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	P	PROFESSIONAL ELECTIVE			
Course designed by	Department of Software Engineering				
Approval	32nd Academic Council Meeting, 23rd July, 2016				

PURPOSE	Big corporations and financial institutions use the internet to exchange the financial data to facilitate domestic and international business. Data integrity and security are very hot and pressing issues for Electronic commerce. This course provides better understanding of the technical aspects and process of E-commerce.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Distinguish the E-Commerce framework and business model applications	a	g	h				
2.	Outline the Infrastructure of E-commerce	g						
3.	Apply security algorithms	e	k					
4.	Identify and operate e-payment mechanisms.	i						

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: INTRODUCTION	7			
1.	Introduction to E- Commerce	1	C	1	1
2.	Generic Framework of E- Commerce	1	C	1	1
3.	Business Models	2	C	1	1
4.	Consumer Oriented E- Commerce Applications	2	C	1	1
5.	Mercantile Process Models	1	C	1	1
	UNIT II: NETWORK INFRASTRUCTURE AND MOBILE COMMERCE	9			
6.	Network Infrastructure for E-Commerce	1	C	1,2	1,3
7.	Market forces behind I Way, Component of I way Access Equipment	2	C	1,2	1,3
8.	Global Information Distribution Network	1	C	2	2
9.	Broad band Telecommunication (ATM, ISDN, Frame Relay).	2	C	2	2
10.	Mobile Commerce, Mobile Computing Application	2	C	2	2
11.	Wireless Application Protocols, WAP Technology	1	C,D	2	2
	UNIT III: WEB SECURITY	**10**			
12.	Security Issues on Web- World Wide Web & Security	2	C,D	2,3	1
13.	Importance of Firewall- Components of Firewall,	2	C,I	3	2
14.	Factors to consider in Firewall Design- Limitations of Firewalls	2	C,D	2,3	2
15.	Transaction Security- Client Server Network	2	C	3	2
16.	Emerging Client Server Security Threats-Network Security.	2	C	3	2
	UNIT IV: SECURITY	**10**			
17.	Encryption Techniques	1	C	3	2
18.	Symmetric Encryption- Keys and Data Encryption standard, Triple encryption,	3	C,D	3	2
19.	Asymmetric encryption- Secret Key Encryption, Public and Private pair key encryption	3	C,D	3	2

20.	Digital Signatures-Virtual Private Network (VPN)	3	C,D	2,3	2
	UNIT V: ELECTRONIC PAYMENTS	**9**			
21.	Overview of Electronics payments, The SET Protocol, Payment Gateway, Certificates	2	C	4	1,4
22.	Digital Token, Smart Cards, Credit Cards, Magnetic Strip Cards, E-Checks, Credit/ Debit card EPS	2	C,D	4	1,4
23.	Mobile Payments, Online Banking, Home banking, Emerging financial Instruments,	2	C,D	4	1,4
24.	EDI Application in Business, E-commerce laws, Forms of Agreement, Government Policies and Agenda	2	C,D	4	2,5
25.	E-Commerce Strategy in Business Models and Internet Start-ups: A Business Case Study.	1	O	4	2,5
	Total contact hours	45			
LEARNING RESOURCES					
Sl. No.	**TEXT BOOKS**				
1.	Ravi Kalakota and Andrew B Whinston, “Frontiers of Electronic Commerce”, Pearson Education, 2013.				
2.	Greenstein and Feinman, “E-Commerce”, TMH,2001				
	REFERENCE BOOKS/OTHER READING MATERIAL				
3.	Denieal Amor, “The E-Business Revolution”, Addison Wesley, Second edition 2002.				
4.	Bajaj & Nag, “E-Commerce: The Cutting Edge of Business”, TMH,Second Edition 2005				
5.	DiwanParag / Sharma Sunil , “E-commerce :A Manager's Guide to E-Business”First edition 2000				

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
						End semester examination Weightage :	**50%**

15CS324E	**Machine Learning**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Elective				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	This Course will enable the students to study various aspects of Machine Learning and its applications useful in modern data processing							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, students will be able to								
1.	Understand the concepts of machine learning	a						
2.	Understand the clustering techniques and their utilization in machine learning	a	b					
3.	Study the neural network systems for machine learning	a	b					
4.	Learn and understand the linear learning models in machine learning	a						
5.	Study the tree based machine learning techniques and to appreciate their capability	a						

Session	**Description of Topic**	**Contact hours**	**C- D- I- O**	**IOs**	**Reference**
UNIT I: Introduction		**9**			
1.	Machine learning: What and why?	1	C	1	1,6
2.	Types of Machine Learning - Supervised Learning - Unsupervised Learning - reinforcement	1	C	1	1,2,6
3.	The Curse of dimensionality	1	C	1	1,6
4.	Over fitting and linear regression	1	C	1	1,6
5.	Bias and Variance	1	C	1	1,6
6.	Learning Curve	1	C	1	1,6
7.	Classification	1	C	1	1,6
8.	Error and noise	1	C	1	2,6
9.	Parametric vs. non-parametric models-Linear models	1	C	1	1,6
UNIT II: Clustering Approaches		**9**			
10.	Measuring (dis)similarity - Evaluating the output of clustering method	1	C	2	2,7
11.	Spectral clustering - Graph Laplacian - Normalized graph Laplacian	1	C	2	2,7
12.	Hierarchical clustering -Agglomerative clustering - Divisive clustering - Choosing the number of clusters	1	C	2	2,7
13.	Bayesian hierarchical clustering	1	C	2	2,7
14.	Clustering datapoints and features	1	C	2	2,7
15.	Bi-clustering	1	C	2	2,7
16.	Multi-view clustering	1	C	2	2,7
17.	K-Means clustering	1	C	2	2,7
18.	K-meloids clustering	1	C	2	2,7
UNIT III: NEURAL NETWORKS		**9**			
19.	Biological motivation for Neural Network ; Neural network Representation	1	C	3	4
20.	Perceptrons	1	C	3	4
21.	Feed forward networks	1	C	3	4
22.	Multilayer Networks and Back Propagation Algorithms	2	C	3	4
23.	Convergence and local minima and Hidden layer representation in back propagation	1	C,D	3	4
24.	Recurrent networks	1	C	3	4
25.	Application of neural network- Face recognition using neural network	2	C,D	3	4
UNIT IV: LINEAR MODELS		**9**			
26.	Linear Regression	1	C	4	2,5

Session	Description of Topic	Contact hours	C- D- I- O	IOs	Reference
27.	Logistic Regression	1	C	4	2,5
28.	Maximum Likelihood estimation (least squares)	1	C	4	1,5
29.	Robust linear regression	1	C	4	1,5
30.	Robust Linear Regression	1	C	4	1,5
31.	Ridge Regression	1	C	4	1,5
32.	Principal Component Analysis	1	C	4	1,5
33.	Bayesian Classifier	1	C	4	1 & 3
34.	Support Vector Machines	1	C	4	1
UNIT V: TREE LEARNING		**9**			
35.	Directed and Undirected trees	1	C	5	1
36.	Decision tree representation	1	C	5	**3**
37.	Basic decision tree learning algorithm	1	C	5	3
38.	Inductive bias in decision tree	1	C	5	3
39.	Issues in decision tree	1	C	5	3
40.	Classification and regression trees(CART)	1	C	5	1
41.	Random forest	1	C	5	1
42.	Multivariate adaptive regression trees(MART)	1	C	5	1
43.	Junction tree algorithm	1	C	5	1
Total contact hours		**45***			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012
2.	Ethem Alpaydin, “Introduction to Machine Learning”, Prentice Hall of India, 2005
3.	Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.
4.	Laurene Fausett, "Fundamentals of Neural Networks, Architectures, Algorithms and Applications”, Pearson Education, 2008
	REFERENCE BOOKS/OTHER READING MATERIAL
5.	Hastie, Tibshirani, Friedman, “The Elements of Statistical Learning” (2nd ed)., Springer, 2008
6.	Stephen Marsland, “Machine Learning –An Algorithmic Perspective”, CRC Press, 2009
7.	Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2006

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS325E	**Digital Image Processing**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Elective				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	To acquire knowledge about the procedure of digital image data acquisition, processing, analysis, and their application							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, students will be able to								
1.	Understand the digital image fundamentals.	a						
2.	Improve their ability in image enhancement and restoration	a	e					
3.	Equip themselves familiar with image segmentation and compression	a	e					
4.	Familiarize with the image representation and recognition	a	e					
5.	Develop codes for various image processing techniques/applications using MATLAB Image Processing Toolbox	a	b	e				

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOS**	**Reference**
UNIT I: DIGITAL IMAGE FUNDAMENTALS		**8**			
1.	Introduction – Digital Image Processing and overview of syllabus	1	C	1	1-7
2.	Origin – Fundamental Steps in Digital Image Processing – Components – Elements of Visual Perception	2	C,D	1	1,3,4
3.	Image Sensing and Acquisition – Image Sampling and Quantization	2	C,D	1	1,3,4
4.	Relationships between pixels	1	C	1	1,3,4
5.	Introduction to Image processing toolbox in MATLAB	2	C,I	1,5	2
UNIT II: IMAGE ENHANCEMENT		**10**			
6.	**Spatial Domain:** Gray level transformations – Histogram processing	3	C	2	1,3,4
7.	Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering	3	C	2	1,3,4
8.	**Frequency Domain:** Basics of filtering **–** Smoothing and Sharpening frequency domain filters.	2	C	2	1,3,4
9.	MATLAB code for histogram equalization, spatial and frequency domain filter.	2	C,I	2,5	2,3,4
UNIT III: IMAGE RESTORATION AND SEGMENTATION		**10**			
10.	Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Inverse Filtering – Wiener	3	C	2,3	1,3,4
11.	**Segmentation:** Point, Line, and Edge Detection- Marr-Hildreth & Canny edge detector	2	C	2,3	1,3,4
12.	–Edge Linking and Boundary detection Local & Regional processing – Region based segmentation	2	C	2,3	1,3,4
13.	Morphological processing – Watershed segmentation algorithm.	1	C	2,3	1,3,4
14.	MATLAB code for restoring an image after degradation using adaptive and wiener filter – Edge detection operators	2	C,I	2,3,5	2,3,4
UNIT IV: WAVELETS AND IMAGE COMPRESSION		**9**			
15.	Wavelets – Sub band coding – Multi resolution expansions	2	C	3	1,3,4
16.	**Compression:** Fundamentals – Image Compression methods – Huffman, Arithmetic coding	2	C,D	3	1,3,4
17.	LZW coding, Run Length Encoding, Block Transform coding, Wavelet coding, JPEG standard.	3	C,D	3	1,3,4
18.	MATLAB code for image compression: Huffman coding , Arithmetic coding, wavelet coding	2	C,I	3,5	2,3,4
UNIT V: IMAGE REPRESENTATION AND RECOGNITION		**8**			
19.	Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments	2	C	4	1,3,4
20.	Boundary description – Shape number – Fourier Descriptor	2	C	4	1,3,4

Session	Description of Topic	Contact hours	C-D-I-O	IOS	Reference
21.	Patterns and Pattern classes – Recognition based on matching	2	C,D	4	1,3,4
22.	MATLAB code for image boundary segments, Fourier Descriptor, Recognition based on matching	2	C,I	4,5	2,3,4
Total contact hours		**45***			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2014.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
3.	Jayaraman S, Esaki Rajan S, T.Veera Kumar, “Digital Image Processing”, Tata McGraw Hill Pvt. Ltd., Seventh Reprint, 2012.
4.	S.Sridhar, “Digital Image Processing”, Oxford University Press, 2015.
5.	Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2015.
6.	Willliam K Pratt, “Digital Image Processing”, John Willey, 2014.
7.	http://eeweb.poly.edu/~onur/lectures/lectures.html.

Course nature		**Theory**					
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS326E	**Visualization Techniques**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	P	Professional Elective			
Course designed by	Department of Computer Science and Engineering				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE	This course aims at understanding Information and Scientific visualization techniques and gives a clear picture of various abstraction mechanisms

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Ability to learn about different Visualization Techniques	a	g	k				
2.	Ability to study the Interaction techniques in information visualization fields	a	b					
3.	Ability to understand Various abstraction mechanisms	a	b					
4.	Ability to create interactive visual interfaces	a	b					

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I : FOUNDATIONS FOR DATA VISUALIZATION		**9**			
1.	Introduction to Visualization	1	C	1	1,4,7
2.	Visualization stages	2	C,D	1	1,4,7
3.	Experimental Semiotics based on Perception	1	C	1	1
4.	Gibson‘s Affordance theory	1	C	1	1
5.	A Model of Perceptual Processing	2	C,D	1	1
6.	Costs and Benefits of Visualization	1	C	1	1
7.	Types of Data	1	C	1	1
UNIT II : COMPUTER VISUALIZATION		**9**			
8.	Non-Computer Visualization	1	C	1	2,5
9.	Computer Visualization: Exploring Complex Information Spaces	1	C	1,2	2,5
10.	Fisheye Views – Applications	**2**	C	2	2
11.	Comprehensible Fisheye views – Fisheye views for 3D data	1	C	2	2
12.	Non Linear Magnification	1	C	1	2
13.	Comparing Visualization of Information Spaces	1	C	1,2	2
14.	Abstraction in computer Graphics	1	C	1,3	2,8
15.	Abstraction in user interfaces	1	C	1,3	2,8
UNIT III : MULTIDIMENSIONAL VISUALIZATION		**9**			
16.	1D, 2D, 3D Visualization techniques	2	C,D	1,3	3
17.	Trees	1	C,D	3	3
18.	Web Works	2	C	3	3
19.	Data Mapping: Document Visualization	2	C,D,I	3	3,5
20.	Workspaces	2	C,D	3	3
UNIT IV : TEXTUAL METHODS OF ABSTRACTION		**9**			
21.	From Graphics to Pure Text	1	C	1,3	2
22.	Figure Captions in Visual Interfaces	1	C,D	1.3	2
23.	Interactive 3D illustrations with images and text – Related work	1	C,D,I	3	2,6
24.	Consistency of rendered – images and their textual labels	1	C	3	2
25.	Architecture	2	C	3	2
26.	Zoom techniques for illustration purpose	2	C	3	2
27.	Interactive handling of images and text	1	C	3	2
UNIT V : ABSTRACTION IN TIME AND INTERACTIVE SYSTEMS		**9**			
28.	Animating non Photo realistic Computer Graphics	1	C,I	4	2
29.	Interaction Facilities and High Level Support for Animation Design	1	C,I	4	2,6
30.	Zoom Navigation in User Interfaces	1	C	4	2
31.	Interactive Medical Illustrations	1	C	4	2
32.	Rendering Gestural Expressions	1	C	4	2

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
33.	Animating design for Simulation	1	C,D	4	2
34.	Tactile Maps for Blind People	1	C,D	4	2
35.	Synthetic holography	1	C	1,4	2
36.	Abstraction Versus Realism, Integrating spatial and non-spatial data	1	C	1,4	2
Total contact hours		45*			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Colin Ware "Information Visualization Perception for Design", 3 rd edition, Morgan Kaufman 2012.
2.	Stuart.K.Card, Jock.D.Mackinlay and Ben Shneiderman, "Readings in Information Visualization Using Vision to think", Morgan Kaufmann Publishers, 1999.
3.	Thomas Strothotte, "Computer Visualization–Graphics Abstraction and Interactivity", Springer Verlag Berlin Heiderberg 1998.
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Chaomei Chan, "Information Visualization", Beyond the horizon, 2nd edition, Springer Verlag, 2004.
5.	Pauline Wills, "Visualisation: A Beginner's Guide", Hodder and Stoughlon, 1999.
6.	Benedikt. M, "Cyberspace: Firot Steps", MIT Press, 1991.
7.	http://www.silvalifesystem.com/articles/visualization-techniques/
8.	http://www.barnesandnoble.com/w/computational-visualization-thomasstrothotte/1111486638

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS327E	**Cellular Automata**			**L**	**T**	**P**	**C**
				3	**0**	**0**	**3**
Co-requisite:	Nil						
Prerequisite:	Nil						
Data Book / Codes/Standards	Nil						
Course Category	P	Professional Elective					
Course designed by	Department of Computer Science and Engineering						
Approval	32nd Academic Council Meeting , 23rd July 2016						

PURPOSE	To understand how Cellular Automata ideas can be used in Computer Processors, Cryptography, Artificial Intelligence, Biology, Finance, Physics etc.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand how simple rules can lead to phenomenally complex and Beautiful behaviors.	a						
2.	Understand universal computation from a mathematical point of view, and how very simple cellular automata rules can reproduce computers as powerful as any desktop or super computer.	a	c					
3.	Understand the close theoretical relationship between computer science and other disciplines particularly Mathematics and Physics.	a	b					
4.	Understand applications of Theoretical Computer Science to physical and social sciences, particularly Sociology, Biology (including medical applications), and Physics (including fluid flow)..	a	b					
5.	Expose to the concept of three dimensional analytical geometry.	a	d					

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**Los**	**Reference**
UNIT I : INTRODUCTION		**9**			
1	Introduction-Short History	1	C	1	1
2	CA &Computation -Why Study CA? -CA as Powerful Computation Engines	1	C-D	1	1
3	CA as Discrete Dynamical System Simulators	1	C-D	1	1
4	Mathematical Preliminaries -Set Theory	1	C-D	1	1
5	Information Theory - Graph Theory	1	C-D	1	1
6	Groups, Rings and Fields	1	C-D	1	1
7	Rings and Fields	1	C-D	1	1
8	Abstract Cellular Automata	1	C-D	1	1
9	One Dimensional and two Dimensional CA	1	C-D	1	1
UNIT II : PHENOMENOLOGICAL STUDIES OF CELLULAR AUTOMATA		**9**			
10	Phenomenological Studies of Generic CA	1	C	1,2	1,4
11	One-dimensional Systems -Space-Time Patterns	1	C	1,2	1
12	Behavioural Classes -Difference Patterns Blocking Transformations	1	C-D	1,2	1,4
13	General Properties of Elementary CA -Local Properties -Global Properties	1	C	1,2	1
14	A Small Sampling of Rules - The k=2, r = l rule R22	1	C-D	1	1,3
15	The k=2, r-1 rule R30	1	C	1,2	1
16	Just-Critical-Like Behavior-Particle-Like Behavior for Space Time Pattern	1	C	1,2	1
17	Reversible Rules	1	C	1	1
18	Parameterizing the Space of CA Rules	1	C	1	1
UNIT III : CELLULAR AUTOMATA AND LANGUAGE THEORY		**9**			
19	Cellular Automata and Language Theory	1	C	1,2,3	1
20	Regular Languages/ Finite Automata	1	C-D-I	1,2,3	1
21	Context-Free Languages/ Push-Down Automata	1	C-D-I	1,2,3	1
22	PDA Examples	1	C-D-I	1,2,3	1
23	CA Rule + Finite State Transition Graph	1	C	1,2	1
24	Regular Language Complexity -Entropy-Power Spectra of	1	C	1,2,3	1

Session	Description of Topic	Contact hours	C-D-I-O	Los	Reference
	Regular Languages				
25	Numerical Estimates	1	C-D-I	1,2,3	1
26	Li’s Algorithm for Generating Power Spectra - Reversible Computation	1	C	1	1,2
27	Universal Logic Gates, The Billiard Ball Model	1	C	1	1,2
UNIT IV : PROBABILISTIC CELLULAR AUTOMATA		**9**			
28	Probabilistic CA Critical Phenomena	1	C	1,3	2
29	A Heuristic Discussion	1	C-D	1,2,3	2
30	-Contd-	1		1,2,3	1,2
31	Boltzmann Distribution	1	C	1	1,2
32	Free Energy -Stochastic Dynamics	1	C	1,3	2
33	Monte Carlo Dynamics	1	C-D	3	2
34	Critical Exponents	1	C	3	2
35	Monte Carlo Dynamics some examples	1	C-D	1,2,3	2,3
36	Ising Model ,General-One Dimensional Ising Model	1	C	1,3	2,3
UNIT V : QUANTUM CELLULAR AUTOMATA		**9**			
37	Quantum Cellular Automata-Introduction	1	C	1,2,3	2,3,4
38	General Properties	1	C	1,2	2
39	A Conservation Law –k=2 systems k=3 systems	1	C	1,2,3	2
40	Reaction-Diffusion Systems	1	C	1,2,3	2,3,4
41	The Belousov-Zhabotinskii Reaction	1	C	1,3	2,3
42	Greenberg-Hastings Model -Hodgepodge Rule	1	C	1,2,3	2
43	Applications to Immunology	1	C	1,2,3	2
44	Random Boolean Networks	1	C	1,2,3	2
45	Overview of the Dynamics of (N , K) Nets	1	C	1,2,3	2,4
Total contact hours		**45***			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Andrew Ilachinski **“***Cellular Automata A Discrete Universe*” - World scientific publishing company private limited, 2001. (Unit 1,2,3).
2.	Andrew Adamatzky *“Game of Life Cellular Automata”*- Springer; 1st Edition, 2010. (Unit 4,5)
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	*Michael Batty,* “Cities and Complexity: Understanding Cities with Cellular Automata, Agent-Based Models, and Fractals**”,** The MIT Press,2007
4.	*Bastien Chopard, Michel Droz, “*Cellular Automata Modeling of Physical Systems**”,** Cambridge University Press, 2005

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS328E	**Virtual Reality**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	P	Professional Elective			
Course designed by	Department of Computer Science and Engineering				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE	To acquire a knowledge about the basic concepts of Virtual Reality and its applications, system functions and design considerations.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will have an understanding about								
1.	The basic functioning of Virtual Reality Systems	a						
2.	The concepts of Geometric modeling and Geometrical Transformations.	a						
3.	Learning to animate the Virtual Environment.	a	c					
4.	Applications of the Virtual Environment	a	h					
5.	The various types of Hardware's and software's in virtual Reality systems	a	h					

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: INTRODUCTION		9			1
1.	Introduction– Computer graphics	1	C,D	1-5	1
2.	Real Time Computer graphics	1	C	1	1
3.	Flight Simulation – Virtual Environments	1	C	1	1
4.	Requirements – benefits of virtual reality	1	C	1	1
5.	Introduction–The Virtual world space	1	C	1	1
6.	Positioning the virtual observer	1	C	1.2	1
7.	The perspective projection–human vision	1	C	1	1
8.	Stereo perspective projection–3Dclipping	1	C	1	1
9.	Colourtheory–Simple3D modeling	1	C	1	1
	UNIT II: Geometric Modeling Geometrical Transformations	9			
10.	Introduction–From 2Dto3D–3D space curves	1	C,D	2	1
11.	3D boundary representation	1	C	2	1
12.	Introduction–Frames of reference– Modeling transformations	1	C	2	1
13.	Instances–Picking–Flying	1	C	2	1
14.	Scaling the VE– Collision detection	1	C	2	1
15.	Introduction–The virtual environment	1	C	2	1
16.	The Computer environment	1	C	2	1
17.	VR Technology–Model of interaction	1	C	2	1
18.	VR System.	1	C,D	2	1
UNIT III: VIRTUAL ENVIRONMENT		9			
19.	Introduction–The dynamics of numbers	1	C	3	1,2
20.	Linear and Non-linear interpolation	1	C	3	1,2
21.	The animation of objects–linear and non-linear translation- shape & object in between	1	C	3	1,2
22.	Freeform – deformation–particle system	1	C	3	1,2
23.	Introduction–Objects falling in a graphical field	1	C	3	1,2
24.	Rotating wheels–Elastic collisions	1	C	3	1,2
25.	Projectiles–simple pendulum	1	C	3	1
26.	Springs	1	C	3	1
27.	Flight dynamics of an aircraft	1	C	3	1
UNIT IV: VR HARDWARES & SOFTWARES		9			
28.	Introduction–the age- the ear	1	C	5	1,3
29.	Thesomaticsenses	1	C	5	1
30.	Introduction–sensor hardware	1	I	5	1,3
31.	Head-coupled displays–Aquatic hardware	1	I	5	1,3
32.	Integrated VR systems	1	C	5	1,3
33.	Introduction– Modeling virtual world	1	C	5	1

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
34.	Physical simulation	1	C	5	1
35.	VR toolkits	1	D,I	5	1
36.	Introduction to VRML	1	C	5	1
UNIT V: VR APPLICATION		**9**			
37.	Introduction– Engineering	1	D	4	1,4
38.	Entertainment	1	D	4	1,4
39.	Science	1	C	4	1,4
40.	Training	1	C	4	1,4
41.	**The Future**: Introduction	1	C	4	1
42.	**The Future**: Introduction	1	C	4	1
43.	Virtual environments	2	C	4	1,4
44.	Modes of interaction	1	C	4	1
Total Contact hours		**45***			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOK**
1.	John Vince, “*Virtual Reality Systems*“, Pearson Education, 2002
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	Adams, “*Visualizations of Virtual Reality*”,TataMcGrawHill,2000.
3.	Grigore C. Burdea,PhilippeCoiffet ,“*Virtual Reality Technology*” ,WileyInterscience,1 Edition,1994.
4.	WilliamR.Sherman, AlanB.Craig, “*Understanding Virtual Reality:Interface, Application,and Design*”,Morgan Kaufmann,1stEdition,2002.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Attendance	Surprise Test	Model Exam	**Total**
	Weightage	**10%**	**10%**	**5%**	**5%**	**20%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS329E	**Geographical Information Systems**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Elective				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	The purpose of this course is to ensure that students become sufficiently grounded in theoretical knowledge of GIS and gain skills including data capture, analysis, modeling and cartographic representation techniques.							
At the end of the course, student will be able to		**STUDENT OUTCOMES**						
1.	Understand basic concepts of GIS data structures and analysis	a	b					
2.	Gain fundamental cartographic knowledge of map projections, scale, coordinates and mapping accuracy	a	b	c				
3.	Use spatial analysis techniques to solve geographic problems	a	b	c				
4.	Find sources of geographic data	a	c					
5.	Gain the skills necessary to create GIS data through a variety of methods	a	b					
6.	Providing an introductory understanding of the ethical questions surrounding data creation, analysis, and representation	c						

Session	**Description of Topic**	**Contact hours**	**C-D- I-O**	**IOs**	**Reference**
UNIT I: FUNDAMENTALS OF GIS		**9**			
1.	Introduction to GIS, Defining GIS	2	C	1	1,2
2.	Components of GIS	1	C	1	1,3
3.	Introduction to Spatial data, Maps and their influence on the character of spatial data	2	C,D,I	2	1,2,3
4.	Basic spatial entities, Thematic characteristics of spatial data	2	C,D,I	1	1
5.	Sources of Spatial data, Field data sources – Surveying and GPS	2	C,D,I,O	4	1
UNIT II: SPATIAL DATA MODELING		**9**			
6.	Spatial data modeling introduction, Spatial data models & data structures	2	C,D,I,O	6	1,2,3
7.	Modeling Surfaces and Networks, Modeling third dimension, Modeling fourth dimension	3	C,D,I,O	5,6	1,3
8.	Introduction to attribute data management, Database data models and creating database	2	C,D,I	5	1,3
9.	GIS Database applications, Database developments	2	O	6	1,3
UNIT III: DATA INPUT AND EDITING		**11**			
10.	Introduction to data input and editing, Methods of Data input	2	C,D,I	5	1,2,4
11.	Data editing, Towards an integrated database	2	I,O	6	1,2
12.	Introduction to data analysis, Measurements in GIS, Queries and reclassification	2	C,D,I	2	1,2,3
13.	Buffering and neighborhood function, Map overlay and spatial interpolation, Analysis of surfaces and networks	2	C,DI, O	3	1,2,4
14.	Remote Sensing and GIS Integration- Principles, Classifications and Characteristics	1	C,D	5	3
15.	Extraction of Metric and Thematic Information’s, Integration of Remote Sensing and GIS	2	C,D,I	5	3
UNIT IV: ANALYTICAL MODELING IN GIS		**7**			
16.	Introduction to analytical modeling, Process models	2	C,D	3,5	1
17.	Modeling physical, environmental and human processes, Modeling the decision making process and its issues	2	C,D	5	1,3
18.	Maps as output, Non-cartographic output	2	I,O	6	1,2
19.	Spatial multimedia and Mechanisms of delivery	1	C	5	1
UNIT V: ISSUES IN GIS		**9**			
20.	Development of computer methods for handling spatial data, Handling spatial data manually, Development of GIS	3	C,D	5	1

Session	Description of Topic	Contact hours	C-D- I-O	IOs	Reference
21.	Data quality issues, Describing data quality, Describing data errors sources of errors in GIS	3	C,O	6	1
22.	Real time GIS Applications	1	O	3	1,2
23.	Future of GIS, GIS Project Design and management	2	C	3,5	1,4
Total contact hours		**45***			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOK**
1.	Ian Heywood, Sarah Cornelius and Steve carver, “Introduction to geographical information systems”, Pearson Education, 4th Edition, 2012
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	DeMers, M.N., “Fundamentals of Geographic Information Systems”, 4thEdition, Wiley Press, 2012.
3.	Lo C.P. and Yeung, A.K.W.,“Concepts and Techniques of Geographic Information Systems”, Prentice Hall, 2002.
4.	Burrough, P.A. and R.A. McDonald, “Principles of Geographical Information Systems”, Oxford University Press, 1998.

