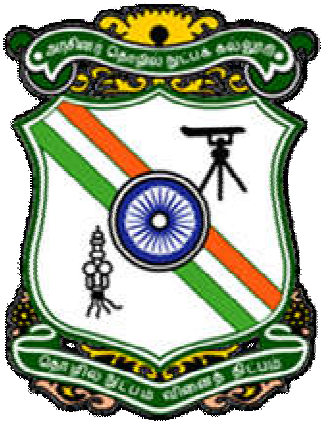

GOVERNMENT COLLEGE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University)

Coimbatore - 641 013

Curriculum For

B. E. Computer Science and Engineering

(Full Time)

2022

Regulations

OFFICE OF THE CONTROLLER OF EXAMINATIONS
GOVERNMENT COLLEGE OF TECHNOLOGY
THADAGAM ROAD, COIMBATORE - 641 013
PHONE : 0422 - 2433355
E.mail: gctcoe@gct.ac.in

VISION AND MISSION OF THE INSTITUTION

VISION

To emerge as a centre of excellence and eminence by imparting futuristic technical education in keeping with global standards, making our students technologically competent and ethically strong so that they can readily contribute to the rapid advancement of society and mankind**.**

MISSION

- To achieve academic excellence through innovative teaching and learning practices.
- To enhance employability and entrepreneurship.
- To improve the research competence to address societal needs.
- To inculcate a culture that supports and reinforces ethical, professional behaviours for a harmonious and prosperous society.

GOVERNMENT COLLEGE OF TECHNOLOGY

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Coimbatore - 641 013

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION AND MISSION

VISION

To be in the frontier of Computer Science and Engineering and to produce globally competent graduates with moral values committed to build a vibrant nation.

MISSION

- To strengthen the core competence in Computer Science and Engineering through analytical learning.
- To produce successful graduates with personal and professional responsibilities and committed to lifelong learning.
- To uplift innovative research in Computer Science and Engineering to serve the needs ofIndustry, Government and Society.

GOVERNMENT COLLEGE OF TECHNOLOGY

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Coimbatore - 641 013

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: Graduates will be in computing profession as experts in solving hardware/software engineering problems by their depth of understanding in core computing knowledge or will have completed or will be pursuing research leading to higher degrees.

PEO 2: Graduates will have sufficient breadth of understanding to enable continued professional development and lifelong learning throughout their career.

PEO 3: Graduates will demonstrate creativity in their engineering practices including entrepreneurial and collaborative ventures with strategic thinking, planning and execution.

PEO 4: Graduates will communicate effectively, recognize and incorporate societal needs and constraints in their professional endeavors, and practice their profession with high regard to legal and ethical responsibilities.

GOVERNMENT COLLEGE OF TECHNOLOGY

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Coimbatore - 641 013

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PROGRAMME OUTCOMES(POs)

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/Development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

GOVERNMENT COLLEGE OF TECHNOLOGY

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Coimbatore - 641 013

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PROGRAMME SPECIFIC OUTCOMES (PSOs)

The Programme Specific Outcomes of B.E. Computer Science and Engineering programme are:

PSO1: Students at the time of graduation will be able to apply mathematics and theoretical computer science and develop computing solutions using state-of-art hardware and software techniques.

PSO2: Students at the time of graduation will be able to design efficient computing solutions to interdisciplinary societal problems using standard practices, tools and technologies.

PSO3: Students at the time of graduation will be able to apply domain knowledge and use Appropriate technology for innovative research.

GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE – 641 013
B.E. COMPUTER SCIENCE AND ENGINEERING

FIRST SEMESTER

SI. No.	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
	22SMC1Z0	Induction Programme	MC	-	-	-	-	-	-	0
1	22SHS1Z1	தமிழர் மரபு Heritage of Tamils	HSMC	40	60	100	1	0	0	1
2	22SHS1Z2	Professional English	HSMC	40	60	100	2	1	0	3
3	22SBS1Z1	Linear Algebra and Calculus	BS	40	60	100	3	1	0	4
4	22SBS1Z2	Engineering Physics	BS	40	60	100	3	0	0	3
5	22SES101	Programming in C	ES	40	60	100	3	0	0	3
6	22SMC1Z1	Environmental Science and Engineering	MC	40	60	100	3	0	0	0
PRACTICAL										
7	22SHS1Z3	Cambridge English	HSMC	60	40	100	0	0	2	1
8	22SBS1Z3	Physics Laboratory	BS	60	40	100	0	0	3	1.5
9	22SES1Z2	Workshop Practice	ES	60	40	100	0	0	3	1.5
10	22SES103	Programming in C Laboratory	ES	60	40	100	0	0	3	1.5
		TOTAL		**480**	**520**	**1000**	**15**	**2**	**11**	**19.5**

SECOND SEMESTER

SI. No.	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
	THEORY									
1	22SHS2Z4	தமிழரும் தொழில்நுட்பமும் Tamils and Technology	HSMC	40	60	100	1	0	0	1
2	22SHS2Z5	Values and Ethics	HSMC	40	60	100	3	0	0	3
3	22SBS204	Vector Spaces and Differential Equations with MATLAB	BS	40	60	100	3	1	0	4
4	22SBS205	Physics for Information Science	BS	40	60	100	3	0	0	3
5	22SBS206	Applied Chemistry	BS	40	60	100	3	0	0	3
6	22SES204	Basics of Electrical and Electronics Engineering	ES	40	60	100	3	0	0	3
		NCC Credit Course (Optional)					2	0	0	0
	PRACTICAL									
7	22SBS2Z7	Chemistry Laboratory	BS	60	40	100	0	0	3	1.5
8	22SES2Z5	Engineering Graphics	ES	60	40	100	1	0	4	3
		TOTAL		**360**	**440**	**800**	**17**	**1**	**7**	**21.5**

GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE - 641013
B.E. COMPUTER SCIENCE AND ENGINEERING
2022 REGULATIONS

THIRD SEMESTER

Sl. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22SBS308	Probability, Random Processes and Queueing Theory (Common to CSE & IT)	BS	40	60	100	3	1	0	4
2	22SES306	Digital Systems	ES	40	60	100	3	0	0	3
3	22SES307	Discrete Structures	ES	40	60	100	3	0	0	3
4	22SPC301	Data Structures (Common to *EEE*, *ECE & CSE*)	PC	40	60	100	3	0	0	3
5	22SPC302	Foundations of Data Science (Common to CSE & IT)	PC	40	60	100	3	0	0	3
THEORY WITH PRACTICAL COMPONENT										
6	22SPC303	Object Oriented Programming	PC	50	50	100	3	0	2	4
PRACTICAL										
7	22SES308	Engineering Exploration For Computer Science and Engineering (Common to CSE & IT)	ES	60	40	100	0	0	3	1.5
8	22SES309	Digital Systems Laboratory	ES	60	40	100	0	0	3	1.5
9	22SPC304	Data Structures Laboratory (Common to ECE & CSE)	PC	60	40	100	0	0	3	1.5
Total				**430**	**470**	**900**	**18**	**1**	**11**	**24.5**

FOURTH SEMESTER

Sl. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22SES410	Analog and Digital Communication	ES	40	60	100	3	0	0	3
2	22SPC405	Computer Architecture	PC	40	60	100	3	0	0	3
3	22SPC406	Data Base Management Systems	PC	40	60	100	3	0	0	3
4	22SPC407	System Programming and Operating systems	PC	40	60	100	3	0	0	3
5	22SPC408	Design and Analysis of Algorithms (Common to CSE & IT)	PC	40	60	100	3	1	0	4
6	22SPC409	Theory of Computation (Common to CSE & IT)	PC	40	60	100	3	1	0	4
PRACTICAL										
7	22SPC410	Data Base Management Systems Laboratory	PC	60	40	100	0	0	3	1.5
8	22SPC411	System Programming and Operating Systems Laboratory	PC	60	40	100	0	0	3	1.5
Total				**360**	**440**	**800**	**18**	**2**	**6**	**23**

GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE – 641 013
B.E. COMPUTER SCIENCE AND ENGINEERING

FIFTH SEMESTER

Sl. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22SES511	Embedded Computing Systems	ES	40	60	100	3	0	0	3
2	22SPC512	Computer Networks (Common to *ECE,CSE & IT*)	PC	40	60	100	3	0	0	3
3	22SPC513	Artificial Intelligence (Common to *CSE & IT*)	PC	40	60	100	3	0	0	3
4	22SPC514	Web Programming	PC	40	60	100	3	0	0	3
5	22SMC5Z2	Constitution of India (Common to all Branches)	MC	40	60	100	3	0	0	0
THEORY WITH PRACTICAL COMPONENT										
6	22SPC515	Software Engineering Methodologies	PC	50	50	100	3	0	2	4
PRACTICAL										
7	22SPC516	Computer Networks Laboratory (Common to *CSE & IT*)	PC	60	40	100	0	0	3	1.5
8	22SEE501	Embedded Computing Systems Laboratory	EEC	60	40	100	0	0	3	1.5
Total				**470**	**430**	**900**	**21**	**0**	**8**	**19**

SIXTH SEMESTER

SI. No.	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22SHS606	Industrial Management and Economics (Common to *EIE,CSE & IT)*	HSMC	40	60	100	3	0	0	3
2	22SPC617	Computer Network Security	PC	40	60	100	3	0	0	3
3	22SPC618	Compiler Design	PC	40	60	100	3	0	0	3
4	22SPC619	Machine Learning (Common to *CSE & IT*)	PC	40	60	100	3	0	0	3
5	22SPE$XX	Professional Elective I	PE	40	60	100	3	0	0	3
6	22#OE/ PE$XX	Open Elective I/ Professional Elective VI	OE1/PE6	40	60	100	3	0	0	3
PRACTICAL										
7	22SPC620	Compiler Design Laboratory	PC	60	40	100	0	0	3	1.5
8	22SES612	Design Thinking for Computer Science and Engineering	ES	100	-	100	0	0	3	1.5
9	22SEE602	Machine Learning Laboratory	EEC	60	40	100	0	0	3	1.5
		TOTAL		**460**	**440**	**900**	**18**	**0**	**9**	**22.5**

SEVENTH SEMESTER

Sl. No.	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22SPC721	Digital Image Processing	PC	40	60	100	3	0	0	3
2	22SPC722	Cloud Essentials	PC	40	60	100	3	0	0	3
3	22SPE$XX	Professional Elective II	PE	40	60	100	3	0	0	3
4	22SPE$XX	Professional Elective III	PE	40	60	100	3	0	0	3
5	22#OE/ PE$XX	Open Elective II/ Professional Elective VII	OE2/PE7	40	60	100	3	0	0	3
PRACTICAL										
6	22SEE703	Integrated Business Data Solutions Laboratory	EEC	60	40	100	0	0	4	2
7	22SEE704	Engineering Project in Community Service	EEC	60	40	100	0	0	4	2
8	22SEE$IX	Internship*	EEC	100	-	100				4
		TOTAL		**420**	**380**	**800**	**15**	**0**	**8**	**23**

EIGHTH SEMESTER

Sl. No.	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22SPE$XX	Professional Elective IV	PE	40	60	100	3	0	0	3
2	22SPE$XX	Professional Elective V	PE	40	60	100	3	0	0	3
PRACTICAL										
3	22SEE805	Capstone Project	EEC	60	40	100	0	0	16	8
		TOTAL		**140**	**160**	**300**	**6**	**0**	**16**	**14**

Note:

Internship of four consecutive weeks or two 2 consecutive weeks which are completed during the vacation of fourth (and/or) fifth (and/or) sixth semester shall be considered here.

TOTAL CREDITS : 167

CURRICULUM DESIGN FOR CBCS 2022 REGULATIONS
FULL TIME B.E. COMPUTER SCIENCE AND ENGINEERING (U.G)

SUMMARY

Sl.NO	Course Category	Credits Per Semester									Total Credits	Total Credits in %	Credits As Per AICTE Model Curricula
		I	II	III	IV	V	VI	VII	VIII	Internship			
	HS/HSMC	5	4				3				12	7.18	16
2	BS	8.5	11.5	4							24	14.37	23
3	ES	6	6	9	3	3	1.5				28.5	17.07	29
4	PC			11.5	20	14.5	10.5	6			62.5	37.43	59
5	PE						3	6	6		15	8.98	12
6	OE						3	3			6	3.59	9
7	EEC					1.5	1.5	4	8	4	19	11.38	`15
8	MC	0				0					0	0	Non Credit
Total		19.5	21.5	24.5	23	19	22.5	19	14	4	167	100	163*

SUMMARY OF CREDIT DISTRIBUTION
HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT(HS/HSMC)

Sl. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	22SHS1Z1	தமிழர் மரபு Heritage of Tamils	HSMC	40	60	100	1	0	0	1
2	22SHS1Z2	Professional English	HSMC	40	60	100	2	1	0	3
3	22SHS1Z3	Cambridge English	HSMC	60	40	100	0	0	2	1
4	22SHS2Z4	தமிழரும் தொழில்நுட்பமும் Tamils and Technology	HSMC	40	60	100	1	0	0	1
5	22SHS2Z5	Values and Ethics	HSMC	40	60	100	3	0	0	3
6	22SHS606	Industrial Management & Economics (Common to EIE,*CSE & IT)*	HSMC	40	60	100	3	0	0	3

BASIC SCIENCE (BS)

SI.NO	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	22SBS1Z1	Linear Algebra and Calculus	BS	40	60	100	3	1	0	4
2	22SBS1Z2	Engineering Physics	BS	40	60	100	3	0	0	3
3	22SBS1Z3	Physics Laboratory	BS	60	40	100	0	0	3	1.5
4	22SBS204	Vector Spaces and Differential Equations with MATLAB	BS	40	60	100	3	1	0	4
5	22SBS205	Physics for Information Science	BS	40	60	100	3	0	0	3
6	22SBS206	Applied Chemistry	BS	40	60	100	3	0	0	3
7	22SBS2Z7	Chemistry Laboratory	BS	60	40	100	0	0	3	1.5
8	22SBS308	Probability, Random Processes and Queueing Theory (Common to *CSE & IT*)	BS	40	60	100	3	1	0	4

ENGINEERING SCIENCE(ES)

SI.NO	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	22SES101	Programming in C	ES	40	60	100	3	0	0	3
2	22SES1Z2	Workshop Practice	ES	60	40	100	0	0	3	1.5
3	22SES103	Programming in C Laboratory	ES	60	40	100	0	0	3	1.5
4	22SES204	Basics of Electrical and Electronics Engineering	ES	40	60	100	3	0	0	3
5	22SES2Z5	Engineering Graphics	ES	60	40	100	1	0	4	3
6	22SES306	Digital Systems	ES	40	60	100	3	0	0	3
7	22SES307	Discrete Structures	ES	40	60	100	3	0	0	3
8	22SES308	Engineering Exploration forComputer Science and Engineering (Common to *CSE & IT*)	ES	60	40	100	0	0	3	1.5
9	22SES309	Digital Systems Laboratory	ES	60	40	100	0	0	3	1.5
10	22SES410	Analog and Digital Communication	ES	40	60	100	3	0	0	3
11	22SES511	Embedded Computing Systems	ES	40	60	100	3	0	0	3
12	22SES612	Design Thinking for Computer Science and Engineering	ES	100	-	100	0	0	3	1.5

PROFESSIONAL CORE

SI.NO	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	22SPC301	Data Structures (Common to *EEE,ECE &CSE*)	PC	40	60	100	3	0	0	3
2	22SPC302	Foundations of Data Science (Common to *CSE&IT*)	PC	40	60	100	3	0	0	3
3	22SPC303	Object Oriented Programming	PC	50	50	100	3	0	2	4
4	22SPC304	Data Structures Laboratory (Common to ECE & CSE)	PC	60	40	100	0	0	3	1.5
5	22SPC405	Computer Architecture	PC	40	60	100	3	0	0	3
6	22SPC406	Data Base Management Systems	PC	40	60	100	3	0	0	3
7	22SPC407	System Programming and Operating systems	PC	40	60	100	3	0	0	3
8	22SPC408	Design and Analysis of Algorithms (Common to *CSE&IT*)	PC	40	60	100	3	1	0	4
9	22SPC409	Theory of Computation (Common to CSE & IT)	PC	40	60	100	3	1	0	4
10	22SPC410	Data Base Management Systems Laboratory	PC	60	40	100	0	0	3	1.5
11	22SPC411	System Programming andOperating Systems Laboratory	PC	60	40	100	0	0	3	1.5
12	22SPC512	Computer Networks (Common to *ECE,CSE & IT*)	PC	40	60	100	3	0	0	3
13	22SPC513	Artificial Intelligence (Common to *CSE & IT*)	PC	40	60	100	3	0	0	3
14	22SPC514	Web Programming	PC	40	60	100	3	0	0	3

15	22SPC515	Software Engineering Methodologies	PC	50	50	100	3	0	2	4
16	22SPC516	Computer Networks Laboratory (Common to *CSE & IT*)	PC	60	40	100	0	0	3	1.5
17	22SPC617	Computer Network Security	PC	40	60	100	3	0	0	3
18	22SPC618	Compiler Design	PC	40	60	100	3	0	0	3
19	22SPC619	Machine Learning (Common to *CSE & IT*)	PC	40	60	100	3	0	0	3
20	22SPC620	Compiler Design Laboratory	PC	60	40	100	0	0	3	1.5
21	22SPC721	Digital Image Processing	PC	40	60	100	3	0	0	3
22	22SPC722	Cloud Essentials	PC	40	60	100	3	0	0	3

OPEN ELECTIVE

Sl. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	22COE$01	DISASTER MANAGEMENT AND MITIGATION	OE	40	60	100	3	0	0	3
2	22COE$02	WATER SANITATION AND HEALTH	OE	40	60	100	3	0	0	3
3	22MOE$03	NANOTECHNOLOGY AND SURFACE ENGINEERING	OE	40	60	100	3	0	0	3
4	22MOE$04	INDUSTRIAL SAFETY MANAGEMENT	OE	40	60	100	3	0	0	3
5	22EOE$05	RENEWABLE POWER GENERATION SYSTEMS	OE	40	60	100	3	0	0	3
6	22EOE$06	SMART GRID TECHNOLOGY	OE	40	60	100	3	0	0	3
7	22LOE$07	CMOS VLSI DESIGN	OE	40	60	100	3	0	0	3
8	22LOE$08	MOBILE COMMUNICATION	OE	40	60	100	3	0	0	3
9	22POE$09	RAPID PROTOTYPING	OE	40	60	100	3	0	0	3
10	22POE$10	MANAGERIAL ECONOMICS	OE	40	60	100	3	0	0	3
11	22NOE$11	MEASUREMENT AND CONTROL	OE	40	60	100	3	0	0	3

12	22NOE$12	INDUSTRIAL AUTOMATION	OE	40	60	100	3	0	0	3
13	22SOE$13	PROGRAMMING IN JAVA	OE	40	60	100	3	0	0	3
14	22SOE$14	NETWORK ESSENTIAL	OE	40	60	100	3	0	0	3
15	22I0E$15	VIDEO CREATION AND EDITING	OE	40	60	100	3	0	0	3
16	22IOE$16	DIGITAL MARKETING	OE	40	60	100	3	0	0	3
17	22BOE$17	PRINCIPLES OF FOOD TECHNOLOGY	OE	40	60	100	3	0	0	3
18	22BOE$18	BIOLOGY FOR ENGINEERS	OE	40	60	100	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES

SI.NO	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	22SEE501	Embedded Computing Systems Laboratory	EEC	60	40	100	0	0	3	1.5
2	22SEE602	Machine Learning Laboratory	EEC	60	40	100	0	0	3	1.5
3	22SEE703	Integrated Business Data Solutions Laboratory	EEC	60	40	100	0	0	4	2
4	22SEE704	Engineering Project in Community Service	EEC	60	40	100	0	0	4	2
5	22SEE805	Capstone Project	EE	60	40	100	0	0	16	8
6	22SEE$IX	Internship	EEC	100		100				4

MANDATORY COURSES

SI.NO	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	22SMC1Z0	Induction Programme	MC	-	-	-	-	-	-	0
2	22SMC1Z1	Environmental Science and Engineering	MC	40	60	100	3	0	0	0
3	22SMC5Z2	Constitution of India (Common to all Branches)	MC	40	60	100	3	0	0	0

VALUE ADDED COURSES

Sl. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	22SEEC$07	Swayam/NPTEL Course	EEC	100	-	100	1	0	0	1
2	22SEEC$08	Online Courses from Coursera	EEC	100	-	100	1	0	0	1
3	22SEEC$09	Marketing Tech 101	EEC	100	-	100	1	0	0	1

Professional Electives-Verticals

Verticals	Course Code	Course Name
Artificial Intelligence	22SPE$01	Knowledge Representation
	22SPE$02	Ethics and AI (Common to CSE & IT)
	22SPE$03	Deep Learning (Common to CSE & IT)
	22SPE$04	Natural Language Processing
	22SPE$05	Game Theory (Common to CSE & IT)
	22SPE$06	Soft Computing (Common to CSE & IT)
	22SPE$07	Cognitive Science (Common to CSE & IT)
Full Stack Development (Common to CSE & IT)	22SPE$08	Web Application Security (Common to CSE & IT)
	22SPE$09	Dev-ops (Common to CSE & IT)
	22SPE$10	Cloud Engineering
	22SPE$11	Principles of Programming Languages (Common to CSE & IT)
	22SPE$12	UI&UX design (Common to CSE & IT)
	22SPE$13	App Development (Common to CSE & IT)
Data Science and Analytics ***- Minor**	22SPE$14	Big Data Technologies
	22SPE$15	Data Warehousing and Data Mining
	22SPE$16	Computer Vision (Common to CSE & IT)
	22SPE$03	Deep Learning (Common to CSE & IT)
	22SPE$17	Recommender Systems (Common to CSE & IT)
	22SPE$18	Exploratory Data Analytics (Common to CSE & IT)

	22SPE$19	Video Analytics
Cyber Security and Data Privacy (Common to CSE & IT)	22SPE$20	Modern Cryptography (Common to CSE & IT)
	22SPE$21	Engineering Secure Software Systems (Common to CSE & IT)
	22SPE$22	Security and Privacy in cloud (Common to CSE & IT)
	22SPE$23	Crypto-currency and Block chain Technologies (Common to CSE & IT)
	22SPE$24	Ethical Hacking (Common to CSE & IT)
	22SPE$25	Cyber Security Essentials
	22SPE$26	Digital and Mobile Forensics (Common to CSE & IT)
	22SPE$27	Social Network Security (Common to CSE & IT)

***- Minor Degree**

GOVERNMENT COLLEGE OF TECHNOLOGY
(An Autonomous Institution Affiliated to Anna University)
Coimbatore–641013.

COMPUTER SCIENCE AND ENGINEERING

22SMC1Z0	INDUCTION PROGRAMME	SEMESTER I

Details of the Programme:
Day 0: College Admission
Day1: Orientation Programme
Day2 Onwards: Induction Programme

Activities:
Physical activity,
Playground Events,
Yoga Practices,
Literary,
Proficiency modules,
Team Building,
Lectures by Eminent people,
Familiarization to department,
Branch oriented information,
Motivational speakers,
Talent exposure,
Quiz completion,
Visit to local areas….etc.

22SHS1Z1	தமிழர் மரபு Heritage of Tamils *(Common to all Branches)*	SEMESTER I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	HSMC	1	0	0	1

UNIT – I	LANGUAGE AND LITERATURE	3 Periods
Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature- Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.		
UNIT – II	**HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE**	**3 Periods**
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role ofTemples in Social and Economic Life of Tamils.		
UNIT – III	**FOLK AND MARTIAL ARTS**	**3 Periods**
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.		
UNIT – IV	**THINAI CONCEPT OF TAMILS**	**3 Periods**
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature- Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.		
UNIT – V	**CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**	**3 Periods**
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.		
Contact Periods: **Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods**		

TEXT BOOK:

1	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித்தமிழ் – முனைவர் இல.சுந்தரம் . (விகடன் பிரசுரம்).
3	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4	பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

REFERENCES:

1	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by:International Institute of Tamil Studies.
3	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu)(Published by: International Institute of Tamil Studies).
4	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by:International Institute of Tamil Studies.)
5	Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by:Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,Tamil Nadu)
6	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay)(Published by: The Author)
7	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
8	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) –Reference Book.

22SHS1Z1	**தமிழர் மரபு Heritage of Tamils** *(Common to all Branches)*	SEMESTER I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	HSMC	1	0	0	1

அலகு I	மொழி மற்றும் இலக்கியம்	3 Periods

இந்திய மொழிக் குடும்பங்கள்- திராவிட மொழிகள்- தமிழ் ஒரு செம்மொழி- தமிழ் செவ்விலக்கியங்கள் –சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை-சங்க இலக்கியத்தில் பகிர்தல் அறம்-திருக்குறளில் மேலாண்மைக் கருத்துக்கள்-தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்தசமயங்களின் தாக்கம்-பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள்-சிற்றிலக்கியங்கள்-தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி-தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II	மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை–சிற்பக் கலை	3 Periods

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள்– பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள்-பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ் , நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III	நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்	3 Periods

தெருக்கூத்து, கரகாட்டம்-வில்லுப்பாட்டு-கணியான் கூத்து – ஒயிலாட்டம் - தோல்பாவைக் கூத்து-சிலம்பாட்டம் –வளரி-புலியாட்டம் - தமிழர்களின் விளையாட்டுகள்.

அலகு IV	தமிழர்களின் திணைக் கோட்பாடுகள்	3 Periods

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு –சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் –சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V	இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு	3 Periods
இந்திய விடுதலைபோரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.		
Contact Periods: **Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods**		

TEXT BOOK:

1	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித்தமிழ் – முனைவர் இல.சுந்தரம் . (விகடன் பிரசுரம்).
3	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4	பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

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1	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by:International Institute of Tamil Studies.
3	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu)(Published by: International Institute of Tamil Studies).
4	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by:International Institute of Tamil Studies.)
5	Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by:Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,Tamil Nadu)
6	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay)(Published by: The Author)
7	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
8	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) –Reference Book.

22SHS1Z2	PROFESSIONAL ENGLISH *(Common to all Branches)*	SEMESTER I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	HSMC	2	1	0	3

Course Objectives	1. To engage learners in meaningful language activities to improve their LSRW skills 2. To enhance learners' awareness of general rules of writing for specific audiences 3. To help learners understand the purpose, audience, contexts of different types of writing 4. To develop analytical thinking skills for problem solving in communicative contexts 5. To demonstrate an understanding of job applications and interviews for internship and placements	
UNIT – I	**FUNDAMENTALS OF COMMUNICATION**	**9 Periods**
Listening –Listening to Personal Introduction and Filling a form Speaking - Self Introduction; Introducing someone in a formal context Reading -Reading Biographies/ Autobiographies and E-mails relevant to technical contexts. Writing - Writing Biographies/ Autobiographies; Drafting Professional E-mails. Grammar - Present Tense (Simple Present, Present Progressive, Present Perfect, Present Perfect Continuous); Parts of Speech Vocabulary - Word Formation with Prefixes; Antonyms; Portmanteau Words		
UNIT – II	**SUMMATION AND PROBLEM SOLVING**	**9 Periods**
Listening - Listening to Short-Stories / Personal Experiences/Watching Movies. Speaking - Narrating Personal Experiences / Events and Short Stories Reading - Reading Travelogues and Books. Writing - Report on an event (Field Trip, Industrial Visit, Educational Tours etc.), Review on Books and Movies. Grammar –Past Tense (Simple Past, Past Progressive, Past Perfect, Past Perfect Continuous); Impersonal Passive Vocabulary - Word Formation with suffixes; Synonyms; Phrasal Verbs.		
UNIT – III	**DESCRIPTION OF A PROCESS / PRODUCT**	**9 Periods**
Listening - Listening to Digital Marketing Advertisements for Product /Process Descriptions Speaking –Describing/Interpreting a Picture; Giving instructions to use the product. Reading – Reading Advertisements, Gadget Reviews; User Manuals. Writing - Writing Definitions; Product /Process Description; Transcoding; Content Writing Grammar -Future Tense(Simple Future, future continuous, Future Perfect, Future Perfect Continuous); If Clauses Vocabulary - Homonyms; Homophones, One Word Substitutes.		
UNIT – IV	**EXPRESSION**	**9 Periods**
Listening – Listening to/Watching Formal Job interviews or Celebrity Interviews Speaking – Participating in a Face to Face or Virtual Interview (Job/Celebrity Interview), virtual interviews Reading – Company profiles, Statement of Purpose, (SOP), Excerpts of interview with professionals from Newspaper, Magazine and other Resources Writing – Job / Internship Application – Cover letter & Resume Grammar – Question types: 'Wh' / Yes or No/ and Tags; Subject- Verb Agreement. Vocabulary – Idiomatic Expressions		
UNIT – V	**PUBLIC SPEAKING**	**9 Periods**
Listening – Listening to Ceremonious Speeches on You Tube and Jotting down phrases Speaking – Delivering Welcome Address; Introducing the Chief-Guest; Proposing Vote of Thank and Felicitation Reading – Excerpts of Speeches from Newspaper, Magazines and Motivational Books Writing – Drafting a Welcome Address, Introduction to the Chief-Guest, Vote of Thanks and Felicitation Grammar –Common Errors Vocabulary – Commonly Confused Words		
Contact Periods: **Lecture: 30 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	***English for Science & Technology*** *Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.*
2	***Communicative English,*** *Global Publishers, Chennai 2017 by Dr.J.Anbazhagan Vijay*

REFERENCES

1	*Raman.Meenakshi, Sharma.Sangeeta(2019).* ***Professional English.*** *Oxford University Press. New Delhi.*
2	***Learning to Communicate*** *– Dr. V. Chellammal, Allied Publishing House, New Delhi,2003*
3	***Using English****, Orient Blackswan, Chennai, 2017 by Board of Editors*
4	***OER****(Authentic Open Educational Resources)*

	COURSE OUTCOMES: On completion of the course, the students will be able to:	**Bloom's Taxonomy Mapped**
CO1	Participate in a basic communicative task.	K3
CO2	Analyse problems in order to arrive at feasible solutions and communicate them orally and in the written format.	K3
CO3	Describe a product or process or mechanism.	K2
CO4	Present their opinions in a planned and logical manner, and draft effective resumes in context of job search.	K3
CO5	Deliver speeches at formal functions.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	-	-	1	-	-	2	-	-	3	3	-	-	-	1	1
CO2	-	1	1	-	-	2	-	-	1	3	-	1	-	1	-
CO3	-	-	-	1	-	-	-	-	-	3	-	-	-	1	1
CO4	-	-	1	-	-	-	-	-	2	3	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-
22SHS1Z2	**-**	**1**	**1**	**1**	**-**	**1**	-	-	**2**	**3**	-	**1**	-	1	1

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	3.3.2, 6.1.1, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2.
CO2	2.1.1, 2.2.3, 2.2.4, 3.1.2, 6.2.1, 9.2.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 12.3.1, 12.3.2.
CO3	4.1.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2.
CO4	3.3.2, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2
CO5	9.2.2, 9.2.3, 9.2.4, 10.1.1, 10.1.3, 10.2.1, 10.2.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	-	12	88	-	-	-	100
CAT2	-	18	82	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	100	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	100	-	-	-	100
ESE	-	20	80	-	-	-	100

22SBS1Z1	LINEAR ALGEBRA AND CALCULUS *(Common to all Branches)*	SEMESTER I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	BS	3	1	0	4

Course Objectives	1. To acquire knowledge of system of equations, eigenvalues, eigenvectors, diagonalization of matrices and reduction of quadratic forms to canonical forms. 2. To obtain the knowledge of analyze the functions using Limits and derivative recognize the appropriate tools of differential calculus to solve applied problems. 3. To obtain the knowledge of definite and improper integration and recognize the appropriate tools of Integral Calculus to solve applied problems 4. To develop the skills in solving the functions of several variables by partial derivatives. 5. To acquire knowledge of multiple integration and related applied problems in various geometry	
UNIT – I	**LINEAR ALGEBRA**	**9+3 Periods**
Consistency of System of Linear Equations - Eigen values and eigenvectors - Diagonalization of matrices by orthogonal transformation - Cayley-Hamilton Theorem - Quadratic to canonical forms.		
UNIT – II	**DIFFERENTIAL CALCULUS**	**9+3 Periods**
Limit and continuity of function - Rolle's theorem - Mean value theorems - Taylor's and Maclaurin's theorems. Application of Differential Calculus: Radius of curvature, Centre of curvature, Circle of curvature and Evolutes of a curve.		
UNIT – III	**INTEGRAL CALCULUS**	**9+3 Periods**
Evaluation of definite integral by trigonometric substitution - Convergence and Divergence of improper integrals - Beta & Gamma functions and their properties - Applications of definite integrals to evaluate surface areas and volume of revolution (Cartesian coordinates only).		
UNIT – IV	**PARTIAL DERIVATIVES AND ITS APPLICATIONS**	**9+3 Periods**
Partial derivatives - total derivative - Taylor's series – Jacobians - Maxima, minima and saddle points - Method of Lagrange multipliers.		
UNIT – V	**MULTI VARIABLE INTEGRAL CALCULUS**	**9+3 Periods**
Double integral - Area as double integral - change of order of integration in double integrals - Triple Integrals - Volume as Triple Integral. Change of variables: Cartesian to polar, Spherical polar coordinates, Cylindrical polar coordinates.		
Contact Periods: **Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods**		

TEXT BOOK

1	*Veerarajan T.,* ***"Engineering Mathematics I"****, Tata McGraw-Hill Education(India)Pvt. Ltd, New Delhi,2015.*
2	*David C.Lay,* ***"Linear Algebra and Its Application"****, Pearson Publishers, 6th Edition, 2021.*

REFERENCES

1	*B.S.Grewal,* ***"Higher Engineering Mathematics"****, Khanna Publishers, 44th Edition, 2017.*
2	*Howard Anton,* ***"Elementry Linear Algebra"****, 11th Edition, Wiley Publication, 2013.*
3	*Narayanan.S and Manicavachagom Pillai. T.K. –* ***"Calculas Vol I and Vol II",*** *S.chand & Co, Sixth Edition, 2014.*
4	*H.K. Dass,* ***"Advance Engineering Mathematics"****, S. Chand and company, Eleventh Edition, 2015.*
5	*Jain R.K. and Iyengar S.R.K.,* ***"Advanced Engineering Mathematics"****, Narosa Publicaitons, Eighth Edition, 2012.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Solve the linear system of equations, diagonalize matrix by orthogonal transformation and reduce quadratic form to canonical form.	K5
CO2	Compare and contrast the ideas of continuity and differentiability and use them to solve engineering problems.	K5
CO3	Acquire fluency in integration of one variable and apply them to find surface area and volumes.	K5
CO4	Apply the techniques of partial derivatives in functions of several variables.	K5
CO5	Use multiple integration for finding area, surface and volume of different geometry.	K5

COURSE ARTICULATION MATRIX

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	1	1	-	-	-	-	-	-	-	1	3	3	2
CO2	3	3	1	1	-	-	-	-	-	-	-	1	3	3	1
CO3	3	3	1	1	-	-	-	-	-	-	-	1	3	2	1
CO4	3	3	1	1	-	-	-	-	-	-	-	1	3	2	-
CO5	3	3	1	1	-	-	-	-	-	-	-	1	3	2	-
22SBS1Z1	**3**	**3**	**1**	**1**	-	-	-	-	-	-	-	**1**	**3**	**3**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.1.2, 2.1.1, 2.1.3, 2.2.1, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 2.4.4, 3.1.1, 3.2.1, 3.3.1, 4.1.1, 4.1.2, 12.2.1.
CO2	1.1.1, 1.1.2, 2.1.1, 2.1.3, 2.2.1, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 2.4.4, 3.1.1, 3.2.1, 3.3.1, 4.1.1, 4.1.2, 12.2.1.
CO3	1.1.1, 1.1.2, 2.1.1, 2.1.3, 2.2.1, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 2.4.4, 3.1.1, 3.2.1, 3.3.1, 4.1.1, 4.1.2, 12.2.1.
CO4	1.1.1, 1.1.2, 2.1.1, 2.1.3, 2.2.1, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 2.4.4, 3.1.1, 3.2.1, 3.3.1, 4.1.1, 4.1.2, 12.2.1.
CO5	1.1.1, 1.1.2, 2.1.1, 2.1.3, 2.2.1, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 2.4.4, 3.1.1, 3.2.1, 3.3.1, 4.1.1, 4.1.2, 12.2.1.

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	40	30	10	-	-	100
CAT2	20	40	30	10	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	20	40	30	10	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	20	40	30	10	-	-	100
ESE	20	40	30	10	-	-	100

22SBS1Z2	ENGINEERING PHYSICS *(Common to all Branches)*	SEMESTER I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	BS	3	0	0	3

Course Objectives	1. To understand the basics about crystal systems and defects. 2. To understand the principle, characteristics, working and applications of laser and optical fiber. 3. To solve problems in bending of beams. 4. To solve quantum mechanical problems with the understanding of Quantum Principles. 5. To understand the properties, production and applications of ultrasonic waves.	
UNIT – I	**CRYSTAL PHYSICS**	**9 Periods**
Introduction – Crystalline and amorphous materials – Lattice – Unit Cell –Crystal system - Bravais lattices – Miller indices – Reciprocal lattice - d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC, and HCP structures – Crystal defects – Point, line and surface defects.		
UNIT – II	**LASER PHYSICS AND FIBER OPTICS**	**9 Periods**
Introduction- Principle of laser action - characteristics of laser - Spontaneous emission and Stimulated emission –Einstein's coefficients - population inversion – methods of achieving population inversion – Optical Resonator -Types of Lasers – Principle, construction and working of CO_2 Laser - applications of laser. Introduction – Basic Principles involved in fiber optics- Total internal reflection–Propagation of light through optical fiber –Derivation for Numerical Aperture and acceptance angle - fractional index change.		
UNIT – III	**PROPERTIES OF MATTER**	**9 Periods**
Elasticity- Hooke's law- stress-strain diagram - Factors affecting elasticity – Moment (Q) - Couple (Q) – Torque (Q) – Beam - Bending moment - Depression of a cantilever –Twisting Couple- Young's modulus by uniform bending - I shaped girders.		
UNIT – IV	**QUANTUM PHYSICS AND APPLICATIONS**	**9 Periods**
Limitations of classical Physics - Introduction to Quantum theory - Dual nature of matter and radiation- de-Broglie wavelength in terms of voltage, energy, and temperature –Heisenberg's Uncertainty principle – verification – physical significance of a wave function- Schrödinger's Time independent and Time dependent wave equations –- Particle in a one dimensional potential well - Scanning Electron Microscope (SEM)-Transmission Electron Microscope (TEM).		
UNIT – V	**ULTRASONICS**	**9 Periods**
Introduction - properties of ultrasonic waves - production of ultrasonic waves -Magnetostriction effect- Magnetostriction generator- Piezoelectric effect- Piezoelectric generator- Acoustic grating - Determination of wavelength and velocity of ultrasonic waves-cavitation - applications- ultrasonic drilling- ultrasonic welding- ultrasonic soldering and ultrasonic cleaning-Non- destructive Testing- Pulse echo system.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*K. Rajagopal**, "Engineering Physics"**, PHI Learning Private Limited, 2015.*
2	*P. K. Palanisamy, "**Engineering Physics-I",** Scitech publications Private Limited, 2015.*
3	*M. Arumugam, **"Engineering Physics"**, Anuradha Publishers, 2010.*

REFERENCES:

1	*Arthur Beiser,* ***"Concepts of Modern Physics"****, Tata McGraw-Hill, 2010.*
2	*D. Halliday, R. Resnick and J. Walker,* ***"Fundamentals of Physics"****, 6th Edition, John Wiley and Sons, 2001.*
3	*William T. Silfvast,* ***"Laser Fundamentals"****, 2nd Edition, Cambridge University Press, New York 2004.*
4	*M. N. Avadhanulu and P.G. Kshirsagar,* ***"A Textbook of Engineering Physics"****, S. Chand and Company Ltd, 2010.*
5	*R. K. Gaur and S. L. Gupta,* ***"Engineering Physics",*** *Dhanpat Rai Publishers, 2009.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Interpret the crystal structure and analyse the type of defect.	K4
CO2	Explain the principle, characteristics, working and applications of laser and optical fiber, Analyse and solve problems in laser and optical fiber.	K4
CO3	Solve problems in bending of beams. Apply the knowledge in construction of buildings.	K3
CO4	Explain the importance of quantum mechanics. Solve problems in basic quantum physics. Apply the wave equations in real time problems.	K3
CO5	Explain the properties and production of ultrasonic waves. Apply ultrasonic waves for industrial problems.	K3

COURSE ARTICULATION MATRIX

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	-	-	-	-	-	-	-	-	-	-	1	1	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-	2	1	-
22SBS1Z2	**3**	**2**	-	-	-	-	-	-	-	-	-	-	**1**	**1**	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.2.1, 1.3.1, 2.1.1, 2.1.3, 2.2.3, 2.3.1, 2.4.1.
CO2	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.3, 2.3.1, 2.4.1.
CO3	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.3, 2.2.1, 2.2.3, 2.2.4, 2.3.1, 2.4.1.
CO4	1.1.1, 1.2.1, 1.3.1, 2.1.1, 2.1.3, 2.2.3, 2.3.1, 2.4.1.
CO5	1.1.1, 1.2.1, 1.3.1, 2.1.1, 2.1.3, 2.3.1, 2.4.1.

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	15	15	10	-	100
CAT2	30	30	15	15	10	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	40	40	20	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	40	40	20	-	-	-	100
ESE	30	30	15	15	10	-	100

22SES101	PROGRAMMING IN C *(Common to all Branches Except MECH & PRODN)*	SEMESTER I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	0	0	3

Course Objectives	1. To study the basic concepts of computer and programming fundamentals. 2. To understand the data types in C , flow control statements, Arrays, Functions Pointers, Structures, Unions and File concepts in C.	
UNIT – I	**COMPUTER AND PROGRAMMING FUNDAMENTALS**	**9 Periods**
Computer fundamentals – Evolution, classification, Anatomy of a computer: CPU, Memory, I/O – Introduction to software –Classification of programming languages – Compiling –Linking and loading a program – Introduction to OS – Types of OS.		
UNIT – II	**DATATYPES AND FLOW OF CONTROL**	**9 Periods**
Structured programming – Algorithms – Structure of a C program – Variables – Data types – Operators and expressions – Input and Output statements – Tokens –Type Conversion – Control statements.		
UNIT – III	**ARRAYS AND FUNCTIONS**	**9 Periods**
1DArrays– 2D Arrays – Multidimensional Arrays – Strings – String handling functions – Functions – Recursion – Array as function arguments – Storage Classes – Enumerations.		
UNIT – IV	**POINTERS**	**9 Periods**
Introduction to pointers – Pointers arithmetic – call by reference – Relationship between Array and Pointers – Relationship between String and pointers – pointers to pointers – array of pointers – pointers to an array – Dynamic memory allocation – Arguments to main().		
UNIT – V	**STRUCTURES AND UNIONS, FILE OPERATIONS**	**9 Periods**
Preprocessor directives – Structures – Unions – Bit fields – Opening and closing a file – Working with file of records – Random access to file of records.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

PradipDey, Manas Ghosh, ***"Computer Fundamentals and Programming in C",*** *Second Edition, Oxford University Press, 2018.*

REFERENCES:

1	*Al Kelley, Ira Pohl* ***,"A Book on C- Programming in C*** *",Fourth Edition, Addison Wesley, 2001.*
2	*Herbert Schildt ,* ***"C: The Complete Reference"****, Fourth Edition, McGraw Hill Education, 2017.*
3	*YashavantP.Kanetkar,* ***"Let Us C",*** *15th edition, BPB Publications,2016.*
4	*Brian W. Kernighan and Dennis Ritchie,* ***"The C Programming Language",*** *Second Edition, Prentice Hall Software Series, 2015.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Articulate the basics of computer and evolution of programming languages.	K1
CO2	Write simple C programs using appropriate datatypes and control statements.	K3
CO3	Write C programs using arrays, functions and enumerations.	K3
CO4	Use pointers effectively to develop programs.	K3
CO5	Create user defined datatypes using structures & union and effectively manipulate them in file operations.	K6

COURSE ARTICULATION MATRIX

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	3	1	-	-	-	-	-	-	-	-	1	3	3	3
CO2	1	3	1	-	-	-	-	-	-	-	-	1	3	3	3
CO3	1	3	1	-	-	-	-	-	-	-	-	1	3	3	3
CO4	1	3	1	-	-	-	-	-	-	-	-	1	3	3	3
CO5	1	3	1	-	-	-	-	-	-	-	-	1	3	3	3
22SES101	**1**	**3**	**1**	-	-	-	-	-	-	-	-	**1**	**3**	**3**	**3**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.3, 12.2.1.
CO2	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.3, 3.2.3, 3.3.1, 12.1.2.
CO3	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.3, 3.2.3, 3.3.1, 12.1.2.
CO4	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.3, 3.2.3, 3.3.1, 12.1.2.
CO5	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.3, 3.2.3, 3.3.1, 12.1.2.

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	50	20	30	-	-	-	100
CAT2	20	30	50	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	50	-	50	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	100	-	-	-	100
ESE	20	30	50	-	-	-	100

22SMC1Z1	ENVIRONMENTAL SCIENCE AND ENGINEERING *(Common to all Branches)*	SEMESTER I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	MC	3	0	0	0

Course Objectives	1. To study the modern agriculture related problems, natural resources and its harnessing methods. 2. To study the interrelationship between living organism and environment. 3. To educate the people about causes of pollutions and its controlling methods. 4. To impart the knowledge of various environmental threats and its consequences. 5. To study the various water conservation methods, Act, Population policy, Welfare programs.	
UNIT – I	**ENVIRONMENTAL ENERGY RESOURCES**	**9 Periods**
Food-effects of modern agriculture, fertilizers, pesticides, eutrophication & biomagnifications-Energy resources: renewable resources - Hydro Energy, Solar & Wind. Non-renewable resources – Coal and Petroleum - harnessing methods.		
UNIT – II	**ECO SYSTEM AND BIODIVERSITY**	**9 Periods**
Eco system and its components - biotic and abiotic components. Biodiversity: types and values of biodiversity, hot spots of biodiversity, endangered and endemic species, conservation of biodiversity: In situ and ex situ conservation. Threats to biodiversity-destruction of habitat, habit fragmentation, hunting, over exploitation and man-wildlife conflicts. The IUCN red list categories.		
UNIT – III	**ENVIRONMENTAL POLLUTION**	**9 Periods**
Air pollution, classification of air pollutants – sources, effects and control of gaseous pollutants SO_2, NO_2, H_2S, CO, CO_2 and particulates. Water pollution - classification of water pollutants, organic and inorganic pollutants, sources, effects and control of water pollution. Noise pollution - decibel scale, sources, effects and control.		
UNIT – IV	**ENVIRONMENTAL THREATS**	**9 Periods**
Global warming-measure to check global warming - impacts of enhanced Greenhouse effect, Acid rain-effects and control of acid rain, ozone layer depletion- effects of ozone depletion, disaster management - flood, drought, earthquake and tsunami.		
UNIT – V	**SOCIAL ISSUES AND ENVIRONMENT**	**9 Periods**
Water conservation, rain water harvesting, e-waste management, Pollution Control Act, Wild life Protection Act. Population growth- exponential and logistic growth, variation in population among nations, population policy. Women and Child welfare programs. Role of information technology in human and health, COVID-19 - effects and preventive measures.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Sharma J.P., **"Environmental Studies"**, 4th Edition, University Science Press, New Delhi 2016.*
2	*Anubha Kaushik and C.P.Kaushik**, "Environmental Science and Engineering"**, 7th Edition, New Age International Publishers, New Delhi, 2021.*

REFERENCES:

1	*A K De, **"Environmental Chemistry"**, 8th Edition, New Age International Publishers, 2017.*
2	*G. Tyler Miller and Scott E. Spoolman, **"Environmental Science"**, Cengage Learning India Pvt, Ltd, Delhi, 2014.*
3	*ErachBharucha, **"Textbook of Environmental Studies"**, Universities Press(I) Pvt, Ltd, Hyderabad, 2015.*
4	*Gilbert M.Masters**, "Introduction to Environmental Engineering and Science"**, 3rd Edition, Pearson Education, 2015.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Recognize and understandabout the various environmental energy resources and the effective utility of modern agriculture.	K2
CO2	Acquire knowledge about the interaction of biosphere with environment and conservation methods of bio diversity.	K2
CO3	Be aware of the sources of various types of pollution, their ill effects and preventive methods.	K2
CO4	Identify and take the preventive measures to control the environmental threats and effects of Global warming, Ozone depletion, Acid rain, and natural disasters.	K2
CO5	Demonstrate an idea to save water and other issues like COVID -19.	K2

COURSE ARTICULATION MATRIX

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	1	1	1	-	-	3	-	-	-	-	-	-	1	-
CO2	-	-	1	-	-	-	3	-	-	-	-	-	-	1	-
CO3	2	1	1	1	-	-	3	-	-	-	-	-	-	1	-
CO4	2	1	1	1	-	-	3	-	-	-	-	-	-	1	-
CO5	-	1	1	1	-	2	3	-	-	-	-	-	-	1	-
22SMC1Z1	**2**	**1**	**1**	**1**	-	**1**	**3**	-	-	-	-	-	-	**1**	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.2.1, 1.4.1, 2.1.2, 2.3.1, 3.1.5, 3.2.1, 4.3.1, 7.1.1, 7.1.2, 7.2.1.
CO2	3.1.5, 7.1.1, 7.1.2, 7.2.1.
CO3	1.2.1, 1.3.1, 1.4.1, 2.1.2, 2.3.1, 3.1.5, 3.2.1, 4.1.3, 4.3.1, 7.1.1, 7.1.2, 7.2.1.
CO4	1.2.1, 1.4.1, 2.1.2, 2.3.1, 3.1.5, 4.1.3, 4.3.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2.
CO5	2.1.2, 2.2.2, 3.1.5, 4.1.3, 4.3.1, 6.2.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2.

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	40	20	20	-	-	100
CAT2	20	40	20	20	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	20	40	20	20	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	20	40	20	20	-	-	100
ESE	20	40	20	20	-	-	100

22SBS1Z3	PHYSICS LABORATORY *(Common to all Branches)*	SEMESTER I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	BS	0	0	3	1.5

Course Objectives	1. To impart practical knowledge on the concept of properties of matter and utilize the experimental techniques to measure the properties 2. To impart practical knowledge on the modulii of elasticity 3. To analyze the properties of semiconductors 4. To learn practically the basic electronic concepts of transistor and logic gates 5. To realize the principle, concepts and working of a solar cell and study the properties of ferromagnetic material 6. To understand the concept of quantum physics
S. No.	**LABORATORY EXPERIMENTS**
1.	Determination of refractive index of the glass and given liquid – Spectrometer diffraction method.
2.	Determination of Planck's constant.
3.	Determination of Young's Modulus of the material in the form of bar – Cantilever Bending - Koenig's Method.
4.	a) Particle size determination using diode laser. b) Determination of numerical aperture and acceptance angle in an optical fiber.
5.	Hall effect - Determination of semiconductor parameters.
6.	Determination of band gap of semiconductor material.
7.	Determination of velocity of sound and compressibility of the given liquid-Ultrasonic Interferometer.
8.	Determination of moment of inertia of disc and rigidity modulus of a wire-Torsional pendulum.
9.	Transistor characteristics.
10.	Solar cell characteristics.
11.	Determination of Hysteresis losses in a Ferromagnetic material-B-H curve unit.
12.	Logic Gates – Verification and Construction.
Contact Periods: **Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods**	

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Determine refractive index and compressibility of liquids, micro size of particles and numerical aperture of an optical fibre	K5
CO2	Measure the Young's and rigidity modulii of the given material	K5
CO3	Determine the bandgap of a given semiconductor material and identify the type of semiconductor and its carrier concentration through Hall measurement	K5
CO4	Analyze the characteristics of transistor and verify the truth table of logic gates	K4
CO5	Measure the efficiency of a solar cell and energy loss associated with the ferromagnetic material by plotting B-H curve	K5
CO6	Determine the Planck's constant and work function	K5

COURSE ARTICULATION MATRIX

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	1	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	2	1	-
CO6	3	2	-	-	-	-	-	-	-	-	-	-	1	1	-
22SBS1Z3	**3**	**2**	-	-	-	-	-	-	-	-	-	-	**2**	**1**	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.3, 2.4.1, 2.4.2, 2.4.3, 2.4.4.
CO2	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.3, 2.4.1, 2.4.2, 2.4.3, 2.4.4.
CO3	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.3, 2.4.1, 2.4.2, 2.4.3, 2.4.4.
CO4	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.3, 2.4.1, 2.4.2, 2.4.3, 2.4.4.
CO5	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.3, 2.4.1, 2.4.2, 2.4.3, 2.4.4.
CO6	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.3, 2.4.1, 2.4.2, 2.4.3, 2.4.4.

22SES1Z2	WORKSHOP PRACTICE *(Common to all Branches)*	SEMESTER I

PREREQUISTES	CATEGORY	L	T	P	C
NIL	ES	0	0	3	1.5

Course Objectives	1. To make various basic prototypes in the carpentry trade such as Half Lap joint, Lap Tee joint, Dovetail joint, Mortise & Tenon joint. 2. To make various welding joints such as Lap joint, Lap Tee joint, Edge joint, Butt joint and Corner joint. 3. To make various moulds in foundry such as Cube, Straight pipe, V pulley, and Conical bush. 4. To make various components using sheet metal such as Tray, Frustum of cone and Square box. 5. To understand the working and identify the various components of CNC Machines.

LIST OF EXPERIMENTS			
1. Introduction to use of tools and equipment's in Carpentry, Welding, Foundry and Sheet metal 2. Safety aspects in Welding, Carpentry, Foundry and sheet metal. 3. Half Lap joint and Dovetail joint in Carpentry. 4. Welding of Lap joint and Butt joint and T-joint. 5. Preparation of Sand mould for Cube, Conical bush, Pipes and V pulley 6. Fabrication of parts like Tray, Frustum of cone and Square box in sheet metal 7. CNC Machines demonstration and lecture on working principle. 8. Electrical wiring and simple house wiring.			
Contact periods:			
Lecture: 0 Periods	**Tutorial: 0 Periods**	**Practical: 45 Periods**	**Total: 45 Periods**

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Safely Use tools and equipment's used in Carpentry, Welding, Foundry and Sheet metal to create basic joints.	**K2**
CO2	Prepare sand mould for various basic pattern shapes.	**K3**
CO3	Fabricate parts like Tray, Frustum of cone and Square box in sheet metal.	**K3**
CO4	Practice on the Welding and Carpentry	**K3**
CO5	Demonstrate the working of CNC Machines.	**K2**

COURSE ARTICULATION MATRIX
a) CO and PO Mapping

COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	3	2	1	3	1	2	3	3	2	3			-
CO2	2	2	3	2	1	3	3	2	3	3	2	3			1
CO3	2	2	3	2	1	3	3	2	3	3	2	3			-
CO4	2	2	3	2	1	3	3	2	3	3	2	3			-
CO5	2	2	3	2	3	-	-	2	3	3	2	2			1
22SES1Z2	**2**	**2**	**3**	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**2**	**3**			**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 4.1.1, 4.1.4, 4.2.1, 4.3.1, 5.2.2, 5.3.2, 6.1.1, 6.2.1,7.1.2, 8.2.1, 8.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.1.1, 11.3.1, 12.1.1, 12.2.2, 12.3.1, 12.3.2.
CO2	1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 4.1.1, 4.1.4, 4.2.1, 4.3.1, 5.2.2, 5.3.2, 6.1.1, 6.2.1, 7.1.1, 7.1.2, 7.2.2, 8.2.1, 8.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.1.1, 11.3.1, 12.1.1, 12.2.2, 12.3.1, 12.3.2.
CO3	1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1,3.3.2, 3.4.1, 4.1.1, 4.1.4, 4.2.1, 4.3.1, 5.2.2, 5.3.2, 6.1.1, 6.2.1, 7.1.1, 7.1.2, 7.2.2, 8.2.1, 8.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.1.1, 11.3.1, 12.1.1, 12.2.2, 12.3.1, 12.3.2.
CO4	1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 4.1.1, 4.1.4, 4.2.1, 4.3.1, 5.2.2, 5.3.2, 6.1.1, 6.2.1, 7.1.1, 7.1.2, 7.2.2, 8.2.1, 8.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.1.1, 11.3.1, 12.1.1, 12.2.2, 12.3.1, 12.3.2.
CO5	1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 4.1.1, 4.1.4, 4.2.1, 4.3.1, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.2, 7.1.1, 7.2.2, 8.2.1, 8.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.1.1, 11.3.1, 12.2.2, 12.3.1, 12.3.2.

22SES103	PROGRAMMING IN C LABORATORY *(Common to all Branches Except MECH & PRODN)*	SEMESTER I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	0	0	3	1.5

Course Objectives	To understand the concepts like Data types, Flow control statements, Functions, Arrays, command line arguments, Pointer, Dynamic memory allocation, Preprocessor Directives, Structures ,Unions and Files in C.

EXERCISES ILLUSTRATING THE FOLLOWING CONCEPTS:			
1	Operators, Expressions and IO formatting.		
2	Decision Making and Looping.		
3	Arrays and Strings.		
4	Functions and Recursion.		
5	Pointers.		
6	Dynamic Memory Allocation.		
7	Command line arguments.		
8	Preprocessor Directives.		
9	Structures.		
10	Unions.		
11	Files.		
12	MiniProject.		
Contact periods:			
Lecture: 0 Periods	**Tutorial: 0 Periods**	**Practical: 45 Periods**	**Total: 45 Periods**

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Use appropriate data types and flow control statements to write C programs.	K6
CO2	Write C programs using arrays, functions and command line arguments.	K6
CO3	Write C programs using pointers, dynamic memory allocation and preprocessor directives.	K6
CO4	Implement user defined data types using structures & union and effectively manipulate them in file operations.	K6
CO5	Develop simple applications using C.	K6

COURSE ARTICULATION MATRIX

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3	1	1	-	-	-	-	-	-	-	-	3	3	3
CO2	2	3	1	1	-	-	-	-	-	-	-	-	3	3	3
CO3	2	3	1	1	-	-	-	-	-	-	-	-	3	3	3
CO4	2	3	1	1	-	-	-	-	-	-	-	-	3	3	3
CO5	2	3	2	1	-	-	-	-	3	3	-	-	3	3	3
22SES103	**2**	**3**	**2**	**1**	-	-	-	-	**1**	**1**	-	-	**3**	**3**	**3**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 2.4.4, 3.2.3, 3.3.1, 4.1.1, 4.1.2, 4.2.1
CO2	1.1.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 2.4.4, 3.2.3, 3.3.1, 4.1.1, 4.1.2, 4.2.1
CO3	1.1.1, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 2.4.4, 3.2.3, 3.3.1, 4.1.1, 4.1.2, 4.2.1
CO4	1.1.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.3.2, 2.4.1, 2.4.3, 2.4.4, 3.2.3, 3.3.1, 4.1.1, 4.1.2, 4.2.1
CO5	1.1.1, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.3.2, 2.4.1, 2.4.3, 2.4.4, 3.1.1, 3.1.5, 3.1.6, 3.2.3, 3.3.1

22SHS2Z4	தமிழரும் தொழில்நுட்பமும் TAMILS AND TECHNOLOGY *(Common to all Branches)*	SEMESTER II

PREREQUISITES	CATEGORY	L	T	P	C
NIL	HSMC	1	0	0	1

UNIT – I	WEAVING AND CERAMIC TECHNOLOGY	3 Periods
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW)– Graffiti on Potteries.		
UNIT – II	**DESIGN AND CONSTRUCTION TECHNOLOGY**	**3 Periods**
Designing and Structural construction House & Designs in household materials during Sangam Age- Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.		
UNIT – III	**MANUFACTURING TECHNOLOGY**	**3 Periods**
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold-Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.		
UNIT – IV	**AGRICULTURE AND IRRIGATION TECHNOLOGY**	**3 Periods**
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.		
UNIT – V	**SCIENTIFIC TAMIL & TAMIL COMPUTING**	**3 Periods**
Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.		
Contact Periods: **Lecture: 15 Periods** **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 15 Periods**		

TEXT BOOK:

1	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித்தமிழ் – முனைவர் இல.சுந்தரம் . (விகடன் பிரசுரம்).
3	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4	பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

REFERENCES:

1	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by:International Institute of Tamil Studies.
3	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu)(Published by: International Institute of Tamil Studies).
4	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by:International Institute of Tamil Studies.)
5	Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by:Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,Tamil Nadu)
6	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay)(Published by: The Author)
7	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
8	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) –Reference Book.

