Vel Tech Multi Tech

Dr.Rangarajan Dr.Sagunthala Engineering College

An Autonomous Institution

DEPARTMENT OFARTIFICIAL INTELLIGENCE AND DATASCIENCE

PROGRAMME OUTCOMES (POs) PROGRAMME SPECIFIC OUTCOMES (PSOs) PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) COURSE OUTCOMES (COs)

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE PROGRAMME OUTCOMES (POS)

POS	PROGRAMME OUTCOMES (POS)
GA1	Engineering Knowledge: Apply knowledge of mathematics, science, engineering fundamentals and an Engineering Specialization to the solution of complex engineering problems.
GA2	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.
GA3	Design / Development of solutions: Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
GA4	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.
GA5	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.
GA6	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.
GA7	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.
GA8	Ethics : Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
GA9	Individual and team work : Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
GA10	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
GA11	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.
GA12	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.

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)
PEO1	Train the graduates with the potential of strong knowledge in the respective field and to create innovative multidisciplinary solutions for challenges in the society
PEO2	Groom the engineers to understand, analyze different nature of data and use Machine Learning techniques to develop software systems with varying complexity for data intensive applications
PEO3	To practice professionalism among the graduates and reflect good leadership skills with ethical standards and continued professional development through lifelong learning.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO's	PROGRAMME SPECIFIC OUTCOMES (PSOs)
PSO1	To impart theoretical knowledge in the respective field along with recent industrial tools and techniques to solve societal problems
PSO2	Apply the core competency obtained in the field of Machine Learning for analysis, design and development of computing systems for multi-disciplinary problems
PSO3	Acquire knowledge in the field of intelligence, deep learning and develop software solutions for security and analytics of large volume of data.

S.NO	CATEGORY	CREDITS (Regular)	CREDITS (Lateral)
	Foundation Courses		
Α	Humanities and Social Science (HSS)	10	3
	Basic Science (BS)	23	9
	Engineering Science (ES)	15	0
В	Professional Core Courses (PC)	72	65
С	Professional Elective courses (PE)	18	18
D	Open Elective Courses (OE)	9	9
Ε	Project, Seminar, Internship in industry or at Higher Learning institutions (PROJ)	16	16
F	Mandatory Courses prescribed by AICTE/UGC Not to be included for CGPA (MC)		
	TOTAL	163	120

CURRICULUM STRUCTURE

B.Tech - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE Curriculum Syllabus – Regulation 2019 SEMESTER I

Course	Name of the Course	Categor	L	Т	Р	Credit
Code		У				S
191MA101	Engineering Mathematics – I	BS	2	2	0	3
191PH101	Engineering Physics	BS	3	0	0	3
191CH101	Engineering Chemistry	BS	3	0	0	3
191HS101	English for Engineering Students	HSS	3	0	0	3
191RA111	Basic Engineering Science	ES	3	0	0	3
191CS111	Introduction to Programming in C	ES	3	0	0	3
191PH10A	Physics Laboratory	BS	0	0	2	1
191CH10A	Chemistry Laboratory	BS	0	0	2	1
191CS11A	Programming in C Laboratory	ES	0	0	2	1
	•	Total	17	2	6	21

SEMESTER II

Course	Name of the Course	Categor	L	Т	Р	Credit
Code		У				S
191MA202	Calculus and Differential Equations	BS	2	2	0	3
191HS201	Environmental Science and Engineering	HSS	3	0	0	3
191EC212	Digital System Design	ES	3	0	0	3
191ME211	Engineering Graphics	ES	2	2	0	3
191AI221	Foundations of Data Science	PC	3	0	0	3
191CS221	Problem Solving and Python Programming	PC	3	0	0	3
191ME21A	Engineering Practice Laboratory	ES	0	0	4	2
191CS22A	Problem Solving and Python Programming Laboratory	PC	0	0	2	1
	தமிழர் மரபு / Scientific Thoughts in Tamil					
		HSS	0	0	1	1
		Total	16	4	6	22

SEMESTER III

Course	Name of the Course	Categor	L	Т	Р	Credit
Code		У				S
191MA303	Probability and Statistics	BS	2	2	0	3
191AI321	Data Structures	PC	3	0	0	3
191CS322	Computer Architecture	PC	3	0	0	3
191CS323	Object Oriented Programming	PC	3	0	0	3
191CS324	Software Engineering	PC	3	0	0	3
191AI322	Introduction to Artificial Intelligence	PC	3	0	0	3
191AI32A	Data Structures Laboratory	PC	0	0	2	1
191CS32B	Object Oriented Programming Laboratory	PC	0	0	2	1
191HS30A	Advanced Reading and Writing Skills Laboratory	HSS	0	0	2	1
	தம ிழரும ் ததµழ ில ் ந ுட ்பம ும ்/Tamils and Technology	HSS	0	0	1	1
		Total	17	2	6	22

SEMESTER IV

Course	Name of the Course	Categor	L	Т	Р	Credit
Code		У				S
191MA403	Discrete Mathematics	BS	2	2	0	3
191CS424	Computer Networks	PC	3	0	0	3
191CS422	Database Management Systems	PC	3	0	0	3
191AI421	Embedded Systems	PC	3	0	0	3
191CS423	Operating Systems	PC	3	0	0	3
191CB422	Software Design and Modeling	PC	3	0	0	3
191CS42A	Database Management Systems Laboratory	PC	0	0	2	1
191CS42C	Networks Laboratory	PC	0	0	2	1
191CS42B	Operating Systems Laboratory	PC	0	0	2	1
191MC46A	Internship / Training – I	MC	0	0	0	**
		Total	17	2	6	21

SEMESTER V

Course	Name of the Course	Categor	L	Т	Р	Credit
Code		у				S
191MA504	Graph Theory and Applications	BS	2	2	0	3
191AI521	Design and Analysis of Algorithms	PC	3	0	0	3
191AI522	Internet Programming	PC	3	0	0	3
	Professional Elective – I	PE	3	0	0	3
	Professional Elective – II	PE	3	0	0	3
	Open Elective – I	OE	3	0	0	3
191HS50A	Professional Communication	HSS	0	0	2	1
191AI52A	Design and Analysis of Algorithms Laboratory	PC	0	0	2	1
191AI52B	Internet Programming Laboratory	PC	0	0	2	1
191MC56A	Technical Seminar	MC	0	0	0	**
		Total	17	2	6	21

SEMESTER VI

Course	Name of the Course	Categor	L	Т	Р	Credit
Code		у				S
191AI621	Big Data Analytics	PC	3	0	0	3
191AI622	Computer Graphics and Multimedia	PC	3	0	0	3
191CB621	Machine Learning Techniques	PC	3	0	0	3
	Professional Elective – III	PE	3	0	0	3
	Open Elective – II	OE	3	0	0	3
191AI62A	Computer Graphics and Multimedia Laboratory	PC	0	0	2	1
191AI62B	Data Analytics Laboratory	PC	0	0	2	1
191AI67A	Mini Project	PROJ	0	0	4	2
191MC66A	Internship / Training – II	MC	0	0	0	**
		Total	15	0	8	19

SEMESTER VII

Course	Name of the Course	Categor	L	Т	Р	Credit
Code		У				S
191AI721	Artificial Neural Networks and Deep Learning	PC	3	0	0	3
191CS721	Cloud Computing	PC	3	0	0	3
	Professional Elective – IV	PE	3	0	0	3
	Professional Elective – V	PE	3	0	0	3
	Open Elective – III	OE	3	0	0	3
191AI72A	Artificial Neural Networks and Deep Learning Laboratory	PC	0	0	2	1
191CS72A	Cloud Computing Laboratory	PC	0	0	2	1
191AI77A	Project Work - Phase I	PROJ	0	0	2	2
		Total	15	0	6	19

SEMESTER VIII

Course	Name of the Course	Categor	L	Т	Р	Credit
Code		У				S
191AI821	Blockchain Technology	PC	3	0	0	3
	Professional Elective – VI	PE	3	0	0	3
191AI87A	Project Work - Phase II	PROJ	0	0	24	12
		Total	6	0	24	18

Total Credits: 163

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE LIST OF PROFESSIONAL ELECTIVES

Year	Semester	Professi onal Elective	Course Code	Name of the Course	Category	L	Т	Р	С
III	V		191CS539	Internet Of Things	PE	3	0	0	3
III	V		191AI531	Multi Core Architecture and Programming	PE	3	0	0	3
III	V	Ι	191AI532	Principles of Programming Languages	PE	3	0	0	3
III	V		191AI533	Soft Computing	PE	3	0	0	3
III	V		191AI534	Software Reliability And Metrics	PE	3	0	0	3
III	V		191AI535	Data mining and warehousing	PE	3	0	0	3
III	V		191AI536	Fuzzy logic and Neural networks	PE	3	0	0	3
III	V	II	191AI537	Network Design and Technologies	PE	3	0	0	3
III	V		191AI538	Security Practices	PE	3	0	0	3
III	V		191CS536	Software Testing	PE	3	0	0	3
III	VI		191AI631	Bio- Informatics	PE	3	0	0	3
III	VI		191AI632	Malware Analysis in Data science	PE	3	0	0	3
III	VI	III	191AI633	Real Time Systems	PE	3	0	0	3
+III	VI		191AI634	Sentiment Analysis	PE	3	0	0	3
III	VI		191AI635	Virtual and Augmented Reality	PE	3	0	0	3
IV	VII		191IT737	Pattern Recognition	PE	3	0	0	3
IV	VII		191CS737	Social Network Analysis	PE	3	0	0	3
IV	VII	IV	191AI731	Business Intelligence	PE	3	0	0	3
IV	VII		191AI732	Information Retrieval	PE	3	0	0	3
IV	VII		191AI733	Trust Networks	PE	3	0	0	3
IV	VII		191CS732	Digital Image Processing	PE	3	0	0	3
IV	VII		191IT735	Game Programming	PE	3	0	0	3
IV	VII	V	191AI734	Data Visualization	PE	3	0	0	3
IV	VII		191AI735	Ethics of Engineers	PE	3	0	0	3
IV	VII		191AI736	Software Project Management	PE	3	0	0	3
IV	VIII		191AI831	AI For Clinical Information System	PE	3	0	0	3
IV	VIII		191AI832	Human Computing Interaction	PE	3	0	0	3
IV	VIII	VI	191AI833	Natural Language Processing	PE	3	0	0	3
IV	VIII		191AI834	Robotics	PE	3	0	0	3
IV	VIII		191AI835	Software Orientated Architecture	PE	3	0	0	3

Verticals		Course Code	Name of the Course	Category	L	Т	Р	Credits
	Ι	191ITV51	Physics to Quantum Computing	PE	3	0	0	3
	II	191ITV52	Quantum Circuits	PE	3	0	0	3
X7	III	191ITV53	Quantum Computer Systems design	PE	3	0	0	3
V	IV	191ITV54	Quantum Computing Architecture and Algorithms	PE	3	0	0	3
QUANTUM	V	191ITV55 -	Quantum Information	PE	3	0	0	3
COMPUTING	VI	191ITV56	Quantum Internet	PE	3	0	0	3
	VII	191ITV57	Quantum machanics and atoms	PE	3	0	0	3
	VIII	191ITV58	Quantum ML	PE	3	0	0	3
			TOTAL		24	0	0	24
	Ι	191ITV61	Business Analytics	PE	2	0	2	3
	II	191ITV62	Computer Vision	PE	2	0	2	3
	III	191ITV63	Exploratory Data Analysis	PE	2	0	2	3
VI	IV	191ITV64	Image and Video Analytics	PE	2	0	2	3
VI	V	191ITV65	Network Security	PE	2	0	2	3
DATA SCIENCE	VI	191ITV66	Neural Networks and Deep Learning	PE	2	0	2	3
	VII	191ITV67	Recommender Systems	PE	2	0	2	3
	VIII	191ITV68	Text and Speech Analysis	PE	2	0	2	3
		•	TOTAL		16	0	16	24
	Ι	191ITV71	Cognitive Science	PE	2	0	2	3
	II	191ITV72	Data Exploration and Visualization	PE	2	0	2	3
	III	191ITV73	Game Theory	PE	2	0	2	3
VII	IV	191ITV74	Machine Learning for Signal Processing	PE	3	0	0	3
MACHINE	V	191ITV75	Machine Learning with Big data	PE	3	0	0	3
LEARNING	VI	191ITV76	Machine Learning with Python	PE	2	0	2	3
	VII	191ITV77	Neural Networks and Deep Learning	PE	2	0	2	3
	VIII	191ITV78	Text and Speech Analysis	PE	2	0	2	3
		•	TOTAL		18	0	12	24
	Ι	191ITV81	Behavioral Economics	PE	3	0	0	3
	II	191ITV82	Customer Relation Management	PE	3	0	0	3
	III	191ITV83	Entrepreneurship Development	PE	2	0	2	3
VII	IV	191ITV84	Financial Management	PE	3	0	0	3
VII	V	191ITV85	Fundamentals of Management	PE	3	0	0	3
MANAGEMENT	VI	191ITV86	Human Resource Management for Entrepreneurs	PE	3	0	0	3
	VII	191ITV87	IT Project Management	PE	3	0	0	3
	VIII	191ITV88	PE	3 23	0 0	0 2	3 24	

Verticals		Course Code	Name of the Course	Category	L	Т	Р	Credits
	Ι	191ITV91	Conversational Systems	PE	3	0	0	3
	II	191ITV92	Digital Marketing	PE	2	0	2	3
	III	191ITV93	Enterprise Security	PE	3	0	0	3
IV	IV	191ITV94	Financial Analytics	PE	3	0	0	3
	V	191ITV95	Marketing Research and Marketing Management	PE	3	0	0	3
MAKKEIING	VI	191ITV96	Recommender Systems	PE	2	0	2	3
	VII	191ITV97	Risk Analytics	PE	3	0	0	3
	VIII	191ITV98	Social Text and Media Analytics	PE	3	0	0	3
			TOTAL		22	0	4	24

Verticals		Course Code	Name of the Course	Category	L	Т	Р	Credits	
	Ι	191ITV11	App Development	PE	2	0	2	3	
	II	191ITV12	Bio-Inspired Optimization Techniques	PE	3	0	0	3	
I	III	191ITV13	Business Analytics	PE	2	0	2	3	
-	IV	191ITV14	Cognitive Science	PE	2	0	2	3	
ARTIFICIAL	V	191ITV15	Computer Vision	PE	2	0	2	3	
INTELLIGENCE	VI	191ITV16	Ethics and AI	PE	2	0	2	3	
	VII	191ITV17	Knowledge Engineering	PE	2	0	2	3	
	VIII	191ITV18	Soft Computing	PE	2	0	2	3	
			TOTAL		17	0	14	24	
	Ι	191ITV21	Cloud Services Management	PE	2	0	2	3	
	II	191ITV22	Data Warehousing	Services ManagementPE2arehousingPE2					
	III	191ITV23	Principles of Cloud Computing	PE	2	0	2	3	
II	IV	191ITV24	Security and Privacy in Cloud	PE	2	0	2	3	
CLOUD	V	191ITV25	Software Defined Networks	PE	2	0	2	3	
COMPUTING	VI	191ITV26	Storage Technologies	PE	3	0	0	3	
	VII	191ITV27	Stream Processing	2	3				
	VIII	191ITV28	Virtualization	PE	2	0	2	3	
			TOTAL		17	0	14	24	
	Ι	191ITV31	Cryptocurrency and Blockchain Technologies	PE	2	0	2	3	
	II	191ITV32	Cryptography and Cyber Security	PE	3	0	0	3	
ш	III	191ITV33	Digital and Mobile Forensics	PE	2	0	2	3	
111	IV	191ITV34	Ethical Hacking	PE	2	0	2	3	
CYBER	V	191ITV35	Modern Cryptography	PE	2	0	2	3	
SECURITY	VI	191ITV36	Network Security	PE	2	0	2	3	
	VII	191ITV37	Security and Privacy in Cloud	PE	2	0	2	3	
	VIII	191ITV38	Social Network Security	PE	2	0	2	3	
			TOTAL		17	0	14	24	
	Ι	191ITV41	Augmented Reality / Virtual Reality	PE	2	0	2	3	
	II	191ITV42	Digital marketing	PE	2	0	2	3	
	III	191ITV43	Game Development	PE	2	0	2	3	
IV	IV	191ITV44	Multimedia and Animation	PE	2	0	2	3	
CREATIVE	V	191ITV45	Multimedia Data Compression and Storage	PE	2	0	2	3	
MEDIA	VI	191ITV46	UI and UX Design	PE	2	0	2	3	
	VII	191ITV47	Video Creation and Editing	PE	2	0	2	3	
	VIII	191ITV48	Visual Effects	PE	2	0	2	3	
			TOTAL		16	0	16	24	

VERTICALS

Verticals		Course Code	Name of the Course	Category	L	Т	Р	Credits
	Ι	191ITV51	Physics to Quantum Computing	PE	3	0	0	3
	II	191ITV52	Quantum Circuits	PE	3	0	0	3
X7	III	191ITV53	Quantum Computer Systems Design	PE	3	0	0	3
V	IV	191ITV54	Quantum Computing Architecture and Algorithms	PE	3	0	0	3
QUANTUM	V	191ITV55 -	Quantum Information	PE	3	0	0	3
COMPUTING	VI	191ITV56	Quantum Internet	PE	3	0	0	3
	VII	191ITV57	Quantum machanics and atoms	PE	3	0	0	3
	VIII	191ITV58	Quantum ML	PE	3	0	0	3
			TOTAL		24	0	0	24
	Ι	191ITV61	Business Analytics	PE	2	0	2	3
	II	191ITV62	Computer Vision	PE	2	0	2	3
	III	191ITV63	Exploratory Data Analysis	PE	2	0	2	3
VI	IV	191ITV64	Image and Video Analytics	PE	2	0	2	3
V1	V	191ITV65	Network Security	PE	2	0	2	3
DATA SCIENCE	VI	191ITV66	Neural Networks and Deep Learning	PE	2	0	2	3
	VII	191ITV67	Recommender Systems	PE	2	0	2	3
	VIII	191ITV68	Text and Speech Analysis	PE	2	0	2	3
		I	TOTAL		0	16	24	
	Ι	191ITV71	Cognitive Science	PE	2	0	2	3
	II	191ITV72	Data Exploration and Visualization	PE	2	0	2	3
	III	191ITV73	Game Theory	PE	2	0	2	3
VII	IV	191ITV74	Machine Learning for Signal Processing	PE	3	0	0	3
MACHINE	V	191ITV75	Machine Learning with Big data	PE	3	0	0	3
LEARNING	VI	191ITV76	Machine Learning with Python	PE	2	0	2	3
	VII	191ITV77	Neural Networks and Deep Learning	PE	2	0	2	3
	VIII	191ITV78	Text and Speech Analysis	PE	2	0	2	3
			TOTAL		18	0	12	24
	Ι	191ITV81	Behavioral Economics	PE	3	0	0	3
	II	191ITV82	Customer Relation Management	PE	3	0	0	3
	III	191ITV83	Entrepreneurship Development	PE	2	0	2	3
	IV	191ITV84	Financial Management	PE	3	0	0	3
VII	V	191ITV85	Fundamentals of Management	PE	3	0	0	3
MANAGEMENT	VI	191ITV86	Human Resource Management for Entrepreneurs	PE	3	0	0	3
	VII	191ITV87	IT Project Management	PE	3	0	0	3
	VIII	191ITV88	3 23	0 0	0 2	3 24		

Verticals		Course Code	Name of the Course	Category	L	Т	Р	Credits
	Ι	191ITV91	Conversational Systems	PE	3	0	0	3
	II	191ITV92	Digital Marketing	PE	2	0	2	3
	III	191ITV93	Enterprise Security	PE	3	0	0	3
IV	IV	191ITV94	Financial Analytics	PE	3	0	0	3
IX	V	191ITV95	Marketing Research and Marketing Management	PE	3	0	0	3
MARKETING	VI	191ITV96	Recommender Systems	PE	2	0	2	3
	VII	191ITV97	Risk Analytics	PE	3	0	0	3
	VIII	191ITV98	Social Text and Media Analytics	PE	3	0	0	3
			22	0	4	24		

VEL TECH Multi Tech Dr.Rangarajan Dr.Sakunthala Engineering College (Autonomous), Avadi, Chennai

SEMESTER - I

YEAR	Ι	SEMESTER	I	L	Т	Р	С
COURSE CODE / COURSE TITLE	191MA101	/ENGINEERING MATHE	EMATICS – I	2	2	0	3

✓ To develop greater knowledge and understanding of mathematics and to attain the skills necessary for success in the study of higher mathematics.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Analyze the characteristics equation of a linear system with Eigen values and vectors for practical application.
CO2	Determine the bending of family of curves using differential calculus which deals in various disciplines.
CO3	Apply partial derivatives in various engineering problems.
CO4	Identify and solve the real time problems using Linear differential equations.
CO5	Identify and solve the real time problems using higher order differential equations.

					CO -	PO MA	APPINO	Ĵ						PSO's	
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	2	I	-	I	I	-	-	1	-	-	-
CO 2	3	3	2	2	1	I	-	I	I	-	-	1	-	-	-
CO 3	3	3	2	2	1	-	-	-	-	-	-	1	-	-	-
CO 4	3	3	2	2	1	-	-	-		-	-	1	-	-	-
CO 5	3	3	2	2	1	-	-	I		-	-	1	-	-	-
со	3	3	2	2	1	-	-	-	-	-	-	1	-	-	-

YEAR	Ι	SEMESTER	TER I		Т	Р	С
COURSE CODE / COURSE TITLE	191F	PH101 / ENGINEERING PH	YSICS	3	0	0	3

✓ The course aims to equip engineering undergraduates with principles of Physics in a broader sense with a view to lay foundation for the various engineering courses.

	COURSE OUTCOMES										
On com	On completion of the course, students will be able to										
C01	Demonstrate the proficiency on the properties of matter and its applications.										
CO2	Describe the working principles of Laser and its developments in industrial and medical applications.										
CO3	Explain the propagation of waves in optical fibers and their applications.										
CO4	Apply the theory of wave nature of particles in various microscopic applications.										
CO5	Analyze the structure of materials and its crystal growth techniques.										

					CO –	PO MA	PPINO	3					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-	
CO 2	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-	
CO 3	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-	
CO 4	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-	
CO 5	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-	
СО	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-	

YEAR	Ι	SEMESTER	I	L	Т	Р	С
COURSE CODE / COURSE TITLE	COURSE CODE / COURSE TITLE 191CH101 / ENGINEERING CHEMISTRY						3

✓ To acquaint the students with the development of microscopic chemistry in terms of atomic, molecular and intermolecular forces and acquires the knowledge of water treatment. The students will be able to analyze the properties and applications of polymer and advanced materials.

	COURSE OUTCOMES											
On com	On completion of the course, students will be able to											
CO1	Analyze microscopic chemistry in terms of atomic, molecular orbital and Intermolecular Forces.											
CO2	Investigate the water treatment and softening methods.											
CO3	Appraise the types and mechanism of electro chemical reaction in batteries and fuel cells.											
CO4	Explain the basic principle, types and mechanism of polymerization process and techniques.											
CO5	Assess the advanced materials properties, characterization and application of energy storage.											

					CO	– PO N	/IAPPIN	IG					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	2	2	-	-	-	-	I	-	-	-	1	-	-	
CO 2	3	3	2	2	-	I	-	-	I	-	-	-	1	-	-	
CO 3	3	3	2	2	-	-	-	-	-	-	-	-	1	-	-	
CO 4	3	3	2	2	-	-	-	-	I	-	-	-	1	-	-	
CO 5	3	3	2	2	-	-	-	-	I	-	-	-	1	-	-	
со	3	3	2	2	-	-	-	-	-	-	-	-	1	-	-	

YEAR	Ι	SEMESTER	I	L	Т	Р	С
COURSE CODE / COURSE TITLE	191HS1	01 / ENGLISH FOR ENGIN STUDENTS	NEERING	3	0	0	3

- ✓ Equip students with the English language skills required for the successful undertaking of academic studies.
- ✓ Improve general and academic listening skills.
- Provide guidance and practice in basic geranial and classroom conversation and to engage in specific academic speaking activities.
- ✓ Strengthen the reading and writing skills of students of engineering.

	COURSE OUTCOMES											
On completion of the course, students will be able to												
CO1	Infer meanings of unfamiliar words from context.											
CO2	Enable to achieve linguistic competence and be able to use grammar as a tool or resource in the Comprehension and creation of oral and written discourse efficiently according to the situation.											
CO3	Write cohesively, coherently and flawlessly with a wide range of vocabulary and organizing their ideas Logically on a topic.											
CO4	Activate and reinforce the habit of reading and writing effectively in their discipline.											
CO5	Collaborate with multicultural environment.											

					CO	– PO N	APPIN	IG					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	3	-	-	-	2	2	-	2	1	-	-
CO 2	-	-	-	-	3	-	-	-	2	2	-	2	1	-	-
CO 3	-	-	-	-	3	-	-	-	2	2	-	2	1	-	-
CO 4	-	-	-	-	3	-	-	-	2	2	-	2	1	-	-
CO 5	-	-	-	-	3	-	-	-	2	2	-	2	1	-	-
СО	-	-	-	-	3	-	-	-	2	2	-	2	1	-	-

YEAR	Ι	SEMESTER	I	L	Т	Р	С
COURSE CODE / COURSE TITLE	191RA11	11 / BASIC ENGINEERING	SCIENCE	3	0	0	3

✓ To gain knowledge in fundamental concepts of Electrical and Electronics Engineering

✓ To gain knowledge in fundamental concepts Civil and Mechanical Engineering

✓ To understand the architecture level concepts of Computer Science Engineering

	COURSE OUTCOMES										
On completion of the course, students will be able to											
CO1	Describe the basic Electrical Circuits.										
CO2	Explain the basics of Electronic Circuits.										
CO3	Demonstrate the basic structure of Computer Architecture.										
CO4	Analyze the basics of Civil Engineering.										
CO5	Define the basics of Mechanical Engineering.										

					СО	– PO N	/IAPPIN	IG					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	2	2	I	2	2	-	I	-	-	2	1	-	-	
CO 2	3	3	2	2	I	2	2	-	I	-	-	2	1	-	-	
CO 3	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-	
CO 4	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-	
CO 5	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-	
со	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-	

YEAR	Ι	SEMESTER	I	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CS111/	INTRODUCTION TO PRO IN C	GRAMMING	3	0	0	3

- \checkmark Learn the organization of a digital computer.
- \checkmark Be exposed to the number systems.
- ✓ Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
 Be familiar with programming in C.
- ✓ Learn to use arrays, strings, functions, pointers, structures and unions in C.

	COURSE OUTCOMES								
On completion of the course, students will be able to									
CO1	Describe the basic concepts of C programming for problem-solving.								
CO2	Write simple applications using basic programming constructs.								
CO3	Develop applications using arrays and strings to solve different problems.								
CO4	Apply the concepts of function modules and memory allocation using Pointers.								
CO5	Implement the concept of structures for developing applications.								