Course nature		**Theory**				
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15EC252	**Principles of Communication Systems** *(Common to IT, CSE, EEE)*	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	**P**	**Professional Core**	**Communication**		
Course designed by	Department of Electronics and Communication Engineering				
Approval	30th Academic Council Meeting, 24th March , 2016				

Purpose	To gain the knowledge on basic concepts of conventional analog and digital communication systems and to get knowledge on the importance of radio communication systems.

Instructional Objectives		**Student Outcomes**		
At the end of the course, the learner will be able to		H	M	L
1.	Understand the concepts of analog communication techniques.	e		
2.	Know different types of radio transmitters and receivers	e	a	
3.	Understand the concept of Pulse and data communication system	e		
4.	Gain knowledge on different digital communication techniques.	e	a	b
5.	Understand the fundamentals of various radio communication systems.	e		

H-High Correlation, **M**-Medium Correlation, **L**-Low correlation

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	Unit-I: Analog Communication	**9**			
1.	Introduction to Communication Systems: Modulation ,Need for Modulation ,Types of modulation, Principles of Amplitude Modulation, Types of Amplitude Modulation	3	C	1	1,2,3
2.	Generation of AM waves, Linear Modulation, Switching modulator, Collector Modulation method, Non-linear Modulation, Balanced Modulator	3	C	1	1
3.	Angle modulation, FM and PM waveforms, Phase deviation and Modulation index , Frequency deviation and Percent modulation, FM modulators, Direct Method, Varactor diode modulator, Indirect method, Comparison between AM and FM	3	C	1	1,2,3
	Unit-II: Radio Transmitters and Receivers	**9**			
4.	Demodulation of AM waves, Linear diode	4	C	2	1

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	detector, AM Transmitters, Low power level and High power level transmitters, AM Receivers, TRF receiver, super heterodyne receiver				
5.	FM Demodulators, Slope detector, Foster seely discriminator	3	C	2	1
6.	FM Transmitters, Direct and indirect FM transmitters, FM super heterodyne receiver	2	C	2	1
	Unit-III: Pulse and Data Communication	**9**			
7.	Pulse Communication: Pulse Amplitude Modulation (PAM), Pulse Time Modulation (PTM)	3	C	3	1,3
8.	Pulse code Modulation (PCM),Comparison of various Pulse Communication System (PAM,PTM,PCM)	2	C	3	1,3
9.	Data Communication: Standards Organizations for Data Communications, Data Communication Circuits, Data Communication Codes, Error Detection and Correction Techniques.	4	C	3	1
	Unit-IV: Digital Communication	**9**			
10.	Digital Pass band Transmission and Reception: Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Binary Phase Shift Keying (BPSK)	3	C	4	1,2
11.	Quadrature Phase Shift Keying (QPSK), 8-PSK, Quadrature Amplitude Modulation (QAM), 8-QAM	4	C	4	1,2
12.	Bandwidth efficiency, Comparison of various Digital Communication System	2	C	4	1,2
	Unit-V: Radio Communication Systems (Elementary Treatment Only)	**9**			
13.	Microwave Communication: Introduction to microwave transmission, Advantages and disadvantages of microwave radio, Analog versus digital microwave, Frequency modulated microwave radio system	2	C	5	2,4
14.	Fiber optical communication: Elements of an optical fiber, Principles of light transmission in a fiber, Modes in optical fiber waveguides, Advances in optical fiber communication	3	C	5	1
15.	Mobile communication: Cellular Concept and Frequency Reuse, Channel Assignment and Hand off, A Basic cellular network, GSM, GPRS, UMTS	4	C	5	1,5
	Total contact hours	**45**	Exclusive of assessment hours		

Learning Resources	
1.	R.P.Singh, S.D.Sapre, “Communication Systems, Analog and Digital”, Tata McGraw Hill 5th Reprint 2015.
2.	Wayne Tomasi, “Electronic Communications Systems Fundamentals Through Advanced”, Pearson Education Asia, 5th Edition, 2009.
3.	Simon Haykin, “Communication Systems”, John Wiley and Sons, Inc., 4th Edition, 2001.
4.	Samuel Y. Liao, “Microwave Devices and Circuits”, 3rd edition, Pearson education, 2011 reprint.
5.	Jochen Schiller, “Mobile Communications”, 2nd edition, Pearson education Ltd, United Kingdom 2012.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15EC323E	**Embedded System Design**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	**P**	**Professional Elective**		**Computers**	
Course designed by	Department of Electronics and Communication Engineering				
Approval	30th Academic Council Meeting, 24th March 2016				

Purpose	This course presents fundamental concepts of Embedded system design and programming, Real time operating system.			
Instructional Objectives		**Student Outcomes**		
At the end of the course, the learner will be able to		**H**	**M**	**L**
1.	Understand the basics of embedded system development tools and Atmel RISC Processors	e	a	
2.	Write C programs for Microcontrollers	e	a	
3.	Familiarize with the concepts of RTOS	e		d

H-High Correlation, **M**-Medium Correlation, **L**-Low correlation

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
Unit-I: ATMEL RISC Processors and Development Tools		**9**			
1.	Introduction, Basics of developing for embedded systems	2	C	1	1
2.	Embedded system Initialization	2	C	1	1
3.	Atmel RISC Processors Architecture, Memory, Reset and interrupt functions	1	C	1	2,3
4.	Parallel I/O ports, Timer/Counters, Serial communication using UART, SPI, Analog Interfaces	3	C	1	2,3
5.	AVR RISC Assembly language instruction set	1	C	1	2,3
Unit-II: Elements of C Programming and Preprocessor Functions		**9**			
6.	Variables and constants, I/O operations, Operators and Expressions	2	C	2	2
7.	Control statements	1	C	2	2
8.	Functions, Pointers and Arrays, Structure and Unions, Memory types	3	C	2	2
9.	Real time methods	2	C,D	2	2
10.	Standard I/O and Preprocessor functions	1	C	2	2
Unit-III: IDE and Project Development		**9**			

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
11.	Code Vision AVR C Compiler and IDE: IDE Operation, C Compiler Options	3	C	1	2
12.	Compile and Make Projects, Program the target device, AVR code generator, Atmel AVR Studio debugger	2	C	1	2
13.	Project development: Process steps	1	C,D	1	2
14.	Example Projects	3	C,D	1	2
Unit-IV: RTOS Internals		**9**			
15.	Introduction to RTOS: scheduler, objects, services, key characteristics	2	C	3	1
16.	Tasks	2	C	3	1
17.	Semaphores	2	C	3	1
18.	Message queues	1	C	3	1
19.	Pipes, Event Registers, Signals, Condition variables	2	C	3	1
Unit-V: RTOS Services		**9**			
20.	Other RTOS services	1	C	3	1
21.	Exceptions and Interrupts	2	C	3	1
22.	Timer and timer services	2	C	3	1
23.	I/O subsystem	1	C	3	1
24.	Memory management	1	C	3	1
25.	Modularizing an application for concurrency	1	C	3	1
26.	Common design problems	1	C	3	1
	Total Contact Hours	**45**	Exclusive of assessment hours		

Learning Resources	
1.	Qing Li with Caroline Yao "Real-Time Concepts for Embedded Systems " CMP books 2011
2.	Barnett, Cox, & O'Cull "Embedded C Programming and the Atmel AVR" Thomson Delmar learning 2006
3.	www.Atmel.com

Course nature		**Theory**				
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

ELECTIVES
Dept. Elective-III and Elective-IV

15CS330E	Human Computer Interface		L	T	P	C
			3	0	0	3
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Elective				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	The purpose of this course is to make the students knowledgeable in the area of designing, implementing and using interactive computer systems and how effective design of human computer interfaces influence individuals and organizations.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand the basic HCI concepts and various design process, standards and guidelines	a						
2.	Perform implementation support and evaluation of their design	k						
3.	learn various models like Brain computing	a						
4.	learn various dialogue notations and importance of groupware	a						

Session	Description of Topic	Contact hours	C-D-I- O	IOs	Reference
UNIT I : FOUNDATIONS		**9**			
1.	The Human – Input-output channels – Human Memory	2	C	1	1
2.	Thinking – emotions – Psychology & design of interactive systems	1	C	1	1
3.	Computer – Text entry devices	1	C	1	1
4.	Positioning, Pointing & drawing	1	C	1	1
5.	Display devices for Virtual reality,3D	1	D	1	1
6.	Interaction – models – Frameworks & HCI	1	C	1	1
7.	Ergonomics – Interaction style	1	C	1	1
8.	WIMP Interfaces – context	1	C	1	1
9.	Paradigms for Interaction	1	C	1	1
UNIT II : SOFTWARE PROCESS & DESIGN RULES		**9**			
10.	Interaction design basics – user focus – scenarios	1	C	2	1,3
11.	Navigation – screen design & layout	1	C	2	1
12.	HCI in software process – life cycle	1	C	1	1
13.	Usability engineering	1	C	1	1,3
14.	Interactive design & prototyping	1	C	2	1,2
15.	Design rules – Principles for usability – standards	1	C	1	1
16.	Guidelines	1	C	1	1
17.	Golden rules	1	C	1	1
18.	HCI patterns	1	C	1	1
UNIT III: IMPLEMENTATION & USER SUPPORT		**9**			
19.	Implementation support – Windowing system elements	1	C	2	1,2
20.	Using tool kits – user interface management	1	C	2	1,2
21.	Evaluation techniques – goals	1	C	2	1
22.	Expert analysis – choosing a method	1	C	2	1
23.	Universal design principles	1	C	2	1
24.	Multimodal interaction, user support	1	C	2	1

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
25.	User support – requirements	1	C	2	1
26.	Approaches – adaptive help systems	1	C	2	1
27.	Designing user support system	1	C	2	1
UNIT IV: COGNITIVE, COMMUNICATION & COLLABORATIVE MODELS		**9**			
28.	Cognitive models – Goal & task hierarchies	1	D	3	1,4
29.	Linguistic models – Physical & device models – architectures	1	C	3	1,4
30.	Communication & collaboration models	1	C	3	1
31.	Face-to-face communication	1	C	3	1
32.	Conversation – text based	1	C	3	1
33.	Group working	1	C	3	1,4
34.	Brain computing Interface concepts	1	C	3	1,4
35.	Brain Signals - EEG	1	C	3	1,4
36.	BCI Application – case Study	1	D	3	4
UNIT V : UBIQUITOUS COMPUTING, HYPERTEXT, WWW		**9**			
37.	Ubiquitous computing application research	1	C	4	1
38.	Virtual & augmented reality –	1	C	4	1
39.	Information & data visualization	1	C	4	1
40.	Understanding hypertext	1	C	4	1
41.	Finding things, Web Technology & issues	1	C	4	1
42.	Static Web content and Dynamic Web content	1	C	4	1
43.	Groupware systems	1	C	4	1
44.	Computer mediated communication	1	C	4	1
45.	Frameworks for groupware	1	C	4	1
	Total contact hours	**45***			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Alan Dix- Janet Finlay- Gregory D. Abowd and Russel Beale- *Human – Computer Interaction*, (3rd Edition), Pearson Education, 2004.
2.	Ben Shneiderman and Catherine Plaisant, *Designing the User Interface: Strategies for Effective Human-Computer Interaction*, (5th Edition), Pearson Addison-Wesley, 2009.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	John M.Carrol, "*Human Computer Interaction in the New Millenium*", Pearson Education, 2002
4.	Jonathan Worlpaw andElizabeth Winter Wolpaw,"Brain – Computer Interfaces"Oxford University Press 2012.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS331E	**Data Mining And Analytics**			**L**	**T**	**P**	**C**
				3	**0**	**0**	**3**
Co-requisite:	Nil						
Prerequisite:	Nil						
Data Book / Codes/Standards	Nil						
Course Category	P	Professional Elective					
Course designed by	Department of Computer Science and Engineering						
Approval	32nd Academic Council Meeting , 23rd July 2016						

PURPOSE	To acquire knowledge of Data mining techniques							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, students will be able to								
1.	Understand the concepts of Data Mining	a						
2.	Familiarize with association rule mining	a						
3.	Familiarize various classification algorithms	a						
4.	Understand the concepts of Cluster analysis	a						
5.	Implement the Data mining concepts with various domains	a	k					

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: Introduction		**9**			
1.	Introduction to Data Mining – Kinds of Data	2	C	1-4	1-3
2.	Data mining Functionalities – Interesting Patterns	2	C	1	1-3
3.	Task Primitives	1	C	1	1
4.	Issues in Data Mining	1	C	1	1
5.	Data Preprocessing	3	C	1	1,2,4
UNIT II: Association Rules		**8**			
6.	Basic Concepts	1	C	2	1,2
7.	Frequent Item Set Mining Methods	3	C	2	1,3
8.	Association Rules	2	C,I	2	1,3,4
9.	Correlation analysis	2	C	2	1,3
UNIT III: Classification and Prediction		**9**			
10.	Issues Regarding Classification and Prediction	1	C	3	1,2,3
11.	Decision Tree Induction Classification	2	C,I	3	1,2,4
12.	Bayesian and Rule Based Classification	3	C,I	3	1,4
13.	Support Vector Machine	2	C,I	3	1,2,4
14.	Prediction	1	C	3	1,2
UNIT IV: Cluster Analysis		**9**			
15.	What is Cluster Analysis	1	C	4	1
16.	Types of Data in Cluster Analysis	2	C	4	1
17.	Categorization of Clustering Methods	3	C,I	4	1,2,4
18.	Hierarchical Methods	3	C,I	4	1,2
UNIT V: PLASTIC ANALYSIS		**10**			
19.	Applications and Trends in Data Mining	3	C	5	1,2
20.	Machine learning	3	C,I	5	4
21.	Big data	2	C,I	5	5
22.	Cloud computing	2	C,I	5	6
Total contact hours		**45***			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Jiawei Han and Micheline Kamber,“Data Mining – Concepts and Techniques”, Second Edition, Morgan Kaufmann Publishers, 2006.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	M. H. Dunham, “Data Mining: Introductory and Advanced Topics”, Pearson Education. 2001.
3.	D. Hand, H. Mannila and P. Smyth, “Principles of Data Mining”, Prentice Hall. 2001.
4.	I H. Witten and E. Frank, “Data Mining: Practical Machine Learning Tools and Techniques”, Morgan Kaufmann. 2000.
5.	Nathan Marz, James Warren, “Big Data-Principles and best practices of scalable real-time data systems”, DreamTech Press, 2015
6.	Arshdeep Bahga, Vijay Madisetti, "Cloud Computing: A Hands-On Approach", University Press, 2016

Course nature					**Theory**		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Mini Project	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15IT326E	**CLOUD COMPUTING**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL ELECTIVE				
Course designed by	Department of Information Technology					
Approval	32nd Academic Council Meeting , July 2016					

PURPOSE		To introduce emerging cloud computing and its techniques, its services and security concerns that will lead to design and development of various cloud service models						
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand the current trend and basics of cloud computing	i	j					
2.	Learn cloud enabling technologies and its applications	i	j					
3.	Explore different cloud mechanisms and get exposure to advanced clouds	j	l					
4.	Analyze the cost metrics, handle the security threats and construct different cloud delivery design models	k						

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I : CLOUD COMPUTING FUNDAMENTALS AND MODELS		**8**			
1.	Introduction to Networking, Data communication, Cloud Computing, Origin of Cloud Computing, Basic Concepts and Terminology	3	C	1	1,2
2.	Goals and Benefits, Risks and Challenges, Roles and Boundaries, Cloud Characteristics	3	C	1,2	1,2
3.	Cloud Delivery Models, Cloud Deployment Models	2	C	1,2	1,2
UNIT II : CLOUD:ENABLING TECHNOLOGY AND APPLICATIONS		**7**			
4.	Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology	2	C	2	1
5.	Web Technology, Multitenant Technology, Service Technology	2	C	2	1
6.	Applications, Cloud computing for Healthcare, Energy Systems, Transportation Systems, Manufacturing Industry, Government, Education and Mobile Communication	3	C	2	1,2
UNIT III : CLOUD COMPUTING MECHANISMS		**8**			
7.	Cloud Infrastructure Mechanisms: Logical Network Perimeter, Virtual Server: Cloud Storage Device, Cloud Usage Monitor, Resource Replication, Ready-Made Environment	3	C	2.3	1
8.	Specialized Cloud Mechanisms: Automated Scaling Listener, Load Balancer, SLA Monitor, Pay Per Use Monitor: Audit Monitor, Failover System, Hypervisor, Resource Cluster, Multi:Device Broker	3	C	2,3	1
9.	Cloud Management Mechanisms: Remote Administration System, Resource Management System, SLA Management System, Billing Management System	2	C	2,3	1
UNIT IV: COST METRICS AND CLOUD COMPUTING ARCHITECTURAL MODEL		**12**			

10.	Cost Metrics and Pricing Models: Business Cost Metrics, Cloud Usage Cost Metrics, Cost Management Considerations	2	C	4	1,2
11.	Service Quality Metrics and SLAs: Service Quality Metrics, SLA Guidelines	2	C	4	1,2
12.	Fundamental Cloud Architectures: Illustration with Case Study	2	C	1,2,3,4	1,2
13.	Design approaches with Case Study, Design methodology for IaaS Service Model, Google API	3	C,D,I	1,2,3,4	2,4
14.	Design methodology for PaaS Service Model, Study of SaaS Service Model	3	C,D,I	1,2,3,4	2,4
UNIT V: CLOUD SECURITY AND ADVANCED CLOUD CONCEPTS		**10**			
15.	Fundamental Cloud Security: Basic Terms and Concepts, Threat Agents, Cloud Security Threats	2	C	4	1,2
16.	Cloud Security Mechanisms: Encryption, Hashing: Digital Signature, Public Key Infrastructure, Identity and Access Management	3	C,I	2,3,4	1,2
17.	Single Sign-On: Kerberos authentication, One-time password, Basic cloud data security mechanisms	3	C,I	2,3,4	1,2
18.	Advanced Clouds, Mobile Cloud, Media Cloud, Green Cloud	2	C	3	1,2
	TOTAL CONTACT HOURS	45*			

Sl. No.	**LEARNING RESOURCES**
1.	Thomas Erl, ZaighamMahmood,RichardoPuttini, "Cloud Computing:Concepts, Technology and Architecture", Fourth Printing, 2014, Prentice Hall/PearsonPTR, ISBN: 9780133387520.
2.	ArshdeepBahga, Vijay Madisetti, "Cloud Computing: A Hands-On Approach", 2016, University Press, ISBN: 9780996025508.
3.	K.Chandrasekaran, "Essentials of Cloud Computing", 2014, Chapman and Hall/CRC Press, ISBN 9781482205435.
4.	Thomas Erl, Robert Cope, Amin Naserpour, “Cloud Computing Design Patterns”, 2015, Prentice Hall/Service Tech Press, Pearson, ISBN: 978-0133858563.

Course nature					**Theory**		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* - Excluding Assessment Hours

15CS332E	**Wireless Sensor Networks**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Elective				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	This course provides a broad coverage of challenges and research results related to the design and management of wireless sensor networks							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand basic sensor network concepts	a						
2.	Know physical layer issues, Medium Access Control Protocols	a	b					
3.	Comprehend network and transport layer characteristics and protocols	a	b					
4.	Understand the network management and Middleware services	a	b					

Session	**Description of Topic**	**Contact hours**	**C-D- I-O**	**IOs**	**Reference**
UNIT I: FUNDAMENTALS OF SENSOR NETWORKS		**9**			
1.	Introduction to computer and wireless sensor networks and Overview of the syllabus	1	C	1-4	1-4
2.	Motivation for a network of Wireless Sensor nodes- Sensing and sensors-challenges and constraints	2	C	1	1-4
3.	node architecture-sensing sub system, processor subsystem-communication interfaces- prototypes	2	C,D	1	1
4.	Application of Wireless sensors	4	C,D	1	1
UNIT II: COMMUNICATION CHARACTERISTICS AND DEPLOYMENT MECHANISMS		**11**			
5.	Wireless Transmission Technology and systems-Radio Technology Primer-Available Wireless Technologies	2	C	1,3	2
6.	Hardware- Telosb, Micaz motes	4	C,I	1-3	2
7.	Time Synchronization- Clock and the Synchronization Problem	1	C	1	1
8.	Basics of time synchronization-Time synchronization protocols	2	C	1	1
9.	Localization- Ranging Techniques- Range based Localization-Range Free Localization- Event driven Localization	2	C	1,3	1
UNIT III: MAC LAYER		**7**			
10.	Overview-Wireless Mac Protocols-Characteristics of MAC protocols in Sensor networks	3	C	2	1-4
11.	Contention free MAC Protocols- characteristics- Traffic Adaptive Medium Access-Y-MAC, Low energy Adaptive Clustering	2	C,I	2	1
12.	Contention based MAC Protocols- Power Aware Multi-Access with signaling, Sensor MAC-Timeout MAC-Data gathering MAC	2	C,I	2	1
UNIT IV: Routing in Wireless Sensor Networks		**9**			
13.	Design Issues in WSN routing- Data Dissemination and Gathering-Routing Challenges in WSN	1	C	3	1-4
14.	Flooding-Flat Based Routing – SAR, Directed Diffusion-MCFA-Coherent and non-Coherent Processing	3	C, I	3	1,3
15	Hierarchical Routing- LEACH, PEGASIS, TEEN, APTEEN	3	C, I	3	1,3
16	Query Based Routing- Negotiation Based Routing- Geographical Based Routing	2	C,I	3	1,3
UNIT V :MIDDLEWARE AND SECURITY ISSUES		**9**			
17.	WSN middleware principles-Middleware architecture-Existing middleware	3	C	4	2
18.	operating systems for wireless sensor networks-performance and traffic management	4	C	4	2
19.	Fundamentals of network security-challenges and attacks Protocols and mechanisms for security	2	C	2-4	1-4

Session	Description of Topic	Contact hours	C-D- I-O	IOs	Reference
Total contact hours		45[*]			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Waltenegus Dargie, Christian Poellabauer , “Fundamentals of Wireless Sensor Networks, Theory and Practice”, Wiley Series on wireless Communication and Mobile Computing, 2011
2.	Kazem Sohraby, Daniel manoli , “Wireless Sensor networks- Technology, Protocols and Applications”, Wiley InterScience Publications 2010.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Bhaskar Krishnamachari , “ Networking Wireless Sensors”, Cambridge University Press, 2005
4.	C.S Raghavendra, Krishna M.Sivalingam, Taieb znati , “Wireless Sensor Networks”, Springer Science 2004.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Programming Assignment-1	Programming Assignment-2	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15IT327E	**CRYPTOGRAPHY**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL ELECTIVE				
Course designed by	Department of Information Technology					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	Providing secure communication and ensuring confidentiality and integrity of information are a major concern in the field of information technology. This course deals with the techniques and mathematics used to provide information security.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand OSI security architecture and classical encryption techniques.	j						
2.	Acquire fundamental knowledge on the concepts of finite fields and number theory.	a						
3.	Understand various block cipher and stream cipher models.	j						
4.	Describe the principles of public key cryptosystems, hash functions and digital signature.	j						
5.	Gain a first-hand experience on encryption algorithms, encryption modes.	i						

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: CLASSICAL CRYPTOGRAPHY		**7**			
1.	Introduction to Security attacks	1	C	1	1,2
2.	Symmetric cipher model, Security mechanisms	1	C	1	1,2
3.	Substitution techniques:Caesar cipher, Monoalphabetic cipher	2	C,I	1	1
4.	Polyalphabetic ciphers, Onetime pad	2	C,I	1	1
5.	Transposition techniques, Steganography	1	C	1	1
UNIT II: FINITE FIELDS AND NUMBER THEORY		**10**			
6.	Groups, Rings, Fields	1	C	2	1
7.	Euclid's Algorithm	2	C,I	2	1
8.	Modular arithmetic	1	C	2	1
9.	Finite Fields, Polynomial Arithmetic	2	C	2	1
10.	Prime Numbers, Testing for Primality	1	C,I	2	1
11.	Fermat’s and Euler’s Theorem	1	C,I	2	1
12.	The Chinese remainder theorem	1	C,I	2	1
13.	Discrete Logarithms	1	C	2	1
UNIT III: BLOCK CIPHERS		**9**			
14.	Block cipher principles	1	C	3	1
15.	Data Encryption Standard	2	C,I	3	1
16.	Block cipher Modes of operation	2	C	3	1
17.	Advanced Encryption Standard	2	C,I	3	1
18.	Blowfish, RC5 algorithm	2	C	3	1,2
UNIT IV: PUBLIC-KEY CRYPTOGRAPHY		**9**			
19.	Principles of Public-key Cryptosystems	2	C	4	1
20.	The RSA algorithm	2	C,I	4	1
21.	Key management	1	C	4	1
22.	Diffie,Hellman key exchange	2	C,I	4	1
23.	Elliptic curve: Arithmetic, Elliptic Curve Cryptography	2	C,I	4	1
UNIT V: HASH FUNCTIONS AND CRYPTOGRAPHIC APPLICATIONS		**10**			
24.	MAC	1	C	4	1
25.	Hash Algorithms (MD5, SHA)	2	C,I	4	1

26.	Digital Signature Standard	2	C,I	4	1
27.	Applications pertaining to Encryption using different ciphers and modes,	3	I	5	3
28.	One-way hash algorithms.	2	I	5	3
	TOTAL CONTACT HOURS	45*			

Sl. No.	**LEARNING RESOURCES**
1.	William Stallings, "Cryptography and Network Security", 6th Edition, 2014, Pearson Education, ISBN: 9789332518773.
2.	AtulKahate , "Cryptography and Network Security", 2nd Edition, 2009, McGraw Hill Education India Pvt Ltd, ISBN:100070151458.
3.	WebTutorial: http://www.cis.syr.edu/~wedu/seed/cryptography.htmlas on 14/04/2016