22SHS2Z4	தமிழரும் தொழில்நுட்பமும் TAMILS AND TECHNOLOGY *(Common to all Branches)*	SEMESTER II

PREREQUISITES	CATEGORY	L	T	P	C
NIL	HSMC	1	0	0	1

அலகு I	நெசவு மற்றும் பானைத் தொழில்நுட்பம்	3 Periods
சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள்– பாண் டங்களில் கீறல் குறியீடுகள்.		
அலகு II	**வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்**	**3 Periods**
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும்– சிலப்பதிகாரத்தில் மேடைஅமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும்- சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள்-மாதிரிகட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சிஅம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர்மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.		
அலகு III	**உற்பத்தித் தொழில் நுட்பம்**	**3 Periods**
கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண் டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகக்கள்.		
அலகு IV	**வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்**	**3 Periods**
அணை, ஏரி, குளங்கள் , மதகு – சோழர்காலக் குமுழித்தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார்அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு –அறிவுசார் சமூகம்.		
அலகு V	**அறிவியல் தமிழ் மற்றும் கணினித்தமிழ்**	**3 Periods**
அறிவியல் தமிழின் வளர்ச்சி-கணினித்தமிழ் வளர்ச்சி- தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.		
Contact Periods: **Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods**		

TEXT BOOK:

1	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித்தமிழ் – முனைவர் இல.சுந்தரம் . (விகடன் பிரசுரம்).
3	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4	பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

REFERENCES:

1	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by:International Institute of Tamil Studies.
3	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu)(Published by: International Institute of Tamil Studies).
4	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by:International Institute of Tamil Studies.)
5	Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by:Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,Tamil Nadu)
6	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay)(Published by: The Author)
7	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
8	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) –Reference Book.

22SHS2Z5	VALUES AND ETHICS *(Common to all Branches)*	SEMESTER II

PREREQUISITES	CATEGORY	L	T	P	C
NIL	HSMC	3	0	0	3

Course Objectives	1. To understand and appreciate the ethical issues faced by an individual in profession, society and polity. 2. To learn about Engineering Ethics and case studies. 3. To understand the negative health impacts of certain unhealthy behaviours. 4. To appreciate the need and importance of physical, emotional health and social health. 5. To get familiar with the global issues.	
UNIT – I	**BEING GOOD AND RESPONSIBLE**	**9 Periods**
Morals, Values and Ethics - Integrity - Work Ethics - Service Learning - Civic Virtue - Respect for Others - Living Peacefully - Caring - Sharing - Honesty - Courage - Valuing Time - Cooperation - Commitment - Empathy - Self-Confidence - Character		
UNIT – II	**ENGINEERING AS SOCIAL EXPERIMENTATION**	**9 Periods**
Engineering Ethics: Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Models of Professional Roles. Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – Case studies : Chernobyl disaster and Titanic disaster		
UNIT – III	**ADDICTION AND HEALTH**	**9 Periods**
Peerpressure - Alcoholism: Ethicalvalues, causes, impact, laws, prevention–Illeffects of smoking- Prevention of Suicides; Sexual Health: Prevention and impact of premarital pregnancy and Sexually Transmitted Diseases. DrugAbuse: Abuse of different types of legal and illegal drugs: Ethical values, causes, impact, laws and prevention		
UNIT – IV	**PROFESSIONAL ETHICS**	**9 Periods**
AbuseofTechnologies: Hacking and other cybercrimes, Addiction to mobile phone usage, Video games and Social networking websites		
UNIT – V	**GLOBAL ISSUES**	**9 Periods**
Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers - consulting engineers - engineers as expert witnesses and advisors - Code of Conduct – Corporate Social Responsibility		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Mike W Martin and Roland Schinzinger, **"Ethics in Engineering"**, 4 th Edition, McGraw-Hill, New York 2017.*
2	*Govindarajan M, Natarajan S and Senthil Kumar VS, **"Engineering Ethics"**, Prentice Hall of India, New Delhi, 2013.*

REFERENCES:

1	*Dhaliwal,K.K,* ***"Gandhian Philosophy of Ethics: A Study of Relationship between his Presupposition and Precepts",*** *WritersChoice, NewDelhi, India, 2016.*
2	*Jayshreesuresh, B.S.Raghavan,* ***"Human values and professional ethics"****, S.Chand and company Ltd, New Delhi, 2nd Edition, 2007.*
3	*L.A. and Pagliaro,A.M****, "Handbook of Child and Adolescent Drug and Substance Abuse: Pharmacological, Developmental and Clinical Considerations",*** *Wiley Publishers, U.S.A,2012.*
4	*Pandey,P.K(2012****),"SexualHarassmentandLawinIndia",*** *LambertPublishers,Germany. 2012.*
5	*Kiran D.R,* ***"Professional ethics and Human values,"*** *Tata McGraw Hill, New Delhi, 2007.*
6	*Edmund G See Bauer and Robert L Barry,* ***"Fundamentals of Ethics for Scientists and Engineers"****, Oxford University Press, Oxford, 2001.*
7	*David Ermann and Michele S Shauf,* ***"Computers, Ethics and Society"****, Oxford University Press, 2003.*
8	*Govindarajan M, Natarajan S, Senthil Kumar V. S,* ***"Engineering Ethics"****, Prentice Hall of India, New Delhi, 2004.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Follow sound morals and ethical values scrupulously to prove as good citizens.	K3
CO2	Assess the relevance of ethics and morals in engineering and to learn case studies.	K3
CO3	Describe the concept of addiction and how it will affect the physical and mental health.	K2
CO4	Identify ethical concerns while using advanced technologies.	K2
CO5	Judge the code of conduct, Environmental ethics and computer ethics.	K3

COURSE ARTICULATION MATRIX

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	-	-	-	-	-	3	3	3	3	3	3	-	-	-	-
CO2	-	-	-	-	-	3	1	3	3	-	-	-	-	-	-
CO3	-	-	-	-	-	3	1	3	3	2	3	-	-	-	-
CO4	-	-	-	-	-	3	3	3	3	1	3	1	-	-	2
CO5	-	-	-	-	-	3	3	3	3	-	1	3	-	-	2
22SHS2Z5	-	-	-	-	-	**3**	**3**	**3**	**3**	**2**	**2**	**1**	-	-	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	6.1.1, 6.2.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 8.1.1, 8.2.1, 8.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.1.1, 11.1.2, 11.2.1, 11.3.1.
CO2	6.1.1, 6.2.1, 7.1.1, 8.1.1, 8.2.1, 8.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1.
CO3	6.1.1, 6.2.1, 7.1.1, 8.1.1, 8.2.1, 8.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.2.1, 10.3.1, 10.3.2, 11.1.1, 11.1.2, 11.2.1, 11.3.1.
CO4	6.1.1, 6.2.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 8.1.1, 8.2.1, 8.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.3.1, 10.3.2, 11.1.1, 11.1.2, 11.2.1, 11.3.1, 11.3.2, 12.1.1.
CO5	6.1.1, 6.2.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 8.1.1, 8.2.1, 8.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 11.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2.

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	20	20	-	-	100
CAT2	30	30	20	20	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	30	30	20	20	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	30	30	20	20	-	-	100
ESE	30	30	20	20	-	-	100

22SBS204	VECTOR SPACES AND DIFFERENTIAL EQUATIONS WITH MATLAB *(Common to CSE & IT Branches)*	SEMESTER II

PREREQUISITES	CATEGORY	L	T	P	C
NIL	BS	3	1	0	4

Course Objectives	1. To be familiar with MATLAB and solving the simple equations 2. To gain methods to solve second order differential equations with constant and variable coefficients. 3. To acquire knowledge of testing convergence of sequences and series. 4. To gain the concepts of vector spaces and linear transformations. 5. To obtain the knowledge of decomposition and inner product spaces.	
UNIT – I	**MATLAB**	**9+3 Periods**
MATLAB Basics- Simple problems: solving equations, matrix operations, calculating eigen values and eigen vectors, solving linear system of equations, differentiation.		
UNIT – II	**ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER**	**9+3 Periods**
Higher order linear differential equations with constant coefficients -variable coefficients: Cauchy-Euler equation, Cauchy-Legendre equation-Method of variation of parameters-Simultaneous first order linear equations with constant coefficients.		
UNIT – III	**SEQUENCES AND SERIES**	**9+3 Periods**
Convergence of sequence, tests for convergence of series of positive terms: comparison test, D' Alembert's ratio test, Cauchy's Integral test, Raabe's test, logarithmic test, Gauss test, Cauchy's root test- alternating series: Leibnitz test – power series: absolutely convergent, conditionally convergent.		
UNIT – IV	**VECTOR SPACES I**	**9+3 Periods**
Vector Space, linear dependence of vectors, basis, dimension, Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank-nullity theorem, composition of linear maps, Matrix associated with a linear map.		
UNIT – V	**VECTOR SPACES II**	**9+3 Periods**
Eigen bases, Cholesky Decomposition, Inner product spaces- norm, orthogonality, orthonormal set,Gram-Schmidt orthogonalization.		
Contact Periods: **Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods**		

TEXT BOOK

	*B.S.Grewal, **"Higher Engineering Mathematics"**, Khanna Publishers, New Delhi, 44thEdition, 2018.*
2	*Howard Anton, Chris Rorres, **"Elements of Linear Algebra with Applications"**, Wiley, New Delhi, 2ndEdition, 2015.*
3	*Brain R.Hunt, Ronald L.Lipsman, Jonathan M. Rosenberg with Kevin R.Coombes, John E. Osborn and Garrett J.Stuck, **"A Guide to MATLAB for beginners and experienced users"**, Published in the United States of America by Cambridge University Press, New York 2001.*

REFERENCES

1	*E. A. Coddington,* ***"An Introduction to Ordinary Differential Equations"****, Prentice Hall India, 1995.*
2	*G.F. Simmons and S.G. Krantz,* ***"Differential Equations"****, Tata McGraw Hill, 2007.*
3	*Srimanta Pal and suboth.C.Bhunia,* ***"Engineering Mathematics"****, Oxford university publications, New Delhi, 2015.*
4	*Gilbert Strang,* ***"Linear Algebra and its Applications"****, Cengage Learning, Delhi, 4th Edition, 2006.*
5	*D.Poole,* ***"Linear Algebra: A Modern Introduction"****,2nd Edition, Brooks/Cole,2005.*
6	*V. Krishnamurthy, V.P. Mainra and J.L. Arora, "****An introduction to Linear Algebra"****, Affiliated East–West press, Reprint 2005.*
7	*Amos Gilat,* ***"MATLAB:An Introduction with Applications"****,Wiley, The Ohio State University, 6th Edition, 2013.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Solve algebraic equations by using MATLAB.	K5
CO2	Find solution for higher order linear differential equation with constant and variable coefficients and simultaneous differential equation.	K5
CO3	Perform basic computation in convergence and divergence of sequences and series	K5
CO4	Demonstrate the concepts of vector spaces and linear transformation orientation with matrices.	K5
CO5	Use Cholesky Decomposition and orthogonal transformation including Inner product spaces in the applications of many different fields.	K5

COURSE ARTICULATION MATRIX

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	-	3	-	-	-	-	-	1	-	2	3	3	2
CO2	2	1	-	-	-	-	-	-	-	-	-	2	3	3	1
CO3	2	1	-	-	-	-	-	-	-	-	-	2	3	2	1
CO4	2	1	-	-	-	-	-	-	-	-	-	2	3	2	-
CO5	2	1	-	-	-	-	-	-	-	-	-	2	3	2	-
22SBS204	**3**	**2**	-	1	-	-	-	-	-	1	-	**2**	**3**	**3**	**1**
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.4.1, 4.1.1, 4.1.2, 4.2.1, 4.3.1 ,4.3.2, 4.3.3, 10.1.1, 12.1.1, 12.2.1, 12.2.2.
CO2	1.1.1, 1.1.2, 1.3.1, 2.1.1, 2.1.3, 2.2.3, 2.4.1, 4.4.1, 12.1.1, 12.2.1, 12.2.2.
CO3	1.1.1, 1.1.2, 1.3.1, 2.1.1, 2.1.3, 2.2.3, 2.4.1, 4.4.1, 12.1.1, 12.2.1, 12.2.2.
CO4	1.1.1, 1.1.2, 1.3.1, 2.1.1, 2.1.3, 2.2.3, 2.4.1, 4.1.1, 12.1.1, 12.2.1, 12.2.2.
CO5	1.1.1, 1.1.2, 1.3.1, 2.1.1, 2.1.3, 2.2.3, 2.4.1, 4.1.1, 12.1.1, 12.2.1, 12.2.2.

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	40	20	10	-	-	100
CAT2	30	40	20	10	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	30	40	20	10	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	30	40	20	10	-	-	100
ESE	30	40	20	10	-	-	100

22SBS205	PHYSICS FOR INFORMATION SCIENCE *(Common to CSE & IT Branches)*	SEMESTER II

PREREQUISTIES	CATEGORY	L	T	P	C
NIL	BS	3	0	0	3

Course Objectives	1. To understand the properties of electronic materials. 2. To understand the characteristics of semiconductors. 3. To explain different number systems and their application in logic gates 4. To understand the properties of magnetic and superconducting materials and apply them for specific purpose 5. To explain engineered semiconductor materials and their Applications

UNIT – I	**ELECTRONIC MATERIALS**	**9 Periods**

Classical Free electron theory of metals – Postulates – Electrical and Thermal conductivity of metals – Derivation of Wiedeman – Franz law – Lorentz number – Drawbacks of Classical theory – Fermi distribution Function – Effect of temperature – Density of energy states in metals (derivation) – Carrier concentration in metals - Calculation of Fermi energy at 0 K

UNIT – II	**SEMICONDUCTORS**	**9 Periods**

Properties of semiconductors – elemental and compound semiconductors - Direct and indirect band gaps - Intrinsic and extrinsic semiconductors - Fermi level - Carrier concentration in intrinsic semiconductor - Dependence of Fermi level on temperature – Electrical conductivity – band gap determination – extrinsic semiconductors – Carrier concentration in P-type and N-type semiconductors - Dependence of Fermi level on impurity concentration and temperature for P-type and N-type semiconductors.

UNIT – III	**DIGITAL ELECTRONICS**	**9 Periods**

Introduction – Binary number system – place value – decimal to Binary conversion – Binary to decimal conversion – Octal and hectadecimal numbers. Logic Gates – Three basic Logic Gates:OR, AND, NOT: operation, circuit, truth table, Boolean expression – Universal gate: NAND and NOR Gates:NOT, AND and OR from NAND & NOR Gates – Exclusive OR Gate - Problems

UNIT – IV	**MAGNETIC AND SUPER CONDUCTING MATERIALS**	**9 Periods**

Origin of magnetic moment - Bohr magneton - Dia, Para, and Ferro magnetic materials - Domain theory of ferromagnetism - Hysteresis - Hard and Soft magnetic materials. Magnetic recording – Magnetic Tapes – Floppy disk – Optical Recording – Magneto Optical Recording – Principle – Recording – Reading – Construction.

Superconductivity - Types of superconductors - BCS theory of superconductivity (qualitative) - properties- Meissner effect, effect of magnetic field and current - Applications of superconductors: Cryotron, Magnetic levitation.

UNIT – V	**ENGINEERED SEMICONDUCTOR MATERIALS**	**9 Periods**

Introduction - Quantum confinement – Density of states in 2D, 1D and 0D (qualitatively) - Practical examples of low-dimensional systems such as quantum wells, wires, and dots – Nanomaterials – Properties – Methods of synthesize – Top-down & Bottom-up Approach – Ball Milling – Chemical vapour deposition – Applications of Nanomaterials.

Contact Periods:
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOK:

1.	*P.K.Palanisamy, "**EngineeringPhysics-II**",Scitech Publications(India)pvt.Ltd, 2015.*
2.	*V.Rajendran, "**Material Science**", Tata McGraw-Hill Publications, 2011.*
3.	*S. Jayakumar, **"Materials Science"**, R.K.publishers, 2008.*
4.	*V. K. Mehta and Shalu Mehta, **"Principles of Electronics"**, S.Chand& Company Ltd., 2001.*

REFERENCES:

1.	*William D Callister and David G. Rithwish,* ***"Materials science & Engineering:An introduction****",Wiley, 2013.*
2.	*P. Bhattacharya,* ***"Semiconductor Optoelectronic Devices"****, Prentice Hall of India, 1997.*
3.	*G.W. Hanson,* ***"Fundamentals of Nanoelectronics"****, Pearson Education, 2009.*
4.	*M.Moris Mano,* ***"Digital Logic and Computer Design"****, Prentice- Hall of India Pvt. Ltd., 1998.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explain the physical properties of conducting materials.	K2
CO2	Explain the characteristics of intrinsic and extrinsic semiconductors.	K2
CO3	Explain different number systems. Apply logic gates in circuits.	K3
CO4	Explain magnetic and superconductor characteristics. Apply magnetic materials and superconductors for industrial problems.	K3
CO5	Explain low dimensional systems and Choose suitable method for the synthesis. Apply nanomaterials for real time problems.	K3

COURSE ARTICULATION MATRIX
a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	1	-
CO3	3	3	1	-	1	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	1	1	-	-	-	-	-	-	-	2	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	2	1	-
22SBS205	**3**	**3**	**1**	**1**	**1**	-	-	-	-	-	-	-	**1**	**1**	-

1-Slight, 2 – Moderate, 3 - Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.2.3, 2.2.4, 2.2.5, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4.
CO2	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.2.3, 2.2.4, 2.2.5, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4.
CO3	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.2.3, 2.2.4, 2.2.5, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.5, 5.1.1.
CO4	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.2.3, 2.2.4, 2.2.5, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.5, 4.3.1, 5.1.1.
CO5	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.2.3, 2.2.4, 2.2.5, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.5.

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	30	10	-	-	100
CAT2	30	30	30	10	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	30	30	30	10	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	30	30	30	10	-	-	100
ESE	30	30	30	10	-	-	100

22SBS206	APPLIED CHEMISTRY *(Common to EEE, ECE, EIE, CSE & IT Branches)*	SEMESTER II

PREREQUISITES	CATEGORY	L	T	P	C
NIL	BS	3	0	0	3

Course Objectives	1. To know about the second law of thermodynamics and its various functions. 2. To understand the concept of electrochemistry, primary, secondary batteries, construction and its uses. 3. To understand the basic principles of corrosion, mechanism and its protection methods. 4. To acquire basic knowledge about the nanoparticles, its preparations, properties, types and applications in various field. 5. To impart the knowledge of preparations of single crystal, wafer preparation, P-N junction formation by various methods.	
UNIT – I	**CHEMICAL THERMODYNAMICS**	**9 Periods**
The Second law of thermodynamics-Concepts of entropy, Work and free energy functions - Maxwell's relationships for reversible and irreversible process - Gibbs Helmholtz equation – Partial molar free energy-Chemical potential-Gibb's Duhem Equation, Clausius - Clapeyron equation.		
UNIT – II	**ELECTRO CHEMISTRY AND STORAGE DEVICES**	**9 Periods**
Cells–Electro chemical cell and electrolytic cell – electrodes– electrode potentials – standard oxidation and reduction potentials-Hydrogen and Calomel electrodes- EMF series and its significance. Batteries - Types of batteries- Primary - Zn/$MnO_2$and Li/$SOCl_2$ - Construction, working and applications. Secondary batteries-Lead acid battery and lithium-ion battery – Li-TiS_2- Construction, working and Applications.		
UNIT – III	**CORROSION**	**9 Periods**
Corrosion-Definition -Classifications: Chemical Corrosion and Electro chemical corrosion mechanism-Pilling Bedworth rule–Galvanic series and its importance- preventing methods-Cathodic protection (sacrificial anode and impressed current conversion method). Protective Coatings-Inorganic coating-surface preparation-Electro plating method applied to Cr and Ni, Organic coating- paints - constituents and its functions.		
UNIT – IV	**NANO MATERIALS**	**9 Periods**
Nanomaterials and bulk materials; Size-dependent properties (Optical, Electrical and Mechanical); Types of nanomaterials: Definition- properties and uses of nanoparticle, nanorod and nanotube. Preparation of nanomaterials: chemical vapour deposition, electrochemical deposition. Applications of nanomaterials in medicine and electronics.		
UNIT – V	**FABRICATION**	**9 Periods**
Silicon for IC chips - single crystal – preparation by Czochralski and float zone processes- wafer preparation, P-N junction formation – Ion implantation. Diffusion and epitaxial growth techniques - Insulator layer by oxidation- Printing of circuits by photolithography – masking and electron beam methods- etching by chemical and electrochemical methods.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Jain. P.C. and Monica Jain, **"Engineering Chemistry"**, DhanpatRai Publications Pvt Ltd, New Delhi, 16th Edition, 2017.*
2	*S.S. Dara**, "A text book of Engineering Chemistry"**, S. Chand Publishing, 12th Edition, 2018.*

REFERENCES:

1	*Dara. S.S, Umarae, **"Text book of Engineering Chemistry"**, S. Chand Publications, 2013.*
2	*M.S.Tyagi, **"Introduction to semiconductor materials and devices"**, WileyIndia, 2012.*
3	*B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday**, "Textbook of nanoscience and nanotechnology"**, Universities Press-IIM Series in Metallurgy and Materials Science, 2018.*
4	*B.R Puri, L.R Sharma & M. S. Pathania, **"Principles of Physical Chemistry" aginN .S** Chand and Co., 2017.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Analyzethe applications of thermodynamics and its various functions.	K3
CO2	Implement the new ideas related to batteries which find uses in the society including engineering fields.	K3
CO3	Identify the corrosion mechanisms and its controlling methods.	K3
CO4	Applying the concepts of nanoscience and nanotechnology in the synthesis of nanomaterials for engineering applications.	K3
CO5	Construct the silicon chips and their fabrication methods and to apply in preparation ofelectrical and electronic instruments.	K3

COURSE ARTICULATION MATRIX

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	1	-	1	-	-	-	-	-	-	-	-	-	-
CO2	2	1	1	-	1	-	-	-	-	-	-	-	-	1	-
CO3	1	1	1	1	1	2	1	-	-	-	-	-	-	-	-
CO4	1	1	1	1	1	-	-	-	-	-	-	-	-	-	-
CO5	1	1	1	1	1	-	-	-	-	-	-	-	-	1	-
22SBS206	**2**	**1**	**1**	**1**	**1**	**1**	**1**	-	-	-	-	-	-	**1**	-
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.2.1, 2.1.2, 2.1.3, 2.3.1, 3.2.2, 5.1.1.
CO2	1.1.2, 1.2.1, 2.3.1, 3.2.2, 5.1.1.
CO3	1.2.1, 2.3.1, 3.2.2, 4.1.1, 4.3.1, 5.1.1, 6.1.1, 7.1.1.
CO4	1.2.1, 2.2.2, 2.3.1, 3.2.2, 4.1.1, 4.3.1, 5.1.1, 5.1.2, 7.1.1.
CO5	1.2.1, 2.3.1, 3.2.2, 4.1.2, 5.1.1.

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	40	20	10	-	-	100
CAT2	30	40	20	10	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	30	40	20	10	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	30	40	20	10	-	-	100
ESE	30	40	20	10	-	-	100

22SES204	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING *(Common to CIVIL, MECH, PRODN, CSE, IT & IBT Branches)*	SEMESTER II

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	0	0	3

Course Objectives	1. To study the basic concepts of electric circuits, electronic devices and communication engineering. 2. To know the fundamentals of DC and AC machines. 3. To familiar with the basics of analog and digital electronics. 4. To understand the basics of house wiring. 5. To introduce the components of electrical installations and energy conservation.	
UNIT – I	**ELECTRICAL CIRCUITS**	**9 Periods**
Electrical circuit elements (R,L and C) - Voltage and Current sources – Ohm's Law – Kirchoff laws – Time domain analysis of First order RL and RC circuits – Representation of sinusoidal waveforms – Average, RMS and Peak values – Phasor representation – Real, Reactive, Apparent power and power factor.		
UNIT – II	**ELECTRICAL MACHINES AND MEASUREMENTS**	**9 Periods**
Construction, Principle of Operation, basic equations and Types, Characteristics and Applications of DC generators, DC motors, Single phase Transformer, Single phase and Three phase Induction motor. Operating principles of Moving coil, Moving iron Instruments (Ammeter and Voltmeters).		
UNIT – III	**ANALOG AND DIGITAL ELECTRONICS**	**9 Periods**
Analog Electronics: Semiconductor devices – P-N junction diode, Zener diode, BJT, Operational amplifier – principle of operation, Characteristics and applications. Digital Electronics: Introduction to numbers systems, basic Boolean laws, reduction of Boolean expressions and implementation with logic gates.		
UNIT – IV	**FUNDAMENTAL OF COMMUNICATION AND TRANSDUCERS**	**9 Periods**
Types of Signals : Analog and Digital Signals – Modulation and Demodulation :Principles of Amplitude and Frequency Modulations – Resistive, Inductive, capacitive Transducers- Introduction.		
UNIT – V	**ELECTRICAL INSTALLATIONS AND ENERGY CONSERVATION**	**9 Periods**
Single phase and three phase system – phase, neutral and earth, basic house wiring -tools and components, different types of wiring - basic safety measures at home and industry – Energy efficient lamps - Energy billing. Introduction to UPS and SMPS.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*R.Muthusubramaniam,R.Salivaganan, Muralidharan K.A., **"Basic Electrical and Electronics Engineering"** Tata McGraw Hill , Second Edition 2010.*
2	*Mittle V.N and Aravind Mittal, **"Basic Electrical Engineering",** Tata McGraw Hill, Second Edition, New Delhi, 2005.*

REFERENCES:

1	*D.P.Kothari, I.J. Nagrath, **"Basic Electrical Engineering"**, Tata McGraw Hill, 2010.*
2	*Nagsarkar T.K and Sukhija M.S, **"Basic Electrical Engineering"**, Oxford Press, 2005.*
3	*E.Hughes,**"Electrical and Elecronics Technology"**, Pearson, 2010.*
4	*MohmoodNahvi and Joseph A.Edminister, **"Electric Circuits"**, Shaum Outline series, McGraw Hill, Sixth edition, 2014.*
5	*Premkumar N and Gnanavadivel J, **"Basic Electrical and Electronics Engineering"**, Anuradha Publishers, 4th Edition, 2008.*
6	*Allan S Morris, **"Measurement and Instrumentation Principles"** Elsevier, First Indian Edition, 2008.*
7	*S.L. Uppal, **"Electrical Wiring Estimating and Costing"**, Khanna publishers, New Delhi, 2006.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Analyze the DC and AC circuits.	K4
CO2	Describe the operation and characteristics of electrical machines.	K4
CO3	Classify and compare various semiconductor devices and digital electronics.	K3
CO4	Infer the concept of communication engineering and Transducers.	K2
CO5	Assemble and Implement electrical wiring and electrical installations.	K6

COURSE ARTICULATION MATRIX

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3	3	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	2	3	2	1	-	2	1	-	-	-	-	-	-	-
CO3	3	2	3	2	1	-	-	-	-	1	-	-	-	-	-
CO4	2	3	3	2	-	-	3	-	-	-	-	1	1	-	2
CO5	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
22SES204	**3**	**3**	**3**	**2**	**1**	**-**	**1**	**1**	**-**	**1**	**-**	**1**	**1**	**-**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.3, 5.2.1, 5.2.2.
CO2	1.1.1, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3,2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 5.2.1, 5.2.2, 7.2.1, 7.2.2, 8.1.1.
CO3	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 5.2.1, 5.2.2, 10.3.1.
CO4	1.1.1, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 7.1.1, 7.1.2, 7.2.1, 12.3.1, 12.3.2.
CO5	1.1.1, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.3.

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	35	35	20	10	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	25	25	50	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	25	25	40	10	-	-	100
ESE	35	35	20	10	-	-	100

22SBS2Z7	CHEMISTRY LABORATORY *(Common to all Branches)*	SEMESTER II

PREREQUISITES	CATEGORY	L	T	P	C
NIL	BS	0	0	3	1.5

Course Objectives	To inculcate the practical applications of Chemistry to students and make them apply in the fields of engineering and technology.

LIST OF EXPERIMENTS			
1.	Estimation of hardness by EDTA method.		
2	Conductometric titration of mixture of strong acid and weak acid using strong base.		
3.	Estimation of chloride by Argentometric method.		
4.	Potentiometric titration of ferrous iron by dichromate.		
5.	Determination of Saponification value of an oil.		
6.	Estimation of Iron by Spectrophotometry.		
7.	Estimation of Dissolved Oxygen.		
8.	Estimation of HCl by pH titration.		
9.	Estimation of Copper in brass sample.		
10.	Estimation of Manganese in Pyrolusite ore.		
11.	Anodiziation of aluminium.		
12.	Determination of corrosion rate and inhibitor efficiency of mild steel in acid media by weight loss method.		
Contact Periods:			
Lecture: 0 Periods	**Tutorial: 0 Periods**	**Practical: 45 Periods**	**Total: 45 Periods**

REFERENCE BOOKS:

1	*A.O. Thomas, "**Practical Chemistry**", Scientific Book Centre, Cannanore, 2006.*
2	*Vogel's "**Text book of Quantitative Analysis**", Jeffery G H, Basset J. Menthom J, Denney R.C., 6th Edition, EBS, 2009.*

COURSE OUTCOMES: Upon the completion of the course, the student will be able to:		Bloom's Taxonomy Mapped
CO1	Analyze the quality of water samples with respect to their hardness and DO.	K3
CO2	Determine the amount of metal ions through potentiometric and spectroscopic techniques.	K3
CO3	Infer the strength of acid, mixtures of acids by pH meter and conductivity cell.	K3
CO4	Estimate the chloride, manganese and copper from various samples.	K3
CO5	Interpret the corrosion rate determination and anodizing method.	K2

COURSE ARTICULATION MATRIX
a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	1	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	1	1	1	-	-	1	-	-	-	-	-	-	1	-
22SBS2Z7	**2**	**1**	**1**	**1**	-	-	**1**	-	-	-	-	-	-	**1**	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.2.1, 2.3.1, 3.1.5.
CO2	1.1.1, 1.2.1, 1.3.1, 2.1.2.
CO3	1.1.1, 1.2.1, 2.1.3, 4.1.3.
CO4	1.2.1, 1.3.1, 2.3.1.
CO5	1.1.1, 1.2.1, 1.3.1, 2.3.1, 3.1.5, 4.2.1, 7.1.1.

22SES2Z5	ENGINEERING GRAPHICS *(Common to all Branches)*	SEMESTER II

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	1	0	4	3

Course Objectives	1. Understand the geometrical constructions. 2. Study the various types of projections. 3. Identify different section of solids. 4. Perform the development of surfaces and view of solids. 5. Familiarize with CAD packages.	
UNIT – I	**GEOMETRICAL CONSTRUCTIONS AND PLANE CURVES**	**3+12 Periods**
Principles of Engineering Graphics and their significance - Basic geometrical constructions. Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Drawing of tangents and normal to the above curves.		
UNIT – II	**ORTHOGRAPHIC PROJECTIONS**	**3+12 Periods**
Introduction to Orthographic Projection - Conversion of pictorial views to orthographic views. Projection of points - Projection of straight lines with traces - Projection of planes (polygonal and circular surfaces) inclined to both the principal planes.		
UNIT – III	**PROJECTION AND SECTION OF SOLIDS**	**3+12 Periods**
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids, when the axis is inclined to both the principal planes by rotating object method. Sectioning of prisms, pyramids, cylinder and cone in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section.		
UNIT – IV	**DEVELOPMENT OF SURFACES AND ISOMETRIC PROJECTIONS**	**3+12 Periods**
Development of lateral surfaces of simple and sectioned solids – prisms, pyramids, cylinder and cone. Principles of isometric projection – isometric scale – isometric projections of simple solids and truncated solids - prisms, pyramids, cylinder, cone- combination of two solid objects in simple vertical positions.		
UNIT – V	**COMPUTER AIDED DRAFTING**	**3+12 Periods**
Introduction to computer aided drafting package to make 2D Drawings. Object Construction: Page layout – Layers and line types – Creating, editing and selecting the geometric objects. Mechanics: Viewing, annotating, hatching and dimensioning the drawing – Creating blocks and attributes. Drafting: Create 2D drawing. A number of chosen problems will be solved to illustrate the concepts clearly. (Demonstration purpose only, not to be included in examination).		
Contact Periods: **Lecture: 15 Periods Tutorial: 0 Periods Practical: 60 Periods Total: 75 Periods**		

TEXT BOOKS:

1	*K.Venugopal, **"Engineering Graphics"**, New Age International (P) Limited, 2016.*
2	*K.V.Natarajan, **"A text book of Engineering Graphics"**, Dhanalakashmi Publishers, Chennai, 2016.*

REFERENCES:

1	*K.L.Narayana and P.Kannaiah,* ***"Text book on Engineering Drawing"****, 2nd Edition, SciTech Publications (India) Pvt. Ltd, Chennai, 2009.*
2	*N.S.Parthasarathy and Vela Murali,* ***"Engineering Graphics"****, Oxford University Press, New Delhi, 2015.*
3	*K.R.Gopalakrishna,* ***"Engineering Drawing" (Vol. I&II combined),*** *Subhas Publications, Bangalore, 2014.*
4	*Basant Agarwal and C.M.Agarwal,* ***"Engineering Drawing"****, Tata McGraw Hill Publishers, New Delhi, 2013.*
5	*Kevin Lang and Alan J.Kalameja, "****AutoCAD 2012 Tutor for Engineering Graphics"****, Cengage Learning Publishers, 1st Edition, 2011.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Acquire on representing solids as per international standards.	K3
CO2	Impart knowledge on different types of projections.	K3
CO3	Generate and interrupt the true shape of section.	K3
CO4	Develop the various surfaces according to the standards.	K3
CO5	Know the concept of computers in drafting engineering diagrams.	K6

COURSE ARTICULATION MATRIX
a) CO and PO Mapping

COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	1	1	1	1	2	-	3	1	3	1	3	-	-	-
CO2	3	1	1	1	1	2	-	3	1	3	1	3	-	-	-
CO3	3	1	1	1	1	2	-	3	1	3	1	3	-	-	-
CO4	3	1	1	1	1	2	-	3	1	3	1	3	-	-	-
CO5	3	1	1	1	1	2	-	3	1	3	1	3	-	3	3
22SES2Z5	**3**	**1**	**1**	**1**	**1**	**2**	**-**	**3**	**1**	**3**	**1**	**3**	**-**	**1**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.3, 2.4.2, 3.1.2, 3.1.4, 3.2.1, 4.3.3, 5.1.1, 6.2.1, 8.1.1, 8.2.1, 8.2.2, 9.2.1, 9.2.4, 10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.3.1, 12.1.1, 12.2.1, 12.2.2, 12.3.1, 12.3.2.
CO2	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.3, 2.4.2, 3.1.2, 3.1.4, 3.2.1, 4.3.3, 5.1.1, 6.2.1, 8.1.1, 8.2.1, 8.2.2, 9.2.1, 9.2.4, 10.1.1, 10.1.2, 10.2.1, 10.3.1, 10.3.2, 11.3.1, 12.1.1, 12.2.1, 12.2.2, 12.3.1, 12.3.2.
CO3	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.3, 2.4.2, 3.1.2, 3.1.4, 3.2.1, 4.3.3, 5.1.1, 6.2.1, 8.1.1, 8.2.1, 8.2.2, 9.2.1, 9.2.4, 10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.3.1, 12.1.1, 12.2.1, 12.2.2, 12.3.1, 12.3.2.
CO4	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.3, 2.4.2, 3.1.2, 3.1.4, 3.2.1 ,4.3.3, 5.1.1, 6.2.1, 8.1.1 , 8.2.1, 8.2.2, 9.2.1, 9.2.4, 10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.3.1, 12.1.1, 12.2.1, 12.2.2, 12.3.1, 12.3.2.
CO5	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.3, 2.4.2, 3.1.2, 3.1.4, 3.2.1, 4.3.3, 5.1.1, 6.2.1, 8.1.1, 8.2.1, 8.2.2, 9.2.1, 9.2.4, 10.1.1, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.3.1, 12.1.1, 12.2.1, 12.2.2, 12.3.1, 12.3.2.

22SBS308	PROBABILITY, RANDOM PROCESSES AND QUEUEING THEORY *(Common to CSE & IT Branches)*	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	BS	3	1	0	4

Course Objectives	To enhance the fundamental knowledge in probability concepts and its applications relevant to various streams of Engineering and Technology. This is a foundation course which mainly deals with topic such as probability, standard statistical distributions, statistical averages regarding one or more random variables, random process, Markov chains and queueing models with finite/infinite capacity in single/multi servers and plays an important role in the understanding of Science, Engineering and Computer Science among other disciplines.	
UNIT – I	**PROBABILITY AND RANDOM VARIABLES**	**9+3 Periods**
Sample spaces–Events – Probability Axioms–Conditional Probability–Independent Events – Baye's Theorem. Random Variables: Distribution Functions–Expectation–Moments–Moment Generating Functions.		
UNIT – II	**PROBABILITY DISTRIBUTIONS**	**9+3 Periods**
Binomial, Poisson, Geometric, Uniform, Exponential, Normal, Gamma, Weibull (Mean, Variance and Simple problems). Functions of random variables.		
UNIT – III	**MULTI DIMENSIONAL RANDOM VARIABLES**	**9+3 Periods**
Two dimensional: Joint distributions – Marginal Distributions – Conditional distributions – Covariance – Correlation and Regression lines. Multidimensional: Mean vectors and covariance matrices.		
UNIT – IV	**RANDOM PROCESSES**	**9+3 Periods**
Definition and Examples – first and Second order, Strict sense stationary, Wide sense stationary and ergodic processes- Markov processes – Poisson processes – Birth and Death processes – Markov chains – Transition probabilities – Limiting distributions.		
UNIT – V	**QUEUEING THEORY**	**9+3 Periods**
Markovian models-M/M/1 and M/M/C, finite and infinite capacity, M/G/1 queue (steady state solutions only) Pollazack Khintchine formula-Problems only.		
Contact Periods: **Lecture: 45 Periods** **Tutorial: 15 Periods** **Practical: 0 Periods** **Total: 60 Periods**		

TEXT BOOK

1	*Veerarajan T.,* ***Probability and Random Processes****, with Queueing Theory and Queueing Networks, Fourth Edition, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2016.*
2	*Veerarajan T.,* ***Higher Engineering Mathematics****, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2016.*

REFERENCES

1	*Gupta S.C and Kapoor V.K..,* ***Fundamentals of Mathematical Statistics****, Sultan Chand & Sons, New Delhi, 2015.*
2	*Gupta S.P.,* ***Statistical methods****, Sultan Chand & Sons, New Delhi, 2015.*
3	*Trivedi K.S.,* ***Probability and Statistics with Reliability, Queueing and Computer Science Applications****, Prentice Hall of India, New Delhi.*
4	*Hwei Hsu.,* ***SchauPm's outline series of Theory and Problems of Probability and Random Process,*** *Tata McGraw Hill Publishing Co., New Delhi, 2015.*
5	*Kandasamy, Thilagavathy and Gunavathy, ,* ***Probability and Random Process,*** *S. Chand & Co. Ramnagar, New Delhi , Reprint 2013.*
6	*Richard A. Johnson and Dean W. Wichern.,* ***AppliedMultivariate Statistical Analysis,*** *Sixth Edition, Pearson Education, Asia, 2012.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Apply the knowledge of basic probability concepts in engineering problems.	K5
CO2	Identify various standard probability distributions and apply them in real life.	K5
CO3	Find the correlation and regression for multi dimensional random variables.	K5
CO4	Apply the random process in Markovian and Birth- death problems.	K5
CO5	Utilize queuing models in real life problems.	K5

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	-	-	-	-	-	-	-	2	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	2	3	3	3
CO3	3	3	2	2	-	-	-	-	-	-	-	2	3	3	3
CO4	3	3	2	2	-	-	-	-	-	-	-	2	3	3	3
CO5	3	3	2	2	-	-	-	-	-	-	-	2	3	3	3
22SBS308	**3**	**3**	**2**	**2**	**-**	**-**	-	-	-	-	**-**	**2**	**3**	**3**	**3**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1,1.1.2,1.2.1,1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.5, 3.2.3, 3.3.1, 3.4.1, 4.1.1, 4.1.2, 4.2.1, 4.2.2, 12.1.2 , 12.2.1, 12.2.2
CO2	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.5, 3.2.3, 3.3.1, 3.4.1, 4.1.1, 4.1.2, 4.2.1, 4.2.2, 12.1.2 , 12.2.1, 12.2.2
CO3	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.5, 3.2.3, 3.3.1, 3.4.1, 4.1.1, 4.1.2, 4.2.1, 4.2.2, 12.1.2 , 12.2.1, 12.2.2
CO4	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.5, 3.2.3, 3.3.1, 3.4.1, 4.1.1, 4.1.2, 4.2.1, 4.2.2, 12.1.2 , 12.2.1, 12.2.2
CO5	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.5, 3.2.3, 3.3.1, 3.4.1, 4.1.1, 4.1.2, 4.2.1, 4.2.2, 12.1.2 , 12.2.1, 12.2.2

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding(K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	40	20	10	-	-	100
CAT2	30	40	20	10	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	30	40	20	10	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	30	40	20	10	-	-	100
ESE	30	40	20	10	-	-	100

22SES306	DIGITAL SYSTEMS	SEMESTERIII

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	0	0	3

Course Objectives	The objective of the course is to learn the basic concepts of digital systems components, to design combinational logic circuits and sequential logic circuits.	
UNIT – I	**INTRODUCTION TO NUMBER SYSTEMS AND CODES**	**9 Periods**
Binary Number Systems-Signed Binary Numbers-Binary Arithmetic-1's and 2's Complement- Binary codes: BCD, Gray code, Excess 3 code, ASCII code -Introduction To Boolean Algebra - Minimization Of Boolean Function Using Karnaugh Map-SOP-POS-Quine Mclusky Methods - Code Conversion - Binary Code to Gray Code And Gray to Binary-BCD to Excess-3 and Excess 3 to BCD Code		
UNIT – II	**COMBINATIONAL LOGIC CIRCUITS**	**9 Periods**
Introduction to combinational logic- Design procedure - Multiplexer/Demultiplexer -Decoders-Encoders - Priority Encoders- Implementation of Combinational Logic Circuits using Multiplexer and Decoder -Design of Integer Arithmetic Circuits Using Combinational Logic: Integer Adder - Ripple Carry Adder And Carry Lookahead Adder-Integer Subtraction Using Adders - Design of Combinational Circuits Using Programmable Logic Devices(PLDS):Programmable Read Only Memories(PROM)-Programmable Logic Arrays(PLA)-Programmable Array Logic(PAL) Devices.		
UNIT – III	**SEQUENTIAL CIRCUITS**	**9 Periods**
Latches:RS Latch And JK Latch-Flipflops-RS,JK,T And D Flipflops-Master-Slave Flipflops-Edge Triggered Flipflops-Analysis And Design of Synchronous Sequential Circuits: Introduction To Sequential Circuits - Characteristics Table-Characteristic Equations And Excitation Table		
UNIT – IV	**MODULAR SEQUENTIAL LOGIC CIRCUITS**	**9 Periods**
Registers-Register with parallel load -Overview of Shift Register - Counters- Ripple counter - Synchronous/Asynchronous counters-Up-Down counters, Ring counter-Johnson Counters		
UNIT – V	**ALGORITHMS STATE MACHINES AND MEMORIES**	**9 Periods**
RTL Notations - ASM Charts-Notations- VHDL : Introduction to HDL-VHDL-Library-Introduction to memories - Read,Write Cycles - Random Access Memory- TTL RAM Cell - ROMs-EPROM - MOS Static RAM Cell-Dynamic RAM Cell-Refreshing Memory Cycle.		
Contact Periods: **Lecture: 45 Periods** **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**		

TEXT BOOK

1	*M. Morris Mano, Michael D. Ciletti* ***"Digital Design"*** *5thedition,Pearson Education, 2013*

REFERENCES

1	*A P Malvino,D P Leach And Gountansala* ***"Digital Principles And Applications"*** *7th Edition, Tata Mc Graw Hill, 2010*
2	*Stephen Brown,Zvonko Vranesic,* ***"Fundamentals Of Digital Logic Design With VHDL"****, 3rd Edition, Tata Mc Graw Hill, 2008.*
3	*Mark K Bach,* ***"Complete Digital Design"****, Tata Mc Graw Hill, 2003*
4	*Wakerly Pearson,* ***"Digital Design:Principles And Practices"****, 4th Edition, Pearson Education, 2008*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Apply knowledge of number systems and codes in problem solving related to code conversion and number system.	K3
CO2	Analyze and design combinational logic devices using logic gates.	K4
CO3	Analyze and design sequential logic devices using flip flops.	K4
CO4	Explain fundamentals of different types of memories.	K2
CO5	Simulate of digital circuits using VHDL	K6

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping															
Os/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	3	1	-	-	-	-	-	1	-	-	3	3	-
CO2	2	3	3	1	-	-	-	-	-	1	-	-	3	3	-
CO3	2	3	3	1	-	-	-	-	-	1	-	-	3	3	-
CO4	2	1	2	1	-	-	-	-	-	1	-	-	3	3	-
CO5	2	3	3	1	3	-	-	-	-	1	-	-	3	3	-
22SES306	**2**	**3**	**3**	1	1	**-**	**-**	-	**-**	1	**-**	**-**	**3**	**3**	**-**
1 – Slight, 2 – Moderate, 3 – Substantial															
b) CO and Key Performance Indicators Mapping															
CO1	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4 , 3.1.1, 3.1.2, 3.1.6, 3.2.1, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.3.1, 10.1.1														
CO2	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4 , 3.1.1, 3.1.2, 3.1.6, 3.2.1, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.3.1, 10.1.2														
CO3	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4 , 3.1.1, 3.1.2, 3.1.6, 3.2.1, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.3.1, 10.1.3														
CO4	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.2.2, 4.1.1, 4.1.2, 10.1.3														
CO5	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4 , 3.1.1, 3.1.2, 3.1.6, 3.2.1, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.3.1, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 10.1.1														

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	20	20	-	-	100
CAT2	30	30	20	10	-	10	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	50	50	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	10	-	40	-	50	100
ESE	20	30	30	10	-	10	100

22SES307	DISCRETE STRUCTURES	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	0	0	3

Course Objectives	The objective of the course is to equip students with the necessary skills to apply propositional and predicate calculus to evaluate the truth value of statements, use counting techniques to develop an understanding of relations, apply algebraic structures and morphisms to solve related problems, analyze graphs, and understand the patterns and laws of graph mining.	
UNIT – I	**PROPOSITIONAL AND PREDICATE CALCULUS**	**9 Periods**
Proposition: Logical connectives and its truth tables – Conditional and Biconditionals – Applications of Propositions: Boolean Searches, Logic Puzzles – Logical Equivalences and Implications – Theory of inference for statement calculus. Predicate Calculus: Quantifiers – Formulas – Free & Bound variable – Inference theory of predicate calculus.		
UNIT – II	**COUNTING, RELATIONS AND FUNCTIONS**	**9 Periods**
Counting: The Basics of Counting – The Pigeonhole Principle – Permutation and Combinations. Relations: Graph and Matrix representation of a relation – Properties of Binary Relation – Closure of relation – Warshall's algorithm – Equivalence Relation and Partitions – Partial Ordering Relations and Lattices. Functions: Mathematical Induction - Types and Composition of Functions - Inverse Function.		
UNIT – III	**ALGEBRAIC STRUCTURES AND MORPHISM**	**9 Periods**
Groups: Subgroups – Generators and Evaluation of Powers – Cosets and Lagrange's Theorem – Permutation groups and Burnside Theorem – Codes and Group Codes. Morphism: Isomorphism and Automorphism, Homomorphism and Normal Subgroups – Rings, Integral domains and Fields.		
UNIT – IV	**GRAPH THEORY**	**9 Periods**
Introduction - Basic Terminology – Multigraphs and Weighted graphs - Digraphs and relations representation of graphs - operations on graphs - Paths and Circuits - Graph traversals - shortest paths in weighted graphs - Euclidian paths and circuits - Hamiltonian Paths and Circuits - The Traveling Salesperson Problem - Planar Graphs - Graph Coloring – Case Study.		
UNIT – V	**GRAPH MINING LAWS**	**9 Periods**
Patterns in Static Graph –Patterns in Evolving Graph – Patterns in Weighted Graph – Structure of Specific Graph : The Internet – The World Wide Web – Graph Generators : Random Graph Models – Generators for Internet Topology.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	*C.L. Liu, D.P. Mohapatra* ***"Elements of Discrete Mathematics: A Computer Oriented Approach",*** *Third Edition Tata MCgraw Hill, (SIE), 2012.[Unit 1 – 4]*
2	*Deepayan Chakrabarti, Christos Faloutsos* ***"Graph Mining: Laws, Tools, and Case Studies"*** *Margon & Claypool publishers 2012.[Unit 5]*

REFERENCES

1	*Kenneth H Rosen,* ***Discrete Mathematics and its Applications with Combinatorics and Graph Theory****, Seventh Edition, MCgraw Hill Education India Private Limited, New Delhi, 2013.*
2	*Krishnaiyan Thulasiraman, Subramanian Arumugam, Andreas Brandstädt, Takao Nishizeki, "****Handbook of Graph Theory, Combinatorial Optimization, and Algorithms****", CRC press, 2016.*
3	*William Kocay, Donald L. Kreher* ***"Graphs, Algorithms, and Optimization",*** *Second Edition, CRC Press, 2017.*
4	*J.P. Tremblay and R. Manohar,* ***"Discrete Mathematical Structure and Its Application to Computer Science",*** *TMG Edition, Tata Mcgraw-Hill, 2015.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Demonstrate the ability to use propositional and predicate calculus to evaluate the truth value of statements and solve logic problems.	K5
CO2	Apply counting techniques and develop an understanding of relations and their properties, and use graph and matrix representation to solve problems.	K3
CO3	Demonstrate the ability to apply algebraic structures and morphism to solve problems related to groups, subgroups, rings, and fields.	K3
CO4	Analyze graphs and solve problems related to shortest path,Hamiltonian Paths , and graph coloring	K4
CO5	Use graph mining as a powerful pattern tool by understanding their laws to derive valuable information.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping															
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	1	-	-	-	-	-	-	-	2	3	-	3
CO2	3	2	-	1	-	-	-	-	-	-	-	2	3	-	3
CO3	3	2	-	1	-	-	-	-	-	-	-	2	3	-	3
CO4	3	2	-	2	1	-	-	-	-	-	-	2	3	3	3
CO5	3	3	-	3	1	-	-	1	-	-	-	2	3	3	3
22SES307	**3**	**2**	**-**	**1**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**2**	**3**	**3**	**3**
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 4.1.1, 12.1.1, 12.2.2, 12.3.2
CO2	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.3.1, 2.3.2, 2.4.1, 4.3.3, 4.3.4, 12.1.1, 12.2.2, 12.3.2
CO3	1.1.1, 1.1.2, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.3.2, 2.4.3, 2.4.4, 4.1.1, 4.3.3, 12.1.1, 12.2.2, 12.3.2
CO4	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.3.1, 2.4.3, 2.4.4, 4.1.1, 4.3.3, 4.3.4, 5.1.2, 12.1.1, 12.2.2, 12.3.2
CO5	1.1.1, 1.1.2, 10.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.3.2, 4.3.3, 4.3.4, 5.1.2, 5.2.2, 8.2.2, 12.1.1, 12.1.2, 12.2.2, 12.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total 100%**
CAT1	10	20	50	-	20	-	100
CAT2		20	60	20	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	30	40	-	30	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	30	30	40	-	-	100
ESE	10	20	40	20	10	-	100

22SPC301	DATA STRUCTURES *(Common to EEE, ECE & CSE Branches)*	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
PROGRAMMING IN C	PC	3	0	0	3

Course Objectives	The objective of the course is to enable the students to analyze the time complexity of an algorithm, Understand and Use List, Stack, Queue, Tree and graph Data structures and effectively use sorting and searching Techniques.	
UNIT – I	**INTRODUCTION AND ABSTRACT DATATYPES**	**9 Periods**
Algorithm Analysis: Calculation of Running Time – Abstract Data Type- List ADT: Array implementation of List, Linked Lists, Doubly Linked List, Circularly Linked Lists- Cursor implementation of Linked List		
UNIT – II	**STACK AND QUEUE ADT**	**9 Periods**
Stack ADT: Stack Model, Implementation of stacks, Applications: Balancing Symbols, Postfix expression evaluation, Infix to postfix conversion, Function Calls – Queue ADT: Queue Model, Implementation of Queues, Applications.		
UNIT – III	**TREE ADT**	**9 Periods**
Preliminaries – Implementation of Trees – Tree Traversals – Binary Tree: Implementation, Expression Tree – Search Tree ADT – AVL Trees - BTrees – Red Black Trees.		
UNIT – IV	**GRAPH ALGORITHMS**	**9 Periods**
Definitions – Representation of Graphs – Traversal- Topological sort – Shortest Path Algorithms: Dijkstra's Algorithm – Network Flow Problem – Minimum Spanning Tree: Prim's and Kruskal's algorithm.		
UNIT – V	**SORTING AND SEARCHING**	**9 Periods**
Sorting: Insertion Sort – Shell Sort – Heap Sort – Merge Sort – Quick Sort – Bucket Sort – External Sorting: Simple Algorithm, Multi way merge, Poly Phase Merge – Searching : Linear Search – Binary Search – Hashing : Hash Functions– Collision Resolution: Separate Chaining – Open Addressing – Linear Probing– Quadratic Probing – Double Hashing – Rehashing.		
Contact Periods: **Lecture: 45 Period** **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**		

TEXT BOOK

1	*Mark Allen Weiss* ***"Data Structures and Algorithm Analysis in C"*** *Second Edition, Pearson Education Limited, 2002.*

REFERENCES

1	*Thomas H. Cormen , Charles E. Leiseron, Ronald L.Rivest, Clifford Stein,* ***"Introduction to Algorithms",*** *Third Edition, PHI learning Pvt. Ltd., 2011.*
2	*Sartaj Sahni,* ***"Data Structures, Algorithms and applications in C++",*** *Second Edition, Universities Press, 2005.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Analyze the time complexity of various algorithms	K4
CO2	Define and use list, stack and queue Data Structures	K3
CO3	Define and use Tree Data Structure	K3
CO4	Define and use Graph Data Structure	K4
CO5	Use appropriate sorting and searching Techniques	K4

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping															
Cos/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	1	2	1	-	-	-	-	-	-	-	1	3	3	2
CO2	2	2	2	2	2	2	-	-	-	1	-	1	3	3	2
CO3	2	2	2	2	2	2	-	-	-	1	-	1	3	3	2
CO4	2	2	2	2	2	2	-	-	-	1	-	1	3	3	2
CO5	2	2	1	1	-	-	-	-	-	-	-	1	3	3	2
22SPC301	**2**	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**1**	**-**	**1**	**3**	**3**	**2**
1 – Slight, 2 – Moderate, 3 – Substantial															
b) CO and Key Performance Indicators Mapping															
CO1	1.1.1,1.3.1, 1.4.1,2.1.2, 2.2.2, 2.3.1,2.4.1,3.1.6,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,4.2.2,4.3.1,12.2.2.														
CO2	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2														
CO3	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2														
CO4	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2														
CO5	1.3.1,1.4.1,2.1.2.2.1,2.2.3,2.3.1,2.4.4,3.1.3,3.1.6, 3 .2.3, 3.3.2, 4.1.2, 4.2.1,4.3.1,6.1.1, 10.3.1, 11.2.1, 12.1.1,12.2.2,12.3.2														

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	-	20	30	50	-	-	100
CAT2	-	10	80	10	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	80	20	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	80	20	-	-	100
ESE	-	30	50	20	-	-	100

22SPC302	FOUNDATIONS OF DATA SCIENCE *(Common to CSE & IT Branches)*	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	This course will introduce the fundamental concepts in the field of data science required for solving data science problems	
UNIT – I	**R FOR DATASCIENCE**	**9 Periods**
Reading and getting data into R – ordered and unordered factors – arrays and matrices – lists and data frames – reading data from files – probability distributions and statistical models in R - Introduction to graphical analysis –plots – displaying multivariate data – matrix plots – multiple plots in one window - exporting graph using graphics parameters.		
UNIT – II	**INTRODUCTION TO DATA SCIENCE AND DESCRIBING DATA**	**9 Periods**
Data Science Process: Roles and stages. Basic Statistical descriptions of Data - Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores		
UNIT – III	**DESCRIBING RELATIONSHIPS**	**9 Periods**
Correlation –correlation coefficient for quantitative data –computational formula for correlation coefficient – Populations, Samples and Probability – Sampling distribution of the mean		
UNIT – IV	**GENERALIZING BEYOND DATA**	**9 Periods**
Hypothesis testing: z-test, Null Hypothesis and Alternate Hypothesis, One tailed and Two Tailed Tests, Estimation of Confidence Interval		
UNIT – V	**MODELING METHODS**	**9 Periods**
Choosing and evaluating models -Linear and logistic regression: Building a model, Making Predictions, Reading Model summary and characterizing co-efficient quality unsupervised methods: Cluster Analysis		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	Nina Zumel, John Mount, **"Practical Data Science with R",** Manning Publications, 2014. (Unit I and V)
2	Robert S. Witte and John S. Witte, **"Statistics",** Eleventh Edition, Wiley Publications, 2017. (Units II, III and IV)

REFERENCES

1	W. N. Venables, D. M. Smith and the R Core Team, **"An Introduction to R",** 2013.
2	Mark Gardener, **"Beginning R - The Statistical Programming Language",** John Wiley & Sons, Inc., 2012.
3	Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, **"Practical Data Science Cookbook",** Packt Publishing Ltd., 2014
4	Montgomery, D. C. and G. C. Runger. Applied Statistics and Probability for Engineers. 5th Edition. John Wiley & Sons, Inc., NY, USA, 2011

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Use R Libraries for Data Wrangling	K3
CO2	Define the data science process	K1
CO3	Analyze and interpret data using an ethically responsible approach.	K4
CO4	Apply hypotheses and data into actionable predictions	K3
CO5	Formulate and use appropriate models of data analysis to solve problems	K4

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	2	1	3	-	-	-	-	-	1	-	2	2	2
CO2	1	1	1	1	-	-	-	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	3	-	3	-	-	-	-	2	2	2
CO4	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	-	-	-	-	-	-	-	1	2	2	2
22SPC302	**3**	**3**	**3**	**3**	**2**	**1**	**-**	**1**	**-**	**-**	**1**	**1**	**2**	**2**	**2**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1, 1.4.1, 2.3.2, 3.1.2, 3.2.1, 3.2.2, 4.1.3, 5.1.1, 5.1.2, 5.2.2, 5.3.1, 5.3.2, 11.3.2
CO2	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.2, 2.2.1, 2.2.3, 2.3.2, 3.1.2, 3.2.1, 3.2.2, 4.1.3
CO3	1.3.1, 1.4.1, 2.2.4, 2.4.1, 2.4.2, 2.4.4, 3.1.5, 3.2.2, 3.4.2, 4.1.2, 4.1.4, 4.3.2, 5.2.1, 5.3.1, 5.3.2, 6.2.1, 8.1.1, 8.2.1
CO4	1.3.1, 1.4.1, 2.2.4, 2.4.1, 2.4.2, 2.4.4, 3.1.5, 3.2.2, 3.4.2, 4.1.2, 4.1.4, 4.3.2
CO5	1.3.1, 1.4.1, 2.2.4, 2.4.1, 2.4.2, 2.4.4, 3.1.5, 3.2.2, 3.4.2, 4.1.2, 4.1.4, 4.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Rememberin g(K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Individual Assessment1 /Case Study 1/ Seminar 1 / Project1	30	20	40	5	5	-	100
Individual Assessment2 /Case Study 2/ Seminar 2 / Project 2	30	20	30	10	5	5	100
ESE	30	30	40	-	-	-	100

22SPC303	OBJECT ORIENTED PROGRAMMING *(Common to CSE & IT Branches)*	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	2	4

Course Objectives	The objective of the course is to create an understand on object orientedprogramming concepts using Java programming language and to familiarize students with GUI based application development and server side programming.	
UNIT – I	**INTRODUCTION TO OOP AND JAVA**	**9+6 Periods**
Overview of OOP – Object oriented programming paradigms – Features of Object Oriented Programming – Java Buzzwords – Overview of Java – Java Virtual Machine - Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java – Defining classes in Java – Constructors-Methods -Access specifiers - Static members- Java Doc comments – Inheritance –Packages –interfaces		
UNIT – II	**EXCEPTION HANDLING AND MULTITHREADING**	**9+6 Periods**
Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model– Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication Suspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing		
UNIT – III	**STRINGS ,STREAMS AND OBJECT SERIALIZATION**	**9+6 Periods**
Strings: Basic String class, methods and String Buffer Class. I/O Basics – Working with files - Object Streams and Serialization - Lambda expressions, Collection framework List, Map, Set, Generics Annotations		
UNIT – IV	**GUI AND DATABASE PROGRAMMING**	**9+6 Periods**
Introducing swing – components and containers – swing controls and swing menus. Design of JDBC – JDBC configuration – executing SQL statements – Query Execution – scrollable and updatable result set – transactions - Connection Management in Web and Enterprise Applications.		
UNIT – V	**NETWORKING AND SERVER SIDE PROGRAMMING**	**9+6 Periods**
Networking basics – Inent address –TCP/IP sockets – datagrams – introducing java.net.http Introduction to servlet - servlet life cycle - Developing and Deploying Servlets - Exploring Deployment Descriptor (web.xml) - Handling Request and Response – using Cookies - Session Tracking Management.		
Contact Periods: **Lecture: 45 Periods** **Tutorial: 0 Periods** **Practical: 30 Periods** **Total: 75 Periods**		

List of Experiments

Program to demonstrate concepts like abstraction, encapsulation, inheritance, polyporphism and packages.
Program to demonstrate the use of inbuilt and custom generated Java Exception handling Methods
Program to demonstrate creation of thread and inter thread communication.
Program to demonstrate the application of String handling functions
Program to demonstrate the use of File handling methods
Program to demonstrate the need for object serialization and deserialization

Demonstrate the use of Java collection frameworks in reducing application development time
Build a simple GUI application using swing
Develop simple student management system using JDBC with MySQL Database
Develop simple multiuser chat application
Develop simple banking application using servlets.