					CO	– PO N	APPIN	IG					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	2	2	1	-	-	-	-	-	-	-	1	2	1	2	-	
CO 2	2	2	1	-	-	-	-	-	-	-	1	2	1	1	1	
CO 3	2	2	1	-	-	-	-	-	-	-	1	2	1	2	-	
CO 4	2	2	1	-	-	-	-	-	-	-	1	2	1	1	1	
CO 5	2	2	1	-	-	-	-	-	-	-	1	2	-	2	-	
СО	2	2	1	-	-	-	-	-	-	-	1	2	1	2	1	

YEAR	Ι	SEMESTER	I	L	Т	Р	С
COURSE CODE / COURSE TITLE	191P	'H10A / PHYSICS LABORA	TORY	0	0	2	1

✓ Students will be able to demonstrate an understanding of the scientific method, so that they may use thetraining beneficial in their higher pursuits.

COURSE OUTCOMES											
On completion of the course, students will be able to											
1	Apply the principles of properties of matter in determining the various elastic properties										
2	Determine Young's modulus by non-uniform bending method.										
3	Applying Photo electric effect to determine Planks Constant.										
4	Determination of wavelength of mercury spectrum – spectrometer grating.										
5	Attain the practical knowledge to apply principles of optics for various engineering applications										

					CO	– PO N	IAPPIN	G					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	2	2	2	-	-	-	-	-	-	-	1	1	-	-	
CO 2	3	2	2	2	-	I	-	-	I	-	-	1	1	-	-	
CO 3	3	2	2	2	-	-	-	-	-	-	-	1	1	-	-	
CO 4	3	2	2	2	-	-	-	-	-	-	-	1	1	-	-	
CO 5	3	2	2	2	-	-	-	-	-	-	-	1	1	-	-	
СО	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-	

YEAR	Ι	SEMESTER	I	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CH	10A / CHEMISTRY LABO	RATORY	0	0	2	1

 \checkmark To furnish the conceptual understanding of the basic principles involved in chemical analysis.

 \checkmark To attain the analytical knowledge of students by conducting various experiments.

	COURSE OUTCOMES											
On co	On completion of the course, students will be able to											
CO1	Acquire knowledge on quantitative chemical analysis by instrumentation and volumetric method.											
CO2	Analyse the water sample for hardness, chloride, sodium/potassium content, dissolved oxygen etc.											
CO3	Solve analytical problems in spectrometer and flame photometer for the identification and quantification.											
CO4	Estimate Copper in ore and Nickel in Steel											
CO5	Analyse rate of corrosion by weight loss method.											

					CO	– PO N	APPIN	IG					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	2	2	1	-	-	-	-	-	-	-	1	1	-	-	
CO 2	3	2	2	1	-	-	-	-	-	-	-	1	1	-	-	
CO 3	3	2	2	1	-	-	-	-	-	-	-	1	1	-	-	
CO 4	3	2	2	1	-	-	-	-	-	-	-	1	1	-	-	
CO 5	3	2	2	1	-	-	-	-	-	-	-	1	1	-	-	
со	3	2	2	1	-	-	-	-	-	-	-	1	1	-	-	

YEAR	Ι	SEMESTER	Ι	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CS11A/	PROGRAMMING IN C LA	BORATORY	0	0	2	1

- \checkmark To develop programs in C using basic constructs.
- \checkmark To develop applications in C using strings, pointers, functions, structures.
- \checkmark To develop applications in C using file processing.

COURSE OUTCOMES										
On completion of the course, students will be able to										
CO1	Write C programs for simple applications making use of basic constructs, arrays and strings.									
CO2	Develop C programs involving functions, recursion, pointers, and structures.									
CO3	Design applications using sequential and random-access file processing.									

	CO – PO MAPPING														PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3		
CO 1	3	2	2	2	2	-	I	1	I	-	-	2	1	1	1		
CO 2	3	2	2	2	2	-	-	1	-	-	-	2	1	1	1		
CO 3	3	2	2	2	2	-	-	1	-	-	-	2	1	1	1		
СО	3	2	2	2	2	-	-	1	-	-	-	2	1	1	1		

SEMESTER – II

YEAR	Ι	I SEMESTER II					С
COURSE CODE / COURSE TITLE	191MA2()2/ CALCULUS AND DIFFI EQUATION	ERENTIAL	2	2	0	3

 \checkmark To extend student's logical and mathematical maturity and ability to deal with abstraction.

✓ The ability to apply the basic concepts of differential calculus and their applications in the field of Information Technology.

	COURSE OUTCOMES											
On completion of the course, students will be able to												
C01	Use algebraic manipulation and theorem, properties, limits and continuity in an interval.											
CO2	Apply derivative principles and rules to different kinds of problem.											
CO3	Analyze the different types of differentiation and moving forward for advanced differentiation.											
CO4	Analyze the derivative functions for different applications.											
CO5	Evaluate the functions using differentiation.											

					СО	– PO N	APPIN	IG					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	1	I	1	-	-	-	-	1	1	-	-
CO 2	3	3	2	2	1	-	1	-	-	-	-	1	1	-	-
CO 3	3	3	2	2	1	-	1	-	-	-	-	1	1	-	-
CO 4	3	3	2	2	1	-	1	-	-	-	-	1	1	-	-
CO 5	3	3	2	2	1	-	1	-	-	-	-	1	1	-	-
со	3	3	2	2	1	-	1	-	-	-	-	1	1	-	-

YEAR	Ι	SEMESTER	п	L	Т	Р	С
COURSE CODE / COURSE TITLE	191E	C212 /DIGITAL SYSTEM I	DESIGN	3	0	0	3

- ✓ To present the Digital fundamentals, Boolean algebra and its applications in digital systems.
- \checkmark To familiarize with the design of various combinational digital circuits using logic gates.
- \checkmark To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits.
- \checkmark To explain the various semiconductor memories and related technology.

On com	COURSE OUTCOMES On completion of the course, students will be able to										
CO1	Apply the theorems and postulates of Boolean algebra, the techniques of Karnaugh Maps and Quine - McCluskey tabulation techniques for simplification of logic functions.										
CO2	Design combinational logic circuits for various applications and implement them using logic gates or other devices like multiplexers, decoders and simulate them using Hardware Description Language(HDL).										
CO3	Design synchronous sequential logic circuits like counters and shift registers and implement them using different flip flops.										
CO4	Analyze the given Asynchronous sequential logic circuit to determine its function.										
CO5	Review the various memory and programmable logic devices.										

	CO – PO MAPPING														PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3			
CO 1	3	2	2	2	-	-	-	-	-	-	-	-	3	2	1			
CO 2	3	2	2	2	-	-	-	-	-	-	-	-	3	1	1			
CO 3	3	2	2	2	-	-	-	-	-	-	-	-	3	2	1			
CO 4	3	2	2	2	-	-	-	-	-	-	-	-	3	1	1			
CO 5	3	2	2	2	-	-	-	-	-	-	-	-	3	2	1			
со	3	2	2	2	-	-	-	-	-	-	-	-	3	2	1			

YEAR	Ι	SEMESTER	II	L	Т	Р	С
COURSE CODE / COURSE TITLE	191HS201	ENCE AND	3	0	0	3	

- ✓ This course provides the basic knowledge of structure and function of ecosystem and better understanding of natural resources, biodiversity and their conservation practices.
- ✓ It describes the need to lead more sustainable lifestyles, to use resources more equitably.
- ✓ It helps to create a concern for our environment that will trigger pro-environmental action, including activities, we can do in our daily life to protect it.
- \checkmark Furthermore, it deals the social issues and ethics to develop quality engineer in our country.

	COURSE OUTCOMES											
On completion of the course, students will be able to												
CO1	Interpret the concept of ecosystem, biodiversity and its conservation.											
CO2	Demonstrate the environmental impacts of energy development.											
CO3	Categorize the various environmental pollutions and select suitable preventive measures.											
CO4	Perceive the environmental effects of human population and the implementation of welfare programs.											
CO5	Recall the environmental ethics and legal provisions.											

					CO	– PO N	IAPPIN	IG					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	-	2	3	3	-	-	-	2	1	2	2
CO 2	3	3	2	2	-	2	3	-	-	-	-	2	1`	2	2
CO 3	3	3	2	2	-	2	3	-	-	-	-	2	1	2	2
CO 4	3	3	2	2	-	2	3	-	-	-	-	2	1	2	2
CO 5	3	3	2	2	-	2	3	3	-	-	-	2	1	2	2
со	3	3	2	2	-	2	3	3	-	-	-	2	1	2	2

YEAR	I	SEMESTER	II	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CS221 / PH PROGRAMM	ROBLEM SOLVING ANDP IING	YTHON	3	0	0	3

 \checkmark To know the basics of algorithmic problem solving.

- \checkmark To read and write simple Python programs.
- \checkmark To develop Python programs with conditionals and loops.
- \checkmark To define Python functions and call them.
- ✓ To use Python data structures lists, tuples, dictionaries.
- \checkmark To do input /output with files in Python.

	COURSE OUTCOMES										
On com	On completion of the course, students will be able to										
CO1	Describe the algorithmic solutions for simple computational problems.										
CO2	Identify the various data, expressions and statements in python programming.										
CO3	Use control flow and functions for solving problems.										
CO4	Distinguish list, tuples and dictionaries in python programming.										
CO5	Develop simple programs using files, modules and packages in python.										

					CO -	PO MA	PPINO	Ĵ					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	1	-	-	-	-	-	-	-	-	1	3	3	1	
CO 2	3	2	1	-	-	-	-	-	-	-	-	1	3	2	1	
CO 3	3	2	1	-	-	-	-	-	-	-	-	1	3	1	1	
CO 4	3	2	1	-	-	-	-	-	-	-	-	1	3	2	1	
CO 5	3	2	1	1	-	Ι	I	1	-	-	-	1	3	2	1	
СО	3	2	1	1	-	-	-	1	-	-	-	1	3	2	1	

B. Tech - Artificial Intelligence and Data Science

YEAR	Ι	SEMESTER	II	L	Т	Р	С
COURSE CODE / COURSE TITLE	191M	E211 / ENGINEERING GR	APHICS	2	2	0	3

✓ To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.

 \checkmark To expose them to existing national standards related to technical drawings.

	COURSE OUTCOMES										
On com	On completion of the course, students will be able to										
CO1	Draw engineering curves and apply the concepts of free hand sketching.										
CO2	Draw orthographic views of points, lines and surfaces.										
CO3	Draw visualizations of simple solid objects as per orthographic projections.										
CO4	Draw sections and developments made in drawing.										
CO5	Draw pictorial drawings of simple objects.										

					CO –	PO MA	APPINO	3					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	3	-	2	1	-	-	I	1	1	1	2	-	1	
CO 2	3	3	3	-	2	1	-	-	I	1	1	1	2	-	1	
CO 3	3	3	3	-	2	1	-	-	-	1	1	1	2	-	1	
CO 4	3	3	3	-	2	1	-	-	-	1	1	1	2	-	1	
CO 5	3	3	3	-	2	1	-	-	-	1	1	1	2	-	1	
СО	3	3	3	-	2	1	-	-	-	1	1	1	2	-	1	

YEAR	Ι	SEMESTER	II	L	Т	Р	С
COURSE CODE / COURSE TITLE	191AI221	/ FOUNDATIONS OF DAT.	A SCIENCE	3	0	0	3

- \checkmark To know the basic difference between data and information.
- ✓ To learn the basics of Data Science.
- ✓ To understand the various Methodologies available in Data Science.
- \checkmark To be familiarized with the Open-Source Tools.
- \checkmark To know the Applications in Data Science.

	COURSE OUTCOMES							
On com	On completion of the course, students will be able to							
CO1	Analyze the basic difference between data and information.							
CO2	Explain the basics of Data science and diagnose the tools and technology.							
CO3	Apply the data science methodologies in solving complex problems.							
CO4	Use the Open-source tools and interpret it.							
CO5	Analyze the various tools of data science.							

	CO – PO MAPPING								PSO's						
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	1	-	-	1	-	-	-	-	-	1	3	3	1
CO 2	3	2	1	-	1	1	-	-	-	-	-	1	3	2	1
CO 3	3	2	1	-	1	1	-	-	-	-	-	1	3	2	1
CO 4	3	2	1	1	1	1	-	-	-	-	-	1	3	2	1
CO 5	3	2	1	1	1	1	-	-	-	-	-	1	3	2	1
со	3	2	1	1	1	1	-	-	-	-	-	1	3	2	1

YEAR	Ι	SEMESTER	II	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CS22A PR	/ PROBLEM SOLVING AN OGRAMMING LABORAT	ND PYTHON YORY	0	0	2	1

- \checkmark Write, test, and debug simple Python programs.
- \checkmark Implement Python programs with conditionals and loops.
- ✓ Use functions for structuring Python programs.
- ✓ Represent compound data using Python lists, tuples, and dictionaries.
- \checkmark Read and write data from/to files in Python.

On com	COURSE OUTCOMES On completion of the course, students will be able to						
C01	Solve problems using conditionals and loops in Python.						
CO2	Develop Python programs by defining functions.						
CO3	Use lists, tuples and dictionaries for solving complex problems in python programming.						
CO4	Create python programs using files.						

	CO – PO MAPPING								PSO's						
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	1	-	-	-	-	-	-	-	1	3	2	1
CO 2	3	2	1	1	-	-	-	-	-	-	-	1	3	1	1
CO 3	3	2	1	1	-	-	-	-	-	-	-	1	3	2	1
CO 4	3	2	1	1	-	-	-	-	-	-	-	1	3	2	1
со	3	2	1	1	-	-	-	-	-	-	-	1	3	2	1

YEAR	Ι	SEMESTER	II	L	Т	Р	С	
COURSE CODE / COURSE TITLE	0	0	4	2				
	COURSE OBJECTIVES							
To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.								

COURSE OUTCOMES

On com	pletion of the course, students will be able to
CO1	Use mechanical and civil engineering equipments to join the structures and perform basic
	machining operations and fabricate models in sheet meta
CO2	Use electrical and electronics engineering equipments to test the respective electrical and
	electronic parameters

	CO – PO MAPPING									PSO's					
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	2	2	2	-	-	-	1	1	1	1	-	-
CO 2	3	3	3	2	2	2	-	-	-	1	1	1	1	-	-
СО	3	3	3	2	2	2	-	-	-	1	1	1	1	-	-

SEMESTER - III

YEAR	II	SEMESTER	SEMESTER III				С
COURSE CODE / COURSE TITLE	191MA3()3 / PROBABILITY AND ST	FATISTICS	2	2	0	3

	COURSE OBJECTIVES
\checkmark	Introduced to the notion of sampling distributions and have acquired knowledge of statistical techniques useful in making rational decision in management problems.
✓	Exposed to statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.

On com	COURSE OUTCOMES pletion of the course, students will be able to
C01	Demonstrate and apply the basic probability axioms and concepts in their core areas.
CO2	Analyze the concepts of probability distributions in an appropriate place of science and Engineering.
CO3	Calculate the relationship of two dimensional random variables using correlation techniques and to study the properties of two dimensional random variables.
CO4	Apply the concept of testing of hypothesis for small and large samples in real life problems.
CO5	Identify the classification of design of experiment in their respective fields.

					CO –	PO MA	APPIN(3						PSO's	
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	1	-	-	-	Ι	-	-	1	2	2	1
CO 2	3	3	2	2	1	-	-	-	-	-	-	1	2	2	1
CO 3	3	3	2	2	1	-	-	-	-	-	-	1	2	2	1
CO 4	3	3	2	2	1	-	-	-	-	-	-	1	2	2	1
CO 5	3	3	2	2	1	-	-	-	-	-	-	1	2	2	1
со	3	3	2	2	1	-	-	-	-	-	-	1	2	2	1

YEAR	II	SEMESTER	Ш	L	Т	Р	С
COURSE CODE /	COURSE CODE /						
COURSE TITLE	COURSE TITLE 191AI321 / DATA STRUCTURES						

	COURSE OBJECTIVES
\checkmark	Define the basic concepts of ADTs used in python. Design the linear data structures – lists, stacks, and queues using python. Analyze the various sorting, searching and hashing algorithms. Construct the tree and graph structures using python.

	COURSE OUTCOMES										
On completion of the course, students will be able to											
CO1	Demonstrate the concepts of ADT and explain the list data structures and its applications.										
CO2	Analyze, design linear data structures - Stacks & queues using array and pointer implementations.										
CO3	Evaluate sorting, searching and hashing algorithms.										
CO4	Design and develop tree data structures and its traversal algorithms.										
CO5	Develop various nonlinear data structures.										

	CO – PO MAPPING													PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	3	2	2	2	-	-	-	-	-	1	1	2	-	
CO 2	3	3	3	2	2	2	-	-	-	-	-	1	1	2	-	
CO 3	3	3	3	2	2	1	-	-	-	-	-	1	1	1	1	
CO 4	3	3	3	2	2	2	-	-	-	-	-	1	1	2	1	
CO 5	3	3	3	2	2	1	-	-	1	-	-	1	1	-	1	
со	3	3	3	2	2	2	-	-	-	-	-	1	1	-	1	

YEAR	II	SEMESTER	Ш	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CS3	322 / COMPUTER ARCHIT	3	0	0	3	

- \checkmark To conceptualize the basic structure and operations of a computer.
- ✓ To study the basic working principles of arithmetic and logic unit and implement fixed-point and floating point arithmetic algorithms.
- ✓ To learn the basics of pipelined execution.
- ✓ To understand parallelism and multi-core processors.
- \checkmark To describe the concepts of memory hierarchies, cache memories and virtual memories.

	COURSE OUTCOMES											
On co	On completion of the course, students will be able to											
CO1	Define the basics concepts of fundamental component, architecture, register organization and performance metrics of a computer.											
CO2	Illustrate the efficient algorithm for binary arithmetic operations.											
CO3	Construct an efficient data path for an instruction format for a given architecture.											
CO4	Categorize various parallel processors.											
CO5	Analyze the memory, I/O devices and cache structures for processor.											

					CO –	PO MA	APPINO	3					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	1	1	1	1	1	1	-	-	1	1	1
CO 2	3	3	2	2	1	1	1	1	1	1	-	-	1	1	1
CO 3	3	3	2	2	1	1	1	-	1	-	1	1	1	1	1
CO 4	3	3	2	2	1	1	-	1	1	-	1	1	1	1	1
CO 5	3	3	2	2	1	1	1	1	1	1	1	1	1	1	1
СО	3	3	2	2	1	1	1	1	1	1	1	1	1	1	1
YEAR	II	SEMESTER	III	L	Т	Р	С								
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COURSE CODE / COURSE TITLE	191CS323/	OBJECT ORIENTED PRO	GRAMMING	3	0	0	3								

✓ To understand Object Oriented Programming concepts and basic characteristics of Java.

- \checkmark To know the principles of packages, inheritance and interfaces.
- \checkmark To define exceptions and use I/O streams.
- \checkmark To develop a java application with threads and generics classes.
- ✓ To design and build simple Graphical User Interfaces.

	COURSE OUTCOMES										
On co	On completion of the course, students will be able to										
CO1	Acquire knowledge in OOPS concept and define the structure of Java programs.										
CO2	Identify the concept of inheritance, interfaces and illustrate the Java Programs.										
CO3	Develop Java applications using Exceptions and I/O streams										
CO4	Analyze and evaluate the concept of threads and generic classes to develop Java applications										
CO5	Create interactive Java programs using AWT and Swings										

					CO –	PO MA	PPINO	J					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	2	2	1	-	-	-	1	-	-	-	1	1	-	-	
CO 2	3	2	2	1	-	-	-	1	-	-	-	1	1	-	-	
CO 3	3	2	2	1	-	-	-	1	-	-	-	1	1	-	-	
CO 4	3	2	2	1	-	-	1	1	-	-	-	1	1	-	-	
CO 5	3	3	2	1	1	-	1	1	-	-	-	1	1	-	-	
СО	3	2	2	1	1	-	1	1	-	-	-	1	1	-	-	

YEAR	II	SEMESTER	III	L	Т	Р	С
COURSE CODE / COURSE TITLE	19105	3324 / SOFTWARE ENGINI	EERING	3	0	0	3

✓ Learn the phases in a software project.

✓ Analyze fundamental concepts of requirements engineering and Analysis Modeling.

✓ Study the various software design methodologies.

 \checkmark Explore various testing and maintenance measures.

	COURSE OUTCOMES											
On com	On completion of the course, students will be able to											
CO1	Remember the key activities in managing a software project.											
CO2	Identify different process models and the approach adopted in gathering requirements.											
CO3	Apply systematic procedure for software design and deployment.											
CO4	Analyze, compare and contrast the various testing and maintenance.											
CO5	Evaluate the Management project schedule, estimate project cost and effort required.											

					CO –	PO MA	PPINO	Ĵ					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	2	1	1	-	-	-	-	-	-	-	-	1	1	1	
CO 2	3	2	1	1	-	-	-	-	-	-	1	-	1	1	1	
CO 3	3	2	2	1	1	-	-	-	1	2	1	1	1	1	1	
CO 4	3	2	1	1	1	-	1	1	2	2	2	2	1	1	1	
CO 5	3	2	2	1	1	2	1	1	2	1	2	2	1	1	1	
со	3	2	1	1	1	1	1	1	1	1	1	1	1	1	1	

YEAR	II	SEMESTER	III	L	Т	Р	С
COURSE CODE / COURSE TITLE	191AI322	2/ INTRODUCTION TO AF INTELLIGENCE	RTIFICIAL	3	0	0	3

✓ Define the various characteristics of Intelligent agents.

- \checkmark Compare the different search strategies in AI.
- ✓ Apply knowledge in solving AI problems.
- ✓ Describe about expert system.
- \checkmark Use the various applications of AI.

	COURSE OUTCOMES											
On com	On completion of the course, students will be able to											
CO1	Compare AI with human intelligence and traditional information processing											
CO2	Use appropriate solving approaches on different AI problems											
CO3	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge Representation and learning.											
CO4	Analyze proficiency developing applications in an 'AI language', expert system shell.											
CO5	Design software agents for communication and component involved in intelligent systems											

					CO -	PO MA	APPINO	Ĵ					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	1	1	-	-	-	-	-	-	-	1	3	3	2	
CO 2	3	2	2	1	1	-	-	-	-	-	-	1	3	3	2	
CO 3	3	2	2	2	1	-	-	-	-	-	-	1	3	3	3	
CO 4	3	2	2	2	1	1	-	-	-	-	-	1	3	3	3	
CO 5	3	2	2	2	1	1	-	-	-	-	-	1	3	3	3	
со	3	2	2	2	1	1	-	-	-	-	-	1	3	3	3	

YEAR	II	SEMESTER	III	L	Т	Р	C
COURSE CODE / COURSE TITLE	191AI32A /	DATA STRUCTURES LA	BORATORY	0	0	2	1

✓ Implement ADTs in Python.

Design and implement linear data structures – lists, stacks, and queues.
 Implement sorting, searching and hashing algorithms.

- \checkmark Solve problems using tree and graph structures.

On com	COURSE OUTCOMES On completion of the course, students will be able to										
CO1	Demonstrate the concepts of ADT and explain the list data structures and its applications.										
CO2	Analyze, design linear data structures - Stacks & queues using array and pointer implementations.										
CO3	Evaluate sorting, searching and hashing algorithms.										
CO4	Design and develop tree data structures and its traversal algorithms.										
CO5	Develop various nonlinear data structures.										

					CO –	PO MA	PPINO	Ĵ					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	3	2	3	1	1	1	1	2	3	3	1	1	1	
CO 2	3	3	3	2	3	1	1	1	1	2	3	3	1	1	1	
CO 3	3	3	3	2	3	1	1	1	1	2	3	3	1	1	1	
CO 4	3	3	3	2	3	1	1	1	1	2	3	3	1	1	1	
CO 5	3	3	3	2	3	1	1	1	1	2	3	3	1	1	1	
со	3	3	3	2	3	1	1	1	1	2	3	3	1	1	1	

YEAR	II	SEMESTER	III	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CS32B/	OBJECT ORIENTED PRO LABORATORY	GRAMMING	0	0	2	1

- ✓ Develop applications using Object Oriented Programming Concepts
- ✓ Develop and implement Java programs principles of packages, inheritance and interfaces.
- ✓ Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.
- ✓ Develop and implement Java programs with array list, exception handling and multithreading.
- ✓ Design applications using file processing, generic programming and event handling.

	COURSE OUTCOMES											
On completion of the course, students will be able to												
CO1	Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects.											
CO2	Analyze the concept of function overloading, operator overloading, virtual functions and polymorphism.											
CO3	Implement Java programs for simple applications that make use of classes, packages and interfaces.											
CO4	Develop and implement Java programs with array list, exception handling and multithreading.											
CO5	Design applications using file processing, generic programming and event handling.											

					CO –	PO MA	APPINO	J					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	2	3	1	1	1	1	2	3	3	1	-	1
CO 2	3	3	3	2	3	1	1	1	1	2	3	3	1	-	1
CO 3	3	3	3	2	3	1	1	1	1	2	3	3	1	-	1
CO 4	3	3	3	2	3	1	1	1	1	2	3	3	1	-	1
CO 5	3	3	3	2	3	1	1	1	1	2	3	3	1	-	1
со	3	3	3	2	3	1	1	1	1	2	3	3	1	-	1

YEAR	II	SEMESTER	III	L	Т	Р	С
COURSE CODE / COURSE TITLE	191HS30A	ADVANCED READING A SKILLS LABORATORY	ND WRITING	0	0	2	1

- Develop their communicative competence in English with specific reference to speaking and listening
- > Enhance their ability to communicate effectively in interviews.
- > Strengthen their prospects of success in competitive examinations.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Demonstrate understanding of elements of writing such as brainstorming for generating topic sentence, central ideas, supporting ideas, organization patterns, editing and drafting different types of paragraphs and essays.
CO2	Understand the strategies of skimming and scanning to read a text analytically and critically respond to it.
CO3	Apply critical thinking skills and infer a text logically in relation to various professional concerns.

	CO – PO MAPPING													PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	-	-	-	-	-	-	I	3	3	2	2	1	-	1	
CO 2	3	-	-	-	-	-	-	I	3	3	2	2	1	-	1	
CO 3	3	-	-	-	-	-	-	-	3	3	2	2	1	-	1	
СО	3	-	-	-	-	-	-	-	3	3	2	2	1	-	1	

SEMESTER – IV

YEAR	II	SEMESTER	IV	L	Т	Р	С
COURSE CODE / COURSE TITLE	191M A	A403 / DISCRETE MATHE	MATICS	2	2	0	3

- ✓ Extend student's logical and mathematical maturity and ability to deal with abstraction.
- ✓ Introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
- \checkmark Apply the basic concepts of combinatorics and graph theory.
- ✓ Familiarize the applications of algebraic structures.
- ✓ Analyze the concepts and significance of lattices and Boolean algebra.

	COURSE OUTCOMES											
On com	On completion of the course, students will be able to											
CO1	Use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, functions, and integers and apply it in their fields.											
CO2	Apply counting principles and estimate probabilities and also to analyze algorithms and programs byrecurrence relation.											
CO3	Analyze the different types of graphs and hence know about the application of graph theory in their field.											
CO4	Analyze the algebraic structures and their application											
CO5	Evaluate Boolean functions and simplify expression using the properties of Boolean algebra.											