Course nature					**Theory**		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* - Excluding Assessment Hours

15IT362E	**Information Storage and Management**	**L**	**T**	**P**	**C**

			3	**0**	**0**	**3**
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL ELECTIVE				
Course designed by	Department of Information Technology					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	The main objective of this course is to demonstrate how the storage technology is evolving to meet the ever increasing demand for space from variety of information sources and the sheer volume. The course discusses the techniques available for effective management of storage and retrieval of data and also the backup and recovery techniques.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Identify the components of managing the data center and understand logical and physical components of a storage infrastructure	k						
2.	Evaluate storage architectures including storage subsystems	l						
3.	Understand the business continuity, backup and recovery methods.	k						
4.	Monitor the storage infrastructure and management activities	m						
5.	Understand the cloud computing services and models	l						

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I : INTRODUCTION		**9**			
1.	Introduction to Information Storage Management, Evolution of Storage Technology	1	C	1	1
2.	Data Centre Infrastructure, Key challenges in managing information.	2	C	1	1
3.	Data Center Environment: Application, Database Management System (DBMS) - Host : Connectivity, Storage, Disk Drive Components	2	C	1	1
4.	Intelligent Storage System: Components of an Intelligent Storage System	2	C	1	1
5.	Storage Provisioning, Types of Intelligent Storage Systems.	2	C	1	1
UNIT II : STORAGE NETWORKING TECHNOLOGIES		**10**			
6.	Fiber Channel: Overview ,SAN and its Evolution, Components of FC SAN, FC Connectivity	2	C	2	1,3,5
7.	FC Architecture, IPSAN-iSCSI components, iSCSI Topologies, iSCSI Protocol Stack,iSCSI Names	2	C	2	1,2,5
8.	NAS: General Purpose Servers versus NAS Devices ,Benefits of NAS- File Systems and Network File Sharing, Components of NAS, NAS I/O Operation	2	C	2	1,3,5
9.	NAS Implementations, NAS File Sharing Protocols	2	C	2	1,3,5
10.	Object Based Storage Devices , Content addressed Storage	2	C	2	1
UNIT III : BUSINESS CONTINUITY AND BACK UP RECOVERY		**9**			
11.	Business Continuity: Information Availability ,BC Terminology, BC Planning life cycle.	2	C	3	1
12.	Failure Analysis, Business Impact Analysis	2	C	3	1
13.	Backup and Archive: Backup Purpose ,Backup Considerations, Backup Granularity	2	C	3	1
14.	Recovery Considerations, Backup Methods	1	C	3	1
15.	Backup Architecture, Backup and Restore Operations	2	C	3	1
UNIT IV : STORAGE SECURITY AND MANAGEMENT		**10**			
16.	Storage Security Framework and Domain	3	C	4	1
17.	Monitoring the Storage Infrastructure: Monitoring Parameters , Components Monitored	2	C	4	1

18.	Monitoring examples	2	C	4	1
19.	Storage Infrastructure Management Activities	1	C	4	1
20.	Storage Management Examples: Storage Allocation to a New Server/Host , File System Space Management	2	C	4	1
UNIT V : CLOUD COMPUTING		**7**			
21.	Cloud Enabling Technologies : Characteristics of Cloud Computing , Benefits of Cloud Computing	2	C	5	1,6
22.	Cloud Service Models, Cloud Deployment models	3	C	5	1,6
23.	Cloud computing Infrastructure, Cloud Challenges.	2	C	5	1,6
	TOTAL CONTACT HOURS	45*			

Sl. No.	**LEARNING RESOURCES**
1.	‘EMC Corporation, “Information Storage and Management”,2nd edition Wiley India, ISBN13: 978-1118094839
2.	UifTroppen Rainer Wolfgang Muller,”Storage Networks Explained”, India, Wiley, 2010, ISBN13: 978-0470741436
3.	Robert Spalding,Storage Networks: The Complete Reference, Osborne, Tata McGraw Hill, 2003, ISBN-13: 978-0072224764
4.	Farley,’Building Storage Networks”, Osborne, Tata McGraw Hill, 2009, ISBN-13: 978-0072130720
5.	Meeta Gupta, Storage Area network Fundamentals, Pearson Education Limited,2002, ISBN13: 978-1587050657
6.	Anthony T .Velte, Toby J.Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach”, Fourth Reprint, Tata McGraw Hill Edition, 2010, ISBN-13: 978-0071626941

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* - Excluding Assessment Hours

15SE333E	**Pervasive Computing**	L	T	P	C
		3	**0**	**0**	**3**
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	P PROFESSIONAL ELECTIVE				
Course designed by	Department of Software Engineering				
Approval	32nd Academic Council Meeting, 23rd July, 2016				

PURPOSE	This course provides a way to understand the concepts of WIRELESS LAN, WAP, WML, PDA and its issues.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1	Understand the fundamental elements of pervasive computing.	b						
2	Learn the design process of Pervasive Computing Environments and its solutions	c						
3	Familiarize hardware, software and the aspects involved in pervasive computing	c	i					
4	Comparative study of protocols, languages, models & technologies involved	g						
5	Learn WAP and voice technology.	i	j					

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I - INTRODUCTION	10			
1.	Pervasive Computing: Past, Present and Future Pervasive computing,	1	C	1	1,2
2.	Pervasive Computing Market, m-Business	2	C	1	1,2
3.	Application examples: Retail, Airline check-in and booking, Healthcare	1	C,I	1,2	1,2
4.	Tracking, Car information system, Sales Force Automation, E-mail access via WAP and voice	1	C,I	1,2	1
5.	Device Technology: Hardware, Human machine interface	1	C	3	1
6.	Bio metrics, Operating systems	2	C	3	1
7.	Java for pervasive devices	2	C	4	1
	UNIT II DEVICE CONNECTIVITY & WEBAPPLICATION CONCEPTS	9			
8.	Device connectivity : Protocols: wireless, mobile phone technologies, mobile internet protocol	2	C	3	1,3
9.	Synchronization and replication protocol, distributed services and message and transaction protocols	2	C	4	1,3
10.	Security	2	C	3	1,3
11.	Device Management	1	C	3	1
12.	Web Application Concepts: WWW Architecture and Protocols	1	C	4	1
13.	Transcoding , Client Authentication via Internet	1	C	4	1
	UNIT IIIWAP & VOICE TECHNOLOGY	8			
14.	WAP and Beyond: Introduction, Components of the WAP architecture	1	C	5	1
15.	WAP infrastructure, WAP security issues	1	C,O	5	1
16.	Wireless Markup Language , WAP push	2	C,D	4,5	1
17.	Products,i-Mode	1	C	5	1
18.	VoiceTechnology: Basics of Speech recognition, Voice Standards	2	C,I	5	1
19.	Speech Applications, Speech and Pervasive Computing, security	1	C,I	5	1

	UNIT IV PDA & PERVASIVE WEB APPLICATION ARCHITECTURE	9			
20.	Device Categories, PDA operation Systems	2	C	3	1
21.	Device Characteristics, SoftwareComponents	1	C	3	1
22.	Standards, Mobile Applications, PDA Browsers	2	C	3	1
23.	Pervasive WebApplication architecture: Background, Scalability and availability, Development of Pervasive Computing webapplications	2	C	2,3	1
24.	Pervasive application architecture.	2	C	2	1
	UNIT V –APPLICATION IN PERVASIVE COMPUTING	9			
25.	User Interface Issues in Pervasive Computing, Architecture	3	C	2	1
26.	Smart Card- based Authentication via internet and ordering goods	2	C,I	2	1
27.	Access from WAP	2	C,I	2	1
28.	Access from personal digital assistants	2	C,I	2	1
29.	Access via voice	2	C,I	2	1
	Total contact hours	45			

LEARNING RESOURCES	
Sl. **No.**	TEXT BOOKS
1.	JochenBurkhardt, Horst Henn, Stefan Hepper, Thomas Schaech & Klaus Rindtorff, “Pervasive Computing, Technology and Architecture of Mobile Internet Applications”, Pearson Education, 2012. ISBN-13**:** 978-0201722154
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	UweHansmann, L. Merk, M. Nicklous, T. Stober, U. Hansmann, “PervasiveComputing (Springer Professional Computing) ”, 2003, Springer Verlag,ISBN:3540002189.
3.	Frank Adelstein, Sandeep KS Gupta, Golden Richard III, Loren Schwiebert, “Fundamentals of Mobile and Pervasive Computing”, McGraw Hill edition, 2006. ISBN-13**:** 978-0071412377

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	Assessment tool	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	Total
	Weightage	10%	15%	15%	5%	5%	50%
End semester examination Weightage :							50%

15IT328E	**Parallel Programming Using OpenCL**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co,requisite:	NIL				
Prerequisite:	15IT212J -Computer Organization and Architecture/15CS203 -Computer System Architecture				
Data Book / Codes/Standards	NIL				
Course Category	P PROFESSIONAL ELECTIVE				
Course designed by	Department of Information Technology				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE	The main objective of this course is to explore the basic concepts of parallelism and to introduce OpenCL as a tool for writing parallel programming.

	INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**						
At the end of the course, students will be able to:								
1.	Identify parallelism in problems	a	c					
2.	Understand graphical processor unit’s(GPU) architecture	i	j					
3.	Work with OpenCL SDK kit.	i	l					
4.	Learn how to optimize web based applications.	a						

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: INTRODUCTION	**9**			
1.	Instruction Level Parallelism, Data Level Parallelism, Task Level Parallelism.	2	C	1	1,4
2.	Synchronization , Thinking Parallel	2	C	1	1,2
3.	Concurrency and Parallel Programming	1	C	1,3	1,2
4.	Introduction to OpenCL, Platform and Devices	2	C,I	1,2	1,2,3
5.	Execution environment , Memory Model and Writing Kernel	2	C,I	1,2	1,2,3
	UNIT II: OpenCL DEVICE ARCHITECTURE	**9**			
6.	Super Scalar Execution ,SIMD and Vector Processing	2	C	2	1,2
7.	Multicore CPU	2	C	2	1,2
8.	GPU Architecture	3	C	2	1,2
9.	APU	2	C	2	1,2
	UNIT III: OpenCL CONCURRENCY	**9**			
10.	Creating workgroups	2	C	2	1,2
11.	Queuing synchronization	2	C	2	1,2
12.	Global Synchronization	2	C	2	1,2
13.	Host side Memory model, Device side memory model.	3	C	2	1,2
	UNIT IV: EXAMPLES	**9**			
14.	Simple Examples, Histogram	2	I	3	1,2
15.	Image Rotation, Convolution	3	I	3	1
16.	Producer, Consumer Problem	2	I	3	1
17.	Utility Functions	2	I	3	1
	UNIT V: OpenCL ACCELERATION OF WEB APPLICATIONS	**9**			
18.	Programming and Synchronization with WebCL.	2	I	4	1
19.	Interoperability	1	C	4	1
20.	Example Application	2	C	3,4	1
21.	Security Enhancement	2	C	4	1
22.	WebCL on Servers	2	C	4	1
	TOTAL CONTACT HOURS	45*			

Sl. No.	**LEARNING RESOURCES**
1.	David R. Kaeli, “Heterogeneous Computing with OpenCL2.0 “, 1st Edition, 2015, Morgan Kaufman Publishers, ISBN: 13: 978,128014141.

2.	Benedict R. Gaster, Lee, Howes,“Heterogeneous computing with OpenCL”, 2011, Morgan Kaufman Publishers, ISBN,13**:** 9780123877666.
3.	Introduction to OpenCL Programming, Training Guide. http://developer.amd.com/tools-and-sdks/opencl-zone/opencl-resources/opencl-course-introduction-to-opencl-programming/ as on date 22/04/16, ISBN,13:978 - 0321749642
4.	David A. Patterson and John L. Hennessy, “Computer Organization and Design: The hardware/Software Interface”, 3rd Edition, 2007, Morgan Kaufman Publishers, ISBN,13: 978,0124077263.

<table>
<tr><th colspan="4">Course nature</th><th colspan="3">Theory</th></tr>
<tr><td colspan="7"><b>Assessment Method (Weightage 100%)</b></td></tr>
<tr><td rowspan="2"><b>In-semester</b></td><td><b>Assessment tool</b></td><td>Cycle test I</td><td>Cycle test II</td><td>Cycle Test III</td><td>Tutorial</td><td><b>Total</b></td></tr>
<tr><td><b>Weightage</b></td><td><b>10%</b></td><td><b>10%</b></td><td><b>15%</b></td><td><b>15% [Experiments (10%) + Mini Project(5%)]</b></td><td><b>50%</b></td></tr>
<tr><td colspan="6"><b>End semester examination Weightage :</b></td><td><b>50%</b></td></tr>
</table>

* - Excluding Assessment Hours

15CS333E	**Biometrics**	**L**	**T**	**P**	**C**
		3	**0**	**0**	3
Co-requisite:	Nil				
Prerequisite:	15CS325E				
Data Book / Codes/Standards	Nil				
Course Category	P | Professional Elective				
Course designed by	Department of Computer Science and Engineering				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE	To understand the biometric system development and evaluation, with an emphasis on different modalities, biometric application development, cryptography, image enhancement and biometrics standards.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand biometrics systems operation from sensor to decision	a						
2.	Describe the principles of the core biometric modalities (face, fingerprint, retina and iris), and to deploy them in authentication scenarios	a	b					
3.	Identify the privacy and security concerns surrounding biometric systems	a						
4.	Deal with poor image qualities and its effect in biometrics.	a	k					
5.	Enumerate the most up-to-date examples of real biometric applications in human authentication	a	b	k				
6.	Organize and conduct biometric data collections, and apply biometric databases in system evaluation	a						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: Introduction to Biometrics		**9**			
1.	History of Biometrics ,Types of Biometric Traits, General Architecture of Biometric System, Biometric Characteristics	3	C	1	1,3,4
2.	Basic working of Biometric Matching , Biometric System Error and Performance Measures	2	C	1	1,3,4
3.	Design of Biometric Systems , Identification and Verification Concepts	2	C,D	1	1,2,3,4
4.	Applications of Biometrics, Benefits of Biometrics versus Traditional Authentication Methods	2	C	1	1,3,4
UNIT II: Face, Fingerprint, Retina and Iris biometrics		**10**			
5.	Introduction to Face, Finger Print Retina and Iris biometrics	2	C	2	1,2,3,4
6.	Design of Face Recognition System, Neural Network for Face Recognition	2	C,D	2	1,2,3,4
7.	Face Detection in video sequences, Challenges in Face Biometrics, Face Recognition Methods, Advantages and Disadvantages	2	C	2	1,2,3,4
8.	Fingerprint Biometrics, Fingerprint Recognition System, Minutiae Extraction	2	C,D	2	1,2,3,4
9.	Design of Retina and Iris Recognition System, Iris Segmentation Method	1	C,D	2	1,2,3,4
10.	Determination of Iris Region, Experimental Results of Iris Location, Applications of Iris Biometrics, Advantages and Disadvantages	1	C	2	1,2,3,4
UNIT III: Privacy Enhancement and cryptography for biometrics		**10**			
11.	Introduction to privacy enhancement and biometric cryptography	1	C	3	1,2
12.	Privacy concerns associated with deployment, identity and privacy, privacy concerns, biometrics with privacy enhancement	1	C	3	1,2
13.	Comparison of biometrics in terms of privacy, soft biometrics	1	C	3	1,2
14.	General purpose crypto system, Model cryptography and attacks	2	C	3	1,2
15.	Symmetric key ciphers, cryptographic algorithms	2	C	3	1,2
16.	Introduction to Multimodal biometrics, Basic architecture of multimodal biometrics	2	C	3	1,2
17.	Multimodal biometrics using face and ear, Characteristic and advantages of multimodal biometrics	1	C	3	1,2

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
UNIT IV: Image Enhancement Techniques		**8**			
18.	Introduction to Image Enhancement Techniques, Current Research in Image Enhancement Techniques	2	C	4	1,5
19.	Image Enhancement, Frequency Domain Filters, Databases and Implementation	3	C	4	1,5
20.	Experimental results of Image Enhancement Techniques	3	I	4	1,5
UNIT V : Biometrics: Scope and future, Repositories for database and biometric standards		**8**			
21.	Scope and future market of biometrics	1	C	5	1,2
22.	Applications of biometrics, Biometrics and information technology infrastructure, Role of biometrics in enterprise security, Role of biometrics in border security	3	C	5	1,2
23.	Smart card technology and biometrics, Radio frequency identification biometrics, DNA biometrics, Comparative study of various biometric techniques	2	C	5	1,2
24.	Biometric Databases and Biometric Standards	2	C	6	1,2
Total contact hours		**45***			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	G.R.Sinha,Sandeep B Patil,"Biometrics:Concepts and Applications",Wiley publications,New Delhi,2013
2.	Robert Newman"Security and Access control using Biometric Technologies",Cengage Learning,,2010
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Jain, A.K., Flynn, P. and Ross, A. Handbook of Biometrics. 2008.
4.	Ruud M.Bolle,Sharath Pankanti, Nalini K. Ratha,Andrew W. Senior, Jonathan H. Connell, "Guide to Biometrics ",Springer ,2009
5.	Rafael C. Gonzalez, Richard Eugene Woods," Digital Image Processing using MATLAB", 2nd Edition, Tata McGraw-Hill Education ,2010

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15IT330E	**Text Mining**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	NIL				
Prerequisite:	15SE205J Programming in Java				
Data Book / Codes/Standards	NIL				
Course Category	P	PROFESSIONAL ELECTIVE			
Course designed by	Department of Information Technology				
Approval	32nd Academic Council Meeting, 23rd July 2016				

PURPOSE	Text mining is the analysis of data contained in natural language text. The application of text mining techniques is used to solve business problems. Text mining can help an organization derive potentially valuable business insights from text-based content such as word documents, email and postings on social media streams like Facebook, Twitter and LinkedIn. This course covers the techniques for interpreting and retrieving required information from large volume of unstructured texts.

	INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Learn the concepts of Machine Learning	b						
2.	Know the concepts of Information Extraction	a						
3.	Understand the concepts of Information Retrieval	b						
4.	Understandand practice the concepts of Classification and Clustering	b						

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I : NATURAL LANGUAGE PROCESSING	**9**			
1.	Text Mining Overview	1	C	1	4
2.	Introduction to Natural Language Processing, Indian Languages	1	C	1	4
3.	Grammar, Syntax, Semantics, Discourse, Synthesis, Machine Translation	2	C	1	4
4.	Morphology, Stemmer	1	C,I	1	4
5.	Regular Expressions, Spell Checkers	2	C,I	1	4
6.	Text Summarization	1	C,I	1	4
7.	Question Answer System	1	C,I	1	4
	UNIT II : INFORMATION EXTRACTION	**9**			
8.	Statistical Modeling	2	C	2	1
9.	Rule Based Extraction	1	C	2	1
10.	Hidden Markov Model, POS Tagger	2	C,I	2	1
11.	Conditional Random Field, CRF Address Parsers	2	C,I	2	1
	UNIT III : INFORMATION RETRIEVAL	**9**			
12.	Precision and Recall	1	C	3	1
13.	Vector Space Models	1	C	3	1
14.	Feature Identification, Feature Selection, Term Document Matrix	1	C	3	1
15.	Principal Component Analysis, Dimension Reduction	2	C,I	3	1
16.	Latent Semantic Indexing, Plagiarism Detection	2	C,I	3	1
17.	Cross Language Retrieval, Query Expansion	2	C	3	1
	UNIT IV : ALGORITHMIC TECHNIQUES	**9**			
18.	Probabilistic Models, Aspect Models	1	C	1	1
19.	Probabilistic Latent Semantic Indexing	2	C	1	1
20.	Expectation Maximization Algorithm	2	C	1	1
21.	Latent Dirichlet Allocation	2	C	1	1
22.	Document Classification	1	C,I	1	1
23.	Polysemy Keyword Retrieval	1	C,I	1	1
	UNIT V : CLASSIFICATION	**9**			

24.	Classification:Naive Bayes Classifier, Support Vector Machines	2	C	4	1
25.	Neural Network	1	C	4	1
26.	Clustering: Agglomerative Clustering, Divisive Clustering, Distance Measures	2	C	4	1
27.	K - Means , K:-Nearest Neighbor	2	C	4	1
28.	Co-clustering, Fuzzy C-Means	1	C	4	1
29.	Taxonomy	1	I	4	1
	TOTAL CONTACT HOURS	45*			

Si.No	**LEARNING RESOURCES**
1.	Charles.T.Meadow,Bert R Boyce,Donald H Karft, “Text Information Retrieval System”, 3rdEdition, 2007, Emerald Group Publishing, ISBN: 0123694124
2.	DavidGrossman, OphirFrieder, ”Information Retrieval–Algorithms andHeuristics”, 2004, Springer, ISBN:1402030048
3.	StefanButtcher,Charles LA Clarke,Dordon. V.Cormack,”Information Retrieval, Implementing and evaluating Search Engine”, MIT Press, 2010, ISBN: 9780262026512
4.	TanveerSiddiqui, Tiwari,“Natural Language Processing and Information Retrieval”, 2008, Oxford University Press, ISBN: 0195692327
5.	Gerald Kowalski, Mary Maybury,”Information Storage and Retrieval Systems”, 2006, Springer, ISBN: 9780306470318

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* - Excluding Assessment Hours

15IT331E	Computer Graphics		L	T	P	C
			2	2	0	3
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL ELECTIVE				
Course designed by	Department of Information Technology					
Approval	32nd Academic Council Meeting , July 2016					

PURPOSE	This course is designed to provide a comprehensive knowledge to hardware and software principles of interactive raster graphics. The basic concepts of 2-D and 3-D modeling, transformations and rendering techniques are discussed.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Gain knowledge about graphics hardware devices and software used	i						
2.	Understand the two/three dimensional graphics and their transformations	i	a					
3.	Get knowledge about various object representation methods and visible surface detection methods	j						
4.	Understand clipping techniques and illumination and color models	j						

Session	Description of Topic	Contact Hours	C-D-I-O	IOs	Reference
	UNIT I : INTRODUCTION	**6**			
1.	Graphics System Overview, Raster and Random scan systems	1	C	1	1,2
2.	Input, Output devices, Line drawing Algorithm-DDA	1	C	1	1,2
3.	Bresenhams Algorithms (Line), Midpoint Circle Algorithm	2	C	1	1,2
4.	Midpoint Ellipse Algorithm, Pixel addressing and Object geometry, filled area primitives	2	C	1	1,2
	UNIT II : TWO DIMENSIONAL GRAPHICS	**6**			
5.	Geometric Transformations ,Matrix, Homogenous and Composite	1	C	2	1
6.	2D Viewing , pipeline and coordinate reference, window to viewport transformation	1	C	2	1
7.	2D Viewing function, Clipping , Point, Line-Cohen Sutherland, Liang Barsky, NLN	2	C,I	4	1,3
8.	Polygon Clipping-Sutherland Hodgeman, Weiler-Atherton, Curve, Text, Exterior Clipping	2	C,I	4	1,3

	UNIT III : 3D CONCEPTS AND OBJECT REPRESENTATIONS	**6**			
9.	3D Concepts & Object representation, Polygon surfaces and tables	2	C	3	1,3
10.	Plane equations and meshes, Curved line & surfaces	1	C	3	1
11.	Quadratic surfaces and Blobby objects, Spline representation	2	C	3	1
12.	Beizerand B-Spline Curves and surfaces	1	C	3	1,3
	UNIT IV: 3D TRANSFORMATIONS AND VIEWING	**6**			
13.	3D geometric and modeling transforms, 3D Viewing , Viewing Pipeline	2	C	2	1
14.	Viewing Coordinates & Projections, 3D Clipping, Visible Surface Detection methods-Back face detection, Z-buffer method	2	C	2	1
15.	A-buffer method, Scan line method, Painter's algorithms, Area subdivision method, Octree, Ray casting method and BSP	2	C	3	1,3
	UNIT V: ILLUMINATION AND COLOUR MODELS	**6**			
16.	Basic models of illumination	1	C	4	1
17.	Halftone and dithering techniques	1	C	4	1,2

18.	Properties of Light, RGB Color Model, YIQ, YIQ and CMY color model	2	C	4	1,3
19.	HSV and HLS color model, Color selection	2	C	4	1,3
	TOTAL CONTACT HOURS	30*			
	TUTORIAL HOURS	30			

Sl. No.	LEARNING RESOURCES
1.	Donald Hearn &M.PaulineBaker,"*ComputerGraphicsC Version*", 2nd Edition,PearsonEducation,2010, ISBN 978-93-325-3587-9
2.	JohnF.Hughes,AndriesVanDam,MorganMcGuire,DavidF.Sklar, James D.Foley,StevenK.Feiner,KurtAkeley,"*ComputerGraphics:Principlesand Practice*",3rd Edition,Addison-WesleyProfessional, 2013, ISBN13: 0785342399523
3.	Samit Bhattacharya, "*Computer Graphics*, 2015. *Oxford University Press*, ISBN13: 978-0-19-809619-1
4.	Peter Shirley, Michael Ashikhmin and Steve Marschner, "*Fundamentals of Computer Graphics*", 3rd Edition, 2009, ISBN13: 9781568814698
5.	http://www.programmingsimplified.com/c/graphics.h

Course nature					**Theory +Tutorial**	
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Tutorial	**Total**
	Weightage	**10%**	**10%**	**15%**	**15% [Experiments (10%) + Mini Project(5%)]**	**50%**
End semester examination Weightage :						**50%**

* - Excluding Assessment Hours

15IT332E	**Software Testing**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	NIL				
Prerequisite:	15IT311- System Integration and Architecture/ 15SE202-Software Engineering Principles				
Data Book / Codes/Standards	NIL				
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Information Technology				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE	The course of software testing will help the students to develop better programming skills and test the programs efficiently. This course demonstrates an in-depth understanding of the tools and technologies for software testing. Hence the need for the course on software testing and its purpose are quite evident.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand the basics of testing, debugging and errors.	a	m					
2.	Learn various methodologies of testing.	a	m					
3.	Understand and apply the concept of Graph theory.	h						
4.	Demonstrate the purpose of Test tool and automation.	l						

Session	**Description of Topic (Theory)**	**Contact Hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I : INTRODUCTION	**10**			
1.	Purpose of testing, Dichotomies	1	C	1	2,3
2.	Model for testing, Consequences of bugs, Taxonomy of bugs	1	C	1	2,3
3.	Transactions and Flow testing: Basic concepts of path testing, predicates	1	C	2	3,4
4.	Path predicates and achievable paths	2	C	2	3,4
5.	Application of path testing	1	C,I	2	3,4
6.	Transaction flow testing techniques. Paths, path products and regular expressions	2	C	2	3,4
7.	Reduction procedure, applications, regular expressions and Flow anomaly detection	2	C	2	3,4
	UNIT II : LOGIC AND DOMAIN TESTING	**8**			
8..	Domains and paths	1	C	1	2
9.	Nice and ugly domains, domain testing	1	C	1	2
10.	domain and interface testing	2	C	1	2,3
11.	Overview of logic based testing, decision tables	1	C	2	2,3
12.	Path expressions, kv charts	2	C,I	2	2,3
13.	Specifications	1	C,I	2	2,3
	UNIT III : STATE, STATE GRAPHS AND TRANSITION TESTING	**9**			
14.	State graphs	1	C	3	1,2
15.	Good and bad state graphs, state testing	1	C	3	1,2
16.	Testability tips	1	C	3	1,2
17.	Graph matrices and application: Matrix of graph	2	C,I	3	1,2
18.	Relations, power of a matrix, node reduction algorithm	2	C,I	3	1,2
19.	Building tools, Exposure to JMeter, Winrunner	2	C,I	3	1,2
	UNIT IV : BLACK BOX TESTING	**9**			
20.	System testing, Acceptance testing, Smoke testing	1	C	2	1,5
21.	Adhoc testing, Performance testing	1	C	2	1,5
22.	Regression testing, Test case design techniques	1	C,I	2	1,5
23.	Software test life cycle: Test plan, preparing Traceability matrix	1	C,I	2	1,5
24.	Writing test execution report, summary report	2	C,I	4	1,5
25.	Retrospect meeting, Defect tracking	2	C,I	4	1,5