TEXT BOOK

1	*Herbert Schildt,* ***"Java: The Complete Reference",*** *11 th Edition, McGraw Hill Education, New Delhi, 2019(Unit I,II,III,IV,V)*
2	*Cay S. Horstmann,* ***"Core Java Fundamentals"****, Volume 2, 9 th Edition, Prentice Hall, 2013.(unit III, IV)*

REFERENCES

1	*Cay S. Horstmann,* ***"Core Java Fundamentals",*** *Volume 1, 12 th Edition, Prentice Hall, 2018.*
2	*Y. Daniel Liang,* ***"Introduction to Java programming-comprehensive version"*** *- Tenth Edition, Pearson ltd 2015*
3	*Paul J. Deitel, Harvey Deitel,* ***"Java SE8 for Programmers (Deitel Developer Series)"*** *3rd Edition, 2014*
4	*NPTEL Course :* ***Programming in Java,*** *https://nptel.ac.in/courses/106105191*
5	*Nicholas S. Williams,* ***"Professional Java for Web Applications",*** *Wrox Press, 2014.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Apply object oriented concepts like classes, abstraction, encapsulation inheritance, interface, polymorphism and packages to solve simple problems	K3
CO2	Make use of exception handling mechanisms and multithreaded model to solve real world problems	K3
CO3	Build Java applications with I/O packages, files, string classes, Collections and generics concept	K6
CO4	Design and implement GUI based applications using swing and applications involving Database Connectivity for real world problems	K6
CO5	Design, Develop and Deploy dynamic web applications using Servlets and Java Server Pages	K6

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	3	2	3	-	-	-	-	-	2	-	3	2	2	2
CO2	2	3	2	3	-	-	-	-	-	2	-	-	2	2	2
CO3	2	3	2	3	-	-	-	-	-	2	-	-	2	2	2
CO4	2	3	2	3	2	-	-	-	-	2	-	3	2	2	3
CO5	2	3	2	3	2	-	1	-	-	2	-	3	2	2	3
22SPC303	**2**	**3**	**2**	**3**	**1**	**-**	**1**	**-**	**-**	**2**	**-**	**2**	**2**	**2**	**3**
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.3, 3.1.6, 3.2.1, 3.2.2,3.2.3,3.3.1,3.4.1,3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4, 10.1.1,10.1.2,10.1.3, 12.1.1,12.1.2,12.2.1,12.2.2,12.3.1
CO2	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.3, 3.1.6, 3.2.1, 3.2.2,3.2.3,3.3.1,3.4.1,3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4, 10.1.1,10.1.2,10.1.3
CO3	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.3, 3.1.6, 3.2.1, 3.2.2,3.2.3,3.3.1,3.4.1,3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4, 10.1.1,10.1.2,10.1.3
CO4	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.3, 3.1.6, 3.2.1, 3.2.2,3.2.3,3.3.1,3.4.1,3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4, 5.1.1,5.1.2,5.2.1,5.2.2, 10.1.1,10.1.2,10.1.3, 12.1.1,12.1.2,12.2.1,12.2.2,12.3.1
CO5	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.3, 3.1.6, 3.2.1, 3.2.2,3.2.3,3.3.1,3.4.1,3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4, 5.1.1,5.1.2,5.2.1,5.2.2, 10.1.1,10.1.2,10.1.3, 12.1.1,12.1.2,12.2.1,12.2.2,12.3.1

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1)%**	**Understanding (K2) %**	**Applying (K3)%**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	-	20	40	20	-	20	100
CAT2	-	30	70	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	50	-	-	50	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	-	-	-	100	100
ESE	-	20	40	20	-	20	100

22SES308	ENGINEERING EXPLORATION FOR COMPUTER SCIENCE AND ENGINEERING *(Common to CSE & IT Branches)*	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	0	0	3	1.5

Course Objectives	The objective of the course is to provide an introduction to the engineering exploration	
UNIT – I	**INTRODUCTION**	**15 Periods**
Introduction to Engineering and Engineering study: Difference between science and engineering, scientist and engineer needs and wants, various disciplines of engineering, some misconceptions of engineering, expectation for the 21st century engineer and Graduate Attributes- Evolution of OS - Software Requirement Specification Document- Engineering Failures and Software bugs		
UNIT – II	**PC HARDWARE AND TROUBLESHOOTING**	**15 Periods**
Formatting PC- Installation of Operating system - Device Drivers Installation –study on Networking devices -network interfacing - Troubleshooting PC		
UNIT – III	**APPS AND GAME DESIGN**	**15 Periods**
Case Study 1: Tic Tac Toe -Hangman- Rock, Paper and scissor game - Pacman Case Study 2: Text to Speech convertor- Voice based calculator- ChatGPT App- Classification of Images Case study 3: Pong game -Space invaders game- Dobble game- Snake and ladder		
Contact Periods: **Lecture: 0 Periods** **Tutorial: 0 Periods** **Practical: 45 Periods** **Total: 45 Periods**		

REFERENCES

1	*Ryan A Brown, Joshua W. Brown and Michael Berkihiser, "**Engineering Fundamentals: Design, Principles, and Careers**", Goodheart-Willcox Publisher, Second edition, 2014.*
2	*Saeed Moaveni, "**Engineering Fundamentals: An Introduction to Engineering**", Cengage learning, Fourth Edition, 2011.*
3	*G. Polya, "**How to Solve It: A New Aspect of Mathematical Method**", Princeton Science Library, Second Edition, 2014.*
4	*K.L. James, "**COMPUTER HARDWARE, Installation, Interfacing, Troubleshooting and Maintenance**", PHI learning, 2013*
5	*https://appinventor.mit.edu/*
6	*https://gamemaker.io/en*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Understand basic engineering concepts	K2
CO2	Write SRS for the given problem statement	K4
CO3	Format and configure OS and device drivers	K4
CO4	Troubleshoot PC and configure networking	K4
CO5	Design apps and games	K6

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	2	1	-	-	-	-	2	-	-	2	2	2	2
CO2	3	3	2	3	2	-	-	-	2	-	3	2	2	2	2
CO3	3	3	2	1	2	-	-	-	2	-	-	2	2	2	2
CO4	3	3	2	1	2	-	-	-	2	-	-	2	2	2	2
CO5	3	3	3	1	3	3	-	3	2	2	3	2	2	2	2
22SES308	**3**	**3**	**3**	**2**	**2**	**1**	**-**	**1**	**2**	**1**	**2**	**2**	**2**	**2**	**2**
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.2.1,1.3.1, 3.1.1,3.1.4, 3.1.6, 4.1.1,4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3,4.3.4, 5.1.1,6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3,9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2,12.3.1
CO2	1.2.1,1.3.1, 3.1.1,3.1.4,3.1.6, 4.1.1,4.1.3, 4.1.4,4.3.1, 4.3.2, 4.3.3, 4.3.4,5.1.1,6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3,9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2,12.3.1
CO3	1.2.1,1.3.1, 3.1.1,3.1.4, 3.1.6, 4.1.1,4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3,4.3.4, 5.1.1,6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3,9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2,12.3.1
CO4	1.2.1,1.3.1, 3.1.1,3.1.4, 3.1.6, 4.1.1,4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3,4.3.4, 5.1.1,6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3,9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2,12.3.1
CO5	1.2.1,1.3.1, 3.1.1,3.1.4, 3.1.6, 4.1.1,4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3,4.3.4, 5.1.1,6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3,9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2,12.3.1

ASSESSMENT PATTERN – CDIO:

Component	**Preparation/ Design**	**Presentation**	**Viva**	**Total**
Study on Engineering Exploration	10	-	-	10
Software Requirement Specification Document Preparation for given problem	10	5	5	20
Formatting PC, Installation of OS and Device drivers	5	5	10	20
Troubleshooting of PC and configuration of Networks	5	5	10	20
Design of Apps and Games	10	10	10	30
Continuous Assessment				100
Model Lab				100

Weightage for record of work done: 75%; Weightage for Model Exam: 25%

22SES309	DIGITAL SYSTEMS LABORATORY	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	0	0	3	1.5

Course Objectives	The objective of this course is to design combinational logic circuits usinglogic gates, to design sequential logic circuits like counters and registers using flip flops and to simulate combinational logic circuits and sequential logic circuits using VHDL.

LIST OF EXPERIMENTS

1. Verification of truth tables of logic gates.
2. Implementation of given Boolean function using logic gates in both SOP and POS form.
3. Design and verify the implementation of Half /Full Adder.
4. Design and verify the implementation of Half /Full Subtractor.
5. Implementation of combinational logic circuits using Multiplexer
6. Implementation of combinational logic circuits using Decoder.
7. Verification of State Tables of RS, J-K, T and D Flip-Flops using NAND gates.
8. Verification of State Tables of RS, J-K, T and D Flip-Flops using NOR gates.
9. Design and implementation of Shift registers.
10. Implementation of Sequence generators.
11. Simulation of Half /Full Adder, Half /Full Subtractor using VHDL.
12. Simulation of Multiplexer (8:1) and De_multiplexer (1:8): using VHDL.
13. Simulation of Encoder and Decoder using VHDL.
14. Simulation of Flip flops and counters using VHDL.

Contact Periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Analyze and design combinational systems using standard gates and minimization methods such as Karnaugh maps	K6
CO2	Analyze and design combinational circuits using standard combinational modules, such as multiplexers and decoders	K6
CO3	Design and implement different sequential logic circuits like counters and registers using flip flops.	K6
CO4	Simulate combinational logic circuits and sequential logic circuits using VHDL.	K6

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	3	2	3	3	-	-	-	-	3	-	-	3	3	-
CO2	1	3	2	3	3	-	-	-	-	3	-	-	3	3	-
CO3	1	3	2	3	3	-	-	-	-	3	-	-	3	3	-
CO4	1	3	2	3	3	-	-	-	-	3	-	-	3	3	-
22SES309	**1**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**3**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.4, 2.3.1,2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.2.1, 3.2.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.3, 4.3.4, 5.1.1, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 10.1.1, 10.1.2, 10.1.3, 10.3.1, 10.3.2
CO2	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.4, 2.3.1,2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.2.1, 3.2.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.3, 4.3.4, 5.1.1, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 10.1.1, 10.1.2, 10.1.3, 10.3.1, 10.3.2
CO3	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.4, 2.3.1,2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.2.1, 3.2.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.3, 4.3.4, 5.1.1, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 10.1.1, 10.1.2, 10.1.3, 10.3.1, 10.3.2
CO4	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.4, 2.3.1,2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.2.1, 3.2.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.3, 4.3.4, 5.1.1, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 10.1.1, 10.1.2, 10.1.3, 10.3.1, 10.3.2

22SPC304	DATA STRUCTURES LABORATORY *(Common to ECE & CSE Branches)*	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
PROGRAMMING IN C LABORATORY	PC	0	0	3	1.5

Course Objectives	The objective of the course is to Implement linear data structures and nonlinear data structures, use appropriate data structures and implement appropriate sorting and searching techniques.

LIST OF EXPERIMENTS

1. Implementation of Stack Operations using array and Linked List
2. Implementation of Queue operations using array and Linked List
3. Application of stacks in Recursion and Infix to postfix conversion
4. Application of Queue in Simulation of FCFS and Round Robin Scheduling
5. Implementation of Linear list, circularly linked list and Doubly linked list.
6. Application of Linked List in Polynomial Manipulations
7. Implementation of binary tree operations
8. Implementation of Tree Traversal Algorithms
9. Implementation of Graph Traversal Algorithms
10. Implementation of Minimum Spanning Algorithms
11. Implementation of hashing techniques.
12. Implementation of sorting techniques.
13. Implementation of searching techniques.

Contact Periods:
Lecture: 0 Periods **Tutorial: 0 Periods** **Practical: 45 Periods** **Total: 45 Periods**

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Implement queue and stack data structures using arrays and Linked Lists	K5
CO2	Implement Tree Data structure and perform tree traversals.	K5
CO3	Implement traversal on Graph Data structure.	K5
CO4	Implement hashing Techniques	K6
CO5	Implement sorting and searching Techniques.	K6

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping														
COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	1	2	3	3	-	-	-	-		-	1	3	3	2
CO2	3	2	2	3	3	2	-	-	-	2	-	2	3	3	2
CO3	3	2	2	3	3	2	-	-	-	2	-	2	3	3	2
CO4	3	2	2	3	3	2	-	-	-	2	-	2	3	3	2
CO5	3	2	2	3	3	-	-	-	-	-	-	1	3	3	2
22SPC304	**3**	**2**	**2**	**3**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**2**	**3**	**3**	**2**
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1,1.3.1, 1.4.1,2.1.2, 2.2.2, 2.3.1,2.4.1,3.1.6,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,4.2.2,4.3.1,12.2.2.
CO2	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2
CO3	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2
CO4	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2
CO5	1.3.1,1.4.1,2.1.2.2.1,2.2.3,2.3.1,2.4.4,3.1.3,3.1.6, 3 .2.3, 3.3.2, 4.1.2, 4.2.1,4.3.1,6.1.1, 10.3.1,11.2.1, 12.1.1,12.2.2,12.3.2

22SES410	ANALOG AND DIGITAL COMMUNICATION	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	0	0	3

Course Objectives	After the completion of the course, the students are able to explain basic analog modulation techniques, explore about wireless communication systems and Digital transmission techniques, analyze about Spread spectrum techniquesand multiple access techniques and describe about working principles of mobile and satellite communication system.

UNIT – I	FUNDAMENTALS OF ANALOG COMMUNICATION	9 Periods

Principles of amplitude modulation-AM envelope - frequency spectrum – bandwidth - modulation index percent modulation - Voltage and power distribution - AM detector – peak detector - Angle modulation FM and PM waveforms - phase deviation and modulation index - frequency deviation and percent modulation - Frequency analysis of angle modulated waves - Bandwidth requirements for Angle modulated waves - FM detector – slope detector.

UNIT – II	DIGITAL COMMUNICATION	9 Periods

Introduction- Shannon limit for information capacity- ASK transmitter, receiver and bandwidth-FSK transmitter, receiver and bandwidth- BPSK transmitter, receiver and bandwidth- QPSK transmitter, receiver and bandwidth- Quadrature Amplitude modulation – transmitter, receiver and bandwidth efficiency- carrier recovery – squaring loop- Costas loop- DPSK – transmitter and receiver.

UNIT – III	DIGITAL TRANSMISSION	9 Periods

Sampling theorem- reconstruction of message from its samples- Pulse modulation- PCM – PCM sampling, quantization- signal to quantization noise rate-companding – analog and digital– percentage error- delta modulation-transmitter and receiver- adaptive delta modulation- differential pulse code modulation-transmitter and receiver- pulse transmission – Inter symbol interference- ISI-Nyquist criteria for distortion less transmission.

UNIT – IV	SPREAD SPECTRUM AND MULTIPLE ACCESS TECHNIQUES	9 Periods

Pseudo-noise sequence -Direct Sequence spread spectrum with coherent binary PSK- Frequency-hop spread spectrum – slow and fast hopping. Multiple access techniques: FDMA- TDMA- CDMA – SDMA wireless communication-frequency reuse and cell splitting- TDMA and CDMA in wireless communication systems- source coding of speech for wireless communications.

UNIT – V	MOBILE AND SATELLITE COMMUNICATIONS	9 Periods

Introduction to Cellular Concepts- Cellular Network Capacity- Cellular Channel Modelling- GSM Network- Digital Cellular Communications Concepts- Equalisation, Channel Diversity, and Speech Coding in Cellular Systems- CDMA and IS-95- UMTS W-CDMA and cdma2000- 4G Cellular Networks and Beyond. Satellite Channel Modelling and Antennae- Satellite Communications Systems- Satellite Applications: INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO.

Contact Periods:
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOK

1.	*Simon Haykin* ***"Communication Systems"*** *Third edition, John Wiley & Sons, 2004. (first four units covered).*
2.	*Wayne Tomasi* ***"Electronic Communication Systems: Fundamentals Through Advanced",*** *Fifth edition, Pearson Education, 2004. (first four units few topics covered).*

3.	*W.C.Y.Lee**, "Mobile Communications Engineering: Theory and applications"**, Second Edition, McGraw-Hill International, 1998. (fifth unit covered).*
4.	*Dennis Roddy,**"Satellite Communication"**, 4th Edition, Mc Graw Hill International, 2006. (fifth unit covered).*

REFERENCES

1.	*B.P.Lathi, **"Modern Analog and Digital Communication systems"**, Fourth Edition, Oxford University Press, 2009.*
2.	*T G Kennedy, B Davis and S R M Prasanna **"Electronic communication systems"**, Fifth Edition, Tata Mc-Graw Hill Education Pvt Limited, 2011.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explain the principles of Amplitude modulation, Frequency modulation and Phase modulation	**K2**
CO2	Describe the operation of transmitter and receiver system for digital communication.	**K2**
CO3	Apply the concept of pulse code modulation for telecommunication networks**.**	**K3**
CO4	Analyze the variousspread spectrum and multiple access techniques	**K4**
CO5	Analyze the working principles of Mobile And Satellite Communications.	**K4**

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping														
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	2	2	2	2	-	-	-	-	1	-	2	2	2	1
CO2	1	2	2	2	2	-	-	-	-	1	-	2	2	2	1
CO3	1	3	2	3	2	-	-	-	-	1	-	2	2	2	1
CO4	1	3	2	3	2	2	-	-	-	1	-	2	2	2	1
CO5	1	3	2	3	2	2	-	-	-	1	-	2	2	2	1
22SES410	**1**	**3**	**2**	**3**	**2**	**1**	**-**	**-**	**-**	**1**	**-**	**2**	**2**	**2**	**1**

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.4, 2.4.1, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.6, 3.2.1, 3.2.2,3.3.2, 3.4.1, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.3.1, 4.3.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 10.1.1, 10.2.1, 12.1.1, 12.1.2, 12.2.2, 12.3.2
CO2	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.4.2, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.4.1, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.3.1, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 10.1.1, 10.2.1, 12.1.1, 12.1.2, 12.2.2, 12.3.2
CO3	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.4.1, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.6,3.2.1, 3.2.2, 3.3.2, 3.4.1, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.3.1, 4.3.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 10.1.1, 10.2.1, 12.1.1, 12.1.2, 12.2.2, 12.3.2
CO4	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3,2.2.4, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.3.2, 3.4.1, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.3.1, 4.3.2, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 6.2.1, 10.1.1, 10.2.1, 12.1.1, 12.1.2, 12.2.2, 12.3.2
CO5	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3,2.2.4, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.3.2, 3.4.1, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.3.1, 4.3.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 6.2.1, 10.1.1, 10.2.1, 12.1.1, 12.1.2, 12.2.2, 12.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3)%**	**Analyzing (K4)%**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	-	60	40	-	-	-	100
CAT2	-	-	40	60	-	-	100
Individual Assessment 1 /Case Study 1/Seminar 1 / Project1	-	50	50	-	-	-	100
Individual Assessment 2 /Case Study 2/Seminar 2 / Project 2	-	-	50	50	-	-	100
ESE	-	40	20	40	-	-	100

22SPC405	COMPUTER ARCHITECTURE	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
DIGITAL SYSTEMS	PC	3	0	0	3

Course Objectives	The objective of the course is to introduce the concepts of computer architecture and organization. It describes overview of MIPS architecture in terms of instruction set, data path, pipelining and memory systems in detail along with performance metrics for designing computer systems.	
UNIT – I	**BASIC STRUCTURE OF A COMPUTER SYSTEM**	**9 Periods**
Introduction - Eight Great Ideas in Computer Architecture -Technologies for Building Processors and Memory – performance -The Power Wall - Amdahl's law - The Switch from Uniprocessors to Multiprocessors - Classes of Computing - High-Level Language to Language of Hardware - Instructions: Operation, Operands, Representing Instructions, Logical operations, Decision making, Supporting Procedures in Computer Hardware, MIPS Addressing- Parallelism and Instructions: Synchronization.		
UNIT – II	**ARITHMETIC FOR COMPUTERS**	**9 Periods**
Signed Number Representation - Fixed and Floating Point Representations - Character Representation. Computer Arithmetic - Addition and Subtraction - Multiplication - Division -Floating point- Parallelism and Computer Arithmetic: Subword Parallelism and Matrix multiplication.		
UNIT – III	**PROCESSOR AND PIPELINING**	**9 Periods**
Single-Cycle Datapath and Control-Multi-cycle Datapath and Control-Micro-programming and Hardwired Control Units.Introduction to Pipelining: Pipelined Datapath and Control – Pipeline Hazards: Structural, Data Hazards: Forwarding versus Stalling–Control Hazards – Exceptions-Parallelism via Instructions.		
UNIT – IV	**MEMORY SYSTEMS AND I/O INTERFACING**	**9 Periods**
Introduction - Memory Technologies - The Basics of Caches - Measuring and Improving Cache Performance - Dependable Memory Hierarchy - Virtual Machines - Virtual Memory - A Common Framework for Memory Hierarchy –Finite State Machine to Control Simple Cache- Parallelism and Memory Hierarchies: Cache Coherence - Redundant Arrays of Inexpensive Disks.		
UNIT – V	**PARALLEL PROCESSORS FROM CLIENT TO CLOUD**	**9 Periods**
Introduction - Difficulty of Creating Parallel Processing Programs - SISD, MIMD, SIMD, SPMD, and Vector - Hardware Multithreading - Multicore and Shared Memory Multiprocessors– Graphics Processing Units - Clusters, Warehouse Scale Computers, and Message-Passing Multiprocessors - Multiprocessor Network Topologies - Cluster Networking - Multiprocessor Benchmarks and Performance Models.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	*David. A. Patterson, John L. Hennessy* ***"Computer Organization and Design: The Hardware/Software Interface"****, Fifth Edition, Morgan-Kaufmann Publishers Inc. 2014*

REFERENCES

1	*Carl Hamachar, ZvoncoVranesic and SafwatZaky, **"Computer Organization"**, 5th edition, McGraw Hill, 2011.*
2	*John P.Hayes, **"Computer Architecture and Organization"** Third Edition, Mc-Graw Hill International, 1998.*
3	*William Stallings, **"Computer Organization and Architecture: Designing for Performance"**, 10th Edition, Pearson Education, 2016.*
4	*Morris Mano. M, **"Computer system Architecture"**, 3rd edition, PHI publication, 2008.*
5	*Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, **"Computer Organization and Embedded Systems"**, Sixth Edition, Tata McGraw Hill, 2012.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Describe and analyze the main functional units of a computer and its performance evaluation.	K3
CO2	Explain the Computer Arithmetic to demonstrate the performance impact of sub word parallelism.	K2
CO3	Identify different pipelining hazards and their inference.	K4
CO4	Explain the Data path and Control and Micro-programming and Hard-wired Control Units.	K2
CO5	Understand virtual memory and caching.	K2
CO6	Understand parallel processor from client to cloud.	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	3	1	2	-	-	2	-	-	-	2	1	3	3	3
CO2	3	2	2	2	-	-	2	-	-	-	-	1	3	3	3
CO3	3	3	2	3	-	-	2	-	-	-	2	1	3	3	3
CO4	3	3	2	3	-	-	2	-	-	-	2	1	3	3	3
CO5	3	3	2	3	-	-	2	-	-	-	2	1	3	3	3
CO6	3	3	2	3	-	-	2	-	-	-	2	1	3	3	3
22SPC405	**3**	**3**	**2**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**1**	**3**	**3**	**3**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.2.2, 3.2.3, 3.3.1, 3.4.2, 4.1.2, 4.1.4, 4.2.1, 4.3.3, 7.1.2, 7.2.2, 11.2.1, 11.3.1, 12.1.1, 12.3.2
CO2	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1,2.2.2, 2.2.4, 2.3.1, 2.3.2, 2.4.1,3.1.4, 3.2.1, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.2.2, 4.3.2, 4.3.3, 7.1.2, 7.2.2, 12.1.2, 12.3.2
CO3	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1,2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1,2.4.3, 3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.2.2, 4.3.2, 4.3.3, 7.1.2, 7.2.2, 11.2.1, 11.3.1, 12.1.1, 12.3.2
CO4	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1,2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1,2.4.3, 3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.2.2, 4.3.2, 4.3.3, 7.1.2, 7.2.2, 11.2.1, 11.3.1, 12.1.1, 12.3.2
CO5	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1,2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1,2.4.3, 3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.2.2, 4.3.2, 4.3.3, 7.1.2, 7.2.2, 11.2.1,11.3.1,12.1.1, 12.3.2
CO6	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1,2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1,2.4.3, 3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.2.2, 4.3.2, 4.3.3, 7.1.2, 7.2.2, 11.2.1,11.3.1, 12.1.1, 12.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	30	30	20	-	-	100
CAT2	10	25	35	30	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	10	20	30	40	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	10	25	35	30	-	-	100
ESE	20	20	40	20	-	-	100

22SPC406	DATABASE MANAGEMENT SYSTEMS	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	The objective of this course is to learn about database design and query processing. To develop transaction processing applications considering concurrency control and recovery issues. To learn about enhanced data models	
UNIT – I	**DATABASE SYSTEM CONCEPTS AND DATA MODELS**	**9 Periods**
Data base approach: Characteristics, Advantages, Applications – Data Models - Three Schema Architecture- Data base System Environment- Data Modeling with ER model-Enhanced ER Model.		
UNIT – II	**RELATIONAL DATA MODEL AND SQL**	**9 Periods**
Relational Model: Concepts - Mapping ER and EER model to relations – Constraints - Schemas – Basic SQL: Data Definition, Data types, Constraint Specification, Data retrieval Queries - Relational Algebra – Triggers - Views		
UNIT – III	**DATABASE DESIGN AND QUERY PROCESSING**	**9 Periods**
Design Guidelines – Functional Dependencies – Normal Forms based on Primary Keys –Second and Third Normal Forms – BCNF – Multi valued Dependencies and Fourth Normal Form – Join Dependency and Fifth Normal Form - Strategies for Query Processing – Query Optimization		
UNIT – IV	**TRANSACTION PROCESSING, CONCURRENCY CONTROL AND RECOVERY**	**9 Periods**
Transaction: Desirable properties, Schedules based on recoverability and serializability - Transaction support in SQL. Concurrency Control: Locking technique -Time stamp based ordering - Multi version concurrency control - Validation and snapshot isolation concurrency control. Recovery Techniques: Concepts, NOUNDO/ REDO recovery based on deferred update, Recovery based on immediate update, Shadow paging, ARIES algorithm, Recovery in multi database systems		
UNIT – V	**NOSQL DATABASES AND ENHANCED DATA MODELS**	**9 Periods**
Introduction to NOSQL Systems: CAP Theorem, Document based systems, NOSQL Key-value stores, CRUD operation using NOSQL- Enhanced Data models: Active Database, Temporal Database, Spatial, multimedia and Deductive Databases.		
Contact Periods: **Lecture: 45 Periods** **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**		

TEXT BOOK

1	*Ramez Elmasri, Shamkant B. Navathe* ***"Fundamentals of Database Systems"*** *Seventh Edition, Pearson Education Limited, 2015*

REFERENCES

1	*Abraham Silberschatz , Henry F. Korth and S. Sudarshan,* ***"Database System Concepts"****, Sixth Edition, McGraw-Hill, 2012.*
2	*Raghu Ramakrishnan and Gehrke,* ***"Database Management Systems"****, Third Edition, McGraw Hill, 2003*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Design a database management system using ER and EER model	K4
CO2	Design a relational database system and write SQL queries in an optimized way	K4
CO3	Write transaction processing applications considering concurrency control and recovery issues	K3
CO4	Perform CRUD operation using NOSQL database	K4
CO5	Explain Active Database, Temporal Database, Spatial, multimedia and Deductive Databases	K2

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	2	3	3	2	-	-	-	-	-	1	-	-	3	3	1
CO2	2	3	3	2	-	-	-	-	-	1	-	-	3	3	1
CO3	2	3	3	2	-	-	-	-	-	1	-	-	3	3	1
CO4	2	3	3	2	-	-	-	-	-	1	-	-	3	3	1
CO5	2	2	2	2	-	-	-	-	-	1	-	-	3	3	1
22SPC406	**2**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**3**	**3**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.2.4,2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.3.1, 4.3.3, 10.1.1
CO2	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2,4.1.3, 4.2.1, 4.3.1, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 10.1.1
CO3	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2,4.1.3, 4.2.1, 4.3.1, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 10.1.1
CO4	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2,4.1.3, 4.2.1, 4.3.1, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 10.1.1
CO5	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.2.4, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.3.1, 4.3.3, 10.1.1

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1)%**	**Understanding (K2) %**	**Applying (K3)%**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	30	40	-	-	10	100
CAT2	20	30	40	-	-	10	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	50	-	-	50	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	50	-	-	50	100
ESE	20	30	50	-	-	-	100

22SPC407	SYSTEM PROGRAMMING AND OPERATING SYSTEMS	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	The objective of the course is to form an understanding on basic working principle of system software, role of OS services in process management, process synchronization , CPU scheduling , memory management ,storage management, file management and protection. To understand concept behind virtual machine.

UNIT – I	INTRODUCTION TO SYSTEM SOFTWARE	9 Periods

Introduction to system software – Overview of language processors – Assemblers – Elements of Assembly language programming – pass structure of assemblers – two pass assembler – single pass assembler - Macro definition and call –Macro expansion –advanced Macro facilities –Design of Macro Preprocessor - relocation and linking concept –design of linker – self relocating programs – loaders

UNIT – II	PROCESS MANAGEMENT AND SYNCHRONIZATION	9 Periods

Operating System structure – Services - Process concepts - process scheduling – operation on processes - inter process communication – examples of IPC systems – communication in client server system – Threads - Multicore Programming - Multithreading Models - Threading Issues - Operating-System Examples

Process synchronization: critical section problem - Peterson's Solution - synchronization Hardware – Mutex lock – semaphores - classical problems of synchronization - monitors – synchronization examples – alternative approaches

UNIT – III	CPU SCHEDULING AND DEADLOCK	9 Periods

Basic Concepts - Scheduling Criteria - Scheduling Algorithms - Thread Scheduling - Multiple-Processor Scheduling - Real-Time CPU Scheduling - Operating-System Examples - Algorithm Evaluation

Deadlock - System model-Deadlock characterization- Methods for Handling Deadlocks - Deadlock prevention- Deadlock avoidance - Deadlock detection- Recovery from deadlock.

UNIT – IV	MEMORY AND STORAGE MANAGEMENT	9 Periods

Main Memory –Logical address and Physical address – Swapping – Continuous memory allocation - segmentation – paging – Structure of page table - Example: ARM Architecture - Virtual memory concepts - Demand paging - Copy-on-Write - Page replacement – Allocation of Frames -Thrashing - Memory-Mapped Files - Allocating Kernel Memory - Other Considerations - Operating-System Examples

Disk Structure-Disk Attachment - Disk scheduling- Disk Management - Swap Space Management – File concept- Access methods- Directory and Disk Structure- File system Mounting - File sharing-Protection - File system implementation – Free Space Management

UNIT – V	PROTECTION AND VIRTUAL MACHINE	9 Periods

Goals of Protection - Principles of Protection - Access Matrix - Implementation of the Access Matrix- Access Control - Revocation of Access Rights - Capability-Based Systems -Language-Based Protection

Virtual Machines – history - Benefits and Features - Building Blocks - Types of Virtual Machines and Their Implementations - Virtualization and Operating-System Components - Examples

Contact Periods:
Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

TEXT BOOK

1	*D.M.Dhamdhere* ***"System Programming",*** *Tata McGraw Hill Education Private Limited , 2011*
2	A. Silberschatz & Peter Baer Galvin and Greg Gagne **"Operating System concepts"** 9th edition, John Wiley and sons Inc., 2012.

REFERENCES

1	Andrew S. Tanenbaum, Albert S. Woodhull: **"Operating Systems, Design and Implementation",** 3rd Edition, Prentice Hall, 2011.
2	Gary Nutt: **"Operating Systems",** 3rd Edition, Pearson Education, 2009
3	D M Dhamdhere, **"Operating Systems: A Concept-based Approach",** 2nd Edition, Tata McGraw-Hill Education, 2009.
4	NPTEL Course : **"Operating System Fundamentals"** https://nptel.ac.in/courses/106105214

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explain the working principle of Assembler, Macros, Linkers and Loaders	K2
CO2	Explore process management and process synchronization techniques	K4
CO3	Identify and apply appropriate CPU scheduling algorithms and Deadlock detection techniques for the given scenario	K4
CO4	Apply appropriate memory management techniques and Storage management techniques for the given scenario	K3
CO5	Explain the concepts behind virtual machine and protection mechanism in OS.	K2

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	2	1	-	1	-	-	-	-	2	-	2	1	1	-
CO2	2	3	2	1	-	-	-	-	-	2	-	2	2	2	1
CO3	2	3	2	1	-	-	-	-	-	2	-	2	2	2	1
CO4	2	3	2	1	-	-	2	-	-	2	-	2	2	2	-
CO5	2	3	1	-	3	-	2	-	-	2	-	2	2	2	2
22SPC407	**2**	**3**	**2**	**1**	**1**	**-**	**1**	**-**	**-**	**2**	**-**	**2**	**2**	**2**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.2, 2.4.1, 3.1.3, 3.1.6, 5.2.2, 10.1.1, 10.1.3, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO2	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.1,3.1.3,3.1.6,3.2.2,3.2.3,3.3.1,4.1.2,4.1.3, 10.1.1,10.1.3, 12.2.1,12.2.2,12.3.1,12.3.2
CO3	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.1,3.1.3,3.1.6,3.2.2,3.2.3,4.1.2,4.1.3, 10.1.1,10.1.3, 12.2.1,12.2.2,12.3.1,12.3.2
CO4	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.1,3.1.3,3.1.6,3.2.2,3.2.3,4.1 .2, 4.1.3, 7.1.1, 7.2.2,10.1.1,10.1.3, 12.2.1,12.2.2,12.3.1,12.3.2
CO5	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.2,2.4.1,2.4.2,3.1.3,3.1.6,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1, 7.1.1,7.2.2,10.1.1,10.1.3, 12.2.1,12.2.2,12.3.1,12.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	-	40	40	20	-	-	100
CAT2	-	30	50	20	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 /Project1	-	-	70	30	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	60	40	-	-	100
ESE	-	40	50	10	-	-	100

22SPC408	**DESIGN AND ANALYSIS OF ALGORITHMS** *(Common to CSE & IT Branches)*	**SEMESTER IV**

PREREQUISITES	CATEGORY	L	T	P	C
DATA STRUCTURES	PC	3	1	0	4

Course Objectives	To apply important algorithmic design paradigms and methods of analysis and synthesize efficient algorithms in common engineering design situations	
UNIT – I	**INTRODUCTION TO ALGORITHM ANALYSIS**	**9+3 Periods**
Fundamentals of Algorithmic Problem Solving - Important Problem Types - Fundamentals of the Analysis of Algorithm Efficiency - Asymptotic Notations and Basic Efficiency Classes - Mathematical Analysis of Non-recursive Algorithms - Mathematical Analysis of Recursive Algorithms - Amortized Analysis		
UNIT – II	**DECREASE AND CONQUER TECHNIQUE**	**9+3 Periods**
Decrease by constant: Insertion sort - Topological algorithm. Decrease-by-a-Constant-Factor: Binary Search - Fake-Coin Problem - Russian Peasant Multiplication -Josephus Problem. Variable-Size Decrease - Computing a Median and the Selection Problem – Interpolation Search - Searching and Insertion in a Binary Search Tree - The Game of Nim.		
UNIT – III	**ALGORITHM DESIGN TECHNIQUES - I**	**9+3 Periods**
Greedy Approach : Prim's algorithm- Kruskal's Algorithm- Dijkstra's Algorithm - Huffman Trees and codes .Divide and Conquer : Merge Sort – Quick sort - Matrix Multiplication of Large Integers - Strassen's Matrix Multiplication Dynamic Programming : Matrix Chain Multiplication – Knapsack problem and Memory Function – optimal binary search tree - Warshall's and Floyd's Algorithms – Longest common Subsequence		
UNIT – IV	**ALGORITHM DESIGN TECHNIQUES - II**	**9+3 Periods**
Backtracking: n-Queen problem – Hamilton Circuit Problem – Subset sum problem - CNF –SAT. Branch and Bound: Assignment problem – Knapsack problem - Travelling Salesman Problem.		
UNIT – V	**NP COMPLETENESS**	**9+3 Periods**
Limitations of algorithm power – Lower bound arguments – Decision Trees - P,NP and – NP Complete problem - Approximation Algorithm for NP Hard Problems: TSP - Knapsack problem Case study (not for evaluation) : Randomized Algorithms - Exact Exponential Algorithm		
Contact Periods: **Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods**		

TEXT BOOK

1	*Anany Levitin* ***"Introduction to the Design and Analysis of Algorithms"*** *Third Edition, Pearson Education, 2012*
2	*Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein* ***"Introduction to Algorithms"*** *Fourth Edition, MIT Press/McGraw-Hill, 2022.(unit 1-Amortized analysis)*

REFERENCES

1	*Singhal, Shefali, and Neha Garg "**Analysis and Design of Algorithms: A Beginner's Hope**", BPB Publications, 2018.*
2	*Sedgewick , Robert, and Kevin Wayne. "**Algorithms**". Fourth edition , Addison-wesley professional, 2011.*
3	*Michael T Goodrich and Roberto Tamassia, "**Algorithm Design: Foundations, Analysis, and Internet Examples**", Second Edition, Wiley, 2006*
4	*NPTEL Course : Design and Analysis of Algorithms https://archive.nptel.ac.in/courses/106/106/106106131/*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Argue the correctness of algorithms and analyze the running time using asymptotic notations and amortized analysis	K4
CO2	Explore different algorithmic approaches, such as Decrease by Constant, Decrease by a Constant Factor, and Variable-Size Decrease and solve problems associated with these paradigms.	K2
CO3	Develop problem-solving skills through practical application of Greedy Approach, Divide and Conquer, and Dynamic Programming.	K3
CO4	Cultivate proficient problem-solving abilities through the utilization of advanced Backtracking and Branch and Bound algorithms.	K3
CO5	Grasp the limitations of algorithmic capabilities and explore approaches to address them through the use of approximation algorithms.	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	2	1	1	1	-	-	-	-	-	1	2	3	3	3
CO2	2	2	1	1	1	-	-	-	-	-	1	2	3	3	3
CO3	2	2	3	1	1	-	-	-	-	-	1	2	3	3	3
CO4	2	2	1	1	1	-	-	-	-	-	1	2	3	3	3
CO5	2	1	1	1	1	-	-	-	-	-	1	2	3	3	3
22SPC408	**2**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**3**	**3**	**3**
1 – Slight, 2 – Moderate, 3 – Substantial															
b) CO and Key Performance Indicators Mapping															
CO1	1.1.1, 2.1.2,2.1.3,2.2.1,2.2.3,2.2.4,2.3.1,2.4.1,3.2.2,3.2.3,3.3.1,4.1.2,4.2.1,5.1.2,5.3.1,11.3.1,12.3.2														
CO2	1.1.1, 1.3.1,1.4.1, 2.1.2,2.1.3,2.2.1,2.2.3,2.2.4,2.3.1,2.4.1,3.2.2, 3.1.6, 3.2.3,3.3.1, 4.1.2,4.2.1,5.1.2,5.3.1, 11.3.1,12.3.2														
CO3	1.1.1, 1.3.1,1.4.1, 2.1.2,2.1.3,2.2.1,2.2.3,2.2.4,2.3.1,2.4.1,3.2.2, 3.1.6, 3.2.3,3.3.1, 4.1.2,4.2.1,5.1.2,5.3.1, 11.3.1,12.3.2														
CO4	1.1.1, 1.3.1,1.4.1, 2.1.2,2.1.3,2.2.1,2.2.3,2.2.4,2.3.1,2.4.1,3.2.2, 3.1.6, 3.2.3,3.3.1, 4.1.2,4.2.1,5.1.2,5.3.1, 11.3.1,12.3.2														
CO5	1.1.1, 1.3.1,1.4.1, 2.1.2,2.1.3,2.2.1,2.2.3,2.2.4,2.3.1,2.4.1,3.2.2, 3.1.6, 3.2.3,3.3.1, 4.1.2,4.2.1,5.1.2,5.3.1, 11.3.1,12.3.2														

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	-	30	30	40	-	-	100
CAT2	10	40	50	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	50	50	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	50	50	-	-	-	100
ESE	10	40	50	-	-	-	100

22SPC409	THEORY OF COMPUTATION *(Common to CSE and IT)*	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	1	0	4

Course Objectives	Understand the foundations of computation including grammars, formal languages, Automata and Turing machines.	
UNIT – I	**INTRODUCTION TO FORMAL LANGUAGES AND FINITE AUTOMATA**	**9+3 Periods**
Introduction to Formal Languages, Grammars and Automata; Types of Grammars - Chomsky's hierarchy of languages, Regular Languages and Regular Expressions, Deterministic Finite Automata (DFA), Non-deterministic Finite Automata (NFA), Non-deterministic Finite Automata with Epsilon transitions, Conversion of NFA into DFA, DFA Minimization..		
UNIT – II	**REGULAR LANGUAGES, CONTEXT FREE GRAMMARS AND NORMAL FORMS**	**9+3 Periods**
Kleene's theorem - Equivalence of Regular Expressions and Finite Automata, Myhill-Nerode Theorem, Moore and Mealy machines and its equivalence, Closure properties of Regular Languages, Pumping Lemma for regular languages. Context-Free Grammar (CFG) and Languages, Derivations and Parse trees, Ambiguity in grammars and languages, Normal forms for CFG, Simplification of CFG, Chomsky Normal Form (CNF) and Greibach Normal Form (GNF)		
UNIT – III	**CONTEXT FREE LANGUAGES AND PUSHDOWN AUTOMATA**	**9+3 Periods**
Closure properties of Context Free Languages, Pumping lemma for CFL, Ogden's Lemma, Push Down Automata (PDA), Languages of pushdown automata, Equivalence of pushdown automata and CFG-CFG to PDA-PDA to CFG, Deterministic Pushdown Automata.		
UNIT – IV	**TURING MACHINES**	**9+3 Periods**
Turing Machines, Language of a Turing Machine, Turing Machine as a Computing Device, Modifications of Turing Machines, Two-way Infinite Tape, Equivalence of One Way Infinite Tape and Two-way Infinite Tape Turing Machines, Multi Tape Turing Machines, Nondeterministic Turing machine, Universal Turing machines.		
UNIT – V	**RECURISVE, RECURSIVELY ENUMERABLE PROBLEMS AND UNDECIDABILITY**	**9+3 Periods**
Recursive and recursively enumerable languages, Properties, Reducibility Theory, Rice Theorem for Recursive and Recursively Enumerable Languages, Halting Problem and undecidability, Post's Correspondence Problem (PCP), Modified Post Correspondence Problem		
Contact Periods: **Lecture: 45 Periods** **Tutorial: 15 Periods** **Practical: 0 Periods** **Total: 60 Periods**		

TEXT BOOK

1	*John C Martin , **"Introduction to Languages and the Theory of Computation"**, 4th Edition, Tata McGraw Hill, 2015*

REFERENCES

1.	*Harry R Lewis and Christos H Papadimitriou, **"Elements of the Theory of Computation"**, 2nd Edition, Prentice Hall of India, 2015.*
2.	*Peter Linz, **"An Introduction to Formal Language and Automata"**, 6th Edition, Jones & Bartlett, 2016.*
3.	*Michael Sipser, **"Introduction to Theory of Computation"**, Third Edition, Cengage learning, 2013*
4.	*Adam Brooks Webber, **"Formal languages: a practical introduction"**, Jim Leisy, 2008.*
5.	*Hopcroft J.E., Motwani R. & Ullman J.D., **"Introduction to Automata Theory, Languages and Computations"**, 3rd Edition, Pearson Education, 2008.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Write Regular Expression/Context free grammar for the given language	K2
CO2	Construct Automata/Turing Machines for the given language	K3
CO3	Explain the properties of Regular/Context Free/Recursive/Recursively Enumerable languages	K1
CO4	Use Pumping lemma	K2
CO5	Identify and prove the given problem is un-decidable using reducibility theory	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2	2	3	-	-	-	-	-	-	1	-	1	2	1	3
CO2	2	2	3	-	-	-	-	-	-	1	-	1	2	1	3
CO3	2	2	-	-	-	-	-	-	-	1	-	1	2	1	3
CO4	2	2	3	-	-	-	-	-	-	1	-	1	2	1	3
CO5	2	2	3	-	-	-	-	-	-	1	-	1	2	1	3
22SPC409	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**2**	**1**	**3**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	2.1.1, 2.1.2, 3.1.1, 3.1.2, 1.1.1, 1.1.1
CO2	2.1.1, 2.1.2, 3.1.1, 3.1.2, 1.1.1, 1.1.1
CO3	2.1.1, 2.1.2, 1.1.1, 1.1.1
CO4	2.1.1, 2.1.2, 3.1.1, 3.1.2, 1.1.1, 1.1.1
CO5	2.1.1, 2.1.2, 3.1.1, 3.1.2, 1.1.1, 1.1.1

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Rememberin g(K1) %	Understanding (K2) %	Applyin g(K3) %	Analyzing (K4) %	Evaluating (K5) %	Creatin g(K6) %	Total %
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	30	20	40	5	5	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	30	20	30	10	5	5	100
ESE	30	30	40	-	-	-	100

22SPC410	DATABASE MANAGEMENT SYSTEMS LABORATORY	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	0	0	3	1.5

Course Objectives	The objective of this course is to practice DDL, DML, DCL and TCL commands, relational algebra operations, Views, stored procedures, cursors, functions, triggers and to develop a simple application with front end and back end design with report generation.

LIST OF EXPERIMENTS

Experiments should be implemented in MySQL/NoSQL

1. DDL and DML commands.
2. Views & Subqueries.
3. Relational Algebra Operations
4. Stored Procedures and Cursors.
5. Stored Functions.
6. Triggers.
7. DCL and TCL commands.
8. Form Design and report generation using PHP/Java/Django
9. Mini Project

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Create and Manipulate a database using DDL, DML, DCL and TCL commands	K6
CO2	Implement a database schema for any real world problem with integrity constraints	K6
CO3	Apply PL/SQL constructs for designing stored procedures, functions, cursors, packages and triggers to access database.	K6
CO4	Design and develop a simple application with front end and back end design with report generation.	K6

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	3	3	3	3	-	-	-	-	3	-	-	3	3	-
CO2	2	3	3	3	3	-	-	-	-	3	-	-	3	3	-
CO3	2	3	3	3	3	-	-	-	-	3	-	-	3	3	-
CO4	2	3	3	3	3	-	-	-	-	3	-	-	3	3	-
22SPC410	**2**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**3**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1,1.4.1, 2.1.1,2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.2, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2 , 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 10.1.1, 10.1.2, 10.1.3, 10.3.1, 10.3.2
CO2	1.3.1,1.4.1, 2.1.1,2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.2, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2 , 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 10.1.1, 10.1.2, 10.1.3, 10.3.1, 10.3.2
CO3	1.3.1,1.4.1, 2.1.1,2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.2, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2 , 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 10.1.1, 10.1.2, 10.1.3, 10.3.1, 10.3.2
CO4	1.3.1,1.4.1, 2.1.1,2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.2, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2 , 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.1.3, 10.3.1, 10.3.2

22SPC411	SYSTEM PROGRAMMING AND OPERATING SYSTEMS LABORATORY	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	0	0	3	1.5

Course Objectives	The objective of the course is to understand the concepts behind the design ofsystem software , process management, memory management, storage management, file management ,protection mechanism and virtual machine.

PRACTICALS
EXERCISES ILLUSTRATING THE FOLLOWING CONCEPTS:

SYSTEM PROGRAMMING
(Experiments should be implemented in C)

1	Design of analysis phase in a two pass assembler
2	Design of synthesis phase in a two pass assembler
3	Design of single pass assembler
4	Design of macro processor
5	Design of linkers and loaders

OPERATING SYSTEMS
(Experiments should be implemented in C++/Java)

6	Implementation of Process synchronization strategy
7	Implementation of process scheduling
8	Implementation deadlock detection algorithm
9	Implementation of paging and Segmentation
10	Implementation of page replacement algorithms
11	Implementation of Disk Scheduling
12	Study on security and protection mechanism in Windows and Linux OS
13	Setting up a Virtual Machine

Contact periods:

Lecture: 0 Periods	Tutorial: 0 Periods	Practical: 45 Periods	Total: 45 Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Simulate system software like single and two pass assemblers, Macroprocessor , linker and loader	K3
CO2	Implement Process synchronization , process scheduling and deadlock detection methods	K6
CO3	Implement to Virtual memory management and Disk management techniques.	K6
CO4	Explore on basic security and protection mechanisms in Windows and Linux OS	K2
CO5	Install and use virtual machine using tools like virtual box	K3

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	3	3	2	1	-	-	-	-	3	-	2	1	1	-
CO2	2	3	3	3	1	-	-	-	-	3	-	2	2	2	1
CO3	2	3	3	3	1	-	-	-	-	3	-	2	2	2	1
CO4	2	3	3	3	1	-	2	-	-	3	-	2	2	2	-
CO5	2	3	3	3	3	-	1	-	-	3	-	3	2	2	2
22SPC411	**2**	**3**	**3**	**3**	**1**	**-**	**1**	**-**	**-**	**3**	**-**	**2**	**2**	**2**	**1**
1 – Slight, 2 – Moderate, 3 – Substantial															
b) CO and Key Performance Indicators Mapping															
CO1	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.2,4.1.2,4.1.3,4.1.4,4.3.1,4.3.4, ,5.1.1, 10.1.1,10.1.2,10.1.3,10.2.2,10.3.1,12.2.1, 12.2.2,12.3.1, 12.3.2													
CO2	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.3,4.3.4, 5.1.1, 10.1.1,10.1.2,10.1.3,10.2.2, 10.3.1, 12.2.1,12.2.2,12.3.1,12.3.2													
CO3	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.3,4.3.4,5.1.1, 10.1.1,10.1.2,10.1.3, 10.2.2, 10.3.1 , 12.2.1,12.2.2,12.3.1,12.3.2													
CO4	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.4,7.1.1,7.2.2,5.1.1,10.1.1,10.1.2 ,10.1.3, 10.2.2,10.3.1, 12.2.1, 12.2.2,12.3.1,12.3.2													
CO5	1.3.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.4,5.1.1,51.2,5.2.1,5.2.2,5.3.1,5.3.2,7.2.2,10.1.1,10.1.2,10.1.3,10.2.2,10.3.1,12.1.1,12.2.1,12.2.2,12.3.1,12.3.2													

22SES511	EMBEDDED COMPUTING SYSTEMS	SEMESTER V

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	0	0	3

Course Objectives	The objective of this course is to make the students understand about the basic hardware and software components and their selection for embedded computing Systems.	
UNIT – I	**INTRODUCTION TO EMBEDDED SYSTEMS AND ARM PROCESSOR**	**9 Periods**
Introduction to Embedded System: Characteristics of Embedded System – Application Areas – Real Time Examples of Embedded System – ES Hardware Design – Design and Development of Embedded Software – Real time ES. ARM Processor: Family – Application of ARM Processor – Compiler –Emulation and Debugging – Difference between RISC & CISC.		
UNIT – II	**EMBEDDED NETWORKING AND INTERRUPTS SERVICES MECHANISM**	**9 Periods**
Embedded Networking: Introduction, I/O Devices – Ports &Buses. Bus communication Protocols –RS232 Standard –RS422 – RS485 – CAN Bus – Serial Peripheral Interface (SPI) – Inter Integrated Circuit (I2C) – Interrupt Sources, Programmed –I/O busy-wait approach without Interrupt Service Mechanism – ISR concept – Multiple interrupt – context switching – Introduction to Devices Drivers.		
UNIT – III	**RTOS BASED EMBEDDED SYSTEM DESIGN**	**9 Periods**
Introduction to Basic concept of RTOS – Task, Process and Threads, Interrupt routines in RTOs , Multiprocessing & Multitasking, Preemptive & Non- Preemptive scheduling, Task communication – Shared Memory, Message Passing, Interprocess communication – Comparison of commercial RTOs Features – RTOS lite, Full RTOS, Vxworks, µc/os –II, RT Linux.		
UNIT – IV	**PROGRAM DESIGN AND ANALYSIS**	**9 Periods**
Component for Embedded Programs, Model's of Programs, Assembly, linking & loading , Basic Compilation Techniques, Program Optimization, Program Level Performance Analysis, Software Performance Optimization, Program-Level energy & Power Analysis , Analysis & Optimization of Program Size, Program Validation & testing.		
UNIT – V	**INTRODUCTION TO LPC2148 MICROCONTROLLER, SYSTEM CONTROL AND GPIO**	**9 Periods**
The LPC 2148: ARM7 Microcontroller – Features of LPC 2148 – Block diagram of LPC 2148 – Pin diagram of LPC 2148 – Architectural Overview – On-chip Flash Program Memory – On-chip StaticRAM. System Control: Crystal Oscillator – PLL – Rest & Wake – Up timer – Brownout Detector – External interrupt input – Memory Mapping control – Power Control. GPIO: General purpose parallel I/O: Features – 8 bit LED's and Switches – Relay & Buzzer.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS :

1.	*Wayne Wolf,* ***"Computers as Components, Principles of Embedded Computing Systems Design"*** *2nd Edition, Elsevier, 2008.(1,2,3,& 4 units)*
2.	*Shibu K V,* ***"Introduction to Embedded Systems"****, Tata McGraw Hill, 2009.(1 and 2 unit)*

REFERENCES :

1.	*James K. Peckol,* ***"Embedded Systems, A contemporary Design Tool",*** *Wiley India, 2008.*
2.	*Tammy Neorgaard,* ***"Embedded Systems Architecture"****, Elsevier, 2005.*
3.	*ARM Company Ltd.* ***"ARM Architecture Reference Manual– ARM DDI 0100E"****(5^{th} unit)*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Apply the microcontroller cores (ARM, RISC, CISC, and SOC) for the Embedded systems**.**	K3
CO2	Explain the design components of embedded systems.	K2
CO3	Comprehend simple real time embedded programs,	K2
CO4	Apply RTOS concepts of task and time management, memory management for embedded systems.	K3
CO5	Create Embedded applications using embedded systems development environment.	K6

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CO1	2	2	1	3	3	-		-	-	1	1	-	3	3	-
CO2	2	1	1	3	3	-		-	-		1	-	3	3	-
CO3	2	2	2	3	3	-	1	-	-	1	1	-	3	3	-
CO4	2	2	1	2	3	-		-	-		1	-	3	3	-
CO5	2	3	2	3	3	-	3	-	-	1	1	-	3	3	-
22SES511	**2**	**2**	**2**	**3**	**3**	**-**	**1**	**-**	**-**	**1**	**1**	**-**	**3**	**3**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 3.1.4, 3.2.1, 3.3.1, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.3.1, 4.3.4, 5.1.1, 5.1.2, 5.2.2, 5.3.1, 5.3.2, 10.1.3, 11.3.2.
CO2	1.3.1, 1.4.1, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 3.1.4, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2 5.1.1, 5.1.2, 5.2.1,5.2.2,5.3.1, 5.3.2, 11.3.2.
CO3	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.4.1, 2.4.2, 2.4.4, 3.1.3,3.1.4, 3.2.1, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.2, 4.3.1, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3,2, 7.1.2, 10.1.2, 11.3.2.
CO4	1.1.2, 1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.3, 3.1.4, 3.2.3, 3.4.1, 4.1.2, 4.1.3, 4.2.1,4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 5.3.2,11.3.2.
CO5	1.1.2, 1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.2.1,,2.1.2, 2.1.3, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.1.3,3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.2, 4.3.1, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3,2, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 10.1.2, 11.3.2.

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	30	30	20	-	-	100
CAT2	10	30	40	20	-	-	100
Individual Assessment 1/Case Study 1/Seminar 1/Project 1	20	30	30	10	10	-	100
Individual Assessment 2/Case Study 2/Seminar 2/Project 2	-	-	40	40	-	20	100
ESE	10	40	30	20	-	-	100

22SPC512	COMPUTER NETWORKS *(Common to ECE, CSE $ IT)*	SEMESTERV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	Upon completion of the course, the students will be familiar with, 1. The division of network functionalities into layers 2. The component required to build different types of networks 3. Identifying the solution for the functionalities in each layer.	
UNIT – I	**INTRODUCTION AND PHYSICAL LAYER**	**9 Periods**
Overview of how the Internet works: browser, webserver, URL, domain name, IP address, packets, Hubs, Bridges, Switches.Overview of the design principles of the Internet: packet switching vs circuit switching, store-and forward networks, layering for modularity. Introduction to the various layers in the Internet. Introduction to performance metrics: end-to-end throughput, delay, jitter and drop rates in a network. Statement of Little's Law. How performance is measured. Physical layer: signalto-noise ratio, bit error rate, modulation, multipath interference. Data Transmission – Transmission Media – Signal Encoding Techniques – Multiplexing – Spread Spectrum		
UNIT – II	**DATALINK LAYER**	**9 Periods**
Medium access protocols: Polling vs. contention-based: TDM, Aloha, CSMA/CD. Data Link Layer: Mechanisms for error detection/recovery: Parity checks, CRC and data link layer protocols. Switched LANs: L2 addressing and ARP– Virtual LAN (VLAN) –Ethernet frame structure, Wireless LAN (802.11)		
UNIT – III	**NETWORK LAYER**	**9 Periods**
Network Layer: Network architecture and performance: Network topology; Router architecture: queueing and switching. Performance evaluation of a network link: traffic characteristics, performance measures, Kendall's notation. IP Protocol: - Need for an Internet address, and its design. Hierarchical IP addressing, Subnetting, IPv4 and IPv6, structure of IP datagram, IP forwarding. Routing protocols: Link state routing. Distance vector routing: count-to-infinity, routing convergence. Structure of the Internet: end-user organizations and ISPs. difference between intra-domain (OSPF) and inter-domain (BGP) routing, Congestion Avoidance in Network Layer		
UNIT – IV	**TRANSPORT LAYER**	**9 Periods**
Transport Layer: Importance of the transport layer; end-to-end principle. Transport layer protocols: TCP and UDP, process-to process delivery, multiplexing, port numbers, header structure - Reliable transmission of packets over an unreliable network: sequence numbers, ACKs, timeout, retransmissions. Stop and wait, and sliding window - TCP connection setup and teardown - Flow control and congestion control at the transport layer. Differences between the two. Overview of TCP congestion control: Slow start and reaction to timeouts - TCP congestion control: Slow start; congestion avoidance using loss-based and delay-based control. Introduction to Quality of services (QOS).		
UNIT – V	**APPLICATION LAYER**	**9 Periods**
Application Layer: Internet names, how DNS works, Application layer protocols: HTTP, SMTP, SNMP, web applications. Security attacks and defences: DMZ, firewalls. Peer-to-peer applications. P2P file distribution. Audio and video streaming. Challenges of streaming over best effort IP		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	A.S. Tanenbaum and D.J. Wetherall, **"*Computer Networks"*,** 5th edition, Pearson, 2013.
2	J.F. Kurose and K.F. Ross, **"*Computer networking: a top-down approach"***, 6th edition, Pearson, 2017.