					CO –	PO MA	APPINO	Ĵ					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	2	2	1	-	-	-	I	-	-	1	3	3	2	
CO 2	3	3	2	2	1	-	-	-	-	-	-	1	3	3	2	
CO 3	3	3	2	2	1	-	-	-	-	-	-	1	3	3	2	
CO 4	3	3	2	2	1	-	-	-	-	-	-	1	3	3	2	
CO 5	3	3	2	2	1	-	-	-	I	-	-	1	3	3	2	
СО	3	3	2	2	1	-	-	-	-	-	-	1	3	3	2	

YEAR	п	II SEMESTER		L	Т	Р	С
COURSE CODE / COURSE TITLE	COURSE CODE / COURSE TITLE 191CS422 / DATABASE MANAGEMENT SYSTEMS						3

- ✓ Learn the fundamentals of data models and to represent a database system using ER diagrams.
- ✓ Study SQL and relational database design.
- ✓ Analyze the internal storage structures using different file and indexing techniques which will help in physical DB design.
- ✓ Apply the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.
- ✓ Evaluate an introductory knowledge about the Storage and Query processing Techniques.

	COURSE OUTCOMES										
On completion of the course, students will be able to											
CO1	Remember the modern and futuristic database applications based on size and complexity.										
CO2	Identify and Map ER model to Relational model to perform database design effectively.										
CO3	Apply queries using normalization criteria and optimize queries.										
CO4	Analyze contrast various indexing strategies in different database systems.										
CO5	Evaluate how advanced databases differ from traditional databases.										

	CO – PO MAPPING														PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3		
CO 1	3	2	1	1	1	1	-	1	1	-	-	1	2	1	I		
CO 2	3	2	2	1	-	1	1	1	1	-	-	2	2	1	-		
CO 3	3	2	2	1	2	1	1	1	-	-	-	1	2	1	-		
CO 4	3	2	2	2	2	1	1	-	-	-	-	2	1	1	-		
CO 5	3	3	2	2	1	2	2	1	2	2	2	2	1	1	-		
со	3	2	2	2	2	1	1	1	1	2	2	2	1	1	-		

YEAR	п	SEMESTER	IV	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CS423 / OI	PERATING SYSTEMS		3	0	0	3

- \checkmark To understand the basic concepts and functions of operating systems.
- \checkmark Understand the structure and functions of OS.
- ✓ Learn about Processes, Threads and Scheduling algorithms.
- \checkmark Understand the principles of concurrency and Deadlocks.
- \checkmark To analyze various memory management schemes.
- \checkmark To understand I/O management and File systems.
- ✓ To be familiar with the basics of Linux system and Mobile OS like iOS and Android.

On com	COURSE OUTCOMES pletion of the course, students will be able to
CO1	Describe the Basic Concepts and functions of OS and Process.
CO2	Compare various scheduling algorithms and Understand deadlock, prevention and avoidance algorithms.
CO3	Distinguish the various memory management schemes.
CO4	Analyze the functionality of file systems.
CO5	Review the administrative tasks on Linux Servers and to Compare iOS and Android Operating Systems.

					CO –	PO MA	APPINO	Ĵ					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	3	1	1	1	-	-	-	-	-	1	1	1	-	
CO 2	3	3	3	2	2	-	-	-	-	-	-	1	1	-	-	
CO 3	3	3	3	2	2	-	-	-	-	-	-	1	1	-	-	
CO 4	3	3	3	3	2	-	-	-	-	-	-	1	1	-	-	
CO 5	3	3	3	3	3	2	2	2	1	1	2	2	1	-	-	
со	3	3	3	2	2	2	2	2	1	1	2	1	1	-	-	

YEAR	II	SEMESTER	L	Т	Р	С	
COURSE CODE / COURSE TITLE	191CS424 / Co	OMPUTER NETWORKS		3	0	0	3

 \checkmark To understand the division of network functionalities into layers.

- \checkmark To be familiar with the components required to build different types of networks.
- \checkmark To be exposed to the required functionality at each layer.
- \checkmark To learn the flow control and congestion control algorithms.

	COURSE OUTCOMES										
On com	On completion of the course, students will be able to										
CO1	Identify the basic layers and its functions in Computer networks and the working of various application layer protocols.										
CO2	Compare the performance of a network.										
CO3	Discuss the basics of how data flows from one node to another.										
CO4	Analyze and design routing algorithms.										
CO5	Design protocols for various functions in the network.										

					CO –	PO MA	APPIN(Ĵ					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	2	2	1	1	1	-	-	-	-	1	1	1	-	-	
CO 2	3	2	2	1	1	-	-	-	-	-	1	1	1	-	-	
CO 3	3	2	2	1	1	1	-	-	-	-	1	1	1	-	-	
CO 4	3	2	2	1	-	1	-	-	-	-	1	1	1	-	-	
CO 5	3	2	2	1	-	2	1	-	1	-	1	1	1	-	-	
со	3	2	2	1	1	1	1	-	1	-	1	1	1	-	-	

YEAR	II	SEMESTER	IV	L	Т	Р	С
COURSE CODE / COURSE TITLE	191AI421/ EN	IBEDDED SYSTEMS		3	0	0	3

 \checkmark To learn the architecture and programming networks.

- \checkmark To become familiar with the embedded computing platform design and analysis.
- \checkmark To get thorough knowledge in interfacing concepts
- \checkmark To design an embedded system and to develop programs

	COURSE OUTCOMES											
On completion of the course, students will be able to												
CO1	Define the concept of embedded system, microcontroller, different components of microcontrollerand their interactions.											
CO2	Get familiarized with programming environment to develop embedded solutions.											
CO3	Program ARM microcontroller to perform various tasks.											
CO4	Analyze the key concepts of embedded systems such as I/O, timers, interrupts and interaction with peripheral devices.											
CO5	Use the case studies at different areas.											

					CO –	PO MA	APPINO	J					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	3	3	-	-	-	1	-	-	-	-	3	3	1	
CO 2	3	3	3	3	-	I	-	1	-	_	-	-	3	3	2	
CO 3	3	3	3	3	-	-	-	1	-	-	-	-	3	2	1	
CO 4	3	3	3	3	-	-	-	1	-	-	-	-	3	3	2	
CO 5	3	3	3	3	-	-	-	1	-	-	-	-	3	3	2	
со	3	3	3	3	-	-	-	1	-	-	-	-	3	3	2	

YEAR	II	II SEMESTER IV					С
COURSE CODE / COURSE TITLE	191CB422 / SO	OFTWARE DESIGN AND N	MODELING	3	0	0	3

- ✓ To learn UML notation and symbols
- \checkmark To analyze and design systems and software solutions in the object-oriented approach
- ✓ To Employ the UML notation to create effective and efficient system designs
- \checkmark To learn various types of testing

	COURSE OUTCOMES										
On com	On completion of the course, students will be able to										
CO1	Define the basics of UML.										
CO2	Express the software design concepts with UML diagram.										
CO3	Apply the software design concepts with dynamic UML diagrams.										
CO4	Categorize UML based software design into pattern based design using design patterns.										
CO5	Construct the various testing methodologies.										

					CO –	PO MA	PPINO	Ĵ					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	2	2	1	1	1	-	I	I	-	-	-	1	-	-	
CO 2	3	2	2	1	1	1	1	-	-	-	-	-	1	-	-	
CO 3	3	2	2	1	1	1	1	1	-	-	-	-	1	-	-	
CO 4	3	2	2	1	1	1	1	1	1	1	1	1	1	-	-	
CO 5	3	2	2	1	1	1	1	1	1	1	1	1	1	-	-	
со	3	2	2	1	1	1	1	1	1	1	1	1	1	-	-	

YEAR	II	SEMESTER	IV	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CS42A/	DATABASE MANAGEMEN LABORATORY	NT SYSTEMS	0	0	2	1

 \checkmark To learn the data definitions and data manipulation commands.

 \checkmark To understand the uses of nested and join queries.

 \checkmark To apply functions, procedures and procedural extensions of data bases.

 \checkmark To explore the uses of front end tool.

 \checkmark To implementation the typical database applications.

	COURSE OUTCOMES									
On com	On completion of the course, students will be able to									
CO1	Remember typical data definitions and manipulation commands.									
CO2	Identify the design applications to test Nested and Join Queries.									
CO3	Apply simple applications that use Views.									
CO4	Analyze applications that require a Front-end Tool.									
CO5	Evaluate and analyze the use of Tables, Views, Functions and Procedures.									

					CO -	PO MA	APPINO	Ĵ					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	1	-	1	-	I	Ι	-	1	3	1	-	-
CO 2	3	2	2	1	-	1	-	-	-	-	1	3	1	-	-
CO 3	3	2	2	2	-	1	-	-	-	-	1	3	1	-	-
CO 4	3	2	2	2	2	2	-	-	-	-	1	3	1	-	-
CO 5	3	2	2	2	2	2	-	-	-	-	1	3	1	-	-
СО	3	2	2	2	2	1	-	-	-	-	1	3	1	-	-

YEAR	II	SEMESTER	IV	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CS42B/(OPERATING SYSTEMS L	ABORATORY	0	0	2	1

- To learn Unix commands and shell programming.
- To implement various CPU Scheduling Algorithms.
- To implement Process Creation and Inter Process Communication.
- To implement Deadlock Avoidance and Deadlock Detection Algorithms.
- To implement Page Replacement Algorithms.
- To implement File Organization and File Allocation Strategies.

	COURSE OUTCOMES									
On com	On completion of the course, students will be able to									
CO1	Compare the performance of various CPU Scheduling Algorithms.									
CO2	Implement Deadlock avoidance and Detection Algorithms.									
CO3	Demonstrate Semaphores.									
CO4	Create processes and implement IPC.									
CO5	Analyze the performance of the various Page Replacement Algorithms and Implement File Organization and File Allocation Strategies									

					CO –	PO MA	APPINO	J					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	2	2	2	2	2	2	2	2	2	1	1	1
CO 2	3	3	3	2	2	2	2	2	2	2	2	2	1	1	1
CO 3	3	3	3	2	2	2	2	2	2	2	2	2	1	1	1
CO 4	3	3	3	2	2	2	2	2	2	2	2	2	1	1	1
CO 5	3	3	3	2	2	2	2	2	2	2	2	2	1	1	1
СО	3	3	3	2	2	2	2	2	2	2	2	2	1	1	1

YEAR	II	SEMESTER	IV	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CS42C / N	ETWORKS LABORATOR	Y	0	0	2	1

- \checkmark To learn network commands.
- ✓ To learn socket programming.
- \checkmark To implement and analyze various network protocols.
- \checkmark To learn and use simulation tools.
- \checkmark To use simulation tools to analyze the performance of various network protocols.

On com	COURSE OUTCOMES On completion of the course, students will be able to										
On com											
CO1	Identify various protocols using TCP and UDP.										
CO2	Compare the performance of different transport layer protocols.										
CO3	Use simulation tools to measure the performance of various network protocols.										
CO4	Implement various routing algorithms.										
CO5	Interpret error correction codes.										

					CO –	PO MA	APPINO	Ĵ					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	3	2	2	1	1	-	1	1	1	1	1	1	1	
CO 2	3	3	3	3	2	2	2	-	1	1	1	1	1	1	1	
CO 3	3	3	3	3	3	2	1	-	1	1	1	1	1	1	1	
CO 4	3	3	3	3	3	2	2	-	1	1	1	1	1	1	1	
CO 5	3	3	3	3	3	1	2	-	1	1	1	1	1	1	1	
СО	3	3	3	3	3	2	2		1	1	1	1	1	1	1	

SEMESTER - V

YEAR	III	SEMESTER	v	L	Т	Р	С
COURSE CODE / COURSE TITLE	GRA	APH THEORY AND APPLI	CATIONS	3	0	0	3

 \checkmark To understand fundamentals of graph theory.

- \checkmark To study proof techniques related to various concepts in graphs.
- \checkmark To explore modern applications of graph theory.

	COURSE OUTCOMES										
On com	On completion of the course, students will be able to										
CO1	Define the basic concepts of graphs and different type of graphs.										
CO2	Discuss the properties, theorem and able to prove theorems.										
CO3	Apply suitable graph model and algorithm for solving applications.										
CO4	Analyze the matrix representation of graphs and the related theorem.										
CO5	Classify various graph algorithms and their applications.										

					CO –	PO MA	PPINO	Ĵ					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	3	3	-	-	-	1	1	-	-	1	1	-	-	
CO 2	3	3	3	3	-	-	-	1	-	-	-	-	1	-	-	
CO 3	3	3	3	3	-	-	-	1	-	-	-	-	1	-	-	
CO 4	3	3	3	3	-	-	-	1	-	-	-	-	1	-	-	
CO 5	3	3	3	3	-	-	-	1	-	-	-	-	1	-	-	
со	3	3	3	3	-	-	-	1	-	-	-	-	1	-	-	

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE		INTERNET PROGRAMM	IING	3	0	0	3

- ✓ To understand different Internet Technologies.
 ✓ To create the client-side Programming.
- ✓ To learn server side Programming.
- ✓ To develop php programming and Xml.
- \checkmark To determine java-specific web services architecture.

	COURSE OUTCOMES											
On completion of the course, students will be able to												
CO1	Explain the basic web essential terms.											
CO2	Discuss the creation of dynamic web page using Java Script objects.											
CO3	Create server side programs using Servlets and JSP.											
CO4	Construct simple web pages in PHP and represent data in XML format.											
CO5	Develop AJAX, web services and various interactive web applications.											

					CO –	PO MA	APPIN(J					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	3	1	-	-	-	3	3	3	-	3	1	-	-	
CO 2	3	3	3	1	-	-	-	3	3	3	-	3	1	-	-	
CO 3	3	3	3	1	-	-	-	3	3	3	-	3	1	-	-	
CO 4	3	3	3	1	-	-	-	3	3	3	-	3	1	-	-	
CO 5	3	3	3	1	-	Ι	I	3	3	3	-	3	1	-	-	
со	3	3	3	1	-	-	-	3	3	3	-	3	1	-	-	

YEAR	III	SEMESTER	v	L	Т	Р	С
COURSE CODE / COURSE TITLE	DESIGN	N AND ANALYSIS OF AI	LGORITHMS	3	0	0	3

- \checkmark To learn and apply the algorithm analysis techniques.
- \checkmark To understand the efficiency of alternative algorithmic solutions for the same problem.
- ✓ To apply the different algorithm design techniques.
- \checkmark To analyze the limitations of Algorithmic power.

	COURSE OUTCOMES										
On completion of the course, students will be able to											
CO1	Remember the fundamental needs of algorithms in problem solving.										
CO2	Identify the Design algorithm for various computing problems.										
CO3	Apply the different algorithm design techniques for a given problem.										
CO4	Analyze the existing algorithm to improve efficiency.										
CO5	Evaluate the time and space complexity of various algorithms.										

					CO –	PO MA	PPINO	Ĵ					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	1	-	-	-	-	I	-	-	1	3	2	2
CO 2	3	3	2	1	-	-	-	-	-	-	-	1	3	2	2
CO 3	3	3	2	1	-	-	-	-	-	2	1	1	3	2	2
CO 4	3	3	2	2	-	-	1	-	-	2	1	1	3	2	1
CO 5	2	2	1	1	-	-	1	-	-	2	2	1	3	2	2
со	3	3	2	1	-	-	1	-	-	2	1	1	3	2	2

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE	II	NTERNET PROGRAMMIN	G LAB	3	0	0	3

- ✓ To be familiar with Web page design using HTML/XML and style sheets.
- \checkmark To learn to create dynamic web pages using server side scripting.
- \checkmark To write Client Server applications.
- \checkmark To be familiar with the PHP programming.
- \checkmark To be exposed to creating applications with AJAX and Spring.

COURSE OUTCOMES										
On com	On completion of the course, students will be able to									
CO1	Explain the basic web essential terms.									
CO2	Discuss the creation of dynamic web page using Java Script objects.									
CO3	Create server side programs using Servlets and JSP.									
CO4	Construct simple web pages in PHP and represent data in XML format.									
CO5	Develop AJAX, web services and various interactive web applications.									

					CO –	PO MA	APPINO	Ĵ					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	2	3	2	2	3	3	3	3	3	1	I	-
CO 2	3	2	2	2	3	2	2	3	3	3	3	3	1	-	-
CO 3	3	2	2	2	3	2	2	3	3	3	3	3	1	-	-
CO 4	3	2	2	2	3	2	2	3	3	3	3	3	1	-	-
CO 5	3	2	2	2	3	2	2	3	3	3	3	3	1	-	-
СО	3	2	2	2	3	2	2	3	3	3	3	3	1	-	-

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE	PROFE	SSIONAL COMMUNICAT	FION LAB	0	0	2	1

- Develop their communicative competence in English with specific reference to Speaking and listening.
- > Enhance their ability to communicate effectively in interviews.
- Strengthen their prospects of success in competitive examinations.

	COURSE OUTCOMES											
On completion of the course, students will be able to												
CO1	Equip students with technology driven language skills required for successful undertaking of academic studies with primary emphasis on academic speaking and listening and to prepare students for competitive exams.											
CO2	Identify different genres of reading and writing, and be able to reflect and respond critically on formal communication such as letters, reports and memos.											
CO3	Learn to understand the role of multiple intelligences and incorporate them in communication in a diverse team.											

	CO – PO MAPPING														PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3		
CO 1	3	-	I	-	-	I	-	-	3	3	2	2	3	3	1		
CO 2	3	-	-	-	-	-	-	-	3	3	2	2	3	3	1		
CO 3	3	-	-	-	-	-	-	-	3	3	2	2	3	3	1		
со	3	-	-	-	-	-	-	-	3	3	2	2	3	3	1		

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE	DESIGN	N AND ANALYSIS OF AI LAB	LGORITHMS	0	0	2	1

- \checkmark To learn the problems using divide and conquer strategy.
- \checkmark To understand the problems using backtracking strategy.
- \checkmark To implement problems using greedy and dynamic programming techniques.
- ✓ To perform Optimal Binary Search.

	COURSE OUTCOMES									
On com	On completion of the course, students will be able to									
CO1	Remember how to analyze a problem and design the solution for the problem.									
CO2	Identify design and implement efficient algorithms for a specified application.									
CO3	Apply Strengthen the ability to identify and apply the suitable algorithm for the given real- world problem.									
CO4	Evaluate the design algorithm for various computing problems.									

	CO – PO MAPPING													PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3		
CO 1	3	3	2	1	-	-	-	1	-	-	-	1	3	2	1		
CO 2	3	3	2	2	-	-	-	1	-	-	-	1	3	2	1		
CO 3	3	2	2	1	-	-	-	1	-	-	-	1	3	2	2		
CO 4	3	3	2	2	-	-	-	1	-	-	-	1	3	2	1		
со	3	3	2	2	-	-	-	1	-	-	-	1	3	2	1		

SEMESTER - VI

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	COMPUT	FER GRAPHICS AND MU	LTIMEDIA	3	0	0	3

	COURSE OUTCOMES									
On com	On completion of the course, students will be able to									
CO1	Interpret Illumination and color models.									
CO2	Apply two dimensional transformations and two - dimensional graphics.									
CO3	Design three - dimensional graphics and three - dimensional transformations.									
CO4	Implement clipping techniques to graphics.									
CO5	Outline types of Multimedia File Format and Design Basic 3d Scenes using Blender.									

					CO –	PO MA	APPINO	J					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	3	1	1	-	-	-	1	1	-	1	2	1	1	
CO 2	3	3	3	2	2	-	-	-	1	-	-	1	2	1	1	
CO 3	3	3	3	2	2	-	-	-	1	-	-	1	2	1	1	
CO 4	3	3	3	1	1	-	-	-	1	1	-	1	2	1	1	
CO 5	3	3	3	2	2	-	-	-	1	-	-	1	2	1	1	
со	3	3	3	2	2	-	-	-	1	1	-	1	2	1	1	

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	МАС	MACHINE LEARNING TECHNIQUES					3

- \checkmark To understand the need for machine learning for various problem solving.
- ✓ To study the various supervised, semi-supervised and unsupervised learning algorithm in machine learning.
- \checkmark To understand the latent trends in machine learning.
- \checkmark To design appropriate machine learning algorithms for problem solving.

	COURSE OUTCOMES									
On con	On completion of the course, students will be able to									
CO1	Recall the learning techniques with this basic knowledge.									
CO2	Define effectively neural network and genetic algorithm for appropriate applications.									
CO3	Apply Bayesian techniques and derive effectively learning rules.									
CO4	Analyze the different machine learning techniques.									
CO5	Differentiate reinforcement and analytical learning techniques.									

	CO – PO MAPPING													PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3		
CO 1	3	2	2	1	-	-	-	-	1	-	-	1	3	3	2		
CO 2	3	2	2	1	-	-	-	-	1	-	-	1	3	2	2		
CO 3	3	2	2	1	-	-	-	-	1	-	-	1	3	3	2		
CO 4	3	2	2	1	-	-	-	-	1	-	-	1	3	2	2		
CO 5	3	2	2	1	1	-	-	-	1	-	-	1	3	3	2		
СО	3	2	2	1	1	-	-	-	1	-	-	1	3	3	2		

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE		BIG DATA ANALYTICS		3	0	0	3

 \checkmark To know the fundamental concepts of big data and analytics.

- \checkmark To explore tools and practices for working with big data.
- \checkmark To learn about stream computing.

 \checkmark To know about the research that requires the integration of large amounts of data.

COURSE OUTCOMESOn course, students will be able toCO1Describe the big data tools and its analysis techniques.CO2Identify the data by utilizing clustering and classification algorithms.CO3Apply different mining algorithms and recommendation systems for large volumes of data.CO4Analyze the data streaming methodsCO5Investigate NoSQL databases and management

					CO –	PO MA	APPINO	3					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	2	2	2	1	1	1	-	-	-	-	2	2	-	
CO 2	3	3	2	2	2	1	1	1	-	-	-	1	2	2	-	
CO 3	3	3	2	2	1	1	1	1	1	-	-	1	2	2	-	
CO 4	3	2	2	2	2	1	1	1	1	1	1	1	2	2	-	
CO 5	3	2	2	2	2	1	1	1	1	1	1	1	2	2	-	
со	3	3	2	2	2	1	1	1	1	1	1	1	2	2	-	

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	COMPU	TER GRAPHICS AND MU LABORATORY	LTIMEDIA	0	0	2	3

- ✓ To develop an understanding and awareness how issues such as content, information architecture, motion, sound, design, and technology merge to form effective and compelling interactive experiences for a wide range of audiences and end users.
- ✓ To become familiar with various software programs used in the creation and implementation of multi- media.
- ✓ To appreciate the importance of technical ability and creativity within design practice.
- \checkmark To understand the two-dimensional graphics and their transformations and clipping techniques.
- \checkmark To understand the three-dimensional graphics and their transformations.

On com	COURSE OUTCOMES apletion of the course, students will be able to
CO1	Identify how to generate line, circle and ellipse
CO2	Apply 2D object and various transformation techniques
CO3	Outline various 3D Transformation techniques using OpenGL.
CO4	Implementing multimedia compression techniques and applications.

					CO –	PO MA	APPINO	G					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	2	2	-	-	-	2	2	-	1	3	2	1
CO 2	3	3	3	2	2	2	-	-	2	-	2	1	3	2	1
CO 3	3	3	3	2	2	-	-	-	2	2	2	1	3	2	1
CO 4	3	3	3	2	2	2	-	-	2	-	-	1	3	2	1
CO 5	3	3	3	2	2	2	-	-	2	2	2	1	3	2	1
со	3	3	3	2	2	-	-	-	2	2	-	1	3	2	1

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE		DATA ANALYTICS LAB		3	0	0	3

- ✓ To implement Map Reduce programs for processing big data
- ✓ To realize storage of big data using H base, Mongo DB
- ✓ To analyze big data using linear models
- To analyze big data using machine learning techniques such as SVM / Decision tree classification and clustering

	COURSE OUTCOMES										
On con	On completion of the course, students will be able to										
CO1	Express big data using Hadoop framework.										
CO2	Apply linear and logistic regression models.										
CO3	Perform data analysis with machine learning methods.										
CO4	Analyze clustering methods.										
CO5	Interpret graphical data analysis.										

					CO –	PO MA	APPINO	Ĵ					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	2	2	1	-	-	-	-	-	-	-	3	2	1	
CO 2	3	3	2	2	1	1	-	-	-	-	-	1	3	2	-	
CO 3	3	3	2	2	1	1	1	-	-	-	-	1	3	1	1	
CO 4	3	3	2	2	1	1	1	1	1	1	1	1	3	2	1	
CO 5	3	3	2	2	1	1	1	1	1	1	1	1	3	2	1	
со	3	3	2	2	1	1	1	1	1	1	1	1	3	2	1	

SEMESTER - VII

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	Artific	ial Neural Networks a Learning	nd Deep	3	0	0	3

- \checkmark To learn the basic concepts of machine learning.
- \checkmark Discuss with the various algorithm techniques used in neural networks.
- \checkmark To analyze the strategies used in deep learning.
- ✓ To interpret the concepts of CNN and RNN.
- \checkmark To appraise the tools leading to the advancement of deep learning.

	COURSE OUTCOMES									
On com	On completion of the course, students will be able to									
CO1	Discuss the architectural concepts, key technologies, strengths and limitations of cloud computing.									
CO2	Apply the concept of virtualization in cloud technology.									
CO3	Analyze the ability to understand and use the architecture of compute and storage cloud, service and delivery models.									
CO4	Construct appropriate resource management and Security mechanism to build a cloud environment.									
CO5	Develop operation and economic models of various trending cloud platforms.									

	CO – PO MAPPING													PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3		
CO 1	3	3	3	-	-	-	-	-	-	-	-	1	1	-	-		
CO 2	3	3	3	2	-	-	-	-	-	-	-	1	1	-	-		
CO 3	3	3	3	2	-	-	-	-	-	-	-	1	1	-	-		
CO 4	3	3	3	-	2	-	-	-	-	-	-	2	1	-	-		
CO 5	3	3	3	1	3	-	-	-	-	-	-	2	1	-	-		
СО	3	3	3	2	3	-	-	-	-	-	-	2	1	-	-		

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	19	1CS722/ CLOUD COMPUT	ING	3	0	0	3

- \checkmark To explain the concept of cloud computing.
- \checkmark To appraise the evolution of cloud from the existing technologies.
- \checkmark To apply knowledge on the various issues in cloud computing.
- \checkmark To organize the various advances leading to security concerns.
- \checkmark To design an emergence of cloud as the next generation computing paradigm.

	COURSE OUTCOMES										
On con	On completion of the course, students will be able to										
CO1	Discuss the architectural concepts, key technologies, strengths and limitations of cloud computing.										
CO2	Apply the concept of virtualization in cloud technology.										
CO3	Analyze the ability to understand and use the architecture of compute and storage cloud, service and delivery models.										
CO4	Construct appropriate resource management and Security mechanism to build a cloud environment .										
CO5	Develop operation and economic models of various trending cloud platforms.										