26.	Preparing bug report using defect tracking tool	1	C,I	4	1,5
UNIT V : METRICS AND AUTOMATION		**9**			
27.	Scope of automation, Design and architecture for automation	2	C	4	1
28.	Process model, Challenges for automation	2	C,I	4	1
29.	Test metrics and measurements: Project metrics	2	C,I	4	1
30.	Progress metrics, Productivity metrics	2	C,I	4	1
31.	Test case developed per 100 hour of testing	1	C,D,I	4	1
	TOTAL CONTACT HOURS	45*			

Sl. No.	**LEARNING RESOURCES**
1.	Srinivisandesikan, Ramesh Gopalaswamy, “Software testing : Principles and Practices”, Pearson education , 2006, ISBN= 817758121X
2.	Borizbeizer,” Software testing techniques”, dreamtech, second edition, 2009, ISBN13: 978-0442206727
3.	William E. Perry,”Effective methods of software testing”, Second edition,. John wiley, 2000, ISBN13: 9780471354185
4.	GlenfordJ.Myers, Corey Sandler, Tom Badgett, “Art of software testing”,Johnwiley&sons, 2011, ISBN: 978-1-118-03196-4
5.	Boris Beizer, “Black-Box Testing: Techniques for Functional Testing of Software and Systems”, 1995, ISBN: 978-0-471-12094-0

Course nature					**Theory**		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* - Excluding Assessment Hours

15CS334E	**Network Programming**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	Nil				
Prerequisite:	15IT303J				
Data Book / Codes/Standards	Nil				
Course Category	P	Professional Elective			
Course designed by	Department of Computer Science and Engineering				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE	To learn about the protocols used in internet, understand socket programming and inter system communication, build network applications and services using API.								
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**							
At the end of the course, student will be able to									
1.	Become familiar with elementary socket functions	a	b						
2.	Design and implement client –server applications using Sockets	a	b						
3.	Learn about functions that convert between names and numeric values and protocols	a	b	e					
4.	Analyze network programs	a	e						
5.	Build network applications	a	b	c					

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: Introduction and TCP/IP		**9**			
1.	Introduction – simple daytime client – protocol independence- Error handling – simple daytime server- Roadmap to client/server.	2	C,I	4	1
2.	Overview of TCP/IP protocol- TCP connection establishment and termination – TCP state transition diagram – Time-wait state	3	C	1,4	1,2,4
3.	SCTP association establishment and termination –port numbers – TCP port numbers and concurrent servers- Buffer size and limitations - standard internet services- protocol usage by common Internet applications.	4	C,I	1,4,5	1
UNIT II: Elementary TCP sockets		**10**			
4.	Socket function – connect function – bind function –listen function – accept function.	4		1	1,2
5.	Fork and exec functions – concurrent servers – close function – getsockname and getpeername.	2	C,I	1,2	1
6.	TCP Echo server and Echo client – normal startup and termination	2	C,I	2	1,2
7.	POSIX signal handling –Wait and Waitpid functions – Termination of server process-Crashing and rebooting of server host	2	C,I	2,4	4
UNIT III: Socket options and UDP sockets		**8**			
8.	Get sock opt and set sock opt function	1	C	1	1
9.	IPV4 , ICMP and TCP socket options	2	C,I	1	1,2,3
10.	UDP Echo server and client- recvfrom and send to functions.	2	C,I	1,2,4,5	1,2
11.	Connect function with UDP	1	C,I	1	1
12.	dg_cli function –lack of flow control with UDP .	2	C.I	4	1,2
UNIT IV: DNS, BOOTP and DHCP		**9**			
13.	DNS- resolvers and name servers- gethostbyname function – gethostbyaddr function – getservbyname and getservbyport function.	4	C	3	1,3
14.	tcp_connect function- tcp_listen function - udp_client, udp_connect, udp_server function	3	C,I	3	1,2
15.	BOOTP and DHCP	2	C	3	1,2,3,4
UNIT V: Advanced sockets		**9**			

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
16.	IPV4 and IPV6 interoperability	2	C,I	4	1,2
17.	Daemon processes and the inetd superserver	3	C	4,5	1
18.	Advanced I/O functions	4	C	4	1
Total contact hours		**45***			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	W.Richard Stevens, Bill Fenner, Andrew M. Rudoff “ *Unix Network programming “* 3rd edition Volume – 1, Pearson Education , 2015
2.	Douglas.E.Comer *“ Internetworking with TCP/IP “ principles, protocols and architecture,* 6th Edition , Volume 1, Pearson Education,2013.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Behrouz A.Forouzan , “ *TCP/IP protocol suite”,* 4th edition, Mc Graw Hill education private limited,2010
4.	Wendell Odom , “ *IP networking “,* 1st edition, Pearson Education 2012.

Course nature		**Theory**					
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15SE327E	**Distributed Operating Systems**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	P PROFESSIONAL ELECTIVE				
Course designed by	Department of Software Engineering				
Approval	32nd Academic Council Meeting, 23rd July, 2016				

PURPOSE	Provides essential concepts of the principles of distributed systems and the functionalities of distributed operating system.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Recognize the essential concepts of distributed system.	a	e					
2.	Comprehend about the communication that takes place in Distributed systems	a	b	e				
3.	Realize the necessity of synchronization, consistency and Fault tolerance in a Distributed System.	a	e					
4.	Value the Process management ,File systems, Shared memory	a	b	e				
5.	Acquire apparent scheme regarding distributed object oriented based systems	a	e					

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I:FUNDAMENTALS OF DISTRIBUTED SYSTEMS	**8**			
1.	Introduction to distributed systems, Goals of Distributed Systems	2	C	1	1,2
2.	Hardware Concepts-Bus-based, switched multiprocessors, Bus-based ,Switched micro computers	2	C	1	1
3.	Software Concepts-Network Operating Systems, True Distributed System and Time sharing Multiprocessor Operating System	2	C	1	1,2
4.	Design issues of distributed systems	2	C	1	1,2
	UNIT II:COMMUNICATION IN DISTRIBUTED SYSTEMS	**9**			
5.	Fundamentals of Communication systems, Layered Protocols	2	C	1,2	1
6.	ATM networks	1	C	1,2	1,2
7.	Client Server model - Blocking Primitives and Non-Blocking Primitives,	1	C	1,2	1
8.	Buffered Primitives and Un buffered Primitives	1	C	1,2	1,2
9.	Reliable and Un reliable primitives	1	C	1,2	1,2
10.	Message Passing	2	C,I	1,2	2
11.	Remote Procedure Call	1	C,I	1,2	1
	UNIT III: SYNCHRONIZATION IN DISTRIBUTED SYSTEMS	**9**			
12.	Clock Synchronization - Logical, Physical clocks, clock synchronization algorithms	2	C,I	1,3	1,4,5
13.	Mutual Exclusion – Centralized,Distributed,Token ring algorithms, comparison of three algorithms	2	C,I	1	1
14.	Election Algorithms – The Bully algorithm, ring algorithm	2	C,I	1	1,4
15.	Atomic transactions	1	C,I	1	1
16.	Deadlock prevention and detection in distributed systems	2	C,I	1	1

	UNIT IV: PROCESSES ,FAULT TOLERANCE,DISTRIBUTED SHARED MEMORY	**12**			
17	Threads, System models	1	C	1	1,2
18	Processor Allocation-Allocation models, Design issues for processor allocation algorithm, Processor allocation algorithms	4	C,D,I	1,4	1,3
19	Scheduling in Distributed systems	2	C,D,I	1,4	1,2,3
20	Fault tolerance- Component faults, system failures, synchronous versus asynchronous systems, fault tolerance using active replication and primary backup	3	C,D	1,3	1,2,4
21	Consistency protocols, Page based distributed shared memory	2	C,D	1,3	1,2
	UNIT V: DISTRIBUTED OBJECT BASED SYSTEMS, CASE STUDY	7			
22	Distributed object based systems- DOO Architecture, DOO Process, DOO Communication, Synchronization in Object Based Systems	4	C	1,5	1,2
23	Distributed File Systems	1	C	1,4	1,2
24	Case Study: Ameoba,MachOS,chorus,V-System	2	C	3,4,5	1,2
	Total contact hours	45			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Andrew S. Tanenbaum, “*Distributed Operating Systems*”, PearsonEducation, Reprint , 2011
2.	Pradeep K. Sinha, “*Distributed Operating Systems Concepts and Design*”,PHI, 2012.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	MukeshSinghal, Niranjan G Shivratri “Advanced Concepts in Operating Systems”, McGraw Hill International 2011.
4.	http://www.seas.gwu.edu/~jstanton/courses/cs251/
5.	http://cse.yeditepe.edu.tr/~sbaydere/courses_new/cse532/

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15CS335E	**Computer Forensics**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	15IT303J					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Elective				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	This course provides a way to understand Internet Security and different types of Cyber forensic technologies and enable the student to have a foundation in this emerging area.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	To study various threats associated with security and information warfare	a						
2.	To study about email security and the Importance of Firewalls and their types	a						
3.	To impart an introduction to the need of computer forensics	a						
4.	To study the tools and tactics associated with cyber forensics	a	k					
5.	To analyze and validate computer forensics data	a						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: Network Layer Security & Transport Layer Security		**9**			
1.	IPSec Protocol	2	C	1	1
2.	IP Authentication Header - IP ESP - Key Management Protocol for IPSec	2	C	1	1
3.	Transport layer Security - SSL protocol	3	C	1	1
4.	Cryptographic Computations - TLS Protocol	2	C	1	1
UNIT II: E-Mail Security & Firewalls		**9**			
5.	PGP - S/MIME	2	C	2	1
6.	Internet Firewalls for Trusted System: Roles of Firewalls	2	C	2	1
7.	Firewall related terminology- Types of Firewalls - Firewall designs	3	C	2	1
8.	SET for E-Commerce Transactions	2	C	2	1
UNIT III: Introduction to Computer Forensics		**9**			
9.	Computer Forensics Fundamentals	1	C	3	2
10.	Types of Computer Forensics	2	C	3	2
11.	Forensics Technology and Systems	2	C	3	2
12.	Understanding Computer Investigation	2	C	3	2
13.	Data Acquisition	2	C	3	2
UNIT IV: Evidence Collection And Forensics Tools		**9**			
14.	Processing Crime and Incident Scenes	3	C	4	2
15.	Working with Windows and DOS Systems	3	C	4	2
16.	Current Computer Forensics Tools: Software/ Hardware Tools.	3	C	4	2
UNIT V: Analysis and Validation		**9**			
17.	Validating Forensics Data- Data Hiding Techniques – Performing Remote Acquisition	3	C	5	2
18.	Network Forensics – Email Investigations	3	C	5	2
19.	Cell Phone and Mobile Devices Forensics	3	C	5	2
Total contact hours		**45***			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Man Young Rhee, “Internet Security: Cryptographic Principles, Algorithms and Protocols”, Wiley Publications, 2003.
2.	Christopher Steuart, Bill Nelso, Amelia Phillips, “Guide Computer Forensics and Investigations”, Cengage Learning, India, Fourth Edition, 2013.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	John R.Vacca, “Computer Forensics: Computer Crime Scene Investigation”, Charless RiverMedia, 2002.
4.	Richard E.Smith, “Internet Cryptography”, Pearson Education, 3rd Edition, 2008.
5.	Marjie T.Britz, “Computer Forensics and Cyber Crime: An Introduction”, Pearson Education, 2nd Edition, 2011.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS336E	**Network Routing Algorithms**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	15IT303J					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Elective				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	To understand the principles behind the data transfer mechanisms over the conventional network.								
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**							
At the end of the course, student will be able to									
1.	Understand the principles behind the data transfer mechanisms over the conventional network.	a	b						
2.	Ability to configure routing algorithms over the routers	a	b						
3.	Understand the data traversal through various cross points (routers) in the network	a							
4.	Design routing algorithms for any conventional networks	e							
5.	Understand the various types of key routing protocols used in modern computer networks.	e							

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**Ios**	**Reference**
UNIT I: NETWORK ROUTING: BASICS AND FOUNDATIONS		**9**			
1.	Network Routing: An Introduction to Routing algorithms	1	C	1,3	1
2.	Functions of Router	1	C	1,3	1
3.	IP Addressing	1	C,D	1,3	1,4
4.	Protocol Stack Architecture	1	C	1,3	1,4
5.	Network Topology and Management architectures	1	C	1,3	1,4
6.	PSTN	1	C	1,3	2
7.	Communication Technologies	1	C	1,3	2,4
8.	Standards committees	1	C	1,3	2,4
9.	Network Protocol Analyzer	1	C	1,3	1
UNIT II: ROUTERS AND ADDRESS LOOKUP ALGORITHMS		**9**			
10.	Types of routers	1	C,I	1	1
11.	Elements of a router	1	C	1	1
12.	Packet flow	1	C,I	1,3	1
13.	Packet processing	1	C	1,3	1
14.	Router architectures	1	C,I	1,3	1
15.	Impact of addressing on lookup	1	C	2,4	1
16.	longest prefix matching	1	C,D	2,4	1
17.	Naïve Algorithms	1	C,D	2,4	1
18.	Binary tries and Multi-bit Tries	1	C,D	2,4	1
UNIT III: ROUTING ALGORITHMS: SHORTEST PATH AND WIDEST PATH		**9**			
19.	Bellman Ford algorithm and distance vector approach	1	C,D,I	2,4	2
20.	Dijikstra’s algorithm	2	C,D,I	2,4	2
21.	Comparison of Bellman Ford algorithm and Dijikstra’s algorithm	2	C,D,I	2,4	1
22.	shortest and widest path computation	2	C,D,I	2,4	1
23.	k-shortest path algorithms, Routing Protocols: Framework and Principles	2	C,D,I	2,4	1
UNIT IV: ROUTING IN IP NETWORKS		**9**			
24.	IP Routing and Distance Vector Protocol Family	2	C	1,3	1
25.	Routers, Networks, and Routing information Basics	1	C	1,3	1
26.	RIP v1,v2 – IGRP – EIGRP	2	C,D	2,4,5	1
27.	OSPF and integrated IS-IS	1	C,D	2,4,5	1
28.	IP Traffic Engineering, BGP, Internet Routing Architectures	3	C,D	2,4,5	1
UNIT V: ROUTING IN WIRELESS NETWORKS		**9**			
29.	Internet based mobile ad-hoc networking	2	C,D	1,3	1,3
30.	Destination sequenced Distance Vector (DSDV),	2	C,D	2,4,5	1,3

Session	Description of Topic	Contact hours	C-D-I-O	Ios	Reference
31.	Dynamic source Routing (DSR)	2	C,D	2,4,5	1,3
32.	Ad-hoc on demand Distance Vector (AODV)	1	C,D	2,4.5	1,3
33.	Temporarily Ordered Routing algorithm (TORA).	2	C,D	2,4,5	1,3
Total contact hours		45*			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	D.Medhi and K.Ramasamy, Network Routing : Algorithms, Protocols and Architectures, Morgan Kaufmann Publishers, First Edition 2007.
2.	Steen Strub M, Routing in Communication networks, Prentice Hall International, 1995
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	C.Siva Ram Murthy and B.S.Manoj, Adhoc Wireless Networks, Pearson Education, 2007.
4.	Internetworking Technologies Handbook, Inc. Cisco Systems, ILSG Cisco

Course nature		**Theory**				
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS337E	**High Performance Computing**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Elective				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	The Purpose of this course is to make the student familiar with High Performance Computing Principles and its Environment.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	To learn about Modern Processors and concepts	a						
2.	To understand the concepts of optimizations	a	h					
3.	To learn about Parallel Computers and Programming	a	e					
4.	To Study about Memory Parallel Programming using OpenMP and MPI	a	e					

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I:MODERN PROCESSORS		**9**			
1.	Stored Program Computer Architecture- General purpose cache-based microprocessor	2	C	1	1
2.	Performance based metrics and benchmarks-Moore's Law	2	C	1	1,2
3.	Pipelining- Superscalarity-SIMD Memory Hierarchies Cache-mapping- prefetch-Multicore processors-Mutithreaded processors	3	C	1	1,2
4.	Vector Processors- Design Principles- Maximum performance estimates- Programming for vector architecture.	2	C,D	1	1
UNIT II: BASIC OPTIMIZATION TECHNIQUES FOR SERIAL CODE		**9**			
5.	Scalar profiling- Function and line based runtime profiling- Hardware performance counters- Simple measures large impact	2	C	2	1,4
6.	Elimination of common sub expressions- Avoiding branches- Using SIMD instruction sets- The role of compilers – General optimization	2	C,D	2	1,2
7.	Inlining – Aliasing- Computational Accuracy- Register optimizations- Using compiler logs- C++ optimizations – Temporaries	2	C	2	1,2
8.	Dynamic memory management- Loop kernels and iterators Data Access Optimization: Balance analysis and light speed estimates	2	C	2	1,4
9.	Storage order- Case study: Jacobi algorithm and Dense matrix transpose.	1	C	2	1
UNIT III: PARALLEL COMPUTERS		**9**			
10.	Taxonomy of parallel computing paradigms- Shared memory computers- Cache 1oherence- UMA – ccNUMA	2	C	3	1,5
11.	Distributed-memory computers- Hierarchical systems- Networks- Basic performance characteristics- Buses- Switched	2	C	3	1,3,5
12.	and fattree networks- Mesh networks- Hybrids Basics of parallelization– Data Parallelism – Function Parallelism	1	C,D	3	1,3,5
13.	Parallel Scalability- Factors that limit parallel execution- Scalability metrics- Simple scalability laws	2	C	3	1,5
14.	parallel efficiency – serial performance Vs Strong scalability- Refined performance models	1	C	3	1,5
15.	Choosing the right scaling baseline- Case Study : Can slow processors compute faster- Load balance.	1	C	3	1,5
UNIT IV: SHARED MEMORY PARALLEL PROGRAMMING WITH OPENMP		**9**			
16.	Introduction to OpenMP – Parallel execution – Data scoping- OpenMP work sharing for loops- Synchronization – Reductions	3	C	4	1,3
17.	Loop Scheduling – Tasking – Case Study: OpenMP- parallel Jacobi	3	C,D	4	1,3,5

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	algorithm- Advanced OpenMPwavefront parallelization				
18.	Efficient OpenMProgramming: Profiling OpenMP programs – Performance pitfalls	2	C,D	4	1,5
19.	Case study: Parale Sparse matrix-vector multiply.	1	C	4	1,5
UNIT V: DISTRIBUTED-MEMORY PARALLEL PROGRAMMING WITH MPI		**9**			
20.	Message passing – Introduction to MPI- Messages and point-to-point communication-	1	C	4	1
21.	- Nonblocking point-to-point communication- Virtual topologies – MPI parallelization of Jacobi solver	2	C	4	1
22.	performance properties Efficient MPI programming: MPI performance tools- communication parameters	2	C	4	1
23.	Synchronization, serialization, contention- Reducing communication overhead optimal domain decomposition- Aggregating messages	2	C	4	1
24.	NonblockingVs Asynchronous communication- Collective communication- Understanding intra node P-to-P communication	2	C	4	1
Total contact hours		**45***			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Georg Hager, Gerhard Wellein, "Introduction to High Performance Computing for Scientists and Engineers", Chapman & Hall / CRC Computational Science series, 2011.
2.	John Levesque, Gene Wagenbreth, “High Performance Computing: Programming and Application” CRC Press,2010.
3	Kai Hwang, Zhiweixu “Scalable Parallel Computing: Technology, Architecture, Programming”, McGraw Hill International, 2000.
4	Charles Severance, Kevin Dowd, "High Performance Computing", O'Reilly Media, 2nd Edition, 1998.
5	Kai Hwang, Faye Alaye Briggs, "Computer Architecture and Parallel Processing", McGraw Hill, 1984.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15EC353	**Digital Signal Processing Techniques**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	**P**	**Professional Core**	**Signal Processing**		
Course designed by	Department of Electronics and Communication Engineering				
Approval	30th Academic Council Meeting, 24th March 2016				

Purpose	To provide the fundamentals of continuous and discrete time signals, systems and modern digital processing as well as applications.			
Instructional Objectives		**Student Outcomes**		
At the end of the course, the learners will be able to		**H**	**M**	**L**
1.	Classify, analyze continuous and discrete signals and systems	a	e	c
2.	Know about Frequency domain analysis using Z-Transform and using DFT	e	a	
3.	Design of Finite and Infinite Response filters.	a	e	
4.	Understand the finite world length effects that arise in digital signal processing	e	a	b
5.	Acquire knowledge about the architecture of DSP processors and applications of DSP	e	c	k

H-High Correlation, **M**-Medium Correlation, **L**-Low correlation

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	Unit-I: Classification of Signals and Systems	**9**			
1.	**Classification of Signals:** Continuous time signals - Discrete time signals	1	C	1	1-2
2.	Periodic and Aperiodic signals – Even and odd signals	1	C	1	1-2
3.	Energy and power signals	1	C	1	1-2
4.	Deterministic and random signals –Complex exponential and Sinusoidal signals	1	C	1	1-2
5.	Unit step, Unit ramp, Unit impulse – Representation of signals in terms of unit impulse.	1	C	1	1-2
6.	**Classification of Systems:** Continuous time systems- Discrete time systems –static system- causal system –Stable system	1	C	1	1-2
7.	Linear system – Time Invariant system - Linear Convolution	2	C	1	1-2
8.	Matlab Exercises	1	C,D,I	1	1-2
	Unit–II: Frequency Transformations	**9**			
9	z- transforms-ROC- Properties of Z	1	C	2	1-4

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	transform				
10	Inverse Z transform: Power series expansion - Partial fraction methods	1	C,D	2	1-4
11	Analysis and characterization of LTI system using Z transform-	2	C,D	2	1-4
12	DTFT-Sampling of DTFT-DFT and its inverse- properties of DFT-circular symmetry property	2	C	2	1-4
13	N- point DFT Decimation-in-Time Radix-2 FFT Algorithms	1	C,D	2	1-4
14	N- point DFT Decimation-in-Frequency Radix-2 FFT Algorithms	1	C,D	2	1-4
15	Linear convolution using the DFT-Fast Fourier Transform	1	C,D	2	1-4
	Unit-III: Design of FIR Filters	**9**			
16	Design of Finite Impulse Response Filters-Symmetric and Antisymmetric FIR filters	2	C,D	3	3,4
17	Design of Linear- Phase FIR filters Fourier Series Method	1	C,D	3	3,4
18	Design of Linear- Phase FIR filters Using Rectangular Hamming Window	1	C	3	3,4
19	Design of Linear- Phase FIR filters Using Hanning Window (LPF,HPF,BPF,BSF)	2	C,D	3	3,4
20	Design of Linear- Phase FIR filters Using Blackman Window (LPF,HPF,BPF,BSF)	1	C,D	3	3,4
21	Design of Linear- Phase FIR filters Using Hanning Window (LPF,HPF,BPF,BSF)	1	C	3	3,4
22	MATLAB program for FIR filters	1	C	3	3,4
	Unit–IV: Design of IIR Filters from Analog Filters	**9**			
23	Frequency Response and Characteristics of Analog Filters	1	C,D	3	3,4
24	Analog to Digital transformations techniques	1	C,D	3	3,4
25	Design of Butterworth filter(LPF) using Bilinear Transformation and Impulse Invariance methods	2	C,D	3	3,4
26	Chebyshev Filter (LPF)Designs based on the Bilinear Transformation and Impulse Invariance methods	2	C,D	3	3,4
27	Finite word length effects in digital Filters: Errors- Quantization of Filter Coefficients	1	C,D	4	3,4
28	Limit Cycle oscillations	1	C,D	4	3,4
29	MATLAB programs for IIR Filters	1	C,D,I	3	3,4
	Unit-V: DSP Processor and Applications	**9**			
30	Super Harvard architecture –Data path-multiple access memory -pipelining	2	C	5	5
31	Architecture of TMS320C5X family of DSP	2	C	5	5

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	processors				
33	Addressing Modes of TMS320C5X	2	C	5	5
34	Instruction Set of TMS320C5X	1	C	5	5
35	Applications on digital signal processing	2	C	5	5
	Total contact Hours	**45**	Exclusive of assessment hours		

Learning Resources	
1	Alan V Oppenheim, Ronald W. Schafer “Signals & Systems”, Pearson Education, 1997.
2	Simon Haykin and Barry Van Veen, “Signals and Systems”, John Wiley & Sons Inc, 2nd Edition, 2007.
3	John G. Proakis, Dimitris G. Manolakis, “Digital Signal Processing, Principles, Algorithms and Applications”, Pearson Education, 4th edition, 2007
4	Alan V. Opoenheim, Ronald W. Schafer, John R. Buck, “Discrete Time Signal Processing”, Pearson Education, 8th edition, 2011
5	Venkataramani B, Bhaskar M, “Digital Signal Processors, Architecture, Programming and Application”, Tata McGraw Hill, New Delhi, 2003.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15CS338E	**Database Security And Privacy**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Elective				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	The course provides a foundation in database security and privacy. To design and implement security profiles, password policies, privileges and roles. Also to handle the issues in privacy.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able								
1.	To understand the fundamentals of security, and how it relates to information systems	a	b					
2.	To learn good password policies, and techniques to secure passwords in an organization	a	b	k				
3.	To handle privacy issues	a	b	k				

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I : SECURITY ARCHITECTURE & OPERATING SYSTEM SECURITY FUNDAMENTALS		**8**			
1.	**Security Architecture**: Introduction-Information Systems-Database Management Systems	2	C	1	1,3
2.	Information Security Architecture- Database Security–Asset Types and value-Security Methods	2	C,D	1	1,3
3.	**Operating System Security Fundamentals**: Introduction-Operating System Overview-Security Environment –Components- Authentication Methods	2	C	1	1,3,5
4.	User Administration-Password Policies-Vulnerabilities-E-mail Security	2	D,I	1	1,3,5
UNIT II : ADMINISTRATION OF USERS & PROFILES,PASSWORD POLICIES, PRIVILEGES AND ROLES		**10**			
5.	**Administration of Users**- Introduction-Authentication- Creating Users	2	C,D	1	1,3
6.	SQL Server User-Removing, Modifying Users-Default	2	D,I	1	1,3
7.	Remote Users-Database Links-Linked Servers-Remote Servers-Practices for Administrators and Managers-Best Practices	2	C	1	1,3
8.	**Profiles, Password Policies, Privileges and Roles**: Introduction-Defining and Using Profiles-Designing and Implementing Password Policies	2	C,D,I	2	1,3
9	Granting and Revoking User Privileges-Creating, Assigning and Revoking User Roles-Best Practices	2	I	2	1,3
UNIT III : DATABASE APPLICATION SECURITY MODELS& VIRTUAL PRIVATE DATABASES		**9**			
10.	**Database Application Security Models**: Introduction-Types of Users-Security Models	2	C	2	1,3,5
11.	Application Types-Application Security Models-Data Encryption	2	C	2	1,3,5
12.	**Virtual Private Databases**: Introduction-Overview of VPD-Implementation of VPD using Views, Application Context in Oracle	2	C,D,I	2	1,3,5
13.	Implementing Oracle VPD-Viewing VPD Policies and Application contexts using Data Dictionary	2	D,I	2	1,3,5