REFERENCES:

1	Larry L. Peterson, Bruce S. Davie, ***"Computer Networks: A Systems Approach",*** Fifth Edition, Morgan Kaufmann Publishers Inc., 2011.
2	William Stallings, ***"Data and Computer Communications",*** Eighth Edition, Pearson Education, 2011.
3	*Behrouz A. Forouzan and Firouz Mosharraf,* ***"Computer Networks a Top Down Approach",*** *Tata McGraw-Hill, 2011.*
4	R. Jain, **"*The art of computer systems performance analysis",*** Wiley India, 1991
5	S.K. Bose, **"*An Introduction to Queueing Systems"*,** Springer Science + Business Media New York, 2012

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Summarize layering as a means of tackling complexity, layering applied to the Internet	K2
CO2	Explain protocols as a structured means of reliable communications	K3
CO3	Explain the architecture principles that have enabled the orders of magnitude expansion of the Internet	K3
CO4	Explain networked applications and their protocols, their installation, operation and performance tuning	K3
CO5	Choose the required functionality at each layer for a given application and trace the flow of information from one node to another node in the network.	K3

COURSE ARTICULATION MATRIX

a) CO and PO Mapping

COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	2	-	-	-	1	-	-	-	-	2	2
CO2	2	2	2	2	-	-	-	1	-	-	-	-	2	2
CO3	2	2	2	2	-	-	-	1	-	-	-	-	2	2
CO4	2	2	2	2	-	-	-	1	-	-	-	-	2	2
CO5	2	3	3	3	-	-	-	1	-	-	-	-	3	2
22SPC512	**2**	**3**	**3**	**3**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**3**	**2**

1– Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 4.1.1, 4.2.1, 8.1.1
CO2	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 4.1.1, 4.2.1, 8.1.1
CO3	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 4.1.1, 4.2.1, 8.1.1
CO4	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 4.1.1, 4.2.1, 8.1.1
CO5	1.1.1, 1.2.1, 2.1.1, 2.1.2, 2.3.1, 3.1.1, 3.1.2, 3.4.1, 4.1.1, 4.2.1, 4.2.2, 8.1.1

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Assignment 1	30	20	40	5	5	-	100
Assignment 2	30	20	30	10	5	5	100
Other mode of internal assessments, if any	-	-	-	-	-	-	-
ESE	30	30	40	-	-	-	100

22SPC513	ARTIFICIAL INTELLIGENCE *(Common to CSE and IT)*	SEMESTER V

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	The objective of this course is to make the students understand about the importance and need of Artificial Intelligence in solving real world engineering problems.	
UNIT – I	**INTELLIGENT AGENTS**	**9 Periods**
Introduction to AI – Agents and Environments – concept of rationality – nature of environments – structure of agents. Problem solving agents – search algorithms – uninformed search strategies.		
UNIT – II	**PROBLEM SOLVING**	**9 Periods**
Heuristic search strategies – heuristic functions. Local search and optimization problems – local search in continuous space – search with non-deterministic actions – search in partially observable environments – online search agents and unknown environments		
UNIT – III	**GAME PLAYING AND CONSTRAINT SATISFACTION PROBLEM**	**9 Periods**
Game theory – optimal decisions in games – alpha-beta search – monte-carlo tree search – stochastic games – partially observable games,Limitations of Game Search Algorithms. Constraint satisfaction problems – constraint propagation – backtracking search for CSP – local search for CSP – structure of CSP		
UNIT – IV	**LOGICAL REASONING**	**9 Periods**
Knowledge-based agents – propositional logic – propositional theorem proving – propositional model checking – agents based on propositional logic. First-order logic – syntax and semantics – knowledge representation and engineering – inferences in first-order logic – forward chaining – backward chaining – resolution.		
UNIT – V	**PROBABILISTIC REASONING AND GENERATIVE AI**	**9 Periods**
Acting under uncertainty – Bayesian inference – naïve Bayes models. Probabilistic reasoning – Bayesian networks – exact inference in Bayesian network – approximate inference in Bayesian network – causal networks.Understanding Generative AI-Evolution of AI: From rule-based to generative models– Key generative AI models: RNNs, LSTMs, GPT, and more, Popular use cases for generative AI–Introduction to Prompt Engineering-What is prompt engineering and why it matters–Prompt types: explicit, implicit, and creative prompts–Best Practices for Crafting Effective Prompts		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Stuart Russell and Peter Norvig,* ***"Artificial Intelligence – A Modern Approach",*** *Fourth Edition, Pearson Education, 2021.*
2	*Dan W. Patterson,* ***"Introduction to Artificial Intelligence and Expert Systems",*** *Pearson Education,2017*

REFERENCES :

1	*Deepak Khemani,* ***"Artificial Intelligence",*** *Tata McGraw Hill Education, 2016.*
2	*Kevin Night, Elaine Rich, and Nair B.,* ***"Artificial Intelligence",*** *McGraw Hill, 2017.*
3	*Patrick H. Winston,* ***"Artificial Intelligence",*** *Third Edition, Pearson Education, 2016*
4	*Christopher M. Bishop,* ***"Pattern Recognition and Machine Learning",*** *Springer, 2016.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Identify the role of intelligent agents and associated frameworks.	K2
CO2	Apply problem solving techniques in real world problems.	K4
CO3	Apply game playing and CSP techniques in complex AI problems.	K4
CO4	Summarize logical reasoning techniques	K3
CO5	Evaluate probabilistic reasoning techniques to efficiently handle uncertain environments.	K5

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping													
COs/Pos	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	3	3	2	2	-	-	-	-	-	2	1	3
CO2	3	3	3	3	2	2	-	-	-	-	-	2	1	3
CO3	3	3	3	3	2	2	-	-	-	-	-	2	1	3
CO4	3	3	3	3	2	2	-	-	-	-	-	2	1	3
CO5	3	3	3	3	2	2	-	-	-	-	-	2	1	3
22SPC513	**3**	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**3**
1 – Slight, 2 – Moderate, 3 – Substantial														

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 5.1.1, 5.2.1, 5.3.2, 6.1.1, 6.1.2, 12.1.1, 12.1.2, 12.2.1, 12.3.2
CO2	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 5.1.1, 5.2.1, 5.3.2, 6.1.1, 6.1.2, 12.1.1, 12.1.2, 12.2.1, 12.3.2
CO3	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3,4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 5.1.1, 5.2.1, 5.3.2, 6.1.1, 6.1.2, 12.1.1, 12.1.2, 12.2.1, 12.3.2
CO4	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1,3.1.2,3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4, 4.2.1,4.2.2,4.3.1,4.3.2, 5.1.1, 5.2.1, 5.3.2, 6.1.1, 6.1.2, 12.1.1, 12.1.2, 12.2.1, 12.3.2
CO5	1.1.1,1.1.2,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2, 5.1.1, 5.2.1, 5.3.2, 6.1.1, 6.1.2, 12.1.1, 12.1.2, 12.2.1, 12.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	10	20	30	20	20	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	50	50	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	-	50	50	-	100
ESE	10	20	35	35	-	-	100

22SPC514	WEB PROGRAMMING	SEMESTER V

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	The objective of this course is to provide students with proficiency in full stack development by mastering the MEAN (MongoDB, Express.js, Angular, Node.js) framework stack.	
UNIT – I	**FRONTEND FUNDAMENTALS**	**9 Periods**

Understanding the Basic Web Development Framework – User – Browser – Webserver – Backend Services – MVC Architecture–HTML – CCS

JavaScript - Defining Variables -Understanding JavaScript Data Types - Using Operators - Implementing Looping - Creating Functions - Understanding Variable Scope - Using JavaScript Objects – Strings –Arrays - Error Handling

TypeScript - Learning the Different Types -Understanding Interfaces -Implementing Classes -Class Inheritance - Implementing Modules- Understanding Functions

UNIT – II	RUNTIME ENVIRONMENT	9 Periods

Understanding Node.js - Working with Node Packages - Creating a Node.js Application - Using Events, Listeners, Timers, and Callbacks in Node.js -Implementing Timers - Handling Data I/O in Node.js - Working with JSON - Converting JSON to JavaScript Objects -Converting JavaScript Objects to JSON - Using the Buffer Module to Buffer Data - Understanding Buffered Data - Using the Stream Module to Stream Data - Accessing the File System from Node.js - Implementing HTTP Services in Node.js -Implementing HTTP Clients and Servers in Node.js - Implementing Socket Services in Node.js - Scaling Applications Using Multiple Processors in Node.js

UNIT – III	MIDDLEWARE	9 Periods

Implementing Express in Node.js - Getting Started with Express - Configuring Routes -Implementing Routes - Applying Parameters in Routes - Using Requests Objects - Using Response Objects -Setting Headers - Setting the Status - Sending Response - Sending JSON Responses - Sending Files -Sending a Download Response - Redirecting the Response Implementing a Template Engine

Understanding Middleware - Assigning Middleware Globally to a Path - Assigning Middleware to a Single Route - Adding Multiple Middleware Functions - Using the query Middleware -Serving Static Files - Handling POST Body Data - Sending and Receiving Cookies -Implementing Sessions

Applying Basic HTTP Authentication - Implementing Session Authentication - Creating Custom Middleware

UNIT – IV	BACKEND DEVELOPMENT	9 Periods

Understanding NoSQL and MongoDB - Getting Started with MongoDB and Node.js - Manipulating MongoDB Documents from Node.js - Understanding Database Change Options - Understanding Database Update Operators - Adding Documents to a Collection -Getting Documents from a Collection - Updating Documents in a Collection - Atomically Modifying Documents in a Collection - Understanding Query Objects - Understanding Query Options Objects - Applying MapReduce by Aggregating Results- Using Mongoose for Structured Schema and Validation

UNIT – V	WEB DEVELOPMENT FRAMEWORK	9 Periods

Why Angular?- Angular Components – expressions -Interacting with the Component Class in - Data Binding - Built-in Directives - Custom Directives- Events and Change Detection - Implementing Angular Services in Web Applications - Understanding Angular Services - Using the Built-in Services - Sending HTTP GET and PUT Requests with the http Service -Configuring the HTTP Request- Implementing the HTTP Response Callback Functions -Implementing a Simple JSON File and Using the http Service to Access It - Using routes in Angular - Implementing a Simple Router - Implementing a Router with a Navigation Bar -Implementing a Router with - Creating Your Own Custom Angular Services.

Contact Periods:
Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

TEXT BOOKS:

1	*Brad Dayley, Brendan Dayley, Caleb Dayley, '**Node.js, MongoDB and Angular Web Development**', Addison-Wesley, Second Edition, 2018*
2	*Pinakin Ashok Chaubal ,"**Mastering MEAN Stack**",bpb publications, 2023*

REFERENCES :

1	Paul Deitel, Harvey Deitel, Abbey Deitel "**Internet and World Wide Web- How to Program**" Sixth Edition, Pearson,2020
2	***Infosys Springerboard course : FullStack***
3	*https://javascript.info/*

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Design a web page using HTML , CSS ,java script and typescript	K6
CO2	Develop a basic Node.js application structure.	K6
CO3	Explore the role of Express.js in building web applications	K3
CO4	Develop a web application complete with MongoDB integration	K3
CO5	Design a simple application using MEAN framework	K6

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	2	1	1	2	-	-	-	-	-	-	1	2	2	1
CO2	2	2	1	1	2	-	-	-	-	-	-	1	2	2	1
CO3	2	2	1	1	2	-	-	-	-	-	-	1	2	1	1
CO4	2	2	1	1	2	-	-	-	-	-	-	1	2	1	1
CO5	2	2	1	1	2	-	-	-	-	-	-	2	2	1	1
22SPC514	**2**	**2**	**1**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**1**
1 – Slight, 2 – Moderate, 3 – Substantial															

b)CO and Key Performance Indicators Mapping	
CO1	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.4.2, 3.1.2, 3.1.3, 3.2.2, 4.1.2, 4.1.3, 4.3.1, 5.1.2, 5.2.1, 5.2.2, 12.1.1, 12.2.1
CO2	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.4.2, 3.1.2, 3.1.3, 3.2.2, 4.1.2, 4.1.3, 4.3.1, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 12.1.1, 12.2.1
CO3	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1 , 2.2.2, 2.4.2, 3.1.2,3.1.3,3.2.2, 4.1.2, 4.1.3, 4.3.1, 4.3.3, 4.3.4, 5.1.1,5.1.2, 5.2.1, 5.2.2, 12.1.1, 12.2.1
CO4	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.4 .2 , 3.1.2, 3.1.3, 3.2.2, 4.1.2,4.1.3,4.3.1, 5.1.1,5.1.25.2.1,5.2.2 ,12.1.1, 12.2.1
CO5	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.4.2, 3.1.2, 3.1.3, 3.2.2, 4.1.2, 4.1.3, 4.3.1, 5.1.1,5.1.2, 5.2.1, 5.2.2, 12.1.1, 12.2.1, 12.2.2, 12.3.2

ASSESSMENTPATTERN –THEORY							
Test /Bloom's Category *	**Remembering (K1)%**	**Understanding (K2)%**	**Applying (K3)%**	**Analyzing (K4)%**	**Evaluating (K5)%**	**Creating (K6)%**	**Total %**
CAT1	-	40	40	-	-	20	100
CAT2	-	20	40	20	-	20	100
IndividualAssessment1 /CaseStudy1/ Seminar 1 /Project1	-	-	50	-	-	50	100
IndividualAssessment2 /CaseStudy2/ Seminar2 / Project2	-	-	-	-	-	100	100
ESE	-	30	40	30	-	-	100

22SMC5Z2	CONSTITUTION OF INDIA *(Common to all Branches)*	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	MC	3	0	0	0

Course Objectives	*The objective of the course is to familiarize the students on the role, powers and functions of Indian government. Also understand the recent acts in India.	
UNIT- I	**INTRODUCTION AND EMERGENCY PROVISIONS**	**9 Periods**
Historical Background: The Company rule, The Crown rule - Constituent Assembly: Composition, Objectives - Preamble and Salient features of the Indian Constitution - Fundamental Rights, Fundamental Duties, Directive Principles of state policy, Emergency Provisions - National Emergency, President Rule, Financial Emergency.		
UNIT- II	**SYSTEM OF GOVERNMENT**	**9 Periods**
Parliamentary system: merits, demerits, reasons for adopting parliamentary system – Federal system: Evaluation of federal features – Centre-State relations: Legislative, Administrative and Financial relations – Local Government: Panchayat Raj and urban local government.		
UNIT- III	**UNION AND STATE GOVERNMENT**	**9 Periods**
President of India: Election, Powers and functions - Prime Minister and Cabinet: Structure and functions – Governor: Powers and functions - Chief Minister and Council of Ministers: Functions.		
UNIT- IV	**ORGANS OF GOVERNANCE AND RECENT ACTS**	**9 Periods**
Parliament: Lok Sabha and Rajya Sabha, Composition and powers - State Legislative Assembly and Legislative Council: Composition and powers - Judicial System in India: Structure and features - Supreme Court and High Court: Composition, Jurisdiction, Recent acts in significance-RTI, Citizenship act, POCSO act.		
UNIT- V	**POLITICAL DYNAMICS**	**9 Periods**
Political parties: Party system, Recognition of National and State parties – Elections: Electoral system and reforms – Pressure groups – National Integration: Obstacles, National Integration Council – Foreign Policy: Principles and Objectives.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Period**		

TEXT BOOK:

1	*National portal of India, "**The Constitution of India**" (Full Text), https://legislative.gov.in/constitution-of-india*
2	*Dr.B.R.Ambedkar, "**The Constitution of India**", SudhirPrakashan, 2020*

REFERENCES:

1	*Durga Das Basu, "**Introduction to the Constitution of India**, LexisNexis, 2022*
2	*P.M.Bakshi, "**The Constitution of India**", LexisNexis, 2020*
3	*Subash C Kashyap, "**Our Parliament**", National Book Trust, 2021*
4	*Subash C Kashyap, "**Our Political System**", National Book Trust, 2011*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Know the evolution of Indian Constitution and its basic premises.	K1
CO2	Explain the system of governance in India.	K2
CO3	Describe the structure of Union and State Governments	K2
CO4	Obtain the knowledge of functions of Legislature and Judiciary	K1
CO5	Know the political system of India	K1

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
CO2	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-
CO3	-	-	-	-	-	2	-	1	1	-	-	-	-	-	-
CO4	-	-	-	-	-	1	-	1	2	-	-	-	-	1	-
CO5	-	-	-	-	-	2	-	2	1	-	-	-	-	-	-
22SMC5Z2	-	-	-	-	-	**2**	-	**1**	**1**	-	-	-	1	1	1
1 – Slight, 2 – Moderate, 3 – Substantial															
b) CO and Key Performance Indicators Mapping															
CO1	6.1.1, 6.2.1, 8.1.1, 8.2.1, 8.2.2, 9.1.2														
CO2	6.1.1, 6.2.1, 8.1.1, 8.2.1, 8.2.2, 9.1.2														
CO3	6.1.1, 6.2.1, 8.1.1, 8.2.1, 8.2.2														
CO4	6.1.1, 6.2.2, 9.1.2, 9.2.1														
CO5	6.2.2, 8.1.1,8.2.2, 9.1.2, 9.2.1														

ASSESSMENT PATTERN– THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	50	50	-	-	-	-	100
CAT2	50	50		-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	50	50	-	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	50	50	-	-	-	-	100
ESE	50	50	-	-	-	-	100

22SPC515	SOFTWARE ENGINEERING METHODOLOGIES	SEMESTER V

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	2	4

Course Objectives	The objective of this course is to enable the students to understand the role of software process and a process model in a projects, the role of SRS in a project and how requirements are validated, the techniques for estimation, design, testing and project management of large software development projects.	
UNIT – I	**SOFTWARE PROCESS MODEL**	**9+6 Periods**
Principle of Software engineering–Software myths-Prescriptive process model:Waterfall Model-Incremental Process Models-Evolutionary Process Models-Concurrent Models–Unified process–Agile Development: Agility Principles-Extreme Programming– Test Driven Development – Fundamentals – Test Doubles and Mocking – Refactoring – Difference between TDD and BDD- Other Agile Process Model. Case study - Ruby on Rails ,JUnit and TestNG (not for Evaluation)		
UNIT – II	**SOFTWARE REQUIREMENT MODELING**	**9+6 Periods**
Requirement Engineering–Eliciting Requirement-Quality Function Deployment-Building Requirement model-Negotiating Requirement-Validating Requirement-Requirement Analysis-ScenarioBasedModeling-DataModeling-ClassBasedModeling-FlowOrientedModeling.		
UNIT – III	**SOFTWARE DESIGN AND ESTIMATION**	**9+6 Periods**
Design Process - Design Concepts – Design model - architectural design - component level design –User interface design .Software Project Estimation – Decomposition techniques- Empirical Estimation model–specialized estimation technique for Agile Development-project scheduling–risk management.		
UNIT – IV	**SOFTWARE QUALITY AND TESTING**	**9+6 Periods**
Software Quality–Review Techniques–Software Quality Assurance-Test Driven Development–Strategic approach to software testing–Testing Strategies for Conventional software-Object-Oriented software–Validation testing–system testing–Art of Debugging–Testing Conventional Application–Testing Object-Oriented Application-Case study Tarantula: Software testing tool for Agile Development.		
UNIT – V	**SOFTWARE PROJECT MANAGEMENT**	**9+6 Periods**
Software Configuration Management-The SCM repository-The SCM process-The Configuration Management for Web apps- Project Management-The management Spectrum – The People – The Product–The Process-The Project-The W5HH Principle-Critical Practices-Process and Project Metrics.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 15 Periods Total: 60 Periods**		

LISTOFEXPERIMENTS:

1.	Identify a software system that needs to be developed.
2.	Document the Software Requirements Specification (SRS) for the identified system.
3.	Identify use cases and develop the Use Case model.
4.	Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.
5.	Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams.
6.	Draw relevant State Chart and Activity Diagrams for the same system.
7.	Implement the system as per the detailed design
8.	Test the software system for all the scenarios identified as per the use case diagram
9.	Improve the reusability and maintainability of the software system by applying appropriate design patterns.
10.	Implement the modified system and test it for various scenarios
11	Implement TDD rules(Red ,Green ,Refactor) to develop a typical model code using Ruby on Rails framework.
12	Implement below list of experiments and enhance customer experience for a fictional retail store using retail domain deep dive. • Inventory Management Optimization • Customer Behavior Analysis • Supply Chain Efficiency • Data Analytics and Machine Learning • Customer Satisfaction and Loyalty • Sustainability and Green Retailing

TEXT BOOK:

1	*RogerPressman.S,"**SoftwareEngineering:APractitioner'sApproach**",EighthEdition,McGrawHill, 2014.*

REFERENCES:

1.	*Ian Sommerville,"**Software Engineering**",Nineth Edition,Pearson Education Asia,2011*
2.	*Shari Lawrence P fleeger, Joanne M.Atlee,"**Software Engineering:Theory and Practice**",Fourth Edition, Pearson Education,2011.*
3.	*Victor Farci, Alex Garcia, "**Test-Driven Java Development**", Packt Publishing, 2015*
4	*Michael hartl,"**The Ruby on Rails Tutorial-Learn Web Development with Rails**", Third Edition, 2015.*

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Compare various Software Development Life cycle Models	K2
CO2	Design requirement model for a software project	K3
CO3	Perform architectural design, component level design and UI design as well as apply cost and schedule estimation strategies.	K3
CO4	Apply testing strategies to verify and validate a software application.	K3
CO5	Assess project progress using project management techniques	K5

COURSE ARTICULATION MATRIX:

a)CO and PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	3	-	-	-	-	-	2	-	3	2	2	2
CO2	2	3	2	3	-	-	-	-	-	2	-	-	2	2	2
CO3	2	3	2	3	-	-	-	-	-	2	-	-	2	2	2
CO4	2	3	2	3	2	-	-	-	-	2	-	3	2	2	3
CO5	2	3	2	3	2	-	1	1	-	2	-	3	2	2	3
22SPC515	**2**	**3**	**2**	**3**	**1**	**-**	**1**	**1**	**-**	**2**	**-**	**2**	**2**	**2**	**3**

1–Slight,2 –Moderate, 3– Substantial

b)CO and Key Performance Indicators Mapping

CO1	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.3, 3.1.6, 3.2.1,3.2.2,3.2.3,3.3.1,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4, 10.1.1,10.1.2,10.1.3, 12.1.1,12.1.2,12.2.1,12.2.2,12.3.1
CO2	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.3, 3.1.6, 3.2.1,3.2.2,3.2.3,3.3.1,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4,10.1.1,10.1.2,10.1.3
CO3	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.3, 3.1.6, 3.2.1, 3.2.2,3.2.3,3.3.1,3.4.1,3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4, 10.1.1,10.1.2,10.1.3
CO4	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.3, 3.1.6, 3.2.1,3.2.2,3.2.3,3.3.1,3.4.1,3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4, 5.1.1,5.1.2,5.2.1,5.2.2, 10.1.1,10.1.2,10.1.3, 12.1.1,12.1.2,12.2.1,12.2.2,12.3.1
CO5	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.3, 3.1.6, 3.2.1, 3.2.2,3.2.3,3.3.1,3.4.1,3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4, 10.1.1,10.1.2,10.1.3, 12.1.1,12.1.2,12.2.1,12.2.2,12.3.1

ASSESSMENT PATTERN –THEORY							
Test /Bloom's Category*	**Remembering (K1)%**	**Understanding (K2)%**	**Applying (K3) %**	**Analyzing (K4)%**	**Evaluating (K5)%**	**Creating (K6)%**	**Total %**
CAT 1	-	30	30	40	-	-	100
CAT 2	-	20	40	40	-	-	100
IndividualAssessment1 /CaseStudy1/ Seminar 1 /Project1	-	-	50	50	-	-	100
IndividualAssessment2 /CaseStudy2/ Seminar 2 /Project2	-	-		50	-	50	100
ESE	-	20	40	40	-	-	100

22SPC516	COMPUTER NETWORKS LABORATORY *(Common to CSE & IT)*	SEMESTER V

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	0	0	3	1.5

Course Objectives	The objective of this course is to make the students familiar with Linux and web based tools, Socket programming,NS2/NS3 Simulators

LIST OF EXPERIMENTS

1. (i) Use Linux tools like ifconfig, dig, ethtool, route, netstat, nslookup, and ip to understand the networking configuration of the computer that the student is working on.
   (ii) Install and configure some network applications, e.g. Apache, Bind (DNS)
2. (i) Use Wireshark to capture packets when browsing the Internet. Examine the structure of packets: the various layers, protocols, headers, payload
   (ii) Understand various header fields and their usage in different application layer protocols using Wireshark packet capture
3. Socket programming:
   a. write a simple clientserver program using TCP and UDP sockets
   b. Modify server to handle multiple clients concurrently
4. Measure TCP throughput between two hosts in a network using tools like iperf. Modify TCP configuration parameters. Use the tc Linux utility or similar to control bandwidth, delay, loss. Observe impact on measured throughput.
5. Experiment with multiple applications running concurrently to generate congestion: Observe the behaviour of congestion control protocols in NS-2/NS-3, change various network parameters and observe evolution of the TCP congestion window.
6. Use tools like ping and trace route to explore various Internet paths to popular servers.
7. Use web-based tools like the who is utility to query Internet registries, and understand which IP addresses are allocated to the student's network. Find out which are the major ISPs, and which is the ISP of the student's network.
8. Configure a simple mesh network using computers in the lab, or using Mininet. Setup static routes to conform to the desired mesh topology.
9. Use NS-2/NS-3 to simulate a mesh of at least 4 nodes and 3 links to evaluate performance under various conditions
10. Use Linux network tools like ethtool to observe and analyze link layer packet statistics and errors
11. Use NS- 2/NS-3 to simulate medium access protocols. Observe contention, collisions and packet loss in medium access protocols. Observe the working of error detection/recovery mechanisms.
12. Understand the behavior of Wi-Fi using NS-2/NS-3.
13. Simulate transport protocols optimized for data centers in NS-2/NS-3.
14. Use cell phone to measure cellular signal strength (RSS) at various places in the campus. Draw a contour map with cell phone towers and RSS levels. Correlate with upload/download speed using tools like Measurement Lab speed test.
15. Implement a streaming audio/video server using open-source software.

Contact Periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Install and configure network applications	K3
CO2	Write a simple client server program using socket programming	K3
CO3	Measure TCP throughput between two hosts in a network using tools	K3
CO4	Use linux/web based tools to understand the network architecture	K3
CO5	Use NS- 2/NS-3 to simulate protocols	K3

COURSE ARTICULATION MATRIX

a) CO and PO Mapping

COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	1	1	3	1	-	1	-	-	-	-	1	1	1
CO2	2	2	2	2	2	1	-	1	-	-	-	-	2	2	2
CO3	2	2	2	2	2	1	-	1	-	-	-	-	2	2	2
CO4	1	1	1	1	3	1	-	1	-	-	-	-	1	1	1
CO5	1	1	1	1	3	1	-	1	-	-	-	-	1	1	1
22SPC516	**2**	**2**	**2**	**2**	**3**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**2**

1– Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1, 2.1.2, 3.1.1, 4.1.1, 5.1.1, 5.2.1, 5.3.1, 8.1.1
CO2	1.1.1, 1.3.1, 2.1.1, 2.1.2, 3.1.1, 3.2.1, 4.1.1, 4.1.2, 5.1.1, 5.2.1, 8.1.1
CO3	1.1.1, 1.3.1, 2.1.1, 2.1.2, 3.1.1, 3.2.1, 4.1.1, 4.1.2, 5.1.1, 5.2.1, 8.1.1
CO4	1.3.1, 2.1.2, 3.1.1, 4.1.1, 5.1.1, 5.2.1, 5.3.1, 8.1.1
CO5	1.3.1, 2.1.2, 3.1.1, 4.1.1, 5.1.1, 5.2.1, 5.3.1, 8.1.1

22SEE501	EMBEDDED COMPUTING SYSTEMS LABORATORY	SEMESTER V

PREREQUISITES	CATEGORY	L	T	P	C
NIL	EEC	0	0	3	1.5

Course Objectives	The objective of this course is to implement assembly programs on ARM based Processor, Configuration of GPIO port pins and Usage of Timer and Interrupt handler.

LIST OF EXPERIMENTS

1. Study of ARM based Processor
2. Simple Assembly Program for
   a. Addition | Subtraction | Multiplication | Division
   b. Operating Modes, System Calls and Interrupts
   c. Loops, Branches, Operators.
3. Write an Assembly programs to configure and control General Purpose Input/output(GPIO) port pins.
4. Write an Assembly programs to read digital values from external peripherals and execute Them with the Target board.
5. Program to perform reading and writing from a file
6. Program to demonstrate Time delay program using built in Timer / Counter feature on IDE environment
7. Program to demonstrate a simple interrupt handler and setting up a timer.
8. Program to Interface 8 Bit LED and Switch Interface
9. Program to implement Buzzer Interface on IDE environment
10. Program to display a message in a 2 line x 16 Characters LCD display and verify the result in debug terminal.
11. Mini project

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Write simple Assembly program in an ARM based Processor.	**K3**
CO2	Analyze and implement program for configuring GPIO port pin, Timer and Interrupts.	**K4**
CO3	Demonstrate the Usage of Files.	**K2**
CO4	Create programs that interact with other devices like LED, Switch and LCD.	**K6**
CO5	Develop simple Embedded applications**.**	**K5**

COURSE ARTICULATION MATRIX :
a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	2	1	3	3	-	-	-	-	1	1	-	3	3	-
CO2	2	1	1	3	3	-	-	-	-	-	1	-	3	3	-
CO3	2	2	2	3	3	-	1	-	-	1	1	-	3	3	-
CO4	2	2	1	2	3	-	-	-	-	-	1	-	3	3	-
CO5	2	3	2	3	3	-	3	-	-	1	1	-	3	3	-
22SEE501	2	2	2	3	3	-	1	-	-	1	1	-	3	3	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 3.1.4, 3.2.1, 3.3.1, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.3.1, 4.3.4, 5.1.1, 5.1.2, 5.2.2, 5.3.1, 5.3.2, 10.1.3, 11.3.2.
CO2	1.3.1, 1.4.1, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 3.1.4, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2 5.1.1, 5.1.2, 5.2.1,5.2.2,5.3.1, 5.3.2, 11.3.2.
CO3	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.4.1, 2.4.2, 2.4.4, 3.1.3,3.1.4, 3.2.1, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.2, 4.3.1, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3,2, 7.1.2, 10.1.2, 11.3.2.
CO4	1.1.2, 1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.3, 3.1.4, 3.2.3, 3.4.1, 4.1.2, 4.1.3, 4.2.1,4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 5.3.2,11.3.2.
CO5	1.1.2, 1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.2.1,,2.1.2, 2.1.3, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.1.3,3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.2, 4.3.1, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3,2, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 10.1.2, 11.3.2.

22SHS606	INDUSTRIAL MANAGEMENT AND ECONOMICS *(Common to EIE,CSE & IT)*	SEMESTER VI

PREREQUISITES	CATEGORY	L	T	P	C
NIL	HSMC	3	0	0	3

Course Objectives	1. To understand the role of ergonomics in organizational setting. 2. To understand the important legislations that govern organizational management. 3. To understand the microeconomic concepts and it's impact on engineering decisions and everyday life activities. 4. To understand the macroeconomic concepts and it's impact on organizations and everyday life activities. 5. To understand the role of stock markets and taxation on individual consumers and organizations.

UNIT– I	**INDUSTRIAL MANAGEMENT**	**9 Periods**

Meaning, Scope, Importance, Evolution and growth, Need, Ergonomics – Need at Workplace, Reasons for importance, Benefits, Hazards of non-ergonomically designed workplace, Principles of ergonomics, Ergonomic Assessment Software Safety Culture – An Introduction.

UNIT– II	**INDRODUCTION TO THE PROVISIONS OF LEGISLATIONS GOVERNING INDUSTRIES IN INDIA**	**9 Periods**

Factories Act, Employees State Insurance Act, Workmen's Compensation Act, Sexual Harassment of women at workplace (Prevention, Prohibition & Redressal) Act.

UNIT– III	**MICROECONOMICS**	**9 Periods**

Definition, Scope, Differences with macro economics, Demand – Definition, Law of Demand, Demand Schedule, Exceptions to Law of Demand, Factors affecting demand, Elasticity of demand Supply – Definition, Law of Supply, Supply Schedule, Factors affecting supply, Elasticity of Supply.

UNIT– IV	**MACROECONOMICS**	**9 Periods**

Definition, Scope, Money – Evolution, Types, Functions, Reserve Bank of India – Definition, Functions – Credit control measures, Commercial banks – Definition, Need, Functions, Types of deposits, Types of loans, Inflation & Deflation – Definitions, Types, Methods of controlling inflation and deflation, Impact of inflation and deflation on different segments of people.

UNIT– V	**KEY ECONOMIC INDICATORS**	**9 Periods**

Gross Domestic Product, Unemployment, Stock Market trends, Taxation.

Contact Periods:
Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

TEXTBOOK:

1	*Kiran U.V* ***, "Fundamentals of Ergonomics,"*** *JTS Publications, 2020*
2	*Gupta C.B, Sultan, "****Management Theory and Practice,"*** *Chand and Sons, 2021*
3	*Gaurav Jain, "****Microeconomics,"*** *Neoblocks and Printers Private Limited, 2017*
4	*Gaurav Jain, "****Macroeconomics,"*** *Ajmer Graphics, 2019*

REFERENCES:

1	*Bridger, "****Introduction to Human Factors and Ergonomics,"*** *Taylor & Francis publishers, 2017*
2	*Koontz &Weihrich, "****Elements of Management"*** *McGraw Hill, 2020*
3	*Bright David, "****Principles of Management,"*** *Open Stax Textbooks, 2022*
4	*Robert Pindyck & Daniel, Rubinfeld, "****Microeconomics,"*** *Pearson Education, 2017*
5	*G.S.Gupta, "****Microeconomics – Theory and Applications,"*** *McGraw Hill Education, 2017*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Establish ergonomical workspaces and enhance productivity.	K3
CO2	Implement the statutory requirements for a safe workplace.	K4
CO3	Understand the impact of microeconomics concepts on individual behavior.	K2
CO4	Understand the interplay between the economics cycles, business performance and engineering decisions.	K2
CO5	Implement appropriate financial decisions that would contribute to the country's GDP and also suit the taxation policies in practice from time to time.	K4

COURSEARTICULATIONMATRIX:

a)CO and PO Mapping

COs/ POs	**PO 1**	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	-	-	3	-	-	3	3	-	-	-	2	-	3	1	2
CO2	-	-	-	-	-	3	-	3	2	-	-	1	-	3	2
CO3	-	-	-	-	-	-	2	-	-	-	3	-	3	3	2
CO4	-	-	2	-	3	-	-	-	-	-	-	-	2	2	1
CO5	-	-	-	2	-	-	-	-	-	-	1	-	3	2	1
22SHS606	**-**	**-**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**-**	**2**	**1**	**3**	**3**	**2**

1–Slight, 2 –Moderate,3–Substantial

b)CO and Key Performance Indicators Mapping

CO1	3.1.3, 3.1.5, 3.4.1, 3.4.2, 6.1.1, 7.1.2, 11.2.1
CO2	6.2.1, 8.2.2, 9.1.1, 9.2.4, 12.1.2, 12.3.1
CO3	7.1.1, 11.1.1, 11.2.1
CO4	3.3.1, 3.4.1, 5.1.2, 5.2.2, 12.3.1, 12.3.2
CO5	4.3.2, 4.3.4, 11.1.1, 11.2.1

ASSESSMENTPATTERN–THEORY							
Test/Bloom's Category*	**Remembering(K1)%**	**Understanding (K2)%**	**Applying (K3)%**	**Analyzing (K4)%**	**Evaluating (K5)%**	**Creating (K6)%**	**Total %**
CAT1	-	20	40	40	-	-	100
CAT2	-	20	40	40	-	-	100
IndividualAssessment1 /CaseStudy1/Seminar 1 /Project1	-	-	50	50	-	-	100
IndividualAssessment2 /CaseStudy2/Seminar2 / Project2	-	-	50	50	-	-	100
ESE	-	20	50	30	-	-	100

22SPC617	COMPUTER NETWORK SECURITY	SEMESTER VI

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	This course provides an in-depth exploration of the principles, techniques, and technologies used to secure computer networks. Students will learn about network vulnerabilities and attacks, cryptographic protocols, access control mechanisms, firewalls, intrusion detection and prevention systems, secure coding practices, and network security best practices.	
UNIT– I	**INFORMATION AND NETWORK SECURITY CONCEPTS**	**9 Periods**
Cybersecurity, Information Security and Network Security - OSI Security Architecture – Security Attacks and Services, Security Mechanisms – Cryptography, Network Security, Trust and Trustworthiness, Standards. Number Theory – Divisibility and the Division algorithm, Euclidean Algorithm, Modular Arithmetic, Prime numbers, Fermat's and Euler's theorem, Testing for Primality, Chinese remainder theorem, discrete logarithms		
UNIT– II	**CRYPTOGRAPHY**	**9 Periods**
Symmetric Key Ciphers:DES, AES, Electronic Codebook, Pseudo random number generators, RC4. Asymmetric Key Ciphers: RSA,DiffieHellman key exchange, Elgamal, Elliptic curve cryptography.		
UNIT– III	**KEY DISTRIBUTION AND ACCESS CONTROL**	**9 Periods**
Remote user authentication principles, Symmetric key distribution using symmetric encryption, Kerberos, Key distribution using asymmetric encryption, X.509 certificates, Public-key infrastructure, Federated identity management. Network Access control – Extensible authentication protocol, IEEE 802.1X Port based network access control, Wireless network security, Cloud Security		
UNIT– IV	**SECURITY ATTACKS**	**9 Periods**
Buffer overflow attacks & format string vulnerabilities - Denial-of-Service Attacks -Hijacking attacks: exploits and defenses - Internet worms – viruses – spyware –phishing – botnets - TCP session hijacking - ARP attacks - route table modification - UDP hijacking - man-in-the-middle attacks		
UNIT– V	**SYSTEM SECURITY**	**9 Periods**
Network defense tools: Firewalls, VPNs, Intrusion Detection Systems, and Filters. Email Security: Pretty Good Privacy (PGP) and S/MIME - Network security protocols in practice- Introduction to Wireshark – SSL – IP Security, and IKE -DNS security- Secure Socket Layer (SSL) and Transport Layer Security (TLS) - Secure Electronic Transaction (SET)		
Contact Periods: **Lecture: 45 Periods** **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**		

TEXTBOOK:

1	*William Stallings,* ***"Network Security Essentials – Applications and Standards"****, Sixth Edition, Pearson, 2017*

REFERENCES:

1	*William Stallings,* ***"Cryptography and Network Security: Principles and Practice"****, Eighth edition, Pearson, 2023.*
2	*Charlie Kaufman, Radia Perlman, Mike Speciner, Ray Perlner,* ***"Network Security: Private Communication in a public world"****, Third Edition, Addison-Wesley, Pearson Education, 2023*
3	*Denise Kinsey, Michael Stewart,* ***"Network Security, Firewalls and VPNs"****, Third Edition, Jones and Bartlett Publishers, 2020.*

COURSEOUTCOMES: Upon completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Explain the fundamental principles and concepts of network security	K2
CO2	Apply cryptographic techniques such as encryption, hashing, and digital signatures to secure data communication	K3
CO3	Implement access control mechanisms, including authentication, authorization, and accounting, to restrict unauthorized access to network resources	K2
CO4	Identify and analyze network vulnerabilities, threats, and attacks	K4
CO5	Configure and manage network security devices such as firewalls, IDS/IPS, VPNs, and secure gateways	K3

COURSE ARTICULATION MATRIX:

a)CO and PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	2	1	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	2	2	-	-	-	-	-	2	3	3	3
CO3	3	3	3	3	2	2	-	-	-	-	-	2	3	3	3
CO4	3	3	3	3	2	2	-	-	-	-	-	2	3	3	3
CO5	3	3	3	3	2	2	-	-	-	-	-	2	3	3	3
22SPC617	**3**	**3**	**3**	**3**	**2**	**2**	**-**	-	**-**	-	**-**	**2**	**3**	**3**	**3**

1–Slight, 2 –Moderate,3–Substantial

b)CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1
CO2	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 6.2.1, 12.1.2, 12.2.1, 12.2.2
CO3	1.1.1, 1.1.2, 1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 6.2.1, 12.1.2, 12.2.1, 12.2.2
CO4	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 12.1.2, 12.2.1, 12.2.2
CO5	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 12.1.2, 12.2.1, 12.2.2

ASSESSMENTPATTERN–THEORY							
Test/Bloom's Category*	**Remembering (K1)%**	**Understanding (K2)%**	**Applying (K3)%**	**Analyzing (K4)%**	**Evaluating (K5)%**	**Creating (K6)%**	**Total %**
CAT1	-	30	30	40	-	-	100
CAT2	20	30	30	20	-	-	100
IndividualAssessment1 /CaseStudy1/Seminar 1 /Project1	-	40	30	30	-	-	100
IndividualAssessment2 /CaseStudy2/Seminar2 / Project2	-	30	30	40	-	-	100
ESE	20	20	30	30	-	-	100

22SPC618	COMPILER DESIGN	SEMESTER VI

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	The objective of this course is to make the students to learn and understand design issues for all the phases of a compiler like Lexical Analysis, various parsing techniques, syntax directed translation, intermediate code generation, runtime storage management, optimize the code and implement code generator.	
UNIT – I	**LEXICAL ANALYSIS**	**9 Periods**
Structure of a compiler – Analysis of source program – Phases of a compiler – Grouping of phases – Compiler construction tools - Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens –Finite Automata – Regular Expressions to Automata – Minimizing DFA – LEX		
UNIT – II	**SYNTAX ANALYSIS**	**9 Periods**
Need and Role of the Parser-Context Free Grammars - Writing a grammar - Top Down Parsing - General Strategies Recursive Descent Parser Predictive Parser-LL(1) Parser – Bottom Up Parsing - Shift Reduce Parser - LR Parsers – Construction of SLR (1) Parsing Table, Canonical LR (1) Parsing Table and LALR (1) Parsing Table – Parser Generators – YACC		
UNIT – III	**INTERMEDIATE CODE GENERATION**	**9 Periods**
Syntax directed definitions – Construction of syntax trees - Evaluation Orders for Syntax Directed Definitions - Syntax Directed Translation Schemes - Intermediate Code Generation – Three Address Code – Types and Declarations – Expression Translation – Control Flow– Back Patching -Type Checking.		
UNIT – IV	RUN-TIME ENVIRONMENT AND CODE GENERATION	**9 Periods**
Storage Organization - Stack Allocation Space - Parameter passing - Access to Non-local Data on the Stack - Heap Management - Introduction to Garbage Collection - Issues in Code Generation - Design of Code Generator - Register Allocation and Assignment - Instruction Selection by Tree Rewriting		
UNIT – V	**CODE OPTIMIZATION**	**9 Periods**
Principal Sources of Optimizations - DAG - Basic Blocks and Flow Graphs – Optimization of Basic Blocks - Global Data Flow Analysis - Constant Propagation – Peephole Optimizations.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	*Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman,* ***"Compilers: Principles, Techniques, and Tools"****, Updated Second Edition, Pearson Education, 2023.*

REFERENCES

1	*LeBlanc Jr., Richard J., Cytron, Ron K., Fischer, Charles N.,* ***"Crafting a Complier",*** *First Edition, Addison Wesley, 2011*
2	*V. Raghavan,* ***"Principles of Compiler Design",*** *Tata McGraw Hill Education Publishers, 2017.*
3	*Torben Egidius Mogensen,* ***"Introduction to Compiler Design",*** *Second Edition, Springer, 2017.*
4	*K. D. Cooper, L. Torczon,* ***"Engineering a Compiler", Morgan-Kaufmann,*** *Third Edition, 2022.*
5	*K. Muneeswaran,* ***"Compiler Design",*** *Oxford University Press, 2013*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Design a Lexical Analyzer to recognize the tokens, patterns.	K3
CO2	Develop a top down and Bottom up parser for the CFG grammar	K3
CO3	Understand syntax-directed translation and Generate three address code for a simple program	K2
CO4	Analyze run time environment and design the code generator for the program.	K4
CO5	Identify and apply the suitable code optimization techniques	K2

COURSE ARTICULATION MATRIX :

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PSO 3
CO1	1	3	3	2	2	-	-	-	-	-	-	1	3	1	1
CO2	1	3	3	2	2	-	-	-	-	-	-	1	3	1	2
CO3	1	3	2	2	2	-	-	-	-	-	-	1	3	1	2
CO4	1	3	2	3	2	-	-	-	-	-	-	1	3	1	2
CO5	1	3	3	2	2	-	-	-	-	-	-	1	3	1	2
22SPC618	**1**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**1**	**2**
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1,2.2.2,2.2.3,2.2.4, 2,3,1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.3,4.2.1, 4.3.1, 4.3.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2,12.1.1, 12.1.2
CO2	1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1,2.2.2,2.2.3,2.2.4, 2,3,1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.3,4.2.1, 4.3.1, 4.3.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 12.1.1, 12.1.2
CO3	1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1,2.2.2,2.2.3,2.2.4, 2,3,1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.6, 3.2.1,3.2.2,3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.3,4.2.1, 4.3.1, 4.3.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 12.1.1
CO4	1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1,2.2.2,2.2.3,2.2.4, 2,3,1, 2.4.2, 2.4.4, 3.1.1, 3.1.6, 3.2.1,3.2.2,3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.3,4.2.1, 4.3.1, 4.3.2,4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 12.1.1, 12.1.2
CO5	1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1,2.2.2,2.2.3,2.2.4, 2,3,1, 2.4.2, 2.4.4, 3.1.1, 3.1.3, 3.1.6, 3.2.1,3.2.2,3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.3,4.2.1, 4.3.1, 4.3.2,4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 12.1.1, 12.1.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	30	50	-	-	-	100%
CAT2	10	20	30	40	-	-	100%
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	10	50	40	-	-	100%
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	50	50	-	-	100%
ESE	-	20	40	40	-	-	100%

22SPC619	MACHINE LEARNING *(Common to CSE & IT)*	SEMESTER VI

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	The objective of this course is to make the students will be familiar with the characteristics of Machine Learning algorithms, Supervised, Unsupervised and Reinforcement learning techniques, probability based learning techniques and graphical models of machine learning algorithms	
UNIT – I	**INTRODUCTION**	**9 Periods**
Learning – Types of Machine Learning –Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm –Introduction to Machine learning tools		
UNIT – II	**SUPERVISED LEARNING**	**9 Periods**
Statistical decision theory: Regression and classification - Linear Separability – Linear Regression and Locally weighted regression – K Nearest Neighbour learning - Perceptron - Multi-layer Perceptron –Back-Propagation - Support Vector Machines – Decision Trees - Classification and Regression Trees – Random Forests - Different ways to Combine Classifiers – Ensemble Learning – Boosting – Bagging – Evaluation Measures – Multiclass classification		
UNIT – III	**DIMENSIONALITY REDUCTION AND UNSUPERVISED LEARNING**	**9 Periods**
Dimensionality Reduction: Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Unsupervised learning problems-Hierarchical Agglomerative Clustering (HAC)-Single-link, complete-link, group-average similarity- k-Means and Mixtures of Gaussians-Flat clustering, k-Means algorithms-Mixture of Gaussian model		
UNIT – IV	**GRAPHICAL MODELS**	**9 Periods**
Probability and Learning – Data into Probabilities –Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– Bayesian Belief Network – EM-algorithm - Markov Random Fields – Hidden Markov Models – Tracking Methods		
UNIT – V	**REINFORCEMENT LEARNING**	**9 Periods**
Reinforcement Learning – Introduction -Elements of Reinforcement Learning – Learning Task – Q-learning – k-armed Bandit Elements – Model-Based learning – Value Iteration – Policy iteration – Temporal Difference Learning - Exploration Strategies – non-deterministic rewards and actions		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*Ethem Alpaydin,* ***"Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)",*** *Fourth Edition, MIT Press, 2020*

REFERENCES:

1	*Jason Bell,* ***"Machine learning – Hands on for Developers and Technical Professionals",*** *First Edition, Wiley, 2014*
2	*Peter Flach,* ***"Machine Learning: The Art and Science of Algorithms that Make Sense of Data",*** *First Edition, Cambridge University Press, 2012.*
3	*Stephen Marsland,* ***"Machine Learning – An Algorithmic Perspective",*** *Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.*
4	*Tom M Mitchell,* ***"Machine Learning",*** *First Edition, McGraw Hill Education, 2017*
5	*Trevor Hastie, Robert Tibshirani, Jerome Friedman,* ***"The Elements of Statistical Learning",*** *Second Edition ,Springer, 2017*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Differentiate between supervised, unsupervised, semi-supervised machine learning approaches	K2
CO2	Apply specific supervised or unsupervised machine learning algorithm for a particular problem	K3
CO3	Analyse and suggest the appropriate machine learning approach for the various types of problem	K3
CO4	Design and make modifications to existing machine learning algorithms to suit an individual application	K3
CO5	Provide useful case studies on the machine learning algorithms	K3

COURSE ARTICULATION MATRIX

a) CO and PO Mapping

COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	1	1	-	-	-	-	-	-	-	-	2	1	3
CO2	2	2	3	3	-	-	-	-	-	-	-	-	2	1	3
CO3	2	2	3	3	-	-	-	-	-	-	-	-	2	1	3
CO4	2	2	3	3	-	-	-	-	-	-	-	-	2	1	3
CO5	2	2	3	3	-	-	-	-	-	-	-	-	2	1	3
22SPC619	**2**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**3**

1– Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 2.1.1, 3.1.1, 4.1.1
CO2	1.1.1, 1.2.1, 2.1.1, 2.2.1, 3.1.1, 3.3.1, 3.3.2, 3.4.1
CO3	1.1.1, 1.2.1, 2.1.1, 2.2.1, 3.1.1, 3.3.1, 3.3.2, 3.4.1
CO4	1.1.1, 1.2.1, 2.1.1, 2.2.1, 3.1.1, 3.3.1, 3.3.2, 3.4.1
CO5	1.1.1, 1.2.1, 2.1.1, 2.2.1, 3.1.1, 3.3.1, 3.3.2, 3.4.1

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Assignment 1	30	20	40	5	5	-	100
Assignment 2	30	20	30	10	5	5	100
Other mode of internal assessments, if any	-	-	-	-	-	-	-
ESE	30	30	40	-	-	-	100

22SPC620	COMPILER DESIGN LABORATORY	SEMESTER VI

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	0	0	3	1.5

Course Objectives	The objective of this course is to make the students familiar with tools for compiler writing, Implement various parsing techniques, Intermediate code generation, and generate optimized machine code

LIST OF EXPERIMENTS

1. Implementation of Symbol Table
2. Design a lexical analyzer for the given language. The lexical analyzer should ignore redundant spaces, tabs and new lines, comments etc.
3. Implement NFAs that recognize identifiers, constants, and operators of the mini language.
4. Implementation of Lexical Analyzer using Lex Tool.
5. Generate YACC specification for a few syntactic categories.

a) Program to recognize a valid arithmetic expression that uses operators +, - , * and /.

b) Program to recognize a valid variable which starts with a letter followed by any number of letters or digits.

c) Evaluate an arithmetic expression with parentheses, unary and binary operators using Flex and Yacc (CALCULATOR)

6. Create LL(1) parse table for a given CFG and Simulate LL(1) Parsing.
7. Implementation of LR Parsers using YACC
8. Convert the BNF rules into Yacc form and write code to generate abstract syntax tree.
9. Generate three address code for a simple program using LEX and YACC.
10. Stack and heap management at run time.
11. Implement simple code optimization techniques (Constant folding, Strength reduction and Algebraic transformation)
12. Construction of flow graph from list of three address statements.
13. Implement the back end of the compiler which takes the three address code and produces the 8086 assembly language instructions that can be assembled and run using a 8086 assembler. The target assembly instructions can be simple move, add, sub, jump. Also simple addressing modes are used.

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Design a Lexical Analyzer using Lex and languages	K3
CO2	Develop parser for the given CFG grammar	K3
CO3	Implement the intermediate code generator for the specified intermediate language	K3
CO4	Generate an assembly language program for the given source language program	K4
CO5	Implement a simple code optimization and storage organization techniques	K3

COURSE ARTICULATION MATRIX :

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	3	3	2	2	-	-	-	-	-	-	1	3	1	1
CO2	1	3	3	2	2	-	-	-	-	-	-	1	3	1	2
CO3	1	3	2	2	2	-	-	-	-	-	-	1	3	1	2
CO4	1	3	2	3	2	-	-	-	-	-	-	1	3	1	2
CO5	1	3	3	2	2	-	-	-	-	-	-	1	3	1	2
22SPC620	1	3	3	2	2	-	-	-	-	-	-	1	3	1	2
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping

CO1	1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1,2.2.2,2.2.3,2.2.4, 2,3,1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.6, 3.2.1,3.2.2,3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.3,4.2.1, 4.3.1, 4.3.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 12.1.1, 12.1.2
CO2	1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1,2.2.2,2.2.3,2.2.4, 2,3,1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.6, 3.2.1,3.2.2,3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.3,4.2.1, 4.3.1, 4.3.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2,12.1.1, 12.1.2
CO3	1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1,2.2.2,2.2.3,2.2.4, 2,3,1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.6, 3.2.1,3.2.2,3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.3,4.2.1, 4.3.1, 4.3.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 12.1.1
CO4	1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1,2.2.2,2.2.3,2.2.4, 2,3,1, 2.4.2, 2.4.4, 3.1.1, 3.1.6, 3.2.1,3.2.2,3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.3,4.2.1, 4.3.1, 4.3.2,4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 12.1.1, 12.1.2
CO5	1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1,2.2.2,2.2.3,2.2.4, 2,3,1, 2.4.2, 2.4.4, 3.1.1, 3.1.3, 3.1.6, 3.2.1,3.2.2,3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.3,4.2.1, 4.3.1, 4.3.2,4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 12.1.1, 12.1.2

22SES612	DESIGN THINKING FOR COMPUTER SCIENCE AND ENGINEERING	SEMESTER VI

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	0	0	3	1.5

Course Objectives	The objective of this course is to make the students to foster creativity, empathy and problem-solving skills using combined elements of lateral and design thinking
	LATERAL THINKING
I	**Introduction to Lateral Thinking** Overview of lateral thinking concepts and principles Introduction to Six Thinking Hats methodology Divide students into groups and assign each group a different "thinking hat". Have them analyze a problem or idea from the perspective of their assigned hat to gain diverse insights.
II	**Creative Problem-Solving Exercises** Alternative Uses exercise: Brainstorming Unconventional Ideas Provide students with a common object (e.g., paperclip, a shoe) and challenge them to brainstorm as many alternative uses for it as possible. Encourage them to think creatively and explore unconventional ideas. Reverse Thinking: Flipping Assumptions and Exploring opposite solutions Flip the problem statement and ask students to brainstorm solutions that achieve the opposite outcome. Storytelling with constraints: Creating Narratives with limitations Random word association: Making connections and Associations Select a random word and ask students to brainstorm associations, ideas or solutions related to that word. Encourage them to make unexpected connections and explore new possibilities. Role reversal: Viewing problems from different perspectives
III	**Case Studies** 8) Analyzing real world applications of lateral thinking
	DESIGN THINKING
	Introduction to Design Thinking 1) Overview of design thinking principles and process 2) Understanding User-Centered Design and Empathy Have students create empathy maps for a specific user persona by identifying what the user sees, hears, thinks, feels, and does. This exercise helps students empathize with users and understand their needs and preferences.
I.	**Empathize and Define** 3) Creating Empathy Maps and User Personas 4) Problem Framing Workshop: Defining Design Challenges Guide students through a problem framing workshop where they define design challenges from different perspectives. Encourage them to reframe problems using "How Might We" statements to encourage ideation 5) Synthesis and Insights: Analyzing user data and identifying patterns
II.	**Ideate and Prototype** 6) Rapid Prototyping: Turning ideas into tangible solutions Challenge students to rapidly prototype solutions to a design challenge using low-fidelity materials (e.g., paper, cardboard). Encourage them to iterate quickly and test their prototypes with users for feedback 7) Design Sprints: Accelerated Prototyping and Testing Lead students through a design sprint process where they ideate, prototype, and test solutions to a specific problem within a constrained timeframe (e.g., one week). Encourage them to iterate quickly and learn from user feedback. 8) Iterative Design: Feedback loops and Iteration cycles 9) Low-fidelity and High-fidelity prototypes: tools and techniques

III.	**Test and Iterate** 10) Usability testing: Gathering Feedback from Users 11) Iterative Testing and Refinement

Contact Periods:
Lecture: 0 Periods **Tutorial: 0 Periods** **Practical: 45 Periods** **Total: 45 Periods**

TEXTBOOK

1	*Edward de Bono,* ***"Lateral Thinking: A Textbook of Creativity"****, Penguin Life, 2016*
2	*Tim Brown,* ***"Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation"****, Harper Business, Revised and Updated Edition, 2019*

REFERENCES

1	*Paul Sloane,* ***"Lateral Thinking for Every day – Extraordinary solutions to ordinary problems"****, KoganPage, 2023*
2	*Karl T Ulrich,* ***"Design: Creation of artifacts in Society"****, University of Pennsylvania, 2011*
3	*NPTEL Course:* ***"Design Thinking – A Primer"*** *https://onlinecourses.nptel.ac.in/noc22_mg32/preview*
4	*Coursera:* ***"Design Thinking Specialization"****, Univesity of Virginia* *https://www.coursera.org/specializations/uva-darden-design-thinking*
5	*https://www.udemy.com/course/master-lateral-thinking*

COURSEOUTCOMES: Upon completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Understand the concepts and principles of lateral and design thinking	K2
CO2	Apply reverse thinking, storytelling, role reversal techniques in design process	K3
CO3	Identify stakeholder's requirements for a project	K3
CO4	Develop prototypes of multiple concepts using user's feedback	K4
CO5	Evaluate and select the best design solution among the potential solutions with its functional decomposition	K5

COURSE ARTICULATION MATRIX:

a)CO and PO Mapping

COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	3	3	3	1	2	2	-	3	3	-	3	-	3	3
CO2	1	3	3	3	1	2	2	-	3	3	-	3	-	3	3
CO3	1	3	3	3	1	2	2	-	3	3	-	3	-	3	3
CO4	1	3	3	3	1	2	2	-	3	3	-	3	-	3	3
CO5	1	3	3	3	1	2	2	-	3	3	-	3	-	3	3
22SES612	**1**	**3**	**3**	**3**	**1**	**2**	**2**	**-**	**3**	**3**	**-**	**3**	**-**	**3**	**3**

1–Slight, 2 –Moderate,3–Substantial

b)CO and Key Performance Indicators Mapping

CO1	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 4.1.1, 4.1.2, 4.2.1, 5.1.1, 5.1.2, 5.2.1, 6.1.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2

CO2	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 4.1.1, 4.1.2, 4.2.1, 5.1.1, 5.1.2, 5.2.1, 6.1.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO3	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 4.1.1, 4.1.2, 4.2.1, 5.1.1, 5.1.2, 5.2.1, 6.1.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO4	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 4.1.1, 4.1.2, 4.2.1, 5.1.1, 5.1.2, 5.2.1, 6.1.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO5	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 4.1.1, 4.1.2, 4.2.1, 5.1.1, 5.1.2, 5.2.1, 6.1.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2

22SEE602	MACHINE LEARNING LABORATORY	SEMESTER VI

PREREQUISITES	CATEGORY	L	T	P	C
NIL	EEC	0	0	3	1.5

Course Objectives	The objective of this course is to make the students familiar with implementation of machine learning algorithms in real time problem for getting solutions, implementation of supervised/unsupervised learning and their applications, theoretical and practical aspects of probabilistic graphical models

LIST OF EXPERIMENTS

1. Study of Python fundamentals, dictionaries, tuples, functions and looping constructs.

2. Study of object oriented programming concepts, generators, file I/O and regular expression.

3. Study and explain how to create and import various modules and packages.

4. Implement the concept of decision trees with suitable data set from real world problem and classify the data set to produce new sample.

5. Detecting Spam mails using Support vector machine.

6. Implement facial recognition application with artificial neural network.

7. Study and implement amazon toolkit: Sagemaker.

8. Implement character recognition using Multilayer Perceptron.

9. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

10. Implement sentiment analysis using random forest optimization algorithm

11. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.