					CO –	PO MA	APPINO	Ĵ					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	2	2	1	-	-	-	-	-	-	-	1	1	-	-	
CO 2	3	2	2	1	-	-	-	-	1	-	-	1	1	-	-	
CO 3	3	2	2	2	1	-	-	-	-	-	-	1	1	-	-	
CO 4	3	2	2	1	-	-	-	-	-	-	-	1	1	-	-	
CO 5	3	2	2	1	1	-	-	-	-	-	-	1	1	-	-	
со	3	2	2	1	1	-	-	-	-	-	-	1	2	-	-	

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	ARTIFIC	CIAL NEURAL NETWORK LEARNING LAB	AND DEEP	3	0	0	3

 \checkmark To learn and analyze the tool used in neural networks.

- \checkmark Apply the structure of a neuron in artificial.
- ✓ Analyze learning classifiers in network (Supervised and Unsupervised).
- ✓ Analyze the concepts of learning rules using CNN and RNN.

	COURSE OUTCOMES											
On completion of the course, students will be able to												
CO1	Understand the characteristics and types of artificial neural network and remember working of biological Neuron and Artificial Neural Network.											
CO2	Use learning algorithms on perceptron and apply back propagation learning on Neural Network.											
CO3	Apply Feedback NN and plot a Boltzmann machine and associative memory on various applications.											
CO4	Analyze different types of auto encoders with dimensionality reduction and regularization.											
CO5	Design Convolutional Neural Network and classification using Convolutional Neural Network.											

					CO –	PO MA	APPINO	Ĵ					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	2	-	I	-	I	-	-	-	2	1	-	-
CO 2	3	3	3	2	-	I	-	I	-	-	-	2	1	-	-
CO 3	3	3	3	2	-	-	-	-	-	-	-	2	1	-	-
CO 4	3	3	3	2	-	-	-	-	-	-	-	2	1	-	-
CO 5	3	3	3	1	3	-	-	-	-	-	-	2	1	-	-
СО	3	3	3	2	3	-	-	-	-	-	-	2	1	-	-

YEAR	IV	SEMESTER	VII		Т	Р	С
COURSE CODE / CLOUD COMPUTING LABORATORY			0	0	2	1	

 \checkmark To develop web applications in cloud.

- ✓ To design and development process involved in creating a cloud based Application.
- \checkmark To implement and use parallel programming using Hadoop.

	COURSE OUTCOMES											
On completion of the course, students will be able to												
CO1	nstall various virtualization tools such as Virtual Box, VMware workstation.											
CO2	Use Cloud SIM to run various schedulers.											
CO3	Design a web application in a IaaS environment.											
CO4	Develop a generic cloud environment which can be used as a private cloud.											
CO5	Implement version control systems with various command repositories.											

	CO – PO MAPPING													PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	3	2	-	I	-	I	ŀ	-	-	2	1	-	-	
CO 2	3	3	3	2	-	-	-	-	-	-	-	2	1	-	-	
CO 3	3	3	3	2	-	-	-	-	-	-	-	2	1	-	-	
CO 4	3	3	3	2	-	-	-	-	-	-	-	2	1	-	-	
CO 5	3	3	3	1	3	-	-	-	-	-	-	2	1	-	-	
СО	3	3	3	2	3	-	-	-	-	-	-	2	1	-	-	

SEMESTER - VIII

YEAR	IV	SEMESTER	VIII	L	Т	Р	С
COURSE CODE / COURSE TITLE	COURSE CODE / BLOCKCHAIN TECHNOLOGY						

- \checkmark To understand the basic concepts of blockchain.
- ✓ To learn about blockchain in Cryptography.
 ✓ To study about Bitcoin.
- ✓ To build smart contracts and Etherum.
- ✓ To develop an application using blockchain development tools and hyperledger tools.

	COURSE OUTCOMES											
On completion of the course, students will be able to												
CO1	Recognize the basic concept of blockchain and its types, Consensus theorem, Decentralization.											
CO2	Interpret how cryptography techniques working in blockchain using RSA and other encryption standard.											
CO3	Apply knowledge of Bitcoin techniques, Mining algorithm, PoW, PoS, PoD.											
CO4	Analyze the concept of Smart Contracts, Ethereum with EVM and development tools.											
CO5	Formulate knowledge of blockchain development tools and hyperledger concepts.											

					CO –	PO MA	APPIN	3					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	-	2	-	2	1	-	2	2	2	2	2
CO 2	3	3	3	2	-	2	-	2	1	-	2	2	2	2	1
CO 3	3	3	3	2	-	2	-	2	1	-	2	2	2	2	2
CO 4	3	3	3	3	2	2	-	2	1	-	2	2	2	2	1
CO 5	3	3	3	3	2	2	-	2	1	-	2	2	2	2	2
со	3	3	3	2	2	2	-	2	1	-	2	2	2	2	2
PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVES

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CS539 / I	NTERNET OF THINGS		3	0	0	3

- \checkmark To understand the fundamentals of IoT.
- ✓ To understand the concepts of IoT Architectures and smart objects in IoT
- \checkmark To learn about the basics of IoT Protocols.
- ✓ To build simple IoT systems with Arduino and Raspberry Pi.
- \checkmark To apply the concept of IoT in the real-world Scenario.

On com	COURSE OUTCOMES On completion of the course, students will be able to									
CO1	Explain the concept of IoT.									
CO2	Analyze various protocols for IoT.									
CO3	Design a Portable of an IoT system using Rasperry Pi/Arduino.									
CO4	Deploy an IoT application and connect to the cloud.									
CO5	Analyze applications of IoT in real time scenario.									

	CO-PO & PSO Mapping														
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	1	-	1	-	-	-	-	-	1	3	2	1
CO 2	3	3	1	1	-	1	-	-	-	-	-	1	3	2	2
CO 3	3	3	1	1	1	1	-	-	-	-	-	1	3	2	1
CO 4	3	3	1	1	1	1	-	-	-	-	-	1	3	2	1
CO 5	3	3	1	1	1	1	-	-	-	-	-	1	3	2	1
СО	3	3	1	1	1	1	-	-	-	-	-	1	3	2	1

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE	SOFTW	ARE RELIABILITY AND	METRICS	3	0	0	3

✓ To introduce to the basic concepts of Software Reliability.

- ✓ To understand about the varied Reliability models.
- ✓ To relate the Software Reliability models.
- \checkmark To familiarize about measurement and its scope.
- \checkmark To assess and model the reliability of software systems.

	COURSE OUTCOMES
	COURSE OUTCOMES
On com	pletion of the course, students will be able to
CO1	Recall the fundamental concepts of Software Reliability.
CO2	Review the basics of Software Reliability Modeling.
CO3	Apply the concepts of Comparison Criteria.
CO4	Relate the concepts of Measurements in Software Engineering.
CO5	Formulate the Measurement of Internet Product Attributes and Quality Management Models.

					CO –	PO MA	PPINO	J					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	3	2	-	-	-	2	2	2	2	2	2	1	1	
CO 2	3	3	3	2	-	-	I	2	2	2	2	2	2	1	1	
CO 3	3	3	3	3	3	1	-	2	2	2	2	2	2	1	1	
CO 4	3	3	3	2	-	2	-	2	2	2	2	2	2	1	1	
CO 5	3	3	3	3	3	2	-	2	2	2	2	2	2	1	1	
СО	3	3	3	2	3	2	-	2	2	2	2	2	2	1	1	

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE	191AI532 / LANGUA(PRINCIPLES OF PROGRA	AMMING	3	0	0	3

- \checkmark To understand and describe syntax and semantics of programming languages.
- \checkmark To study data, data types, and basic statements.
- ✓ To explore call-return architecture and ways of implementing them.
- ✓ To implement object-orientation, concurrency and event handling in programming languages.
- ✓ To develop programs in non-procedural programming paradigms.

	COURSE OUTCOMES
On com	pletion of the course, students will be able to
C01	Remember syntax and semantics of programming languages.
CO2	Design and implement subprogram constructs.
CO3	Apply object-oriented, concurrency, and event handling programming constructs.
CO4	Develop programs in Scheme, ML, and Prolog.
CO5	Evaluate new programming languages.

					CO –	PO MA	PPINO	J					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	2	-	I	I	2	2	2	2	2	3	2	1
CO 2	3	3	3	2	-	-	-	2	2	2	2	2	3	2	1
CO 3	3	3	3	3	3	1	-	2	2	2	2	2	3	2	1
CO 4	3	3	3	2	-	2	-	2	2	2	2	2	3	2	1
CO 5	3	3	3	3	3	2	I	2	2	2	2	2	3	2	1
со	3	3	3	2	3	2	-	2	2	2	2	2	3	2	1

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE		SOFT COMPUTING		3	0	0	3

- ✓ Learn the basic concepts of Soft Computing
- ✓ Familiarize with various techniques like neural networks, genetic algorithms and fuzzy systems.
- ✓ Apply soft computing techniques to solve problems.
- Provide the mathematical background for carrying out the optimization associated with neural network learning.

	COURSE OUTCOMES
On com	pletion of the course, students will be able to
CO1	Apply suitable soft computing techniques for various applications.
CO2	Integrate various soft computing techniques for complex problems.
CO3	Relate with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
CO4	Describe with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.
CO5	Develop some familiarity with current research problems and research methods in Soft Computing Techniques.

					CO –	PO MA	PPINO	J					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	1	1	1	-	-	1	-	-	1	3	2	2
CO 2	3	2	2	1	1	1	-	-	1	-	-	1	3	2	2
CO 3	3	2	1	1	1	1	-	-	1	-	-	1	3	2	2
CO 4	3	3	2	1	1	1	-	-	1	-	-	1	3	2	2
CO 5	3	3	2	1	1	1	-	-	1	-	-	1	3	2	1
СО	3	2	2	1	1	1	-	-	1	-	-	1	3	2	2

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE	MU	LTICORE ARCHITECTU PROGRAMMING	RE AND	3	0	0	3

- \checkmark To study the need for multi-core processors, and their architecture.
- \checkmark To understand the challenges in parallel and multi-threaded programming.
- \checkmark To learn about the various parallel programming paradigms.
- \checkmark To develop multi-core programs and design parallel solutions.

	COURSE OUTCOMES											
On com	pletion of the course, students will be able to											
CO1	Describe multi core architectures and identify their characteristics and challenges.											
CO2	Identify the issues in programming Parallel Processors.											
CO3	Apply the programs using OpenMP and MPI.											
CO4	Analyze the programming for serial processors and programming for parallel processors											
CO5	Design parallel programming solutions to common problems.											

					CO –	PO MA	PPINO	Ĵ					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	1	-	-	1	1	_	-	-	-	1	-	-
CO 2	3	3	2	2	-	-	1	1	-	-	-	-	1	-	-
CO 3	3	3	2	1	-	-	1	1	-	-	-	-	1	-	-
CO 4	3	3	2	1	-	Ι	1	1	-	-	-	I	1	I	-
CO 5	3	3	2	1	-	Ι	1	1	-	-	-	I	1	I	-
со	3	3	2	1	-	-	1	1	-	-	-	-	1	-	-

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE	DAT	FA MINING AND WAREH	OUSING	3	0	0	3

- ✓ To learn data warehouse concepts, architecture, business analysis and tools.
- \checkmark To understand data pre-processing and data visualization techniques.
- \checkmark To study algorithms for finding hidden and interesting patterns in data.
- ✓ To understand and apply various classification and clustering techniques using tools.

	COURSE OUTCOMES											
On com	pletion of the course, students will be able to											
CO1	Learn about Data warehouse system and perform business analysis with OLAP tools.											
CO2	Understand the suitable pre-processing and visualization techniques for data analysis.											
CO3	Apply frequent pattern and association rule mining techniques for data analysis.											
CO4	Analyze appropriate classification and clustering techniques for data analysis.											
CO5	Review the weka tool and solve real world data mining problems.											

					CO –	PO MA	PPINO	3					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	2	-	-	I	1	1	-	-	I	1	-	-
CO 2	3	2	2	2	-	-	-	1	1	-	-	-	1	-	-
CO 3	3	2	2	2	-	-	-	1	1	-	-	-	1	-	-
CO 4	3	2	2	2	-	-	-	1	1	-	-	-	1	-	-
CO 5	3	2	2	2	-	-	-	1	1	-	-	-	1	-	-
со	3	2	2	2	-	-	-	1	1	-	-	-	1	-	-

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE	NETWOR	K DESIGN AND TECHNOI	LOGIES	3	0	0	3

- ✓ To Learn the principles required for network design
- \checkmark To explore various technologies in the wireless domain
- \checkmark To study about 3G and 4G cellular networks
- ✓ To understand the paradigm of Software defined networks

	COURSE OUTCOMES											
On com	pletion of the course, students will be able to											
CO1	Recognize the components required for designing a network.											
CO2	Describe a network at high-level using different networking technologies.											
CO3	Apply the various protocols of wireless and cellular networks.											
CO4	Analyze the features of 4G and 5G networks.											
CO5	Create software defined networks.											

					CO –	PO MA	APPINO	Ĵ					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	2	2	-	1	1	-	-	-	-	-	3	2	1	
CO 2	3	3	3	2	-	1	1	-	-	-	-	-	3	2	1	
CO 3	3	3	2	2	-	1	1	-	-	-	-	-	3	2	1	
CO 4	3	2	2	1	-	1	1	-	-	-	-	-	3	2	1	
CO 5	3	3	3	2	-	1	1	-	-	-	-	-	3	2	1	
со	3	3	2	1	-	1	1	-	-	-	-	-	3	2	1	

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE	FUZZY	Y LOGIC AND ARTIFICIA NETWORK	L NEURAL	3	0	0	3

- ✓ Describe the concepts of fuzzy logic principles.
- Summarize the applications of fuzzy systems.
 Discuss the models of ANN.
- ✓ Compose the types of genetic algorithm and optimization technique.
- ✓ Organize the various application related to design and manufacture.

	COURSE OUTCOMES
On com	pletion of the course, students will be able to
CO1	State the skill in basic understanding on fuzzy logic.
CO2	Classify the various fuzzy logic applications.
CO3	Explore the functional components of neural classification and functional components.
CO4	Develop and implement a basic trainable neural network to design and manufacturing.
CO5	Discuss the various applications of Neural Network.

					CO –	PO MA	APPINO	J					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	1	-	-	-	-	-	-	-	-	3	2	1
CO 2	3	3	2	1	1	-	-	-	-	-	-	-	3	2	1
CO 3	3	3	2	2	1	-	-	-	1	-	-	-	3	2	1
CO 4	3	3	3	2	2	1	-	-	1	1	-	-	3	2	1
CO 5	3	3	3	2	2	1	-	I	1	1	-	I	3	2	1
со	3	3	2	2	2	1	-	-	1	1	-	-	3	2	1

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE		SECURITY PRACTICE	S	3	0	0	3

- \checkmark To learn the core fundamentals of system and web security concepts.
- \checkmark To have thorough understanding in the security concepts related to networks.
- \checkmark To deploy the security essentials in IT Sector.
- \checkmark To be exposed to the concepts of Cyber Security and encryption concepts.
- ✓ To perform a detailed study of Privacy and Storage security and related issues.

	COURSE OUTCOMES											
On com	pletion of the course, students will be able to											
CO1	Recognize the core fundamentals of system security											
CO2	Classify the security concepts related to networks in wired and wireless scenario											
CO3	Execute and Manage the security essentials in IT Sector											
CO4	Experiment the concepts of Cyber Security and encryption Concepts											
CO5	Build a thorough knowledge in the area of Privacy and Storage security and related Issues.											

					CO –	PO MA	PPINO	J					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	1	-	1	I	1	-	-	1	1	1	-	-
CO 2	3	2	2	1	-	1	-	1	-	-	1	1	1	-	-
CO 3	3	2	2	1	-	1	-	1	-	-	1	1	1	-	-
CO 4	3	2	2	1	-	1	I	1	2	1	2	1	1	-	-
CO 5	3	2	2	1	-	1	-	1	2	1	2	1	1	-	-
со	3	2	2	1		1		1	2	1	1	1	1	-	-

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE		SOFTWARE TESTING	5	3	0	0	3

- \checkmark To learn the criteria for test cases.
- \checkmark To learn the design of test cases.
- \checkmark To understand the needs of the testing.
- ✓ To Evaluate working products
- \checkmark To apply test automation techniques

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Design test cases suitable for a software development for different domains.
CO2	Identify suitable tests to be carried out.
CO3	Prepare test planning based on the document.
CO4	Document test plans and test cases designed.
CO5	Make use of the latest test tool for functional and performance testing.

					CO -	PO MA	PPINO	Ĵ					PSO's		
со	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	2	2	2	2	3	3	3	3	3	2	1
CO 2	3	3	3	3	2	2	2	2	3	3	3	3	3	2	1
CO 3	3	3	3	3	2	2	2	2	3	3	3	3	3	1	1
CO 4	3	3	3	3	2	2	2	2	3	3	3	3	3	2	2
CO 5	3	3	3	3	2	2	2	2	3	3	3	3	3	2	2
со	3	3	3	3	2	2	2	2	3	3	3	3	3	2	2

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE		SENTIMENT ANALYS	IS	3	0	0	3

- To know a user or audience opinion on a target object
- Analysing a vast amount of text from various sources.
- Identify key emotional triggers.

	COURSE OUTCOMES											
On com	On completion of the course, students will be able to											
CO1	Underline the core fundamentals of social sentiment.											
CO2	Express the knowledge about adaptive customer's service and their applications.											
CO3	Use the ability of AI to generate and understand natural language.											
CO4	Analyze the improvement of customer service by evaluating customer reactions in real-time.											
CO5	Establish customers support in conveying the desired emotion in their messages.											

					CO –	PO MA	APPINO	Ĵ					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	1	1	-	-	-	-	-	-	I	1	-	-
CO 2	2	1	1	1	1	-	-	-	I	1	1	1	1	-	-
CO 3	2	1	1	1	1	-	-	-	1	1	1	2	1	-	-
CO 4	2	1	1	1	1	-	-	-	1	1	2	2	1	-	-
CO 5	2	1	1	1	1	-	-	-	2	1	2	2	1	-	-
со	2	1	1	1	1	-	-	-	1	1	2	2	1	-	-

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE		BIO- INFORMATICS		3	0	0	3

 \checkmark To understand the need for bio informatics in biological database.

 \checkmark To study the various algorithm using in sequential analysis.

 \checkmark To learn the latent trends in biological systems.

✓ To design appropriate bio informatics data using PERL programming.

	COURSE OUTCOMES										
On completion of the course, students will be able to											
CO1	Learn the basic concepts of Bio informatics.										
CO2	Define various algorithms used for genetic structure.										
CO3	Apply distance based trees based on morphological.										
CO4	Analyze efficient technique methods in protein secondary structure prediction.										
CO5	Implement PERL programming for bio informatics.										

					CO -	PO MA	APPINO	Ĵ					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	2	2	1	-	-	-	-	1	-	-	1	3	2	1	
CO 2	3	2	2	1	-	-	-	-	1	-	-	1	3	2	1	
CO 3	3	2	2	1	-	-	-	-	1	-	-	1	3	2	1	
CO 4	3	2	2	2	-	-	-	-	1	-	-	1	3	2	1	
CO 5	3	2	3	1	1	-	-	-	1	-	-	1	3	2	1	
со	3	2	2	1	1	-	-	-	1	-	-	1	3	2	1	

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	VIRT	TUAL AND AUGMENTED	REALITY	3	0	0	3

- \checkmark To understand the fundamentals of the Virtual Reality.
- ✓ Explore the various Health Hazards.
- ✓ Gather knowledge about the Interaction Patterns and Techniques.
- ✓ Explore the techniques behind Augmented Reality.
- ✓ To understand the concepts of virtual reality infrastructure.

	COURSE OUTCOMES									
On com	pletion of the course, students will be able to									
CO1	Explore the basic concepts of the Virtual Reality.									
CO2	Identify the various health effects of Virtual Reality.									
CO3	Apply the concepts of Interaction Patterns and Techniques.									
CO4	Analyze the Augmented Reality Techniques.									
CO5	Describe infrastructure for virtual reality.									

	CO – PO MAPPING														PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3			
CO 1	3	3	3	1	1	-	-	-	-	-	-	2-	1	-	-			
CO 2	3	3	3	1	1	-	-	-	-	-	-	2	1	-	-			
CO 3	3	3	3	1	1	-	-	-	-	-	-	2	1	-	-			
CO 4	3	3	3	1	1	-	-	-	-	-	-	2	1	-	-			
CO 5	3	3	3	1	1	-	-	-	-	-	-	2	1	-	-			
со	3	3	3	1	1	-	-	-	-	-	-	2	1	-	-			

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE		REAL TIME SYSTEM	S	3	0	0	3

- ✓ To learn real time operating system concepts, the associated issues & amp; Techniques.
- ✓ To understand design and synchronization problems in Real Time System.
- \checkmark To explore the concepts of real time databases.
- ✓ To develop and evaluation techniques present in Real Time System.

COURSE OUTCOMESOn commutation of the course, students will be able toCO1Remember Real-time scheduling and schedule-ability analysis, including clock-driven and priority-
driven scheduling.CO2Identify the Theoretical background (specification/verification) and practical knowledge of real-time
operating systems.CO3Apply the use of multitasking techniques in real time systems, understand the fundamental concepts of
real-time operating systems and memory management.CO4Analyze the evaluation techniques present in Real Time System data base.CO5Evaluate and compare types and Functionalities in commercial OS, application development using RTOS.

	CO – PO MAPPING													PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3		
CO 1	3	2	1	1	-	-	-	-	-	-	-	2	3	2	1		
CO 2	3	1	1	1	-	-	-	-	-	2	1	2	3	2	1		
CO 3	3	2	1	1	1	1	1	-	-	2	1	2	3	1	1		
CO 4	3	2	2	1	1	1	1	2	1	3	1	2	3	2	1		
CO 5	3	2	2	2	1	1	1	2	1	3	1	2	3	2	1		
со	3	1	1	1	1	1	1	2	1	2	1	2	3	2	1		

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	MALV	VARE ANALYSIS IN DATA	A SCIENCE	3	0	0	3

- \checkmark To learn the concept of malware and reverse engineering.
- \checkmark To understand the configuration of JIT debugger for shell code analysis.
- \checkmark To study the concept of debugging.
- ✓ To Implement tools and techniques of malware analysis.

	COUDSE OUTCOMES									
	COURSE OUTCOMES									
On comp	On completion of the course, students will be able to									
CO1	Describe the concept of different types of malware in data science.									
CO2	Explain the concept of malware and reverse engineering.									
CO3	Demonstrate debugging with python Scripts.									
CO4	Analyze Artifacts in Process Memory.									
CO5	Design techniques of malware analysis.									

					CO –	PO MA	APPINO	Ĵ					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	3	2	-	1	1	I	-	-	-	1	2	-	-	
CO 2	3	3	2	1	-	1	1	I	-	-	-	1	1	-	-	
CO 3	3	3	3	2	-	1	1	I	-	-	-	1	2	-	-	
CO 4	3	3	2	1	-	1	1	-	-	-	-	1	1	-	-	
CO 5	3	3	2	1	-	1	1	-	-	-	-	1	1	-	-	
СО	3	3	2	1	-	1	1	-	-	-	-	1	2	-	-	

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	INFORMA	INFORMATION RETRIEVAL TECHNIQUES					3

- \checkmark To understand the basics of Information Retrieval.
- ✓ To learn different modeling and retrieval evaluation for Information Retrieval.
- ✓ To understand machine learning techniques for text classification and clustering.
- \checkmark To understand various search engine system operations.
- ✓ To learn different techniques of recommender system.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1 Use an open source search engine framework and explore its capabilities.

CO3 Apply appropriate method of classification or clustering.

CO4 Demonstrate the entire process flow of a web search engine

CO5 Design and implement a recommender system

					CO –	PO MA	APPINO	J					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	2	1	-	1	-	-	-	-	-	-	-	1	-	-	
CO 2	3	2	2	1	1	I	-	-	-	-	-	-	1	-	-	
CO 3	3	2	1	1	1	-	-	-	-	-	-	-	1	-	-	
CO 4	3	1	1	1	1	I	-	-	-	-	-	-	1	-	-	
CO 5	3	1	1	-	1	-	-	-	-	-	-	-	1	-	-	
со	3	2	1	1	1	-	-	-	-	-	-	-	1	-	-	

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	S	SOCIAL NETWORK ANALYSIS					3

 \checkmark Understand the concept of semantic web and related applications.

- ✓ Learn knowledge representation using ontology.
- ✓ Understand human behavior in social web and related communities.
- ✓ Analyze the visualization of social networks.
- ✓ Summarize how networks evolve in time.

On com	COURSE OUTCOMES On completion of the course, students will be able to									
CO1	Develop semantic web related applications.									
CO2	Represent knowledge using ontology.									
CO3	Predict human behavior in social web and related communities.									
CO4	Visualize social networks.									
CO5	Examine social networks analysis using case studies.									

	CO – PO MAPPING														PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3		
CO 1	3	3	3	1	1	1	-	-	-	-	-	1	2	1	-		
CO 2	3	3	2	1	1	1	-	-	-	-	-	1	2	1	-		
CO 3	3	3	1	1	1	1	-	-	-	-	-	1	2	1	-		
CO 4	3	3	3	1	1	1	-	-	-	-	-	1	2	1	-		
CO 5	3	3	2	1	1	1	-	-	-	-	-	1	2	1	-		
со	3	3	2	1	1	1	-	-	-	-	-	1	2	1	-		

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE		BUSINESS INTELLIGEN	ICE	3	0	0	3

 \checkmark To exposed with the basic rudiments of business intelligence system.

- \checkmark To study exposed with the basic rudiments of business intelligence system.
- \checkmark To understand the business intelligence life cycle and the techniques used in it.
- ✓ To design appropriate different data analysis tools and techniques.

	COURSE OUTCOMES											
On completion of the course, students will be able to												
CO1	Recall the basic concepts of Business intelligence.											
CO2	Review the ooda loop and business rules.											
CO3	Apply sorting and data transformation.											
CO4	Relate efficient technique in data reporting.											
CO5	Formulate star and snow flake schema.											

	CO – PO MAPPING														PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3		
CO 1	3	3	2	2	-	I	-	-	1	-	-	1	1	1	-		
CO 2	3	3	2	2	-	-	-	-	1	-	-	1	1	-	-		
CO 3	3	3	2	2	-	-	-	-	1	-	-	1	1	-	-		
CO 4	3	3	2	2	-	-	-	-	1	-	-	1	1	-	-		
CO 5	3	3	3	2	1	-	-	-	1	-	-	1	1	-	-		
со	3	3	2	2	1	-	-	-	1	-	-	1	1	-	-		

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE		PATTERN RECOGNITI	ON	3	0	0	3

- \checkmark To learn the fundamentals of pattern recognition and its relevance to classical and modern problems.
- \checkmark To identify, where, when and how pattern recognition can be applied
- \checkmark To introduce the most recent applications of pattern recognition techniques.