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
14.	Policy Manager Implementing Row and Column level Security with SQL Server	1	D,I	2	1,3,5
UNIT IV : AUDITING DATABASE ACTIVITIES		**9**			
15.	**Auditing Database Activities**: Using Oracle Database Activities-Creating DLL Triggers with Oracle	3	D,I	2	1,3
16.	Auditing Database Activities with Oracle-Auditing Server Activity with SQL Server 2000	3	D,I	2	1,3
17.	Security and Auditing Project Case Study strategy	3	C	2	1,3
UNIT V : PRIVACY PRESERVING DATA MINING TECHNIQUES		**9**			
18.	**Privacy Preserving Data Mining Techniques**: Introduction-Privacy Preserving Data Mining Algorithms	2	C,D	3	2,4
19.	General Survey-Randomization Methods-Group Based Anonymization	3	C	3	2,4
20.	Distributed Privacy Preserving Data Mining-Curse of Dimensionality	3	C,D	3	2,4
21.	Application of Privacy Preserving Data Mining	1	C	3	2,4
Total contact hours		**45***			

LEARNING RESOURCES	
1.	.Hassan A. Afyouni, “Database Security and Auditing”, Third Edition, Cengage Learning, 2009. (UNIT 1 to IV)
2.	Charu C. Aggarwal, Philip S Yu, “Privacy Preserving Data Mining”: Models and Algorithms, Kluwer Academic Publishers, 2008.(UNIT V).
3	Ron Ben Natan, ”Implementing Database Security and Auditing”, Elsevier Digital Press, 2005.
4	http://charuaggarwal.net/toc.pdf
5	http://adrem.ua.ac.be/sites/adrem.ua.ac.be/files/securitybook.pdf

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15MA317E	**OPTIMIZATION TECHNIQUES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	NA				
Prerequisite:	15MA102 (or) 15MA104 (or) 15MA205B				
Data Book / Codes/Standards	Yes				
Course Category	E	ELECTIVE	MATHEMATICS		
Course designed by	Department of Mathematics				
Approval	-- Academic Council Meeting -- , 2016				

PURPOSE	To understand and apply optimization techniques to industrial operations		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1.	Identify the optimization of resources and apply techniques to industrial problems.	a	e
2.	Predict the life time of replacement items	a	e
3.	Ascertain the optimal sequence to do the jobs through the machinesand CPM-PERT Network models.	a	e
4.	To know the goal of inventory control	a	e
5.	Employ the concept of Transportation and Assignment problems.	a	e

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: LINEAR PROGRAMMING PROBLEM	**9**			
1.	Formulation of an LPP model	1	C, I	1	1-7
2.	Graphical Method of LPP	2	C, I	1	1,3,4,6
3.	Simplex algorithm- Maximization case	2	C, I	1	1,3,4,6
4.	Simplex algorithm- Minimization case	2	C, I	1	1,3,4,6
5.	Artificial variable techniques	2	C, I	1	1,3,4,6
	UNIT II: REPLACEMENT AND GAME THEORY	**9**			
6.	Replacement of items that deteriorate with time and value of money remains constant	2	C, I	2	1,3,4,6
7.	Replacement of items which do not deteriorate with time and equipment that fails suddenly	2	C, I	2	1,3
8.	Two person zero sum games	1	C, I	2	1,3
9.	Saddle point, pure strategies, mixed strategies and dominance property	2	C, I	2	1,3,4,6
10.	Graphical method for 2 x n and m x 2 games	2	C, I	2	1,5,6

	UNIT III: RESOURCE SCHEDULING AND NETWORK ANALYSIS	**9**			
11.	Sequencing problem :Models with n jobs through two machines	2	C, I	3	2,5,7
12.	Sequencing problem :Models with n jobs through three machines	2	C,I	3	2,5,7,1
13.	Sequencing problem :Models with n jobs through m machines	1	C,I	3	2,5,7
14.	Critical Path Method (CPM)	2	C,I	3	1,2
15.	PERT in network	2	C,I	3	1,2
	UNIT IV: INVENTORY CONTROL	**9**			3.6
16.	Inventory models – Introduction, Economic ordering quantity, Reorder level.	2	C,I	4	7
17.	Deterministic models – Purchasing model with no shortages	2	C,I	4	1,5,6
18.	Deterministic models –Manufacturing model with no shortages	1			
19.	Deterministic models – Purchasing model with shortages	2	C,I	4	4,5
20.	Deterministic models – Manufacturing model with shortages	1			
21.	Optimum cost	1	C,I	4	1,2
	UNIT V: ADVANCED LINEAR PROGRAMMING	**9**			
22.	Initial basic solution of transportation problem by Vogel's Approximation Method	2	C,I	5	3,4
23.	Optimality test- MODI method	2	C,I	5	3, 4
24.	Unbalanced transportation problem	2	C,I	5	3,4
25.	Degenerate solution	1	C,I	5	3,4
26.	Assignment problem- Hungarian method	1	C,I	5	3, 4
27.	Travelling salesman problem	1	C,I	5	3, 4
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	KantiSwarup, Gupta P. K., and Man Mohan, *Operations Research*, Sultan Chand & Sons, 1994.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	Gupta, P.K., and Hira, D.S., *Operations Research*S.Chand& Sons., 2000.
3.	Sundaresan.V, Ganapathy Subramanian. K.S. and Ganesan.K, *Resource*

	Management Techniques, A.R. Publications, 2002
4.	Sharma S.D., *Operations Research*, KedarnthRamnath& Co., Meerut 1994
5.	Taha, H.A, *Operations Research - An Introduction*, 7th edition, Prentice Hall of India, New Delhi.
6.	Gupta P. K., and Manmohan, *Operations Research and Quantitative Analysis* – S. Chand &Co. New Delhi.
7.	Billy B. Gillet., *Introduction to Operations Research*, TMH Publishing and Co.

Course nature					**Theory**		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
						End semester examination Weightage :	**50%**

ELECTIVES

Dept. Elective-V and Elective-VI

15CS421E	**Natural Language Processing**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data\Book/ Codes/Standards	Nil					
Course Category	P	Professional Elective				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	This course provides a sound understanding of Natural Language Processing and challenges involved in that area							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Provide the student with knowledge of various levels of analysis involved in NLP	a	b					
2.	Understand the applications of NLP	a	j					
3.	Gain knowledge in automated Natural Language Generation and Machine Translation	a						

Session	**Description of Topic**	**Contact hours**	**C-D-I- O**	**IOs**	**Reference**
UNIT I: OVERVIEW AND MORPHOLOGY		**9**			
1	Introduction – Models -and Algorithms - -Regular Expressions Basic Regular Expression Patterns – Finite State Automata	3	C	1	1,2
2	Morphology -Inflectional Morphology - Derivational Morphology -	3	C, D	1	1,2
3	Finite-State Morphological Parsing --Porter Stemmer	3	C,I		1,2
UNIT II : WORD LEVEL AND SYNTACTIC ANALYSIS		**9**			
4	N-grams Models of Syntax - Counting Words - Unsmoothed N-grams	3	C, D	1	1,2
5	Smoothing- Backoff DeletedInterpolation – Entropy - English Word Classes - Tagsets for English	2	C	1,2	1,2
6	Part of Speech Tagging-Rule Based Part of Speech Tagging - Stochastic Part of Speech Tagging - Transformation-Based Tagging -	4	C,D,I	1,2	1,2
UNIT III : CONTEXT FREE GRAMMARS		**9**			
7	Context Free Grammars for English Syntax- Context- Free Rules and Trees -	3	C	1,2	1,2
8	Sentence- Level Constructions–Agreement – Sub Categorization	2	C	1,2	1,2
9	Parsing – Top-down – Earley Parsing -feature Structures – ProbabilisticContext-Free Grammars	4	C	1,2	1,2
UNIT IV : SEMANTIC ANALYSIS		**9**			
10	Representing Meaning - Meaning Structure of Language - First Order Predicate Calculus	2	C	1,2	1,2
11	Representing Linguistically Relevant Concepts -Syntax- Driven Semantic Analysis - Semantic Attachments -Syntax- Driven Analyzer	3	C, D	1,2	1,2
12	- Robust Analysis - Lexemes and Their Senses - Internal Structure - Word SenseDisambiguation -Information Retrieval	4	D,I	1,2	1,2
UNIT V : LANGUAGE GENERATION AND DISCOURSE ANALYSIS		**9**			
13	Discourse -Reference Resolution - Text Coherence - Discourse Structure – Coherence	2	D,I	1,2,3	1,3
14	Dialog and Conversational Agents - Dialog Acts – Interpretation - Conversational Agents -	2	D,I	1,2,3	1,3
15	Language Generation – Architecture -Surface Realizations - Discourse Planning .	2	D,I	1,2,3	1,3
16	Machine Translation -Transfer Metaphor–Interlingua – Statistical Approaches	3	D,I	1,2,3	1,3
Total contact hours		**45^{*}**			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Daniel Jurafsky and James H Martin, ”Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, Prentice Hall, 2nd Edition, 2008.
2.	C. Manning and H. Schutze, “Foundations of Statistical Natural Language Processing”, MIT Press. Cambridge, MA:,1999
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	James Allen, Bejamin/cummings, “Natural Language Understanding”, 2nd edition, 1995.

Course nature							**Theory**
Assessment Method (Weightage 100%)							
In- semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS422E	**Knowledge Based Decision Support Systems**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Elective				
Course designed by	Department of Computer science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	The purpose of this course is to impart knowledge on decision support systems and implementation							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Get an overview of decision support systems	a						
2.	Get Familiarize on group decision support systems	a	d					
3.	Learn about knowledge management	a						
4.	Study about Intelligent DSS	a						
5.	Get familiarize on building decision support systems	a	c					

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I : INTRODUCTION TO DECISION SUPPORT SYSTEMS		**9**			
1	Management Support Systems: An Overview, Changing Business Environments and Computerized Decision	1	C	1	1
2	Managerial Decision Making and Techniques of Managerial Decision Support	1	C	1	1
3	The Concept of Decision Support Systems (DSS)	1	C	1	1
4	Decision Support Systems: An Overview	1	C	1	1
5	DSS configurations, description, characteristics and capabilities, classifications, components and subsystems.	1	C	1	1
6	Decision Making, Systems, Modeling, and Support	1	C	1	1
7	Decision Making: Introduction, Definitions, Models	1	C	1	1
8	Phases of the Decision Making Process: The Intelligence Phase, the Design Phase, the Choice Phase, the Implementation Phase	1	C	1	1
9	Supporting Decisions	1	C	1	1
UNIT II: GROUP DECISION SUPPORT SYSTEMS		**9**			
10	Making Decisions in Groups: Characteristics, Process, Benefits, and Dysfunctions – Supporting Group work with Computerized systems	3	C	2	1
11	Tools for Indirect Support of Decision Making – Products and Tools for GDSS/GSS and Successful Implementation.	2	C, D	2	1
12	Decision Analysis with Decision Tables and Decision Trees	1	C	2	1
13	Applications of Data Mining	2	C	2	1-2
14	Role of Data Warehouses in decision support	1	C	2	1-2
UNIT III: KNOWLEDGE MANAGEMENT		**9**			
15	Knowledge Management: Introduction – Organizational Learning and Transformation – Knowledge Management Activities – Approaches to Knowledge Management	3	C	3	1
16	Information Technology (IT) in Knowledge Management – Knowledge Management Systems Implementation -	3	C	3	1
17	Roles of People in Knowledge Management – Ensuring the success of knowledge Management Efforts.	3	C	3	1
UNIT IV: INTELLIGENT DECISION SUPPORT SYSTEMS		**9**			
18	Artificial Intelligence: Concepts, Definitions and Applications	3	C	4	1
19	Expert Systems: Basic Concepts, Applications, Knowledge engineering, Suitable Problem Areas, Benefits, Limitations, and success Factors.	3	C	4	1
20	Advanced Intelligent Systems: Machine Learning techniques – Genetic Algorithms – Fuzzy inference systems – Support Vector machines – Intelligent agents.	3	C	4	1

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
UNIT V: BUILDING DECISION SUPPORT SYSTEMS		**9**			
21	Building decision support systems	3	C,D	5	1-2
22	Management support systems: RFID and New BI Application opportunities – Reality Mining – Online Social Networking – Cloud Computing and Business Intelligence	3	C,D	5	1
23	The impact of Management support systems – Impacts on Organizations and Individuals	3	C	5	1
Total contact hours		**45***			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1	Efraim Turban, Jay Aronson E., Ting-Peng Liang, "Decision Support Systems and Intelligent Systems", 9th Edition, Pearson Education, 2014.
	REFERENCE BOOKS/OTHER READING MATERIAL
2	George M .Marakas, "Decision Support Systems in the 21st century", Pearson, 2016.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15IT422E	**Internet of Things**	**L**	**T**	**P**	**C**
		2	**2**	**0**	**3**
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	E	PROFESSIONAL ELECTIVE			
Course designed by	Department of Information Technology				
Approval	32nd Academic Council Meeting, 23rd July 2016				

PURPOSE	We are surrounded by millions of things and devices. Internet of Things (IoT) is a technological need to interconnect all such devices, things with us anywhere, anytime. This course attempts to address the paradigm shift in technologies, standards and tools needed to achieve the interoperability and thereby develop applications

	INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**						
	At the end of the course, student will be able to							
1.	Understand the basics of IoT and its application sectors	a						
2.	Understand M2M and IoT	a						
3.	Understand and become proficient in IoT platforms	a	i					
4.	Understand and apply IoT protocols appropriately	a	i					
5.	Design and develop IoT based applications	c	l					

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**	**Reference**
	UNITI : INTRODUCTION AND CONCEPTS OF IOT	**5**			
1.	Introduction to IOT, definition and characteristics of IOT, Overview of the syllabus	1	C	1	1
2.	Architecture of Internet of Things, Physical and logical design of IOT, IOT enabling technologies, IOT levels and deployment templates	2	C	1	1
3.	Domain specific IOTs, home automation, cities, environment, Domain specific IOTs, Energy, retail, agriculture, industry, health and lifestyle	2	C	1	1
	UNIT II : IOT AND M2M COMMUNICATION	**8**			
4.	M2M, difference between IOT and M2M, ETSI M2M Architecture, system architecture	2	C	2	1
5.	ETSI M2M SCL resource structure, Security in ETSI M2M framework, SDN and NFV for IOT, IOT system management, need for IOT system management	3	C	2	1
6.	SNMP, Network operator requirements, NETCONF-YANG, IOT system management with NETCONF-YANG, IoT Design methodology-case study on IOT system for Weather Monitoring	2	C,I	2	1
	UNIT III : IoT PLATFORMS	**6**			
7.	Introduction to Hardware used for IoT: Microcontrollers, Microprocessors, SoC, Sensors	2	C,I	3	1
8.	Introduction to Arduino, Pi, Spark, Intel Galileo	3	C,I	3	1
	UNIT IV: IoTTECHNICAL STANDARDS AND PROTOCOLS	**5**			
9.	RF Protocols: RFID, NFC;IEEE 802.15.4: ZigBee, Z-WAVE, THREAD; Bluetooth Low Energy (BLE), IPv6 for Low Power and Lossy Networks (6LoWPAN) and Routing Protocol for Low power and lossy networks (RPL)	2	C	4	1,2
10.	CoAP ,XMPP, Web Socket, AMQP, MQTT, WebRTC, PuSH	2	C	4	1,2
11.	Architectural Considerations in Smart Object Networking	1	C	4	5
	UNIT V: DEVELOPING INTERNET OF THINGS	**6**			

12.	IoT platforms design methodology, IoT Physical devices and endpoints,	2	C	5	1
13.	IoT Systems: Logical design using Python, IoT physical servers and cloud offerings (Cloud computing for IoT)	3	C,I	5	1
	TOTAL CONTACT HOURS	30*			
	TUTORIAL HOURS	30			

Sl. No.	**LEARNING RESOURCES**
1.	ArshdeepBahga, Vijay Madisetti, “Internet of Things, A Hands -on Approach”, 1st Edition 2015, University Press, ISBN: 978-81-7371- 954-7
2.	Oliver Hersent, David Boswarthick, Omar Elloumy, “The Internet of Things”,1st Edition ,2015,ISBN: 978-81-265-5686-1
3.	Michael Miller, “The Internet of Things, How Smart TVs, Smart Cars, Smart Homes, and Smart Cities are changing the World”, First edition ,2015, Pearson , ISBN:978-93-325-5245-6
4.	https://thingsee.com/blog/quality-hardware-list-for-your-iot-projects, as on date: 25/04/16
5.	https://tools.ietf.org/html/rfc7452, as on date: 25/04/2016
6.	http://dret.net/lectures/iot-spring15/protocols, as on date: 25/04/2016
7.	http://iot.intersog.com/blog/overview-of-iot-development-standards-and-frameworks, as on date: 25/04/2016

Course nature				**Theory +Tutorial**		
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Tutorial	**Total**
	Weightage	**10%**	**10%**	**15%**	**15% [Experiments (10%) + Mini Project(5%)]**	**50%**
End semester examination Weightage :						**50%**

* - Excluding Assessment Hours

15CS423E	**Software Defined Networks**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	NIL					
Course Category	P	Professional Elective				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	This course introduces software defined networking, an emerging paradigm in computer networking that allows a logically centralized software program to control the behavior of an entire network.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Differentiate between traditional networks and software defined networks	a						
2.	Understand advanced and emerging networking technologies	a	b	c				
3.	Obtain skills to do advanced networking research and programming	a	b	c				k
4.	Learn how to use software programs to perform varying and complex networking tasks	a	b	c				k
5.	Expand upon theknowledge learned and apply it to solve real world problems	a	b	g				

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: INTRODUCING SDN		**9**			
1.	SDN Origins and Evolution – Introduction – Why SDN?	1	C	1	1,4,5
2.	Centralized and Distributed Control and Data Planes	2	C	1	2,4,5
3.	The Genesis of SDN	2	C	1	1,4,5
4.	Introducing Mininet	4	D,I	3	1,2,3,7
UNIT II: SDN ABSTRACTIONS		**11**			
5.	How SDN Works	2	C,D	1,2	1,5,6
6.	The Openflow Protocol	1	C,D	2	1,2,3
7.	SDN Controllers: Introduction - General Concepts - VMware - Nicira- VMware/Nicira	1	D,I	3	1,2,3,5
8.	OpenFlow-Related - Mininet - NOX/POX - Trema - Ryu - Big Switch Networks/Floodlight	2	D,I	3	1,2,3,5
9.	Layer 3 Centric - Plexxi - Cisco OnePK	1	D,I	3	2
10.	Setting up the Environment and Implementation of Controllers in Mininet	4	D,I	3	1,2.3,8
UNIT III: PROGRAMMING SDN'S		**8**			
11.	Network Programmability	2	I,O	4	2,6
12.	Network Function Virtualization	2	I,O	2	2,5
13.	NetApp Development, Network Slicing	4	I,O	3,4	1,2,3
UNIT IV: SDN APPLICATIONS AND USE CASES		**11**			
14.	SDN in the Data Center	2	I	2	1,2,5
15.	SDN in Other Environments	1	I	2	1
16.	SDN Applications	2	I	5	1,2
17.	SDN Use Cases	2	I	5	1,2,5
18.	The Open Network Operating System	4	D,I,O	3	1,2,3
UNIT V: SDN'S FUTURE AND PERSPECTIVES		**6**			
19.	SDN Open Source	2	C	2	1
20.	SDN Futures	2	C	1,5	1,6
21.	Final Thoughts and Conclusions	2	C	5	1,2
Total contact hours		**45***			

LEARNING RESOURCES

Sl.No.	**TEXT BOOKS**
1.	Software Defined Networks: A Comprehensive Approach by Paul Goransson and Chuck Black, Morgan Kaufmann Publications, 2014
2.	SDN - Software Defined Networks by Thomas D. Nadeau & Ken Gray, O'Reilly, 2013
3.	Software Defined Networking with OpenFlow By SiamakAzodolmolky, Packt Publishing, 2013
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Feamster, Nick, Jennifer Rexford, and Ellen Zegura. "The road to SDN: an intellectual history of programmable networks." ACM SIGCOMM Computer Communication Review 44.2 (2014): 87-98.
5.	Kreutz, Diego, et al. "Software-defined networking: A comprehensive survey." Proceedings of the IEEE 103.1 (2015): 14-76.
6.	Nunes, Bruno AA, et al. "A survey of software-defined networking: Past, present, and future of programmable networks." Communications Surveys & Tutorials, IEEE 16.3 (2014): 1617-1634.
7.	Lantz, Bob, Brandon Heller, and Nick McKeown. "A network in a laptop: rapid prototyping for software-defined networks." Proceedings of the 9th ACM SIGCOMM Workshop on Hot Topics in Networks. ACM, 2010.
8.	Monsanto, Christopher, et al. "Composing software defined networks." Presented as part of the 10th USENIX Symposium on Networked Systems Design and Implementation (NSDI 13). 2013.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Assignments	Quiz	**Total**
	Weightage	**5%**	**5%**	**10%**	**25%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15SE323E	**Design Patterns**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Co-requisite:	NIL	
Prerequisite:	NIL	
Data Book / Codes/Standards	NIL	
Course Category	P	PROFESSIONAL ELECTIVE
Course designed by	Department of Software Engineering	
Approval	32nd Academic Council Meeting, 23rd July, 2016	

PURPOSE	To learn how to reuse the design solution for different kind of software problems and to understand about the interactions between objects.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Conceive the importance of reuse of solution for common problems in software development.	c	a					
2.	Identify the appropriate patterns for design problems.	a						
3.	Implement the various design pattern solution for appropriate scenarios	e						
4.	Refactoring the badly designed program properly using patterns.	b	a	c				

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: OBJECT DESIGN	**9**			
1.	Basics of UML - Class Diagram - Interaction Diagrams – relationships	2	C	1	1
2.	Object design - Reuse concepts – Solution objects, Inheritance, and design patterns	2	C	1	1
3.	Principles and Strategies of Design Patterns - Open-Closed Principle – Designing from Context - Encapsulating Variation- Abstract Classes vs Interfaces	3	C	2	2
4.	Design Patterns & Architecture, Gang of Four (GoF) patterns	2	C,D	2	2
	UNIT II : BEHAVIORAL PATTERNS (STRATEGY, MEDIATOR, TEMPLATE METHOD)	**9**			
5.	Strategy pattern- Intent, Motivation, Applicability, Structure, Participants, collaborations, consequences	1	C	2,3	2,3
6.	Strategy pattern- Implementation and sample code	1	C,I	2,3	2,4
7.	Mediator - Intent, Motivation, Applicability, Structure, Participants, collaborations, consequences	1	C	2,3	2,3
8.	Mediator- Implementation and sample code	1	C,I	2,3	2,3,4
9.	Template Method- Intent, Motivation, Applicability, Structure, Participants, collaborations, consequences	1	C	2,3	2,3
10.	Template Method- Implementation and sample code	2	C,I	2,3	2,4
11.	Case study: Identify which pattern is applicable for the given case study and justify	2			
	UNIT III : CREATIONAL PATTERNS (ABSTRACT FACTORY PATTERN, FACTORY METHOD PATTERN, SINGLETON PATTERN)	**9**			
12.	Abstract factory- Intent, Motivation, Applicability, Structure, Participants, collaborations, consequences	1	C	2,3	2,3
13.	Abstract factory- Implementation and sample code	1	C,I	2,3	2,4
14.	Singleton pattern- Intent, Motivation, Applicability, Structure, Participants, collaborations, consequences	1	C	2,3	2,3

15.	Singleton pattern Implementation and sample code	1	C,I	2,3	2,4
16.	Factory method pattern- Intent, Motivation, Applicability, Structure, Participants, collaborations, consequences	1	C	2,3	2,3
17.	Factory method pattern Implementation and sample code	2	C,I	2,3	2,4
18.	Case study: Identify which pattern is applicable for the given case study and justify	2			
	UNIT IV : STRUCTURAL PATTERNS (ADAPTER, BRIDGE, DECORATOR, FACADE)	**9**			
19.	Adapter- Intent, Motivation, Applicability, Structure, Participants, collaborations, consequences	1	C	2,3	2,3
20.	Adapter- Implementation and sample code	1	C,I	2,3	2,3
21.	Bridge- Intent, Motivation, Applicability, Structure, Participants, collaborations, consequences	1	C	2,3	2,3
22.	Bridge- Implementation and sample code	1	C,I	2,3	2,4
23.	Decorator, Facade- Intent, Motivation, Applicability, Participants, collaborations, consequences Structure	1	C	2,3	2,3
24.	Decorator, Facade- Implementation and sample code	2	C,I	2,3	2,4
25.	Case study: Identify which pattern is applicable for the given case study and justify	2			
	UNIT V : CASE STUDY (REVERSE ENGINEERING)	**9**			
26.	What to Expect from Design Patterns	1	C	1	2
27.	The Pattern Community An Invitation	1	C	1	2
28.	A Parting Thought	1	C	2,4	2
29.	A Case Study : Designing a Document Editor : Design Problems, Document Structure	2	C	2,4	2
30.	Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards	2	C	2,4	2
31.	Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation	2	C	2,4	2
	Total contact hours	45			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Bruegge, Bernd and Allen H. Dutoit. “Object-Oriented Software Engineering: UsingUML, Patterns and Java”,Pearson: Prentice Hall Publishers 2004
2.	Erich Gamma, Richard Helm, “Design Patterns: Elements of reusable software development”, Pearson Education, 2005
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Alan Shalloway, James R Trott "Design pattern explained", Pearson Education, 2005.
4.	Eric Freeman, Elisabeth Robson, Bert Bates, and Kathy Sierra, “Head First Design Patterns”, O’reillyPublications, 2004.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15IT424E	**Business Intelligence and Analytics**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	NIL					
Prerequisite:	15IT340E Data Warehousing and Data Mining					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL ELECTIVE				
Course designed by	Department of Information Technology					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	To provide in-depth knowledge of handling data and business analytics tools that can be used for fact-based decision making process.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Become familiar with the processes needed to develop, report and analyze business data	i						
2.	Apply BI enabling technologies in organizational settings	k	l					
3.	Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization	j	k					
4.	Learn how to use and apply selected business analytics software	l						

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I : OVERVIEW OF BUSINESS INTELLIGENCE, ANALYTICS, AND DECISION SUPPORT		**9**			
1.	Information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems, A Framework for Business Intelligence	3	C	1	1,4
2.	Business Analytics Overview, Brief Introduction to Big Data Analytics	2	C,D,I	4	1
3.	Clickstream Analysis: Metrics, Clickstream Analysis: Practical Solutions, Competitive Intelligence Analysis	4	C	4	2
UNIT II : FOUNDATIONS AND TECHNOLOGIES FOR DECISION MAKING		**9**			
4.	Decision Making: Introduction and Definitions, Phases of the Decision, Making Process	1	C	1,2	1
5.	The Intelligence Phase, Design Phase, Choice Phase, Implementation Phase	2	C	2	1
6.	Decision Support Systems: Capabilities, Decision Support Systems: Classification	3	C	2	1,4
7.	Decision Support Systems: Components	2	C	2	1,4
UNIT III : TECHNIQUES FOR PREDICTIVE MODELING AND SENTIMENT ANALYSIS		**9**			
8.	Basic Concepts of Neural Networks, Developing Neural Network, Based Systems	1	C	3	1,3
9.	Illuminating the Black Box of ANN with Sensitivity, Support Vector Machines	1	C,D,I	2	1,3
10.	A Process, Based Approach to the Use of SVM, Nearest Neighbor Method for Prediction, Sentiment Analysis Overview	3	C	2,3	1,3
11.	Sentiment Analysis Applications, Sentiment Analysis Process	2	C	2,3	1,3
12.	Sentiment Analysis and Speech Analytics	1	C	1,2,3	1
UNIT IV : OPTIMIZATION AND MULTI-CRITERIA DECISION MAKING SYSTEMS		**9**			
13.	Decision Support Systems Modeling, Structure of Mathematical Models for Decision Support, Decision Making Under Certainty, Uncertainty and Risk	2	C	3	1
14.	Decision Modeling with Spreadsheets, Mathematical Programming Optimization	3	C,I	3,4	1

15.	Decision Analysis with Decision Tables and Decision Trees	2	C,I	3,4	1
16.	Multi-Criteria Decision Making With Pairwise Comparisons	2	C	3	1
UNIT V: AUTOMATED DECISION SYSTEMS AND EXPERT SYSTEMS		**9**			
17.	Automated Decision Systems, The Artificial Intelligence Field	1	C	3	1,4
18.	Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering	4	C	3	1
19.	Development of Expert Systems, Location, Based Analytics for Organizations, Cloud Computing and BI	3	C,D,I	3,4	1
	TOTAL CONTACT HOURS	45*			

Sl. No.	**LEARNING RESOURCES**
1.	Ramesh Sharda, DursunDelen, Efraim Turban, J. E. Aronson, Ting-Peng Liang, David King, "Business Intelligence and Analytics: System for Decision Support", 10thEdition, Pearson Global Edition, 2013, ISBN: 9781292009209.
2.	AvinashKaushik, "Web Analytics 2.0 - The Art of Online Accountability & Science of Customer Centricity", 2010, Wiley, ISBN: 9780470529393.
3.	Stephen Marsland, “Machine Learning – An Algorithmic Perspective”, 2nd Edition, 2015, Chapman& Hall / CRC Press, Taylor& Francis Group, ISBN:9781466583283.
4.	Vicki L. Sauter, "Decision Support Systems for Business Intelligence", 2nd Edition, 2011, Wiley, ISBN: 9780470433744.