12. Design and implement the Hidden Markov Models.

13. Design and implement the Clustering algorithm.

Contact Periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Design Java/Python programs for various Learning algorithms	K3
CO2	Apply appropriate Machine Learning algorithms to data sets	K5
CO3	Design Machine Learning algorithms to solve real world problems.	K6
CO4	Analyse and suggest the appropriate machine learning approach for the various types of problem	K6
CO5	Make modifications to existing machine learning algorithms to suit an individual application	K6

COURSE ARTICULATION MATRIX															
a) CO and PO Mapping															
COs/ Pos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	3	3	3	-	-	1	-	-	-	-	2	1	3
CO2	2	2	3	3	3	-	-	1	-	-	-	-	2	1	3
CO3	2	2	3	3	3	-	-	1	-	-	-	-	2	1	3
CO4	2	2	3	3	3	-	-	1	-	-	-	-	2	1	3
CO5	2	2	3	3	3	-	-	1	-	-	-	-	2	1	3
22SEE603	2	2	3	3	3	-	-	1	-	-	-	-	2	1	3
1– Slight, 2 – Moderate, 3 – Substantial															
b) CO and Key Performance Indicators Mapping															
CO1	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 3.2.1, 4.1.1, 4.2.1, 4.3.2, 5.1.1, 5.2.1, 5.2.2, 8.1.1														
CO2	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 3.2.1, 4.1.1, 4.2.1, 4.3.2, 5.1.1, 5.2.1, 5.2.2, 8.1.1														
CO3	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 3.2.1, 4.1.1, 4.2.1, 4.3.2, 5.1.1, 5.2.1, 5.2.2, 8.1.1														
CO4	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 3.2.1, 4.1.1, 4.2.1, 4.3.2, 5.1.1, 5.2.1, 5.2.2, 8.1.1														
CO5	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 3.2.1, 4.1.1, 4.2.1, 4.3.2, 5.1.1, 5.2.1, 5.2.2, 8.1.1														

22SPC721	DIGITAL IMAGE PROCESSING	SEMESTER VII

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	The objective of the course is to learn and understand basic image processing steps, image enhancement techniques, image restoration, segmentation, morphology, image compression and recognition methods.	
UNIT – I	**FUNDAMENTALS OF IMAGE PROCESSING**	**9 Periods**
Introduction – Applications of Image Processing – Steps in Image Processing Applications – Components – Elements of Visual Perception - Digital Imaging System – Sampling and Quantization – Relationships between pixels: Pixel Connectivity, Distance Measures – Color Fundamentals and Models: RGB, HSI models – File Formats – Image Operations.		
UNIT – II	**IMAGE ENHANCEMENT**	**9 Periods**
Image Transforms: Discrete Fourier Transform – Fast Fourier Transform – Discrete Cosine Transform – Hoteling Transform – Image Enhancement in Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering – Image Enhancement in Frequency Domain: Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering		
UNIT – III	**IMAGE RESTORATION**	**9 Periods**
Image Restoration – degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering.		
UNIT – IV	**IMAGE SEGMENTATION AND MORPHOLOGY**	**9 Periods**
Image Segmentation – Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging - Watershed segmentation algorithm - Binary and Gray level morphology operations – Erosion, Dilation, Opening and Closing Operations		
UNIT – V	**IMAGE COMPRESSION AND RECOGNITION**	**9 Periods**
Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK :

1	*Rafael Gonzalez, Richard E. Woods,* ***"Digital Image Processing",*** *Fourth Edition, Pearson Education, 2018.*

REFERENCES

1	*Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,* ***"Digital Image Processing using MATLAB",*** *Third Edition,Pearson Education, Inc., 2020.*
2	*Anil K. Jain,* ***"Fundamentals of Digital Image Processing",*** *PHI, 2011.*
3	*Milan Sonka, Vaclav Hlavac, Roger Boyle,* ***"Image Processing, Analysis and Machine Vision"****, Fourth Edition, Cengage Learning, 2014*
4	*Kenneth R. Castleman,* ***'Digital Image Processing',*** *Pearson, 2007.*
5	*S. Sridhar,* ***"Digital Image Processing",*** *Second Edition, Oxford University Press, 2016.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Process digital images using fundamental steps of image processing and simple arithmetic, logical operations	K2
CO2	Apply image transform techniques and enhance the images by using the smoothing, sharpening in spatial and frequency domain	K3
CO3	Identify the degradation model and restore the image using spatial filtering.	K4
CO4	Critically analyze different approaches to image segmentation and learn the basic morphological operations.	K4
CO5	Apply lossy and lossless image compression techniques for digital images and recognize an object using shape and texture measures	K3

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	1	1	1	-	-	-	-	-	-	1	3	1	1
CO2	2	2	2	2	1	-	-	-	-	-	-	1	3	2	2
CO3	2	3	2	2	2	-	-	-	-	-	-	1	3	2	1
CO4	2	3	2	2	2	-	-	-	-	-	-	2	3	2	2
CO5	2	3	3	2	2	-	-	-	-	-	-	2	3	2	2
22SPC721	**2**	**3**	**2**	**2**	**2**	**-**	**-**	-	-	-	**-**	**1**	**3**	**2**	**2**
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.3, 2,3,1, 3.1.1, 3.1.3, 3.4.1, 4.1.3, 4.2.1, 5.1.1, 5.2.1, 12.1.1
CO2	1.1.1, 1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.3, 2.2.4, 2,3,1, 2.4.1, 2.4.2, 3.1.1, 3.1.3, 3.1.6, 3.3.1, 3.4.1, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 5.1.1, 5.2.1, 12.1.1, 12.1.2
CO3	1.1.1, 1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1, 2.2.3, 2.2.4, 2,3,1, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.6, 3.2.2, 3.3.1, 3.4.1, 4.1.1, 4.1.3, 4.2.1, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 12.1.1, 12.1.2
CO4	1.1.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.2.4, 2,3,1, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.6, 3.2.2, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.3, 4.2.1, 4.3.1, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 12.1.1, 12.1.2, 12.2.2
CO5	1.1.1, 1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.2.4, 2,3,1, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.6, 3.2.2, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.3, 4.2.1, 4.3.1, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 12.1.1, 12.1.2, 12.2.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	10	30	40	20	-	-	100
CAT2	-	20	40	40	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	50	50		-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	40	40	20	-	100
ESE	20	20	30	30	-	-	100

22SPC722	CLOUD ESSENTIALS	SEMESTER VII

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	The objective of this course is to make the students to understand about cloud computing concepts, models, cloud enabling technologies, cloud infrastructure mechanisms, fundamental cloud security and its mechanisms and use recent cloud platforms.	
UNIT – I	**INTRODUCTION**	**9 Periods**
Understanding Cloud Computing: Definition, Origin and Influences, Basic Concepts, Goals and Benefits, Risks and Challenges – Fundamental Concepts and Models: Roles and Boundaries – Cloud Characteristics – Cloud Delivery Models – Cloud Deployment Models		
UNIT – II	**VIRTUALIZATION**	**9 Periods**
Basics of virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – tools and Mechanisms – Virtualization of CPU, Memory, I/O Devices – Virtual clusters and resource management – Virtualization for data –center Automation.		
UNIT – III	**CLOUD INFRASTRUCTURE MECHANISMS**	**9 Periods**
Logical Network Perimeter -Virtual Server - Cloud Storage Device - Cloud Usage Monitor - Resource Replication - Ready-Made Environment – Containers: Introduction, Understanding Containerization –Containers vs Virtual Machines - Case Study on Docker : A leading Container Platform, Working with Docker Containers, Container Images and Registries, Docker Networking and Volumes, Docker Compose, Best Practices for Containers		
UNIT – IV	**FUNDAMENTAL CLOUD SECURITY AND SECURITY MECHANISMS**	**9 Periods**
Basic Terms and Concepts - Threat Agents - Cloud Security Threats – Cloud Security Mechanisms: Encryption, Hashing, Digital Signature, Public Key Infrastructure (PKI), Identity and Access Management (IAM), Single Sign-On (SSO), Cloud-Based Security Groups, Hardened Virtual Server Images		
UNIT – V	**CLOUD PLATFORMS**	**9 Periods**
Introduction to Google Cloud Platform (GCP): Overview and History, GCP Services and Products, GCP Architecture - GCP Core Services - Introduction to Azure (Microsoft): Overview and History, Azure Services and Products, Azure Architecture- Comparison: Azure vs. GCP: Service Offerings, Performance and Scalability, Pricing and Cost Management, Security and Compliance		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

***Not for Evaluation**

GCP:

- Setting Up Accounts and Access
- Creating Virtual Machines (VMs)
- Storage Services
- Database Services
- Deploying Applications
- Monitoring and Management
- Compute Services (Data Proc, Data Flow)

TEXT BOOKS:

1	*Thomas Erl, Ricardo Puttini, and Zaigham Mahmood* ***,"Cloud Computing: Concepts, Technology & Architecture"*** *, Pearson, 2013 (Unit-I, III, IV)*
2	*Kai Hwang, Geoffrey C Fox, Jack G Dongarra,* ***"Distributed and Cloud Computing, From Parallel Processing to the Internet of Things"****, Morgan Kaufmann Publishers, 2012 (Unit-II)*
3	*Jonah Carrio Andersson* ***,"Learning Microsoft Azure",*** *O'Reilly Media, Inc,2023 (Unit-V)*
4	*Praveen Kukreti,* ***"Google Cloud Platform All-In-One Guide: Get Familiar with a Portfolio of Cloud-based Services in GCP",*** *BPB Publications, 2023 (Unit-V)*

REFERENCES:

1	*Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi* ***"Mastering Cloud Computing Foundations and Applications Programming"****, 2013.*
2	*Tim Mather, Subra Kumaraswamy, Shahed Latif,* ***"Cloud Security & Privacy"*** *O'Reilly Media, September 2009.*
3	*James Turnbull,* ***" The Docker Book"****, OReilly Publishers, 2014*
4	*Docker Documentation - https://docs.docker.com/*
5	*https://www.javatpoint.com/google-cloud-platform*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explain the cloud computing concepts and models.	K2
CO2	Understand Virtualization Technology and apply them in real world scenarios.	K3
CO3	Understand the infrastructure mechanisms of cloud computing and use containers for cloud applications.	K3
CO4	Apply security mechanisms to counter common threats.	K3
CO5	Analyze and propose a suitable cloud solution using GCP and Azure.	K4

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	-	-	-	-		-	-	-	-	1	1	1	1
CO2	2	2	1	-	2	-	2	-	-	-	-	2	2	2	1
CO3	2	2	1	-	-	-	-	-	-	-	-	2	1	1	1
CO4	2	2	1	-	-	2	-	2	-	-	-	2	1	1	1
CO5	2	2	3	-	2	2	-	-	2	-	2	2	3	3	3
22SPC722	**2**	**2**	**1**	**-**	**1**	**1**	-	-	**-**	-	**1**	**2**	**3**	**2**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2, 12.1.1,12.1.2,12.2.1,12.2.2,12.3.1,12.3.2
CO2	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2, 5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,7.1.1,7.1.2,7.2.1,7.2.2, 12.1.1,12.1.2,12.2.1,12.2.2,12.3.1,12.3.2
CO3	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2, 3.1.1,3.1.2, 12.1.1,12.1.2,12.2.1,12.2.2,12.3.1,12.3.2
CO4	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2, 3.1.1,3.1.2,6.1.1,8.1.1,8.2.1,8.2.2, 12.1.1,12.1.2,12.2.1,12.2.2,12.3.1,12.3.2
CO5	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2, 2.4.1,2.4.2,2.4.3,2.4.4, 3.1.1,3.1.2,3.1.3,3.1.4,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.4.1,3.4.2,5.1.1,5.1.2, 5.2.1,5.2.2,5.3.1,5.3.2,9.1.1,9.1.2,9.2.1,9.2.2,9.2.3,9.2.4,9.3.1,11.1.1,11.1.2,11.2.1,11.3.1,11.3.2, 12.1.1,12.1.2,12.2.1,12.2.2,12.3.1,12.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	40	40	-	-		100
CAT2	20	30	30	20	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	20	40	40	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	20	30	30	20	-	-	100
ESE	20	30	40	10	-	-	100

22SEE703	INTEGRATED BUSINESS DATA SOLUTIONS LABORATORY	SEMESTER VII

PREREQUISITES	CATEGORY	L	T	P	C
NIL	EEC	0	0	4	2

Course Objectives	Provide hands-on experience in designing, implementing, and managing integrated business data solutions.
	Big Data
1.	Analyze any real-world dataset from a specific domain (e.g., healthcare, finance, e-commerce) using big data technologies to derive actionable insights. Design and implement a big data solution to address a specific business challenge or problem faced by an organization.
	Data warehousing
2.	Create a star schema for retail sales data warehouse. Design dimension tables for products, customers, time, and geography, along with a fact table for sales transactions
3.	Develop an ETL process using SQL scripts to extract data from a source system (e.g., transactional database), transform it (e.g., aggregate, cleanse, join), and load it into a data warehouse. Perform data quality checks on the incoming data to identify and handle issues such as missing values, duplicates, and inconsistencies. Write SQL queries to retrieve information from the data warehouse, such as total sales revenue by product category, customer demographics, or sales trends over time.
	Hadoop
4.	Implement a Hadoop MapReduce program to count the frequency of words in a large text corpus.
	Maven
5.	Build automation and project management using maven plugin
	Hive
6.	Create Hive tables with various data types (primitive, collection, array, struct, map). Use Hive commands to load data from local files, HDFS, or other databases into Hive tables
7.	Write queries to perform basic data retrieval, filtering, aggregation, sorting, and joining operations using HiveQL. Partition tables based on date, region, or other relevant columns, and bucket tables to optimize data retrieval and join operations
	Scala
8.	Create and manipulate lists, sets, and maps. Write pure functions, use immutability, and apply concepts like map, filter, fold, and recursion.
9.	Define Classes with abstract methods and concrete implementations and mix traits.
	Spark
10.	Read stock market data into a DataFrame, use window functions to calculate the moving average price for each stock, and display the results.
11.	Train a machine learning model to predict customer churn using historical customer data using MLlib.
	GitHub
12.	Set Up GitHub Account and initialize a Git repository locally. Create a new branch and switch between branches. Make changes to files in different branches. Review and merge pull requests. Integrate Git with desktop client.
	CI/CD
13.	Create a basic CI/CD pipeline for a sample application. Set up a version control repository (e.g., GitHub), configure a CI tool (e.g., Jenkins, GitLab CI), define stages for building, testing, and deploying the application, and trigger the pipeline on code commits.

14.	Dockerize the application and deploy it using containers Write a Dockerfile to package the application into a container, set up a container registry (e.g., Docker Hub, Amazon ECR), and deploy the containerized application to a container orchestration platform (e.g., Kubernetes, Docker Swarm) using the CI/CD pipeline.
15.	Set up monitoring and logging for the deployed application. Configure monitoring tools (e.g., Prometheus, Grafana) to collect metrics and visualize performance data, set up centralized logging (e.g., ELK stack, Fluentd) to aggregate logs from different components, and integrate monitoring and logging into the CI/CD pipeline for proactive issue detection and troubleshooting.
Contact Periods: **Lecture: 0 Periods** **Tutorial: 0 Periods** **Practical: 60 Periods** **Total: 60 Periods**	

COURSEOUTCOMES: Upon completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Design and implement end-to-end big data solutions	K4
CO2	Extract data from various sources, transform it to a common format, and load it into a target database or data warehouse	K3
CO3	Understand the interaction between Spark, Scala, Hive, and other Hadoop ecosystem components.	K2
CO4	Implement various Apache Spark transformations and actions for data processing, analytics, and machine learning	K3
CO5	Develop data pipelines for data ingestion, processing, analysis, and visualization	K4

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3	2	2	2	-	1	-	3	2	3	2	2	3	2
CO2	2	3	2	2	2	-	1	-	3	2	3	2	2	3	2
CO3	2	3	2	2	2	-	1	-	3	2	3	2	2	3	2
CO4	2	3	2	2	2	-	1	-	3	2	3	2	2	3	2
CO5	2	3	2	2	2	-	1	-	3	2	3	2	2	3	2
22SEE703	**2**	**3**	**2**	**2**	**2**	**-**	**1**	**-**	**3**	**2**	**3**	**2**	**2**	**3**	**2**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.4.2,2.4.3,3.1.1,3.1.5,3.1.6,3.2.1,3.4.2,4.1.2,4.2.1,4.2.2, 4.3.1,5.1.1,5.1.2,5.2.1,5.2.2,7.1.1,9.1.1,9.1.2,9.2.1,9.2.4,9.3.1,10.1.2,10.1.3,10.3.1,11.1.1,11.2.1,11.3.1,11.3.2,12. 1.1,12.1.2,12.3.2
CO2	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4, 2.4,2,2.4.3,2.4.4,3.1.1,3.1.6,3.2.1,3.2.3,3.3.2,4.1.1,4.1.4,4.2.1, 4.2.2,4.3.4,5.1.2,5.1.1,5.2.1,7.1.2,9.1.1,9.1.2,9.2.1,9.2.4,9.3.1,10.1.3,10.2.1,10.3.2,11.1.2,11.2.1,11.3.1,11.3.2,12. 1.1,12.1.2,12.2.2
CO3	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.2,2.4.3,3.1.1,3.2.2,3.2.3,3.3.2,3.4.1,4.1.2,4.2.1,4.2.2, 4.3.1,4.3.4,5.1.1,5.1.2,5.2.1, 7.1.2,9.1.1,9.1.2,9.2.1, 9.2.4,9.3.1, 10.2.1,10.2.2,10.3.2, 11.1.2,11.2.1,11.3.1,11.3.2, 12.1.1,12.1.2,12.2.2
CO4	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.2,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.2,4.1.2,4.1.3, 4.2.1,4.3.1,4.3.4, 5.1.1,5.2.1,5.3.1,5.3.2, 7.2.2,9.1.1,9.1.2,9.2.1, 9.2.4,9.3.1, 10.1.3, 10.2.1,10.3.1, 11.1.2,11.2.1,11.3.1,11.3.2, 12.1.1, 12.1.2, 12.2.2
CO5	1.3.1,1.4.1, 2.1.1,2.1.2, 2.1.3,2.2.1,2.2.2,2.2.3, 2.2.4,2.3.1,2.3.2, 2.4.3, 3.1.1,3.1.5,3.2.1,3.2.2,3.3.1,3.3.2,3.4.2, 4.1.1,4.1.2,4.2.1,4.2.2,4.3.4, 5.1.1,5.2.1,5.3.1,5.3.2, 7.1.2,9.1.1,9.1.2,9.2.4,9.2.1,9.3.1,10.1.3, 10.2.2,10.3.2, 11.1.2,11.2.1,11.3.1,11.3.2, 12.1.1,12.1.2,12.2.2

22SEE704	ENGINEERING PROJECT IN COMMUNITY SERVICE	SEMESTER VII

PREREQUISITES	CATEGORY	L	T	P	C
NIL	EEC	0	0	4	2

Course Objectives	To provide an environment where teams of students can exercise their engineering skills by being exposed to realistic systems and customers and at the same time helping their community.

Problem identification – Identifying the issues within the community -Preliminary survey - Preparing a questionnaire, formats and survey forms. - A preliminary survey including the socio-economic conditions of the allotted habitation - Different types of surveys, tools and techniques for collecting the information. - Analysis of collected data and mapping of issues with the solutions available. - Based on the survey and the specific requirements of the habitation, Community Awareness Campaigns – Identifying the factors – Normalization of factors and finding the path way for problem solution – Selection of problem from the community and mapping of issues - Planning for working: Aim, objective and scope, time line - Application of engineering knowledge and tools for solutions

Validation of the solution by supervising the execution of solution - Measuring the attainment of the solution: Feedback from community

Contact Periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 60 Periods Total: 60 Periods

COURSE OUTCOMES: Upon Completion of the course, the students will able to:		**Bloom's Taxonomy Mapped**
CO1	Identify engineering related problems in the community.	K2
CO2	Analyze and Design different solutions to solve the problems of community.	K4
CO3	Apply economical solution to those problems in the field.	K4
CO4	To understand complexity and ambiguity	K1
CO5	Connections with professionals and community members for learning and career opportunities	K2

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	2	2	-	1	2	1	-	2	-	1	-	1	1	1
CO2	-	2	2	-	1	2	1	-	2	-	1	-	1	1	1
CO3	-	2	2	-	1	2	1	-	2	-	1	-	1	1	1
CO4	-	2	2	-	1	2	1	-	2	2	1	-	1	1	1
CO5	-	2	2	-	1	2	1	-	2	2	1	-	1	1	1
22SEE704	**-**	**2**	**2**	**-**	**1**	**2**	**1**	**-**	**2**	**1**	**1**	**-**	**1**	**1**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

22SEE805	CAPSTONE PROJECT	SEMESTER VIII

PREREQUISITES	CATEGORY	L	T	P	C
NIL	EEC	0	0	16	8

Course Objectives	The objective of this course is to develop skills of students to formulate a complex engineering problem with an awareness of issues pertaining to society, health, safety, legal, environment, culture and examine the impact of the proposed solution on these issues by exploring the students to use of new tools, algorithms and techniques required to carry out the projects, which helps them to gain experience in organization and implementation of a project.

Contact Periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 240 Periods Total: 240 Periods

COURSE OUTCOMES: Upon Completion of the course, the students will able to:		**Bloom's Taxonomy Mapped**
CO1	Formulate complex engineering problems for the current need of the society with reasonable assumptions and constraints.	K3
CO2	Perform exhaustive literature survey on identified problem	K3
CO3	Able to design and develop solution to the problem by selecting appropriate tools and technologies for implementation.	K6
CO4	Able to work as an individual or team to implement and execute the project inorder to manage time and complexity.	K4
CO5	Able to write effective technical report and demonstrate through presentation.	K6

COURSEARTICULATIONMATRIX:

a)CO and PO Mapping

COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	3	3	3	3	-	-	3	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3	-	-	3
CO4	3	3	-	-	-	-	-	-	3	-	-	3	-	2	2
CO5	3	3	-	-	-	-	-	-	-	3	3	3	-	-	3
22SEE805	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**2**	**2**	**2**	**3**	**2**	**2**	**2**

1–Slight, 2 –Moderate,3–Substantial

b)CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1
CO2	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 6.2.1, 12.1.2, 12.2.1, 12.2.2
CO3	1.1.1, 1.1.2, 1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 6.2.1, 12.1.2, 12.2.1, 12.2.2
CO4	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 12.1.2, 12.2.1, 12.2.2
CO5	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 12.1.2, 12.2.1, 12.2.2

22SPE$01	KNOWLEDGE REPRESENTATION

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The objective of this course is to familiarize students with the fundamentals of knowledge representation, including classical logic, propositional and predicate logic, inheritable knowledge, non-monotonic logic, and practical applications.	
UNIT – I	**INTRODUCTION TO KNOWLEDGE REPRESENTATION**	**9 Periods**
knowledge representation and classical logic - syntax, semantics and natural deduction - automated theorem proving - suitability of logic for knowledge representation - satisfiability solvers - SAT solver technology—complete methods - incomplete methods -beyond SAT: quantified Boolean formulas and model counting – approaches to knowledge representation –issues in knowledge representation.		
UNIT – II	**PROPOSITIONAL AND PREDICATE LOGIC**	**9 Periods**
propositional logic - syntax and semantics -natural deduction - direct proofs - tableau method - first order logic - syntax and semantics - resolution refutation - unification algorithm - horn clauses and logic programming - PROLOG		
UNIT – III	**REPRESENTATION OF INHERITABLE KNOWLEDGE**	**9 Periods**
semantic nets – frames – conceptual dependency –scripts –CYC – description logic and its extensions - DLs and predicate logic - tableau based reasoning techniques - other reasoning technique - DLs in ontology language applications –language independent representation		
UNIT – IV	**NON MONOTONIC LOGIC**	**9 Periods**
non monotonic logic – types - default logic – auto epistemic logic - circumscription –preliminaries - computational properties - non monotonic inference relations - semantic specification of inference relations - relating default and auto epistemic logics - relating default logic and circumscription – other non-monotonic logics		
UNIT – V	**KNOWLEDGE REPRESENTATION IN APPLICATIONS**	**9 Periods**
ontological engineering – categories and objects - events - mental events and mental objects – reasoning systems for categories – reasoning with default information- internet shopping world- knowledge representation and question answering - the semantic web: webizing knowledge representation		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*Frank van Harmelen, Vladimir Lifschitz, Bruce Porter "**Handbook of Knowledge Representation**" ,1st edition , ELSEVIER ,2007*
2	*Elaine Rich,Kevin Knight,Shivashankar B. Nair, "**Artificial Intelligence**", 3rd edition, Tata McGraw Hill, 2009*

REFERENCES :

1	*Russell and Norvig, "**Artificial Intelligence, A Modern Approach**", 3rd edition, Pearson Prentice Hall,2010*
2	*Ronald J. Brachman, Hector J. Levesque, "**Knowledge Representation and Reasoning**", Morgan Kaufmann, 2004*
3	*Deepak Khemani. "**A First Course in Artificial Intelligence"**, McGraw Hill Education" 2013.*
4	*NPTEL Course: "**Artificial Intelligence: Knowledge Representation And Reasoning"*** https://onlinecourses.nptel.ac.in/noc23_cs09/course

	COURSE OUTCOMES: Upon completion of the course, the students will be able to:	Bloom's Taxonomy Mapped
CO1	Articulate the basics of knowledge representation and their methodology**.**	K2
CO2	Apply propositional and predicate logic to represent knowledge required to explain the given scenario and create knowledge required base using PROLOG	K4
CO3	Use semantic nets, frames, conceptual dependency, scripts , CYC to express inheritable knowledge and description logic	K3
CO4	Identify the required non monotonic logic for the given scenario	K3
CO5	Identify suitable knowledge representation and create knowledge base for simple applications**.**	K4

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CO1	2	2	2	3	2	-	-	-	-	1	-	-	1	2	2
CO2	2	2	2	3	2	-	-	-	-	1	-	-	-	2	3
CO3	2	2	2	3	2	-	-	-	-	1	-	-	1	2	3
CO4	2	2	2	3	2	-	-	-	-	1	-	-	1	2	3
CO5	2	2	2	3	2	-	-	-	-	1	-	1	1	2	3
22SPE$01	**2**	**2**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**1**	**2**	**3**

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1,1.3.1,1.4.1,2.1.1,2.1.3,2.2.2,2.2.3,2.4.2,2.4.3,3.1.1,3.1.5,3.2.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.3.1,4.3.2,4.3.3,4.3.4,5.1.2,5.2.1,5.3.1,5.3.2,10.1.1,10.1.2
CO2	1.1.1,1.3.1,1.4.1,2.1.1,2.1.3,2.2.2,2.2.3,2.4.2,2.4.3,3.1.1,3.1.5,3.2.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.3.1,4.3.2,4.3.3,4.3.4,5.1.2,5.2.1,5.3.1,5.3.2,10.1.1,10.1.2
CO3	1.1.1,1.3.1,1.4.1,2.1.1,2.1.3,2.2.2,2.2.3,2.4.2,2.4.3,3.1.1,3.1.5,3.2.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.3.1,4.3.2,4.3.3,4.3.4,5.1.2,5.2.1,5.3.1,5.3.2,10.1.1,10.1.2
CO4	1.1.1,1.3.1,1.4.1,2.1.1,2.1.3,2.2.2,2.2.3,2.4.3,3.1.1,3.1.5,3.2.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.3.1,4.3.2,4.3.3,4.3.4,5.1.2,5.2.1,5.3.1,5.3.2,10.1.1,10.1.2
CO5	1.1.1,1.3.1,1.4.1,2.1.1,2.1.3,2.2.2,2.2.3,2.4.2,2.4.3,3.1.1,3.1.5,3.2.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.3.1,4.3.2,4.3.3,4.3.4,5.1.2,5.2.1,5.3.1,5.3.2,10.1.1,10.1.2,12.1.1,12.2.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	Remembering (K1)%	Understanding (K2) %	Applying (K3)%	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	30	40	30	-	-	100
CAT2	10	30	40	20	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	70	30	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	50	50	-	-	100
ESE	-	30	40	30	-	-	100

22SPE$02	ETHICS AND AI *(Common to CSE $ IT)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The objective of the course is to understand the need for ensuring ethics in Artificial Intelligence and to overcome the risk for human rights and other fundamental values.	
UNIT – I	**INTRODUCTION**	**9 Periods**
Role of Artificial Intelligence in human life – Understanding Ethics – Need for Ethics in Artificial Intelligence – Ethical considerations of AI – Current initiatives of Ethics in AI – Ethical issues and artificial entities.		
UNIT – II	**FRAMEWORKS AND MODELS**	**9 Periods**
AI Governance by human rights – Incompatible initiatives of private sector AI – Normative Models – Codes and Standards – The role of professional norms in the governance of Artificial Intelligence.		
UNIT – III	**CONCEPTS AND ISSUES**	**9 Periods**
Accountability in Computing Systems – Transparency – Responsibility an AI – Ethical analysis and design – Race and Gender- AI as a moral right holder – autonomy.		
UNIT – IV	**PERSPECTIVES AND APPROACHES**	**9 Periods**
Social failure modes of technology and the Ethics of AI – A human centered approach for AI Ethics – Integrating Ethical values and economical values - Fairness – The complexity of otherness – Calculative composition		
UNIT – V	**CASES AND APPLICATIONS**	**9 Periods**
Ethics of AI in Transport – The case for Ethical AI in Military – Ethics of AI in Biomedical research, patient care and public health- Ethics of AI in Law – Robot teaching: pedagogy and policy – Smart City Ethics.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Markus D Dubber, Frank Pasquale, Sunil Das, " **The Oxford Handbook of Ethics of AI**", Oxford University Press, 2020.*
2	*Paula Beddington, "**Towards a Code of Ethics for Artificial Intelligence**", Springer, 2017.*

REFERENCES:

1	*S. Matthew Liao, "Ethics of Artificial Intelligence", Oxford University Press, 2020.*
2	*Nick Bostrom and Eliezer Yudkowsky, **"The Ethics of Artificial Intelligence",** Cambrige University Press, 2014.*
3	*Wallach W and Allen C, " **Moral Machines: Ceaching Robots Right From Wrong**", Oxford Univeristy Press, 2008*
4	*Mark Coeckelbergh, "**AI Ethics**", MIT Press, 2020.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Identify the need for Ethics in Artificial Intelligence	K2
CO2	Summarize frameworks for normative assessment and governance.	K2
CO3	Describe the ethical dimensions of Artificial Intelligence	K3
CO4	Criticize selection of methodological approached for AI Ethics.	K4
CO5	Argue Ethics in AI for selected Artificial Intelligence applications.	K4

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping															
COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	-	-	-	-	-	3	-	3	1	-	-	1	-	2	-
CO2	-	-	-	-	-	3	-	3	1	-	-	3	-	2	-
CO3	-	-	-	-	-	3	-	3	1	-	-	3	-	2	-
CO4	-	-	-	-	-	3	-	3	1	-	-	3	-	2	-
CO5	-	-	-	-	-	3	-	3	1	-	-	3	-	2	-
22SPE$02	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**1**	**-**	**-**	**3**	**-**	**2**	**-**
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	6.1.1, 6.2.1,8.1.1, 8.2.1, 8.2.2, 9.1.2,12.1.2, 12.2.2
CO2	6.1.1, 6.2.1,8.1.1, 8.2.1, 8.2.2, 9.1.2, 12.1.1, 12.1.2, 12.2.1, 12.2.2,12.3.1
CO3	6.1.1, 6.2.1,8.1.1, 8.2.1, 8.2.2, 9.1.2, 12.1.1, 12.1.2, 12.2.1, 12.2.2,12.3.1
CO4	6.1.1, 6.2.1,8.1.1, 8.2.1, 8.2.2, 9.1.2, 12.1.1, 12.1.2, 12.2.1, 12.2.2,12.3.1
CO5	6.1.1, 6.2.1,8.1.1, 8.2.1, 8.2.2, 9.1.2,12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	35	35	-	-	-	100
CAT2	-	35	35	30	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	50	50	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	50	50	-	-	100
ESE	10	20	30	40	-	-	100

22SPE$03	DEEP LEARING (Common to CSE & IT)

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The Objective of this course is to make the students familiar with Perceptron Learning Algorithms, Feedforward Neural Networks, Deep Neural Networks, Convolution Neural Networks, Recurrent Neural Networks	
UNIT – I	**INTRODUCTON TO DEEP LEARNING**	**9 Periods**
Basics: Biological Neuron, Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm.		
UNIT – II	**FEEDFORWARD NETWORKS**	**9 Periods**
Representation Power of Feedforward Neural Networks, Backpropagation, Empirical Risk Minimization, Regularization, Autoencoders.		
UNIT – III	**DEEP NEURAL NETWORKS**	**9 Periods**
Difficulty of training deep neural networks, Greedy layerwise training. Gradient Descent (GD), Stochastic Gradient Descent (GD), Better Training of Neural Networks: Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), Regularization methods (dropout, drop connect, batch normalization).		
UNIT – IV	**CONVOLUTIONAL NEURAL NETWORKS**	**9 Periods**
Convolutional Networks: The Convolution Operation - Variants of the Basic Convolution Function - Structured Outputs - Data Types - Efficient Convolution Algorithms - Random or Unsupervised Features- LeNet, AlexNet		
UNIT – V	**RECURRENT NEURAL NETWORKS**	**9 Periods**
Recurrent Neural Networks: Bidirectional RNNs - Deep Recurrent Networks Recursive Neural Networks - The Long Short-Term Memory and Other Gated RNNs		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	Ian Goodfellow and Yoshua Bengio and Aaron Courville., ***" Deep Learnin ",*** MIT Press, 2016

REFERENCES:

1	Raúl Rojas, ***"Neural Networks: A Systematic Introduction ",*** Springer-Verlag, Berlin, 1996.
2	Yegnanarayana, B., ***"Artificial Neural Networks ",*** PHI Learning Pvt. Ltd, 2009
3	Christopher Bishop., ***"Pattern Recognition and Machine Learning ",*** Springer,2016
4	Nikhil Buduma, ***"Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms",*** O'Reilly publications, 2017

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Summarize the basics of neural network and deep learning	K2
CO2	Implement basic neural network model with hidden layers	K3
CO3	Analyze optimization and generalization in deep learning	K3
CO4	Criticize convolutional neural network and how it is applied to analyzing visual imagery	K3
CO5	Appraise Recurrent Neural Network (RNN) and its temporal dynamic behavior which helps us to remembers some information about a sequence to predict the next information	K3

COURSE ARTICULATION MATRIX															
a) CO and PO Mapping															
COs/ Pos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	
CO1	1	1	1	1	-	-	-	-	-	-	-	-	2	1	
CO2	2	2	2	2	1	-	-	-	-	-	-	-	2	1	
CO3	3	3	3	3	2	-	-	-	-	-	-	-	2	1	
CO4	3	3	3	3	2	-	-	-	-	-	-	-	2	1	
CO5	3	3	3	3	2	-	-	-	-	-	-	-	2	1	
22SPE$03	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	
1– Slight, 2 – Moderate, 3 – Substantial															
b) CO and Key Performance Indicators Mapping															
CO1	1.1.1, 2.1.1, 3.2.1, 4.1.1														
CO2	1.1.1, 1.2.1, 2.1.1, 2.2.2, 3.1.2, 3.3.2, 4.1.1, 4.1.2, 4.3.1, 5.1.1														
CO3	1.1.1, 1.2.1, 1.3.1, 1.3.2, 2.1.1, 2.2.2, 2.2.3, 2.3.1, 3.1.2, 3.3.2, 3.3.3, 3.4.2, 4.1.1, 4.1.2, 4.3.1, 5.1.1, 5.2.1, 5.2.3														
CO4	1.1.1, 1.2.1, 1.3.1, 1.3.2, 2.1.1, 2.2.2, 2.2.3, 2.3.1, 3.1.2, 3.3.2, 3.3.3, 3.4.2, 4.1.1, 4.1.2, 4.3.1, 5.1.1, 5.2.1, 5.2.3														
CO5	1.1.1, 1.2.1, 1.3.1, 1.3.2, 2.1.1, 2.2.2, 2.2.3, 2.3.1, 3.1.2, 3.3.2, 3.3.3, 3.4.2, 4.1.1, 4.1.2, 4.3.1, 5.1.1, 5.2.1, 5.2.3														

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Assignment 1	30	20	40	5	5	-	100
Assignment 2	30	20	30	10	5	5	100
Other mode of internal assessments, if any	-	-	-	-	-	-	-
ESE	30	30	40	-	-	-	100

22SPE$04	NATURAL LANGUAGE PROCESSING				
PREREQUISITES	**CATEGORY**	**L**	**T**	**P**	**C**
NIL	**PE**	**3**	**0**	**0**	**3**

Course Objectives	The objective of the course is to get familiar with the foundational algorithms used in Natural Language Processing (NLP) and their practical applications	
UNIT– I	**INTRODUCTION**	**9 Periods**
Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance		
UNIT– II	**WORD LEVEL ANALYSIS**	**9 Periods**
Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Partof-Speech Tagging-General Framework – approaches – other Statistical Machine learning approaches –Sequence Labelling for part of speech and Named Entity – HMM Part-of-Speech tagging		
UNIT– III	**VECTOR SEMANTICS AND EMBEDDING**	**9 Periods**
Lexical Semantics – Vector Semantics – Words and Vectors – Cosine for measuring similarity –TF-IDF –PMI – Word2Vec – Semantic properties of embedding-Word Sense Inventories and Problem characteristics –Early approaches to Sense Disambiguation – Supervised approach – Lightly Supervised approach – Unsupervised WSD and sense discovery		
UNIT– IV	**LANGUAGE MODELS**	**9 Periods**
RNN and LSTM – Transformer and Pretrained Language Models –Self attention networks – Language models for zero shot learning – Fine tuning and Masked Language Models –Training Bidirectional Encoders – Transfer Learning through Fine tuning		
UNIT– V	**Applications**	**9 Periods**
Machine Translation - Question Answering and Information Retrieval - Chatbots & Dialogue Systems - Automatic Speech Recognition and Text-to-Speech **Case study(Not For Evaluation)** : Modern applications with a focus on training ChatGPT and GPT models: Exploring Generative AI and NLP		
Contact Periods: **Lecture:45 Periods** **Tutorial:0 Periods** **Practical:0 Periods** **Total:45 Periods**		

TEXT BOOKS :

1	*Daniel Jurafsky and James H.Martin, "**Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition**" Third edition , Prentice Hall Series,2023*
2	*Nitin Indurkhya and Fred J. Damerau, **"Handbook of Natural Language Processing",** Second Edition, Chapman and Hall/CRC Press, 2010.*

REFERENCES:

1	*Pushpak Bhattacharyya, Aditya Joshi, **"Natural Language Processing",** Wiley 2023*
2	***Steven Bird, Ewan Klein and Edward Loper,* "Natural Language Processing with Python", *FirstEdition, OReilly Media (https://www.nltk.org/book/)***
3	***Ahmed J. Obaid, Bharat Bhushan, Muthmainnah S., S. SumanRajest"Advanced Applications of Generative AI and Natural Language Processing Models"**IGI Global,2023*
4	*NPTEL course :**Natural Language Processing*** *https://archive.nptel.ac.in/noc/courses/noc19/SEM2/noc19-cs56/*

COURSEOUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Apply regular expressions and finite-state automata to solve NLP tasks such as text normalization, pattern matching, and syntactic analysis.	K3
CO2	Summarize key algorithms for statistical NLP and sequence labeling	K2
CO3	Utilize word senses and WordNet for disambiguation and lexicons for Sentiment, Affect, and Connotation	K2
CO4	Develop proficiency in advanced deep learning architectures and techniques, including RNNs, LSTMs, Transformers, pretrained language models, self-attention networks, fine-tuning strategies, and transfer learning, to effectively address complex challenges in natural language processing tasks.	K3
CO5	Design and implement practical NLP applications, such as machine translation, question answering system ,chatbots, automatic speech and text to speech recognition systems.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	1	2	1	-	-	-	-	-	-	1	2	2	1
CO2	2	2	1	2	1	-	-	-	-	-	-	1	2	2	1
CO3	2	2	1	2	1	-	-	-	-	-	-	1	2	1	1
CO4	2	2	1	2	1	-	-	-	-	-	-	1	2	1	1
CO5	2	2	2	2	1	-	-	-	-	-	-	2	2	1	1
22SPE$04	**2**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**1**
1 – Slight, 2 – Moderate, 3 – Substantial															

b)CO and Key Performance Indicators Mapping	
CO1	1.1.2,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.3.2,2.4.1,3.1.2,3.2.2,3.3.1,4.3.1,4.3.2,4.3.3,4.3.4,5.2.1,12.1.1
CO2	1.1.2,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.3,2.3.2,2.4.1,3.1.2,3.2.2,3.3.1,4.3.1,4.3.2,4.3.3,4.3.4,5.2.1,5.2.2, 12.1.1
CO3	1.1.2,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.3.2,2.4.1,3.1.2,3.2.2,3.3.1,3.4.1,4.1.3,4.3.1,4.3.2,4.3.3, 4.3.4,5.2.1,5.2.2,12.1.1
CO4	1.1.2,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.2,2.4.1,3.1.2,3.2.2,3.3.1,3.4.1,4.1.3,4.3.1,4.3.3, 4.3.4,5.2.1,12.1.1
CO5	1.1.2,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.2,2.4.1,3.1.1,3.1.2,3.2.2,3.3.1,3.4.1,4.1.3,4.3.1, 4.3.3,4.3.4,5.2.1,12.1.1,12.2.2,12.3.1,12.3.2

ASSESSMENTPATTERN –THEORY							
Test /Bloom's Category*	**Remembering (K1)%**	**Understanding (K2)%**	**Applying (K3)%**	**Analyzing (K4)%**	**Evaluating (K5)%**	**Creating (K6)%**	**Total %**
CAT1	10	40	50	-	-	-	100
CAT2	10	30	30	30	-	-	100
IndividualAssessment1 /CaseStudy1/ Seminar 1 /Project1	-	30	70	-	-	-	100
IndividualAssessment2 /CaseStudy2/ Seminar2 / Project2	-	-	50	50	-	-	100
ESE	-	30	40	30	-	-	100

22SPE$05	GAME THEORY *(Common to CSE $ IT)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The objective of the course is to understanding of strategic decision-making, equilibrium concepts, and Master strategic complexities in games with incomplete information. Apply game theory to analyze cooperative behavior and coalition formation strategies.	
UNIT – I	**INTRODUCTION**	**9 Periods**
Introduction: What is Game Theory - An outline of the history of game theory- Definition of Games- Actions, Strategies, Preferences, Payoffs – Examples - Strategic form games and examples: Prisoner's Dilemma, Bach or Stravinsky, Matching Pennies - Notion of Nash Equilibrium - Examples of Nash Equilibrium - Best Response Functions - Dominated Actions - Symmetric Games and Symmetric Equilibria.		
UNIT – II	**GAMES WITH PERFECT INFORMATION**	**9 Periods**
Mixed Strategy Nash Equilibrium- Randomization of Actions, Mixed strategy Nash equilibrium, Dominated actions, Pure strategy equilibria in the presence of randomization, Illustrations: expert diagnosis reporting a crime - Finding all mixed strategy Nash equilibria of some representative games.		
UNIT – III	**EXTENSIVE GAMES WITH PERFECT INFORMATION**	**9 Periods**
Extensive games with Perfect Information- Extensive games, Strategies and outcomes, Nash equilibrium, Subgame perfect equilibrium, finding subgame perfect equilibria using backward induction - Allowing for simultaneous moves in extensive games with perfect information - Example of committee decision making - Two Player Zerosum Games: Maxminimization and Nash Equilibrium - Strictly competitive games - Nash equilibrium in strictly competitive games - Minimax theorem - Solution via linear programming - Examples.		
UNIT – IV	**GAMES WITH IMPERFECT INFORMATION**	**9 Periods**
Bayesian and Repeated Games - Motivational Examples - Definition of a Bayesian Game and Bayesian Nash Equilibrium and examples - Auctions: Independent private values, Nash equilibrium of first price auction and second price auction, common valuations, revenue equivalence of auctions - Idea of repeated games - Finitely repeated prisoner's dilemma, infinitely repeated prisoner's dilemma, strategies in a repeated prisoner's dilemma, Nash equilibria and equilibria payoffs in infinitely repeated prisoner's dilemma, sub-game perfect equilibria and equilibria payoffs in infintely repeated prisoner's dilemma.		
UNIT – V	**COALITIONAL GAMES**	**9 Periods**
Coalitional Games - The Core - Illustrations: Ownership and distribution of wealth - exchanging homogeneous items - exchanging heterogeneous items - voting – matching - Shapley value and examples.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK :

1	*M. J. Osborne,"* ***An Introduction to Game Theory"****,Oxford University Press, 2012(reprinted 2022).*

REFERENCES :

1	*M. Machler, E. Solan, S. Zamir,* ***"Game Theory"****, Cambridge University Press, 2013*
2	*N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani (Editors),* ***"Algorithmic Game Theory"*** *Cambridge University Press, 2007.*
3	*A.Dixit and S. Skeath,* ***"Games of Strategy"****, Second Edition, W W Norton & Co Inc, 2004.*
4	*YoavShoham, Kevin Leyton-Brown,* ***"Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations"****, Cambridge University Press 2008.*
5	*Zhu Han, Dusit Niyato, Walid Saad, Tamer Basar and Hjorungnes,* ***"Game Theory in Wireless and Communication Networks"****, Cambridge University Press, 2012.*
6	*Y.Narahari,* ***"Game Theory and Mechanism Design"****, IISC Press, World Scientific.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Summarize the fundamentals of game theory and concepts.	K1
CO2	Discuss the use of Nash Equilibrium for other problems.	K1
CO3	Identify key strategic aspects and based on these be able to connect them to appropriate game theoretic concepts given a real world situation.	K3
CO4	Identify some applications that need aspects of Bayesian Games.	K3
CO5	Use various Coalitional games concepts.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	2	1	2	2	-	-	-	-	-	-	2	2	2	1
CO2	1	2	1	2	2	-	-	-	1	2	1	2	2	2	1
CO3	1	2	2	2	3	-	-	-	-	2	2	1	2	2	2
CO4	1	2	2	2	3	-	-	-	1	2	2	1	2	2	2
CO5	1	2	2	2	3	-	-	1	2	2	2	2	2	2	2
22SPE$05	**1**	**2**	**2**	**2**	**3**	**-**	**-**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**2**

1 – Slight, 2 – Moderate, 3 – Substantial

CO and Key Performance Indicators Mapping

CO1	1.1.1, 2.1.1, 2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.2.2, 3.2.3, 3.3.1, 3.4.2, 4.1.2, 4.2.1, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 12.1.1, 12.2.1,12.3.2.
CO2	1.1.1, 2.1.1, 2.1.2, 2.1.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.2.2, 4.3.3, 5.1.2, 5.2.1, 5.3.2, 9.1.2, 9.2.4, 10.1.1, 10.1.2,10.2.1, 10.3.1, 11.3.1, 12.1.1, 12.1.2,12.3.2.
CO3	1.1.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.2.1, 4.2.2, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1,5.3.2, 10.1.1, 10.1.2,10.2.1, 10.3.1, 11.1.2, 11.3.1, 12.1.1, 12.3.2.
CO4	1.1.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.2.1, 4.2.2, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1,5.3.2, 9.1.2, 9.2.4, 10.1.1, 10.1.2,10.2.1, 10.3.1, 11.1.2, 11.3.1, 12.1.1, 12.3.2.
CO5	1.1.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.2.1, 4.2.2, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1,5.3.2, 8.1.1, 9.1.2, 9.2.3, 9.2.4, 10.1.1, 10.1.2,10.2.1, 10.3.1,11.1.2, 11.3.1, 12.1.1, 12.2.1, 12.3.2.

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	30	10	-	-	100
CAT2	20	20	30	30	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	30	30	20	20	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	20	20	30	30	-	-	100
ESE	20	40	30	10	-	-	100

22SPE$06	SOFT COMPUTING *(Common to CSE $ IT)*				
PREREQUISITES	**CATEGORY**	**L**	**T**	**P**	**C**
NIL	**PE**	**3**	**0**	**0**	**3**

Course Objectives	Understand fundamentals of Neural Network, Fuzzy logic and GeniticAlgoritms	
UNIT – I	**FUNDAMENTALS OF NEURAL NETWORKS**	**9 Periods**
Basic Concepts of Neural Networks–Human Brain–Model of an Artificial Neuron-Neural Network Architecture–characteristics of Neural Network–Learning Methods–Taxonomy of Neural Network Architectures=Early Neural Network Architectures.		
UNIT – II	**FUZZY SET THEORY**	**9 Periods**
Fuzzy vs Crisp–Crisp sets–Fuzzy sets–Crisp Relations–Fuzzy Relations.		
UNIT – III	**FUZZY SYSTEMS**	**9 Periods**
Crips Logic–Predictive Logic–Fuzzy Logic–Fuzzy Rule Based System–Defuzzification Methods–Applications		
UNIT – IV	**FUNDAMENTALS OF GENETIC ALGORITHMS**	**9 Periods**
Genetic Algorithm: History–Basic Concepts–Creation of Offsprings –Working Principle–Encoding–Fitness Function–Reproduction - Exploratory algorithm		
UNIT – V	**GENETIC MODELLING**	**9 Periods**
Inheritance Operations– Cross-Over–Inversion and Deletion –Mutation Operation–Bitwise Operators–Bitwise Operator used in GA=Generational Cycle –Conversion of Genetic Algorithm=Applications–Multilevel Optimization–Real Life Problems, Differences and Similarities between GA and Other Traditional methods.		
Contact Periods: **Lecture: 9 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 9 Periods**		

TEXT BOOK:

1	S. Rajasekaran, G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications", Prentice Hall of India, 2010.
2	J.S.R. Jang, C.T. Sun, E. Mizutani, "Neuro-Fuzzy and Soft Computing", Pearson Education, 2004.

REFERENCES :

1	S.N. Sivanandam, S.N. Deepa, "Principles of Soft Computing", Second Edition, Wiley-India, 2007.
2	Siman Haykin, "Neural Networks", Prentice Hall of India, 1999.
3	Timothy Ross, "Fuzzy Logic with Engineering Applications", Wiley Publications, 2016.
4	David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Pearson Education, 2008.

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	understand fuzzy sets Theory	K2
CO2	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.	K3
CO3	Design and analyzing neural networks for pattern classification and regression problems	K4
CO4	Understand fundamentals of Genetic Algorithms	K2
CO5	Apply genetic algorithms to optimization problems.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping														
COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	3	3	2	2	-	-	-	-	-	2	1	3
CO2	3	3	3	3	2	2	-	-	-	-	-	2	1	3
CO3	3	3	3	3	2	2	-	-	-	-	-	2	1	3
CO4	3	3	3	3	2	2	-	-	-	-	-	2	1	3
CO5	3	3	3	3	2	2	-	-	-	-	-	2	1	3
22SPE$06	**3**	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**3**
1 – Slight, 2 – Moderate, 3 – Substantial														

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.1,2.4.2,2.4.3,2.4.4, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4, 4.2.1,4.2.2,4.3.1,4.3.2, 5.1.1, 5.2.1, 5.3.2, 6.1.1, 6.1.2, 12.1.1, 12.1.2, 12.2.1, 12.3.2
CO2	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.1,2.4.2,2.4.3,2.4.4, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4, 4.2.1,4.2.2,4.3.1,4.3.2, 5.1.1, 5.2.1, 5.3.2, 6.1.1, 6.1.2, 12.1.1, 12.1.2, 12.2.1, 12.3.2
CO3	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.1,2.4.2,2.4.3,2.4.4, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4, 4.2.1,4.2.2,4.3.1,4.3.2, 5.1.1, 5.2.1, 5.3.2, 6.1.1, 6.1.2, 12.1.1, 12.1.2, 12.2.1, 12.3.2
CO4	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.1,2.4.2,2.4.3,2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4, 4.2.1,4.2.2,4.3.1,4.3.2, 5.1.1, 5.2.1, 5.3.2, 6.1.1, 6.1.2, 12.1.1, 12.1.2, 12.2.1, 12.3.2
CO5	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.1,2.4.2,2.4.3,2.4.4, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4, 4.2.1,4.2.2,4.3.1,4.3.2, 5.1.1, 5.2.1, 5.3.2, 6.1.1, 6.1.2, 12.1.1, 12.1.2, 12.2.1, 12.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	10	20	30	20	20	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	50	50	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	-	50	50	-	100
ESE	10	20	35	35	-	-	100

22SPE$07	COGNITIVE SCIENCE *(Common to CSE $ IT)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	To introduce the students theoretical background of cognition and computational intelligence, make them explore probabilistic programming language and understand computational inference models and computational learning models of cognition.	
UNIT– I	**PHILOSOPHY,PSYCHOLOGY AND NEUROSCIENCE**	**9 Periods**
Philosophy: Mental-physical Relation – From Materialism to Mental Science – Detour before the naturalistic turn –The Philosophy of Science–The Mind in Cognitive Science –Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing–Neurosciences:CognitiveNeuroscience–Perception–Decision–LearningandMemory–Language Understanding and Processing.		
UNIT– II	**COMPUTATIONAL INTELLIGENCE**	**9 Periods**
MachinesandCognition–ArtificialIntelligence–ArchitecturesofCognition–KnowledgeBased Systems – Logical Representation and Reasoning – Logical Decision Making – Decision making under Uncertainty – Learning – Language – Vision – Robotics.		
UNIT– III	**PROBABILISTIC PROGRAMMING LANGUAGE**	**9 Periods**
Web PPL Language–Syntax–Using Java script Libraries–Manipulating probability types and distributions–Finding Inference–Exploring random computation–Coroutines: Functions that receive continuations–Enumeration–Other basic computation.		
UNIT– IV	**IMPLEMENTING THE INFERENCE MODELS OF COGNITION**	**9 Periods**
Generative Models–Conditioning–Causal and statistical dependence–Conditional dependence–Data Analysis–Algorithms for Inference.		
UNIT– V	**IMPLEMENTING THE LEARNING MODELS OF COGNITION**	**9 Periods**
Learning as Conditional Inference–Learning with a Language of Thought–Hierarchical Models–Occam's Razor–Learning(Deep)Continuous Functions–Mixture Models.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXTBOOK :

1	*Robert A. Wilson, Frank C. Keil,* ***"The MIT Encyclopedia of the Cognitive Sciences"****, The MIT Press, 1999.*

REFERENCES:

1	*NoahD. Goodman, Andreas Stuhlmuller,* ***"The Design and Implementation of Probabilistic Programming Languages"****, Electronic version of book, https://dippl.org/.*
2	*Noah D. Goodman, Joshua B. Tenenbaum, The Prob Mods Contributors,* ***"Probabilistic Models of Cognition"****, Second Edition, 2016, https://probmods.org/.*

COURSEOUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Understand the theory behind cognition.	K2
CO2	Connect to the cognition elements computationally.	K2
CO3	Implement mathematical functions through Web PPL.	K3
CO4	Develop a cognitive inference model.	K4
CO5	Develop a cognitive learning model.	K4

COURSEARTICULATIONMATRIX:

a)CO and PO Mapping														
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	3	3	1	-	-	-	-	-	1	-	1	3	3
CO2	2	3	3	1	-	-	-	-	-	1	-	1	3	3
CO3	2	3	3	1	3	-	-	-	-	1	-	1	3	3
CO4	2	3	3	1	-	-	-	-	-	1	-	1	3	3
CO5	2	3	3	1	-	-	-	-	-	1	-	1	3	3
22SPE$07	**2**	**3**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**3**	**3**
1–Slight, 2–Moderate,3– Substantial														

b)CO and Key Performance Indicators Mapping	
CO1	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2,2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2,4.2.1,10.2.1, 12.1.2, 12.2.1
CO2	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2,2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2,4.2.1,10.2.1, 12.1.2, 12.2.1
CO3	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1,3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2,4.2.1, 5.1.1,5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2,10.2.1, 12.1.2, 12.2.1
CO4	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4,2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1,3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2,4.2.1,10.2.1,12.1.2, 12.2.1
CO5	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4,2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1,3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2,4.2.1,10.2.1,12.1.2, 12.2.1

ASSESSMENTPATTERN–THEORY							
Test/Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzin g (K4)%**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	40	30	-	-	-	100
CAT2	20	40	30	10	-	-	100
Individual Assessment1 /CaseStudy1/ Seminar1/ Project1	20	40	40	-	-	-	100
Individual Assessment2 /CaseStudy2/ Seminar 2 / Project2	-	40	40	20	-	-	100
ESE	20	40	40	-	-	-	100

22SPE$08	WEB APPLICATION SECURITY *(Common to CSE and IT)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	Upon completion of the course the students will be familiar with the common security threats faced by web applications, such as SQL injection, cross-site scripting (XSS), cross-site request forgery (CSRF), and man-in-the-middle attacks, able to respond effectively to security threats and incidents, design secure web applications from the ground up, including secure authentication and authorization, secure communication protocols, firewalls, intrusion detection systems, also able to apply industry standards and regulations, such as OWASP Top 10, and PCI DSS, that outline best practices for web application security, able to .understand the principles of web security, browser security and database security and prevent security vulnerabilities.	
UNIT – I	**INTRODUCTION**	**9 Periods**
Structure of a Modern Web Application – REST APIs – Javascript – SPA Frameworks – Web Servers – Sever side databases – Client-side data stores – Network Security vs Application Security – Thinking like a defender – OWASP Top Ten List – Security Fundamentals – Input Validation – Attack surface reduction – Classifying and Prioritizing threats		
UNIT – II	**WEB SECURITY PRINCIPLES**	**9 Periods**
Authentication – Two factor and Three factor authentication – Web application authentication – Securing Password based authentication – Best Practices – Authorization – Access Control – Session management fundamentals – Securing web application session management		
UNIT – III	**BROWSER SECURITY**	**9 Periods**
Same origin policy – Definition – Client-side vs Server-side - Exceptions – Cross site Scripting – XSS Discovery and Exploitation – Stored XSS – Reflected XSS – DOM-based XSS – Mutation-based XSS - Cross site Request Forgery – Query parameter tampering – Alternate GET payloads – CSRF against POST endpoints		
UNIT – IV	**DATABASE AND FILE SECURITY**	**9 Periods**
SQL Injection – Code injection – Command injection – Setting database permissions – Stored procedure security – Insecure direct object references – File Security principles – Keeping source code secure – Security through Obscurity – Forceful browsing – Directory traversal		
UNIT – V	**SECURE DEVELOPMENT AND DEPLOYMENT**	**9 Periods**
Securing modern web applications – Secure application architecture – Reviewing Code – Vulnerability discovery and management – Defending against XSS, CSRF, XXE, Injection and DoS attacks – Industry standards – Maturity models – Securing third party dependencies		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Andrew Hoffman,* ***"Web Application Security – Exploitation and Countermeasures for Modern Web Applications"****, O'Reilly, 2020*
2	*Bryan Sullivan, Vincent Liu,* ***"Web Application Security – A Beginner's Guide"****, McGraw Hill, 2012*

REFERENCES:

1	*Mike Shema,* ***"Hacking Web Apps – Detecting and Preventing Web Application Security Problems"****, Elsevier, 2012*
2	*Ron Lepofsky,* ***"The Manager's Guide to Web Application Security – A Concise guide to Web Application Security"****, Apress, 2014*
3	*Dafydd Stuttard, Marcus Pinto,* ***"The Web Application Hacker's Handbook – Finding and Exploiting Security flaws"****, John Wiley & Sons, Second Edition, 2011*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Familiar with secure coding best practices, such as OWASP Top 10	K2
CO2	Write secure code, including input validation, error handling, and password protection	K3
CO3	Comprehend the most common web security threats, such as cross-site scripting (XSS), cross-site request forgery (CSRF), SQL injection, and others	K2
CO4	Implement and manage web security policies and procedures, including incident response planning and management, security auditing, and security monitoring	K3
CO5	Identify and prioritize potential security threats to web applications and develop effective strategies for mitigating those threats	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO1	2	2	2	1	1	-	1	-	-	-	-	-	2	1
CO2	2	1	2	1	3	-	1	-	-	-	-	-	2	1
CO3	2	1	2	1	3	-	1	-	-	-	-	-	2	1
CO4	2	2	2	1	-	2	2	-	1	2	2	1	2	1
CO5	2	2	2	1	-	-	1	-	-	-	-	-	2	1
22SPE$08	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**-**	**1**	**1**	**1**	**1**	**2**	**1**

1– Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1,1.3.1,1.4.1,2.1.1,2.2.2,2.2.3,2.3.1,2.4.1,3.1.1,3.1.6,3.2.1,3.3.1,3.3.2,4.1.1,4.2.1,4.3.1, 5.1.2,7.1.1
CO2	1.1.1,1.3.1,1.4.1,2.1.1,2.2.3,2.4.1,3.1.1,3.1.6,3.2.1,3.3.1,3.3.2,4.1.1,4.2.1,4.3.1,5.1.1,5.1.2, 5.2.1,5.2.2,5.3.1,5.3.2,7.1.1
CO3	1.1.1,1.3.1,1.4.1,2.1.1,2.2.3,2.4.1, 3.1.1,3.1.6,3.2.1,3.3.1,3.3.2,4.1.1,4.2.1,4.3.1,5.1.1,5.1.2, 5.2.1,5.2.2,5.3.1,5.3.2,7.1.1
CO4	1.1.1,1.3.1,1.4.1,2.1.1,2.1.2,2.2.3,2.3.1,2.4.1,3.1.1,3.1.6,3.2.1,3.3.1,3.3.2,4.1.1,4.2.1,4.3.1,6 3.1.1,7.1.1,7.1.2,9.3.1,10.1.1,10.1.2,10.3.1,11.1.1,11.2.1,11.3.1,12.3.2
CO5	1.1.1,1.3.1,1.4.1,2.1.1,,2.1.2,2.2.3,2.3.1,2.4.1,3.1.1,3.1.6,3.2.1,3.3.1,3.3.2,4.1.1,4.2.1,4.3.1, 7.1.1

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Assignment 1	30	30	40	-	-	-	100
Assignment 2	30	30	40	-	-	-	100
Other mode of internal assessments, if any	-	-	-	-	-	-	-
ESE	30	30	40	-	-	-	100

22SPE$09	**DEV-OPS** *(Common to CSE & IT)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The objective of this course is to make the students understand about the concepts of DevOps principles, agile development methodologies, DevOps tools and technologies, orchestrate containers using Docker and Kubernetes, script writing to automate tasks and create pipelines for CI/CD, monitoring and Logging tools.	
UNIT – I	**INTRODUCTION**	**9 Periods**
What is DevOps – Roles and responsibilities of DevOps engineer – DevOps and SDLC – Virtualization – Shell scripting – SSH – Git for DevOps–Branches – Merge requests – Commits – Resolving Conflicts – Deletions – Build tools and Package managers – Artifact Repository manager		
UNIT – II	**CONTAINERS**	**9 Periods**
What is container – Docker components and architecture – Docker vs. Virtual machine – Main docker commands – Docker compose – running multiple services – Dockerfile – Building a docker image - Deploy containerized app – Docker volumes		
UNIT – III	**ORCHESTRATION**	**9 Periods**
What is Container orchestration - Introduction to Kubernetes – Components – Architecture – Commands – YAML configuration – Namespaces – Service types – Persisting data – Deploying Kubernetes Cluster – Stateful app deployment using Helm		
UNIT – IV	**CI/CD PIPELINE**	**9 Periods**
What is Build Automation –Continuous Integration and Continuous Delivery Principles -Introduction to Jenkins – Install Jenkins on Cloud Server – Plugins – Build tools – Docker in Jenkins – Configuring Jenkins pipeline –Multi-branch pipeline Job – Webhooks		
UNIT – V	**MONITORING**	**9 Periods**
Docker container monitoring – statistics – metrics – events – Performance monitoring – Container monitoring – Container administration – Auditing and Analyzing Vulnerabilities in Kubernetes – Enhancing observability and monitoring in Kubernetes with Prometheus and Grafana		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Mikael Krief,* ***"Learning DevOps - The complete guide to accelerate collaboration with Jenkins, Kubernetes, Terraform and Azure DevOps"****, Packt Publishing, 2019*
2	*Jose Manuel Ortega Candel,* ***"Implementing DevSecOps with Docker and Kubernetes",*** *BPB Publications, First Edition, 2022*

REFERENCES:

1	*Joakim Verona,* ***"Practical DevOps"****, Packt Publishing, 2016*
2	*Len Brass, Ingo Weber, Liming Zhu,* ***"DevOps – A Software Architect's Perspective"****, Pearson Education, 2015*
3	*Gene Kim, Jez Humble, Patrick Debois, John Willis,* ***"The DevOps Handbook – How to create world-class agility, reliability and security in technology organizations"****, IT Revolution, Second edition, 2016*
4	*Jennifer Davis, Katherine Daniels,* ***"Effective DevOps"****, O'Reilley Media, 2015*
5	*https://github.com/milanm/DevOps-Roadmap*
6	*https://github.com/annfelix/DEVOPS-WORLD*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Understand the DevOps principles and practices, such as continuous integration, continuous delivery, infrastructure as code, and collaboration between development and operations teams	K2
CO2	Implement containerization and container orchestration using tools such as Docker and Kubernetes	K3
CO3	Create and manage infrastructure on public and private cloud platforms such as AWS, Azure, and GCP using tools such as Terraform and CloudFormation	K4
CO4	Write scripts to automate tasks and create pipelines for continuous integration and continuous delivery	K3
CO5	Understand the purpose of monitoring and logging tools such as Prometheus and Grafana and be able to use them to monitor and analyze system performance	K4

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	2	2	1	-	-	-	1	-	-	2	3	1	2
CO2	1	2	2	1	2	-	-	-	-	-	1	1	3	1	2
CO3	1	2	2	2	2	-	-	-	-	-	1	1	3	1	2
CO4	1	3	2	3	2	-	-	-	1	-	-	2	3	1	2
CO5	1	3	3	3	2	-	-	-	1	-	2	2	3	1	2
22SPE$09	**1**	**2**	**2**	**2**	**2**	-	-	-	**1**	-	**1**	**2**	**3**	**1**	**2**
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1, 2.1.2, 2.2.2,2.2.4, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.3.1, 3.4.1, 4.1.1, 4.1.2, 4.2.1, 4.3.1, 4.3.2, 5.2.1, 5.2.2, 9.1.1, 9.1.2, 12.1.1, 12.1.2, 12.2.2
CO2	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2,2.2.3, 2.2.4, 2.4.2, 2.4.4, 3.1.1, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.2.1, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 11.2.1, 12.1.1, 12.2.2
CO3	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2,2.2.3, 2.2.4, 2.4.4, 3.1.1, 3.1.2, 3.1.6, 3.2.1, 3.2.2, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.2.1, 4.3.1, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 11.2.1, 12.1.1, 12.2.2
CO4	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2,2.2.3, 2.2.4, 2.4.2, 2.4.4, 3.1.1, 3.1.2, 3.1.6, 3.2.1, 3.2.2, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.3.1, 4.3.2,4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 9.1.2, 12.1.1, 12.1.2, 12.2.2, 12.3.2
CO5	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2,2.2.3, 2.2.4, 2.4.2, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.2, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 9.1.1, 9.1.2, 11.2.1, 12.1.1, 12.1.2, 12.2.2, 12.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	30	30	20	-	-	100
CAT2	20	30	30	20	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	20	30	30	20	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	20	30	30	20	-	-	100
ESE	20	30	30	20	-	-	100

22SPE$10	CLOUD ENGINEERING

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The objective of the course is to understanding of cloud computing concepts, technologies, architectures, and Cloud service models. Analyze Cloud service provide and cloud technology for data processing.	
UNIT – I	**CLOUD COMPUTING FUNDAMENTALS**	**9 Periods**
Computing Paradigms and its types, Motivation for Cloud Computing - The Need for Cloud Computing, Defining Cloud Computing - Definition of Cloud computing, Cloud Computing Is a Service, Cloud Computing Is a Platform, Principles of Cloud computing - Five Essential Characteristics, Three Service Offering Models.		
UNIT – II	**CLOUD COMPUTING ARCHITECTURE AND MANAGEMENT**	**9 Periods**
Cloud architecture - Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications, on the Cloud, Managing the Cloud -Managing the Cloud Infrastructure, Managing the Cloud application, Migrating Application to Cloud - Phases of Cloud Migration Approaches for Cloud Migration. Cloud Deployment Models- Private Cloud, Public Cloud, Community Cloud, Hybrid Cloud.		
UNIT – III	**CLOUD SERVICE MODEL**	**9 Periods**
Infrastructure as a Service -Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platform as a Service - Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS, Summary of PaaS Providers, Software as a Service - Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS, Summary of SaaS Providers, Other Cloud Service Models, SOA and Cloud, Memory and Storage Technologies, Networking Technologies, Software Process Models for Cloud, Agile SDLC for Cloud Computing. Operating System, Application Environment		
UNIT – IV	**CLOUD SERVICE PROVIDERS**	**9 Periods**
EMC - EMC IT, Captiva Cloud Toolkit, Google - Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services - Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue ,service, Microsoft - Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM - Cloud Models, IBM Smart Cloud, SAP Labs - SAP HANA Cloud Platform, Virtualization Services Provided by SAP, Sales force - Sales Cloud, Service Cloud: Knowledge as a Service, Rack space, VMware, Manjra soft - Aneka Platform erfect equilibria and equilibria payoffs in infintely repeated prisoner's dilemma.		
UNIT – V	**CLOUD TECHNOLOGIES AND ADVANCEMENTS HADOOP**	**9 Periods**
MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine — Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK :

1	*K. Chandrasekhran,* ***"Essentials of cloud Computing"*** CRC press, 2020

REFERENCES :

1	*Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley,* ***"Cloud Computing: Principles and Paradigms"*** *2018.*
2	*Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier,* ***"Distributed and Cloud Computing"****, 2017.*
3	*Subra Kumaraswamy, Shahed Latif, O'Reilly,* ***"Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance"****, Tim Mather SPD, rp2019.*
4	*Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra,* ***"Distributed and Cloud Computing, From Parallel Processing to the Internet of Things"****, Morgan Kaufmann Publishers, 2020.*
5	*George Reese,* ***"Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)"*** *O'Reilly, 2021.*
6	*Toby Velte, Anthony Velte, Robert Elsenpeter,* ***"Cloud Computing – A Practical Approach"****, Tata Mcgraw Hill, 2018.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Summarize the foundational understanding of cloud computing concepts, principles, and technologies.	K2
CO2	Explain the cloud computing architecture and manage applications.	K2
CO3	Use cloud service models for application development and deployment	K3
CO4	Analyze various cloud service provider and apply them to solve problems on the cloud.	K4
CO5	Analyze advanced cloud technologies.	K4

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CO1	2	2	2	2	2	-	-	-	-	1	1	2	2	2	1
CO2	2	2	2	2	2	-	-	-	-	2	2	2	2	2	1
CO3	2	2	2	2	3	-	-	-	-	2	2	2	2	2	2
CO4	2	2	2	2	3	-	-	-	-	2	2	2	2	2	2
CO5	2	2	2	2	3	-	-	-	-	2	2	2	2	2	2
22SPE$10	**2**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**2**	**2**	**2**

1 – Slight, 2 – Moderate, 3 – Substantial

b)CO and Key Performance Indicators Mapping

CO1	1.1.1, 2.1.1, 1.3.1, 2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.2.2, 3.2.3, 3.3.1, 3.4.2, 4.1.2, 4.2.1, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 10.1.1, 11.2.1, 12.1.1, 12.2.1,12.3.2.
CO2	1.1.1, 2.1.1, 1.3.1, 2.1.2, 2.1.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.2.2, 4.3.3, 5.1.2, 5.2.1, 5.3.2, 10.1.1, 10.1.2,10.2.1, 10.3.1, 11.2.1, 11.3.1, 12.1.1, 12.1.2,12.3.2.
CO3	1.1.1, 2.1.1, 1.3.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.2.1, 4.2.2, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1,5.3.2, 10.1.1, 10.1.2,10.2.1, 10.3.1, 11.1.2, 11.3.1, 12.1.1, 12.1.2, 12.3.2.
CO4	1.1.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.2.1, 4.2.2, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1,5.3.2, 10.1.1, 10.1.2,10.2.1, 10.3.1, 11.1.2, 11.3.1, 12.1.1,12.1.2, 12.3.2.
CO5	1.1.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.2.1, 4.2.2, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1,5.3.2, 10.1.1, 10.1.2,10.2.1, 10.3.1,11.1.2, 11.3.1, 12.1.1, 12.2.1, 12.3.2.