	COURSE OUTCOMES										
On com	pletion of the course, students will be able to										
CO1	Describe the basic pattern classifier algorithms.										
CO2	Explain the various parameter estimation methods.										
CO3	Use the dimensionality reduction techniques.										
CO4	Analyze the Artificial neural networks and deep neural networks.										
CO5	Interpret the recent advancement in pattern recognition.										

	CO – PO MAPPING														PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3			
CO 1	3	3	2	2	-	-	-	-	-	-	-	-	3	3	2			
CO 2	3	3	2	2	-	2	2	2	-	-	-	1	3	3	2			
CO 3	3	3	2	2	-	-	-	2	-	-	-	1	3	3	2			
CO 4	3	3	2	2	-	2	2	2	-	-	-	1	3	2	2			
CO 5	3	3	3	2	2	1	1	-	-	-	-	-	3	3	2			
со	3	3	2	2	2	2	2	2	-	-	-	1	3	3	2			

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE		TRUST NETWORKS		3	0	0	3

	COURSE OBJECTIVES
\checkmark	To understand trust network. To learn how decentralization of trust is achieved. To study the technologies behind crypto currencies. To impart knowledge in block chain network mining. To acquire knowledge in emerging concepts using block chain.

	COURSE OUTCOMES										
On completion of the course, students will be able to											
CO1	Recall the basics of trusted networks and block-chain technology.										
CO2	Build the algorithms for decentralization of networks.										
CO3	Interpret and implement block-chain technology.										
CO4	Analyze the technologies behind crypto currencies technology.										
CO5	Impart knowledge in emerging concepts IOT and Cloud using block-chain.										

	CO – PO MAPPING														PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3		
CO 1	3	3	3	1	2	1	-	-	-	-	2	2	2	1	-		
CO 2	3	3	3	-	2	I	-	-	I	-	2	2	2	1	-		
CO 3	3	3	3	-	2	1	-	-	-	-	2	2	2	1	-		
CO 4	3	3	3	1	-	1	-	-	I	-	2	2	1	1	-		
CO 5	3	3	3	1	2	2	2	-	I	-	2	2	2	1	-		
со	3	3	3	1	2	1	-	-	-	-	2	2	2	1	-		

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE		DATA VISUALIZATIO	N	3	0	0	3

- \checkmark To learn how accurately represent voluminous complex data set in web and from other data sources
- \checkmark To understand the methodologies used to visualize large data sets
- ✓ To develop the process involved in data visualization and security aspects involved in data visualization

On com	COURSE OUTCOMES On completion of the course, students will be able to										
CO1	Define the use various methodologies present in data visualization.										
CO2	Design the process involved and security issues present in data visualization.										
CO3	Apply appropriate data visualization techniques given particular requirements imposed by the data.										
CO4	Implement the layouts for geo-mapping.										
CO5	Evaluate appropriate design principles in the creation of presentations and visualizations.										

					CO –	PO MA	APPINO	J					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	1	-	I	-	1	-	1	-	·	3	2	1
CO 2	3	2	2	1	-	I	-	1	-	1	-	·	3	2	2
CO 3	3	2	1	1	-	-	-	1	-	1	-	-	3	3	1
CO 4	3	2	1	1	-	-	-	1	-	1	-	-	3	3	1
CO 5	3	2	2	1	-	-	-	1	-	1	-	-	3	3	1
со	3	2	2	1	-	-	-	1	-	1	-	-	3	3	1

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE		ETHICS OF ENGINEER	RS	3	0	0	3

✓ To enable the students to create an awareness on Engineering Ethics and Human Values,

✓ To install Moral and Social Values and Loyalty and to appreciate the rights of others..

COURSE OUTCOMES

On comp	pletion of the course, students will be able to
CO1	Define the importance of value education in society.
CO2	Identify the ethics, human values that supports individual growth and their personal development.
CO3	Use Engineering ethics in solving moral dilemma problems.
CO4	Analyze the importance of value education towards national and global development.
CO5	Develop professionals in software industry with idealistic, practical and moral values.

					CO –	PO MA	APPINO	Ĵ					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	-	3	2	3	3	-	-	-	3	3	2
CO 2	3	3	3	3	-	2	2	3	3	-	-	-	3	3	1
CO 3	3	3	3	3	-	3	1	3	3	-	-	-	3	2	2
CO 4	3	3	3	3	-	1	1	3	3	-	-	-	3	3	2
CO 5	3	3	3	3	-	2	2	3	3	-	-	-	3	2	2
со	3	3	3	3	-	2	2	3	3	-	-	-	3	3	2

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	I	DIGITAL IMAGE PROCES	SING	3	0	0	3

- ✓ To become familiar with digital image fundamentals
- ✓ To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- \checkmark To learn concepts of degradation function and restoration techniques.
- \checkmark To study the image segmentation and representation techniques.
- ✓ To become familiar with image compression and recognition methods

	COURSE OUTCOMES
On com	pletion of the course, students will be able to
CO1	Define the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
CO2	Analyze the images using the techniques of smoothing, sharpening and enhancement.
CO3	Design the restoration concepts and filtering techniques.
CO4	Apply the basics of segmentation, features extraction, compression and recognition methods for color models.
CO5	Use data compression techniques and topological features.

	CO – PO MAPPING														PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3		
CO 1	3	3	3	3	-	-	-	-	-	-	-	1	3	2	1		
CO 2	3	3	3	3	-	-	-	-	-	-	-	1	3	2	1		
CO 3	3	3	3	3	-	-	-	-	-	-	-	1	3	2	1		
CO 4	3	3	3	3	-	-	-	-	-	-	-	1	3	2	1		
CO 5	3	3	3	3	-	-	-	-	-	-	-	1	3	2	1		
со	3	3	3	3	-	-	-	-	-	-	-	1	3	2	1		

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE		GAME PROGRAMMIN	G	3	0	0	3

- \checkmark Describe the concepts of models of a 3D graphics.
- \checkmark Explain the various principles in game design.
- ✓ Compose the concepts of Hardware and Software Renderers.
- ✓ Identify the various gaming platforms and frameworks.
- \checkmark Recognize the gaming interface using 2d and 3d.

	COURSE OUTCOMES											
On completion of the course, students will be able to												
CO1	Discuss the fundamental concepts of 3D.											
CO2	Summarize the design principles in gaming.											
CO3	Illustrate the Renderers of hardware and software.											
CO4	Explore the various gaming platforms and frameworks.											
CO5	Use OpenGL to create new gaming interface.											

	CO – PO MAPPING														PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3		
CO 1	3	2	1	1	1	I	-	-	-	-	-	-	3	2	1		
CO 2	3	2	2	1	1	-	1	-	-	-	-	-	3	2	1		
CO 3	3	3	2	1	1	-	1	-	-	-	-	-	3	2	1		
CO 4	3	3	3	2	2	1	1	-	-	-	1	-	3	2	1		
CO 5	3	3	3	2	2	2	1	-	1	1	1	-	3	2	1		
со	3	3	2	2	2	2	1	-	1	1	1	-	3	2	1		

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	SOF	FWARE PROJECT MANA	GEMENT	3	0	0	3

- ✓ Understand the Software Project Planning and Evaluation techniques.
- ✓ To plan and manage projects at each stage of the software development life cycle (SDLC).
- ✓ To learn about the activity planning and risk management principles.
- \checkmark To manage software projects and control software deliverables.
- ✓ To develop skills to manage the various phases involved in project management and people management.
- ✓ To deliver successful software projects that support organization's strategic goals.

	COURSE OUTCOMES										
On com	On completion of the course, students will be able to										
CO1	Recognize Project management principles while developing the Software.										
CO2	Classify and estimate the projects based on various project life cycles.										
CO3	Demonstrate Activity Planning Schedules and Manage Risks.										
CO4	Analyze and control the project management approaches.										
CO5	Formulate in managing people and organizing teams.										

					CO –	PO MA	APPINO	J					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	2	-	2	-	2	2	2	2	2	3	2	2
CO 2	3	3	3	3	2	2	-	3	3	3	3	3	3	2	2
CO 3	3	3	3	3	3	3	-	3	3	3	3	3	3	2	2
CO 4	3	3	3	3	3	2	-	3	3	3	3	2	3	2	2
CO 5	3	3	3	3	3	3	-	3	3	3	3	3	3	2	2
со	3	3	3	3	3	3	-	3	3	3	3	3	3	2	2

YEAR	IV	SEMESTER	VIII	L	Т	Р	С
COURSE CODE / COURSE TITLE	HU	MAN COMPUTER INTER	ACTION	3	0	0	3

- ✓ Define the foundations of Human Computer Interaction.
- ✓ Organize the design technologies for individuals and persons with disabilities.
- \checkmark Identify the issues and models of HCI.
- ✓ Summarize the concepts of mobile HCI.
- \checkmark Recognize the guidelines for user interface.

	COURSE OUTCOMES
On com	pletion of the course, students will be able to
CO1	Summarize effective dialog for HCI.
CO2	Design effective HCI for individuals and persons with disabilities.
CO3	Illustrate the importance of user feedback.
CO4	Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
CO5	Develop meaningful user interface.

					CO –	PO MA	APPINO	Ĵ					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	2	1	1	1	-	-	2	2	3	3	2
CO 2	3	3	2	2	2	2	1	-	1	-	2	1	3	3	2
CO 3	3	3	3	2	2	-	-	-	1	-	2	2	3	2	2
CO 4	3	3	3	2	2	-	-	-	-	-	2	2	3	3	2
CO 5	3	3	3	2	2	2	-	-	-	-	2	2	3	3	2
со	3	3	3	2	2	2	1	1	1	-	2	2	3	3	2

YEAR	IV	SEMESTER	VIII	L	Т	Р	С
COURSE CODE / COURSE TITLE	SOFT	WARE ORIENTED ARCHI	ITECTURE	3	0	0	3

- ✓ Define fundamentals of XML.
- ✓ Summarize the overview of Service Oriented Architecture and Web services and their importance.
- \checkmark Analyze the web services standards and technologies.
- ✓ Learn service oriented analysis and design for developing SOA based applications.

	COURSE OUTCOMES										
On completion of the course, students will be able to											
CO1	Define fundamental of XML technologies.										
CO2	Summarize the overview of Service Oriented Architecture and Web services and their importance.										
CO3	Analyze the web services standards and technologies.										
CO4	Use web services extensions to develop solutions.										
CO5	Apply service modeling, service oriented analysis and design for application development.										

					CO –	PO MA	APPINO	J					PSO's		
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	1	1	-	1	-	1	-	-	1	1	-	-
CO 2	3	2	2	1	1	-	1	-	1	-	-	1	1	-	-
CO 3	3	3	1	1	1	-	1	-	1	-	-	1	1	-	-
CO 4	3	2	3	1	1	-	1	-	1	-	-	1	1	-	-
CO 5	3	3	2	1	1	-	1	-	1	-	-	1	1	-	-
со	3	3	2	1	1	-	1	-	1	-	-	1	1	-	-

YEAR	IV	SEMESTER	VIII	L	Т	Р	С
COURSE CODE / COURSE TITLE	AI FOR	CLINICAL INFORMATIO	ON SYSTEM	3	0	0	3

- \checkmark To exposed with the basic rudiments of business intelligence system.
- \checkmark To study exposed with the basic rudiments of business intelligence system.
- \checkmark To understand the business intelligence life cycle and the techniques used in it.
- ✓ To design appropriate different data analysis tools and techniques.

COURSE OUTCOMES										
On completion of the course, students will be able to										
CO1	Explain autonomous agents that make effective decisions in fully informed, partially observable, and adversarial settings.									
CO2	Choose appropriate algorithms for solving given AI problems.									
CO3	Design and implement logical reasoning agents.									
CO4	Apply and implement agents that can reason under uncertainty.									
CO5	Analyze the planning models support for CIS.									

					CO –	PO MA	APPINO	3					PSO's			
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	3	2	2	-	-	-	-	1	-	-	1	3	2	1	
CO 2	3	3	2	2	-	-	-	-	1	-	-	1	3	2	1	
CO 3	3	3	2	-	-	-	-	-	1	-	-	1	3	2	1	
CO 4	3	2	2	2	-	-	-	-	1	-	-	1	3	2	1	
CO 5	3	2	3	1	1	-	-	-	1	-	-	1	3	2	1	
со	3	3	2	2	1	-	-	-	1	-	-	1	3	2	1	

YEAR	IV	SEMESTER	VIII	L	Т	Р	С
COURSE CODE / COURSE TITLE	NAT	NATURAL LANGUAGE PROCESSING					3

✓ To learn the fundamentals of natural language processing

- \checkmark To understand the use of CFG and PCFG in NLP
- \checkmark To understand the role of semantics of sentences and pragmatics
- \checkmark To apply the NLP techniques to IR applications

COURSE OUTCOMES

On completion of the course, students will be able to							
CO1	Learn the given text with basic Language features.						
CO2	Understand the use of different statistical approaches for different types of NLP applications.						
CO3	Apply a rule based system to tackle morphology/syntax of a language.						
CO4	Analyze a tag set to be used for statistical processing for real-time applications.						
CO5	Design an innovative application using NLP components.						

CO – PO MAPPING											PSO's				
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	1	-	-	-	-	1	1	-	-	3	2	1
CO 2	3	3	3	2	-	-	-	-	1	1	-	-	3	2	1
CO 3	3	3	2	1	-	-	-	-	1	1	-	-	3	2	1
CO 4	3	2	3	2	-	-	-	-	1	1	-	-	3	2	1
CO 5	3	3	2	1	-	-	-	-	1	1	-	-	3	2	1
со	3	3	2	1	-	-	-	-	1	1	-	-	3	2	1

YEAR	IV	SEMESTER	VIII	L	Т	Р	С
COURSE CODE / COURSE TITLE		ROBOTICS		3	0	0	3

- ✓ The objective of this course is to import knowledge about industrial robots for their control and design.
- ✓ To study the use of various types of End of Effectors and Sensors
- ✓ To impart knowledge in Robot Kinematics and Programming
- \checkmark To learn Robot safety issues and economics.

COURSE OUTCOMESOn completion of the course, students will be able toCO1Remember kinematic and dynamic analyses with simulation.CO2Design control laws for a robot.CO3Apply the Integrate mechanical and electrical hardware for a real prototype of robotic device.CO4Analyze a robotic system for given application.CO5Evaluate and develop application-based Robots.

CO – PO MAPPING											PSO's				
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	1	-	-	-	-	2	-	-	2	3	3	2
CO 2	3	2	1	1	1	-	-	-	2	-	-	2	3	3	2
CO 3	3	2	1	1	1	-	-	-	1	1	2	2	3	3	2
CO 4	3	2	2	2	1	1	2	2	1	1	2	2	3	3	2
CO 5	3	2	2	2	1	1	1	1	2	1	2	2	3	3	2
со	3	2	1	1	1	1	1	1	1	1	2	2	3	3	2

VELTECH MULTITECH DR.RANGARAJAN DR.SAKUNTHALA ENGINEERING COLLEGE

DEPARTMENT OF BIOMEDICAL ENGINEERING

PROGRAM OUTCOMES (POs):

S.NO	PROGRAM OUTCOMES
	Engineering knowledge: Apply the knowledge of mathematics, science, engineering
	fundamentals and an engineering specialization to the solution of complex engineering
PO1	problems.
PO2	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.
PO3	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.
PO4	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.
PO5	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.
PO6	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.
PO7	Environment and sustainability: Understand the impact of the professional engineering
	solutions in societal and environmental contexts, and demonstrate the knowledge of, and need
D OO	for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and
DOG	Norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in
	diverse teams, and in multidisciplinary settings.
PO10	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.
PO11	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
PO12	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.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

S.NO	PROGRAM SPECIFIC OUTCOMES
1.	Able to understand the mathematical and physical foundations of biomedical
	engineering and how these are applied in the analysis of biological systems for
	biomedical instruments and technological advancement for health care .(Understand)
	Able to design a variety of electronic devices and software for applications including
2.	biomedical instrumentation, physiological measurement, rehabilitation engineering and
	medical image & informatics.(Design)
	Able to meet desired needs within realistic constraints such as economic, environmental,
3.	social, ethical, health and safety, manufacturability and sustainability.(society,
	Environmental, sustainability)

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The program educational objectives for the Biomedical Engineering program describe accomplishments that graduates are expected to attain within four years after graduation.

- To enrich the students to liberate themselves in learning skills involving complex thoughts, problem analysis and finding solutions.
- To identify opportunities and develop the level of competency in technical and communication skills to establish their excellence in professionalism.
- To implement the versatile qualities acquired to a chosen career, by providing an impact for the sustainable growth and success.
- To explore their ideas in research and promoting them to be exceptionally good in meeting the challenges of innovation and creativity.

VEL TECH MULTI TECH Dr. RANGARAJAN Dr. SAKUNTHALA ENGINEERING COLLEGE

B.E. DEGREE (BIOMEDICAL ENGINEERING PROGRAMME)

(AN AUTOTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY)

REGULATIONS 2019

CREDIT DISTRIBUTION								
S. No.	Code	Category	Credits (Regular)	Credits (Lateral)				
1	HSS	Humanities and Social Sciences	8	2				
2	BS	Basic Sciences	23	6				
3	ES	Engineering sciences	19	4				
4	PC	Programme Core	80	73				
5	PE	Programme Electives	18	18				
6	OE	Open Electives	6	6				
7	MC	Mandatory Courses	0	0				
8	PROJ	Project	12	12				
		Total Credits	166	121				

COURSES OF STUDY

SEMESTER – I

Sl. No	Course Code	Name of the Course	Category	No. of Week	Credits							
				L	Т	Р						
	THEORY											
1	191HS101	English for Engineering Students	HSS	3	0	0	3					
2	191CH101	Engineering Chemistry	BS	3	0	0	3					
3	191PH101	Engineering Physics	BS	3	0	0	3					
4	191MA101	Engineering Mathematics I	BS	3	0	0	3					
5	191ME111	Basic Civil and Mechanical Engineering	ES	3	0	0	3					
6	191EE111	Basic Electrical and Electronics Engineering	ES	3	0	0	3					
7	191ME112	Engineering Graphics	ES	2	2	0	3					
PRACTICAL												
1	191PH10A	Physics Laboratory	BS	0	0	2	1					
2	191CH10A	Chemistry laboratory	BS	0	0	2	1					
			Total	19	4	4	23					
SEMESTER – II

Sl. No	Course Code	Name of the Course	Category	No. of Week	No. of Periods / Week		Credits
110				L	Т	Р	-
		THEORY	Y			_	
1	191HS201	Environment Science and Engineering	HSS	3	0	0	3
2	191MA201	Engineering Mathematics II	BS	2	2	0	3
3	191PH201	Materials Science For Electronics Engineering	BS	3	0	0	3
4	191EC21A	Electronic Devices and Circuits	ES	3	0	0	3
5	191BM221	Introduction To Biomedical Engineering	PC	3	0	0	3
6	191BM222	Fundamentals Of Biochemistry	PC	3	0	0	3
		PRACTIC	AL			_	
1	191ME21A	Engineering Practices Laboratory	ES	0	0	4	2
2	191EC21A	Circuits and Devices Laboratory	ES	0	0	2	1
3	191BM22A	Bio-Chemistry Laboratory	PC	0	0	2	1
			Total	17	2	8	22

SEMESTER – III

Sl.	Course	Name of the Course	Category	No. of Periods / Week			Credit s
INO	Code			L	Т	Р	8
	L	THEORY	I		1		
1	191MA301	Linear Algebra And Numerical Methods	BS	2	2	0	3
2	191CS311	Data Structures In C	ES	3	0	0	3
3	191BM321	Anatomy And Human Physiology	PC	3	0	0	3
4	191BM322	Digital Logic Design	PC	3	0	0	3
5	191BM323	Signals And System	PC	3	0	0	3
6	191BM324	Biosensors & Instrumentation	PC	3	0	0	3
		PRACTICA	L				I
7	191CS31A	Data Structures In C Laboratory	ES	0	0	2	1
8	191BM32A	Anatomy And Human Physiology Laboratory	PC	0	0	2	1
9	191BM32B	Digital Design Laboratory	PC	0	0	2	1
	Total					6	21

SEMESTER – IV

S1.	Course	Name of the Course	~	No. of Periods / Week			Credit
No	Code	Name of the Course	Category	Week			s
				L	Т	Р	
		THEORY	I				<u> </u>
1	191MA401	Probability And Random Process	BS	2	2	0	3
2	191BM421	Biomedical Instrumentation	PC	3	0	0	3
3	191BM422	Biomechanics	PC	3	0	0	3
4	191BM423	Biosignal Processing	PC	3	0	0	3
5	191BM424	Pathology And Microbiology	PC	3	0	0	3
6	191BM425	Bioethics & Intellectual Property	PC	3	0	0	3
		Rights (IPRs)					
		PRACTICA	L				
7	191HS40A	Reading And Writing Skill	HSS	0	0	2	1
		Laboratory					
8	191BM42B	Biosignal Processing Lab	PC	0	0	2	1
9	191BM42A	Pathology And Microbiology Lab	PC	0	0	2	1
	Total					6	21

SEMESTER – V

Sl.	Course	Name of the Course	Category	No. o Week	ls /	Credits	
INO	Code			L	Т	Р	
		THEORY	ľ			•	
1	191BM521	Diagnostic And Therapeutic Equipment	PC	3	0	0	3
2	191BM522	Hospital Management	PC	2	2	0	3
3	191BM523	Control Systems in medicine	PC	3	0	0	3
4	191BM524	Biomaterials & Artificial Organs	PC	3	0	0	3
5	191BM525	Microprocessor& Microcontroller	PC	3	0	0	3
6		Program Elective-I	PE	3	0	0	3
		PRACTICA	AL	1	1		<u> </u>
7	191BM52B	Diagnostic And Therapeutic Equipments Lab	PC	0	0	2	1
8	191BM52A	Microprocessor & Microcontroller Lab	PC	0	0	2	1
		Το	otal	16	4	4	20

SEMESTER – VI

Sl. No	Course Code	Name of the Course	Category	No. o Weel	No. of Periods / Week		Credit s
				L	Т	Р	
		THEORY					
1	191BM621	Advanced Microcontrollers and its Applications	PC	3	0	0	3
2	191BM622	Communication Systems	PC	3	0	0	3
3	191BM623	Medical Informatics	PC	3	0	0	3
4	191BM624	Radiological Equipments	PC	3	0	0	3
5		Program Elective-II	PE	3	0	0	3
6		Open Elective-I	OE	3	0	0	3
		PRACTICA	L	•	•		
7	191HS60A	Communication Skills Laboratory	HSS	0	0	2	1
8	191BM62A	Communication Systems Laboratory	PC	0	0	2	1
9	191BM62B	Innovation Practices Laboratory	PC	0	0	2	1
		То	otal	18	0	6	21

SEMESTER – VII

Sl. Course Code		Name of the Course	Category	No. o Week	ls /	Credit s	
No				L	Т	Р	S
		THEORY			-		
1	191BM721	Medical Device Design	PC	3	0	0	3
2	191BM722	Medical Imaging Processing	PC	2	2	0	3
3	191BM723	Medical Robotics	PC	3	0	0	3
4		Program Elective-III	PE	3	0	0	3
5		Program Elective-IV	PE	3	0	0	3
6		Open Elective-II	OE	3	0	0	3
		PRACTICA	Ĺ		-		
7	191BM72A	Medical Devices Laboratory	PC	0	0	2	1
8	191BM72B	Medical Image Processing Laboratory	PC	0	0	2	1
9	191BM77A	Project Work Phase-I	PROJ	0	0	4	2
		17	2	8	22		

SEMESTER – VIII

Sl. No	Course Code	Name of the Course	Category	No. of Week	Credits					
				L	Т	Р				
	THEORY									
1		Program Elective-V	PE	3	0	0	3			
2		Program Elective-VI	PE	3	0	0	3			
	•	PRACTICA	ÀL							
3	191BM87A	Project Work Phase-II	PROJ	0	0	20	10			
	Total				0	20	16			

LIST OF PROGRAM ELECTIVES

SEMESTER-V

PROGRAM ELECTIVE-I

S.NO	Course	Course Title	Category	L	Т	Р
	Code					
1	191BM531	Biomechanics	3	0	0	3
2	191BM532	Biometric Systems	3	0	0	3
3	191BM533	Tissue Engineering	3	0	0	3
4	191BM534	VLSI Design	3	0	0	3

SEMESTER-VI

PROGRAM ELECTIVE-II

S.NO	Course Code	Course Title	Category	L	Т	Р
1	191BM631	Medical Optics	3	0	0	3
2	191BM632	Nanotechnology And Applications	3	0	0	3
3	191BM633	Telehealth Technology	3	0	0	3
4	191BM634	Virtual Reality	3	0	0	3

SEMESTER-VII

PROGRAM ELECTIVE-III

S.NO	Course	Course Title	Category	L	Т	Р
	Code					
1	191BM731	Brain Computer Interface And Its Applications	3	0	0	3
2	191BM732	Drug Delivery System	3	0	0	3
3	191BM733	Lasers In Medicine	3	0	0	3
4	191BM734	Physiological Modelling	3	0	0	3

SEMESTER-VII

PROGRAM ELECTIVE-IV

S.NO	Course Code	Course Title	Category	L	Т	Р
1	191BM735	Biofluids And Dynamics	3	0	0	3
2	191BM736	Bioinformatics	3	0	0	3
3	191BM737	Computer Networks	3	0	0	3
4	191BM738	Pattern Recognition And Neural Networks	3	0	0	3

SEMESTER-VIII

PROGRAM ELECTIVE-V

S.NO	Course Code	Course Title	Category	L	Т	Р
	191BM831	Assist Devices	3	0	0	3
1	191BM832	Neural Engineering	3	0	0	3
3	191BM833	Principles Of Management	3	0	0	3
4	191BM834	Soft Computing Techniques	3	0	0	3

SEMESTER-VIII

PROGRAM ELECTIVE-VI

S.NO	Course Code	Course Title	Category	L	Т	Р
	191BM835	Electrical Safety And Quality Assurance	3	0	0	3
1	191BM836	Embedded And Real Time	3	0	0	3

		Systems				
2	191BM837	Rehabilitation Engineering	3	0	0	3
3	191BM838	Wearable Systems	3	0	0	3

OPEN ELECTIVE OFFERED TO OTHER DEPARTMENTS

S.NO	COURSE CODE	COURSE TITLE	L	Т	Р	С
1	191BM541	Basic Of Bioinformatics	3	0	0	3
2	191BM542	Electronics In Medicine	3	0	0	3
3	191BM543	Introduction To Biomedical Devices	3	0	0	3
4	191BM544	Introduction To Human Anatomy Systems	3	0	0	3
5	191BM545	Principles Of Telemedicine	3	0	0	3

OPEN ELECTIVE OFFERED BY OTHER DEPARTMENTS

S.NO	COURSE CODE	NAME OF THE COURSE	L	Τ	Р	CREDITS	DEPT
	191CE541	Advanced course in Entrepreneurship(should be opted as Open Elective II)	3	0	0	3	CIVIL
	191CE542	Air Pollution And Control Engineering	3	0	0	3	CIVIL
	191CE543	Construction materials and Techniques	3	0	0	3	CIVIL
	191CE544	Foundational Course on Entrepreneurship	3	0	0	3	CIVIL
	191CE545	Disaster Management	3	0	0	3	CIVIL
	191CE546	Housing Planning and management	3	0	0	3	CIVIL