Course nature					**Theory**		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* - Excluding Assessment Hours

15CS424E	**Semantic Web**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Elective				
Course designed by	Department of Computer science and Engineering					

Approval	32nd Academic Council Meeting , 23rd July 2016

PURPOSE	This course provides the students with the concepts to create the Semantic Web include a systematic treatment of the different languages like XML, RDF, OWL, and rules and technologies (explicit metadata, ontologies, and logic and inference) that are central to Semantic Web development.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand the XML technologies, RDF and OWL	a	i					
2.	Develop semantic web application using protégé	a	i					
3.	Develop semantic web services	a	i					

Session	Description of Topic	Contact hours	C-D- I-O	IOs	Reference
UNIT I: THE SEMANTIC WEB VISION		**9**			
1.	Levels of semantics, Semantic Web Technologies – Layered Architecture.	3	C	2	1
2.	Thinking and Intelligent Web applications tools.The information age.	3	C,D	2	1
3.	Today’s World Wide Web Limitations, syntactic web, data-unstructured, semi structured and structured	3	C ,D	1	2
UNIT II: ONTOLOGY DEVELOPMENT		**9**			
4.	The role of XML – XML and the web – Web services – XML technologies – XML revolution - Structuring with schemas – presentation technologies.	4	C,D	1	5 and 6
5.	Introduction to RDF, Syntax for RDF, Simple Ontologies in RDF Schema, An Example.	2	C,D	1	1,2,3,5,6 and 7
6.	Querying in RDF. OWL language – OWL Syntax and Intuitive Semantics, OWL Species, examples.	3	C,D	2	1,23,5,6`and 7,
UNIT III : ONTOLOGY RULES AND QUERYING		**9**			
7.	Ontology tools- Ontology development using protégé, Description Logics, Automated Reasoning with OWL	2	C,D	2	1,2,3,4,5,6and 7,
8.	Exercises – First-Order Rule Language, Combining Rules with OWL DL.	4	C ,D, I	2	1,2 3,4,5,6and 7,
9.	SPARQL: Query Language for RDF, Conjunctive Queries for OWL DL, Exercises, Ontology Engineering.	3	C ,D,I	2	1,2 3,4,5,6and 7,
UNIT IV: SEMANTIC WEB SERVICE		**9**			
10.	Semantic web service concepts	3	C	1	5 and 6
11.	Representation mechanisms for semantic web services	3	C ,D	1	5 and 6
12.	WSMO – WSDL-S – Related work in the area of semantic web service frameworks.	3	C, D	3	5 and 6
UNIT V: SEMANTIC WEB SERVICE DISCOVERY		**9**			
13	Shortcomings and limitation of conventional web service discovery	2	C	3	5 and 6
14	Centralized discovery architecture – P2P discovery architecture – Algorithm approaches	4	C,D	3	5 and 6
15	Web service modeling ontology – Conceptual model for service discovery –Discovery based on semantic descriptions	3	C ,D	3	5 and 6
Total contact hours		**45***			

LEARNING RESOURCES	
1.	Grigoris Antoniou and Frank Van Harmelen, “A Semantic Web Primer”, The MIT Press, Cambridge, Massachusetts London, England, 2004.
2.	Pascal Hitzler, Markus Krötzschand Sebastian Rudolph ,”Foundations of Semantic Web Technologies” Chapman & Hall/CRC, 2009.
3.	Toby Segaran, Colin Evans, Jamie Taylor, “Programming the Semantic Web Build Flexible Applications with Graph Data,” O'Reilly Media,2009.
4.	www.semanticweb.org
5.	Frank. P. Coyle, “XML, Web Services and the data revolution”, Pearson Education, 2002.
6.	Jorge Cardoso, “Semantic web services: Theory, tools and applications”, Information science, 2007.
7.	Michael C, Daconta, Leo J. Obrst and Kevin T. Smith, “The semantic Web: A guide to the future of

	XML, web services, and knowledge management”, John wiley& sons, 2003.

Course nature							**Theory**
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

		L	T	P	C
15SE427E	**Wireless And Mobile Communication**	**3**	**0**	**0**	**3**
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	P PROFESSIONAL ELECTIVE				
Course designed by	Department of Software Engineering				
Approval	32nd Academic Council Meeting, 23rd July, 2016				

PURPOSE	The purpose of learning this course is to know about the fundamental concepts of mobile communications and wireless networks technologies.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Apply wireless technology concepts to Engineering problems related to communication	a						
2.	Improve their knowledge on digital and analog modulation techniques.	a	c					
3.	Equip themselves familiar with principles of mobile communication	a						
4.	Familiarize with the digital cellular standards.	a	c					
5.	Expose to the emerging wireless technologies	a	b					

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: INTRODUCTION TO ANALOG AND DIGITAL MODULATION SCHEMES	**9**			
1.	Introduction to wireless communication and Elements of a wireless communication system, signal and noise	2	C	1-2	1,2,3,4,5
2.	The radio _frequency spectrum- Analog modulation schemes -Amplitude modulation- frequency and phase modulation	3	C	2	1,2,3,4
3.	Introduction to Digital modulation - Frequency shift keying-Phase shift keying	2	C,D	2	1,2,3,4
4.	Multiplexing and Multiple access- Spread spectrum systems.	2	C,D	2	1,2,3,4
	UNIT II: PRINCIPLES OF MOBILE COMMUNICATION	**9**			
5.	Cellular concept- Cell area- signal strength and cell parameter-capacity of cell	2	C	2	1,3,4,6
6.	Co channel interference-Frequency reuse concept- Cell splitting – cell sectoring-multiple radio access protocols	2	C,D	2	1,2,3
7.	Frequency division Multiple Access – Time Division Multiple Access- Space Division Multiple Access-Code Division Multiple Access	3	D	2	2
8.	OFDM-Comparison of multiple division techniques.	2	D,I	1,2	2
	UNIT III: DIGITAL CELLULAR STANDARDS	**9**			
9.	GSM -frequency bands and channels- frames in GSM – Interfaces ,planes and layers of GSM	2	C	4	2,7
10.	Handoff-short messaging service-GPRS-EDGE-	2	D	4	1,2
11.	3G CELLULAR SYSTEMS-MMS-UMTS-Satellite system infrastructure-GPS-Limitations of GPS-Beneficiaries of GPS-	3	C.D	4	2,9
12.	4G cellular systems - **4G –standards(LTE/wimax)**	2	C,D	4	5,6,9

	UNIT IV: MOBILE NETWORK AND TRANSPORT LAYER	**9**			
13.	Mobile IP-goals-IP Packet delivery-Tunneling-Reverse tunneling	2	C,D	3	3,9
14.	IPV6-Dynamic host routing protocol	1	D	3	6
15.	Traditional TCP-Congestion control-classical TCP-Snooping-Mobile TCP	2	D	3	3
16.	Transaction oriented TCP-TCP over 2.5/3G Wireless Networks	2	C	3	3
17.	Wireless Application protocol-architecture-wireless transport layer security-wireless markup language-Push architecture.	2	C,D	3	3
	UNIT V:EMERGING WIRELESS TECHNOLOGIES	**9**			
18.	IEEE 802.11-IEEE802.15, Mobile ad hoc networks – Characteristics	2	D,I	5	2
19.	Routing-AODV ,VANETS - wireless sensor networks – RFID technology	3	D,I	5	2,8
20.	Wi –Fi standards – Wimax standards	2	C,D	5	2,8
21.	Femtocell network – Push -to –talk technology for SMS.	2	D,I	5	2
	Total contact hours	45			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Roy Blake, “Wireless communication technology” CENGAGE Learning, sixth Indian reprint 2013.
2.	Dharma PrakashAgrawal , Qing –An Zeng , “ Introduction to wireless and mobile systems” CENGAGE Learning, first edition 2014.
3.	~~Jochen Schiller, “Mobile Communications”, Addision Wesley, 2nd Edition, 2011.~~
4.	~~Singal T.L. , “Wireless communication” Tata McGraw Hill Education private limited , 2011.~~
	REFERENCE BOOKS/OTHER READING MATERIAL
5.	G.I Papadimitriou, A.S. Pomportsis, P.Nicopolitidis, M.S.Obaidat, “Wireless Networks”, John-Wiley and Sons,2003.
6.	Gray J.Mullet,”Wireless Telecommunications Systems And Networks “,CengageLearning,Reprint 2014.
7.	UpenaDalal, “Wireless communication” Oxford University press, first edition 2009.
8.	KavehPahlavan&Prashant Krishnamurthy, “Wireless Networks” PHI,2002.
9.	MartynMallick, “Mobile and Wireless Design Essentials”, Wiley Dreamtech India Pvt. Ltd., 2004.

Course nature	**Theory**						
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

15IT426E	**Parallel Architecture and Algorithms**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co,requisite:	NIL					
Prerequisite:	15IT212J- Computer Organization and Architecture/15CS203-Computer System Architecture					
Data Book / Codes/Standards	NIL					
Course Category	P	PROFESSIONAL ELECTIVE				
Course designed by	Department of Information Technology					
Approval	32nd Academic Council Meeting, 23rd July 2016					

PURPOSE	The main objective of the course is to provide the students with the basic concepts of the concurrency features exist in the processors of today and the technology behind. Students are also exposed how to make best use of those features by writing parallel programming.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course students will be able to :								
1.	Understand parallel architecture and their features	h						
2.	Understand and apply thread concepts to exploit the architectural features	j						
3.	Learn to use standard techniques and paradigms while developing parallel algorithms	i						
4.	Develop simple parallel programs to improve performance	c						
5.	Understand the principles of distributed systems and issues in implementation	i						

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I : INTRODUCTION		**9**			
1.	Instruction Set, Measuring Performance, MIPS Architecture	1	C	1	1,2
2.	Pipelining Basics, Hazards	2	C	1	1,2
3.	Software Scheduling, Loop Unrolling, Loop Transformation	2	C	1	1,2
4.	Dynamic Scheduling, Hardware Based Speculation	2	C	1	1,2
5.	Branch Prediction	2	C	1	1,2
UNIT II : THREAD BASED IMPLEMENTATION		**9**			
6.	Thread Management	1	C	2	1,3
7.	Attributes of Thread with Example	2	C,I	2	1,3
8.	Mutual Exclusion and Mutex Usage	2	C,I	2	1,3
9.	Thread Implementation	2	C,I	2	1,3
10.	Event and Conditional Variable’s, Java Threads.	2	C,I	2	1,3
UNIT II : PARALLELISM PARADIGMS AND PROGRAMMING		**9**			
11.	Data Flow Computing, Systolic Architectures	2	C	3	1
12.	Functional and Logic Paradigms	2	C	3	1
13.	Distributed Shared Memory	1	C	3	1
14.	Fortran 90, nCUBE C,OCCAM,C-LINDA and OpenMP	1	C,I	3	1
15.	Debugging Parallel Programs	2	C,I	3	1
UNIT IV: PARALLEL MACHINES		**9**			
16.	Synchronization and Communication	1	C	4	1,4
17.	Strategies for Parallelism	2	C	4	1,4
18.	Parallel Machines, Speedup, Complexity and Cost	1	C	4	1,4
19.	Quadrant Problem, Matrix Multiplications	2	C	4	1,4
20.	Parallel Sorting Algorithms	2	C	4	1,4
21.	MapReduce in Parallelism	1	C	4	1,4

UNIT V: APPLICATIONS		**9**			
22.	Introduction to Distributed Database, Issues, Systems	2	C	5	1,3
23.	Distribution Options, Database Integrity and Concurrency Control	2	C	5	1,3
24.	DDBM’s Structure	2	C	5	1,3
25.	Introduction to Distributed Operating System, Network Operating Systems, Issues.	2	C	5	1,4
26.	Amoeba	1	C	5	1,4
	TOTAL CONTACT HOURS	45*			

Sl. No.	**LEARNING RESOURCES**
1.	M.Sasi Kumar, “Introduction to Parallel Processing”,PHI Edition, 2014, ISBN: 978812035031.
2.	David A. Patterson and John L. Hennessy, “Computer Organization and Design: The hardware/Software Interface”, 3rd Edition,2007, Morgan Kaufmann, ISBN-13: 978-0124077263.
3.	BehroozParhami, “Introduction to Parallel Processing: Algorithms and Architectures”, Illustrated Edition, 1999,Springer,ISBN: 9780306459702.
4.	Christian Bischof, “Parallel Computing: Architectures, Algorithms, and Applications”, IOS press,2008,ISBN-13: 978-1586037963.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* - Excluding Assessment Hours

15CS425E	**Service Oriented Architecture**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Elective				
Course designed by	Department of Computer Science & Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	To gain the basic principles of service orientated architecture							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Learn service oriented analysis techniques	a						
2.	Learn technology underlying the service design	k						
3.	Learn advanced concepts in building SOA	c						
4.	Understand the Java Web services	a						
5.	To know about various Web services specification standards	b						

Session	Description of Topics	Contact hours	C D I O	IOs	Reference
UNIT I : FUNDAMENTAL OF SOA		**9**			
1.	**Understand the Fundamental of SOA and Defining SOA**: Introduction to SOA , Understand the necessity of SOA, Defining	1	C	1	1
2.	**Explain the Evolution of SOA**: Analyze the SOA timeline from XML to Web services to SOA , Describe a brief history about XML, Web Services and SOA	1	C	1	1
3.	**Introduction to Service Oriented Enterprise (SOE):**	1	C	1	1
4.	**Comparing SOA to past architectures :** Analyze the past architectures	1	C	1	1
5.	**Understand the Basic concepts of SOA Architecture: Understand** the Scope Of SOA and **Analyze** the SOA Reference Model	1	C	1	1
6.	**Understand the Key Service characteristics of SOA: List** the Key Service characteristics of SOA	1	C	1	1
7.	**Understand the Anatomy of SOA :** Analyze SOA architecture and Receive knowledge to establish the SOA environment	1	C	1	1
8.	**Analyze how components in an SOA interrelate: Understand the** SOA component and **Analyze** specific behaviors, and relationships among these components	1	C	1	1
9.	**Understand the Technical Benefits and Business Benefits of SOA:** List the Technical Benefits of SOA ,and **Assess** Business Benefits of SOA	1	C	1	1
UNIT II : WEB SERVICE AND SOA		**9**			
10.	**Introduction to Web Services and Primitive SOA:** Understand Web Service Framework with respect to SOA and List the Logical components of the Web services framework	1	C	2	1
11.	**Explain Service descriptions with WSDL layout** :Analyze the WSDL Services with SOA and Identify and Categorize the Meta data and service contracts	1	C	2	1
12.	**Explain Messaging with SOAP :** Analyze the SOAP Protocol and SOA and Describe the SOAP nodes and message path	1	C	2	1
13.	**Understand the Message exchange Patterns and Coordination**: Analyze the Web Services a Activity Management, Coordination types and coordination protocols	1	C	2	1
14.	**Explain about Atomic Transactions:** categorize the ACID properties and analyze atomic transaction with SOA	1	C	2	1
15.	**Understand Business activities with SOA:** analyze business activities and protocols	1	C	2	1
16.	**Understand the advanced concepts of Orchestration and Choreography: Receive** knowledge on advanced concepts of Orchestration and Choreography	1	C,I	2	1
17.	**Understand Service layer abstraction:** Analyze the Service layer configuration scenarios	1	C,I	2	1
18.	**Understand Application Service Layer :** problems solved by layering services **Analyze Business Service Layer and Orchestration Service Layer**: Analyze the case study Scenarios	1	C,I	2	1
UNIT III : BUILDING SOA		**9**			
19.	**Understand basic phases of the SOA delivery lifecycle:** Explain the various SOA Delivery Strategies and analyze top- down strategy , bottom-up strategy and agile strategy with Pros and cons	1	C,D	3	1
20.	**Introduction to service-oriented analysis and process steps:** Analyze the Objectives and service-oriented process steps	1	C,D	3	1

21.	**Understand the Business-centric SOA and Deriving business services-service modelling**: List the Benefits of a business-centric SOA and Identify Sources from which business	1	C-D	3	1
22.	**Introduction to service-oriented design** :Objectives of service- oriented design and Understand various technology underlying the	1	C-D	3	1
23.	**Introduction to WSDL language basics** :Define the structure of WSDL and implement sample WSDL file	1	C	3	1
24.	**Introduction to SOAP basics** : Recognize SOAP language basics Define the structure of SOAP and Implement SOAP style web services in Java.	1	C	3	1
25.	**Understand SOA composition guidelines:** List the SOA Composition Guidelines and Evaluate the preliminary steps to composing SOA and choosing service layers and standards	1	C	3	1
26.	**Understand the Entity-centric business service design**: List the step-by-step process	1	C	3	1
27.	**Explain Application service design:** List the Application service design process steps	1	C	3	1
	Describe Task centric business service design: categorize the Task-centric business service design process steps				
UNIT IV: JAVA WEB SERVICES		**9**			
28. .	**Introduction to SOA support in J2EE**: Understand the SOA platform basics and building blocks	1	C	4	1-4
29. .	**Overview of Java API for XML-based web services(JAX-WS):** Receive knowledge on creation of SOA compliant web service using Java API for XML-based web services (JAX-WS) and acquire hands-on experience.	1	C	4	1-4
30. .	**Introduction to Java Architecture for XML binding (JAXB):** Building web services and client with examples	1	C	4	1-4
31. .	**Introduction to** Java API for XML Registries(JAXR)	1	C	4	1-4
32. .	**Overview of** Java API for XML based RPC (JAX-RPC)	1	C	4	1-4
33.	**Explain** Web Services Interoperability	1	C	4	1-4
34.	**Introduction to** SOA support in .NET: Receive knowledge on .NET Platform overview	1	C	4	1-4
35.	**Overview of ASP.NET web services**: Understand the ASP.NET Programming Basics and Creating a Web Site Using Visual Studio IDE	1	C	4	1-4
36. .	**Analyze the Case Studies:** Implement the Small Business Customer Management application as a web applications using ASP.NET	1	C	4	6
	Overview of Web Services Enhancements (WSE)				
UNIT V: WS* SPECIFICATION STANDARDS & SECURITY		**9**			
37. .	**Introduction to WS-BPEL basics:** Basic terms used in the BPEL terminology	1	C	5	1-7
38. .	WS-Coordination overview	1	C	5	1-7
39. .	**Introduction to** WS-Choreography	1	C	5	1-7
40. .	**Describe the** WS-Policy with SOA	1	C	5	1-7
41. .	**Overview of** WS Security	1	C	5	1-7
42. .	**Overview of** Notification and Eventing	1	C	5	1-7
43. .	**Explain about** Transaction Management	1	C	5	4
44. .	**Analyze the** Case study-SOA in cloud	1	C	5	4
45.	**Research issues:** Analyze the research focus on SOA and issues	1	C	5	4
	Comparative Analysis of SOA and Cloud Computing				
Total contact hours		**45***			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**

1.	Thomas Erl, “Service-Oriented Architecture: Concepts, Technology, and Design”, Pearson Education, 2009.
2.	Eric Newcomer, Lomow, “Understanding SOA with Web Services”, Pearson Education, 2005
3.	JamesMcGovern,Sameer Tyagi,Michael E Stevens,Sunil Mathew,”Java Web Services Architecture”,Elsevier,2003.
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Achieving Service-Oriented Architecture: Applying an Enterprise Architecture Approach, Rick Sweeney, 2010
5.	Shankar Kambhampaly, “Service –Oriented Architecture for Enterprise Applications”, Wiley India Pvt Ltd, 2008.
6.	Newcomer, Lomow, “Understanding SOA with Web Services”, Pearson Education, 2005
7.	Sandeep Chatterjee, James Webber, “Developing Enterprise Web Services, An Architect’s Guide”, Pearson Education, 2005.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS426E	**Pattern Recognition Techniques**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Elective				
Course designed by	Department of Computer Science Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	This course provide a way to learn the various pattern recognition techniques and their applications

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, students will be able to		a						
1.	Understand the fundamentals of Pattern Recognition techniques	a						
2.	Learn Statistical models of Pattern Recognition	a						
3.	Understand the principles of Clustering approaches to Pattern Recognition	a						
4.	Understand the Syntactic Pattern Recognition techniques	a	c	k				
5.	Understand the Neural Network approach to Pattern Recognition	a	c	k				

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: INTRODUCTION TO PATTERN RECOGNITION		**8**			
1.	Pattern and features , Classification, Description, Pattern Mappings	1	C	1	1,2,3
2.	Patterns and Feature Extraction with examples	1	C	1	1,2,3
3.	Classifiers, Decision Regions, Boundaries	1	C	1	1,2,3
4.	Training and learning in pattern recognition systems	1	C	1	1,2,3
5.	Pattern recognition approaches , Statistical pattern recognition , Syntactic pattern recognition , Neural pattern recognition , Comparison	2	C	1	1
6.	Black Box approaches , Reasoning driven pattern recognition	1	C	1	1,2
UNIT II: STATISTICAL PATTERN RECOGNITION		**10**			
7.	Introduction to StatPR, Statistical models, Gaussian case and Class Dependence	1	C	2	1
8.	Discriminant Functions- Uniform Densities – Classifier Performance, Risk and Errors	1	C	2	1
9.	Supervised learning – Parametric estimation – Maximum Likelihood Estimation	1	C	2	1
10.	Bayesian parameter estimation	1	C	2	1
11.	Nonparametric approaches- Density estimation	1	C	2	1
12.	Parzen Windows , k-nn Nonparametric estimation	1	C	2	1
13.	Nearest Neighbor Rule	1	C	2	1
14.	Linear Discrimant Functions, Fisher's Linear Discriminant – Discrete and Binary Classification problems	2	C	2	1
15.	Techniques to directly obtain Linear Classifiers	1	C	2	1
UNIT III: UNSUPERVISED LEARNING AND CLUSTERING		**8**			
16.	Formulation of unsupervised problems, Unsupervised Learning Approaches	2	C	3	1
17.	Clustering for unsupervised learning and classification, c-means algorithm	1	C	3	1
18.	Learning Vector Quantization, Formal Characterization of General Clustering Procedures	2	C	3	1
19.	Clustering Strategies , Cluster Swapping Approaches	1	C	3	1
20.	Hierarchical clustering procedure	1	C	3	1
UNIT IV: SYNTACTIC PATTERN RECOGNITION		**11**			
21.	Syntactic Pattern Recognition, Grammar based approaches, Formal Grammars, Types of Grammars	2	C	4	1

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
22.	String generation as Pattern Description	1	C	4	1
23.	Recognition by String Matching and Parsing,	1	C	4	1
24.	Cocke-Younger-Kasami (CYK) Parsing Algorithm	1	C,D	4	1
25.	Augmented Transition Networks, High Dimensional Grammars, Stochastic Grammars and applications	2	C	4	1
26.	Graph based structural representations ,Graph Isomorphism	2	C	4	1
27.	Attributed Graphs, Match Graphs, Cliques, Structural Unification using attributed graphs	2	C,D	4	1
UNIT V: NEURAL PATTERN RECOGNITION		**9**			
28.	Neural Networks fundamentals, Learning in Neural networks, Physical Neural Networks	1	C	5	1
29.	Artificial Neural Networks model, activation functions, weights,	1	C	5	1
30.	Neural Network based Pattern Associators, CAM , Linear Associative Mappings, Different approaches	2	C	5	1
31.	Heteroassociative memory design, Hebbian learning	1	C,D	5	1
32.	Feedforward Network Architecture, Training in Feedforward networks, GDR, Derivation of Delta Rule	2	C,D	5	1
33.	Backpropagation Algorithm, Pattern Associator for Character Classification	2	C,D	5	1
Total contact hours		**45***			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOK**
1.	Robert J, Schalkoff, “Pattern Recognition: Statistical, Structural and Neural Approaches”, John Wiley & Sons Inc., New York, Reprint 2014.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	Earl Gose, Richard Johnsonbaugh, Steve Jost, “Pattern Recognition and Image Analysis”, Prentice Hall of India Private Ltd., New Delhi – 110 001, 1999.
3.	Duda R.O. and Hart P.E., “Pattern Classification and Scene Analysis”, Wiley, New York, 1973

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS427E	**Nature Inspired Computing Techniques**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Elective				
Course designed by	Department of Computer Science Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	To understand the fundamentals of nature inspired techniques which influence computing, study the Swarm Intelligence and Immuno computing techniques and familiarize the DNA Computing							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student willhave an understanding of								
1.	The basics Natural systems.	a						
2.	The concepts of Natural systems and its applications.	a	c	e				
3.	Basic Natural systems functions(operations)	a	c	e				
4.	Natural design considerations.	a	c					
5.	Integration of Hardware and software in Natural applications.	a	c					