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	30	30	10	-	-	100
CAT2	20	20	30	30	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	30	30	20	20	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	20	20	30	30	-	-	100
ESE	30	20	30	20	-	-	100

22SPE$11	PRINCIPLES OF PROGRAMMING LANGUAGES *(Common to CSE & IT)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	Upon completion of the course the students will be familiar with the syntax and semantics of programming languages, call-return architecture and ways of implementing them also able to analyze and evaluate the different programming paradigms, Practice Functional and Concurrent programming with Haskell, also able to explain the design concepts and issues behind programming languages like C, Java, Scala, Lisp, Prolog, or any new language	
UNIT – I	**FOUNDATIONS**	**9 Periods**
Evolution of Major Programming Languages –Overview of Compilation – Describing Syntax and Semantics – Lexical and Syntax analysis - Names, Scopes and Bindings – Data Types – Expressions and Assignment Statements –Type Systems		
UNIT – II	**CORE ISSUES IN LANGUAGE DESIGN**	**9 Periods**
Control Flow – Structured and Unstructured Flow – Sequencing – Selection – Iteration – Recursion – Subroutines and Control Abstraction – Stack layout – Calling Sequences – Parameter Passing – Blocks – Dynamic Scoping - Exception Handling – Coroutines – Events		
UNIT – III	**OBJECT ORIENTED PARADIGM**	**9 Periods**
Abstract Data Types and Encapsulation Concepts – Design Issues – Namespaces - Inheritance - Inner Classes – Type Extensions – Dynamic Method Binding – Mix-in Inheritance – True Multiple Inheritance - Examples – Object Models – Smalltalk, C++, Java, Scala		
UNIT – IV	**FUNCTIONAL AND LOGIC PROGRAMMING**	**9 Periods**
Functional Programming – Programs as Functions – Delayed Evaluation – Lambda Calculus – Examples from Lisp - Introduction to Haskell Programming – Comparison of Functional and Imperative languages – Logic Programming - Predicate Calculus – Proving theorems – Resolution and Unification - Elements of Prolog – Applications		
UNIT – V	**CONCURRENT PROGRAMMING**	**9 Periods**
Parallel Processing and Programming Languages – Threads – Semaphores – Monitors – Message Passing – Parallelism in Non-Imperative Languages – Java threads – Haskell concurrency primitives and abstractions		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Robert W. Sebesta,* ***"Concepts of Programming Languages"****, Pearson Education, Twelfth Edition, 2019*
2	*Michael L. Scott,* ***"Programming Language Pragmatics"****, Morgan Kauffman, Fourth Edition, 2016*

REFERENCES:

1	*Kenneth C. Louden, Kenneth A. Lambert,* ***"Programming Languages – Principles and Practice"****, Course Technology, Cengage Learning, Third Edition, 2011*
2	*Daniel P. Friedman, Mitchell Wand,* ***"Essentials of Programming Languages"****, MIT Press, Third Edition, 2008*
3	*Carlo Ghezzi, Mehdi Jazayeri,* ***"Programming Language Concepts"****, John Wiley & Sons, Third Edition, 2008*
4	*Peter Sestoft,* ***"Programming Language Concepts"****, Springer-Verlag, Second Edition, 2017*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Summarize the key concepts and theories behind programming languages, including syntax, semantics, grammar, and parsing	K2
CO2	Compare the different programming language paradigms and be able to choose the appropriate paradigm for different types of software	K3
CO3	Explain the core issues in procedural and object-oriented programming language design	K2
CO4	Apply functional programming concepts and logic programming concepts and be able to write functional code using languages such as Lisp or Prolog or Haskell or Scheme	K3
CO5	Describe the principles of concurrent and parallel programming, including threads, locks, and semaphores, and be able to write concurrent and parallel code using languages Java or Haskell	K3

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO1	2	2	2	1	1	-	1	-	-	-	-	-	2	1
CO2	2	1	2	1	3	-	1	-	-	-	-	-	2	1
CO3	2	1	2	1	3	-	1	-	-	-	-	-	2	1
CO4	2	2	2	1	-	2	2	-	1	2	2	1	2	1
CO5	2	2	2	1	-	-	1	-	-	-	-	-	2	1
22SPE$11	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**-**	**1**	**1**	**1**	**1**	**2**	**1**

1– Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1,1.3.1,1.4.1,2.1.1,2.2.2,2.2.3,2.3.1,2.4.1,3.1.1,3.1.6,3.2.1,3.3.1,3.3.2,4.1.1,4.2.1, 4.3.1,5.1.2,7.1.1
CO2	1.1.1,1.3.1,1.4.1,2.1.1,2.2.3,2.4.1,3.1.1,3.1.6,3.2.1,3.3.1,3.3.2,4.1.1,4.2.1,4.3.1,5.1.1, 5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,7.1.1
CO3	1.1.1,1.3.1,1.4.1,2.1.1,2.2.3,2.4.1, 3.1.1,3.1.6,3.2.1,3.3.1,3.3.2,4.1.1,4.2.1,4.3.1,5.1.1,5.1.2, 5.2.1,5.2.2,5.3.1,5.3.2,7.1.1,
CO4	1.1.1,1.3.1,1.4.1,2.1.1,2.1.2,2.2.3,2.3.1,2.4.1,3.1.1,3.1.6,3.2.1,3.3.1,3.3.2,4.1.1,4.2.1, 4.3.1,6.1.1,7.1.1,7.1.2,9.3.1,10.1.1,10.1.2,10.3.1,11.1.1,11.2.1,11.3.1,12.3.2
CO5	1.1.1,1.3.1,1.4.1,2.1.1,,2.1.2,2.2.3,2.3.1,2.4.1,3.1.1,3.1.6,3.2.1,3.3.1,3.3.2,4.1.1,4.2.1, 4.3.1,7.1.1,

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Assignment 1	30	30	40	-	-	-	100
Assignment 2	30	30	40	-	-	-	100
Other mode of internal assessments, if any	-	-	-	-	-	-	-
ESE	30	30	40	-	-	-	100

22SPE$12	UI AND UX DESIGN *(Common to CSE & IT)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The course is designed to teach the fundamentals of UI/UX design along with industry-standard design tools to evaluate and improve their designs for better user experience.	
UNIT – I	**INTRODUCTION TO UI DESIGN**	**9 Periods**
Basics of HCI - Design process- HCI in software process – Basics of interaction design - UI Design and Why it matters – UI disasters – Case studies – Design Process – Introduction – Usability Engineering – Task centered approaches – Use cases – Personas – Tasks – Scenarios –Design centered approaches – Psychology and human factors for UI Design – Fitts Law – Short-term – long-term – attention – perception – conceptual models – Design principles – visibility – feedback – mappings – constraints – High-level models – distributed cognition – activity theory – situated action		
UNIT – II	**USER RESEARCH**	**9 Periods**
UserCentered Approaches to Interaction Design -User Research methods – Interview and Focus groups – Observations – Contextual inquiry – Ethics and Consent – User Research Protocol – Log Analysis – Surveys and Questionnaires – Translating User Research to Support design – Qualitative analysis – Quantitative analysis – Examples - Implications for Design – From Research to Ideas – Ideation – Selection – Communicating to Stakeholders		
UNIT – III	**PROTOTYPING**	**9 Periods**
Interface Prototying techniques – Low fidelity – Paper prototype – Wireframing – Tool-based – Physical low fidelity prototyping – Introduction to Design principles and patterns – Layout – Color and consistency – Cultural factors – Interaction design patterns – Google Material design – Design critiques – eliciting and giving feedback		
UNIT – IV	**UNIVERSAL DESIGN**	**9 Periods**
Introduction – Sensory and Cognitive Impairments – Physical limitations – tools and standards – Design for older adults and children – Socio-economic differences – Design for different platforms and contexts – Mobile UI design – Wearable – Automotive User Interfaces – IoT and Physical Computing		
UNIT – V	**EVALUATING USER INTERFACES AND TOOLS**	**9 Periods**
Introduction to Evaluating User interfaces and Evaluation in UI Design process – Evaluation without users – Action Analysis – Cognitive Walkthroughs – Heuristic Evaluation – Nielsen's heuristics – Evaluation with Users – User Testing – Goals – Formative and Summative Evaluation – Ethics in evaluation – Tools – Adobe XD – Figma –Invision -Sketch		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Rex Hartson, Pardha S Pyla,* ***"The UX Book: Agile UX Design for a Quality User Experience"****, Morgan Kaufmann, Second Edition, 2018*
2	*Joel Marsh,* ***"UX for beginners"****, O'Reilly Media, 2015*

REFERENCES :

1	*Alan Cooper, Robert Riemann, David Cronin, Christopher Noessel,* ***"About Face: The Essentials of Interaction Design"****, Wiley, Fourth Edition, 2014*
2	*Ben Coleman, and Dan Goodwin,* ***"Designing UX: Prototyping: Because Modern Design is Never Static"****, SitePoint , 2017*
3	*Westley Knight,* ***"UX for Developers: How to Integrate User-Centered Design Principles Into Your Day-to-Day Development Work"****, Apress, 2018*
4	https://in.coursera.org/specializations/user-interface-design

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Articulate UI/UXdesign principles and tools	K2
CO2	Conduct user research to gain insights into user needs and behaviors, and apply these insights to inform design decisions	K3
CO3	Create wireframes and prototypes using design software to communicate design ideas	K4
CO4	Design interfaces that adapt to different devices and screen sizes using responsive design principles	K4
CO5	Collaboratively design and evaluate interfaces for web and mobile applications using tools like Adobe XD, Figma ,Invision and Sketch.	K4

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	2	2	-	-	-	-	-	-	-	-	-	1	2	2	1
CO2	2	3	2	1	-	-	-	-	-	-	-	1	2	2	1
CO3	2	3	2	2	1	-	-	-	-	-	-	2	2	1	1
CO4	2	3	3	2	1	-	-	-	-	-	-	2	2	1	1
CO5	2	3	3	2	1	-	-	1	-	-	-	2	2	1	1
22SPE$12	**2**	**3**	**2**	**2**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**2**	**2**	**2**	**1**
1 – Slight, 2 – Moderate, 3 – Substantial															

b)CO and Key Performance Indicators Mapping	
CO1	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.4.1,12.3.1
CO2	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.5, 3.3.2, 4.2.2, 4.3.1, 4.3.4,12.1.1,12.2.2
CO3	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.2, 3.1.3, 3.1.5, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.,2, 4.1.2, 4.2.1, 4.2.2, 4.3.1, 4.3.4,5.2.2,12.1.1,12.1.2, 12.2.2
CO4	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.4, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.2, 4.1.2, 4.2.1, 4.2.2, 4.3.1, 4.3.4,5.2.2,12.1.1,12.1.2, 12.2.2
CO5	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.4, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 4.1.3, 4.2.2, 4.3.1, 4.3.4, 5.1.2,5.2.2,8.2.2,12.1.1, 12.1.2,12.2.2

ASSESSMENTPATTERN –THEORY							
Test /Bloom's Category*	**Remembering (K1)%**	**Understanding (K2)%**	**Applying (K3)%**	**Analyzing (K4)%**	**Evaluating (K5)%**	**Creating (K6)%**	**Total %**
CAT1	-	40	40	20	-	-	100
CAT2	-	20	40	40	-	-	100
IndividualAssessment1 /CaseStudy1/ Seminar 1 /Project1	-	-	70	30	-	-	100
IndividualAssessment2 /CaseStudy2/Seminar2 / Project2	-	-	50	50	-	-	100
ESE	-	30	40	30	-	-	100

22SPE$13	**APP DEVELOPMENT** *(Common to CSE & IT)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	Upon completion of the course the students will be familiar with the basic concepts of DART programming language, the development process of mobile application framework and able to develop simple mobile application using Flutter able to collect and analyze data from mobile applications, using tools such as Google Analytics and Firebase, and use the insights to improve the app's performance, usability, and user engagement, able to understand the major mobile platforms,deploy mobile applications to the target platform, following best practices for distribution, monetization, and app store optimization.	
UNIT – I	**PROGRAMMING DART**	**9 Periods**
Creating a DART project - main function – variables – data types – conditionals – loops – functions – object-oriented programming – objects – classes – constructors - inheritance – abstract class - DART project structure and libraries		
UNIT – II	**INTRODUCTION TO FLUTTER**	**9 Periods**
Flutter framework – Installing Android Studio – Installing and Configuring Flutter SDK – Run flutter app on android virtual device and mobile phone – Flutter widgets – Scaffold – Image – Container – Row and column – Card – Icon - Layouts – State management – Form validation - Data structures and Collections – Lists – Maps - Exception handling		
UNIT – III	**FLUTTER NAVIGATION AND ROUTING**	**9 Periods**
Button Widget – Types – App Structure and navigation – Navigate with Named routes – Navigate to new screen and back - Send and return data among screens – Animate a widget – WebView widget – Introduction to Material design – Elements - Scrolling – Inputs and Selections – Dialogs – Alerts – Panels – MVC pattern - Provider – Consumer - Selector		
UNIT – IV	**FIREBASE, GPS AND GOOGLE MAPS**	**9 Periods**
JSON – Adding firebase to app - Firebase authentication – signup and login to Flutter app – Configuring Firebase authentication – Firebase database – Real time database – cloud Firestore – Location aware apps – Adding Google maps to Flutter app – Google map marker		
UNIT – V	**APP TESTING AND PUBLISHING**	**9 Periods**
Debugging tools – Dart analyzer – Flutter performance and optimizing - profiling – best practices – Deployment – code obfuscation – Build and release Android app – Build and release iOS app – Continuous delivery		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Sanjib Sinha, **"Beginning Flutter with Dart"**, Lean publishing, First Edition, 2021*
2	*Thomas Bailey, Alessandro Biessek, **"Flutter for Beginners"**, Packt Publishing, Second Edition, 2021*

REFERENCES:

1	*Sufyan bin Uzayr,* ***"Mastering Flutter – A Beginner's Guide"****, Taylor and Francis, First Edition, 2022*
2	*Simone Alessandria, Brian Kayfitz,* ***"Flutter Cookbook"****, Packt Publishing, First Edition, 2021*
3	*Rap Payne,* ***"Beginning App Development with Flutter: Create cross platform mobile apps"****, Apress, First Edition, 2019*
4	*Marco L Napoli,* ***"Beginning Flutter – A hands on guide to App Development"****, John Wiley & Sons, First Edition, 2020*
5	*https://docs.flutter.dev/*
6	*https://firebase.google.com/*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Setup a new Material App using Android Studio and use pre-made Flutter widgets for User Interface Design	K1
CO2	Summarize the difference between Stateful and Stateless Widgets and Explore how Flutter widgets react to state changes	K2
CO3	Apply common mobile design patterns to structure flutter apps and navigation	K3
CO4	Design mobile applications with backend services, APIs and Create signup and login screens using Firebase Authentication and Cloud Firestore	K4
CO5	Analyze the mobile app usage data and user feedback, and use the insights to improve app performance, usability, and user engagement	K3

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO 1	PSO 2
CO1	2	3	3	3	2	-	-	-	2	1	2	1	2	1
CO2	2	3	3	3	2	-	-	-	2	1	2	1	2	1
CO3	2	3	3	3	2	-	-	-	2	1	2	1	2	1
CO4	2	3	3	3	2	-	-	-	2	1	2	1	2	1
CO5	2	3	3	3	2	-	-	-	2	1	2	1	2	1
22SPE$13	**2**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**2**	**1**	**2**	**1**	**2**	**1**

1– Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1,1.1.2,1.3.1,1.4.1,2.4.1,3.2.1,3.2.2,3.3.1, 3.4.1,3.4.2,4.1.3,4.3.2,8.1.1,8.1.2
CO2	1.1.1,1.1.2,1.3.1,1.4.1,2.1.1,2.1.2,2.2.1,2.2.3,2.2.4,2.4.4,3.1.1,3.1.3,3.4.1,4.3.1,4.3.2,4.3.4,7.1.1,1 1.1.1,11.2.1, 12.3.1
CO3	1.1.1,1.1.2,1.3.1,1.4.13.2.1,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.2,4.2.2,5.3.2,
CO4	1.1.1,1.1.2,1.3.1,1.4.1,2.1.1,2.1.2,2.2.22.2.3,2.2.4,2.3.12.4.2,2.4.4,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2, 3.4.1,3.4.2, 4.1.2,4.2.2,5.3.2,
CO5	1.1.1,1.1.2,1.3.1,1.4.1, 2.1.1,2.1.2,2.2.2,,2.2.3,2.2.4,2.3.1,,2.4.2,2.4.4,3.1.1,3.1.5,3.1.6,3.2.2, 3.2.3,3.3.1,3.4.1,4.1.2, 4.3.1,4.3.2,4.3.3, 4.3.4, 7.1.2, 8.1.1, 8.1.2, 10.3.1,10.3.2, 11.2.1,12.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Assignment 1	-	20	30	50	-	-	100
Assignment 2	-	20	30	50	-	-	100
Other mode of internal assessments, if any	-	-	-	-	-	-	-
ESE	30	30	40	-	-	-	100

22SPE$14	BIG DATA TECHNOLOGIES

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The objective of this course is to make the students to learn about process, manage, and derive insights from big data using distributed computing platforms and advanced analytics techniques	
UNIT– I	**INTRODUCTION TO BIG DATA**	**9 Periods**
Introduction to Big Data – Characteristics - Challenges – Business use cases - Evolution of analytic scalability – Convergence – Parallel processing systems –Distributed computing - Cloud computing - Big data sources – Nuts and Bolts – Security, Compliance, Auditing and Protection-Evolution of Bigdata–Best Practices–Big data Integration and Processing – Big data pipelines – Data modeling		
UNIT– II	**BIG DATA TOOLS AND TECHNIQUES**	**9 Periods**
Big data platform – Hadoop Ecosystem - NoSQL – Hadoop - HDFS – YARN – Hbase – MapReduce Framework – Hive – Pig – Spark – Programming examples – MovieLens dataset.		
UNIT– III	**INTRODUCTION TO ANALYTICS**	**9 Periods**
Introduction to predictive analytics – Business analytics: types and applications- Models: predictive models – descriptive models – decision models - applications – analytical techniques – Apache Spark MLib		
UNIT– IV	**MINING DATA STREAMS**	**9 Periods**
Stream Data Model – Sampling data in a stream, Filtering Streams, Counting distinct elements in a stream, Estimating moments, Counting ones in a window, Decaying windows. Advanced windowing, Exactly-Once and side effects, Streams and Tables – Practicalities of Persistent State, Streaming SQL – Beam model , SQL model – Streaming Joins – Unwindowed and windowed joins.		
UNIT– V	**APPLICATIONS**	**9 Periods**
Recommendation systems - Content based and Collaborative filtering, dimensionality reduction, Netflix challenge. Mining Social Network Graphs –Clustering, Direct discovery of communities, Partitioning of graphs, Finding overlapping communities, Simrank, Counting triangles.Case Studies – Retail Domain, Healthcare analytics, Financial data analytics.		
Contact Periods: **Lecture: 45 Periods** **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**		

TEXTBOOK:

1	*Seema Acharya, SubashiniChellappan,* ***"Big data and Analytics"****, 2nd Edition, Wiley, 2020 (Units I, II)*
2	*Bart Baesens,* ***"Analytics in a Big Data World: The Essential Guide to Data Science and its Applications"****, Wiley, 2014 (Unit III)*
3	*AnandRajaraman and Jeffrey David Ullman,* ***"Mining of Massive Datasets"****, 3rd Edition, CambridgeUniversity Press, 2019.http://www.mmds.org/(Units IV, V)*

REFERENCES:

1	*Tyler Akidau, SlavaChemyak, Reuven Lax,* ***"Streaming Systems"****, O'Reilly, 2018*
2	*Frank J Ohlhorst,* ***"Big Data Analytics: Turning Big Data into Big Money"****, Wiley and SAS Business Series, 2012*
3	*DT Editorial Services,* ***"Big data black book"****, Dreamtech Press, 2015*

COURSEOUTCOMES: Upon completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Understand the evolution, characteristics, concepts and challenges of big data	K2
CO2	Examine how to leverage Hadoop's capabilities for efficient distributed computing and big data processing	K3
CO3	Apply basic and advanced analytics techniques to extract insights from big data	K3
CO4	Evaluate the various techniques for handling streaming data, including windowing, aggregations, filtering, and transformations	K4
CO5	Explain futuristic vision and applications of BigData	K2

COURSE ARTICULATION MATRIX:

a)CO and PO Mapping															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	3	3	3	2	2	-	-	-	2	2	3	3	3
CO2	3	3	3	3	3	2	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	3	2	-	-	-	-	-	-	3	3	3
CO4	3	3	3	3	3	2	-	-	-	-	-	-	3	3	3
CO5	3	3	3	3	3	2	2	-	-	-	2	2	3	3	3
22SPE$14	**3**	**3**	**3**	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**2**	**2**	**3**	**3**	**3**
1–Slight, 2 –Moderate,3–Substantial															

b)CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.1,3.1.2, 3.1.3, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2,4.3.3, 4.3.4, 5.2.1, 5.3.1, 6.1.1, 7.1.1, 7.1.2, 11.1.1, 11.3.1, 12.2.1, 12.2.2
CO2	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1
CO3	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1
CO4	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1
CO5	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.1,3.1.2, 3.1.3, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.2.1, 5.3.1, 6.1.1, 7.1.1, 7.1.2, 11.1.1, 11.3.1, 12.2.1, 12.2.2

ASSESSMENTPATTERN–THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	20	30	30	-	-	100
CAT2	-	20	40	40	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	10	20	40	30	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	30	40	30	-	-	100
ESE	20	20	30	30	-	-	100

22SPE$15	DATA WAREHOUSING AND DATA MINING

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The objective of the course is to enable students to understand data warehouse using data model, warehouse architecture and OLAP server, Association mining techniques used for the development of efficient data mining system, Classification and prediction methods and Clustering the data using clustering techniques and Applications of data mining	
UNIT – I	**INTRODUCTION TO DATA WAREHOUSE**	**9 Periods**
Introduction- a multi-dimensional data model – Data cube technology-Data warehouse architecture- Types of OLAP servers-Data warehouse implementation-Data warehousing to data mining.		
UNIT – II	**INTRODUCTION TO DATA MINING**	**9 Periods**
Data mining – functionalities - Major issues - Data cleaning - Data integration and Transformation - Data reduction - Discretization and concept hierarchy generation-Efficient and scalable frequent item set mining methods-Mining various kinds of association rules-Association mining to correlation analysis-Constraint based association mining.		
UNIT – III	**CLASSIFICATION AND PREDICTION**	**9 Periods**
Introduction – Issues – Classification by decision tree induction - Bayesian classification- Rule based classification-Classification by back propagation- Other classification methods- Prediction-Accuracy and error measures- Evaluating the accuracy.		
UNIT – IV	**CLUSTER ANALYSIS**	**9 Periods**
Cluster analysis – Types of data – Partitioning methods – Hierarchical methods – Density based methods-Grid based methods – Model based Clustering methods – Clustering High dimensional data – Constraint based cluster analysis – outlier analysis.		
NIT – V	**DATA MINING APPLICATIONS**	**9 Periods**
Data mining for financial analysis-Retail Industry-Telecommunication Industry-Biological data analysis-Other scientific applications-Intrusion detection.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK :

1	*Jiewei Han, MichelineKamber,* ***"Data mining concepts and techniques"****, Morgan Kaufmann Pub, Third Edition, 2012.*

REFERENCES:

1	*William H. Inmon,* ***"Building the data ware house",*** *Wiley Dreamtech Pvt Ltd., Fourth Edition, 2005*
2	*Ian H.Witten, Eibe Frank,* ***"Data Mining: Practical M/c Learning tools and techniques with Java implementation"****, Morgan Kaufmann Pub, Third Edition, 2011.*
3	*K.P. Soman, Shyam Diwakar, V. Ajay,* ***"Insight into Data Mining, theory and practice",*** *PHI Pvt Ltd, 2006*
4	*Ronen Feldman, James Sangee,* ***"The Text Mining Handbook: Advanced Approaches in analyzing unstructured data",*** *Cambridge University Press, 2007.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Develop data warehouse using Star, snowflake, fact constellation schema and OLAP concepts.	K5
CO2	Transform data to normalized form and solve problems using association mining.	K3
CO3	Apply classification techniques like decision tree induction, Bayesian classification, Rule based classification and back propagation to classify an unlabeled data	K3
CO4	Apply model based clustering method and remove the irrelevant data using outlier analysis.	K3
CO5	Analyze data mining for transaction analysis, biological data analysis, social network analysis	K4

COURSE ARTICULATION MATRIX:

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO 3**
CO1	2	2	2	2	2	-	-	-	-	1	-	1	2	2	1
CO2	2	2	2	2	2	-	-	-	-	1	-	1	2	2	1
CO3	2	2	2	2	3	-	-	-	-	1	-	1	2	2	1
CO4	2	2	2	2	3	-	-	-	-	1	-	1	2	2	1
CO5	2	2	2	2	3	-	-	-	-	1	-	1	2	2	1
22SPE$15	**2**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**2**	**2**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

CO and Key Performance Indicators Mapping

CO	Key Performance Indicators
CO1	1.1.1, 2.1.1, 2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.2.2, 3.2.3, 3.3.1, 3.4.2, 4.1.2, 4.2.1, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 12.1.1, 12.2.1,12.3.2.
CO2	1.1.1, 2.1.1, 2.1.2, 2.1.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.2.2, 4.3.3, 5.1.2, 5.2.1, 5.3.2, 9.1.2, 9.2.4, 10.1.1, 10.1.2,10.2.1, 10.3.1, 11.3.1, 12.1.1, 12.1.2,12.3.2.
CO3	1.1.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.2.1, 4.2.2, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1,5.3.2, 10.1.1, 10.1.2,10.2.1, 10.3.1, 11.1.2, 11.3.1, 12.1.1, 12.3.2.
CO4	1.1.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.2.1, 4.2.2, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1,5.3.2, 9.1.2, 9.2.4, 10.1.1, 10.1.2,10.2.1, 10.3.1, 11.1.2, 11.3.1, 12.1.1, 12.3.2.
CO5	1.1.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.2.1, 4.2.2, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1,5.3.2, 8.1.1, 9.1.2, 9.2.3, 9.2.4, 10.1.1, 10.1.2,10.2.1, 10.3.1,11.1.2, 11.3.1, 12.1.1, 12.2.1, 12.3.2.

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	-	30	30	30	-	10	100
CAT2	-	20	40	40	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	30	30	40	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	30	30	40	-	-	100
ESE	-	40	40	20	-	-	100

22SPE$16	COMPUTER VISION *(Common to CSE & IT)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The objective of the course is to familiarize the basic concepts of camera calibration, Image formation, color models, Filters, Edge detection and Texture, concepts of stereoscopic imaging and Motion analysis, implement Hough Transform and clustering based segmentation, Image Classification, Object detection and Recognition algorithms.	
UNIT – I	**IMAGE FORMATION AND MODELS**	**9 periods**
Image Formation: Geometric Primitives and transformations – Photometric Image Formation – Lighting and Shading - Local Shading Models - Global Shading Models. Color: Human Color Perception - Representing Color – Digital Camera: sampling and aliasing – calibration		
UNIT – II	**EARLY VISION-ONE IMAGE**	**9 periods**
Linear Filters: Linear Filters and Convolution - Shift invariant linear systems - Spatial Frequency and Fourier Transforms – Sampling and aliasing - Filters as Templates - Edge Detection: Estimating Derivatives with Finite Differences - Gradient-based Edge Detectors. Neighborhoods: Build and Description - Texture: Representing Texture - Synthesizing Textures for Rendering –Image Denoising - Shape from Texture.		
UNIT – III	**EARLY VISION-MULTIPLE IMAGES**	**9 periods**
Stereopsis: Binocular Geometry, Reconstruction - Binocular Fusion: Local and Global Methods - Structure and Motion: Euclidean Structure from Two Images and Multiple Images - Affine Structure from Motion - Affine Structure from Two Images and Multiple Images - Affine to Euclidean Images - Affine Motion Segmentation. Projective Structure From Motion: Projective Scene Reconstruction from Two Views - Motion Estimation from Two or Three Views - Motion Estimation from Multiple Views - From Projective to Euclidean Structure and Motion.		
UNIT – IV	**MID-LEVEL VISION**	**9 periods**
Segmentation Using Clustering Methods - Human vision: Grouping and Gestalt -Applications: Shot Boundary Detection, Background Subtraction and Skin Finding - Image Segmentation by Clustering - Segmentation by Graph - Fitting:The Hough Transform -Fitting Lines and planes - Fitting Curves - Fitting to the Outlines of Surfaces .Tracking: Tracking as an Abstract Inference -Linear Dynamic Models and the Kalman Filter - Non-Linear Dynamic Models -Particle Filtering - Data Association.		
UNIT – V	**HIGH-LEVEL VISION**	**9 periods**
Registration: Registering Rigid and Deformable Objects – Smooth surfaces: Elements – Contour Geometry –Range Data: Range data segmentation – Range Image registration - Linear Combinations of Models –Image Classification: Good Image Features – Image classification of single objects –Object Detection using sliding window approach – Recognition: Face Recognition – Category Recognition – context and scene understanding.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*David Forsyth and Jean Ponce* ***"Computer vision: a modern approach"*** *2nd edition, Pearson India Education Services Pvt. Ltd, 2015.*

REFERENCES :

1	*Richard Szeliski,* ***"Computer Vision- Algorithms and Applications",*** *2nd Edition, Springer Science & Business Media, 2022*
2	*Simon J.D. Prince,* ***"Computer Vision - Models, Learning and Inference",*** *Cambridge University Press, 2012.*
3	*ReinhardKlette,* ***"Concise Computer Vision: An Introduction into Theory and Algorithms",*** *Springer, 2014*
4	*E. R. Davies,* ***"Computer & Machine Vision, Fourth Edition",*** *Academic Press, 2012.*
5	*D. L. Baggio et al.,* ***"Mastering OpenCV with Practical Computer Vision Projects",*** *Packt Publishing, 2012*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Analyze and apply low level transformation techniques to image formation and model.	K4
CO2	Apply Filters, Features, Texture and Edge detection techniques to enhance an image	K3
CO3	Analyze 3D Reconstruction and motion estimation techniques using multiple views object.	K4
CO4	Implement Hough Transform for geometric shapes and clustering based segmentation.	K3
CO5	Understand the proper use of shape related cue features for image classification, object detection and recognition.	K2

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	1	2	1	-	-	-	-	-	-	2	2	2
CO2	2	3	2	2	1	-	-	-	-	-	-	2	2	1
CO3	2	3	2	2	1	-	-	-	-	-	-	2	2	1
CO4	3	3	2	3	1	-	-	-	-	-	-	2	2	1
CO5	2	3	3	3	1	-	-	-	-	-	-	2	2	1
22SPE$16	**2**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2,2.1.3, 2.2.2,2.2.3, 2,3,1, 2.3.2, 2.4.1, 2.4.4, 3.1.4, 3.1.6, 3.2.1, 4.1.1, 4.1.2, 4.2.1, 4.3.4, 5.1.1, 12.1.1, 12.2.1, 12.2.2
CO2	1.1.1, 1.1.2, 1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1, 2.2.2,2.2.3, 2.2.4, 2,3,1, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.1.3, 3.1.4, 3.1.6, 3.2.1, 3.3.1, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3.4, 5.1.1, 5.1.2, 12.1.1, 12.2.1, 12.2.2
CO3	1.1.2, 1.2.1, 1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1, 2.2.3, 2.2.4, 2,3,1, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.3.1, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.4, 5.1.1, 5.1.2, 12.1.1, 12.2.1, 12.2.2
CO4	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2,2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2,3,1, 2.3.2, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.1.3, 3.1.4, 3.1.6, 3.2.1, 3.2.2, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3.1, 4.3.4, 5.1.1, 5.1.2, 12.1.1, 12.2.1, 12.2.2
CO5	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2,2.1.3, 2.2.1, 2.2.3, 2.2.4, 2,3,1, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.2, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3.1, 4.3.4, 5.1.1, 5.1.2, 12.1.1, 12.2.1, 12.2.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	40	40	-	-	-	100
CAT2	20	40	40	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	20	30	30	20	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	20	30	30	20	-	-	100
ESE	20	40	40	-	-	-	100

22SPE$03	DEEP LEARING (Common to CSE & IT)

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The Objective of this course is to make the students familiar with Perceptron Learning Algorithms, Feedforward Neural Networks, Deep Neural Networks, Convolution Neural Networks, Recurrent Neural Networks	
UNIT – I	**INTRODUCTON TO DEEP LEARNING**	**9 Periods**
Basics: Biological Neuron, Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm.		
UNIT – II	**FEEDFORWARD NETWORKS**	**9 Periods**
Representation Power of Feedforward Neural Networks, Backpropagation, Empirical Risk Minimization, Regularization, Autoencoders.		
UNIT – III	**DEEP NEURAL NETWORKS**	**9 Periods**
Difficulty of training deep neural networks, Greedy layerwise training. Gradient Descent (GD), Stochastic Gradient Descent (GD), Better Training of Neural Networks: Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), Regularization methods (dropout, drop connect, batch normalization).		
UNIT – IV	**CONVOLUTIONAL NEURAL NETWORKS**	**9 Periods**
Convolutional Networks: The Convolution Operation - Variants of the Basic Convolution Function - Structured Outputs - Data Types - Efficient Convolution Algorithms - Random or Unsupervised Features- LeNet, AlexNet		
UNIT – V	**RECURRENT NEURAL NETWORKS**	**9 Periods**
Recurrent Neural Networks: Bidirectional RNNs - Deep Recurrent Networks Recursive Neural Networks - The Long Short-Term Memory and Other Gated RNNs		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	Ian Goodfellow and Yoshua Bengio and Aaron Courville., ***" Deep Learnin ",*** MIT Press, 2016

REFERENCES:

1	Raúl Rojas, ***"Neural Networks: A Systematic Introduction ",*** Springer-Verlag, Berlin, 1996.
2	Yegnanarayana, B., ***"Artificial Neural Networks ",*** PHI Learning Pvt. Ltd, 2009
3	Christopher Bishop., ***"Pattern Recognition and Machine Learning ",*** Springer,2016
4	Nikhil Buduma, ***"Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms",*** O'Reilly publications, 2017

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Summarize the basics of neural network and deep learning	K2
CO2	Implement basic neural network model with hidden layers	K3
CO3	Analyze optimization and generalization in deep learning	K3
CO4	Criticize convolutional neural network and how it is applied to analyzing visual imagery	K3
CO5	Appraise Recurrent Neural Network (RNN) and its temporal dynamic behavior which helps us to remembers some information about a sequence to predict the next information	K3

COURSE ARTICULATION MATRIX															
a) CO and PO Mapping															
COs/ Pos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	
CO1	1	1	1	1	-	-	-	-	-	-	-	-	2	1	
CO2	2	2	2	2	1	-	-	-	-	-	-	-	2	1	
CO3	3	3	3	3	2	-	-	-	-	-	-	-	2	1	
CO4	3	3	3	3	2	-	-	-	-	-	-	-	2	1	
CO5	3	3	3	3	2	-	-	-	-	-	-	-	2	1	
22SPE$03	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	
1– Slight, 2 – Moderate, 3 – Substantial															
b) CO and Key Performance Indicators Mapping															
CO1	1.1.1, 2.1.1, 3.2.1, 4.1.1														
CO2	1.1.1, 1.2.1, 2.1.1, 2.2.2, 3.1.2, 3.3.2, 4.1.1, 4.1.2, 4.3.1, 5.1.1														
CO3	1.1.1, 1.2.1, 1.3.1, 1.3.2, 2.1.1, 2.2.2, 2.2.3, 2.3.1, 3.1.2, 3.3.2, 3.3.3, 3.4.2, 4.1.1, 4.1.2, 4.3.1, 5.1.1, 5.2.1, 5.2.3														
CO4	1.1.1, 1.2.1, 1.3.1, 1.3.2, 2.1.1, 2.2.2, 2.2.3, 2.3.1, 3.1.2, 3.3.2, 3.3.3, 3.4.2, 4.1.1, 4.1.2, 4.3.1, 5.1.1, 5.2.1, 5.2.3														
CO5	1.1.1, 1.2.1, 1.3.1, 1.3.2, 2.1.1, 2.2.2, 2.2.3, 2.3.1, 3.1.2, 3.3.2, 3.3.3, 3.4.2, 4.1.1, 4.1.2, 4.3.1, 5.1.1, 5.2.1, 5.2.3														

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Assignment 1	30	20	40	5	5	-	100
Assignment 2	30	20	30	10	5	5	100
Other mode of internal assessments, if any	-	-	-	-	-	-	-
ESE	30	30	40	-	-	-	100

22SPE$17	RECOMMENDER SYSTEMS *(Common to CSE & IT)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The objective of this course is to cover diverse recommendation systems, including content-based and collaborative filtering, hybrid models and their evaluation strategies.	
UNIT – I	**INTRODUCTION**	**9 periods**
Basic concepts and recent developments – Collaborative recommendation – User based and Item based nearest neighbor recommendation, Rating, Model based and Preprocessing based approaches, Recent practical approaches and systems.		
UNIT – II	**CONTENT AND KNOWLEDGE BASED RECOMMENDATION**	**9 periods**
Content representation and content similarity – Similarity based retrieval, Text classification methods, Knowledge representation, Interacting with constraints based recommender systems - Interacting with Case based recommender systems – Example applications.		
UNIT – III	**HYBRID RECOMMENDATIONS**	**9 periods**
Opportunities for hybridization – Monolithic hybridization design – Parallelized hybridization design – Pipelined hybridization design – Explanations in recommender systems – Explanations in collaborative filtering recommenders		
UNIT – IV	**EVALUATING RECOMMENDER SYSTEMS**	**9 periods**
Properties of evaluations – Popular evaluation designs – Evaluations on historical datasets – Alternative evaluation designs - Case study: Personalized game recommendations on the mobile Internet.		
UNIT – V	**TRUST-AWARE AND CONTEXT AWARE RECOMMENDATION SYSTEMS**	**9 periods**
Trust-aware recommender systems- Folksonomies- Ontological filtering- Extracting semantics from the web- Recommendations in ubiquitous environments- Context-aware recommendation- Application domains.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Dietmar Jannach, Markus Zanker, Alexander Felfernig, and Gerhard Friedrich, "**RecommenderSystems An Introduction**", Cambrige University Press, 2011*
2	*Charu C. Aggarwal, " **Recommender Systems",** Springer, 2016.*

REFERENCES :

1	*Manouselis N, Drachsler H, Verbert K, Duval E, "**Recommender Systems For Learning"**, Springer, 2013*
2	*Ricci F, Rokach L, Shapira D, Kantor B.P, "**Recommender Systems Handbook**" Springer, 2015*
3	*Michael Schrage, "**Recommendation Engines**", MIT Press, 2020.*
4	*NPTEL Course:"**Recommender Systems", Https://onlinecourses.nptel.ac.in/noc24_ge35/preview***

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explore fundamental principles and recent advancements in collaborative recommendation systems and recent practical implementations.	K3
CO2	Compare content based recommendations and Knowledge based recommendations	K2
CO3	Identify appropriate hybrid recommendation models for specific underlying applications	K3
CO4	Assess the recommendations based on well-defined metrics	K4
CO5	Explain the concepts behind Trust-aware and context aware recommender systems.	K2

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping													
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	2	1	1	-	-	-	-	-	-	2	2	2
CO2	2	2	2	1	1	-	-	-	-	-	-	2	2	2
CO3	2	3	2	1	1	-	-	-	-	-	-	2	2	1
CO4	2	3	2	1	1	-	-	-	-	-	-	2	2	1
CO5	2	2	2	1	2	-	-	1	-	-	-	3	2	1
22SPE$17	**2**	**3**	**2**	**1**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**3**	**2**	**2**
1 – Slight, 2 – Moderate, 3 – Substantial														
b) CO and Key Performance Indicators Mapping														
CO1	1.1.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.4.1, 2.4.4, 3.1.2, 3.1.3, 3.1.5, 3.1.6, 3.2.2, 4.3.4, 5.2.1, 12.1.1, 12.2.1, 12.2.2, 12.3.1													
CO2	1.1.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.4.1, 2.4.4, 3.1.2, 3.1.3, 3.1.5, 3.1.6, 3.2.2, 3.3.2, 4.3.4, 5.2.1, 12.1.1, 12.2.1, 12.2.2, 12.3.1													
CO3	1.1.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.4.1, 2.4.4, 3.1.2, 3.1.3, 3.1.5, 3.1.6, 3.2.2, 3.3.1, 3.3.2, 3.4.1, 4.3.4, 5.2.1, 12.1.1, 12.2.1, 12.2.2, 12.3.1													
CO4	1.1.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.2, 3.1.6, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 4.3.4, 5.2.1, 12.1.1, 12.2.1, 12.2.2, 12.3.1													
CO5	1.1.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.4.1, 2.4.4, 3.1.2, 3.1.3, 3.1.5, 3.1.6, 3.2.2, 3.3.1, 3.4.1, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 8.2.2, 12.1.1, 12.2.1, 12.2.2, 12.3.1, 12.3.2													

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	40	40	-	-	-	100
CAT2	20	40	40	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	30	50	20	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	30	50	20	-	-	100
ESE	30	30	40	-	-	-	100

22SPE$18	EXPLORATORY DATA ANALYTICS *(Common to CSE & IT)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The objective of this course is to make students to learn about how to explore and analyze datasets to gain insights, identify patterns, and formulate hypotheses using data visualization, descriptive statistics, data cleaning and preprocessing, dimensionality reduction, and exploratory data mining techniques.	
UNIT–I	**INTRODUCTION TO EDA**	**9 periods**
Exploratory Data Analysis (EDA) Fundamentals – Steps in EDA, Data Types: Numerical Data, Categorical data, Measurement Scales - Comparing EDA with classical and Bayesian Analysis – Software tools for EDA – Visual aids for EDA. Transformation Techniques: Performing data deduplication, replacing values, Discretization and binning, Handling missing data – Traditional methods - Maximum Likelihood Estimation.		
UNIT–II	**EDA USING PYTHON**	**9 periods**
Data Manipulation using Pandas – Pandas Objects – Data Indexing and Selection – Operating on Data – Handling Missing Data – Hierarchical Indexing – Combining datasets – Concat, Append, Merge and Join – Aggregation and grouping – Pivot Tables – Vectorized String Operations, Basics of Matplotlib and Scikit-learn.		
UNIT – III	**CORRELATION ANALYSIS AND TIME SERIES ANALYSIS**	**9 periods**
Types of analysis: Univariate analysis - bivariate analysis - multivariate analysis – Titanic dataset analysis – Simpson's paradox. Time Series Analysis (TSA): Fundamentals of TSA - Characteristics of TSA – TSA with Open Power System data: Time based indexing, Visualizing time series, Grouping time series data, Resampling time series data.		
UNIT – IV	**PATTERN DISCOVERY**	**9 periods**
Dimensionality Reduction – Linear methods: Principal Component Analysis (PCA), Intrinsic dimensionality, Non-linear methods: Multidimensional Scaling, Self-Organizing Maps. Clustering Algorithms – Spectral, Document clustering, Model based clustering. Data Summarization and Visualization – 1D, 2D Statistical data analysis, contingency tables, Scatter plots, Dot charts, Bar plots.		
UNIT – V	**MODEL DEVELOPMENT AND EVALUATION**	**9 periods**
Types of machine learning - Supervised, Unsupervised, Reinforcement learning. Unified machine learning workflow – Data preprocessing, data preparation, training sets and corpus creation, model creation and training, model evaluation, model selection, model deployment. Case Studies: Retail Sales analysis, Healthcare analytics, Social media engagement analysis, Financial market analysis, Customer churn prediction, E-Commerce Product recommendations, Transportation and Logistics optimization.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Suresh Kumar Mukhiya, Usman Ahmed,* ***"Hands-On Exploratory Data Analysis with Python"****, 1st Edition, Packt Publishing, 2020 (Units I, III, IV, V).*
2	*Jake Vander Plas,* ***"Python Data Science Handbook: Essential Tools for Working with Data"****, 1st Edition, O Reilly, 2017 (Unit II).*

REFERENCES :

1	*W.L. Martinez, A.R Martinez, J.L. Solka,* ***"Exploratory Data Analysis with MATLAB"****, CRC Press, Chapman & Hall Book, 3rd Edition, 2017*
2	*Claus O. Wilke,* ***"Fundamentals of Data Visualization"****, O'Reilly publications, 2019*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Understand the importance of exploratory data analysis in the data science process	K2
CO2	Work with various open-source data analysis and manipulation tools available in python	K3
CO3	Use Data exploration and visualization techniques for multivariate and time series data.	K4
CO4	Apply exploratory data mining techniques to uncover hidden patterns and relationships in data.	K3
CO5	Apply exploratory data analysis techniques to solve real-world problems in various domains	K4

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	3	3	3	1	-	-	-	-	-	2	3	3	3
CO2	3	3	3	3	3	1	-	-	-	-	-	1	3	3	3
CO3	3	3	3	3	3	1	-	-	-	-	-	1	3	3	3
CO4	3	3	3	3	3	1	-	-	-	-	-	1	3	3	3
CO5	3	3	3	3	3	1	-	-	-	-	-	1	3	3	3
22SPE$18	**3**	**3**	**3**	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**3**	**3**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3,2.4.4, 3.1.1, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1,4.2.2, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.2.1, 5.2.2, 5.3.1, 6.1.1, 12.1.2, 12.2.1, 12.2.2
CO2	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2,2.4.3, 2.4.4, 3.1.1, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1,4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 12.1.2, 12.2.1, 12.2.2
CO3	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2,2.4.3, 2.4.4, 3.1.1, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1,4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 12.1.2, 12.2.1, 12.2.2
CO4	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2,2.4.3, 2.4.4, 3.1.1, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1,4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 12.1.2, 12.2.1, 12.2.2
CO5	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2,2.4.3, 2.4.4, 3.1.1, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 12.1.2, 12.2.1, 12.2.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	40	30	30	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	40	30	30	-	-	100
ESE	30	40	30	-	-	-	100

22SPE$19	VIDEO ANALYTICS

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The objective of the course is to learn basic video processing techniques, motion estimation algorithms, techniques for video segmentation, tracking analysis, filtering and compression techniques for video, and current trends in video analysis	
UNIT – I	**VIDEO FUNDAMENTALS**	**9 Periods**
Basic Concepts and Terminology – Analog Video Standards – Digital Video Basics – Analog to Digital Conversion – Sampling for analog and digital video – Rectangular and periodic 2-D sampling – Video Sampling Rate and Standards Conversion – Digital Video Formats – Video Features		
UNIT – II	**TWO DIMENSIONAL MOTION ESTIMATION**	**9 Periods**
Fundamentals of Motion Estimation – Optical Flow Methods: 2D Motion Estimation, OF equation methods – Block Based Methods: Block Motion, Phase correlation and Block matching method–Pel Recursive Methods – Bayesien Methods: Optimizations, MAP motion estimation algorithms –Frequency Domain Motion Estimation.		
UNIT – III	**3D MOTION ESTIMATION AND SEGMENTATION**	**9 Periods**
Point Correspondences Methods: Orthographic model, Perspective model, 3D planer surfaces – Optical Flow and Direct methods – Motion segmentation: Dominant-Motion Segmentation - Multiple-Motion Segmentation - Region-Based Motion Segmentation: Fusion of Color and Motion - Simultaneous Motion Estimation and Segmentation – Motion Tracking : Kalman, Particle Filter based tracking - Multi-target/Multi-camera tracking		
UNIT – IV	**VIDEO FILTERING AND COMPRESSION**	**9 Periods**
Video Filtering – Motion Compensated Filtering – Noise filtering – Intra frame and motion adaptive filtering – Restoration – Intraframe and multiframe restoration – Super resolution – Video compression: Approaches, basic compression standards: MPEG-1, MPEG-2 – H.264 –HEVC –stereo and multi view video compression		
UNIT – V	**VIDEO ANALYSIS AND APPLICATIONS**	**9 Periods**
Video Quality Assessment - Video Indexing, Summarization and Retrieval – Video Security and Protection – Wireless video Streaming – Video Surveillance – Face Recognition from video - Audiovisual speech processing - Automatic Video Trailer Generation– Video in painting– Forensic Video Analysis.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK :

1	*A. Murat Tekalp,* ***"Digital Video Processing",*** *Second Edition, Prentice Hall, 2015.*

REFERENCES :

1	*Oges Marques,* ***"Practical Image and Video Processing Using MATLAB",*** *Wiley and Sons (IEEE Press), 2011*
2	*Alan C. Bovik, "****Handbook of Image and Video processing",*** *Second Edition, Academic Press, 2005*
3	*Al Bovik (Alan C Bovik,* ***"The Essential Guide to Video Processing",*** *Academic Press, Second Edition, 2009*
4	*Yunqian Ma, Gang Qian,* ***"Intelligent Video Surveillance: Systems and Technology",*** *CRC Press (Taylor and Francis Group), 2009.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Analyze and implement the basic video processing algorithms in modern technologies	K4
CO2	Analyze the approaches for identifying and tracking objects and person with motion based algorithms	K4
CO3	Segment video based on its features.	K3
CO4	analyze the various filtering and video compression standards	K4
CO5	Analyze the usage of video in various applications	K3

COURSE ARTICULATION MATRIX :

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	2	3	1	1	-	-	-	-	-	-	-	-	3	1	2
CO2	2	3	1	2	1	-	-	-	-	-	-	1	3	1	2
CO3	2	3	1	1	1	-	-	-	-	-	-	1	3	1	2
CO4	2	3	1	1	1	-	-	-	-	-	-	1	3	1	2
CO5	2	2	1	2	2	-	-	-	-	-	-	1	3	1	2
22SPE$19	2	3	1	1	1	-	-	-	-	-	-	1	3	1	2
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.4.1, 2.4.4, 3.1.1,4.3.4
CO2	1.1.1, 1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.2.2, 3.4.1, 4.1.1, 4.1.4, 4.2.2, 4.3.4, 5.1.1, 5.1.2, 12.2.1, 12.2.2
CO3	1.1.1, 1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.2.2, 3.4.1, 4.1.1, 4.1.4, 4.3.4, 5.1.1, 5.1.2, 12.2.1, 12.2.2
CO4	1.1.1, 1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.2.2, 3.4.1, 4.1.1, 4.1.4, 4.3.4, 5.1.1, 5.1.2, 12.2.1, 12.2.2
CO5	1.1.1, 1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1, 2.2.3, 2.2.4, 2.4.2, 3.1.1, 3.2.2, 3.4.1, 4.2.2, 4.3.2, 5.1.1, 5.1.2, 5.2.2, 12.2.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	30	30	20	-	-	100
CAT2	20	30	30	20	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	30	30	40	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	20	40	40	-	-	100
ESE	20	30	30	20	-	-	100

22SPE$20	MODERN CRYPTOGRAPHY *(Common to CSE & IT)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The objective of this course is to make the students to understand the basic concepts of modern cryptography, private key & public key cryptographic algorithms, Identity based encryption mechanism and Post quantum cryptographic algorithms.	
UNIT – I	**INTRODUCTION**	**9 Periods**
Cryptography and Modern Cryptography- Basic Principles of Modern Cryptography - Perfectly-Secret Encryption - Computational Complexity - Zero-knowledge Properties - Zero-knowledge Argument - Protocols with Two-sided-error - Round Efficiency - Non-interactive Zero-knowledge.		
UNIT – II	**SYMMETRIC CRYPTOGRAPHY**	**9 Periods**
Computational Approach to Cryptography - Defining Computationally-Secure Encryption – Secure Communication and Message Integrity-Collision-Resistant Hash Functions - NMAC and HMAC -One-Way Functions -Limitations of Private-Key Cryptography.		
UNIT – III	**ASYMMETRIC CRYPTOGRAPHY**	**9 Periods**
Primes and Divisibility - Modular Arithmetic - Cyclic Groups - Algorithms for Factoring -, Computing Discrete Logarithms - Goldwasser-Micali Encryption Scheme - Rabin Encryption Scheme - Paillier Encryption Scheme - Digital Signature Schemes - Lamport's One-Time Signature Scheme - Signatures from Collision-Resistant Hashing.		
UNIT – IV	**IDENTITY BASED ENCRYPTION**	**9 Periods**
Bilinear map – Security Model- Hardness Assumptions - Boneh-Franklin Identity based Encryption (IBE) – Gentry's IBE- Dual System Encryption – Waters' IBE - Boneh-Boyen IBE – Security Model for Hierarchical IBE - Waters' Realization – Generic Group Model.		
UNIT – V	**POST QUANTUM CRYPTOGRAPHY**	**9 Periods**
Lattice Problems – NTRU Cryptosystem - Lattice-Based Cryptography – Ring Variants of Learning with Errors (LWE) & Learning with Rounding (LWR) - (LWE+LWR)-Based Public-Key Encryption – Ring Variant of Lizard- Code based Cryptography: McEliece&Niederreiter Cryptosystem, Security Analysis.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Jonathan Katz and Yehuda Lindell,* ***"Introduction to Modern Cryptography",*** *CRC press, 2020. (Unit - I, II, III)*
2	*Intae Kim, Wai Kong Lee, Seong Oun Hwang,* ***"Modern Cryptography with Proof Techniques and Implementations",*** *CRC press, 2021.(Unit IV, V)*

REFERENCES :

1	*William Stallings,* ***"Cryptography and Network security Principles and Practices",*** *Pearson/PHI, 2016.*
2	*Wade Trappe, Lawrence C Washington,* ***"Introduction to Cryptography with coding theory"****, Pearson, 2020.*
3	*W. Mao,* ***"Modern Cryptography – Theory and Practice"****, Pearson Education, 2003.*
4	*Song Y. Yan ,* ***"Computational Number Theory and Modern Cryptography"****, Wiley, 2013.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Realize the modern cryptographic principles and concepts.	K2
CO2	Apply a symmetric cryptography mechanism for encryption using hash functions.	K3
CO3	Apply asymmetric cryptography mechanism for public key encryption.	K3
CO3	Determine identity based encryption using hardness assumption and security models.	K3
CO5	Exemplify post-quantum standardization algorithms.	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping														
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	2	2	-	-	-	-	-	-	-	1	3	1
CO2	2	2	2	2	-	-	-	-	-	-	-	1	3	1
CO3	2	2	2	2	-	-	-	-	-	-	-	1	3	1
CO4	2	2	2	3	-	-	-	-	-	-	-	1	3	1
CO5	2	2	2	3	-	-	-	-	-	-	-	1	3	1
22SPE$20	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**1**
1 – Slight, 2 – Moderate, 3 – Substantial														
b) CO and Key Performance Indicators Mapping														
CO1	1.1.1, 1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.3, 2.2.4, 2.4.1, 3.1.1, 3.1.6, 3.2.2, 3.3.1, 3.4.1, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.3.1, 4.3.4, 12.1.1													
CO2	1.1.1, 1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.3, 2.2.4, 2.4.1, 2.4.3, 3.1.1, 3.1.6, 3.2.2, 3.3.1, 3.4.1, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.3.1, 4.3.4, 12.1.1													
CO3	1.1.1, 1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.3, 2.2.4, 2.4.1, 2.4.3, 3.1.1, 3.1.6, 3.2.2, 3.3.1, 3.4.1, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.3.1, 4.3.4, 12.1.1													
CO4	1.1.1, 1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.3, 2.2.4, 2.4.1, 2.4.3, 3.1.1, 3.1.6, 3.2.2, 3.3.1, 3.4.1, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.4, 12.1.1													
CO5	1.1.1, 1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.3, 2.2.4, 2.4.1, 2.4.3, 3.1.1, 3.1.6, 3.2.2, 3.3.1, 3.4.1, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.4, 12.1.1													

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ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	20	20	-	-	100
CAT2	20	30	30	20	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	30	40	30	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	30	40	30	-	-	100
ESE	20	40	40	-	-	-	100

22SPE$21	ENGINEERING SECURE SOFTWARE SYSTEMS *(Common to CSE & IT)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The objective of this course is to make the students understand about the development of robust software solutions while integrating security principles and practices throughout the software development lifecycle.	
UNIT – I	**FUNDAMENTALS OF SOFTWARE SECURITY**	**9 Periods**
Introduction - Software Assurance and Software Security - Threats to software security – Sources of software insecurity – Benefits of Detecting Software Security Defects Early – Managing Secure Software Development– Properties of Secure Software – Influence the Security Properties of Software- Assert and Specify Desired Security Properties.		
UNIT – II	**SECURE SOFTWARE REQUIREMENT ENGINEERING, ARCHITECTURE AND DESIGN**	**9 Periods**
Importance of Requirements Engineering – Quality Requirements – Security Requirements Engineering - SQUARE process Model – Requirements Elicitation - Requirements Prioritization – Critical Role of Architecture and Design – Issues and Challenges – Software Security Practices for Architecture and Design: Architectural Risk Analysis - Software Security Knowledge for Architecture and Design: Security Principles, Guidelines and Attack Patterns.		
UNIT – III	**SECURE CODING AND TESTING**	**9 Periods**
Code Analysis - Coding Practices – Software Security Testing – Security Testing Considerations Throughout the SDLC – Security and Complexity: System Assembly Challenges.		
UNIT – IV	**RISK MANAGEMENT**	**9 Periods**
Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques.		
UNIT – V	**GOVERNANCE AND MANAGING SECURE SOFTWARE**	**9 Periods**
Introduction - Governance and Security – Adopting an Enterprise Software Security Framework – Security and Project Management – Maturity of Practice.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Julia H. Allen,* ***"Software Security Engineering",*** *Pearson Education, 2008.*
2	*Evan Wheeler,* ***"Security Risk Management: Building an Information Security Risk Management Program from the Ground Up"****, First edition, Syngress Publishing, 2011.*

REFERENCES :

1	*McGraw, Gary,* ***"Software Security: Building Security In"****, Addison-Wesley, 2006.*
2	*John Viega, Gary McGraw,* ***"Building Secure Software: How to Avoid Security Problems the Right Way"****, Addison-Wesley, 2011*
3	*Raimundas Matulevicius,* ***"Fundamentals of Secure System Modelling"****, Springer International Publishing, 2017.*
4	*Charles Antony Richard Hoare,* ***"Software System Reliability and Security"****, IOS Press , 2007.*
5	*Heather Adkins, Betsy Beyer, Paul Blankinship, Piotr Lewandowski, Ana Oprea, Adam Stubblefield,* ***"Building Secure and Reliable Systems Best Practices for Designing, Implementing, and Maintaining Systems"****, O'Reilly Media, 2020.*
6	*Erik Fretheim, Marie Deschene,* ***"Secure Software Systems"****, Jones & Bartlett Learning, 2023.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Infer the fundamentals of software security.	K2
CO2	Apply security principles in software development.	K3
CO3	Integrate the appropriate security practices while coding and performing different types of testing.	K3
CO4	Identify, assess, mitigate and communicate security risks effectively in building secure software systems.	K4
CO5	Understand the importance of software security considerations as part of Governance and Project Management	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping													
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	2	2	1	-	-	-	-	-	-	-	2	1
CO2	2	2	2	2	1	-	-	-	2	1	-	-	2	1
CO3	2	1	2	2	1	-	-	-	2	1	-	-	2	1
CO4	2	1	2	2	1	-	-	-	2	1	-	-	1	1
CO5	2	2	2	2	1	-	-	-	-	1	-	-	2	1
22SPE$21	**2**	**2**	**2**	**2**	**1**	**-**	-	-	**2**	**1**	**-**	**-**	**2**	**1**
1 – Slight, 2 – Moderate, 3 – Substantial														

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1,1.4.1,2.1.1,2.2.2,2.2.3,2.4.2,3.1.1,3.1.5,3.2.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.3.1,4.3.2, 4.3.3,5.1.1,10.1.1, 11.2.1
CO2	1.3.1,1.4.1,2.1.1,2.2.2,2.2.3,2.4.2,3.1.1,3.1.5,3.2.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.3.1,4.3.2, 4.3.3,5.1.1,5.2.1, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4,10.1.1, 11.3.1
CO3	1.3.1,1.4.1,2.2.3,2.4.2,3.1.1,3.1.5,3.2.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.3.2,4.3.3,5.1.1,5.2.1, 9.1.1, 9.1.2, 9.2.1,9.2.2, 9.2.3, 9.2.4, 10.1.1, 11.3.1
CO4	1.3.1,1.4.1,2.1.1,2.2.2,2.2.3,3.1.1,3.1.5,3.2.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.3.1,4.3.2,4.3.3, 5.1.1,5.2.1, 9.1.1, 9.1.2, 9.2.1,9.2.2, 9.2.3, 9.2.4,10.1.1,11.1.2
CO5	1.3.1,1.4.1,2.1.1,2.2.2,2.2.3,2.4.2,3.1.1,3.1.5,3.2.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.3.1,4.3.2, 4.3.3,5.1.1,5.2.1,10.1.1, 11.3.2

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ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	30	30	40	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	20	30	30	20	-	-	100
ESE	20	40	40	-	-	-	100

22SPE$22	SECURITY AND PRIVACY IN CLOUD *(Common to CSE & IT)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The objective of this course is to develop proficiency in securing cloud environments while safeguarding data privacy and ensuring regulatory compliance.	
UNIT – I	**INTRODUCTION AND SECURITY LEVELS**	**9 Periods**
The Evolution of Cloud Computing, Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud Barriers to Cloud Computing Adoption in the Enterprise. Infrastructure Security - The Network Level, The Host Level, The Application Level.		
UNIT – II	**DATA SECURITY AND STORAGE**	**9 Periods**
Aspects of Data Security, Data Security Mitigation, Provider Data and Its Security Identity and Access Management- Trust Boundaries and IAM, IAM Challenges, IAM Definitions, IAM Architecture and Practice, IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management, Cloud Service Provider IAM Practice		
UNIT – III	**SECURITY MANAGEMENT IN THE CLOUD**	**9 Periods**
Security Management Standards, Security Management in the Cloud - Availability Management, SaaS Availability Management, PaaS Availability Management, IaaS Availability Management, Access Control - Security Vulnerability, Patch, and Configuration Management.		
UNIT – IV	**PRIVACY**	**9 Periods**
Privacy, Data Life Cycle, Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications		
UNIT – V	**AUDIT AND COMPLIANCE**	**9 Periods**
Internal Policy Compliance - Governance, Risk, and Compliance (GRC), Illustrative Control Objectives for Cloud Computing, Incremental CSP-Specific Control Objectives, Additional Key Management Control Objectives, Control Considerations for CSP Users, Regulatory/External Compliance, Other Requirements, Cloud Security Alliance, Auditing the Cloud for Compliance.		