191CE547	Maintanence, Repair and rehabilitation	3	0	0	3	CIVIL
	structures					
191CE548	Municipal Solid waste management	3	0	0	3	CIVIL
191CE549	Railways, Airports, Docks and harbors	3	0	0	3	CIVIL
	Engineering					
191CE5410	Tall buildings	3	0	0	3	CIVIL
191CE5411	Traffic Engineering and Management	3	0	0	3	CIVIL
191CS541	Big Data Analytics	3	0	0	3	CSE
191CS542	Data Warehousing and Data Mining	3	0	0	3	CSE
191CS543	Grid and Cloud Computing	3	0	0	3	CSE
191CS544	Human Computer Interaction	3	0	0	3	CSE
191CS545	Information Security	3	0	0	3	CSE
191CS546	Information Theory and Coding	3	0	0	3	CSE
191CS547	Internet-of-Things	3	0	0	3	CSE
 191CS548	Machine Learning Techniques	3	0	0	3	CSE
191CS549	Multi-Core Architectures and Programming	3	0	0	3	CSE
 191CS5410	Problem Solving and Python Programming	3	0	0	3	CSE
 191CS5411	Soft Computing	3	0	0	3	CSE
 191CS5412	Software Testing	3	0	0	3	CSE
191CS5413	Software Project Management	3	0	0	3	CSE
 191EC541	Cognitive Radio	3	0	0	3	ECE
191EC542	Computer Networks	3	0	0	3	ECE
191EC543	Digital Image Processing	3	0	0	3	ECE
191EC544	Medical Electronics	3	0	0	3	ECE

191EC545	MEMS and NEMS	3	0	0	3	ECE
191EC546	Speech Signal Processing	3	0	0	3	ECE
191EC547	Robotics and Automation	3	0	0	3	ECE
191EC548	Satellite Communication	3	0	0	3	ECE
191EC549	Sensors and Transducers	3	0	0	3	ECE
 191EC5410	Telecommunication Network Management	3	0	0	3	ECE
 191EC5411	Wireless Communication	3	0	0	3	ECE
 191EC5412	Wireless Networks	3	0	0	3	ECE
 191EE541	Basics of electric power generation	3	0	0	3	EEE
191EE542	Design,Estimation and costing of electrical systems	3	0	0	3	EEE
 191EE543	Electrical machines and appliactions	3	0	0	3	EEE
 191EE544	Energy management and audit	3	0	0	3	EEE
191EE545	Electrical power utilization and safety	3	0	0	3	EEE
191EE546	Introduction to smart grid	3	0	0	3	EEE
191EE547	Non- conventional energy sources	3	0	0	3	EEE
191EE548	Power Electronics and applications	3	0	0	3	EEE
191IT541	Artificial Intelligence	3	0	0	3	IT
191IT542	Blockchain Technologies	3	0	0	3	IT
191IT543	C# & .Net Programming	3	0	0	3	IT
191IT544	Cloud Computing	3	0	0	3	IT
191IT545	Database Management systems	3	0	0	3	IT
191IT546	Machine Learning	3	0	0	3	IT
191IT547	Mobile computing	3	0	0	3	IT

191IT548	Software engineering and design	3	0	0	3	IT
191ME541	Advanced Materials	3	0	0	3	MECH
191ME542	Design Thinking	3	0	0	3	MECH
191ME543	Energy Conservation And Management	3	0	0	3	MECH
191ME544	Lean Six Sigma	3	0	0	3	MECH
191ME545	Material Science and technology	3	0	0	3	MECH
191ME546	Renewable energy sources	3	0	0	3	MECH
191ME547	Testing Of Materials	3	0	0	3	MECH

VEL TECH MULTI TECH DR.RANGARAJAN DR.SAKUNTHALA ENGINEERING COLLEGE B.E Degree (Biomedical Engineering) Programme (An Autonomous Institution affiliated to Anna University)

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICLE 1: BIO ENGINEERING	VERTICAL 2: MEDICAL DEVICE INNOVATION AND DEVELOPMENT	VERTICAL 3: MANAGEMENT (HEALTHCARE)	VERTICAL 4: MECHANICS	VERTICAL 5: SIGNAL AND IMAGE PROCESSING	VERTICAL 6: COMMUNICATION	VERTICAL 7: ADVANCED HEALTHCARE DEVICES
Biomedical Optics	Medical Device	Medical waste	Biomechanics	Biometric Systems	Wearable Devices	Bio MEMS
and photonics	Regulation	Management				
Tissue	Electrical Safety and	Principles of	Rehabilitation	Brain computer	Virtual Reality	Human Assist Devices
Engineering	Quality Assurance	Management	Engineering	Interface and its Applications		
Biomaterials	Bioethics and	Bio Statistics	Physiological	Medical Imaging	Computer Networks	Nanotechnology and its
	Intellectual Property Rights		Modelling	Systems		Application
Artificial Organs	Foundation skills in	Hospital	Ergonomics	Speech Processing	Medical Informatics	Drug Delivery Systems
and Implants	Integrated Product Development	Management				
Genetic	Rapid Prototyping	Forensic Science in	Assistive	Computer Vision	Telehealth in	Medical Robotics
Engineering		Healthcare	Technology		Medicine	
Neural	Medical Innovation	Clinical Engineering	Haptics	Pattern and	Communication	Radiological
Engineering	and Entrepreneurship			Neural Networks	Systems	Equipments
-	-	-	-	-	-	Advancements in Healthcare Technology
-	-	-	-	-	-	Therapeutic Equipment

VELTECH MULTITECH DR.RANGARAJAN DR.SAKUNTHALA ENGINEERING COLLEGE DEPARTMENT OF BIOMEDICAL ENGINEERING REGULATION-2019

SI No	Course Code	Course	Mapping with PO's & PSO's PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12 PS01 PS02														
51 100	Course Code	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	191HS101	English for Engineering Students	-	-	-	-	-	-	-	3	3	3	-	2	-	-	-
2	191CH101	Engineering Chemistry	3	3	2	2	-	2	2	I	-	-	I	2	1	-	-
3	191PH101	Engineering Physics	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
4	191MA101	Engineering Mathematics I	3	3	2	2	1	-	-	-	-	-	-	1	-	-	1
5	191ME111	Basic Civil and Mechanical Engineering	3	3	1	1	-	2	2	1	-	-	-	2	-	-	-
6	191EE111	Basic Electrical and Electronics Engineering	3	2	2	1	1	-	-	-	-	-	-	-	-	-	-
7	191ME112	Engineering Graphics	1	1	2	-	3	1	-	-	-	1	1	1	-	-	-
8	191PH10A	Physics Laboratory	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
9	191CH10A	Chemistry laboratory	3	3	2	2	_	2	2	2	2	-	-	2	1	-	-
10	191HS201	Environment Science and Engineering	3	3	2	2	-	2	3	2	-	-	-	2	-	-	-
11	191MA201	Engineering Mathematics II	3	3	2	2	2	I	-	-	-	-	-	-	2	1	-
12	191PH201	Materials Science For Electronics Engineering	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
13	191EC21A	Electronic Devices and Circuits	3	3	2	2	-	-	-	-	-	-	-	2	2	1	-
14	191BM221	Introduction To Biomedical Engineering	3	-	2	2	-	2	-	-	-	-	-	1	3	1	-
15	191BM222	Fundamentals Of Biochemistry	3	3	3	2	1	-	-	2	-	-	-	1	3	2	-
16	191ME21A	Engineering Practices Laboratory	3	3	2	2	-	2	3	2	-	-	-	2	2	1	-

17	191EC21A	Circuits and Devices Laboratory	3	3	2	2	-	-	-	-	-	-	-	2	3	2	-
18	191BM22A	Bio-Chemistry Laboratory	3	-	2	2	-	2	-	-	-	-	-	2	3	1	1
19	191MA301	Linear Algebra And Numerical Methods	3	3	-	-	3	-	-	-	-	-	-	1	1	-	-
20	191CS311	Data Structures In C	3	3	3	3	3	3	-	-	-	-	3	3	3	3	2
21	191BM321	Anatomy And Human Physiology	3	1	1	2	1	1	1	1	1	1	2	3	2	1	1
22	191BM322	Digital Logic Design	3	3	3	1	-	-	-	-	-	-	-	1	3	2	1
23	191BM323	Signals And System	3	3	3	3	2	2	2	2	2	1	2	2	3	3	3
24	191BM324	Biosensors & Instrumentation	3	3	3	3	2	2	1	1	1	1	1	3	3	1	2
25	191CS31A	Data Structures In C Laboratory	3	3	3	2	-	1	1	1	1	2	-	3	3	2	3
26	191BM32A	Anatomy And Human Physiology Laboratory	3	2	2	1	2	2	-	1	1	1	-	2	3	1	1
27	191BM32B	Digital Design Laboratory	3	3	3	2	-	-	-	-	-	-	-	2	3	2	2
28	191MA401	Probability And Random Process	3	2	-	-	3	-	-	-	-	-	-	1	1	-	-
29	191BM421	Biomedical Instrumentation	3	3	2	1	1	1	1	-	-	-	-	2	3	2	1
30	191BM422	Biomechanics	3	2	1	1	3	1	1	2	-	-	-	2	3	2	1
31	191BM423	Biosignal Processing	3	2	2	2	2	2	1	-	-	-	-	2	3	2	1
32	191BM424	Pathology And Microbiology	2	3	2	3	3	3	2	3	3	3	3				2
33	191BM425	Bioethics & Intellectual Property Rights (IPRs)	-	-	-	2	-	1	1	3	-	1	-	1	1	-	-

35	191HS40A	Reading And Writing Skill Laboratory	-	-	-	-	-	-	-	2	3	3	-	3	1	-	-
36	191BM42B	Biosignal Processing Lab	3	3	3	2	3	1	1	-	-	-	-	2	3	2	1
37	191BM42A	Pathology And Microbiology Lab	2	3	3	1	2	-	-	2	2	-	-	2	3	2	1
38	191BM521	Diagnostic And Therapeutic Equipment	3	2	3	3	3	3	3	0	0	0	0	0	3	3	2
39	191BM522	Hospital Management	-	-	-	-	-	3	2	3	1	-	2	1	-	-	2
40	191BM523	Control Systems in medicine	3	3	3	3	2	-	-	-	-	-	-	-	2	2	3
41	191BM524	Biomaterials & Artificial Organs	2	-	3	-	-	3	3	1	2	-	-	3	3	3	2
42	191BM525	Microprocessor& Microcontroller	3	3	3	3	2	-	-	-	-	-	-	-	2	2	3
43	191BM52B	Diagnostic And Therapeutic Equipments Lab	3	2	2	2	-	2	2	2	-	-	-	3	3	3	2
44	191BM52A	Microprocessor & Microcontroller Lab	3	3	3	3	2	-	-	-	-	-	-	-	2	2	3
45	191BM621	Advanced Microcontrollers and its Applications	3	2	2	2	2	-	-	-	-	-	-	2	2	2	-
46	191BM622	Communication Systems	3	2	2	2	-	2	-	-	-	-	-	2	2	2	-
47	191BM623	Medical Informatics	3	-	-	-	2	1	1	1	-	-	-	-	1	1	1
48	191BM624	Radiological Equipments	3	3	2	3	-	1	-	1	-	-	-	1	2	1	1
49	191HS60A	Communication Skills Laboratory	-	-	-	-	-	-	-	-	1	3	3	-	-	-	-
50	191BM62A	Communication Systems Laboratory	3	2	2	2	-	2	-	-	-	-	-	2	2	2	-
51	191BM62B	Innovation Practices	3	3	3	3	1	1	1	1	1	2	1	2	3	1	1

		Laboratory															
52	191BM721	Medical Device Design	3	2	1	1	-	1	-	-	-	-	-	1	3	1	1
53	191BM722	Medical Imaging Processing	3	3	3	2	2	-	-	-	-	-	-	1	3	1	-
54	191BM723	Medical Robotics	3	3	3	3	2	3	-	-	2	-	-	2	3	2	1
55	191BM72A	Medical Devices Laboratory	3	3	2	2	2	1	-	-	-	-	-	2	3	1	-
56	191BM72B	Medical Image Processing Laboratory	3	3	3	3	3	-	-	-	-	-	-	1	3	1	-
57	191BM77A	Project Work Phase-I	3	3	3	3	1	1	1	1	1	2	1	3	3	1	1
58	191BM78A	Project Work Phase-II	3	3	3	3	1	1	1	1	1	2	1	3	3	1	1
59	191BM531	Biomems	3	3	3	3	3	3	-	-	-	-	-	1	2	1	-
60	191BM532	Biometric Systems	3	2	3	2	2	2	-	2	1	1	-	2	3	3	2
61	191BM533	Tissue Engineering	3	1	1	1	-	1	-	-	-	-	-	1	2	1	-
62	191BM534	VLSI Design	3	3	3	2	1	-	-	-	-	-	-	-	2	1	-
63	191BM631	Medical Optics	3	2	2	3	3	2	3	1	2	2	3	2	3	3	3
64	191BM632	Nanotechnology And Applications	2.4	2.4	2.2	2.4	2.6	2.6	2.2	2.2	2.2	2.6	2.2	2.6	2	2.6	2
65	191BM633	Telehealth Technology	2	2	2	2	2	2	2	2	2	3	2	3	2	3	2
66	191BM634	Virtual Reality	3	3	3	3	2	2	2	2	3	3	2	3	3	3	3
67	191BM731	Brain Computer Interface And Its Applications	3	2	2	2	2	1	2	1	1	1	-	-	2	2	-
68	191BM732	Drug Delivery System	3	3	3	2	-	2	-	-	-	-	-	2	3	2	-

69	191BM733	Lasers In Medicine	3	2	2	2	-	2	-	1	-	-	-	1	2	1	-
70	191BM734	Physiological Modelling	3	3	3	3	3	1	-	-	-	-	-	-	3	2	-
71	191BM735	Biofluids And Dynamics	3	2	2.2	2	2	-	-	-	-	-	-	-	2.6	1.2	-
72	191BM736	Bioinformatics	3	3	3	1.6	2	1	-	-	-	-	-	2	3	2	-
73	191BM737	Computer Networks	3	2	2	2	2	2	-	-	-	-	-	1	3	2	-
74	191BM738	Pattern Recognition And Neural Networks	3	2	2	2	2	-	-	-	-	-	-	3	3	3	-
75	191BM831	Assist Devices	3	2	2	2	2	2	2	1	-	-	-	3	3	2	3
76	191BM832	Neural Engineering	3	2	2	2	2	2	1	-	1	1	1	3	3	3	3
77	191BM833	Principles Of Management	3	-	-	-	-	3	3	3	3	2	2	2	-	-	-
78	191BM834	Soft Computing Techniques	2	-	1	2	2	-	-	2	2	-	1	3	3	1	3
79	191BM835	Electrical Safety And Quality Assurance	3	3	3	3	2	2	3	1	2	2	3	3	3	3	3
80	191BM836	Embedded And Real Time Systems	3	2	3	2	3	2	2	1	1	1	1	3	3	3	3
81	191BM837	Rehabilitation Engineering	2	2	3	2	2	2	3	1	2	2	3	3	3	-	2
82	191BM838	Wearable Systems	3	3	3	2	2	1	1	1	1	1	-	2	3	3	3

YEAR	1	SEMESTER	1	L	Т	Р	С
COURSECODE/ COURSE TITLE		191HS101/ENGLISH FOR ENGINEERING STUDENTS		3	0	0	3

- CO1 Infer meanings of unfamiliar words from context
- **CO2** Enable to achieve linguistic competence and be able to use grammar as a tool or resource in the comprehension and creation of oral and written discourse efficiently according to the situation.
- **CO3** Write cohesively, coherently and flawlessly with a wide range of vocabulary and organizing their ideas logically on a topic.
- **CO4** Activate and reinforce the habit of reading and writing effectively in their discipline.
- CO5 Collaborate with multicultural environment.

					(CO-PC)&PS() MAI	PPING	Ţ					
СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	-	-	-	-	-	-	-	3	3	3	-	2	-	-	_
CO2	-	-	-	-	-	-	-	3	3	3	-	2	-	-	-
CO3	-	-	-	-	-	-	-	3	3	3	-	2	-	-	-
CO4	-	-	-	-	-	-	-	3	3	3	-	2	-	-	-
CO5	-	-	-	-	-	-	-	3	3	3	-	2	-	-	-
со	-	-	-	-	-	-	-	3	3	3	-	2	-	-	-

YEAR	1	SEMESTER	1	L	Т	Р	С
COURSECODE/ COURSE TITLE		191CH101 / ENGINEERING CHEMISTRY		3	0	0	3

- **CO1** Analyse microscopic chemistry in terms of atomic, molecular and Intermolecular forces for real time applications of semiconductors.
- CO2 Investigate the various water treatment and softening methods.
- **CO3** Appraise the types and mechanism of electrochemical reaction in batteries and fuel cells.
- CO4 Explain the basic principle, types and mechanism of polymerization process and techniques.
- **CO5** Assess the properties, characterization and applications of advanced materials for energy storage.

						CC)-PO&	PSO N	APPI	ING					
СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	2	2	-	_	-	_	2	1	_	-
CO2	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-
CO3	3	3	2	2	-	2	2	-	_	-	_	2	1	-	-
CO4	3	3	2	2	-	2	2	-	_	-	_	2	1	_	-
CO5	3	3	2	2	-	2	2	-	_	-	_	2	1	_	-
CO	3	3	2	2	-	2	2	-	_	-	_	2	1	_	
															_

YEAR	1	SEMESTER	1	L	Т	Р	C
COURSECODE/ COURSE TITLE		191MA101/ENGINEERINGMATHEMATICS-I		3	0	0	3

- **CO1** Analyze the characteristics equation of a linear system with Eigen values and vectors for practical application.
- **CO2** Determine the bending of family of curves using differential calculus which deals in various disciplines.
- **CO3** Apply partial derivatives in various engineering problems.
- CO4 Identify and solve the real time problems using higher order differential equations.

						CO-l	PO&P	SO M	APPIN	NG					
СО	PO 1	P 0 2	P 0 3	P 0 4	P 0 5	P 0 6	P 0 7	P 0 8	P 0 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	2	-	-	-	-	-	-	1	-	-	1
CO2	3	3	2	2	1	-	-	-	-	-	-	1	-	-	1
CO3	3	3	2	2	1	-	-	-	-	-	-	1	-	-	1
CO4	3	3	2	2	1	-	-	-	-	-	-	1	-	-	1
CO5	3	3	2	2	1	-	-	-	-	-	-	1	-	-	1
со	3	3	2	2	1	-	_	-	-	-	-	1	-	-	1

YEAR	1	SEMESTER	1	L	Т	Р	C
COURSECODE/ COURSE TITLE		191PH101/ENGINEERINGPHYSICS		3	0	0	3

- **CO1** Demonstrate the proficiency on the properties of matter and its applications
- **CO2** Describe the working principles of Laser and its developments in industrial and medical applications
- CO3 Explain the propagation of waves in optical fibres and their applications
- **CO4** Apply the theory of wave nature of particles in various microscopic applications
- CO5 Analyze the structure of materials and its crystal growth techniques

					CC)-PO&	PSO M	IAPPIN	١G						
СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO2	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO3	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO4	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO5	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
СО	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-

YEAR	1	SEMESTER	1	L	Т	Р	С
COURSECODE/ COURSE TITLE		191ME111/BASIC CIVIL AND MECHANICAL ENGINEERING		3	0	0	3

- CO1 Explain the usage of construction material and proper selection of construction materials
- CO2 Explain about water resources, sewage treatment and transportation systems
- CO3 Explain about the components use in power plants
- CO4 Describe the internal combustion engines
- CO5 Explain about the renewable energy sources and refrigeration cycles

					C	0 -PO 8	kPSO N	MAPPI	NG						
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	1	1	-	2	2	1	-	-	-	2	-	-	-
CO2	3	3	1	1	-	2	2	1	-	-	-	2	-	-	-
CO3	3	3	1	1	-	2	2	1	-	-	-	2	-	-	-
CO4	3	3	1	1	-	2	2	1	-	-	-	2	-	-	-
CO5	3	3	1	1	-	2	2	1	-	-	-	2	-	-	-
СО	3	3	1	1	-	2	2	1	-	-	-	2	-	-	-

YEAR	1	SEMESTER	1	L	Т	Р	С
COURSECODE/ COURSE TITLE		191EE111 /BASIC ELECTRICAL AND ELECTRONICS ENGINEERING		3	0	0	3

- CO1 Summarizes about different structures of Power system and safety measures.
- CO2 Explain about the basics of Electricity
- CO3 Discuss on various electric circuits and use of measuring instruments
- **CO4** Clarify the working of basic electronic devices such as diode, transistor and operational amplifiers
- CO5 Infer about Digital Electronics and Communication System

	CO-PO&PSO MAPPING														
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	1	1	1	-	-	-	-	-	-	-	_	-	-
CO5	2	1	1	1	-	-	-	-	-	-	-	-	_	-	-
СО	3	2	2	1	1	-	-	-	-	-	-	-	-	-	-

YEAR	1	SEMESTER	1	L	Т	Р	С
COURSECODE/ COURSE TITLE		191ME112 / ENGINEERING GRAPHICS		2	2	0	3

- CO1 Draw engineering curves and apply the concepts of free hand sketching
- **CO2** Draw orthographic views of points, lines and surfaces
- CO3 Draw visualizations of simple solid objects as per orthographic projections
- CO4 Draw sections and developments made in drawing
- CO5 Draw pictorial drawings of simple objects

	CO-PO&PSO MAPPING														
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	1	1	2	-	3	1	-	-	-	1	1	1	-	-	-
CO2	1	1	2	-	3	1	-	-	-	1	1	1	-	-	-
CO3	1	1	2	-	3	1	-	-	-	1	1	1	-	-	-
CO4	1	1	2	-	3	1	-	-	-	1	1	1	-	-	-
CO5	1	1	2	-	3	1	-	-	-	1	1	1	-	-	-
СО	1	1	2	-	3	1	-	-	-	1	1	1	-	-	-

YEAR	1	SEMESTER	1	L	Т	Р	C
COURSECODE/ COURSE TITLE		191PH10A / PHYSICS LABORATORY		0	0	2	1

- **CO1** Apply the principles of properties of matter in determining the various elastic properties
- **CO2** Attains the practical knowledge, to apply principles of optics for various engineering applications
- CO3 Demonstrate the technical knowledge on Quantum Mechanical concepts

	CO-PO&PSO MAPPING														
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	РО 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO2	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO3	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
СО	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-

YEAR	1	SEMESTER	1	L	Т	Р	C
COURSECODE/ COURSE TITLE		191CH10A / CHEMISTRY LABORATORY		0	0	2	1

- **CO1** Acquireknowledgeonquantitativechemicalanalysisbyinstrumentationandvolumetric method
- **CO2** Analyzethewatersampleforhardness,chloride,sodium/potassiumcontent,dissolved oxygenetc.
- **CO3** Solveanalyticalproblemsinspectrometerandflamephotometerfortheidentification quantification

	CO-PO&PSO MAPPING														
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	-	2	2	1	2	-	-	2	1	-	-
CO2	3	3	2	2	-	2	2	1	2	-	-	2	1	-	-
CO3	3	3	2	2	-	2	2	1	2	-	-	2	1	-	-
СО	3	3	2	2	-	2	2	1	2	-	-	2	1	-	-

YEAR	1	SEMESTER	2	L	Т	Р	C
COURSECODE/ COURSE TITLE		191HS201-ENVIRONMENTAL SCIENCE ENGINEERING		3	0	0	3

- CO1 Interpret the concept, structure and function of an ecosystem.
- CO2 Identify the values and conservation methods of biodiversity.
- **CO3** Demonstrate the environmental impacts of energy development.
- **CO4** Categorize the various environmental pollutions and select suitable preventive measures.
- **CO5** Perceive the environmental effects of human population and the implementation of welfare PROFESSIONALs.
- CO6 Recall the environmental ethics and legal provisions.

Course outcome							Maj	pping	CO's	with P	'O's				
CO's	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	PSO3
CO1	3	3	2	2	-	2	3	-	-	-	-	2	-	-	-
CO2	3	3	2	2	-	2	3	2	-	-	-	2	-	-	-
CO3	3	3	2	2	-	2	3	-	-	-	-	2	-	-	-
CO4	3	3	2	2	-	2	3	-	-	-	-	2	-	-	-
CO5	3	3	2	2	-	2	3	-	-	-	-	2	-	-	-
CO6	3	3	2	2	-	2	3	2	-	-	-	2	-	-	-
Average CO	3	3	2	2	-	2	3	2	-	-	-	2	-	-	-

YEAR	1	SEMESTER	2	L	Т	Р	C
COURSECODE/ COURSE TITLE		191MA201-ENGINEERING MATHEMATICS II		2	2	0	3

- CO1: Evaluate multiple integrals using change of variables.
- CO2: Apply various integral theorems for solving engineering problems involving cubes and rectangular parallelepipeds.
- CO3: Construct analytic functions of complex variables and transform functions using conformal mappings.
- CO4 Estimate the real and complex integrals over suitable closed paths and contours.
- CO5 Compute linear differential equations using Laplace transform techniques.

Course outcome							Μ	apping	g CO's v	vith PO ^r	s					
	РО	PO	PO	PO	PO	PO	РО	PO	PO8	PO9	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	6	7			10	11	12	1	2	3
CO1:	3	3	2	2	2	-	-	-	-	-	-	-	2	1	-	-
CO2:	3	3	2	2	2	-	-	-	-	-	-	-	2	1	-	-
CO3:	3	3	2	2	2	-	-	-	-	-	-	-	2	1	-	-
CO4:	3	3	2	2	2	-	-	-	-	-	-	-	2	1	-	-
CO5:	3	3	2	2	2	-	-	-	-	-	-	-	2	1	-	-
Ave	3	3	2	2	2	-	-	-	-	-	-	-	2	1	-	-

YEAR	1	SEMESTER	2	L	Т	Р	С
COURSECODE/ COURSE TITLE		191PH201-MATERIALS SCIENCE FOR ELECTRONIC ENGINEERING		3	0	0	3

At the end of the semester the students will be able to:

CO1	Assimilate on classical electron theories, and energy band structures
CO2	Analyze the fundamentals of various magnetic materials, their properties and applications in advanced technologies
CO3	Examine the importance of sound properties in engineering fields by projecting the view of applications in medical field
CO4	Describe the significance of optical properties of materials in advanced engineering technologies
CO5	Assimilate recent technological developments, used in creating products from various bio-materials

Course outcome	Mapping CO's with PO's														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO2	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO3	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO4	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO5	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
AVG	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-

YEAR	1	SEMESTER	2	L	Т	Р	С
COURSECODE/ COURSE TITLE		191EC2A-ELECTRONIC DEVICES AND CIRCUITS		3	0	0	3

CO1	Apply the semiconductor devices in design of electronic devices.
CO2	Explain the fundamentals of transistors and amplifiers
CO3	Analyze the characteristics of different types of transistors.
CO4	Describe the significance of Power devices and display devices.
CO5	Employ the acquired knowledge in design of oscillators and feedback amplifiers.