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: INTRODUCTION		**8**			
1.	Introduction	1	C	1,2	1
2.	From Nature to Nature Computing	1	C	1,2	1
3.	Philosophy	1	C	1,2	1
4.	Three Branches: A Brief Overview	1	C	1,2	1
5.	Individuals, Entities and agents - Parallelism and Distributivity Interactivity	1	C	1,2	1
6.	Adaptation- Feedback-Self-Organization-Complexity, Emergence and	1	C,D	1,3	1
7.	Bottom-up Vs Top-Down- Determination	1	C	1	1
8.	Chaos and Fractals.	1	C,D	1	1
UNIT II: Computing Inspired by Nature		**9**			
9.	Evolutionary Computing	1	C	1,2	1,3
10.	Hill Climbing and Simulated Annealing	1	C,D,I	1,4	1
11.	Darwin's Dangerous Idea	1	C	1,2	1
12.	Genetics Principles	1	C	1,2	1
13.	Standard Evolutionary Algorithm -Genetic Algorithms	1	C,D,I	1,4	1
14.	Reproduction-Crossover	1	C	1,2	1
15.	Mutation	1	C	1,3	2
16.	Evolutionary Programming	1	C,D,I	1,4	1
17.	Genetic Programming	1	C,D,I	1,4	1,2
UNIT III: SWARM INTELLIGENCE		**9**			
18.	Introduction - Ant Colonies	1	C	1	1
19.	Ant Foraging Behaviour	1	D	1,3,4	1,4
20.	Ant Colony Optimization	1	D	1,2,4	1,4
21.	SACO and scope of ACO algorithms	1	C,D	2	1,4
22.	Ant Colony Algorithm (ACA)	1	D,I	1,4	1,4
23.	Swarm Robotics	1	C,D	1,2	1
24.	Foraging for food	1	C	2,4	1
25.	Social Adaptation of Knowledge	1	C	5	1
26.	Particle Swarm Optimization (PSO)	1	C,D	5	1,2
UNIT IV: IMMUNOCOMPUTING		**9**			
27.	Introduction- Immune System	1	C	1	1
28.	Physiology and main components	1	C	2,3	1
29.	Pattern Recognition and Binding	1	C,D	1,3	1

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
30.	Immune Network Theory- Danger Theory	1	C,D	1,4	1
31.	Evaluation Interaction- Immune Algorithms	1	I	1,4	1
32.	Introduction – Genetic algorithms	1	C	1	1
33.	Bone Marrow Models	1	C	1	3,4
34.	Forest's Algorithm	1	CD,	5	1
35.	Artificial Immune Networks	1	C,D,I	1,3	1,3,4
UNIT V: COMPUTING WITH NEW NATURAL MATERIALS		**10**			
36.	DNA Computing: Motivation	1	C	1	1
37.	DNA Molecule	1	C	1	1
38.	Adleman's experiment	1	C,D	1,3	1
39.	Test tube programming language	1	C,D	1,2,5	1
40.	Universal DNA Computers	1	C,D	1,5	1
41.	PAM Model	1	C	1,3	1
42.	Splicing Systems	1	C,D	1,3	1
43.	Lipton's Solution to SAT Problem	1	C,D	1,3	1
44.	Scope of DNA Computing	1	C,D	1	1
45.	From Classical to DNA Computing	1	C,D	1	1
Total contact hours		**45***			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOK**
1.	Leandro Nunes de Castro, " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.
3.	Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.
4.	Marco Dorrigo, Thomas Stutzle," Ant Colony Optimization", PHI,2005

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle test III	Surprise Test	**QUIZ**	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS428E	**Optical Networks**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	15IT303J					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Elective				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	To introduce the concepts of Optical Networks and the algorithms related to connectivity. This course also aims to describe packet switching and queuing terminologies and technologies used in optical fiber communication.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**							
At the end of the course, student will be able to									
1.	To understand the concepts of optical communications	a							
2.	To study the functions wavelength routing networks	a							
3.	To study and understand of GMPLS networks	a							
4.	To get familiarized with network design and management	a							

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: OVERVIEW OF OPTICAL NETWORKING		**9**			
1.	Introduction to Optical Network; Telecommunication network architecture; Services & switching	1	C	1	1
2.	Multiplexing; Layered view of second generation optical networks	1	C	1	1
3.	Optical packet switching; Transmission Basics	1	C,I	1	1
4.	Modes of Fiber; Propagation of signal in Fiber	1	C	1	1
5.	Propagation of signal in Fiber	1	C	1	1
6.	Optical network components	1	C	1	1
7.	Error detection & correction	1	C,I	1	1
8.	Transmission system; Overall system design considerations	1	C,D	1	1
9.	Case study: 1 – National Optical Fiber Network of India	1	C,D	1	4
UNIT II : OPTICAL NETWORK ARCHITECTURES (I)		**9**			
10.	SONET: Architecture, Frames	1	C,D	1,2	2
11.	SONET: VTs, Tus, STS	1	C,D	1,2	2
12.	SONET vs. SDH	1	C	1,2	2
13.	WDM network elements: OLTs, OADMs	1	C,D	1,2	2
14.	WDM: ROADMs, Optical cross connects; All optical OXC	1	C,D	1,2	2
15.	WDM network design: RWA	1	C,D,I	1,2	2
16.	WDM network design: Virtual topology design	1	C,D	1,2	2
17.	Case study: 2 – TJ1100 vs MSPP TJ1600	1	C,D	1,2	5,6
18.	Case study: 3 – A 22,000 km 100G deployment, Xtera Communications	1	C,D	1,2	7
UNIT III : OPTICAL NETWORK ARCHITECTURES (II)		**9**			
19.	DWDM: Introduction, network topologies, ONI	1	C,D	2,4	2
20.	DWDM: network switching, timing & synchronization, channel & link protection, routing	1	C,D,I	2,4	2
21.	Access WDM systems: General PON, CWDM PON	1	C,D	2,4	2
22.	Access WDM systems: CWDM PON, TDM-PON, WDM-PON, hCT-PON	1	C,D	2,4	2
23.	OTN: Layers, FEC in OTN, OTN Frame structure	1	C,D	2,4	2
24.	OTN & DWDM, OTN management	1	C,D	2,4	2
25.	Case study: 4 – Arista DWDM solution	1	C,D	2,4	8
26.	Case study: 5 – GPON deployment in enterprise environment	1	C,D	2,4	9
27.	Case study: 6 – Ciena expert series, OTN	1	C,D	2,4	10

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
UNIT IV : GENERALIZED MULTI-PROTOCOL LABEL SWITCHING (GMPLS)		**9**			
28.	MPLS: LSP, LSP tunnel, Signaling protocol	1	C,D	3	3
29.	Overview of transport network: GbE, TDM, WDM, transport network topologies	1	C,D	3	3
30.	From MPLS to GMPLS: related concepts	1	C,D	3	3
31.	GMPLS Signaling: Sessions, tunnels & LSPs, RSVP-TE, LSP establishment, maintenance & modification	1	C,D,I	3	3
32.	GMPLS Routing: TE information, OSPF-TE	1	C,D,I	3	3
33.	Link management: LMP protocol	1	C,D	3	3
34.	TE in GMPLS, TE Link attributes	1	C,D	3	3
35.	GMPLS PCE & PCE protocol	1	C,D	3	3
36.	Case study: 7 – Cisco nLight technology	1	C,D	3	11
UNIT V: NETWORK MANAGEMENT & SURVIVABILITY		**9**			
37.	Network management functions & framework	1	C,D	4	1
38.	Management protocol: SNMP	1	C,D	4	1
39.	Performance & fault management	1	C	4	1
40.	Connection & Adaptation management	1	C	4	1
41.	Optical safety: OFC protocol	1	C,D	4	1
42.	Network survivability basic concepts	1	C	4	1
43.	Protection in SONET / SDH	1	C,D	4	1
44.	Optical layer protection schemes	1	C,D	4	1
45.	Case study: 8 – TJ5500 EMS	1	C,D	4	12
Total contact hours		**45***			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Rajiv Ramaswami, Kumar N. Sivarajan, Galen H. Sasaki, "Optical Networks-A practical perspective", Elsevier publication, Third edition, 2009.
2.	Stamatios Kartalopoulos, "Next generation Intelligent Optical Networks-From access to backbone", Springer publication, 2008.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Adrian Farrel, Igor Bryskin, "GMPLS architecture and applications", Elsevier publication, 2006.
4.	http://broadbandasia.info/wp-content/uploads/2014/04/NOFN-India_11-April.pdf
5.	http://www.tejasnetworks.com/products_mspp_TJ1100.html
6.	http://www.tejasnetworks.com/products_mspp_TJ1600.html
7.	http://www.xtera.com/wp-content/uploads/2015/10/CP-22000km-100G-2012.pdf
8.	https://www.arista.com/assets/data/pdf/Whitepapers/7500E_DWDM_Use_Cases_White_Paper.pdf
9.	http://ojs.academypublisher.com/index.php/jnw/article/viewFile/jnw09014247/8352
10.	http://www.ciena.com/resources/ebooks/Optical-Transport-Networking-OTN-eBook.html
11.	http://www.cisco.com/c/en/us/products/collateral/switches/catalyst-3750-series-switches/whitepaper_c11-718852.pdf
12.	http://www.tejasnetworks.com/products_network_management_TJ5500.html

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS429E	**Computational Linguistics**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	P	Professional Elective			
Course designed by	Department of Computer Science and Engineering				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE	This Course deals with the fundamentals required for developing a Computational Linguistics model.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	To learn the fundamentals required for Computational Linguistics.	a	b					
2.	To understand the concepts of Language structure, Analysis and their applications.	a	b					
3.	To study various Linguistic Models.	a	b	k				

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: INTRODUCTION		**9**			
1.	Introduction about Computational Linguistics	1	C	1	1,5
2.	Issues - Motivation – Theory of Language	4	C	1	1,5
3.	Features of Indian Languages	2	C	1	4
4.	Issues in Font- Coding Techniques	2	C,D	1	4
UNIT II: MORPHOLOGY AND PARTS-OF-SPEECH		**9**			
5.	Phonology – Computational Phonology	1	C,D	2	1,5
6.	Words and Morphemes – Segmentation	2	C,D	2	1,2,5
7.	Categorization and Lemmatisation – Word Form Recognition	2	D,I	2	1,5
8.	Valency - Agreement - Regular Expressions and Automata	2	D	2	1,2,5
9.	Morphological issues of Indian Languages – Transliteration	2	D	2	4
UNIT III: PROBABILISTIC MODELS		**9**			
10.	Probabilistic Models of Pronunciation and Spelling	1	C,D	3	1,2
11.	Weighted Automata – N- Grams - Corpus Analysis	2	C,D,I	3	1,2
12.	Smoothing – Entropy - Parts-of-Speech – Taggers	2	C,D	3	1,2
13.	Rule based – Hidden Markov Models	2	C,I	3	1,2
14.	Speech Recognition	2	C,D	3	1
UNIT IV: SYNTAX		**9**			
15.	Basic Concepts of Syntax – Parsing Techniques	1	C	3	1
16.	General Grammar rules for Indian Languages	2	D,I	3	1,2
17.	Context Free Grammar – Parsing with Context Free Grammars	2	D,I	3	1,2
18.	Top Down Parser – Earley Algorithm	2	D,I	3	1
19.	Features and Unification - Lexicalised and Probabilistic Parsing.	2	D,I	3	1
UNIT V: SEMANTICS AND PRAGMATICS		**9**			
20.	Representing Meaning – Computational Representation	1	D,I	3	3
21.	Meaning Structure of Language – Semantic Analysis	2	C,D	3	3
22.	Lexical Semantics – WordNet – Pragmatics	2	C,D,I	3	3
23.	Discourse – Reference Resolution	2	D,I	3	3
24.	Text Coherence – Dialogue Conversational Agents	2	D,I	3	3
Total contact hours		**45***			

LEARNING RESOURCES	
1.	Daniel Jurafskey and James H. Martin “Speech and Language Processing”, Prentice Hall, 2000.
2.	Ronald Hausser “Foundations of Computational Linguistics”, Springer-Verleg, 1999.
3.	James Allen “Natural Language Understanding”, Benjamin/Cummings Publishing Co. 1995.
4.	Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
5.	Steve Young and Gerrit Bloothooft “Corpus – Based Methods in Language and Speech Processing”, Kluwer Academic Publishers, 1997.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS430E	**Bioinformatics**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	P	Professional Elective			
Course designed by	Department of Computer Science Engineering				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE	To explore how biological information could be stored in digital form to create bioinformatics resources and how the same may be processed.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, students will be able to		a						
1.	Understand the fundamentals of Bioinformatics	a						
2.	Learn the sequence alignment and the tools used for it	a	b	k				
3.	Understand the principles of Gene Prediction expression and microarrays	a						
4.	Understand the Protein structure prediction techniques	a	b	k				
5.	Understand the Proteomics and Drug delivery techniques	a	b	k				

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
UNIT I: INTRODUCTION TO BIOINFORMATICS		**7**			
1.	Introduction, Major Databases in Bioinformatics, Molecular Biology, Central Dogma of Molecular Biology	1	C	1	1,2,3
2.	Information Search and Data Retrieval, Tools for web search, Data Retrieval tools, Data Mining of Biological Databases	1	C	1	1,3
3.	Genome Analysis, Genome Mapping,	2	C	1	1,3
4.	Sequence Assembly Problem, Genetic Mapping and Linkage Analysis	1	C	1	1,2,3
5.	Cloning, Genome Sequencing,Sequence assembly tools, Human Genome Project	2	C	1	1,2,3
UNIT II: ALIGNMENT OF SEQUENCES AND TOOLS		**11**			
6.	Alignment of Pair of Sequences, Methods, Scoring Matrices, Measuring sequence detection efficiency	2	C	2	1,2,3
7.	Alignment of Multiple Sequences, Methods, Evaluating Multiple Alignments, Applications	2	C	2	1,2,3
8.	Phylogenetic Analysis, Methods,	1	C	2	1
9.	True Evaluation, Problems in Phylogenetic Analysis, Automated tools	1	C	2	1
10.	Tools for Similarity search and sequence alignment, Working with FASTA	2	C	2	1
11.	Working with BLAST, Filtering and Gapped BLAST	2	C	2	1
12.	Comparison of FASTA and BLAST, Case study	1	C	2	1
UNIT III: GENE PREDICTION, EXPRESSION AND MICROARRAYS		**7**			
13.	Basics of Gene Prediction, Pattern Recognition,	1	C	3	1,3
14.	Gene Prediction methods, Tools	2	C	3	1
15.	Gene Expression, Working with DNA Microarrays, Clustering Gene expression Profiles	2	C	3	1,2
16.	Data Sources and Tools for for Microarray Analysis, Applications	2	C	3	1
UNIT IV: PROTEIN CLASSIFICATION AND STRUCTURE PREDICTION		**10**			
17.	Overview of Protein Structure, Protein Structure Visualization	1	C	4	1,3
18.	Structure based Protein Classification, Protein structure Databases, Tools	1	C	4	1
19.	Protein Structure Alignment, Domain Architecture Databases,	1	C	4	1

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	Tools				
20.	Protein Classification Approaches	1	C	4	1
21.	Protein Identification and Characterization	1	C	4	1
22.	Primary Structure Analysis and Prediction	1	C,D	4	1
23.	Secondary Structure Analysis and Prediction	1	C,D	4	1,2
24.	Motifs, Profiles, Patterns, Fingerprints search	1	C	4	1
25.	Methods of sequence based protein prediction, 2D structure prediction, Protein function prediction	2	C,D	4	1
UNIT V: PROTEOMICS AND DRUG DISCOVERY		**10**			
26.	Protein Classification	1	C	5	1,2
27.	Tools and Techniques in Proteomics	2	C,D	5	1,2
28.	Protein-Protein Interactions, Methods of Gene family identification	1	C	5	1,2
29.	Post Translational modification prediction	1	C	5	1,2
30.	Areas influencing Drug Discovery, Pharmacogenetics, Applications	1	C	5	1,2
31.	Analysis of Single Nucleotide Polymorphisms, Parameters in Drug Discovery.	1	C	5	1,2
32.	Drug Discovery Technologies, Target Discovery Strategy	1	C,D	5	1,2
33.	Case Study	2	C,D,I	5	1,2
Total contact hours		**45***			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	S.C Rostogi , Mendiratta, P.Rasogi, " BioInformatics: Methods and Applications ",second edition, PHI 2006.
2.	Dan E.Krane, Michael L.Raymer, "Fundamental concepts of BioInformatics", Pearson Education, 2004.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	T.K. Attwood and D.J Perry Smith, " Introduction to Bio Informatics", Pearson Education, 1st Edition, 2001.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15IT423E	**Data Science and Big Data Analytics**	**L**	**T**	**P**	**C**
		2	**2**	**0**	**3**
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	P	PROFESSIONAL ELECTIVE			
Course designed by	Department of Information Technology				
Approval	32nd Academic Council Meeting, 23rd July 2016				

PURPOSE	Today's world is data-driven world. Increasingly, the efficient operation of organizations across sectors relies on the effective use of vast amounts of data. This course provides grounding in basic and advanced analytic methods and an introduction to big data analytics technology and tools.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Learn about the basics of data Science and to understand the various supervised and unsupervised learning techniques.	a						
2.	Bring together several key technologies used for manipulating, storing, and analyzing big data from advanced analytics perspectives.	i	j					
3.	Realize the Hadoop architecture and implementation of MapReduce Application.	j	l					

Session	Description of Topic (Theory)	Contact Hours	C-D-I-O	IOs	Reference
UNIT I : INTRODUCTION TO DATA SCIENCE		**6**			
1.	Introduction of Data Science, Basic Data Analytics using R, R Graphical User Interfaces	1	C	1	1
2.	Data Import and Export, Attribute and Data Types, Descriptive Statistics, Exploratory Data Analysis, Visualization Before Analysis, Dirty Data, Visualizing a Single Variable, Examining Multiple Variables, Data Exploration Versus Presentation	3	C,D,I	1	1
3.	Statistical Methods for Evaluation, Hypothesis Testing, Difference of Means, Wilcoxon Rank-Sum Test, ANOVA	2	C	1	1
UNIT II : ADVANCED ANALYTICAL THEORY AND METHODS		**6**			
4.	Overview of Clustering, K-means, Use Cases, Overview of the Method, Perform a K-means Analysis using R	2	C	1,2	1,4
5.	Classification, Decision Trees, Overview of a Decision Tree, Decision Tree Algorithms, Evaluating a Decision Tree	2	C	1,2	1,4
6.	Decision Tree in R, Bayes' Theorem, Naïve Bayes Classifier, Smoothing, Naïve Bayes in R	2	C,D,I	1,2	1
UNIT III : ADVANCED ANALYTICS TECHNOLOGY AND TOOLS		**6**			
7.	Analytics for Unstructured Data, Use Cases, MapReduce, Apache Hadoop, The Hadoop Ecosystem, Pig, Hive, Hbase, Mahouth, NoSQL, SQL Essentials	3	C	1,2	1
8.	Joins, Set Operations, Grouping Extensions, In-Database Text Analysis, Advanced SQL, Window Functions, User-defined Functions and Aggregates, Ordered Aggregates, MADlib	3	C	1,2	1
UNIT IV : HADOOP DISTRIBUTED FILE SYSTEM ARCHITECTURE		**6**			
9.	HDFS Architecture, HDFS Concepts, Blocks	2	C	3	2,5

10.	NameNode, Secondary NameNode, DataNode, HDFS Federation, HDFS High Availability, Basic File System Operations	2	C	3	2
11.	Data Flow, Anatomy of File Read, Anatomy of File Write, Anatomy of a MapReduce Job Run	2	C	3	2
UNIT V : PROCESSING YOUR DATA WITH MAPREDUCE		**6**			
12.	Getting to know MapReduce, MapReduce Execution Pipeline, Runtime Coordination and Task Management	2	C	3	3,5
13.	MapReduce Application, Hadoop Word Count Implementation	2	C,D,I	3	5
14.	Installing and Running Pig, Hbase Versus RDBMS, Installing and Running ZooKeeper	2	C	3	3
	TOTAL CONTACT HOURS	30*			
	TUTORIAL HOURS	30			

Sl. No.	**LEARNING RESOURCES**
1.	David Dietrich, Barry Heller and Beibei Yang, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, EMC Education Services, Reprint 2015, Wiley, ISBN: 9788126556533.
2.	Tom White, "Hadoop: The Definitive Guide", 4th Edition, 2015, O'Reilly, ISBN: 9789352130672.
3.	BirisLublinsky, Kevin T. Smith and Alexey Yakubovich, “Professional Hadoop Solutions”, Reprint 2014, Wiley, ISBN 13:9788126551071.
4.	Stephen Marsland, “Machine Learning – An Algorithmic Perspective”, , Taylor& Francis Group, Second Edition, 2015, Chapman & Hall / CRC Press , ISBN:9781466583283.
5.	Nathan Marz, James Warren, “Big Data-Principles and best practices of scalable real-time data systems”, Edition 2015, DreamTech Press, ISBN: 9789351198062.

Course nature				**Theory +Tutorial**		
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Tutorial	**Total**
	Weightage	**10%**	**10%**	**15%**	**15% [Experiments (10%) + Mini Project(5%)]**	**50%**
End semester examination Weightage :						**50%**

* - Excluding Assessment Hours

15CS432E	**Data Centric Networks**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	Nil				
Prerequisite:	15IT303J				
Data Book / Codes/Standards	Nil				
Course Category	P Professional Elective				
Course designed by	Department of Computer Science and Engineering				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE	To acquire an knowledge that deals with current data center architectures, new technologies adopted to create modern data center architectures.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Critically discuss data centre networking technologies and protocols.	A	b					
2.	Evaluate key concepts in modern Layer 2 & Layer 3 data centre networks	a	c					
3.	Concepts related to networking technologies in modern data centers.	A	c					
4.	Design, build and configure complex routed and switched networks	a	b					
5.	Expose to implementing the networking solutions in a virtualized environment	a	c					

Session	**Description of Topic (Theory)**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: INTRODUCTION TO DATA- CENTRIC NETWORKING		**9**			
1.	Data centric networking from different perspectives	3	C	1	1,2
2.	Content-Centric Networking (CCN) and Content Distribution Networks (CDN)	2	C	1	1,2
3.	Requirements for modern data centers	2	C,D	1,3	1,2
4.	Design for flexibility, scalability, environmental control, electrical power, flooring in data centers	2	C	1	1,3
UNIT II: DATA CENTRE ARCHITECTURES		**9**			
5.	Top of rack (TOR), End of rack(EOR) network connectivity	3	C,D	5	3
6.	Solutions that reduce power and cabling in architecture	2	C	5	3
7.	TIA/EIA-942. Structured cabling standards	2	C	5	3
8.	Cable management, bandwidth requirements, I/O connectivity	2	C	5	3,7
UNIT III: SERVER ARCHITECTURES		**9**			
9.	Stand-alone blades	2	C	5	2
10.	Clustering, scaling& optimization in server architectures	2	C	5	2
11.	Redundant Layer 2 and Layer 3 designs	2	C,D	3,2	2,4
12.	Limitation of traditional server deployments	2	C	3	2,3
13.	Case study	1	C	3	2,3
UNIT IV: LAYER 2 NETWORKS		**9**			
14.	IEEE 802.3ba; 40 Gbps and 100 Gbps Ethernet	3	C	4,2	2,4
15.	IEEE 802.1D Spanning Tree Protocol (STP), RSTP, PVST, MSTP. TRILL protocols	3	C,D	4,2	2,5
16.	IEEE 802.1Qbg Edge Virtual Bridging, 802.1Qbh Bridge Port Extension. Fiber Channel over Ethernet (FcoE) vs Internet	3	C	4,2	6,7,8
UNIT V: LAYER 3 NETWORKS		**9**			
17.	Layer 3 Data Centre technologies	3	C	5,2	2,3
18.	Locator Identifier Separation Protocol (LISP). Layer 3 Multicasting..	3	C	5,2	2,5
19.	Protocols; Ipv4, Ipv6, MPLS, OSPF, IS-IS, BGP. OTV, VPLS layer 2 extension	3	C,D	5,2	2,3
	Total contact hours	**45***			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Mouricio Arregoces, “Data Centre Fundamentals”, Cisco Press ,2003
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	SilvanoGai, Claudio DeSanti,“I/O Consolidation in the Data Center” Cisco Press; 1 edition [ISBN: 9781587058882]. 2009.
3.	Kevin Corbin, Ron Fuller, David Jansen, “NX-OS and Cisco Nexus Switching: Next-Generation Data Center Architectures” Cisco Press; 1 edition [ISBN: 9781587058929], 2010.
4.	SilvanoGai, TommiSalli, Roger Andersson, “Cisco Unified Computing System” Cisco Press; 1 edition, [ISBN: 9781587141935], 2010.
5.	Nash Darukhanawalla, Patrice Bellagamba, “Interconnecting Data Centers Using VPLS” Cisco Press; 1 edition, [ISBN: 9781587059926], 2009.
6.	Robert W. Kembel, Roger Cummings (Introduction), “The Fibre Channel Consultant” Northwest Learning Assoc; 3rd edition, [ISBN: 0931836840], 1998.
7.	Robert W Kembal“Fiber Channel Switched Fabric” Northwest Learning Associates, inc. [ISBN: 0931836719], 2009.
8.	John L. Hufferd, “ISCSI”, Addison-Wesley Boston [ISBN: 978- 0201784190], 2003.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS433E	**Network Design And Management**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Elective				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	To give understanding of how to design, manage and secure a computer network and how to capture and analyze the network and network data.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand the various type of networks and the network management basics	a						
2.	Understand the architecture behind standards based network management	a						
3.	Understand the Simple Network Management Protocol	a						
4.	Use the network management Tools	a	i					
5.	Design and troubleshooting the network	a	c					

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
UNIT I: NETWORK MANAGEMENT OVERVIEW		**8**			
1.	Telephone network and management, Distributed computing Environment, Internet and Intranet	1	C	1	1
2.	Communication protocols and standards, Network, systems and services, Challenges in IT Managers	2	C	1	1
3.	Network Management and Architecture	1	C	1	1
4.	Network management perceptive, Current status and future of network management	1	C	1	1
5.	Network Management standards and model, Organizational model, Information model, Communication model, Functional model, ASN.1	3	C	1	1
UNIT II: SNMPv1, SNMPv2, SNMPv3		**10**			
6.	SNMP v1 model, Organization Model, System overview	1	C	2	1,5
7.	SNMP v1 Information model	2	C	2	1,5
8.	SNMPv1 Communication model and Functional model	2	C	2	1,5
9.	SNMPv2	3	C	2	1,5
10.	SNMPv3	2	C	2	1,5
UNIT III: REMOTE MONITORING, NETWORK MANAGEMENT TOOLS AND ENGINEERING		**9**			
11.	RMON1	1	C,I	3	1
12.	RMON2	1	C,I	3	1
13.	System Utilities for management	1	C,I	3	1
14.	Network Statistics Measurement systems	1	C,I	3	1
15.	MIB Engineering	1	C,I	2	1
16.	Network Management System Design	2	C,I	2	1
17.	Network Management Applications	2	C,I	1	1
UNIT IV: FAULT MANAGEMENT, CONFIGURATION MANAGEMENT, PERFORMANCE MANAGEMENT AND ACCOUNT MANAGEMENT		**9**			
18.	Fault management architecture, Algorithm, Self-healing, Avoiding failures,	3	C	1	2,6
19.	Configuration setting, Configuration discovery and Change Control, Configuration management applications, Patch management	3	C	1	2,6