Contact Periods:
Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

TEXT BOOK:

1	*Tim Mather, Subra Kumaraswamy, and Shahed Latif,* ***"Cloud Security and Privacy:An Enterprise Perspective on Risks and Compliance"****, O'Reilly Media, 2011*

REFERENCES:

1	*John R. Vacca,* ***"Cloud Computing Security Foundations and Challenges"****, CRC Press,2nd Edition,2020.*
2	*Siani Pearson, George Yee* ***"Privacy and Security for Cloud Computing"*** *Computer Communications and Networks, Springer, 2013.*
3	*Ronald L. Krutz, Russell Dean Vines,* ***"Cloud Security: A Comprehensive Guide to Secure Cloud Computing"****, Wiley Publishing, 2010*
4	*Ben Halper,* ***"Auditing Cloud Computing: A Security and Privacy Guide"*** *John Wiley & Sons, Inc. Publications, 2011.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Identify the threats, challenges, and security levels associated with infrastructure security.	K2
CO2	Examine the current state of data security and storage in the cloud. Explain the identity and access management (IAM) practice in the cloud.	K3
CO3	Define and use appropriate security management frameworks and standards for the cloud.	K2
CO4	Understand the significance of privacy in the cloud.	K3
CO5	Enumerate the importance of audit and compliance functions within the cloud.	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping														
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	3	1	2	-	-	-	1	1	1	3	3	2
CO2	1	3	2	3	1	-	-	-	2	2	3	2	3	1
CO3	3	2	2	3	2	-	-	-	3	1	1	2	2	3
CO4	2	1	2	3	3	-	-	-	3	2	3	3	1	1
CO5	1	3	3	1	1	-	-	-	2	3	3	2	2	3
22SPE$22	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**2**	**2**	**2**	**2**	**2**	**2**
1 – Slight, 2 – Moderate, 3 – Substantial														

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1.2.2.2,2.2.3,3.1.1,3.1.2,10.1.1,10.1.2,10.1.3,12.1.1,12.1.2,12.2.1, 12.2.2,12.3.1,12.3.2
CO2	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1.2.2.2,2.2.3,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,4.1.1,4.1.2,4.1.3, 4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.3,4.3.4,9.1.1,10.1.1,10.1.2,10.1.3,12.1.1,12.1.2,12.2.1,12.2.2,12.3. 1,12.3.2
CO3	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1.2.2.2,2.2.3,3.1.1,3.1.2,4.1.1,4.1.2,4.1.3,4.1.4,9.1.1,10.1.1,10.1.2, 10.1.3, 12.1.1,12.1.2,12.2.1,12.2.2,12.3.1,12.3.2
CO4	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1.2.2.2,2.2.3,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,4.1.1,4.1.2,4.1.3, 4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.3,4.3.4,9.1.1,10.1.1,10.1.2,10.1.3,12.1.1,12.1.2,12.2.1,12.2.2,12.3. 1,12.3.2
CO5	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1.2.2.2,2.2.3,3.1.1,3.1.2,4.1.1,4.1.2,4.1.3,4.1.4,1,9.1.1,10.1.1,10.1. 2, 10.1.3, 12.1.1,12.1.2,12.2.1,12.2.2,12.3.1,12.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	40	40	-	-	-	100
CAT2	20	40	40	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	20	40	40	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	20	40	40	-	-	-	100
ESE	20	40	40	-	-	-	100

22SPE$23	CRYPTO - CURRENCY AND BLOCKCHAIN TECHNOLOGIES *(Common to CSE & IT)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The objective of this course is to make the students to learn the basics of cryptography primitives used in block chain, networks in Block chain, Crypto currencies and applications of Block chain in various sectors.	
UNIT – I	**INTRODUCTION**	**9 Periods**
Blockchain definitions- Database vs. blockchain- History, motivations & Characteristics - Background of DLT- Different types of blockchain- Overview of blocks - Moore's Law and Blockchain - Cryptography in blockchain- Cryptographic hashing- Digital signatures in blockchain.		
UNIT – II	**NETWORKS IN BLOCKCHAIN**	**9 Periods**
P2P networking architecture- Network discovery - Block synchronization - Building a simple blockchain in a P2P network - Blockchain structure - Blockchain networks - Bitcoin hard forks and altcoins – crypto currency application.		
UNIT – III	**BITCOIN AND CRYPTO CURRENCY**	**9 Periods**
Crypto currency - Bitcoin basics - Keys and addresses – Transactions - Mining and consensus – Bitcoin Network and Payments- Bitcoin Clients and APIs - Alternative Coins- MultiChain platform - Setting up a blockchain environment.		
UNIT – IV	**SMART CONTRACTS AND ETHEREUM**	**9 Periods**
Proof of Existence architecture - Building the Proof of Existence application - Digital assets and identity - Proof of ownership- Smart contracts- NEO blockchain - Choosing the smart contract platform –Ethereum network - Components of the Ethereum ecosystem- Test networks –Setting and Starting up a private network.		
UNIT – V	**BLOCKCHAIN APPLICATIONS**	**9 Periods**
Financial blockchain projects - Non-financial blockchain projects- Blockchain optimizations - Blockchain enhancements - Transaction security model- Decentralized security model - Attacks on the blockchain–Block in Financial system and crowdfunding.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Koshik Raj, "**Foundations of Blockchain: The pathway to cryptocurrencies and decentralized blockchain applications**", Packt publisher, 2019.*

REFERENCES:

1	*Bashir Imran, "**Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained**"Packt publisher, 2017.*
2	*Antony Lewis, **"The Basics of Bitcoins and Blockchains"**, Mango Publising, 2018.*
3	*Chris Dannen, **"Introducing Ethereum and Solidity: Foundations of Cryptocurrency and Blockchain Programming for Beginners"**,Apresspublisher, 2017.*
4	*S Shukla, M. Dhawan, S. Sharma and S. Venkatesan, **"Blockchain Technology: Cryptocurrency and Applications"**, Oxford University Press, 2019.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Examine the basics and apply cryptographic concepts in blockchain.	K2
CO2	Apply the concepts of P2P to achieve decentralization in the blockchain network.	K3
CO3	Demonstrate the concepts of Bitcoin and introduces decentralized application development using MultiChain blockchain framework.	K2
CO4	Apply proof of existence and ownership smart contracts, NEO and Ethereum block chain platform to implement the Blockchain Application.	K3
CO5	Understand the latest advances and its applications in Block Chain Technology.	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	2	1	1	2	3	-	-	-	1	1	-	-	2	2
CO2	2	1	1	2	3	-	-	-	1	1	-	-	2	1
CO3	2	1	1	2	3	-	-	-	1	1	-	-	2	1
CO4	2	1	1	2	3	-	-	-	1	1	-	-	1	1
CO5	2	1	1	2	3	-	-	-	1	1	-	-	2	1
22SPE$23	2	1	1	2	3	-	-	-	1	1	-	-	2	1

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.2,1.3.1,1.4.1,2.1.3,2.2.3,2.4.2,3.3.2,4.1.1,4.1.2,4.3.1,4.3.2,4.3.3,5.1.1,5.1.2,5.2.1,5.3.1,5.3.2, 9.2.1,10.1.1
CO2	1.3.1,1.4.1,2.1.3,2.4.2,3.3.2,4.1.1,4.1.2,4.3.1,4.3.2,4.3.3,5.1.1,5.1.2,5.2.1,5.3.1,5.3.2,9.2.1,10.1.1
CO3	1.3.1,1.4.1,2.1.3,2.4.2,3.3.2,4.1.1,4.1.2,4.3.1,4.3.2,4.3.3,5.1.1,5.1.2,5.2.1,5.3.1,5.3.2,9.2.1,10.1.1
CO4	1.3.1,1.4.1,2.1.3,2.2.3,2.4.2,3.3.2,4.1.1,4.1.2,4.3.1,4.3.2,4.3.3,5.1.1,5.1.2,5.2.1,5.3.1,5.3.2,9.2.1,10 .1.1
CO5	1.3.1,1.4.1,2.1.3,2.4.2,3.3.2,4.1.1,4.1.2,4.3.1,4.3.2,4.3.3,5.1.1,5.1.2,5.2.1,5.3.1,5.3.2,9.2.1,10.1.1

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40	-	-	-	100
CAT2	20	40	40	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	50	50	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	50	50	-	-	-	100
ESE	20	40	40	-	-	-	100

22SPE$24	ETHICAL HACKING *(Common to CSE & IT)*

PREREQUISITE	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The objective of this course is to make the students to explore the tools that gather information on potential target, protect against the hackers, identify vulnerabilities and attacks in network systems & web application.	
UNIT – I	**INTRODUCTION**	**9 Periods**
Introduction to Hacking –Important Terminologies – Hacktivism – Computer Crimes and Implications. Penetration Test – Vulnerability Assessments versus Penetration Test – Pre-Engagement – Rules of Engagement–Penetration Testing Methodologies: OSSTMM–NIST –OWASP – Categories of Penetration Test – Types of Penetration Tests – Vulnerability Assessment Summary – Reports.		
UNIT – II	**INFORMATION GATHERING AND SCANNING**	**9 Periods**
Information Gathering Techniques: Active Information Gathering – Passive Information Gathering – Sources of Information Gathering – Tracing the Location – Traceroute: ICMP, TCP and UDP Traceroute – Enumerating and Fingerprinting the Webservers – Google Hacking – Enumerating SNMP – SMTP Enumeration – Target Enumeration and Port Scanning Techniques – Advanced Firewall/IDS Evading Techniques.		
UNIT – III	**NETWORK ATTACKS**	**9 Periods**
Network Sniffing – Types of Sniffing – Promiscuous versus Non promiscuous Mode – MITM Attacks – ARP Attacks –MAC flooding - Denial of Service Attacks – Hijacking Session with MITM Attack – SSL Strip: Stripping HTTPS Traffic –DNS Spoofing – ARP Spoofing Attack Manipulating the DNS Records – DHCP Spoofing – Remote Exploitation –Attacking Network Remote Services – Attacking SMTP – Attacking SQL Servers – Testing for Weak Authentication.		
UNIT – IV	**EXPLOITATION**	**9 Periods**
Introduction to Metasploit – Reconnaissance with Metasploit – Port Scanning with Metasploit – Compromising a Windows Host with Metasploit – Client Side Exploitation Methods – E–Mails with Malicious Attachments – PDF Hacking – Social Engineering Toolkit – Browser Exploitation – Post–Exploitation – Cracking the Hashes: Brute force Dictionary Attacks – Password Salts – Rainbow Tables – John the Ripper – Gathering OS Information – Harvesting Stored Credentials.		
UNIT – V	**WIRELESS AND WEB HACKING**	**9 Periods**
Wireless Hacking – Introducing Aircrack– Cracking the WEP – Cracking a WPA/WPA2 Wireless Network Using Aircracking – Evil Twin Attack – Causing Denial of Service on the Original AP – Web Hacking – Attacking the Authentication – Brute Force and Dictionary Attacks – Log-In Protection Mechanisms – Captcha Validation Flaw –Captcha RESET Flaw – Manipulating User-Agents to Bypass Captcha and Other Protection – Authentication Bypass Attacks – Testing for the Vulnerability– Session Attacks – SQL Injection Attacks.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*RafayBaloch, **"Ethical Hacking and Penetration Testing Guide"**, CRC Press, 2017.*

REFERENCES:

1	*Kevin Beaver, **"Hacking for Dummies"**, Sixth Edition, Wiley, 2022.*
2	*Kimberly Graves, "**Certified Ethical Hacker STUDY GUIDE"**, Wiley publication, 2010.*
3	*Michael Gregg, "**Certified Ethical Hacker"**, Pearson publication, 2014.*
4	*Matt Walker, "**All-in-one Certified Ethical Hacker Exam Guide"**, McGraw Hill Edition, 2012.*
5	*Jon Erickson, **"Hacking: The Art of Exploitation"**, Second Edition, Rogunix, 2007.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Use the various security tools to assess and to predict the vulnerabilities across any computing system using penetration testing.	K1
CO2	Identify prediction mechanism to prevent any kind of attacks using information gathering mechanisms.	K2
CO3	Protect the system using scanning techniques from malicious software and worms.	K2
CO4	Evaluate the wireless network flaws and able to apply security patches with different exploitations.	K3
CO5	Analyze the risk and support the organization for effective security measures.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	2	2	2	2	3	-	-	1	1	1	-	-	2	1
CO2	2	2	2	2	3	-	-	1	1	1	-	-	2	1
CO3	2	1	2	2	3	-	-	1	1	1	-	-	2	1
CO4	2	1	2	2	3	-	-	1	1	1	-	-	1	1
CO5	2	2	2	2	3	-	-	1	1	1	-	-	2	1
22SPE$24	**2**	**2**	**2**	**2**	**3**	**-**	**-**	**1**	**1**	**1**	**-**	**-**	**2**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1,1.4.1,2.1.1,2.2.2,2.2.3,2.4.2,3.1.1,3.1.5,3.2.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.3.1,4.3.2,4.3.3,5.1.1,5.1.2,5.2.1,5.3.1,5.3.2,8.1.1,9.2.1,10.1.1
CO2	1.3.1,1.4.1,2.1.1,2.2.2,2.2.3,2.4.2,3.1.1,3.1.5,3.2.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.3.1,4.3.2,4.3.3,5.1.1,5.1.2,5.2.1,5.3.1,5.3.2,8.1.1,9.2.1,10.1.1
CO3	1.3.1,1.4.1,2.2.3,2.4.2,3.1.1,3.1.5,3.2.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.3.2,4.3.3,5.1.1,5.1.2,5.2.1,5.3.1,5.3.2,8.1.1,9.2.1,10.1.1
CO4	1.3.1,1.4.1,2.1.1,2.2.2,2.2.3,3.1.1,3.1.5,3.2.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.3.1,4.3.2,4.3.3,5.1.1,5.1.2,5.2.1,5.3.1,5.3.2,8.1.1,9.2.1,10.1.1
CO5	1.3.1,1.4.1,2.1.1,2.2.2,2.2.3,2.4.2,3.1.1,3.1.5,3.2.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.3.1,4.3.2,4.3.3,5.1.1,5.1.2,5.2.1,5.3.1,5.3.2,8.1.1,9.2.1,10.1.1

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40	-	-	-	100
CAT2	20	40	40	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	50	50	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	50	50	-	-	-	100
ESE	20	40	40	-	-	-	100

22SPE$25	CYBER SECURITY ESSENTIALS

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The objective of this course is to provide the skills in cyber security in view of cybercrime, cyber offences, frauds in mobile and wireless devices, handling techniques of cybercrime, organizational implications and cyber terrorism, computer forensics.

UNIT– I	**INTRODUCTION**	**9 Periods**

Definition and Origins of the Word, Who are Cybercriminals?, Classifications of Cybercrimes, The Legal Perspectives, An Indian Perspective, A Global Perspectives. Cyberoffenses: Categories of Cybercrime, How Criminals Plan the Attacks, Social Engineering, Classification of Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets,Attack vector.

UNIT– II	**CYBERCRIME: MOBILE AND WIRELESS DEVICES**	**9 Periods**

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops: Physical Security Countermeasures.

UNIT– III	**TOOLS AND METHODS USED IN CYBERCRIME**	**9 Periods**

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks.

Phishing and Identity Theft: Introduction- Phishing, Spear Phishing, Types of Phishing Scams, Phishing Toolkits and Spy Phishing, Phishing Countermeasures, Identity Theft (ID Theft).

UNIT– IV	**ORGANIZATIONAL IMPLICATIONS AND CYBERTERRORISM**	**9 Periods**

Organizational Implications: Introduction cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cybercriminals

UNIT– V	**UNDERSTANDING COMPUTER FORENSICS**	**9 Periods**

Introduction, Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Anti forensics.

Contact Periods:
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXTBOOK

1	*Sunit Belapure and Nina Godbole,* ***"Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives",*** *Wiley India Pvt Ltd, ISBN: 978-81-265-21791, Publish Date 2011.*

REFERENCES

1	*B. B. Gupta, D. P. Agrawal, Haoxiang Wang,* ***Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives,*** *CRC Press, ISBN 9780815371335, 2018.*
2	*Thomas J. Mowbray,* ***"Cybersecurity: Managing Systems , Conducting Testing, and Investigating Intrusions",*** *Copyright © 2014 by John Wiley & Sons, Inc, ISBN: 91-118 - 84965 -1*
3	*James Graham, Ryan Olson, Rick Howard,* ***"Cyber Security Essentials",*** *CRC Press, 15-Dec2010*

COURSE OUTCOMES: On completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Explain the fundamental concepts of cybercrime and cyber offenses	K1
CO2	Identify the frauds, attacks and security issues in mobile and wireless devices.	K2
CO3	Use and apply modern cyber forensics tools	K4
CO4	Evaluate organizations challenges and implications with respect to cyber security and identify the mindset and skills of hackers and other cybercriminals	K5
CO5	Analyze the computer forensic problems for a feasible solution	K4

COURSEARTICULATIONMATRIX:

a)CO and PO Mapping														
COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	2	2	2	1	3	1	2	-	-	-	3	3	1	2
CO2	2	2	2	2	2	3	2	2	-	-	-	2	3	3	2
CO3	3	2	2	2	2	3	3	3	-	-	-	3	3	3	2
CO4	3	2	2	2	2	3	3	3	-	-	-	2	2	2	1
CO5	3	2	2	2	2	2	2	2	-	-	-	3	3	2	1
22SPE$25	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**3**	**3**	**2**
1–Slight, 2 –Moderate,3–Substantial															
b)CO and Key Performance Indicators Mapping															
CO1	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 4.1.1, 4.2.1, 8.1.1														
CO2	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 4.1.1, 4.2.1, 8.1.1														
CO3	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 4.1.1, 4.2.1, 8.1.1														
CO4	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 4.1.1, 4.2.1, 8.1.1														
CO5	1.1.1, 1.2.1, 2.1.1, 2.1.2, 2.3.1, 3.1.1, 3.1.2, 3.4.1, 4.1.1, 4.2.1, 4.2.2, 8.1.1														

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	30	30	20	-	-	100
CAT2	10	30	40	20	-	-	100
Individual Assessment 1/Case Study 1/Seminar 1/Project 1	20	30	30	10	10	-	100
Individual Assessment 2/Case Study 2/Seminar 2/Project 2	-	-	40	40	-	20	100
ESE	10	40	30	20	-	-	100

22SPE$26	DIGITAL AND MOBILE FORENSICS *(Common to CSE & IT)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The objective of this course is to interpret the principles of digital evidences, duties of cybercrime experts & role of internet in cybercrime investigation and to choose appropriate software for digital forensics investigation.	
UNIT – I	**DIGITAL EVIDENCE**	**9 Periods**
Digital Evidence - Increasing Awareness of Digital Evidence - Principles of Digital Forensics - Challenging Aspects of Digital Evidence - Following the Cybertrail - Language of Computer Crime Investigation - Role of Computers in Crime.		
UNIT – II	**CYBER CRIME AND LAWS**	**9 Periods**
Duty of Experts - Admissibility - Levels of Certainty in Digital Forensics - Direct versus Circumstantial Evidence - Scientific Evidence - Presenting Digital Evidence - Federal Cybercrime Law- Constitutional Law - Specific Cybercrime Offenses – Computer - Integrity Crimes – Computer - Assisted Crimes - Content-Related Cybercrimes.		
UNIT – III	**DIGITAL INVESTIGATIONS**	**9 Periods**
Digital Investigation Process Models – Scaffolding - Applying the Scientific Method - Guidelines for Handling Digital Crime Scenes - Fundamental Principles – Authorization - Digital Crime Scene: Preparing to Handle, Surveying, Preserving - Equivocal Forensic Analysis - Crime Scene Characteristics - Crime Scene Characteristics - Threshold Assessments - Modus Operandi - Motive and Technology.		
UNIT – IV	**COMPUTER AND MOBILE FORENSICS**	**9 Periods**
Representation of Data - Storage Media and Data Hiding - File Systems and Location of Data - Dealing with Password Protection and Encryption - Applying Forensic Science to Computers - Digital Evidence: Windows Systems, UNIX Systems, Macintosh Systems - Understanding Mobile Device Security - Analyzing SIM Cards - Analyzing Android, BlackBerry and iOS devices.		
UNIT – V	**NETWORK FORENSICS**	**9 Periods**
Role of the Internet in Criminal Investigations - Connecting Networks Using Internet Protocols - Legitimate versus Criminal Uses - Using the Internet as an Investigative Tool - Online Anonymity and Self-Protection - Forgery and Tracking: E-mail, Usenet - Linking the Data - Link and Network Layers: Encapsulation - Documentation, Collection, and Preservation - Analysis Tools and Techniques - TCP/IP - Related Digital Evidence.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Eoghan Casey,* ***"Digital Evidence and Computer Crime: Forensic Science, Computers and the Internet"****, Elsevier, Third Edition, 2011. (Unit - I, II, III, V)*
2	*Reiber Lee,* ***"Mobile Forensic Investigations: A Guide to Evidence Collection, Analysis, and Presentation"****, McGraw Hill LLC, Second Edition, 2018. (Unit - IV)*

REFERENCES

1	*Soufiane Tahiri,* ***"Mastering Mobile Forensics"****, Packt Publishing, 2016.*
2	*Oleg Afonin,* ***"Mobile Forensics – Advanced Investigative Strategies"****, Packt Publishing, 2016.*
3	*Filipo Sharevski,* ***"Mobile Network Forensics Emerging Research and Opportunities"****, IGI Global, 2018.*
4	*Ali Dehghantanha, Kim-Kwang Raymond Choo,* ***"Investigations of Cloud and Mobile Applications"****, Elsevier Science, 2016.*

COURSE OUTCOMES: On completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Define the terminologies involved in digital evidence and different aspects of computer crime investigations.	K1
CO2	Summarize the legal issues that arise in computer-related investigations and cyber laws.	K2
CO3	Illustrate the usage of digital evidence in reconstructing a crime or incident, identify suspects and understand criminal motivations.	K4
CO4	Articulate the role of computers and digital devices in crime investigations.	K3
CO5	Exemplify the underlying complexity of computer networks in digital investigation mechanism.	K2

COURSE ARTI CULATION MATRIX:

a) CO and PO Mapping														
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**	**PSO 3**
CO1	2	2	2	2	3	-	-	-	1	1	-	1	2	1	1
CO2	2	2	2	2	3	-	-	-	1	1	-	1	2	1	1
CO3	2	1	2	2	3	-	-	-	1	1	-	1	2	1	1
CO4	2	1	2	2	3	-	-	-	1	1	-	1	2	1	1
CO5	2	2	2	2	3	-	-	-	1	1	-	1	2	1	1
22SPE$26	**2**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**2**	**1**	**1**
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1, 1.4.1, 2.1.1, 2.2.2, 2.2.3, 2.4.2, 3.1.1, 3.1.5, 3.2.1, 3.3.2, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.3.1, 4.3.2, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 5.3.2, 9.2.1, 10.1.1, 12.1.2.
CO2	1.3.1, 1.4.1, 2.1.1, 2.2.2, 2.2.3, 2.4.2, 3.1.1, 3.1.5, 3.2.1, 3.3.2, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.3.1, 4.3.2, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 5.3.2, 9.2.1, 10.1.1, 12.1.2.
CO3	1.3.1, 1.4.1, 2.2.3, 2.4.2, 3.1.1, 3.1.5, 3.2.1, 3.3.2, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.3.2, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 5.3.2, 9.2.1, 10.1.1, 12.1.2.
CO4	1.3.1, 1.4.1, 2.1.1, 2.2.2, 2.2.3, 3.1.1, 3.1.5, 3.2.1, 3.3.2, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.3.1, 4.3.2, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 5.3.2, 9.2.1, 10.1.1, 12.1.2.
CO5	1.3.1, 1.4.1, 2.1.1, 2.2.2, 2.2.3, 2.4.2, 3.1.1, 3.1.5, 3.2.1, 3.3.2, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.3.1, 4.3.2, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 5.3.2, 9.2.1, 10.1.1, 12.1.2.

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	40	30	30	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	40	30	30	-	-	100
ESE	40	30	30	-	-	-	100

22SPE$27	SOCIAL NETWORK SECURITY *(Common to CSE & IT)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	The objective of the course is to understand the importance and need for securing the online social networks and handle attacks and threats effectively in social media platform.	
UNIT – I	**OVERVIEW OF ONLINE SOCIALNETWORKS AND THEIR IMPACTS ON USERS**	**9 Periods**
Online Social Network vulnerabilities - Functional parameters - Statistical analysis based on usage - Usage of social network based on requirements - online social networks issues and impacts - difficulties in detection and mitigation of attacks.		
UNIT – II	**SECURITY CHALLENGES IN SOCIAL NETWORKING**	**9 Periods**
Advanced Persistent threats, Classical threats, social threats – Inbuilt security solutions, Third party software solutions, other security solutions against online social network attacks. Branding - Building of social authority in social platform – COBRAS – Hashtag – Collective intelligence.		
UNIT – III	**DETECTING ATTACKSIN ONLINE SOCIAL NETWORKS**	**9 Periods**
.Fake Account detection – Characteristics analysis of twitter accounts – Selection of features and computing feature set – Petri net based analyzers – Simulation of Petri net in PN2 environment – Evaluation using SPIN model checker – Evaluation and performance analysis.		
UNIT – IV	**VARIOUS THREATS AND THREATHANDLING TOOLS**	**9 Periods**
Attackers in social media platform – categorizes of attacks based on account types - cyber security tools to protect user account and information. Open issues and challenges in existing security solutions – Principles and best practices to protect user accounts in social platform.		
UNIT – V	**DATA THEFT - A CASESTUDY IN FACEBOOK**	**9 Periods**
Facebook data breaker in Indonesia – Expert opinions, Comments, Counter measures - Violating of rights to privacy (Singapore case related to Facebook) – Data protection based on International and National law		
Contact Periods: **Lecture: 45Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK :

1	*Brij Gupta, Somya Ranjan Sahoo, " **Online Social Network Security – Principles, Algorithms, Applications and Perspectives**" ,CRC Press, 2021.*
2	*Micheal Cross, "**Social Media Security**", O'Reilly Syngress , 2017.*

REFERENCES :

1	*Borko Furht, "**Handbook of Social Network Technologies and Application",** Springer, 2016*
2	*Dion Goh and Schubert Foo, "**Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively**", IGI Global Snippet, 2008.*
3	*Xiaohui Liang , Rongxing Lu , Xiaodong Lin , Xuemin Shen"**Security and Privacy in Mobile Social Networks**, Springer, 2013*
4	*Al-Sakib Khan Pathan, "**Securing Social Networks in Cyberspace**", CRC Press, 2021*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Identify the impact of users in online social platforms.	K2
CO2	Analyze security challenges in online social networks.	K4
CO3	Apply Petri net models to detect attacks in online social platforms.	K4
CO4	Use appropriate tools for handling threats in online social networks.	K3
CO5	Argue the real time data thefts in Facebook and devise countermeasures.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	1	2	1	-	-	-	-	-		1	2	-
CO2	2	3	2	1	2	1	-	-	-	-	-	1	1	2	-
CO3	2	3	2	2	2	1	-	-	-	-	-		1	2	-
CO4	2	3	2	2	2	1	-	-	-	-	-	2	1	2	-
CO5	2	3	2	2	2	1	-	-	-	-	-	2	1	2	-
22SPE$27	**2**	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1, 1.4.1, 2.1.2, 2.2.2, 2.4.4, 3.1.2, 3.1.5, 3.2.1, 3.4.1, 4.1.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.2, 6.1.1, 6.2.1.
CO2	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 3.1.2, 3.1.5, 3.2.1, 3.4.1, 4.1.2, 5.1.1, 5.1.2,5.2.1, 5.2.2, 5.3.2, 6.1.1, 6.2.1, 12.1.2, 12.2.2.
CO3	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 3.1.2, 3.1.5, 3.2.1, 3.4.1, 4.1.1, 4.1.2, 5.1.1, 5.1.2,5.2.1, 5.2.2, 5.3.2, 6.1.1, 6.2.1.
CO4	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 3.1.2, 3.1.5, 3.2.1, 3.4.1, 4.1.1, 4.1.2, 5.1.1, 5.1.2,5.2.1, 5.2.2, 5.3.2, 6.2.1, 12.1.1, 12.2.2, 12.3.2.
CO5	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 3.1.2, 3.1.5, 3.2.1, 3.4.1, 4.1.1, 4.1.2, 5.1.1, 5.1.2,5.2.1, 5.2.2, 5.3.2, 6.1.1, 6.2.1, 12.2.1, 12.2.2, 12.3.2.

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	35	35	-	-	-	100
CAT2	-	35	35	30	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	50	50	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	50	50	-	-	100
ESE	10	20	30	40	-	-	100

22COE$01	DISASTER MANAGEMENT AND MITIGATION *(Common to All Branches)*					
PREREQUISITES		**CATEGORY**	**L**	**T**	**P**	**C**
NIL		**OE**	**3**	**0**	**0**	**3**
Course Objective	To impart knowledge to create appropriate planning, preparation and response for emergency treatment in disaster situation					
UNIT – I	**INTRODUCTION TO DISASTERS**					**9 Periods**
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Classification, Causes, Impacts - Global Trends in Disasters: Urban Disasters, Pandemics, Complex Emergencies, Climate Change- Dos and Don'ts during various types of Disasters.						
UNIT – II	**HAZARDS AND RISK VULNERABILITY**					**9 Periods**
Hazard Identification and Hazard Profiling - Hazard Analysis - Types of hazards - Natural and technological Components of Risk- likelihood and Consequence, Trends and Computation of likelihood and Consequence. Risk Evaluation – Purpose, Risk Acceptability, Alternatives, Personnel. Political/ Social, Economic. Vulnerability-Physical Profile, Social Profile, Environmental Profile, Economic Profile - Factors Influencing Vulnerability, Risk Perception.						
UNIT – III	**MITIGATION AND PREPAREDNESS**					**9 Periods**
Mitigation - Types, Obstacles, Assessment and Selection of Mitigation options, Emergency Response capacity, Incorporating Mitigation into Development and Relief Projects. Preparedness- Government Preparedness, Public Preparedness, Media as a Public educator. Obstacles to public education and preparedness.						
UNIT – IV	**RESPONSE AND RECOVERY**					**9 Periods**
Response the Emergency- Pre disaster, post disaster, Provision of Water, Food and Shelter, Volunteer Management, Command, Control and Coordination. Recovery- Short Term and Long-term Recovery- Components of Recovery- Planning, Coordination, Information, Money and Supplies, Allocation of Relief Funds, Personnel. Types of Recovery- Government, Infrastructure, Debris Removal Disposal and Processing, Environment, Housing, Economic and Livelihood, Individual, Family and Social Recovery- Special Considerations in Recovery.						
UNIT – V	**DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES**					**9 Periods**
Concept of Environmental Health and Safety Management – Elements of Environmental Health and Safety Management Policy and implementation and review – ISO 45001-Strucure and Clauses-Case Studies.						
Contact Periods: **Lecture: 45 Periods Tutorial: 00 Periods Practical: 00 Periods Total: 45 Periods**						

TEXT BOOKS :

1	*Singhal J.P.* ***"Disaster Management",*** *Laxmi Publications, 2010.*
2	*Tushar Bhattacharya,* ***"Disaster Science and Management",*** *McGraw Hill India Education Pvt. Ltd., 2012.*

REFERENCES:

1	*Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005.*
2	*Government of India, National Disaster Management Policy,2009.*
3	*Gupta Anil K, Sreeja S. Nair.* ***"Environmental Knowledge for Disaster Risk Management"****, NIDM, New Delhi, 2011*
4	*Kapur Anu Vulnerable India:* ***A Geographical Study of Disasters****, IIAS and Sage Publishers, New Delhi, 2010*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Identify the types of disasters, causes and their impact on environment and society	K2
CO2	Assess vulnerability and various methods of risk reduction measures as well as mitigation.	K2
CO3	Comprehend the mitigation and preparedness process.	K2
CO4	Describe about response and recovery process during disaster.	K2
CO5	Perform disaster damage assessment and management.	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping															
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	-	1	-	2	3	3	2	2	2	-	3	2	-	2
CO2	1	-	1	-	2	3	3	2	2	2	-	3	2	-	2
CO3	1	-	1	-	2	3	3	2	2	2	-	3	2	-	2
CO4	1	-	1	-	2	3	3	2	2	2	-	3	2	-	2
CO5	1	-	1	-	2	3	3	2	2	2	-	3	2	-	2
22COE$01	1	-	1	-	2	3	3	2	2	2	-	3	2	-	2
1 – Slight, 2 – Moderate, 3 – Substantial															
b) CO and Key Performance Indicators Mapping															
CO1	1.2.1, 3.1.5, 5.1.1, 5.2.1, 6.1.1, 6.2.1, 7.1.1, 7.1.2, 7.2.1, 8.1.1, 8.2.2, 9.1.1, 9.1.2, 9.2.1, 10.1.1, 10.1.2, 10.1.3														
CO2	1.2.1, 3.1.5, 5.1.1, 5.2.1, 6.1.1, 6.2.1, 7.1.1, 7.1.2, 7.2.1, **7.2.2,** 8.1.1, 8.2.2, 9.1.1, 9.1.2, 9.2.1, 10.1.1, 10.1.2, 10.1.3														
CO3	1.2.1, 3.1.5, 5.1.1, 5.2.1, 6.1.1, 6.2.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 8.1.1, 8.2.2, 9.1.1, 9.1.2, 9.2.1, 10.1.1, 10.1.2, 10.1.3														
CO4	1.2.1, 3.1.5, 5.1.1, 5.2.1, 6.1.1, 6.2.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 8.1.1, 8.2.2, 9.1.1, 9.1.2, 9.2.1, 10.1.1, 10.1.2, 10.1.3														
CO5	1.2.1, 3.3.6, 5.1.1, 5.2.1, 6.1.1, 6.2.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 8.1.1, 8.2.2, 9.1.1, 9.1.2, 9.2.1, 10.1.1, 10.1.2, 10.1.3														

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	40	40	20	-	-	-	100
CAT2	40	40	20	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	25	50	25	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	25	50	25	-	-	100
ESE	30	30	40	-	-	-	100

22COE$02	**WATER SANITATION AND HEALTH** *(Common to All Branches)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	OE	3	0	0	3

Course Objective	To understand the overview of Environment, Health and Safety (EHS) in industries and related Indian regulations, types of Health hazards, effect, assessment and control methods and EHS Management System	
UNIT – I	**INTRODUCTION**	**9 Periods**
Need for developing Environment, Health and Safety systems in work places- International initiatives, National Policy and Legislations on EHS in India - Regulations and Codes of Practice - Role of Trade Union Safety Representatives – Ergonomics.		
UNIT – II	**OCCUPATIONAL HEALTH AND HYGIENE**	**9 Periods**
Definition of occupational health and hygiene - Categories of health hazards – Exposure pathways and human responses–Exposure Assessment-occupational exposure limits - Hierarchy of control measures - Role of personal protective equipment and the selection criteria.		
UNIT – III	**WORKPLACE SAFETY AND SAFETY SYSTEMS**	**9 Periods**
Features of Satisfactory and Safe design of work premises – good housekeeping - lighting and color, Ventilation and Heat Control, Noise, Chemical and Radiation Safety – Electrical Safety – Fire Safety – Safety at Construction sites, ETP – Machine guarding – Process Safety, Working at different levels.		
UNIT – IV	**HAZARDS AND RISK MANAGEMENT**	**9 Periods**
Safety appraisal – Job Safety Analysis-Control techniques – plant safety inspection – Accident investigation - Analysis and Reporting – Hazard and Risk Management Techniques –Onsite and Offsite emergency Plans. Employee Participation- Education and Training- Case Studies.		
UNIT – V	**ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT**	**9 Periods**
Concept of Environmental Health and Safety Management – Elements of Environmental Health and Safety Management Policy and implementation and review – ISO 45001-Strucure and Clauses-Case Studies.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	***Industrial Health and Safety Acts and Amendments****, by Ministry of Labour and Employment, Government of India.*
2	*Dr.K.U.Mistry, Siddharth Prakashan,* ***"Fundamentals of Industrial Safety and Health"****, 2012*

REFERENCES:

1	*Bill Taylor,* ***"Effective Environmental, Health, and Safety Management Using the Team Approach",*** *Culinary and Hospitality Industry Publications Services, 2005.*
2	*Nicholas P.Cheremisinoff and Madelyn L. Graffia,* ***"Environmental and Health and Safety Management"****, William Andrew Inc. NY, 1995.*
3	*Brian Gallant,* ***"The Facility Manager's Guide to Environmental Health and Safety"*** *, Government Inst Publ., 2007.*
4	*https://archive.nptel.ac.in/courses/114/106/114106017/*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Outline the needs for EHS in industries and related Indian regulations	K2
CO2	Assess the various types of Health hazards, effect, assessment and control methods	K2
CO3	Identity the various safety systems in working environments	K2
CO4	Select the methodology for preparation of Emergency Plans and Accident investigation	K3
CO5	Describe the EHS Management System and its elements	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	-	1	-	3	3	3	2	1	-	2	-	1	1	-
CO2	2	-	1	-	3	3	3	2	1	-	2	-	1	1	-
CO3	2	-	1	-	3	3	3	2	1	-	2	-	1	1	-
CO4	2	-	1	-	3	3	3	2	1	-	2	-	1	1	-
CO5	2	-	1	-	2	3	3	2	1	-	2	-	1	1	-
22COE$02	**2**	**-**	**1**	**-**	**3**	**3**	**3**	**2**	**1**	**-**	**2**	**-**	**1**	**1**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.2.1, 1.3.1, 3.1.4, 3.1.5, 5.1.1, 5.2.1, 5.2.2, 5.3.1, 6.1.1, 6.2.1, 7.1.2, 7.2.1, 7.2.2, 8.1.1, 8.2.2, 9.1.2, 11.1.1, 11.2.1.
CO2	1.2.1, 1.3.1, 3.1.4, 3.1.5, 5.1.1, 5.2.1, 5.2.2, 5.3.1, 6.1.1, 6.2.1, 7.1.2, 7.2.1, 7.2.2, 8.1.1, 8.2.2, 9.1.2, 11.1.1, 11.2.1.
CO3	1.2.1, 1.3.1, 3.1.4, 3.1.5, 5.1.1, 5.2.1, 5.2.2, 5.3.1, 6.1.1, 6.2.1, 7.1.2, 7.2.1, 7.2.2, 8.1.1, 8.2.2, 9.1.2, 11.1.1, 11.2.1.
CO4	1.2.1, 1.3.1, 3.1.4, 3.1.5, 5.1.1, 5.2.1, 5.2.2, 5.3.1, 6.1.1, 6.2.1, 7.1.2, 7.2.1, 7.2.2, 8.1.1, 8.2.2, 9.1.2, 11.1.1, 11.2.1.
CO5	1.2.1, 1.3.1, 3.1.4, 3.1.5, 5.1.1, 5.2.1, 5.2.2, 5.3.1, 6.1.1, 6.2.1, 7.1.2, 7.2.1, 7.2.2, 8.1.1, 8.2.2, 9.1.2, 11.1.1, 11.2.1.

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	40	20	-	-	-	100
CAT2	40	40	20	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	25	50	25	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	25	50	25	-	-	100
ESE	30	30	40	-	-	-	100

22MOE$03	NANOTECHNOLOGY AND SURFACE ENGINEERING *(Common to All Branches)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	OE	3	0	0	3

Course Objectives	To educate the production techniques and characterization techniques of nano materials and to familiarize about the surface modification techniques using nano materials.	
UNIT – I	**ELEMENTS OF NANO-SCIENCE AND NANOTECHNOLOGY**	**9 Periods**
Engineering scale of nanotechnology, different classes of nano-materials, synthesis of nano-materials, fabrication and characterization of nanostructures, Engineering applications-Cosmetics and Consumer Goods, Nano Sensor, Nano catalysts, Water Treatment and the Environment, Paints, Food and Agriculture Industry.		
UNIT – II	**NANOTECHNOLOGY AND CERAMICS**	**9 Periods**
Introduction, Vapor Condensation Methods, Sputtering, Laser Method, Spray Pyrolysis, Thermo Chemical /Flame Decomposition of metal organic Precursors methods		
UNIT – III	**CHARACTERIZATION OF NANOMATERIALS**	**9 Periods**
X-Ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy, UV / Visible Spectroscopy.		
UNIT – IV	**SURFACE ENGINEERING**	**9 Periods**
Introduction to surface engineering, Scope of surface engineering for different engineering materials, Surface Preparation methods such as Chemical, Electrochemical, Mechanical: Sand Blasting, Shot peening, Shot blasting, Hydro-blasting, Vapor Phase Degreasing etc., Coatings: Classification, Properties and applications of Various Coatings.		
UNIT – V	**SURFACE MODIFICATION TECHNIQUES**	**9 Periods**
Surface modification by use of directed energy beams, Plasma, Sputtering & Ion Implantation. Surface modification by Friction stir processing. Surface composites.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*G. Cao, **"Nanostructures and Nanomaterials: Synthesis",** Properties and Applications by Imperial College Press, 2nd edition, 2011.*
2	*Keith Austin "**Surface Engineering Hand Book**", London : Kogan Page, 1998*

REFERENCES:

1	*Gregory Timp, "**Nanotechnology",** Springer, 2012*
2	*Dheerendra Kumar Dwivedi, **"Surface Engineering: Enhancing Life of Tribological Components"**, Springer, 2018*
3	*D. Phil Woodruff,**"Modern Techniques of Surface Science**", Cambridge University Press, 2016*
4	*Sulabha K. Kulkarni ,**"Nanotechnology: Principles and Practices**", Springer, 2019*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Choose appropriate nano material and its manufacturing method.	K1
CO2	Select most suitable technique to deposit a layer of nano material on ceramic surface.	K2
CO3	Identify appropriate techniques to characterize nano materials.	K2
CO4	Select surface preparation, coating techniques and predict their combinational effect for engineering applications.	K2
CO5	Adopt different techniques to modify surfaces and make surface composites as per requirement.	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PSO 3**
CO1	-	1	2	1	1	-	-	-	-	-	-	-	2	2	3
CO2	-	1	2	1	1	-	-	-	-	-	-	-	2	2	3
CO3	-	1	2	1	1	-	-	-	-	-	-	-	2	2	3
CO4	-	2	2	1	1	-	-	-	-	-	1	-	2	3	3
CO5	-	1	2	1	1	-	-	-	-	-	1	-	3	2	3
22MOE$03	**-**	**1**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**2**	**2**	**3**
1 – Slight, 2 – Moderate, 3 – Substantial															
b) CO and Key Performance Indicators Mapping															
CO1	2.2.2, 2.2.3, 2.2.4, 2.3.1, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.3.2, 4.1.1, 4.3.4, 5.1.2														
CO2	2.2.2, 2.2.3, 2.2.4, 2.3.1, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.3.2, 4.1.1, 4.3.4, 5.1.2														
CO3	2.2.2, 2.2.3, 2.2.4, 2.3.1, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.3.2, 4.1.1, 4.3.4, 5.1.2														
CO4	2.1.1, 2.1.2, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.3.2, 4.1.1, 4.3.4, 5.1.2, 5.3.1, 11.3.1														
CO5	2.2.2, 2.2.3, 2.2.4, 2.3.1, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.3.2, 4.1.1, 4.3.4, 5.1.2, 5.3.1, 11.3.1														

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	50	50	-	-	-	-	100
CAT2	30	70	-	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	50	50	-	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	30	70	-	-	-	-	100
ESE	40	60	-	-	-	-	100

22MOE$04	**INDUSTRIAL SAFETY MANAGEMENT** *(Common to All Branches)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	OE	3	0	0	3

Course Objectives	To learn the techniques of industrial safety and management to implement and solve safety problems in engineering.	
UNIT – I	**ENVIRONMENT AND SAFETY PHILOSOPHY**	**9 Periods**
Henrichs Axioms Of Industrial Safety - Concepts Of Safety – Ethics of environmental conservation – Environmental Impact Assessment – Environmental economics – Safety philosophy – Planning for safety – Organising for safety – Directing for safety - Role of Occupier and Factory Manager, Factory Safety Committee, Structure and Functions and Working Tenure Details		
UNIT – II	**SAFETY APPRAISAL AND CONTROL TECHNIQUES**	**9 Periods**
Plant and equipment safety appraisal techniques – Laws and regulation – Hazards and Risks – Major accident hazard control – Importance of Disaster management		
UNIT – III	**ACCIDENT PREVENTION AND SAFETY MANAGEMENT**	**9 Periods**
Incident - Accident - Injury - Dangerous occurrence - Unsafe Act - Unsafe Conditions - Hazards - Error, Oversight - Mistake , Near Miss - Measurement of safety performance - Key elements of Safety Management system (ISO 14001, OHSAS 18001 etc.). ILO Legislations – Convention and Recommendation concerning Safety, Health and Environment – Objectives of Health, Safety and Environment Policy, Responsibility for Implementation of HSE Policy.		
UNIT – IV	**SAFETY MANAGEMENT IN INDUSTRIES**	**9 Periods**
Safe Guarding of machines – Manual handling and storage of materials – Mechanical handling of materials – Hand tools and portable power tools – Electrical hazards – Earth , insulation and continuity tests – Industrial lighting – Safety of pressure vessels – Ventilation and heat control – Housekeeping – Special precautions - Safety in Construction Industry – Safety in Engineering Industry – Safety in Chemical Industries – Safety in Textile Industries – Safety in Dock and Port – Transportation Safety – Safety in Fire and explosive industries.		
UNIT – V	**INDUSTRIAL HYGIENE AND POLLUTION CONTROL**	**9 Periods**
Industrial Hygiene – Air sampling – Noise and vibration – Industrial physiology - Occupational health – Personal Protective Equipment's – Pollution Control strategies.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*Akhil Kumar Das,* ***"Principles of Industrial Safety Management":Understanding the Ws of Safety at Work"*** *PHI Learning , 2021*
2	*Jain R K and Sunil.S.Rao,* ***"Industrial Safety Health and Environment Management System"****, Seventh reprint, Khanna publishers, 2023.*

REFERENCES:

1	*Prathibha Bansal and Anupama Prashar,* ***"Industrial safety and Environment"****, S.K.Kattaria Sons, 2005.*
2	*A.K.Gupta,* ***"Industrial safety and Environment"****, Laxmi Publication Pvt Limited, 2008.*
3	***"Accident Prevention Manual For Industrial Operations****", N.S.C Chicago, 13th Edition 2009.*
4	*Dan Petersen,* ***"Techniques of Safety Management****", Americal Society of Safety Emgineers, 4th edition, 2003.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Understand Environment and safety philosophy.	K1
CO2	Frame Safety appraisal and control technique to create safety management.	K2
CO3	Follow accident prevention procedure to solve safety problem.	K2
CO4	Implement safety management for Industries.	K3
CO5	Follow Industrial Hygiene and Pollution control	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping														
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	-	1	3	-	-	-	-	-	-	-	3	1	2
CO2	3	3	-	1	2	-	-	-	-	-	-	-	3	2	2
CO3	3	3	-	-	3	-	-	-	-	-	-	-	3	1	2
CO4	3	3	-	1	2	-	-	-	-	-	-	-	3	2	2
CO5	3	3	-	-	3	-	-	-	-	-	-	-	3	1	2
22MOE$04	3	3	-	1	3	-	-	-	-	-	-	-	3	1	2
1 – Slight, 2 – Moderate, 3 – Substantial															
b) CO and Key Performance Indicators Mapping															
CO1	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.3, 2.2.1, 2.2.3, 2.2.4, 2.4.4, 4.3.4, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2														
CO2	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.4.3, 2.4.4, 4.1.4, 5.1.2, 5.2.1, 5.3.1, 5.3.2														
CO3	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.4.3, 2.4.4, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 5.3.2														
CO4	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.4.3, 2.4.4, 4.1.4, 5.1.2, 5.2.1, 5.3.1, 5.3.2														
CO5	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.4.3, 2.4.4, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 5.3.2														

ASSESSMENT PATTERN

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	70	20	10	-	-	-	100
CAT2	50	30	20	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	60	40	-	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	50	30	20	-	-	-	100
ESE	50	30	20	-	-	-	100

22EOE$05	RENEWABLE POWER GENERATION SYSTEMS *(Common to All Branches)*				
PREREQUISITES	**CATEGORY**	**L**	**T**	**P**	**C**
NIL	**OE**	**3**	**0**	**0**	**3**
Course Objectives	To understand energy scenarios, energy sources and their utilization, society's present needs and future energy demands, the principles of renewable energy conversion systems				
UNIT – I	**ENERGY SCENARIO**				**9 Periods**
Principles of renewable energy; energy and sustainable development, fundamentals and social implications. worldwide renewable energy availability, renewable energy availability in India, brief descriptions on solar energy, wind energy, tidal energy, wave energy, ocean thermal energy, biomass energy, geothermal energy, oil shale. Introduction to Internet of energy (IOE).					
UNIT – II	**SOLAR ENERGY**				**9 Periods**
Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Solar radiation Measurements- Pyrheliometers, Pyrometer, Sunshine Recorder. Solar Thermal systems: Flat plate collector; Solar distillation; Solar pond electric power plant. Solar electric power generation- Principle of Solar cell, Photovoltaic system for electric power generation, advantages, Disadvantages and applications of solar photovoltaic system.					
UNIT – III	**WIND AND BIOMASS ENERGY**				**9 Periods**
Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, Basic components of wind energy conversion system (WECS); Classification of WECS- Horizontal axis- single, double and multi blade system. Vertical axis- Savonius and Darrieus types. Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies -fixed dome; Urban waste to energy conversion; Biomass gasification (Downdraft).					
UNIT – IV	**TIDAL AND OCEAN THERMAL ENERGY**				**9 Periods**
Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, advantages and limitations. Ocean Thermal Energy Conversion: Principle of working, OTEC power stations in the world, problems associated with OTEC.					
UNIT – V	**GREEN ENERGY**				**9 Periods**
Introduction, Fuel cells: Classification of fuel cells – H_2; Operating principles, Zero energy Concepts. Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy.					
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**					

TEXT BOOK:

1	G D Rai, Non Conventional Energy sources, Khanna Publication, Fourth Edition, 2009
2	Boyle, "Renewable Energy – Power For A Sustainable Future", Oxford, 2012

REFERENCES:

1	S Rao,B.B.Parulekhar, "Energy Technology 3/e: Nonconventional, Renewable and Conventional", Khanna Publishers, 1994
2	G. N. Tiwari,"Solar Energy - Fundamentals, Design, Modelling and Applications", 2002
3	Gilbert M. Masters, "Renewable and Efficient Electric Power Systems" Wiley,2005
4	Shobh Nath Singh, "Non-Convention Energy Resources", Pearson, 2018

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Describe the environmental aspects of renewable energy resources in comparison with various conventional energy systems, their prospects and limitations.	K2
CO2	Summarize the use of solar energy and the various components used in the energy production with respect to applications like - heating, cooling, desalination, electric power generation.	K2
CO3	Apply the conversion principles of wind and tidal energy for the production of electric power generation	K3
CO4	Apply the concept of biomass energy resources and green energy for developing sustainable electric power generation set-up	K3
CO5	Analyze the basic knowledge of ocean thermal energy conversion and hydrogen energy and hence design & evaluate the power generation system	K4

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	3	3	3	-	-	-	-	3	3	3	2
CO2	3	3	3	3	3	3	3	-	-	-	-	3	3	3	2
CO3	3	3	3	3	3	3	3	-	-	-	-	3	3	3	2
CO4	3	3	3	3	3	3	3	-	-	-	-	3	3	3	2
CO5	3	3	3	3	3	3	3	-	-	-	-	3	3	3	2
22EOE$05	3	3	3	3	3	3	3	-	-	-	-	3	3	3	2
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping

CO1	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.3,4.3.4,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,6.1.1,6.2.1,7.1.1,7.1.2,7.2.1,7.2.2,12.1.1,12.1.2,12.2.1,12.2.2,12.3.2.
CO2	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.3,4.3.4,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,6.1.1,6.2.1,7.1.1,7.1.2,7.2.1,7.2.2,12.1.1,12.1.2,12.2.1,12.2.2,12.3.2.
CO3	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.3,4.3.4,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,6.1.1,6.2.1,7.1.1,7.1.2,7.2.1,7.2.2,12.1.1,12.1.2,12.2.1,12.2.2,12.3.2.
CO4	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.3,4.3.4,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,6.1.1,6.2.1,7.1.1,7.1.2,7.2.1,7.2.2,12.1.1,12.1.2,12.2.1,12.2.2,12.3.2.

CO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.3,4.3.4,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,6.1.1,6.2.1,7.1.1,7.1.2,7.2.1,7.2.2,12.1.1,12.1.2,12.2.1,12.2.2,12.3.2.