Course outcome		Mapping CO's with PO's													
CO's	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO2	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1		3
CO1	3	3	2	2	-	-	-	-	-	-	-	2	2	1	-
CO2	3	3	2	2	-	-	-	-	-	-	-	2	2	1	-
CO3	3	3	2	2	-	-	-	-	-	-	-	2	2	1	-
CO4	3	3	2	2	-	-	-	-	-	-	-	2	2	1	-
CO5	3	3	2	2	-	-	-	-	-	-	-	2	2	1	-
Average CO	3	3	2	2	-	-	-	-	-	-	-	2	2	1	-

YEAR	1	SEMESTER	2	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM222-FUNDAMENTALS OF BIOCHEMISTRY		3	0	0	3

CO1	Understand the basics of Eukaryotes and Prokaryotes along with their functions
CO2	Describe about classification of carbohydrates and their metabolic pathways
CO3	Understand the properties and classification of proteins with characterization techniques
CO4	Describe about classification of lipids and their metabolic pathways
CO5	Discuss Structure of Purines and Pyrimidines along with metabolism and disorder of nucleotides

Course outcome	Mapping CO's with PO's														
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	-	2	2	1	2	-	-	-	-	-	1	3	1	-
CO2	3	-	2	2	-	2	-	-	-	-	-	1	3	1	-
CO3	3	-	2	2	-	1	-	-	-	-	-	1	3	1	-
CO4	3	-	2	2	-	2	-	-	-	-	-	1	3	1	-
CO5	3	-	2	1	-	2	-	-	-	-	-	1	3	1	-
Average CO	3	-	2	2	-	2	-	-	-	-	-	1	3	1	-

YEAR	1	SEMESTER	2	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM221- INTRODUCTION TO BIOMEDICAL ENGINEERING		3	0	0	3

CO1	Explain the fundamental concepts of different systems in anatomy and physiology
CO2	Demonstrate the metabolism concepts.
CO3	Demonstrate the basic ideas of health monitoring devices used in health care.
CO4	Explain the concepts of biomaterials and idea of biomechanics used in biomedical engineering design concepts
CO5	Understand the ethical issues to be followed while handling Biomedical Engineering devices.

Course outcome	Mapping CO's with PO's														
CO's	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	PSO 3
C01	3	2	1	1	-	-	-	-	-	-	-	-	2	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	3	3	2	1	-	-	-	-	-	-	1	3	2	-
CO4	3	3	3	2	1	-	-	-	-	-	-	1	3	2	-
CO5	3	-	-	1	-	-	-	3	-	-	-	-	2	-	-
Average CO	3	3	3	2	1	-	-	2	-	-	-	1	3	2	-

YEAR	1	SEMESTER	2	L	Т	Р	C
COURSECODE/ COURSE TITLE		191EC21A-CIRCUITS AND DEVICES LAB		0	0	2	1

- **CO1** Ability to fabricate electrical and electronics circuits.
- **CO2** Demonstrate wide knowledge on mechanical and civil operations

Course outcom e	Mapping CO's with PO's														
CO's	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	PSO 3
CO1	3	3	2	2	-	-	-	-	-	-	-	2	3	2	-
CO2	3	3	2	2	-	-	-	-	-	-	-	2	3	2	-
Averag e CO	3	3	2	2	-	-	-	-	-	-	-	2	3	2	-

YEAR	1	SEMESTER	2	L	Т	Р	С
COURSECODE/ COURSE TITLE		191ME21A-ENGINEERING PRACTICES LABORATORY		0	0	4	2

CO1	Assimilate on classical electron theories, and energy band structures
CO2	Analyze the fundamentals of various magnetic materials, their properties and applications in advanced technologies
CO3	Examine the importance of sound properties in engineering fields by projecting the view of applications in medical field
CO4	Describe the significance of optical properties of materials in advanced engineering technologies
CO5	Assimilate recent technological developments, used in creating products from various bio-materials

Course outcome	Mapping CO's with PO's														
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	-	2	3	-	-	-	-	2	2	1	-
CO2	3	3	2	2	-	2	3	2	-	-	-	2	2	1	-
CO3	3	3	2	2	I	2	3	-	-	-	-	2	2	1	-
CO4	3	3	2	2	-	2	3	-	-	-	-	2	2	1	-
CO5	3	3	2	2	-	2	3	-	-	-	-	2	2	1	-
CO6	3	3	2	2	-	2	3	2	-	-	-	2	2	1	-
Average CO	3	3	2	2	-	2	3	2	-	-	-	2	2	1	-
YEAR	2	SEMESTER	2	L	Т	Р	C								
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COURSECODE/ COURSE TITLE		191BM22A-BIOCHEMISTRY LAB		0	0	2	1								

On the successful completion of the course, students will be able to

CO1	Understand the Biochemistry laboratory functional components
CO2	Understand the basics principle of preparation of buffers
CO3	Have a sound knowledge of qualitative test of different biomolecules.
CO4	Understand the basics knowledge of Biochemical parameter and their interpretation in Blood sample
CO5	Have a sound knowledge of separation technology of proteins and amino acids.

Course outcome	Mapping CO's with PO's														
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	-	2	3	1	2	-	-	•	-	-	1	3	1	1
CO2	3	-	2	3	-	2	-	-	-	-	-	1	3	1	1
CO3	3	-	2	2	-	1	-	-	-	-	-	2	3	1	1
CO4	3	-	2	2	-	2	-	-	-	-	-	2	3	1	1
CO5	3	-	2	2	-	2	-	-	-	-	-	2	3	1	1
Average CO	3	-	2	2	-	2	-	-	-	-	-	2	3	1	1

YEAR	2	SEMESTER	3	L	Т	Р	С
COURSECODE/ COURSE TITLE		191MA301-LINEAR ALGEBRA AND NUMERICAL METHODS		2	2	0	3

After successful completion of the course, students should be able to:

- Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
- Demonstrate accurate and efficient use of advanced algebraic techniques.
- Demonstrate their mastery by solving non trivial problems related to the concepts and by proving simple theorems about the statements proven by the text.
- Have a fundamental knowledge of the basic solutions of equations and eigen value problems.
- Acquire skills in handling situations involving first and second order differential equations.

	PROFESSIONAL OUTCOMES (POs)														
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PO3
CO1	3	2	-	-	-	-	-	-	-	-	-	1	1	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	1	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	1	1	-	-
CO4	3	-	-	-	3	-	-	-	-	-	-	1	1	-	-
CO5	3	-	-	-	3	-	-	-	-	-	-	-	1	-	-

YEAR	2	SEMESTER	3	L	Т	Р	C
COURSECODE/ COURSE TITLE		191CS-311 DATA STRUCTURES		3	0	0	3

- Describe the basics of C PROFESSIONALming language
- Apply the concepts of functions, pointers, structures and unions for the given application
- Analyze and implement linear data structure operations in C
- Analyze and evaluate non linear data structure for the given application
- Apply the hashing concepts an choose the appropriate sorting algorithm for an application

	CO, PO, PSO 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	PSO1	PSO2	PSO 3
CO 1	3	2	3	3	3	-	-	-	-	-	-	-	3	3	-
CO 2	3	3	2	3	3	-	-	-	-	-	-	-	3	3	-
CO 3	3	3	3	3	3	3	-	-	-	-	3	3	3	3	2
CO 4	3	3	3	3	3	3	-	-	-	-	3	3	3	3	2
CO 5	3	3	3	3	3	3	-	-	-	-	3	3	3	3	2
СО	3	3	3	3	3	3	-	-	-	-	3	3	3	3	2

YEAR	2	SEMESTER	3	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM321-ANATOMY & HUMAN PHYSIOLOGY		3	0	0	3

- Explain basic structure and functions of the cell.
- Outline the physiology of respiration, and the different components of respiratory system, Physiology of muscles and joints
- Summarize the physiology of heart associated with blood pressure and Analyze how the neurons transmit the impulse and the reflex mechanism
- Explain the components involved in digestive and urinary system also the physiology
- Explain the mechanism and physiology involved in vision and hearing and understand the use of endocrine glands

					(С О-Р С) and	PSO	Марј	oing					
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	PSO1	PSO2	PSO3
CO 1	3	1	-	1	1	1	1	1	-	1	3	2	1	-	-
CO 2	3	1	-	1	-	1	-	1	-	-	2	2	1	-	-
CO 3	3	1	-	-	1	1	-	1	-	1	2	3	3	1	1
CO 4	3	1	-	-	-	1	1	1	1	-	2	3	1	-	-
CO 5	3	1	1	1	1	1	-	1	1	-	2	3	3	-	1
СО	3	1	1	2	1	1	1	1	1	1	2	3	2	1	1

YEAR	2	SEMESTER	3	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM322-DIGITAL LOGIC DESIGN		3	0	0	3

At the end of the course:

- Use digital electronics in the present contemporary world
- Design various combinational digital circuits using logic gates
- Do the analysis and design procedures for synchronous and asynchronous sequential
- circuits
- Use the semiconductor memories and related technology
- Use electronic circuits involved in the design of logic gates

	CO-PO and PSO 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	PSO1	PSO2	PSO3
CO 1	3	3	2	1	-	-	-	-	-	-	-	1	3	2	1
CO 2	3	3	3	1	-	-	-	-	-	-	-	1	3	2	1
CO 3	3	3	3	2	-	-	-	-	-	-	-	1	3	2	1
CO 4	3	2	2	1	-	-	-	-	-	-	-	1	3	2	1
CO 5	3	2	3	1	-	-	-	-	-	-	-	1	3	2	1
СО	3	3	3	1	-	-	-	-	-	-	-	1	3	2	1

YEAR	2	SEMESTER	3	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM323-SIGNALS AND SYSTEM		3	0	0	3

At the end of the course

- To be able to determine if a given system is linear/causal/stable
- Capable of determining the frequency components present in a deterministic signal
- Capable of characterizing LTI systems in the time domain and frequency domain

To be able to compute the output of an LTI system in the time and frequency domains

CO, PO, PSO MAPPING															
Cos	PO 1	PO	PO	PO	PO	PO	PO 7	PO	PO	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
	l	<u> </u>	3	4	2	0	1	ð	9	10	11	12			
CO 1	3	3	3	3	3	2	-	-	-	-	-	2	3	3	3
CO 2	3	3	3	3	3	2	1	1	-	1	2	3	3	3	3
CO 3	3	2	3	3	2	2	2	2	-	-	-	2	3	2	3
CO 4	3	3	2	3	2	1	2	-	-	-	2	2	3	3	3
CO 5	3	3	3	3	2	1	3	2	2	-	-	3	3	3	3
CO	3	3	3	3	2	2	2	2	2	1	2	2	3	3	3

YEAR	2	SEMESTER	3	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM324-BIOSENSORS & INSTRUMENTATION		3	0	0	3

The students would be able to

- To analyze the performance of sensor and evaluate the various types of sensors
- To apply a rigorous engineering design principles and methodology to design the signal conditioning amplifiers for resistive transducesrs
- To demonstrate the various capacitive and Inductive transducers
- To articulate various photoelectric transducers
- To elucidate various detection devices

CO, PC	CO, PO, PSO MAPPING														
Cos	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO1	PSO2	PSO3
	1	2	3	4	5	6	7	8	9	10	11	12			
CO 1	3	3	3	3	2	2	1	1	1	1	1	3	3	1	2
CO 2	3	3	3	3	2	2	1	1	1	1	1	3	3	1	2
CO 3	3	3	3	3	2	2	1	1	1	1	1	3	3	1	2
CO 4	3	3	3	3	2	2	1	1	1	1	1	3	2	1	2
CO 5	3	3	3	3	2	2	1	1	1	1	1	3	3	1	2
CO	3	3	3	3	2	2	1	1	1	1	1	3	3	1	2

YEAR	2	SEMESTER	3	L	Т	Р	С
COURSECODE/ COURSE TITLE		191CS32A-DATA STRUCTURES IN C LABORATORY		0	0	2	1

- State the functions to implement linear and non-linear data structure operations.
- Identify appropriate linear / non-linear data structure operations for solving a given problem.
- Practice the use of tree and graph data structure operations.
- Analyze appropriate hash functions that result in a collision free scenario for data storage and retrieval.
- Construct appropriate sorting and searching functions based on the application

	CO-PO & PSO Mapping														
СО	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	0	1	2	1	2	3
CO1	3	3	3	2	-	1	1	1	1	2	-	3	3	2	3
CO2	3	3	3	2	-	1	1	1	1	2	-	3	3	2	3
CO3	3	3	3	2	-	1	1	1	1	2	-	3	3	2	3
CO4	3	3	3	2	-	1	1	1	1	2	-	3	3	2	3
CO5	3	3	3	2	-	1	1	1	1	2	-	3	3	2	3
CO	3	3	3	2	-	1	1	1	1	2	-	3	3	2	3

YEAR	2	SEMESTER	3	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM32B-DIGITAL DESIGN LABORATORY		0	0	2	1

At the end of the course , the students can able to

- Design multiplexer , encoder using logic gates.
 Design shift registers using flip flops
 Acquire knowledge in PSPICE

	CO-PO & PSO Mapping														
СО	CO PO PO PO PO6 PO PO8 PO PO1 PO1 PO1 PSO PSO PSO 1 2 3 4 5 7 9 0 1 2 1 2 3														
CO1	3	3	3	2	-	-	-	-	-	-	-	2	3	2	2
CO2	3	3	3	2	-	-	-	-	-	-	-	2	3	2	2
CO3	3	3	3	2	-	-	-	-	-	-	-	2	3	2	2
СО	3	3	3	2	-	-	-	-	-	-	-	2	3	2	2

YEAR	2	SEMESTER	3	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM32A-ANATOMY AND HUMAN PHYSIOLOGY LABORATORY		0	0	2	1

At the end of the course , the students can able to

- Identification and enumeration of blood cells
- Enumeration of haematological parameters
- Analysis of special sensory organs test

	CO-PO & PSO Mapping														
СО	COPOPOPOPOPOPOPOPO1PO1PO1PSOPSOPSOCOPOPOPOPOPOPOPO1PO1PO1PSOPSOPSO														
	1	2	3	4	5	6	7	8	9	0	1	2	1	2	3
CO1	3	-	1	1	2	-	-	-	-	1	-	2	3	1	1
CO2	3	-	2	1	1	-	-	1	1	-	-	2	3	1	1
CO3	3	2	-	-	-	2	-	-	-	-	-	2	3	1	1
CO	3	2	2	1	2	2	-	1	1	1	-	2	3	1	1

YEAR	2	SEMESTER	4	L	Т	Р	C
COURSECODE/ COURSE TITLE		191MA401-PROBABILITY AND RANDOM PROCESSES		2	2	0	3

COURSE OUTCOMES (COS):

- Demonstrate and apply the basic probability axioms and concepts in their core areas.
- Apply the concepts of probability distributions in an appropriate place of science and Engineering.
- Calculate the relationship of two dimensional random variables using correlation techniques and to study the properties of two dimensional random variables.
- Estimate the functions of time when the probability measure is associated through random process.
- **CO,PO,PSO MAPPING PO1** PO2 PO3 **PO4 PO5 PO6** PO7 **PO8 PO9** PO10 PO11 PO12 PSO1 PSO2 Cos PSO3 **CO1** 3 2 1 1 _ _ _ _ _ _ _ _ _ _ _ **CO 2** 3 2 1 1 -_ ----_ --_ -**CO 3** 3 3 _ _ _ _ _ _ _ 1 1 _ _ _ _ **CO 4** 3 3 1 1 -_ _ _ _ _ _ _ _ _ _ **CO 5** 3 3 1 _ _ _ _ _ _ -_ _ _ _ -1 1 CO 3 2 3 -----_ _ _ _ -
- Evaluate the concept of spectral density functions.

YEAR	2	SEMESTER	4	L	Т	Р	С
COURSECODE/ COURSE TITLE		191BM421-BIOMEDICAL INSTRUMENTATION		3	0	0	3

- Differentiate different bio potentials and its propagations.
- Illustrate different electrode placement for various physiological recordings
- Design bio amplifier for various physiological recordings
- Explain various technique for non-electrical physiogical measurements
- Demonstrate different biochemical measurement techniques.

	CO,PO,PSO MAPPING														
Cos	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	0	1	2	1	2	3
CO 1	2	1	1	-	-	-	-	-	-	-	-	1	2	-	-
CO 2	3	2	1	1	1	-	-	-	-	-	-	2	2	1	-
CO 3	3	3	2	1	1	1	1	-	-	-	-	2	3	2	1
CO 4	3	3	2	1	1	1	1	-	-	-	-	2	3	2	1
CO 5	3	3	2	1	1	1	1	-	-	-	-	2	3	2	1
СО	3	3	2	1	1	1	1	-	-	-	-	2	3	2	1

YEAR	2	SEMESTER	4	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM422-BIOMECHANICS		3	0	0	3

- Differentiate the concept of kinetics and kinematics.
- Analyse the stress and strain relationship in bone growth.
- Analyse the concepts of motion in joints.
- Perform biomechanical analysis of spine.
- Outline the principles of biomechanics in ergonomics.

PO,CO,PSO MAPPING															
Cos	PO	PO1	PO1	PO1	PSO	PSO	PSO								
	1	2	3	4	5	6	7	8	9	0	1	2	1	2	3
CO 1	3	2	1	1	2	1	1	-	-	-	-	2	3	2	-
CO 2	3	2	1	1	3	1	1	1	-	-	-	2	3	2	1
CO 3	3	2	1	1	3	1	1	1	-	-	-	2	3	2	1
CO 4	3	2	1	1	3	1	1	1	-	-	-	2	3	2	1
CO 5	3	2	1	1	3	1	1	2	-	-	-	2	3	2	1
CO	3	2	1	1	3	1	1	2	-	-	-	2	3	2	1

YEAR	2	SEMESTER	4	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM423-BIO-SIGNAL PROCESSING		2	2	0	3

- Analyse the origin and nature of biosignals.
- Apply the concept of filtering in biosignal analysis.
- Detect ORS complex in ECG signals and to perform rhythm analysis.
- Perform Fourier domain analysis using transforms.
- Outline the principles of signal processing.

PO,CO,PSO MAPPING															
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	1	-	1	1	-	-	-	-	-	-	2	2	-	-
CO 2	3	2	2	2	2	1	1	-	-	-	-	2	3	2	-
CO 3	3	2	2	2	2	2	1	-	-	-	-	2	3	2	1
CO 4	3	2	2	2	2	2	1	-	-	-	-	2	3	2	1
CO 5	3	2	2	2	2	2	1	-	-	-	-	2	3	2	1
CO 6	3	2	2	2	2	2	1	-	-	-	-	2	3	2	1

YEAR	2	SEMESTER	4	L	Т	Р	С
COURSECODE/ COURSE TITLE		191BM424-PATHOLOGY AND MICROBIOLOGY		3	0	0	3

- Explain the different pathological conditions in cell.
- Discuss the concepts of inflammation.
- Explain the concepts of tumors and carcinogenesis.
- Describe the different culture techniques.
- Explain the techniques involved in pathophysiology.

PO,CO,PSO MAPPING															
Cos	PO	PO1	PO1	PO1	PSO	PSO	PSO								
	1	2	3	4	5	6	7	8	9	0	1	2	1	2	3
CO 1	-	3	1	2	-	1	-	3	-	-	-	-	1	1	2
CO 2	3	1	-	2	3	1	-	1	3	2	-	3	1	-	-
CO 3	1	1	2	3	3	3	2	3	3	-	-	-	1	1	1
CO 4	1	3	1	-	2	3	1	3	-	3	3	3	1	-	1
CO 5	1	2	2	2	-	-	1	3	3	1	-	-	2	2	1
CO 6	2	3	2	3	3	3	2	3	3	3	3	3	2	2	2

YEAR	2	SEMESTER	4	L	Т	Р	С
COURSECODE/ COURSE TITLE		191BM425-BIOETHICS & INTELLECTUAL PROPERTY RIGHTS (IPRs)		3	0	0	3

At the end of the course, the student should be able to:

- Apply bioethics in health care
- Discuss the nature of genetically modified organisms
- Outline the concepts of regulatory mechanisms for GMO's
- Explain the concepts of Intellectual property rights

Describe the concept of Biosafety.

PO,CO,PSO MAPPING															
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	-	-	-	2	-	1	1	3	-	1	-	1	1	-	-
CO 2	-	-	-	2	-	1	1	3	-	1	-	1	1	-	-
CO 3	-	-	-	2	-	1	1	3	-	1	-	1	1	-	-
CO 4	-	-	-	2	-	1	1	3	-	1	-	1	1	-	-
CO 5	-	-	-	2	-	1	1	3	-	1	-	1	1	-	-
CO	-	-	-	2	-	1	1	3	-	1	-	1	1	-	-

YEAR	2	SEMESTER	4	L	Т	Р	C
COURSECODE/ COURSE TITLE		191HS40A-READING AND WRITING SKILLS LABORATORY		0	0	2	1

- Co1: Student will be an active listener so as to respond accurately and effectively
- Co2: Students becomes confident enough to present anything successfully
- Co3: Student becomes free for making queries and answer to queries without hesitation.
- Co4: Student learns to write effectively and be able to draft letters, E-mails impressively.
- Co5: Student understands the dynamics of GD and so participates in GDs confidently.

	PO,CO,PSO MAPPING														
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	-	-	-	-	-	-	-	2	3	3	-	3	1	-	-
CO 2	-	-	-	-	-	-	-	2	3	3	-	3	1	-	-
CO 3	-	-	-	-	-	-	-	2	3	3	-	3	1	-	-
CO 4	-	-	-	-	-	-	-	2	3	3	-	3	1	-	-
CO 5	-	-	-	-	-	-	-	2	3	3	-	3	1	-	-
CO	-	-	-	-	-	-	-	2	3	3	-	3	1	-	-

YEAR	2	SEMESTER	4	L	Т	Р	С
COURSECODE/ COURSE TITLE		191BM42A-PATHOLOGY AND MICROBIOLOGY LABORATORY		0	0	2	1

• Student can perform practical experiments on tissue processing, cryoprocessing, staining Processes etc.

	PO,CO,PSO MAPPING														
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	3	3	1	2	-	-	2	2	-	-	2	3	2	1
СО	2	3	3	1	2	-	-	2	2	-	-	2	3	2	1

YEAR	2	SEMESTER	4	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM42B-BIO-DIGITAL SIGNAL PROCESSING LABORATORY		0	0	2	1

At the end of the course, the student should be able to:

- The learner is able to design amplifiers for the Bio medical signals.
- Carryout basic signal processing operations

• Demonstrate their abilities towards MATLAB based implementation of various DSP systems.

• Design and Implement the FIR and IIR Filters

	PO,CO,PSO MAPPING														
Cos	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
005	1	2	3	4	5	6	7	8	9	0	1	2	1	2	3
CO 1	3	2	2	1	1	-	-	-	-	-	-	1	3	2	-
CO 2	3	2	2	2	2	-	-	-	-	-	-	2	3	2	-
CO 3	3	3	3	2	3	1	1	-	-	-	-	2	3	2	1
CO 4	3	3	3	2	3	1	1	-	-	-	-	2	3	2	1
CO	3	3	3	2	3	1	1	-	-	-	-	2	3	2	1

YEAR	3	SEMESTER	5	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM521-DIAGNOSTIC AND THERAPEUTIC EQUIPMENT		3	0	0	3

- Discuss the various equipment used in ICU and applications of telemetry.
- Explain the types of diathermy and its applications.
- Express the basics of ultrasound and its application in medicine
- Discuss the various extracorporeal and special diagnostic devices used in hospitals
- Outline the importance of patient safety against electrical hazard

	CO,PO, PSO MAPPING														
COs	PO1	PO2	PO3	PO4	PO	PO	PO7	Р	PO	PO	PO	PO1	PSO	PSO	PSO
					5	6		0	9	10	11	2	1	2	3
								8							
CO 1	3	2	2	2	-	2	2	2	-	-	-	3	3	2	2
CO 2	3	3	3	2	-	2	2	2	-	-	-	3	3	3	3
CO 3	3	3	2	2	-	2	2	2	-	-	-	3	3	3	2
CO 4	3	3	3	2	-	2	2	2	-	-	-	3	3	3	3
CO 5	3	2	2	-	-	2	1	1	-	-	-	2	3	2	1
CO	3	2	2	2	-	2	2	2	-	-	-	3	3	3	2

YEAR	3	SEMESTER	5	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM522- HOSPITAL MANAGEMENT		3	0	0	3

- Explain the principles of Hospital administration.
- Identify the importance of Human resource management.
- List various marketing research techniques
- Identify Information management systems and its uses
- Explain safety procedures followed in hospitals.

	CO,PO, PSO MAPPING														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	-	-	-	-	-	1	1	2	1	-	2	1	-	-	2
CO 2	-	-	-	-	-	1	1	1	2	-	3	1	-	-	2
CO 3	-	-	-	-	-	1	1	1	2	-	3	1	-	-	2
CO 4	-	-	-	-	-	1	1	3	2	-	3	1	-	-	2
CO 5	-	-	-	-	-	3	2	3	1	-	2	1	-	-	2

YEAR	3	SEMESTER	5	L	Т	Р	С
COURSECODE/ COURSE TITLE		191BM523-CONTROL SYSTEMS IN MEDICINE		3	0	0	3

Upon completion of this subject, the student will be able to:

- Explain the need for mathematical modeling of various systems, representation of systems in block diagrams and signal flow graphs and are introduced to biological control systems
- Analyze the time response of various systems and discuss the concept of system stability
- Analyze the frequency response characteristics of various systems using different charts
- Explain the concept of modeling basic physiological systems

	CO, PO, PSO MAPPING														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	-	-	2	-	-	-	-	-	-	-	-	-	-
CO 2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO 5	3	3	3	3	2	-	-	-	-	-	-	-	2	2	3
СО	3	3	3	3	2	-	-	-	-	-	-	-	2	2	3

YEAR	3	SEMESTER	5	L	Т	Р	С
COURSECODE/ COURSE TITLE		191BM524-BIOMATERIALS & ARTIFICIAL ORGANS		3	0	0	3

Students will be able to

- To know about artificial organs evaluation process and procedure for transplantation of organs
- To apply a engineering principles for designing an implants
- To design an implantable device based on their various wear and tear properties
- To apply ideas on designing blood interfacing implants
- To design and develop implantable devices and organs on dentistry, maxillofacial and craniofacial.

	CO,PO, PSO MAPPING														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	-	3	-	-	2	3	1	2	-	-	3	3	3	3
CO 2	3	-	3	1	-	3	2	1	2	-	-	3	3	3	3
CO 3	3	-	3	1	-	2	3	2	1	-	-	3	3	3	3
CO 4	3	-	2	-	-	2	2	1	1	-	-	3	3	2	2
CO 5	2	-	3	-	-	3	3	1	2	-	-	3	3	3	2

YEAR	3	SEMESTER	5	L	Т	Р	С
COURSECODE/ COURSE TITLE		191BM525-MICROPROCESSORS AND MICROCONTROLLERS		3	0	0	3

At the end of the course, the students should be able to:

- Execute programmess based on 8086 microprocessor.
- Explain the bus structures used in microprocessor.
- Design and interface I/O circuits.
- Design and implement 8051 microcontroller based systems

Design Memory Interfacing circuits.