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
20.	Approaches for performance management, Performance monitoring and reporting, Performance trouble shooting, Capacity Planning, Account management	3	C	1	2,6
UNIT V: SECURITY MANAGEMENT		**9**			
21.	Small Business Network	2	C	4,5	3,4
22.	Network Administration and Support	2	C	4,5	3,4
23.	Enterprise and Wide Area Networks	2	C	4,5	3,4
24.	Solving Network Problems	3	C,I	4,5	3,4
Total contact hours		**45***			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Mani Subramanian "Network Management Principles and Practice", Second Edition, Pearson Publication, 2012
2.	Dinesh Chandra Verma, "Principles of Computer Systems and Network Management", Springer, 2009
3.	Greg Tomsho, Ed Tittel, David Johnson, "Guide to Network Essentials", Fifth Edition, Cengage Learning, 2010
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Brijendra Singh, "Network Security and Management", Third Edition, PHI Learning Private Limited, 2015
5.	Stallings Williams, "SNMP, SNMPv2, SNMPv3 and RMON 1 and 2", Pearson publication, 2012
6.	Kauffel, "Network Management Problems standards and stretegies", Addison Wesley, 1992

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS434E	**Network Security**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	P	Professional Elective			
Course designed by	Department of Computer Science and Engineering				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE	To understand the various types services i.e. Confidentiality, Authentication, Data Integrity, Non-Repudiation and Access control and the mechanisms used to mitigate the security risks							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Ability to understand the application of mathematics in cryptography	a						
2.	Understand the mechanism used in the classical encryption system and different type of block cipher mode of operation	a	b					
3.	Ability to encrypt/decrypt a message using Secret Key and Public Key	a	b					
4.	Understand the various types of authentication algorithm	a						
5.	Understand the security measure taken over Internet security	j						
6.	Understand the various types of vulnerabilities and detection system	j						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: SECRET KEY CRYPTOGRAPHY		**9**			
1.	Classical Encryption Techniques, SDES	3	D,I	1,2	1,3,5
2.	Block Cipher and Data Encryption Standard (DES)	3	D	2,3	1,3,5
3.	Attack, Linear Cryptanalysis	1	D	3	2,5
4.	Block Cipher Operation and AES	2	D	2,3	1,3,5
UNIT II: PUBLIC KEY CRYPTOGRAPHY		**9**			
5.	Mathematical Background for Cryptography	3	C	1	2,3
6.	Fermat’s and Euler’s Theorems, Testing for Primality	1	C	1	1,3
7.	Public Key Cryptography and RSA	2	D,I	3	1,2,3
8.	Discrete Logarithm and its application	1	C	1	2,3
9.	Elliptic Curve Cryptography	2	C,D,I	3	2.3
UNIT III: AUTHENTICATION		**9**			
10.	Cryptographic Hash	1	D,I	4	2,4,5
11.	Key Management	2	D,I	3	2,4,5
12.	Authentication	4	D,I	4	2,4,5
13.	Secure Hash Algorithm (SHA)	2	D,I	4	1,4,5
UNIT IV: INTERNET SECURITY		**9**			
14.	IP Security – IPSec	2	C	5	2,4
15.	Transport Layer Security	1	C	5	2,4
16.	Wireless LAN Security	2	C	5	2,4
17.	Cell Phone Security	1	C	5	2,4
18.	Web Service Security	3	C	5	2,4
UNIT V: VULNERABILITY AND INTRUSION DETECTION SYSTEM		**9**			
19.	Non-Cryptographic Protocol Vulnerabilities	2	C	6	2
20.	Software Vulnerabilities	2	C	6	2
21.	Virus, Worms and other Malwares	2	C	6	2
22.	Firewall	1	C	6	2
23.	Intrusion Prevention and Detection	2	C	6	2
	Total contact hours	**45***			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Williams Stallings “Cryptography and Network Security – Principles and Practice”, Sixth Edition, Pearson Publication, 2016
2.	Bernard Menezes “Network Security and Cryptography”, Cengage Learning, Third Impression 2014
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Atul Kahate “Cryptography and Network Security”, Tata McGraw Hill Publication Company Limited, 2006
4.	Charlie Kaufman et al “Network Security – Private Communication in a Public World”, Second Edition, PHI Learning Private Limited, 2011
5.	Charles P. Pfleeger et al “Security in Computing “, Third Edition, Pearson Education, 2004

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15EC352E	**Introduction to VLSI Design** *(Common to CSE, EEE)*		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	**P**	**Professional Elective**	**Electronics**			
Course designed by	Department of Electronics and Communication Engineering.					
Approval	30th Academic Council Meeting, 24th March -2016					

Purpose	To get expose on the technology, design concepts, electrical properties and modeling of Very Large Scale Integrated Circuits			
Instructional Objectives At the end of this course, the learner will be able to		**Correlates to Student Outcomes**		
		H	**M**	**L**
1.	Understand the basic MOS Technology and its non-ideal effects	a		e
2.	Understand the MOS Process Technology	c,a	e	
3.	Gain the knowledge in concepts of modeling a digital system using Hardware Description Language.	c,b	a	

H: high correlation, **M**: medium correlation, **L**: low correlation

S.No	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	Unit-I: CMOS Logic Design	**9**			
1	Introduction to VLSI Design	1	C	1	1,2
2	Review of MOS Transistor Theory: nMOS, pMOS Transistor, Enhancement and depletion transistors.	2	C	1	1,2
3	Ideal I-V characteristics	2	C	1	1,2
4	Non-ideal I-V effects	2	C	1	1,2
5	CMOS logic: Basic gates, logic functions	2	C,D	1	1,2
	Unit-II: Electrical Properties of MOS and Performance Estimation	**9**			
6	Pass transistor and transmission logic (Design of gates, multiplexer)	2	C	1	1,2
7	nMOS inverter	1	C	1	1,2
8	Pull up to Pull down ratio (Driven by another nMOS inverter, Driven by one or more pass transistor)	2	C	1	1,2
9	DC characteristics of CMOS Inverter	1	C	1	1,2
10	Interconnect: Resistance, Capacitance	3	C	1	1,2

S.No	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	Unit-III: MOS Technology	**9**			
11	Introduction to IC Technology	1	C	2	1,2
12	nMOS Fabrication	1	C	2	1,2
13	CMOS Fabrication-Pwell, nwell and twintub fabrication process	4	C	2	1,2
14	Latch up in CMOS	1	C	2	1,2
15	Layout Design rules	1	C	2	1,2
16	Stick diagram	1	C,D	2	1,2
	Unit-IV: Introduction to Verilog HDL	**9**			
15	Basic concepts, modules and ports	2	C	3	3
16	Gate-level modeling	2	C,D	3	3
17	Dataflow modeling	2	C,D	3	3
18	Behavioural modeling	2	C,D	3	3
19	Switch-level modeling	1	C, D	3	3
	Unit-V: CMOS Subsystem Design	**9**			
20	Design of Adder: Carry select - carry look ahead - carry skips adder	4	C, D	3	1
21	Design of multiplier - Braun array	2	C, D	3	1
22	Baugh wooley multiplier	2	C, D	3	1
23	Wallace tree Multiplier	1	C, D	3	1
	Total contact hours	**45**	Excluding assessment hours		

Learning resources	
1.	DouglesA.Pucknell, “*Basic VLSI Design”,* Prentice Hall of India, 3rd Edition, reprint 2008.
2.	Neil H.E.Westie,David Harris, *“CMOS VLSI Design”,* Pearson,3rd Edition, 2006.
3.	Samir Palnitker, *“Verilog HDL Guide to Digital Design and synthesis”*,Pearson Education-2nd Edition, 2003.

Course nature						**Theory**	
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

COURSES CUSTOMIZED TO OTHER DEPARTMENTS

15CS251E	**Fundamentals Of Data Structures**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Co-requisite:	Nil					
Prerequisite:	Nil					
Data Book / Codes/Standards	Nil					
Course Category	P	Professional Elective				
Course designed by	Department of Computer Science and Engineering					
Approval	32nd Academic Council Meeting , 23rd July 2016					

PURPOSE	To acquire analytical ability in solving mathematical problems as applied to the respective branches of Engineering.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	To carry out asymptotic analysis of algorithm	a	b					
2.	To be familiar with various data structure concepts like Linked List Stacks, Queues.	a	b					
3.	To have a comprehensive knowledge of Trees,	a						
4.	To learn advanced data structures such as balanced search trees, hash tables and priority queues, Hashing	a	b	k				
5.	To study various graph processing algorithms and Algorithm Design technique	a	b	k				

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: INTRODUCTION TO DATA STRUCTURES		**9**			
1.	Basic terminology – classification of Data structures – Data structure operations	2	C	1	1,5
2.	ADT – Algorithms –different approaches to designing an algorithm	1	C	1	1,5
3.	Mathematical notations and functions	2	C,D	1	1
4.	Time and space complexity	2	C	1	5
5.	Big O notation	1	C,D	1	5
6.	Omega and Theta notation	1	C,D	1	5
UNIT II: ARRAYS AND LIST		**9**			
7.	Array implementation of List - Traversing	2	C,I	2	1,2,3
8.	Insertion – Deletion – Application of List	1	C,D	2	1,2,3
9.	Linked list – Implementation – Insertion – Deletion and Search	2	C,I	2	1,2
10.	Circular Linked List	1	C,D	2	1,2
11.	Double linked list	2	C,D	2	1,2
12.	Cursor based implementation	1	C,D	2	1,2
UNIT III: STACK AND QUEUE		**9**			
13.	STACK – Array implementation	1	C,I	2	2,3,5
14.	STACK – Linked list implementation	1	C,I	2	2,3,5
15.	Applications of STACK – Infix to Postfix – Evaluation of Postfix	2	C,D	2	2,3,5
16.	Recursion – Towers of Hanoi	1	C	2	1,2
17.	QUEUE – Array implementation	1	C,I	2	1,2
18.	QUEUE – Linked List implementation	1	C,I	2	1,2
19.	Circular Queue	1	C	2	1,2
20.	Applications of QUEUE – Priority queue – Double ended queue	1	C	2	1
UNIT IV: TREES		**9**			
21.	General trees – Terminology – Representation of trees – Tree traversal	1	C	3	1,2
22.	Binary tree – Representation – Expression tree – Binary tree traversal	1	C	3	1,2
23.	Threaded Binary Tree	1	C	3	1,2
24.	Binary Search Tree – Construction - Searching	1	C,I	3	1,2
25.	Binary Search Tree- Insertion - Deletion	1	C,D	3	1,2
26.	AVL trees – Rotation1	1	C,D	3	1,2

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
27.	AVL trees – Insertion - Deletion	1	C,D	3	1,2
28.	B-Trees	2	C,D	3	1,2
UNIT V: GRAPHS		**9**			
29.	Graph Terminology	1	C	4	1,2,4
30.	Graph Traversal	1	C,D	4	1,2,4
31.	Topological sorting	1	C,I	4	1,2,4
32.	Minimum spanning tree – Prims - Kruskals	2	C,I	4	1,2,3
33.	Network flow problem	1	C	4,5	1,2,4
34.	Hashing – Hash functions	1	C,I	4,5	1,2,4
35.	Collision avoidance – Separate chaining	1	C,I	4,5	1,2,4
36.	Open addressing – Linear probing – Quadratic Probing	1	C	4,5	1,2,4
	Total contact hours	**45***			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	Seymour Lipschutz, “Data Structures with C”, McGraw Hill Education, Special Indian Edition, 2014.
2.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2011.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	A.V.Aho, J.E Hopcroft and J.D.Ullman, “Data structures and Algorithms”, Pearson Education, First Edition Reprint 2003.
4.	R.F.Gilberg, B.A.Forouzan, “Data Structures”, Second Edition, Thomson India Edition, 2005.
5.	Reema Thareja “Data Structures using C”,Second Edition ,Oxford Higher Education,2014.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS252J	**Data Structures And Algorithms**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	E	Engineering Sciences			
Course designed by	Department of Computer Science and Engineering				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE	To introduce the concept of Data Structures, Algorithm design and analysis.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	To introduce the concepts of linear data structures	a	b					
2.	To learn about non-linear data structures, sorting	a	b					
3.	To introduce the concepts of balanced search tress, indexing and hashing	a	b					
4.	To understand the graph structures	a	b					
5.	To get exposure to the various algorithm design and analysis techniques.	a	b					

Session	**Description of Topic (Theory)**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I : LINEAR STRUCTURES		**6**			
1.	List ADT: Implementation using arrays, linked list, cursor-based linked lists	1	C	1	1
2.	Doubly-linked lists, applications of lists	2	C	1	1
3.	Stack ADT: Concept and Applications.	1	C	1	1,4
4.	Queue ADT: Queue, Circular queue, Applications.	2	C	1	1,4
UNIT II : NON-LINEAR DATA STRUCTURES, SORTING		**6**			
5.	Tree ADT: Basics, Tree traversals, Binary Tree, expression trees, applications, binary search tree.	3	C	2	1,2
6.	Sorting: Insertion Sort – Shell Sort – Heap Sort – Merge Sort – Quick Sort – External Sorting	3	C	2	1,3
UNIT III : BALANCED SEARCH TREES, INDEXING & HASHING		**6**			
7.	Balanced Search Trees, AVL trees, Binary Heaps, B-Tree.	4	C	3	1
8.	Indexing & hashing: Hash Function – Separate Chaining – Open Addressing	2	C	3	1,3
UNIT IV: GRAPHS		**6**			
9.	Definitions – Topological sort – breadth-first traversal - shortest-path algorithms – minimum spanning tree.	3	C	4	1
10.	Prim's and Kruskal's algorithms – Depth-first traversal.	2	C	4	1,3
11.	Applications of graphs	1	C	4	1
UNIT V : ALGORITHM DESIGN AND ANALYSIS		**6**			
12.	Greedy algorithms – Divide and conquer – Dynamic programming.	3	C	5	1
13.	Backtracking – Branch and Bound.	2	C	5	1
14.	Algorithm analysis – Asymptotic notations.	1	C	5	1
Total contact hours		30*			

Sl. No.	**Description of experiments**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
1.	List: Array and linked list implementations	4	C, I	1	1,2
2.	Stack: Array and linked list implementations	4	C, I	1	1,2
3.	Selection sort, Bubble sort implementation	4	C, I	2	1,2
4.	Binary search tree implementations	4	C, I	3	1,2
5.	Linear search, Binary search implementation	4	C, I	3	1,2

Sl. No.	Description of experiments	Contact hours	C-D-I-O	IOs	Reference
6.	Prim's and Kruskal's algorithms implementation	4	C, I	4	1,2
7.	Branch and bound algorithm for traveling salesperson problem implementation	6	C, I	5	1,2
	Total contact hours	30*			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOKS**
1.	M. A. Weiss, “Data Structures and Algorithm Analysis in C”, Pearson India, 2007.
2.	Aaron M. Tenenbaum , Yedidyah Langsam, Moshe J. Augenstein, “Data Structures Using C”, Pearson India, 2009.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	R. F. Gilberg, B.A. Forouzan, “Data Structures: A Pseudocode approach with C”, Second Edition, Cengage India, 2007.
4.	A. V. Aho, J. E. Hopcroft, and J. D. Ullman, “Data Structures and Algorithms”, Pearson India, 2009.

Course nature					**Theory + Practical**		
Assessment Method – Theory Component (Weightage 50%)							
In- semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**
Assessment Method – Practical Component (Weightage 50%)							
In- semester	**Assessment tool**	Experiments	Record	MCQ/Quiz/Viva Voce	Model examination		**Total**
	Weightage	**40%**	**5%**	**5%**	**10%**		**60%**
End semester examination Weightage :							**40%**

* Excluding Assessment Hours

15CS253E	**Speech Recognition System**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	P Professional Elective				
Course designed by	Department of Computer Science Engineering				
Approval	32nd Academic Council Meeting , 23rd July 2016				

PURPOSE	To study the fundamental concepts and techniques for Speech processing and Recognition							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, students will be able to		a						
1.	Learn the fundamental concepts necessary for Speech Processing	a						
2.	Learn the various Probabilistic models	a						
3.	Understand the Grammar for Speech recognition systems	a						
4.	Learn the various Parsing techniques for speech recognition	a						
5.	Analyze and apply the principles learned for Machine Translation	c	k					

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: INTRODUCTION AND FINITE STATE TRANSDUCERS		**9**			
1.	Introduction: Knowledge in Speech and Language processing	1	C	1,3	1,3
2.	Ambiguity – Models and algorithms	1	C	1,3	1,3
3.	Language, thought and understanding	1	C	1,3	1,3
4.	Regular expressions – Finite state automata – Regular Languages	1	C,D	1,3	1,3
5.	Morphology: Survey of English morphology	1	C	1,3	1,3
6.	Morphological parsing	1	C	1,3	1,3
7.	Combining FST Lexicon and rules	1	C	1,3	1,3
8.	The porter stemmer - Human morphological processing	2	C	1,3	1,3
UNIT II:TEXT TO SPEECH AND PROBABILISTIC MODELS		**9**			
9.	Speech Sounds and Phonetic Transcription	1	C	2	1
10.	Phonological Rules – Transducers – Advanced issues in computational phonology	1	C	2	1
11.	Mapping text to phones for TTS – prosody in TTS	1	C	2	1
12.	Probabilistic models: Spelling errors	1	C	2	1
13.	Detecting Non-word errors – Bayesian method to spelling and pronunciation	2	C	2	1
14.	Minimum Edit Distance – Weighted Automata	1	C	2	1
15.	N-grams: Counting words – Smoothing – Back-off – Deleted Interpolation – Entropy	2	C	2	1
UNIT III: SPEECH RECOGNITION AND GRAMMAR		**9**			
16.	Architecture – Overview of Hidden Markov Models	1	C	3	1,2
17.	Viterbi Algorithm	1	C	3	1
18.	Acoustic processing – Acoustic probabilities	1	C	3	1,2
19.	Speech Recognizer – Speech synthesis – English word classes – Part of Speech Tagging	2	C	3	1
20.	Rule Based POS tagging – Transformation Based Tagging – issues	1	C	3	1.2
21.	Context Free Rules and Trees – Sentence Level Constructions – Noun phrase – Agreement – Spoken Language Syntax	2	C	3	1
22.	Grammars and Human Processing.	1	C	3	1,2
UNIT IV: PARSING		**10**			
23.	Parsing as Search – Top Down Parser – Problems	1	C,D	4	1
24.	Earley Algorithm – Finite State Parsing Methods –	2	C	4	1
25.	Probabilistic Context Free Grammars – Problems with PCFGs – Probabilistic Lexicalized CFGs	2	C	4	1
26.	Dependency Grammars – Human Parsing	2	C,D	4	1

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
27.	First Order Predicate Calculus	1	C	4	1
28.	Linguistically Relevant Concepts – Alternative Approaches to Meaning	2	C	4	1
UNIT V: SEMANTIC ANALYSIS AND MACHINE TRANSLATION		**8**			
29.	Syntax Driven Semantic Analysis – Attachments – Robust Semantic Analysis	2	C	5	1
30.	Dialogue and Conversational Agents : Dialogue Acts – Automatic Interpretation – Dialogue	2	C	5	1
31.	Machine Translation : Language Similarities and Differences	2	C	5	1
32.	Transfer Metaphor – Interlingua Idea – Statistical Techniques – Usability and System Development	2	C	5	1
Total contact hours		**45***			

LEARNING RESOURCES	
Sl.No.	**TEXT BOOK**
1.	Daniel Jurafsky, James H. Martin, “Speech and Language processing” , Pearson Education, 2nd Edition, 2009.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	R Rabinder L and Juang B.H “Fundamentals of Speech Recognition”, Prentice Hall, 1993.
3.	Lawrence R. Rabiner, Ronald W. Schafer,”Digital Processing of Speech Signals “, Prentice Hall, 1978

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS254E	Mobile And Pervasive Computing	L	T	P	C
		3	0	0	3

Co-requisite:	Nil	
Prerequisite:	Nil	
Data Book / Codes/Standards	Nil	
Course Category	P	Professional Elective
Course designed by	Department of Computer Science and Engineering	
Approval	32nd Academic Council Meeting , 23rd July 2016	

PURPOSE	To explore the principles behind mobile computing and its close associate pervasive computing.							
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand the impact of constraints and demand of mobile and pervasive computing	a	b					
2.	Understand the modern networks such as 3G and 4G	a	b					
3.	Understand the cellular network principles	e						
4.	Ability to work on wearable computing and context aware computing	e						
5.	Develop applications for modern smart platforms	e						

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
UNIT I: INTRODUCTION TO MOBILE AND PERVASIVE COMPUTING		**9**			
1.	Differences between Mobile Communication and Mobile Computing	1	C	1	1
2.	Applications and Services	1	C	1	1
3.	Making Legacy Applications Mobile Enabled	1	C	1	1
4.	Design Considerations	1	C	1	1
5.	Integration of Wireless and Wired Networks	1	C	1	1,6
6.	Pervasive Computing – Basics and Vision	1	C	1	2,5
7.	Principles of Pervasive Computing	1	C	1	2,5
8.	Standards Bodies	1	C	1	2
9.	Categories of Pervasive Devices	1	C	1	1,5
UNIT II: 3G AND 4G CELLULAR NETWORKS		**9**			
10.	Migration to 3G Networks	1	C	2	1
11.	IMT 2000 and UMTS	1	C	2	1
12.	Radio Network Subsystem	1	C	2	1
13.	UTRAN	1	C	2	1
14.	USIM	1	C	2	1
15.	3.5G and 3.9G a brief discussion	1	C	2	1
16.	4G LAN and Cellular Networks – LTE	1	C	2	1
17.	PDCP, RLC and MAC	1	D	2	1
18.	WiMax IEEE 802.16d/e – WiMax Internetworking with 3GPP	1	D	2	1
UNIT III: SENSOR AND MESH NETWORKS		**9**			
19.	Sensor Networks – Role in Pervasive Computing	1	C	3	2,5
20.	Data Management in Wireless Mobile Environments	2	C	3	2,5
21.	Wireless Mesh Networks – Architecture	2	C	3	1,5
22.	Routing – Cross Layer Approach	2	C	3	1,5
23.	Security Aspects and Applications of Sensor and Mesh networks	2	C	3	1 ,5
UNIT IV: CONTEXT AWARE COMPUTING & WEARABLE COMPUTING		**9**			
24.	Adaptability and Transcoding	2	C,D,I	4	1
25.	Localization	1	C,D	4	1
26.	Mobile middle wares	2	C	4	1
27.	Service Discovery Middleware Health BAN	1	C,D	4	1,6

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
28.	Medical and Technological Requirements-Wearable Sensors	3	C,D	4	1,6
UNIT V: APPLICATION DEVELOPMENT		**9**			
29.	Application architectures	2	C	5	1,4
30.	PDAs and Smartphones	2	C	5	1,4
31.	Programming for CLDC	2	C	5	1,3
32.	GUI in MIDP	1	C	5	1 ,3
33.	Application Development ON Android and iPhone	2	C,D,I	5	1 ,3
Total contact hours		**45***			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, Mobile Computing: Technology, Applications and Service Creation, 2nd edition, Tata McGraw Hill, 2010.
2.	Jochen Burthardt et al, Pervasive Computing: Technology and Architecture of Mobile Internet Applications, Pearson Education, 2003
3.	Reto Meier, Professional Android 2 Application Development, Wrox Wiley,2010.
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Pei Zheng and Lionel M Li, Smart Phone & Next Generation Mobile Computing, Morgan Kaufmann Publishers, 2006.
5.	Frank Adelstein, Fundamentals of Mobile and Pervasive Computing, TMH, 2005
6.	Feng Zhao and Leonidas Guibas, Wireless Sensor Networks, Morgan Kaufmann Publishers, 2004

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours

15CS255E	Design And Analysis Of Algorithms	L	T	P	C
		3	0	0	3
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	P Professional Elective				
Course designed by	Department of Computer Science and Engineering				
Approval	32nd Academic Council Meeting , 23rd July 2016 July 2016				

PURPOSE	The purpose of this course is to ensure that students gets exposed to various algorithmic problem solving techniques to solve various real time application problems							
At the end of the course, student will be able to		**STUDENT OUTCOMES**						
1.	Understand the overview of algorithms and fundamental algorithmic design strategies.	a						
2.	Learn mathematical preliminaries required to analyze and design computer algorithms.	a	b					
3.	Understand the various problem solving techniques such as divide and conquer, greedy, dynamic programming, backtracking, branch and bound.	a	b	c				
4.	Learn how to analyze the computational complexity of various algorithms with asymptotic notations.	a						
5.	Apply important algorithmic design paradigms and methods of analysis in common engineering design situations.	a						

Session	**Description of Topic**	**Contact hours**	**C-D- I-O**	**IOs**	**Reference**
UNIT I: INTRODUCTION TO ALGORITHMS		**8**			
1.	Introduction, Need for Algorithmic Thinking, Overview of Algorithms	1	C	1	1,2,4
2.	Need for Algorithm Efficiency, Fundamental stages of Problem Solving	1	C	1	1,4
3.	Classification of Algorithms, Basics of Algorithm writing- Tools for Problem solving- Algorithm Specifications	3	C,D	3	1
4.	Non Recursive and Recursive Algorithms	3	C,D	1,3	1,2
UNIT II: ALGORITHM ANALYSIS		**9**			
5.	Introduction to Time Complexity, Analysis of Iterative Algorithms	2	C	4	1,4
6.	Rate of Growth, Asymptotic Analysis, Space Complexity Analysis	2	C	4	1,3,4
7.	Introduction and Formulation of Recurrence Equations	2	C	1	1,2
8.	Techniques for solving Recurrence Equations	3	C	2,3	1
UNIT III: DIVIDE AND CONQUER APPROACH		**9**			
9.	Introduction to Divide and Conquer approach, Binary Search	1	C,D,I	3,4,5	1,4,5
10.	Merge Sort, Quick Sort, Finding Maximum and Minimum Elements	4	C,D,I	3,4,5	1,2,3,4,5
11.	Strassen Matrix Multiplication,Tiling Problem	2	C,D,I	3,4,5	1,2,3,4
12.	Closest Pair Problem, Convex Hull	2	C,D,I	3,4,5	1,4
UNIT IV: GREEDY AND DYNAMIC PROGRAMMING APPROACH		**10**			
13.	Introduction to Greedy Approach, Components of Greedy Algorithms	1	C	3	1
14.	Job Sequencing with Deadlines, Knapsack problem	2	C,D,I, O	3,5	1,3,4
15.	Minimum cost spanning trees- Kruskal and Prims Algorithms	2	C,D,I	3,5	1,4,5
16.	Basics of Dynamic Programming, Components of Dynamic Programming	1	C	1	1
17.	Multistage Graph Problem	2	C,D,I, O	3,5	1,4
18.	Flow shop Scheduling Problem, Rod Cutting Problem	2	C,D,I, O	3,5	1,2,4
UNIT V: BACKTRACKING, BRANCH AND BOUND APPROACH		**9**			
19.	Basics of Backtracking, N-queen problem	2	C	2,3,5	1,4
20.	Sum of Subsets, Vertex coloring problem, Hamiltonian Cycles	4	C,D,I	3,5	1,4
21.	Introduction to Branch and Bound Techniques, 0/1 Kanpsack Problem	1	C,D,I	3,5	1,4
22.	Travelling Salesman Problem	2	C,D,I, O	5	1,4
Total contact hours		**45***			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	S.Sridhar,”Design and Analysis of Algorithms”, Oxford Higher Education, 2015
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	Alfred V.Aho, John E.Hopcroft and Jeffrey D.Ullman, “ The Design and Analysis of Computer Algorithms, Pearson, 2013
3.	Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest,” Introduction to Algorithms”, PHI Learning Private Limited,3rd edition,2010
4.	Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran,” Fundamentals of Computer Algorithms”, Universities Press, Second edition,2012
5.	Sara Baase and Allen Van Gelder,”Computer Algorithms, Introduction to Design and Analysis”, Pearson, 3rd Edition, 2009.

Course nature					**Theory**		
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination Weightage :							**50%**

* Excluding Assessment Hours