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	20	30	30	-	-	100
CAT2	20	20	30	30	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	20	20	30	30	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	20	20	30	30	-	-	100
ESE	20	20	30	30	-	-	100

22EOE$06	SMART GRID TECHNOLOGY *(Common to All Branches)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	OE	3	0	0	3

Course Objectives	To provide a comprehensive understanding of Smart Grid Technology, including its components, functions, applications and implications for Energy Management and Distribution.	
UNIT – I	**BASICS OF POWER SYSTEMS**	**9 Periods**
Basics of Power Systems: Load and Generation - Power Flow Analysis- Economic Dispatch and Unit Commitment Problems. Smart Grid: Definition – Applications- Government and Industry-Standardization		
UNIT – II	**SMART GRID COMMUNICATIONS**	**9 Periods**
Two-way Digital Communications Paradigm - Network Architectures - IP-based Systems - Power Line Communications - Advanced Metering Infrastructure		
UNIT – III	**WIDE AREA MEASUREMENT**	**9 Periods**
Sensor Networks - Phasor Measurement Units- Communications Infrastructure- Fault Detection and Self-Healing Systems -Applications and Challenges		
UNIT – IV	**SECURITY AND PRIVACY**	**9 Periods**
Cyber Security Challenges in Smart Grid - Load Altering Attacks- False Data Injection Attacks- Defense Mechanisms - Privacy Challenges- Cyber Security Standards		
UNIT – V	**ECONOMICS AND MARKET OPERATIONS**	**9 Periods**
Introduction, Reasons for restructuring / deregulation of power industry, Understanding the restructuring process - Entities involved. The market place mechanisms-Energy and Reserve Markets- Market Power - Generation Firms- Locational Marginal Prices- Financial Transmission Rights		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK :

1	*Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage "***Smart Grid Technologies and applications"** *John Wiley Publishers Ltd., 2012.*
2	*P. Venkatesh, B.V. Manikandan, S. Charles Raja, A. Srinivasan "***Electrical Power Systems- Analysis, Security and Deregulation"** *PHI Learning Private Limited, New Delhi, 2012.*

REFERENCES :

1	*Lars T. Berger, Krzysztof Iniewski "***Smart Grid applications, Communications and Security***" John Wiley Publishers Ltd., 2012.*
2	*Yang Xiao,* **"Communication and Networking in Smart Grids",** *CRC Press Taylor and Francis Group, 2012.*
3	*Caitlin G. Elsworth,* **"The Smart Grid and Electric Power Transmission"***, Nova Science Publishers Inc, August 2010*
4	*Lars T. Berger, Krzysztof Iniewski "***Smart Grid applications, Communications and Security***" John Wiley Publishers Ltd., 2012.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Recollect the fundamentals of conventional power systems and learn the concept of smart grid	K1
CO2	Interpret the role of communication Technologies in a smart grid	K2
CO3	Apply the state-of-the-art measurement and protection techniques for reliable grid	K3
CO4	Utilize the techniques for ensuring safety and security of the smart grid	K3
CO5	Analyze the economical aspects of the smart grids	K4

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping														
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PS O2**	**PS O3**
CO1	2	2	2	2	2	2	2	-	-	1	1	-	3	2	1
CO2	3	3	1	2	2	-	-	-	-	2	3	2	3	2	1
CO3	3	3	1	2	2	-	-	-	-	2	3	2	3	3	2
CO4	3	3	1	2	2	3	2	2	1	-	-	3	3	3	2
CO5	3	2	2	2	2	-	2	2	-	1	3	3	3	3	2
22EOE$06	**3**	**3**	**1**	**2**	**2**	**3**	**2**	**2**	**1**	**2**	**3**	**3**	**3**	**3**	**2**
1 – Slight, 2 – Moderate, 3 – Substantial															
b) CO and Key Performance Indicators Mapping															
CO1	1.2.1,1.3.1,1.4.1,2.3.1,2.3.2,2.4.4,3.1.3,3.1.6,3.2.1,4.1.4,4.2.1,4.3.4,5.1.1,5.3.1,6.1.1,7.1.1, 7.2.2,10.1.1,10.3.1,11.1.1														
CO2	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.2,2.1.3,2.2.1,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.6, 3.2.13.2.2,3.2.3,4.1.1,4.1.3,4.1.4,5.1.1,5.2.1,5.3.1,12.1.2,12.2.2,12.3.2,10.1.1,10.2.2,10.3. 1,11.1.1,11.2.1,11.3.1,11.3.2,12.3.1,12.3.2														
CO3	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.2,2.1.3,2.2.1,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.6, 3.2.13.2.2,3.2.3,4.1.1,4.1.3,4.1.4,5.1.1,5.2.1,5.3.1,12.1.2,12.2.2,12.3.2,10.1.1,10.2.2,10.3. 1,11.1.1,11.2.1,11.3.1,11.3.2,12.3.1,12.3.2														
CO4	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.2,2.1.3,2.2.1,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.6, 3.2.13.2.2,3.2.3,4.1.1,4.1.3,4.1.4,5.1.1,5.2.1,5.3.1,8.2.2,9.1.2,7.2.1,7.2.2,6.2.1,6.1.1,5.3.2, 5.3.1,5.3.212.1.2,12.2.2,12.3.2,														
CO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.2,2.1.3,2.2.1,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.6, 3.2.13.2.2,3.2.3,4.1.1,4.1.3,4.1.4,5.1.1,5.2.1,5.3.1,12.1.2,12.2.2,12.3.2														

ASSESSMENT PATTERN							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	10	30	40	20	-	-	100
CAT2	10	30	40	20	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	30	30	20	20	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	30	30	20	20	-	100
ESE	10	30	40	20	-	-	100

22LOE$07	**CMOS VLSIDESIGN** *(Common to All Branches)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	OE	3	0	0	3

Course Objective	To introduce various aspects of CMOS logic design in combinational and sequential circuit to design CMOS VLSI system components	
UNIT – I	**CMOSLOGICDESIGN**	**9 Periods**
Inverter- CMOS Logic Gates: Compound Gates – Pass Transistors and Transmission Gates –Tristated – Multiplexers –CMOS Fabrication and Layout: Fabrication Process – Layout Designrule–GateLayouts–StickDiagrams–DesignPartitioning.		
UNIT – II	**MOSTRANSISTORTHEORY**	**9 Periods**
Introduction – Long Channel I-V Characteristics – C-V Characteristics – Non-ideal I-V Effects –DC Transfer Characteristics – CMOS Technologies – Sources of Power Dissipation - DynamicPower–Static Power.		
UNIT – III	**COMBINATIONALCIRCUITDESIGN**	**9 Periods**
CircuitFamilies:StaticCMOS–RatioedCircuits–CascodeVoltageSwitchLogic–Dynamic Circuits–PassTransistorCircuits.Silicon-on-InsulatorCircuitDesign–SubthresholdCirucitDesign.		
UNIT – IV	**SEQUENTIALCIRCUITDESIGN**	**9 Periods**
Sequentialstaticcircuits–Circuitdesignoflatchedandflip-flops–Sequencingdynamiccircuits –Synchronizers–Wavepipelining -VLSIclocking:CMOS clockingstyles-Pipelinedsystems-Clockgenerationanddistribution.		
UNIT – V	**DESIGNOFVLSISYSTEMS**	**9 Periods**
System Specifications – Structural Gate Level Modeling – Switch Level Modeling – BehavioralandRTL Modeling-Addition/subtraction–Comparators–counters–-Multiplexers-BinaryDecoders – Comparators – Priority Encoders – Latches - Flip-Flops and Registers – SRAM –DRAM–ROM.		
Contact Periods: **Lecture: 45 Periods** **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**		

TEXT BOOKS:

1	*N. Weste and David Money Harris, "**CMOS VLSI Design**", Fourth Edition, PearsonEducation,2011*
2	*Uyemura, John P, "**Introduction to VLSI Circuits and Systems**", Wiley & Sons, 8th Reprint 2009*

REFERENCES:

1	*JanM.Rabaey,"**DigitalIntegratedCircuits:ADesignPerspective**",PHI,SecondEdition,2012.*
2	*R.JacobBaker,"**CMOS:CircuitDesign,Layout,andSimulation**",Wiley-IEEE,RevisedSecondEdition,2008.*
3	*Pucknell,"**BasicVLSIDesign**",PrenticeHall,2006.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Realize the CMOS logic design	K2
CO2	Explain the basic MOS transistor theory and power dissipation in CMOS logic.	K2
CO3	Develop combinational circuit design of CMOS logic	K3
CO4	Interpret sequential circuit design of CMOS logic	K2
CO5	Model the digital system using Hardware Description Language	K2

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	-	-	2	-	-	-	2	-	3	3	1	3
CO2	3	2	1	-	-	2	-	-	-	2	-	3	2	1	2
CO3	3	3	2	-	-	2	-	-	-	2	-	3	3	1	3
CO4	3	3	2	-	-	2	-	-	-	2	-	3	3	1	3
CO5	3	3	2	-	-	2	-	-	-	2	-	3	3	1	3
22LOE$07	**3**	**3**	**2**	-	-	**2**	-	-	-	**2**	-	**3**	**3**	**1**	**3**
1 – Slight, 2 – Moderate, 3 – Substantial															
b) CO and Key Performance Indicators Mapping															
CO1	1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.1.5, 3.1.6, 3.3.2, 3.4.1, 3.4.2, 6.1.1, 10.1.1, 10.1.2, 10.1.3, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2														
CO2	1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.4, 3.3.2, 3.4.1, 3.4.2, 6.1.1, 10.1.1, 10.1.2, 10.1.3, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2														
CO3	1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.1.5, 3.1.6, 3.3.2, 3.4.1, 6.1.1, 10.1.1, 10.1.2, 10.1.3, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2														
CO4	1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 3.1.4, 3.1.5, 3.1.6, 3.3.2, 3.4.1, 3.4.2, 6.1.1, 10.1.1, 10.1.2, 10.1.3, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2														
CO5	1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.4, 3.1.5, 3.1.6, 3.3.2, 3.4.1, 3.4.2, 6.1.1, 10.1.1, 10.1.2, 10.1.3, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2														

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	40	40	20	-	-	-	100
CAT2	40	40	20	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	50	50	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	50	50	-	-	-	100
ESE	40	40	20	-	-	-	100

22LOE$08	**MOBILE COMMUNICATION** *(Common to All Branches)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	OE	3	0	0	3

Course Objective	To understand and recall the mobile radio propagation, cellular architectures, equalization and diversity techniques, digital modulation techniques and various wireless network standards.	
UNIT – I	**MOBILE RADIO PROPAGATION**	**9 Periods**
Review of free-space propagation - Radio Wave Propagation in wireless environment - Free Space Propagation Model - Ground Reflection Model, Diffraction, Scattering - Practical link budget design - Small scale fading - Time dispersion parameters - Coherence bandwidth - Doppler spread & Coherence time, Fading due to Multipath time delay spread - Fading due to Doppler spread.		
UNIT – II	**CELLULAR CONCEPT**	**9 Periods**
Hexagonal cell-Cell clustering-Frequency Reuse-Static and dynamic channel assignment strategies - Handoff Strategies - Interference and System Capacity - Trunking - Capacity in Cellular Systems. Multiple Access Techniques: FDMA, TDMA, CDMA, OFDMA.		
UNIT – III	**MULTIPATH MITIGATION TECHNIQUES**	**9 Periods**
Equalization – Adaptive equalization: Linear and Non-Linear equalization, - Diversity – Micro and Macro diversity - Diversity combining techniques - Rake receiver- MIMO Coding: Alamouti Scheme (Qualitative)		
UNIT – IV	**MODULATION TECHNIQUES**	**9 Periods**
Modulation in cellular wireless systems: Binary Phase Shift Keying (BPSK) – QPSK –Orthogonal QPSK-Minimum Shift Keying-Gaussian Minimum Shift Keying - Multicarrier modulation: Orthogonal Frequency Division Multiplexing (OFDM) - PAPR reduction –Windowed OFDM - Filtered OFDM		
UNIT – V	**WIRELESS NETWORKS**	**9 Periods**
Second Generation Cellular Standard: GSM - Third Generation Cellular standards: CDMA -WCDMA- Fourth Generation Cellular Standards: 4G LTE – LTE Advanced – 5G Network – Near Field Communication (NFC) systems – Wireless LAN technology – Hyper LAN – Bluetooth technology – Ultra Wideband (UWB) communication - Introduction to 60 GHz mmWave.		
Contact Periods: **Lecture: 45 Periods** **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**		

TEXT BOOKS:

1	*Theodore S. Rappaport, "Wireless communications", 2nd Edition, Pearson Education, 2010*
2	*Mischa Schwartz, "Mobile Wireless Communications", 1st Edition, Cambridge University Press, 2010*

REFERENCES:

1	*Suvra Sekhar Das and Ramjee Prasad, "Evolution of air interface towards 5G Radio Access Technology and Performance Analysis", River Publishers,2018*
2	*David Tse, Pramod Viswanath, "Fundamentals of Wireless Communication", 1st Edition, Cambridge University Press, 2006.*
3	*Andreas.F. Molisch, "Wireless Communications", 2nd Edition, Wiley, 2011.*
4	*Aditya K Jagannatham, "Principles of Modern Wireless Communication Systems Theory and Practice", 1st Edition, McGraw Hill Education (India) Private Limited, 2017*
5	*William Stallings, "Wireless Communications and networks", 2nd Edition, Pearson, 2009.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Interpret the concepts of radio propagation and fading channel models in wireless communication	K3
CO2	Interpret the functionalities of various cellular concepts and multiple access techniques and solve problems in channel assignment and traffic intensity in cellular system	K4
CO3	Explain various equalization and diversity combining techniques used in multipath propagation	K2
CO4	Discuss the need for digital and multicarrier modulation techniques used in modern cellular system	K2
CO5	Recall the functionalities of various wireless networks used in day-today life.	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping															
COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	2	1	1	-	-	-	-	-	-	-	1	3	-	1
CO2	3	2	1	1	-	-	-	-	-	-	-	1	3	-	1
CO3	3	2	1	1	-	-	-	-	-	-	-	1	3	-	1
CO4	3	2	1	1	-	-	-	-	-	-	-	1	3	-	1
CO5	3	2	1	1	-	-	-	-	-	-	-	1	3	-	1
22LOE$08	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**-**	**1**
1 – Slight, 2 – Moderate, 3 – Substantial															
b) CO and Key Performance Indicators Mapping															
CO1	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.4,3.1.1,3.1.2,3.3.1,4.1.1,4.2.1,4.3.3, 12.1.1,12.2.2														
CO2	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.4,3.1.1,3.1.2,3.3.1,4.1.1,4.2.1,4.3.3, 12.1.1,12.2.2														
CO3	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.4,3.1.1,3.1.2,3.3.1,4.1.1,4.2.1,4.3.3, 12.1.1,12.2.2														
CO4	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.4,3.1.1,3.1.2,3.3.1,4.1.1,4.2.1,4.3.3,12.1.1,12.2.2														
CO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.4,3.1.1,3.1.2,3.3.1,4.1.1,4.2.1,4.3.3,12.1.1,12.2.2														

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	40	20	20	-	-	100
CAT2	50	50		-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	20	40	20	20	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	50	50	-	-	-	-	100
ESE	20	40	20	20	-	-	100

22POE$09	**RAPID PROTOTYPING** *(Common to All Branches)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	OE	3	0	0	3

Course Objectives	*To educate the students with fundamental and advanced knowledge in the field of Rapid Prototyping technology and associated Aerospace, Architecture, Art, Medical and Industrial applications.	
UNIT- I	**INTRODUCTION**	**9 Periods**
Overview - Need - Development of Rapid Prototyping (RP) Technology: Rapid Prototyping -Rapid Tooling - Rapid Manufacturing - Additive Manufacturing. RP Process Chain, Benefits, Applications: Building Printing, Bio Printing, Food Printing, Electronics Printing, Automobile, Aerospace, Healthcare.		
UNIT- II	**VAT POLYMERIZATION AND MATERIAL EXTRUSION**	**9 Periods**
Photo polymerization: Stereo lithography Apparatus (SLA) - Materials -Process - top down and bottom up approach - Advantages - Limitations - Applications. Digital Light Processing (DLP) - Process - Advantages - Applications. Material Extrusion: Fused Deposition Modelling (FDM) - Process-Materials -Applications and Limitations.		
UNIT- III	**POWDER BED FUSION AND BINDER JETTING**	**9 Periods**
Powder Bed Fusion: Selective Laser Sintering (SLS): Process - Powder Fusion Mechanism - Materials and Application. Selective Laser Melting (SLM), Electron Beam Melting (EBM): Materials - Process - Advantages and Applications. Binder Jetting: Three-Dimensional Printing - Materials - Process - Benefits - Limitations - Applications.		
UNIT- IV	**MATERIAL JETTING AND DIRECTED ENERGY DEPOSITION**	**9 Periods**
Material Jetting: Multi jet Modelling- Materials - Process - Benefits - Applications. Directed Energy Deposition: Laser Engineered Net Shaping (LENS) - Process - Material Delivery -Materials –Benefits - Applications.		
UNIT- V	**SHEET LAMINATION AND DIRECT WRITE TECHNOLOGY**	**9 Periods**
Sheet Lamination: Laminated Object Manufacturing (LOM)- Basic Principle- Mechanism: Gluing or Adhesive Bonding - Thermal Bonding - Materials - Application and Limitation. Ink-Based Direct Writing (DW): Nozzle Dispensing Processes, Inkjet Printing Processes, Aerosol DW - Applications of DW.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Ian Gibson, David Rosen, Brent Stucker, Mahyar Khorasani "**Additive manufacturing technologies".** 3rd edition Springer Cham, Switzerland, 2021.*
2	*Andreas Gebhardt and Jan-Steffen Hötter "**Additive Manufacturing: 3D Printing for Prototyping and Manufacturing**", Hanser publications, United States, 2015.*

REFERENCES:

1	*Andreas Gebhardt,* ***"Understanding Additive Manufacturing: Rapid Prototyping, Rapid Manufacturing"****, Hanser Gardner Publication, Cincinnati., Ohio, 2011.*
2	*Milan Brandt,* ***"Laser Additive Manufacturing: Materials, Design, Technologies, and Applications"****, Woodhead Publishing., United Kingdom, 2016.*
3	*Amit Bandyopadhyay and Susmita Bose,* ***"Additive Manufacturing",*** *1st Edition, CRC Press., United States, 2015.*
4	*Kamrani A.K. and Nasr E.A.,* ***"Rapid Prototyping: Theory and practice",*** *Springer., United States ,2006.*
5	*Liou, L.W. and Liou, F.W.,* ***"Rapid Prototyping and Engineering applications: A tool box for prototype development"****, CRC Press., United States, 2011.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Discuss the development of RP technology and how RP technology propagated into various businesses and developing opportunities.	K3
CO2	Demonstrate the Vat polymerization and material extrusion processes and its applications.	K3
CO3	Elaborate the process and applications of powder bed fusion and binder jetting.	K3
CO4	Evaluate the advantages, limitations, applications of material jetting and directed energy deposition processes.	K3
CO5	Describe the sheet lamination and direct write technology.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	2	2	2	-	2	-	3	-	3	3	3	3	-	-	-
CO2	2	2	3	2	3	-	3	-	3	3	1	2	-	-	-
CO3	2	2	3	2	3	-	3	-	3	3	1	2	-	-	-
CO4	2	2	3	2	3	-	3	-	3	3	1	2	-	-	-
CO5	2	2	3	2	3	3	3	-	3	3	1	3	-	-	-
22POE$09	**2**	**2**	**3**	**2**	**3**	**1**	**3**	**-**	**3**	**3**	**2**	**3**	**-**	**-**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.2, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.3, 5.2.2, 5.3.1, 5.3.2, 7.1.2, 7.2.1, 7.2.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.1.1, 11.1.2, 11.2.1, 11.3.1, 11.3.2, 12.1.1, 12.1.2, 12.2.2, 12.3.1, 12.3.2.
CO2	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.2, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.2.1, 4.3.1, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.3.1, 12.1.2, 12.2.2, 12.3.1, 12.3.2.

CO3	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.2, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.2.1, 4.3.1, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.3.1, 12.1.2, 12.2.2, 12.3.1, 12.3.2.
CO4	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.2, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.2.1, 4.3.1, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.3.1, 12.1.2, 12.2.2, 12.3.1, 12.3.2.
CO5	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.2, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.2.1, 4.3.1, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 6.2.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 9.2.1, 9.2.2, 9.2.3, 9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.3.1, 12.1.1, 12.1.2, 12.2.2, 12.3.1, 12.3.2.

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	52	33	-	-	-	100
CAT2	15	68	17	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	50	50	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	100	-	-	-	100
ESE	9	75	16	-	-	-	100

22POE$10	**MANAGERIALECONOMICS** *(Common to All Branches)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	OE	3	0	0	3

Course Objectives	*To introduce the fundamental economic principles necessary for production managers	
UNIT- I	**FUNDAMENTALS OF MANAGERIAL ECONOMICS**	**9 Periods**
Introduction to Economics - Scope of Managerial Economics - General Foundations of Managerial Economics: Economic Approach, Working of Economic System and Circular Flow of Activities - Economics and Business Decisions: Relationship between Economic Theory and Managerial Economics - Role of managerial Economics in Decision making - Concept of Economic Rationality - Opportunity Cost - Marginal and Incremental approach.		
UNIT- II	**DEMAND ANALYSIS**	**9 Periods**
Demand and Supply - Determinants of Demand - Demand Estimation and Forecasting - Price Elasticity of Demand - Price Elasticity- Factors Affecting Price Elasticity - Cross Price Elasticity - Income Elasticity of Demand - Advertisement or Promotional Elasticity - Elasticity of Supply.		
UNIT- III	**DEMAND THEORY**	**9 Periods**
Utility Analysis - Total and Marginal Utility - Law of Diminishing marginal utility - Indifference curve analysis - Consumer Equilibrium - Consumer Surplus - Price effect, Substitution Effect and Income Effect.		
UNIT- IV	**THEORY OF PRODUCTION AND COST**	**9 Periods**
The Production Function - Profit-Maximizing Input Usage - Isoquants and Isocosts – CostMinimization and Optimal Input Substitution - The Cost Function - Breakeven analysis,Contribution analysis - Long-run Costs and Economies of Scale - Multiple Cost Functions andEconomies of Scope - Learning curve.		
UNIT- V	**THEORY OF MARKET AND PRICING**	**9 Periods**
Forms of Markets: Meaning and Characteristics - Market Equilibrium: Practical Importance, Market Equilibrium and Changes in Market Equilibrium. Pricing Functions: Market Structures - Pricing and output decisions under different competitive conditions: Monopoly Monopolistic completion and Oligopoly.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Maheshwari.Y* ***"Managerial Economics",*** *Prentice Hall of India, 2012*
2	*Thomas and Maurice* ***"Managerial Economics: Concept and Applications",*** *McGrawHill, 2005*

REFERENCES:

1	*D.N. Dwivedi, **"Managerial Economics",** Vikas Publishing house, 2015*
2	*Christopher R Thomas, S Charles Maurice, **"Managerial economics",** Mcgraw Hill, 2014*
3	*M. A. Beg, "**Managerial Economics**",Global Professional Publishing Ltd, 2010*
4	*K.C. Sankaranarayanan, "**Managerial Economics**", CBS, 2015*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explain fundamentals of managerial economics	K2
CO2	Discuss the dynamics of Demand	K3
CO3	Explain about various theories of demand	K3
CO4	Discuss about the factors influencing production	K4
CO5	Describe about the theory of market and pricing method	K4

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	1	2	1	3	1	3	3	-	1	3	3	3	-	1	2
CO2	1	3	2	3	1	3	3	-	1	3	3	3	-	1	2
CO3	1	3	2	3	1	3	3	-	1	3	3	3	-	1	2
CO4	1	3	2	3	1	3	3	-	1	3	3	3	1	1	2
CO5	1	3	2	3	1	3	3	-	1	3	3	3	-	1	2
22POE$10	**1**	**3**	**2**	**3**	**1**	**3**	**3**	**-**	**1**	**3**	**3**	**3**	**1**	**1**	**2**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.2.1, 2.1.2, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.4.4, 3.1.1, 3.1.3, 3.1.5, 3.2.3, 3.3.1, 3.4.1, 4.1.1, 4.1.2, 4.3.4, 5.2.1, 5.3.1, 6.1.1, 6.2.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 9.2.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.1.1, 11.2.1, 11.3.1, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO2	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.3, 3.3.2, 3.4.1, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.3.1, 4.3.4, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 6.2.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 9.2.1, 9.3.1, 10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.1.1, 11.2.1, 11.3.1, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO3	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.3, 3.3.2, 3.4.1, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.3.1, 4.3.4, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 6.2.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 9.2.1, 9.3.1, 10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.1.1, 11.2.1, 11.3.1, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO4	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.3, 3.3.2, 3.4.1, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.3.1, 4.3.4, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 6.2.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 9.2.1, 9.3.1, 10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.1.1, 11.2.1, 11.3.1, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2

CO5	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.3, 3.3.2, 3.4.1, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.3.1, 4.3.4, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 6.2.1, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 9.2.1, 9.3.1, 10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.1.1, 11.2.1, 11.3.1, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	50	50		-	-	-	100
CAT2	50	50		-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	33.33	33.33	33.33	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	33.33	33.33	33.33	-	-	-	100
ESE	42	42	16	-	-	-	100

22NOE$11	MEASUREMENT AND CONTROL *(Common to All Branches)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	OE	3	0	0	3

COURSE OBJECTIVE	To teach about the concepts of variable sensors for industrial parameter measurement and to impart knowledge on automatic control system	
UNIT - I	**INTRODUCTION TO MEASUREMENTS**	**9 Periods**
Elements of measurement system - Classification of Instruments – Static and dynamic characteristics of a measurement system - Errors in measurement - Calibration of instruments.		
UNIT - II	**STRAIN AND DISPLACEMENT MEASUREMENT**	**9 Periods**
Strain: Types of strain gauges, theory of operation, strain gauge materials, strain gauge circuits and applications. Displacement: Resistive potentiometer: Linear, circular and helical – LVDT - RVDT - Capacitance transducers – Piezoelectric transducers – Hall Effect devices - Proximity sensors.		
UNIT - III	**PRESSURE AND TEMPERATURE MEASUREMENT**	**9 Periods**
Pressure: Mechanical devices: Diaphragm, bellows, and bourdon tube - Electrical devices: Variable resistance, inductance and capacitance transducers. Temperature: Resistance type temperature sensors: RTD , Thermocouples, Thermopiles and Thermistor - Laws of thermocouple – Radiation methods for temperature measurement.		
UNIT - IV	**FLOW AND LEVEL MEASUREMENT**	**9 Periods**
Flow: Variable head type flow meters: Orifice plate, Venturi tube, Flow nozzle, Pitot tube - Variable area type: Rotameter - Turbine flow meter - Electromagnetic flow meter - Ultrasonic flow meter. Level: Resistive, inductive and capacitive techniques – Ultrasonic methods – Air purge system .		
UNIT - V	**AUTOMATIC CONTROL SYSTEM**	**9 Periods**
Elements of control system – Concept of open loop and closed loop systems – Mathematical modelling - Controllers – Brief idea of Proportional, Derivative and Integral Modes – Pneumatic Controller – Hydraulic Controller.		
Contact Periods: 45 Periods **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*A.K. Sawhney, Puneet Sawhney,* ***"A Course in Mechanical Measurements and Instrumentation & Control"*** *Dhanpat Rai & Co, 2012.*
2	*S. K. Singh, "****Industrial Instrumentation and Control****", McGraw Hill Publication, 3rd Edition, 2016.*

REFERENCES:

1	*William Bolton, "****Instrumentation and Control Systems****," Newnes, Publication, 3rd Edition, 2021.*
2	*E. D. Doeblin,* ***"Measurement Systems: Application and Design",*** *McGraw Hill Publication, 6th Edition, 2017.*
3	*E.W. Golding and F.C. Widdis,* ***"Electrical Measurements and Measuring Instruments"*** *A.H.Wheeler and Co., 5th Edition, 2011.*
4	*Alan S. Morris,* ***"Measurement and Instrumentation Principles",*** *Butterworth-Heinemann Publications, 3rd Edition, 2011.*

COURSE OUTCOMES Upon Completion of the course, the students will be able to		Bloom's Taxonomy Mapped
CO1	Describe the methods of measurement and classification of measuring instruments.	K2
CO2	Suggest suitable sensor for the measurement of strain and displacement.	K2
CO3	Explain the construction and working of transducers for pressure and temperature measurement.	K2
CO4	Elucidate the characteristics of flow and level measuring instruments.	K2
CO5	Elaborate the concept of automatic control system.	K2

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	-	-	-	-	-	-	-	-	3	2
CO2	3	2	2	2	-	-	-	-	-	-	-	-	-	3	2
CO3	3	2	2	2	-	-	-	-	-	-	-	-	-	3	2
CO4	3	2	2	2	-	-	-	-	-	-	-	-	-	3	2
CO5	3	3	3	2	-	-	-	-	-	-	-	-	-	3	3
22NOE$11	**3**	**3**	**3**	**2**	-	-	-	-	-	-	-	-	-	**3**	**2**

b) CO and Key Performance Indicators mapping

CO1	1.1.1, 1.1.2, 1.2.1,1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 3.2.1, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.2, 4.1.3, 4.1.4
CO2	1.1.1, 1.1.2, 1.2.1,1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2,2.2.3, 2.3.1, 2.3.2, 3.1.6, 3.3.2, 3.4.1, 3.4.2, 4.1.2, 4.1.3, 4.1.4
CO3	1.1.1, 1.1.2, 1.2.1,1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 3.1.5, 3.1.6, 3.3.2, 3.4.1, 3.4.2, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2
CO4	1.1.1, 1.1.2, 1.2.1,1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2,2.2.3, 2.2.4, 2.3.1, 2.3.2, 3.1.5, 3.1.6, 3.3.2, 3.4.1, 3.4.2, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2
CO5	1.1.1, 1.1.2, 1.2.1,1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 3.1.5, 3.1.6, 3.2.1, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2

ASSESSMENT PATTERN - THEORY

Test/Bloom's Category	Remembering (K1)%	Understanding (K2) %	Applying (K3)%	Analyzing (K4)%	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60	-	-	-	-	100
CAT2	40	60	-	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	30	70	-	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	30	70	-	-	-	-	100
ESE	40	60	-	-	-	-	100

22NOE$12	**INDUSTRIAL AUTOMATION** *(Common to All Branches)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	OE	3	0	0	3

COURSE OBJECTIVE	To elaborate on the basic concept of automation, including the necessary components and various automation controllers utilized in industrial automation.	
UNIT - I	**INTRODUCTION TO AUTOMATION**	**9 Periods**
Automation overview – Requirement of automation systems – Architecture of industrial automation system –Industrial bus systems: Modbus and Profibus.Introduction to Industry 4.0 and its evolution.		
UNIT - II	**AUTOMATION COMPONENTS**	**9 Periods**
Sensors for temperature – Pressure – Force – Displacement - Speed – Flow- level – Humidity and pH measurement. Actuators – Process control valves –Power electronic drives: DIAC- TRIAC – power MOSFET – IGBT. Introduction to DC and AC servo drives for motion control.		
UNIT - III	**PROGRAMMABLE LOGIC CONTROLLERS**	**9 Periods**
PLC Hardware – power supplies and isolators –Relays – Switches -Seal-in circuits – PLC programming – ladder diagram – sequential flow chart – PLC communication and networking – PLC selection – PLC installation – Advantages – Application of PLC to process control industries and Robotics.		
UNIT - IV	**DISTRIBUTED CONTROL SYSTEM**	**9 Periods**
Overview of DCS – DCS hardware – DCS software configuration – DCS communication – DCS supervisory computer tasks – DCS integration with PLC and Computers.		
UNIT - V	**SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEMS**	**9 Periods**
Introduction - Supervisory Control and Data Acquisition Systems – SCADA HMI Essentials – SCADA Components – SCADA Configuration and Software – HMI hardware and software.		
Contact Periods: 45 Periods **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*Frank D. Petruzella, "**Programmable Logic Controllers**", 5th Edition, McGraw Hill, 2016.*
2	*S.K. Singh "**Industrial Instrumentation and Control**", 3rd Edition, McGraw Hill Companies, 2004.*

REFERENCES:

1	*Sudip Misra, Chandana Roy, Anandarup Mukherjee, **"Introduction to Industrial Internet of Things and Industry 4.0**", CRC Press, 1st edition, 2021*
2	*Bela G Liptak, "**Process software and digital networks – Volume 3**", 4th Edition, CRC press, 2012.*
3	*Romily Bowden, "**HART application guide and the OSI communication foundation**",1999.*
4	*John.W. Webb Ronald A Reis, "**Programmable Logic Controllers - Principles and Applications**", Prentice Hall Inc., 5th Edition, 2003.*
5	*M. P. Lukcas, "**Distributed Control Systems"**, Van Nostrand Reinhold Co., 1986.*

COURSE OUTCOMES Upon Completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Elaborate the basic architecture of automation systems and Industry 4.0.	K2
CO2	Describe the various automation components and industrial bus system involved in industrial automation	K2
CO3	Construct ladder logic diagram using PLC basic functions, timer and counter functions for simple applications	K3
CO4	Illustrate the functionary components and supervisory control of DCS with relevant diagrams	K2
CO5	Describe the basics of SCADA technology.	K2

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	-	1	3	3
CO2	3	2	1	-	-	-	-	-	-	-	-	-	1	3	3
CO3	3	3	2	2	-	-	-	-	1	-	-	2	1	3	3
CO4	3	2	2	-	-	-	-	-	-	-	-	-	1	3	3
CO5	3	2	1	-	-	-	-	-	-	-	-	-	1	3	3
22NOE$12	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**1**	**3**	**3**

b) CO and Key Performance Indicators mapping

CO1	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.3.1, 2.4.3,3.1.1, 3.1.2, 3.1.3, 3.3.1,3.3.2.
CO2	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.3.1, 2.4.3,3.1.1, 3.1.2, 3.1.3, 3.3.1,3.3.2.
CO3	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.3.1, 2.4.3,3.1.1, 3.1.2, 3.1.3, 3.3.1,3.3.2, 4.1.1, 4.1.2, 4.2.1, 4.2.2, 9.1.1, 9.1.2, 10.1.1, 10.1.2, 10.1.3, 12.1.1, 12.1.2.
CO4	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.3.1, 2.4.3,3.1.1, 3.1.2, 3.1.3, 3.3.1,3.3.2.
CO5	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.3.1, 2.4.3,3.1.1, 3.1.2, 3.1.3, 3.3.1,3.3.2.

ASSESSMENT PATTERN - THEORY

Test/Bloom's Category	**Remembering (K1)%**	**Understanding (K2) %**	**Applying (K3)%**	**Analyzing (K4)%**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	60	20	-	-	-	100
CAT2	20	60	20	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	20	60	20	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	20	60	20	-	-	-	100
ESE	20	60	20	-	-	-	100

22SOE$13	**PROGRAMMING IN JAVA** *(Common to All Branches)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	OE	3	0	0	3

Course Objectives	The objective of this course is to provide students with the essential Java constructs necessary for developing an object-oriented program.	
UNIT – I	**FUNDAMENTALS OF JAVA PROGRAMMING**	**9 Periods**
History and Evolution of Java- Overview of java– Operators- Control Structures– Methods- Classes and Objects– Inheritance- Packages and Interfaces- Exception Handling.		
UNIT – II	**THREADS , I/O AND STRING HANDLING**	**9 Periods**
Multi threaded Programming– Enumeration- Auto boxing– Annotations- String Handling- Input/Output: Exploring java.io		
UNIT – III	**EVENT HANDLING**	**9 Periods**
Introducing the AWT: working with windows- graphics and text- Using AWT controls- Layout Manager - Menus - Introducing Swing		
UNIT – IV	**IMAGING AND DATABASE CONNECTIVITY**	**9 Periods**
Imaging: Creating- loading and displaying- Image observer- Double buffering- Media tracker- Image producer– consumer– filters– animation- Java Database Connectivity		
UNIT – V	**NETWORKING**	**9 Periods**
Networking – Remote Method Invocation – Java Beans –Java servlets		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Herbert Schildt, "Java**, The Complete Reference** ", Tata McGrawHill, 12th Edition, 2022*

REFERENCES

1	*Deitel .H.M and Deitel.P.J, " **Java: How to Program** ", Pearson Education Asia, 9th Edition 2011*
2	*Lay.S&Horstmann Gary Cornell, " **Core Java Vol I** ", The Sun Microsystems & press Java Series, 9th Edition, 2012*
3	*NPTEL Course : "**PROGRAMMING IN JAVA"*** ***https://archive.nptel.ac.in/courses/106/105/106105191/***

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Write simple java programs using fundamental concepts of java like control structures, inheritance, packages, interfaces and exception handling	K4
CO2	Write java program using multithreading and string handling	K3
CO3	Write java programs for managing events and to access database	K4
CO4	Write java programs to display and manipulation of graphical images	K3
CO5	Develop client server programs using RMI and servlets	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs / POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	2	1	-	-	-	-	2	-	-	1	2	2
CO2	2	1	2	2	1	-	-	-	-	2	-	-	-	2	3
CO3	2	1	2	2	1	-	-	-	-	2	-	-	1	2	3
CO4	2	1	2	2	1	-	-	-	-	2	-	-	1	2	3
CO5	2	1	2	2	1	-	-	-	-	2	-	2	1	2	3
22SOE$13	**2**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**1**	**1**	**2**	**3**

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.2.1, 2.2.3, 2.2.4, 2.4.3, 3.1.5, 3.1.6, 3.2.2, 3.3.1, 3.3.2, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.2, 5.2.2,10.1.1,10.1.2,10.1.3
CO2	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.4.3, 3.1.5, 3.1.6, 3.2.2, 3.3.2, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.2, 5.2.2,10.1.1,10.1.2,10.1.3
CO3	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.4.3, 3.1.5, 3.1.6, 3.2.2, 3.3.2, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.2, 5.2.2,10.1.1,10.1.2,10.1.3
CO4	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.4.3, 3.1.5, 3.1.6, 3.2.2, 3.3.2, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.2, 5.2.2,10.1.1,10.1.2,10.1.3
CO5	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.4.3, 3.1.5, 3.1.6, 3.2.2, 3.3.2, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.2, 5.1.1, 5.2.2,10.1.1,10.1.2,10.1.3,12.1.1,12.2.1,12.2.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1)%**	**Understanding (K2) %**	**Applying (K3)%**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	-	30	40	30	-	-	100
CAT2	10	30	40	20	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	70	30	-	-	100
Individual Assessment 2 /Case Study 2/Seminar 2 / Project 2	-	-	50	50	-	-	100
ESE	-	30	40	30	-	-	100

22SOE$14	**NETWORK ESSENTIALS** *(Common to All Branches)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	OE	3	0	0	3

Course Objectives	The objective of the course is to understand the basics of networking and able to configure and troubleshoot switches and routers.	
UNIT – I	**INTRODUCTION**	**9 Periods**
Introduction to Computer Networks - Goals and advantages of Computer Networks - Network Topologies – Basic networking devices – Protocols – the need for a layered architecture - The OSI Model and the TCP/IP reference model – the Ethernet LAN – Home Networking – Assembling an office LAN – Testing and Troubleshooting a LAN – Physical layer cabling: Twisted pair and Fiber optics		
UNIT – II	**WIRELESS NETWORKING**	**9 Periods**
Importance of Wireless Networking – IEEE 802.11 Wireless LANs – Bluetooth- WIMAX – RFIDs – Securing the Wireless LANs – Configuring a Point to Multipoint Wireless LAN – Interconnecting network LANs – Switch, Bridges and Routers. Interconnecting LANs with the router, Configuring the network interface-Auto negotiation		
UNIT – III	**ADDRESSING AND ROUTING FUNDAMENTALS**	**9 Periods**
IPv4 and IPv6 addressing – Subnet masks – CIDR blocks – configuration of a router – Console port connection - user EXEC mode – Privileged EXEC mode - Configuration of a switch – Static VLAN configuration - Spanning Tree protocol – Network Management – Power over Ethernet		
UNIT – IV	**ROUTING PROTOCOLS**	**9 Periods**
Static Vs Dynamic Routing Protocols – Distance vector Routing – Link State Routing – Hybrid Routing – Configuring RIP - Network Services – DHCP, DNS - Analyzing Internet Traffic.		
UNIT – V	**TROUBLESHOOTING AND NETWORK SECURITY**	**9 Periods**
Analyzing Computer Networks – FTP data packets – Analyzing Campus Network data traffic – Troubleshooting the router and switch interface, Troubleshooting fiber optics – Intrusion – DOS – Security software and hardware.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK :

1	*Jeffrey S.Beasley Piyasat Nilkaew "**Network Essentials**" 3 rd Edition, Pearson, 2018*
2	*Larry L. Peterson and Bruce S. Davie "**Computer Networks, A Systems Approach**" 5 th edition, Morgan Kaufmann Publishers Inc, 2014.*

REFERENCES :

1	*Behrouz A. Forouzan, "**Data Communications and Networking with TCP/IP Protocol Suite**", Sixth Edition TMH, 2022.*
2	*James F. Kurose, Keith W. Ross, "**Computer Networking, A Top-Down Approach Featuring the Internet**", Eighth Edition, Pearson Education, 2021.*
3	*Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "**Computer Networks: An Open Source Approach**", McGraw Hill, 2012.*
4	*Nader F. Mir, "**Computer and Communication Networks",** Second Edition, Prentice Hall, 2014.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Identify topologies and types of Computer Networks and enumerate the layers of the OSI model and TCP/IP	K2
CO2	Explain the significance of wireless networks and configure a Wireless LAN	K3
CO3	Configure a switcher and a router	K3
CO4	Describe basic routing algorithms and network services	K3
CO5	Troubleshoot the router and switch interface	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-			1	-	-	-	-	-	-	1	2	-
CO2	2	3	-			1	-	-	-	-	-	-	1	2	-
CO3	2	3	-	2	2	1	-	-	-	-	-	-	1	2	-
CO4	2	3	-	2	2	1	-	-	-	-	-	-	1	2	-
CO5	2	3	-	2	2	1	-	-	-	-	-	-	1	2	-
22SOE$14	**2**	**3**	**-**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1, 1.4.1, 2.1.2, 2.2.2, 2.4.4, , 4.1.2, 5.1.1, 5.1.2,5.2.1, 5.2.2, 5.3.2, 6.1.1, 6.1.2
CO2	1.3.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3,2.2.4, 4.1.2, 5.1.1, 5.1.2,5.2.1, 5.2.2, 5.3.2, 6.1.1, 6.1.2
CO3	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3,2.2.4, 4.1.1, 4.1.2, 5.1.1, 5.1.2,5.2.1, 5.2.2, 5.3.2, 6.1.1, 6.1.2
CO4	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3,2.2.4, 4.1.1, 4.1.2, 5.1.1, 5.1.2,5.2.1, 5.2.2, 5.3.2, 6.1.1, 6.1.2
CO5	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3,2.2.4, 4.1.1, 4.1.2, 5.1.1, 5.1.2,5.2.1, 5.2.2, 5.3.2, 6.1.1, 6.1.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	35	35	-	-	-	100
CAT2	10	45	45	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	50	50	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	50	50	-	-	-	100
ESE	10	40	50	-	-	-	100

22I0E$15	VIDEO CREATION AND EDITING *(Common to All Branches)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	OE	3	0	0	3

Course Objectives	Upon completion of the course the students will be familiar with the principles and techniques of video creation and editing, video production equipment and software, visual storytelling and video production, planning, executing, and editing video projects. also able to foster critical thinking and creativity in developing and executing video projects.	
UNIT – I	**INTRODUCTION TO VIDEO CREATION AND EDITING**	**9 Periods**
Overview of video creation and editing -Brief history of video and film production - Understanding visual storytelling: developing documentary and dramatic projects- introduction to digital and film systems		
UNIT – II	**PRE-PRODUCTION**	**9 Periods**
Developing a concept and idea - Scriptwriting and storytelling -The Digital image - Film systems and cameras -The film image - Case Study : Non linear editing system		
UNIT – III	**PRODUCTION**	**9 Periods**
Camera operation and techniques: The video camcorder- The Lens - Lighting and sound recording techniques - Directing actors and crew -Conducting interviews -Shooting the movie - Case Study : Professional video zoom lenses		
UNIT – IV	**POST-PRODUCTION**	**9 Periods**
Picture and Dialogue editing - Editing digital video -sound editing and mixing -Color grading and correction-Sound editing and mixing – working with film in post production Case Study : Digital Audio Recording		
UNIT – V	**DISTRIBUTION AND PROMOTION**	**9 Periods**
Presenting the project - funding sources - budgets- business arrangements- legal and copyright issues- distribution and marketing - publicity and the marketing campaigns-building and sustaining a career -Case Study : Creating a short movie.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK :

1	Steven Ascher and Edward Pincus,The Filmmaker's Handbook: A Comprehensive Guide for the Digital Age,Fifth edition Penguin Publishing Group, 2012

REFERENCES :

1	Walter Murch,In the Blink of an Eye: A Perspective on Film Editing", Silman-James Press,2001
2	Karel Reisz and Gavin Millar,The Technique of Film Editing",second edition ,Taylor and Francis Group 2017
3	Ken Dancyger, The technique of film and video editing , fifth edition , Elsevier 2011.
4	Chris Kenworthy,Digital video production cookbook, OReillyMedia ,2006
5	Mark Brindle, The Digital Filmmaking Handbook ,Quercus Publishing, 2014

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Demonstrate an understanding of the history and evolution of video production and editing.	K2
CO2	Develop and execute a concept, script, and storyboard for a video project	K3
CO3	Plan and prepare for a video shoot, including casting, location scouting, and budgeting.	K3
CO4	Edit and assemble video footage using basic and advanced editing techniques.	K2
CO5	Promote and distribute the final video on various platforms.	K1

COURSE ARTICULATION MATRIX

a) CO and PO Mapping

COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	1	1	1	-	-	-	-	-	-	-	-	1	1
CO2	1	2	3	2	3	-	-	-	-	-	-	-	1	1
CO3	1	2	1	3	3	-	1	-	3	1	2	-	1	1
CO4	1	2	2	2	3	3	-	-	3	1	2	-	1	1
CO5	1	2	2	2	3	3	1	3	3	3	2	-	1	1
22IOE$15	**1**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**2**	**1**	**1**	**-**	**1**	**1**

1– Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1,1.2.1,1.31,2.1.1,2.1.2,2.2.4,2.4.1,3.1.4,3.4.1,4.1.3,
CO2	1.1.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.4.3,3.1.1,3.1.2,3.1.3,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.4.1,3.4.2,4.1.1,4.1.3,4.2.1,4.3.1,4.3.2,4.3.4,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,
CO3	1.1.1,2.1.1,2.1.3,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.3,3.2.1,3.2.2,3.3.1,3.4.2,4.1.1,4.1.3,4.1.4,4.2.2,4.3.1,4.3.2,4.3.3,,5.1.1,5.1.2,5.2.1,5.2.2,5.3.2,7.1.1,9.1.1,9.1.2,9.2.1,9.2.2,9.2.3,10.1.1,11.2.1,11.3.1,11.3.2
CO4	1.1.1,2.1.1,2.1.3,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.3,3.2.1,3.2.2,3.3.1,,3.3.2,3.4.2,4.1.1,4.1.3,4.2.1, ,4.3.1,4.3.2,5.1.1,5.1.2,5.2.1,5.2.2,5.3.2,6.1.1,6.1.2,,9.1.1,9.1.2,9.2.1,9.2.2,9.2.3,10.1.1,11.3.1,11.3.2
CO5	1.1.1 , 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4 2.3.2, 2.4.3, 3.2.1, 3.2.3, 3.3.1, 3.3.2, 3.4.2, 4.1.1, 4.1.3, 4.3.1, 4.3.2, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 6.2.1, 7.12, 8.1.1, 8.2.1,8.2.2, , 9.1.1, 9.1.2, 9.2.1,9.2.2, 9.2.3,9.2.4, 9.3.1, 10.1.1, 10.1.2, 10.1.3,10.2.1, 10.2.2, 10.3.1, 10.3.2, 11.1.1, 11.1.2, 11.2.1

SSESSMENT PATTERN – THEORY

Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Assignment 1	30	30	40	-	-	-	100
Assignment 2	30	30	40	-	-	-	100
Other mode of internal assessments, if any	-	-	-	-	-	-	-
ESE	30	30	40	-	-	-	100

22IOE$16	DIGITAL MARKETING *(Common to All Branches)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	OE	3	0	0	3

Course Objectives	To give insight on the framework to analyze, strategies and plan digital marketing and communication activities for typical marketing situations. Familiarize with the key tools and techniques of digital marketing that are popularly used by professionals in the real world of digital marketing and help them develop the ability to formulate and analyze key metrics to evaluate the performance of typical digital marketing efforts.

UNIT – I	**INTRODUCTION TO DIGITAL MARKETING**	**9 Periods**
Basics of Digital Marketing - online marketplace analysis: digital marketing environment - consumer choice and digital influence online consumer behavior-competitors -suppliers- new channel structures - rate of environment change - economic force-political force -legal force - social force- cultural force.		
UNIT – II	**DIGITAL MARKETING STRATEGY DEVELOPMENT**	**9 Periods**
Digital marketing strategy - The impact of digital media and technology on the marketing mix: product- price-place-promotion -people, process and physical evidence - relationship marketing using digital platforms: the challenge of customer engagement - customer lifecycle management		
UNIT – III	**DIGITAL MARKETING IMPLEMENTATION AND PRACTICE**	**9 Periods**
Delivering the online customer experience: planning website design and redesign projects - initiation of the website project - defining site or app requirement - designing the user experience - development and testing of content - site promotion or traffic building - campaign planning for digital media		
UNIT – IV	**MARKETING COMMUNICATIONS USING DIGITAL MEDIA CHANNELS**	**9 Periods**
Search engine marketing - online public relations - affiliated marketing - interactive display advertising -email marketing and mobile text messaging- social media and viral marketing - offline promotion techniques		
UNIT – V	**EVALUATION OF DIGITAL CHANNEL PERFORMANCE**	**9 Periods**
Create a performance management system - performance metric framework - tools and techniques for collecting metrics -customer experience and content management - online consumer behavior- online retailing - customer acquisition in B2B marketing -online inter-organizational trading		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK :

1	Dave Chaffey Fiona Ellis-Chadwick, Digital Marketing,sixth edition, 2016

REFERENCES :

1	Puneet singh Bhatia, Fundamentals of Digital Marketing , Pearson India Education services,2017
2	Mathur, Vibha, Arora, Saloni,"DigitalMarketing",PHI Learning Pvt. Ltd.,2020
3	Ian Dodson, The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Compaigns, Wiley 2016
4	Dr.Shakti Kundu, Digital Marketing Trends and Prospects:Develop an effective Digital Marketing strategy with SEO, SEM, PPC, Digital Display Ads & Email Marketing techniques,BPB PUBN,2021
5	Seema Gupta , Digital Marketing,Third Edition, McGraw Hill 2022
6.	Simon Kingsnorth, Digital Marketing Strategy:An Integrated Approach to Online Marketing, Kogan page,2022

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explain the role and importance of digital marketing in a rapidly changing business landscape	K1
CO2	Discuss the key elements of a digital marketing strategy	K2
CO3	Demonstrate advanced practical skills in common digital marketing tools such as Social media and Blogs	K2
CO4	Demonstrate advanced practical skills in common digital marketing tools such as SEM	K2
CO5	understand online consumer behavior and influence the extent to which individuals are likely to engage with the digital marketplace	K2

COURSE ARTICULATION MATRIX

a) CO and PO Mapping

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	2	2	-	-	-	-	-	-	-	-	2	2
CO2	1	1	2	2	-	-	-	-	-	-	-	-	2	2
CO3	1	1	2	2	3	-	-	-	-	-	-	-	2	2
CO4	1	1	2	2	3	2	3	3	3	3	3	3	2	2
CO5	1	1	2	2	1	-	3	3	3	3	3	3	2	2
22IOE$16	**1**	**1**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**

1– Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1,2.1.1,2.1.2,3.1.1,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,4.1.1,4.1.3,4.2.1,4.3.3,
CO2	1.1.1,2.1.1,2.1.2,3.1.1,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,4.1.1,4.1.3,4.2.1,4.3.3,
CO3	1.1.1,2.1.1,2.1.2,3.1.1,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,4.1.1,4.1.3,4.2.1,4.3.3,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2
CO4	1.1.1,2.1.1,2.1.2,3.1.1,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,4.1.1,4.1.3,4.2.1,4.3.3,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,6.1.1,7.1.1,7.1.2,7.2.1,7.2.2,8.1.1,8.2.1,8.2.2,9.1.1,9.1.2,9.2.1,9.2.2,9.2.3,9.2.4,9.3.1,10.1.1, 10.1.2,10.1.3,10.2.1,10.2.2,10.3.1,10.3.2,11.1.1,11.1.2,11.2.1,11.3.1,11.3.2,12.1.1,12.1.2,12.2.1,12.2.2, 12.3.1,12.3.2

CO5	1.1.1,2.1.1,2.1.2,3.1.1,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,4.1.1,4.1.3,4.2.1,4.3.3,5.1.1,5.1.2,5.2.1,7.1.1,7.1.2,7.2.1,7.2.2,8.1.1,8.2.1,8.2.2,9.1.1,9.1.2,9.2.1,9.2.2,9.2.3,9.2.4,9.3.1,10.1.1,10.1.2,10.1.3,10.2.1, 10.2.2,10.3.1,10.3.2,11.1.1,11.1.2,11.2.1,11.3.1,11.3.2,12.1.1,12.1.2,12.2.1,12.2.2,12.3.1,12.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Assignment 1	30	30	40	-	-	-	100
Assignment 2	30	30	40	-	-	-	100
Other mode of internal assessments, if any	-	-	-	-	-	-	
ESE	30	30	40	-	-	-	100

22BOE$17	PRINCIPLES OF FOOD TECHNOLOGY *(Common to All Branches)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	OE	3	0	0	3

Course Objectives	To learn about the various food constituents and its additives. To learn about various microbes associated with food. To learn about different food processing and preservation techniques.	
UNIT – I	**FOOD AND ENERGY**	**9 Periods**
Constituents of food – carbohydrates, lipids, proteins, water, vitamins and minerals, dietary sources, role and functional properties in food, contribution to organoleptic and textural characteristics.		
UNIT – II	**FOOD BORNE DISEASES**	**9 Periods**
Classification – food infections – bacterial and other types; food intoxications and poisonings– bacterial and non-bacterial; food spoilage – factors responsible for spoilage, spoilage of vegetable, fruit, meat, poultry, beverage and other food products.		
UNIT – III	**FOOD ADDITIVES**	**9 Periods**
Classification, intentional and non-intentional additives, functional role in food processing and preservation; food colourants – natural and artificial; food flavours; enzymes as food processing aids.		
UNIT – IV	**FOOD PRESERVATION**	**9 Periods**
Principles involved in the use of sterilization, pasteurization and blanching, thermal death curves of microorganisms, canning; frozen storage-freezing characteristics of foods, microbial activity at low temperatures, factors affecting quality of foods in frozen storage; irradiation preservation of foods.		
UNIT – V	**FOOD PACKAGING**	**9 Periods**
Types of packaging material and containers; Interactions between packaging and foods; Packing - meat, dairy, fresh fruits and vegetables, beverages and confectionaries; Food packaging closure and sealing system; Nutrition labelling and legislative requirements.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	***l – The Chemistry Of Its Components****, 6th Edn. Royal Society,London, 2015.*
2	*W.C. Frazier And D.C. Westhoff , **Food Microbiology**, 4th Ed., Mcgraw-Hill Book Co., NewYork 2013.*

REFERENCES

1	*Srinivasan Damodaran and Kirk L. Parkin., "Fennema's Food Chemistry", CRC Press, 5 thedition. 2017.*
2	*Fellows P.J, "Food Processing Technology: Principles and Practices", Woodhead Publishing 4 th edition,2016·*
3	*B. Sivasanker , Food Processing And Preservation, Prentice-Hall Of India Pvt. Ltd. New Delhi 2002.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	learn different constituents present in food and microorganism involved in processing of food.	K1
CO2	learn principles and different preservations techniques of food can also be known.	K1
CO3	learn techniques involved in modern food processing and impact of the process on food quality.	K2
CO4	Explain various preservation and packaging techniques for food product	K2
CO5	Describe the relationship between food and microorganism that basis for fermentation and preservation	K2

COURSE ARTICULATION MATRIX														
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	-	-	1	-	-	-	-	2	3	-	-	1	3
CO2	1	-	-	-	-	-	-	-	-	3	-	-	1	3
CO3	1	-	-	2	-	2	-	-	-	3	-	-	1	3
CO4	1	-	1	-	-	-	-	-	-	3	-	-	1	3
CO5	1	-	2	-	-	-	-	-	-	3	-	-	1	3
22BOE$17	**1**	**-**	**1**	**1**	**-**	**2**	**-**	**-**	**2**	**3**	**-**	**-**	**1**	**3**
1 – Slight, 2 – Moderate, 3 – Substantial														
b) CO and Key Performance Indicators Mapping														
CO1	1.4.2, 2.1.3													
CO2	1.4.1, 3.1.3													
CO3	1.4.4, 2.1.4													
CO4	1.4.1, 2.1.3,3.4.2													
CO5	1.4.1,2.2.1													

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	50	50	-	-	-	-	100
CAT2	60	40	-	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	50	50	-	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	50	50	-	-	-	-	100
ESE	50	50	-	-	-	-	100

22BOE$18	**BIOLOGY FOR ENGINEERS** *(Common to All Branches)*

PREREQUISITES	CATEGORY	L	T	P	C
NIL	OE	3	0	0	3

Course Objectives	1. Understand and interpret commonly reported statistical measures published in healthcare research 2. Analyze the different type of data using appropriate statistical software 3. Demonstrate a good understanding of descriptive statistics and graphical tools 4. Explain fundamental concepts of estimation and hypothesis testing and be confident when interpreting P values and confidence intervals	
UNIT – I	**BASICS OF CELL BIOLOGY**	**9 periods**
An overview of cells – origin and evolution of cells-cell theory-classification of cells – prokaryotic cells and eukaryotic cells; Structure of prokaryotic and eukaryotic cells and their organelles comparison of prokaryotic and eukaryotic cells; Transport across membranes – diffusion - active and passive diffusion.		
UNIT – II	**BASICS OF MICROBIOLOGY**	**9 periods**
Classification of microorganism-microscopic examination of microorganisms; Structural organization and multiplication of bacteria-viruses-algae and fungi; Microorganism used for the production of penicillin-alcohol and vitamin B-12.		
UNIT – III	**HUMAN ANATOMY AND PHYSIOLOGY**	**9 periods**
Basics of human anatomy-tissues of the human body-epithelial-connective-nervous and muscular; Nervous system-Respiratory System-Circulatory system and Digestive system.		
UNIT – IV	**BIO MOLECULES AND IMMUNE SYSTEM**	**9 periods**
Introduction to Biochemistry-classification-structure and properties of carbohydrates- proteins-lipids and nucleic acids; Innate and acquired immunity; Types of immune responses.		
UNIT-V	**APPLIED BIOLOGY FOR ENGINEERS**	**9 periods**
Overview of biosensors - glucometer applications-medicine; Microarray analysis to diagnose the cancer; Microbial production of biofuels; Applications of stem cells.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	*Darnell J, Lodish H, Baltimore D.* ***"Molecular Cell Biology"****, W.H.Freeman; 8th Edition, 2016.*
2	*Pelczar MJ, Chan ECS and Krein NR,* ***"Microbiology",*** *Tata McGraw Hill, 5thEdition, New Delhi.2001.*
3	*Wulf Cruger and Anneliese Cruger,* ***"A Textbook of Industrial Microbiology",*** *Panima Publishing Corporation, 2nd Edition, 2000.*

REFERENCES

1	*David L. Nelson and Michael M Cox,* ***"Lehninger's Principles of Biochemistry",*** *Macmillan Worth Publisher, 4th edition, 2004.*
2	*Brain R.Eggins ,* ***"Chemical Sensors and Biosensors",*** *John Wiley & Sons, 2002.*
3	*Anton Moser,* ***"Bioprocess Technology, Kinetics and Reactors",*** *Springer, Berlin (Verlag),1st edition, 1998*
4	*Kuby J,* ***"Immunology",*** *WH Freeman & Co., 7th edition, 2013.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Understand the functions of cell and their structural organization	K1
CO2	Describe the mechanisms and role of cell in immune system	K1
CO3	Get familiarized biomolecules and human anatomy system	K2
CO4	Illustrate the applications of microbes in industrial process	K3
CO5	Apply the engineering concepts in biology	K3

a) Course Articulation Matrix

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	1	-	-	-	2	2	2	-	-	1	2	2	2
CO2	1	-	-	1	1	-	-	2	3	3	2	2	1	3
CO3	1	1	-	-	-	-	-	1	1	-	-	-	1	3
CO4	-	-	-	-	1	-	-	2	3	3	1	1	1	3
CO5	-	2	-	1	3	-	-	-	-	-	-	-	2	2
22BOE$18	**1**	**1**	**-**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**3**

1 – Slight, 2 – Moderate, 3 – Substantial

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	50	10	10	10	10	10	100
CAT2	50	10	10	10	10	10	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	20	20	20	20	10	10	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	20	20	20	20	10	10	100
ESE	50	10	10	10	10	10	100

VALUE ADDED COURSES

22SEEC$09	MARKETING TECH 101

PREREQUISITES	CATEGORY	L	T	P	C
NIL	EEC	1	0	0	1

Course Objectives	The objective of this course is to make the students familiar with the basics of marketing, Creating ads in social media channels, Publisher side tech and Demand side tech ,AI & ML in Marketing, Building high-performance servers and Cloud technologies
Topics	
• Basics of Marketing • Creating ads in social media channels • Publisher side tech - CMS, Ad Server Integrations • Demand side tech - Ad Servers, Bidders • AI & ML in Marketing • Building high-performance servers • Cloud technologies	
Contact Periods: **Lecture: 15 Periods** **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 15 Periods**	