	CO,PO, PSO MAPPING														
COs	COs PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12 PS01 PS02 H														
CO 1	3	3	-	-	2	-	-	-	-	-	-	-	-	-	-
CO 2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	2	3	-	-	-	-	-	-	-	-	-	2	2	3
CO 4	3	3	3	3	-	-	-	-	-	-	-	-	2	2	3
CO 5	3	3	3	3	2	-	-	-	-	-	-	-	2	2	3
CO	3	3	3	3	2	-	-	-	-	-	-	-	2	2	3

YEAR	3	SEMESTER	5	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM52A-MICROPROCESSORS AND MICROCONTROLLERS LABORATORY		0	0	2	1

- Write AL programmes for fixed and Floating Point and Arithmetic operations
- Interface different I/Os with processor
- Generate waveforms using Microprocessors
- Execute programmess in 8051
- Explain the difference between simulator and Emulator.

	CO,PO, PSO MAPPING														
COs	Os PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12 PSO1 PSO2														
CO 1	3	3	-	-	2	-	-	-	-	-	-	-	-	-	-
CO 2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	2	3	-	-	-	-	-	-	-	-	-	2	2	3
CO 4	3	3	3	3	-	-	-	-	-	-	-	-	2	2	3
CO	3	3	3	3	2	-	-	-	-	-	-	-	2	2	3

YEAR	3	SEMESTER	5	L	Т	Р	С
COURSECODE/ COURSE TITLE		191BM52B-DIAGNOSTIC AND THERAPEUTIC EQUIPMENT LABORATORY		0	0	2	1

- Measure different bioelectrical signals using various methods
- Assess different non-electrical parameters using various methodologies
- Illustrate various diagnostic and therapeutic techniques
- Examine the electrical safety measurements
- Analyze the different bio signals using suitable tools.

	CO,PO, PSO MAPPING														
COs	PO1	PO2	PO3	PO4	PO	PO	PO7	Р	PO	PO	PO	PO1	PSO	PSO	PSO
					5	6		0	9	10	11	2	1	2	3
								8							
CO 1	3	2	2	2	-	2	2	2	-	-	-	3	3	2	2
CO 2	3	3	3	2	-	2	2	2	-	-	-	3	3	3	3
CO 3	3	3	2	2	-	2	2	2	-	-	-	3	3	3	2
CO 4	3	3	3	2	-	2	2	2	-	-	-	3	3	3	3
CO 5	3	2	2	-	-	2	1	1	-	-	-	2	3	2	1
CO	3	2	2	2	-	2	2	2	-	-	-	3	3	3	2

YEAR	3	SEMESTER	5	L	Т	Р	С
COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE 191BM533-TISSUE ENGINEERING		3	0	0	3

- Measure different cell and tissue characteristics.
- Understand the tissue components and its application in wound healing.
- Apply the concept of biomaterials in the field of nanotechnology.
- Understand the concept of gene therapy in tissue engineering
- Apply the knowledge of tissue engineering in recent trends

COs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	-	-	1	-	-	-	-	-	-	-	1	2	-	-
CO 2	3	1	-	1	-	-	-	-	-	-	-	1	2	-	-
CO 3	3	1	1	1	-	1	-	-	-	-	-	1	2	1	-
CO4	3	1	1	1	-	1	-	-	-	-	-	1	2	1	-
CO5	3	1	1	1	-	1	-	-	-	-	-	1	2	1	-
СО	3	1	1	1	-	1	-	-	-	-	-	1	2	1	-

YEAR	3	SEMESTER	5	L	Т	Р	С
COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE 191BM532- BIOMETRIC SYSTEMS		3	0	0	3

- Demonstrate knowledge engineering principles underlying biometric systems.
- Understand the different technologies involved in fingerprint recognition.
- Design Basic face recognition system
- Understand the concepts and design basic voice recognition system Analyze concept of fusion used in biometric applications

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	1	1	1	1	-	2	1	1	-	2	3	2	2
CO 2	3	2	3	1	1	1	-	2	1	1	-	2	3	3	2
CO 3	3	2	3	3	2	2	-	2	1	1	-	2	3	3	2
CO 4	3	2	3	3	2	2	-	2	1	1	-	2	2	2	2
CO 5	3	3	3	3	3	2	-	2	1	1	-	2	3	3	2
CO	3	2	3	2	2	2	-	2	1	1	-	2	3	3	2

YEAR	3	SEMESTER	5	L	Т	Р	С
COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE 191BM534-VLSI DESIGN		3	0	0	3

- Demonstrate knowledge engineering principles underlying CMOS circuits.
- Explain the different combinational logic circuits.
- Design Synchronous and asynchronous sequential circuits.
- Understand the concepts and design of arithmetic building blocks.
- Implement FPGA architectures.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	1	1	-	-	-	-	-	-	-	-	-	2	-	-
CO 2	3	2	2	1	1	-	-	-	-	-	-	-	2	1	-
CO 3	3	2	3	1	1	-	-	-	-	-	-	-	2	2	-
CO 4	3	1	1	-	-	-	-	-	-	-	-	-	2	1	-
CO 5	2	3	3	2	1	-	-	-	-	-	-	-	2	1	-
CO	3	3	3	2	1	-	-	-	-	-	-	-	2	1	_

YEAR	3	SEMESTER	5	L	Т	Р	С
COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE 191BM531-BIO MEMS		3	0	0	3

At the end of the course, the student should be able to:

- Discuss various MEMS fabrication techniques.
- Explain different types of sensors and actuators and their principles of operation at the micro-Scale level.
- Explain about the micro fluidic systems

Apply MEMS in different field of medicine.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	3	1	-	1	-	-	-	-	-	1	2	-	-
CO 2	3	3	3	2	-	2	-	-	-	-	-	1	2	1	-
CO 3	3	1	1	1	-	-	-	-	-	-	-	1	2	-	-
CO 4	1	1	1	3	3	3	-	-	-	-	-	1	2	1	-
CO	3	3	3	3	3	3	-	-	-	-	-	1	2	1	-

YEAR	3	SEMESTER	6	L	Т	Р	С
COURSECODE/ COURSE TITLE		191BM621-ADVANCED MIVROCONTROLLER AND ITS APPLICATIONS		3	0	0	3

- Explain the architecture ,memory organization and programming of PIC microcontroller
- Develop an embedded C program using the internal functional blocks of PIC microcontroller for the given requirement.
- Explain the peripherals and interfacing of controller.
- Implement assembly language programming by ARM processor.
- Explain the architecture and instruction set of ARM processor.

	CO-PO and PSO 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	PSO1	PSO2	PSO3
CO 1	3	1	1	1	1	-	-	-	-	-	-	2	2	1	-
CO 2	3	3	3	2	3	-	-	-	-	-	-	2	3	2	-
CO 3	3	1	1	1	1	-	-	-	-	-	-	2	2	1	-
CO4	3	3	3	3	3	-	-	-	-	-	-	2	3	2	-
CO5	3	1	1	1	1	-	-	-	-	-	-	2	2	1	-
СО	3	2	2	2	2	-	-	-	-	-	-	2	2	2	-

YEAR	3	SEMESTER	6	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM622-COMMUNICATION SYSTEMS		3	0	0	3

- Apply Analog communication techniques in biotelemetry.
- Apply digital communication techniques.
- Analyze source and error control coding.
 Utilize multiple access techniques.
- Explain the techniques involved in Biotelemetry.

	CO-PO and PSO 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	PSO1	PSO2	PSO3
CO 1	3	2	3	1	-	2	-	-	-	-	-	2	2	1	-
CO 2	3	3	3	2	-	2	-	-	-	-	-	2	3	2	-
CO 3	3	1	1	1	-	2	-	-	-	-	-	2	2	1	-
CO4	3	3	3	3	-	2	-	-	-	-	-	2	3	2	-
CO5	3	1	1	1	-	2	-	-	-	-	-	2	2	1	-
CO	3	2	2	2	-	2	-	-	-	-	-	2	2	2	-

YEAR	3	SEMESTER	6	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM623- MEDICAL INFORMATICS		3	0	0	3

- Discuss about health informatics and different ICT applications in medicine.
- Explain the function of Hospital Information Systems
- Analyze medical standards
- Explain about the bioinformatics database
- Discuss the recent trends and virtual reality concepts in informatics.

	CO-PO and PSO Mapping														
Cos	PO1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO 1	3	-	-	-	1	1	1	1	-	-	-	-	1	-	-
CO 2	3	-	-	-	2	1	1	1	-	-	-	-	1	1	1
CO 3	3	-	-	-	-	1	-	-	-	-	-	-	1	-	-
CO 4	3	-	-	-	-	1	-	-	-	-	-	-	1	-	-
CO 5	3	-	-	-	-	1	-	-	-	-	-	-	1	-	-
CO	3	-	-	-	2	1	1	1	-	-	-	-	1	1	1

YEAR	3	SEMESTER	6	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM624-RADIOLOGICAL EQUIPMENTS		3	0	0	3

- 1. Describe the working principle of X ray machine and its application.
- 2. Illustrate the principle computed tomography.
- 3. Interpret the technique used for visualizing various sections of the body using magnetic resonance imaging
- 4. Demonstrate the applications of radio nuclide imaging.
- 5. Outline the methods of radiation safety.

	CO-PO and PSO 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	PSO1	PSO2	PSO3
CO 1	3	3	-	-	-	-	-	-	-	-	-	1	2	-	-
CO 2	3	3	1	3	-	-	-	-	-	-	-	1	2	-	-
CO 3	3	3	2	1	-	-	-	-	-	-	-	1	2	1	-
CO 4	3	3	-	2	-	-	-	-	-	-	-	1	2	-	-
CO 5	3	2	-	-	-	1	-	1	-	-	-	1	2	-	1
СО	3	3	2	3	-	1	-	1	-	-	-	1	2	1	1

YEAR	3	SEMESTER	6	L	Т	Р	С
COURSECODE/ COURSE TITLE		191HS60A-COMMUNICATION SKILLS LABORATORY		0	0	3	2

At the end of the semester the students will be able to:

CO1:To be totally learner-centric with minimum teacher intervention as the course revolves around practice.

CO2:Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.

CO3:Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.

CO4:GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.

CO5:Learners are to be assigned to read/write/listen/view materials outside the classroom as well for graining proficiency and better participation in the class.

	CO-PO and PSO Mapping														
Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	РО 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO 1	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO 2	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	1	3	3	-	-	-	-
CO 4	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO 5	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO	-	-	-	-	-	-	-	-	1	3	3	-	-	-	-

YEAR	3	SEMESTER	6	L	Т	Р	С
COURSECODE/ COURSE TITLE		191BM62A-COMMUNICATION SYSTEMS LAB		0	0	2	1

- Apply modulation and demodulation techniques in biotelemetry. Apply digital communication techniques. •
- -
- Analyze Line coding schemes.

CO-PO and PSO Mapping															
Cos PO PO															PSO3
	1	4	3		3	U	/	0	,	10	11	14			
CO 1	3	2	3	1	-	2	-	-	-	-	-	2	2	1	-
CO 2	3	3	3	2	-	2	-	-	-	-	-	2	3	2	-
CO 3	3	1	1	1	-	2	-	-	-	-	-	2	2	1	-
CO	3	2	2	2	-	2	-	-	-	-	-	2	2	2	-
YEAR	3	SEMESTER	6	L	Т	Р	С								
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COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE- 191BM631- MEDICAL OPTICS		3	0	0	3								

At the end of the course, the students should be able to:

- Demonstrate knowledge of the fundamentals of optical properties of tissues
- Analyze the components of instrumentation in Medical Photonics and Configurations
- Describe surgical applications of lasers.
- Describe photonics and its diagnostic applications.
- Investigate emerging techniques in medical optics

	CO-PO and PSO 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	PSO1	PSO2	PSO3
CO 1	3	2	2	3	3	2	3	1	3	2	3	2	3	3	3
CO 2	3	3	3	3	3	2	2	1	2	2	2	2	3	2	2
CO 3	2	2	2	2	2	2	3	1	2	2	3	2	2	3	3
CO4	3	2	2	2	3	2	2	1	2	3	3	2	3	2	2
CO5	2	3	2	3	2	2	3	3	2	3	3	2	2	3	3
СО	3	2	2	3	3	2	3	1	2	2	3	2	3	3	3

YEAR	3	SEMESTER	6	L	Т	Р	C
COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE- 191BM632- NANOTECHNOLOGY AND APPLICATIONS		3	0	0	3

At the end of the course, the student should be able to:

- Interpret the creation, characterization, and manipulation of nanoscale materials.
- Discuss the exciting applications of nanotechnology at the leading edge of scientific research
- Apply their knowledge of nanotechnology to identify how they can be exploited for new applications.
- To demonstrate an understanding of approaches to engineering nanomaterials and nanostructures.
- To demonstrate an understanding of the challenges on safe nanotechnology.

	CO-PO and PSO 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	PSO1	PSO2	PSO3
CO 1	3	2	2	3	3	2	3	2	3	1	3	3	2	3	2
CO 2	2	2	2	3	2	2	2	2	2	3	2	3	2	3	2
CO 3	2	3	3	2	2	3	3	3	2	3	1	2	2	2	2
CO4	3	3	3	2	3	3	1	1	2	3	2	2	2	3	2
CO 5	2	2	1	2	3	3	2	3	2	3	3	3	2	2	2
CO	2.4	2.4	2.2	2.4	2.6	2.6	2.2	2.2	2.2	2.6	2.2	2.6	2	2.6	2

YEAR	3	SEMESTER	6	L	Т	Р	C
COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE- 191BM633- TELEHEALTH TECHNOLOGY		3	0	0	3

The students will be able to

- Apply multimedia technologies in telemedicine
- Explain protocols behind encryption techniques for secure transmission of data
- Apply telehealth in healthcare.
- Use telehealth technology to provide more efficient access and appropriate systems for patients when referring to specialists and allied health professionals
- Implement an efficient and cost-effective telehealth service within your practice workflow.

	CO-PO and PSO 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	PSO1	PSO2	PSO3
CO 1	3	2	2	3	3	2	3	2	3	1	3	3	2	3	2
CO 2	2	2	2	3	2	2	2	2	2	3	2	3	2	3	2
CO 3	2	3	3	2	2	3	3	3	2	3	1	2	2	2	2
CO 4	3	3	3	2	3	3	1	1	2	3	2	2	2	3	2
CO 5	2	2	1	2	3	3	2	3	2	3	3	3	2	2	2
CO	2	2	2	2	2	2	2	2	2	3	2	3	2	3	2

YEAR	3	SEMESTER	6	L	Т	Р	C
COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE- 191BM634- VIRTUAL REALITY		3	0	0	3

At the end of the course, the student should be able to:

- Analyse &Design a system or process to meet given specifications with realistic engineering constraints.
- Identify problem statements and function as a member of an engineering design team.
- Utilize technical resources
- Exploring towards the utilization of information technology trends
- Propose technical documents and give technical oral presentations related to design mini project results

	CO-PO and PSO 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	PSO1	PSO2	PSO3
CO 1	3	3	3	3	1	2	2	1	3	3	1	3	2	2	2
CO 2	3	2	2	3	1	3	1	1	3	3	1	3	3	3	3
CO 3	2	2	1	1	3	3	1	2	3	2	1	3	3	3	3
CO4	3	3	3	2	3	2	1	2	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	-	3	3	3	3	1	3	3	3
CO	3	3	3	3	2	2	2	2	3	3	2	3	3	3	3

YEAR	4	SEMESTER	7	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM721-MEDICAL DEVICE DESIGN		3	0	0	3

- 1. Describe the working and recording setup of all basic cardiac equipment.
- 2. Explain the working and recording of all basic neurological equipment's.
- 3. Discuss the recording of diagnostic and therapeutic equipment's related to EMG.
- 4. Explain about measurements of parameters related to respiratory system.
- 5. Describe the measurement techniques of sensory responses.

	CO-PO and PSO Mapping														
Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO 10	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	3	1	1	1	-	1	-	-	-	-	-	1	3	-	-
CO 2	3	2	1	1	-	1	-	-	-	-	-	1	3	-	-
CO 3	3	2	1	1	-	1	-	-	-	-	-	1	3	1	1
CO 4	3	2	1	1	-	1	-	-	-	-	-	1	3	1	1
CO 5	3	2	1	1	-	1	-	-	-	-	-	1	3	1	1
CO	3	2	1	1	-	1	-	-	-	-	-	1	3	1	1

YEAR	4	SEMESTER	7	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM722-MEDICAL IMAGE PROCESSING		3	0	0	3

- 1. Know and Explain the basics and fundamentals of digital image processing, such asdigitization, sampling, quantization, and 2D-transforms.
- 2. Operate on images using the techniques of smoothing, sharpening and enhancement.
- 3. Explain the restoration concepts and filtering techniques.
- 4. Learn the basics of segmentation, features extraction, compression and recognition methods for color models.
- 5. Explain the concepts of compression.

	CO-PO and PSO 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	PSO1	PSO2	PSO3
CO 1	3	1	2	1	1	-	-	-	-	-	-	1	3	-	-
CO 2	3	3	2	2	2	-	-	-	-	-	-	1	3	1	-
CO 3	3	3	2	2	2	-	-	-	-	-	-	1	3	1	-
CO 4	3	3	3	2	2	-	-	-	-	-	-	1	3	1	-
CO 5	3	3	3	2	2	-	-	-	-	-	-	1	3	1	-
СО	3	3	3	2	2	-	-	-	-	-	-	1	3	1	-

YEAR	4	SEMESTER	7	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM723-MEDICAL ROBOTICS		3	0	0	3

- Explain the basics of robotic systems.
- Design basic Robotics system and formulate Kinematics.
- Construct Inverse Kinematic motion planning solutions for various Robotic configurations.
- Design Robotic systems for Medical application.
- Implement the concept of robotics in health care.

	CO-PO and PSO Mapping														
Cos	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	-	-	1	1	-	-
CO 2	3	3	3	2	1	1	-	-	1	-	-	-	2	1	-
CO 3	3	3	3	1	1	1	-	-	-	-	-	-	2	1	-
CO 4	3	3	3	3	2	3	-	-	3	-	-	2	3	2	1
CO5	3	3	3	3	2	3	-	-	3	-	-	2	3	2	1
СО	3	3	3	3	2	3	-	-	2	-	-	2	3	2	1

YEAR	4	SEMESTER	7	L	Т	Р	С
COURSECODE/ COURSE TITLE		191BM7A-MEDICAL DEVICES LAB		0	0	2	1

- Analyze the EEG signal
- Discuss the recording of diagnostic and therapeutic equipment's related to EMG.
- Explain about measurements of parameters related to respiratory system
- Analyze the ECG signal
- Analyse the gases present in breath sample.

CO-PO and PSO Mapping															
Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO 10	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	3	3	2	2	2	1	-	-	-	-	-	2	3	1	-
CO 2	3	3	2	2	2	1	-	-	-	-	-	2	3	1	-
CO 3	3	3	2	2	2	1	-	-	-	-	-	2	3	1	-
CO 4	3	3	2	2	2	1	-	-	-	-	-	2	3	1	-
CO 5	3	3	2	2	2	1	-	-	-	-	-	2	3	1	-
CO	3	3	2	2	2	1	-	-	-	-	-	2	3	1	-

YEAR	4	SEMESTER	7	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM72B-MEDICAL IMAGE PROCESSING LAB		0	0	2	1

At the end of the course, the student should be able to:

- 1. Perform enhancing operations on the image using spatial filters and frequency domain
- filters.
- Use transforms and analyse the characteristics of the image.
- Perform segmentation operations in the images.
- Estimate the efficiency of the compression technique on the images.
- Apply image processing technique to solve real health care problems.

CO-PO and PSO 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	PSO1	PSO2	PSO3
CO 1	3	1	2	3	3	-	-	-	-	-	-	1	3	-	-
CO 2	3	3	2	3	3	-	-	-	-	-	-	1	3	1	-
CO 3	3	3	2	3	3	-	-	-	-	-	-	1	3	1	-
CO 4	3	3	3	3	3	-	-	-	-	-	-	1	3	1	-
CO 5	3	3	3	3	3										
CO	3	3	3	3	3	-	-	-	-	-	-	1	3	1	-

YEAR	4	SEMESTER	7	L	Т	Р	C
COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE-III 191BM731-BRAIN COMPUTER INTERFACE AND ITS APPLICATIONS		3	0	0	3

- Explain the significance and role of this course in the presentContemporary world.
- Evaluate concept of BCI.
- Assign functions appropriately to the human and to the machine.
- Use machine learning algorithms for translation.
- Develop high fidelity BCI.

CO-PO and PSO 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	PSO1	PSO2	PSO3
CO 1	2	2	-	-	-	-	3	-	-	-	-	1	1	-	-
CO 2	2	2	-	1	1	1	-	-	-	-	-	-	1	1	-
CO 3	3	2	2	1	2	2	-	-	-	-	-	-	2	2	-
CO 4	3	2	2	2	2	1	1	-	-	-	-	-	2	2	-
CO 5	3	2	2	2	2	2	-	1	1	1	-	-	2	2	-
CO	3	2	2	2	2	1	2	1	1	1	-	-	2	2	-

YEAR	4	SEMESTER	7	L	Т	Р	С
COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE-III 191BM732- DRUG DELIVERY SYSTEMS		3	0	0	3

- Analyse the properties of drugs.
- Apply polymers in drug delivery system.
- Apply polymers in transdrmal drug delivery system.
- Design implantable micro drug delivery systems.
- Impliment the concepts of biosensors in drug delivery system.

CO-PO and PSO 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	PSO1	PSO2	PSO3
CO 1	3	2	2	2	-	1	-	-	-	-	-	2	3	-	-
CO 2	3	2	3	2	-	1	-	-	-	-	-	2	3	2	-
CO 3	3	2	3	2	-	1	-	-	-	-	-	2	3	2	-
CO 4	3	3	3	2	-	2	-	-	-	-	-	2	3	2	-
CO 5	3	3	3	2	-	2	-	-	-	-	-	2	3	2	-
CO	3	3	3	2	-	2	-	-	-	-	-	2	3	2	-

YEAR	4	SEMESTER	7	L	Т	Р	C
COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE-III 191BM733-LASER IN MEDICINE		3	0	0	3

- 1. Demonstrate knowledge of the fundamentals of optical properties of tissues
- 2. Analyze the components of instrumentation in Medical Photonics and Configurations
- 3. Describe surgical applications of lasers.
- 4. Describe photonics and its diagnostic applications.
- 5. Investigate emerging techniques in medical optics.

	CO-PO and PSO 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	PSO1	PSO2	PSO3
CO 1	3	-	-	1	-	1	-	-	-	-	-	1	2	-	-
CO 2	3	2	1	1	-	1	-	-	-	-	-	1	2	1	-
CO 3	3	2	2	2	-	2	-	1	-	-	-	1	2	1	-
CO 4	3	1	1	1	-	1	-	-	-	-	-	1	2	1	-
CO 5	3	2	1	1	-	2	-	1	-	-	-	1	2	1	-
СО	3	2	2	2	-	2	-	1	-	-	-	1	2	1	-

YEAR	4	SEMESTER	7	L	Т	Р	C
COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE-III 191BM734- PHYSIOLOGICAL MODELING		3	0	0	3

- Explain the application of Physiological models
- Describe the methods and techniques for analysis and synthesis of Linear anddynamicsystem
- Develop differential equations to describe the compartmental physiological model
- Describe Nonlinear models of physiological systems
- Illustrate the Simulation of physiological systems.

	CO-PO and PSO 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	PSO1	PSO2	PSO3
CO 1	3	-	-	-	2	1	-	-	-	-	-	-	3	-	-
CO 2	3	2	2	1	2	-	-	-	-	-	-	-	3	2	-
CO 3	3	2	3	2	3	1	-	-	-	-	-	-	3	2	-
CO 4	3	2	3	3	3	1	-	-	-	-	-	-	3	2	-
CO 5	3	3	3	3	2	1	-	-	-	-	-	-	3	2	-
CO	3	3	3	3	3	1	-	-	-	-	-	-	3	2	-

YEAR	4	SEMESTER	7	L	Т	Р	C
COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE-IV 191BM735- BIOFLUIDS AND DYNAMICS		3	0	0	3

- Discuss the basics of Fluid Mechanics
- Construct the intracellular fluid mechanics and ocular mechanics.
- Describe the rheology of blood and mechanics of blood vessels.
- Elucidate on cardio respiratory mechanics and space medicine.
- Develop mathematical models of biological systems with fluids.

	CO-PO and PSO 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	PSO1	PSO2	PSO3
CO 1	3	1	-	1	1	-	-	-	-	-	-	-	2	-	-
CO 2	3	2	2	2	2	-	-	-	-	-	-	-	2	1	-
CO 3	3	2	2	2	2	-	-	-	-	-	-	-	3	1	-
CO 4	3	2	2	2	2	-	-	-	-	-	-	-	3	1	-
CO 5	3	3	3	3	3	-	-	-	-	-	-	-	3	2	-
CO	3	2	2.2	2	2	-	-	-	-	-	-	-	2.6	1.2	-

YEAR	4	SEMESTER	7	L	Т	Р	С
COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE-IV 191BM736- BIOINFORMATICS		3	0	0	3

- Develop models for biological data
- Apply pattern matching techniques to bioinformatics data protein data genomic data
- Apply micro array technology for genomic expression study
- Explain about Pattern matching
- Apply microarray technology.

	CO, PO, PSO 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	PSO1	PSO2	PSO3
CO 1	3	2	3	1	2	-	-	-	-	-	-	2	3	1	-
CO 2	3	3	3	2	2	1	-	-	-	-	-	2	3	2	-
CO 3	3	3	3	2	2	1	-	-	-	-	-	2	3	2	-
CO 4	3	3	3	2	2	1	-	-	-	-	-	2	3	2	-
CO 5	3	3	3	2	2	1	-	-	-	-	-	2	3	2	-
СО	3	3	3	1.6	2	1	-	-	-	-	-	2	3	2	-

YEAR	4	SEMESTER	7	L	Т	Р	С
COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE-IV 191BM737-COMPUTER NETWORKS		3	0	0	3

- Identify the components required to build different types of networks
- Choose the required functionality at each layer for given application
- Identify solution for each functionality at each layer
- Trace the flow of information from one node to another node in the network
- Explain about the application layer.

	CO, PO, PSO 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	PSO1	PSO2	PSO3
CO 1	3	2	1	1	1	1	-	-	-	-		1	3	-	-
CO 2	3	2	1	1	1	1	-	-	-	-	-	1	3	-	-
CO 3	3	2	2	2	2	2	-	-	-	-	-	1	3	2	-
CO 4	3	2	2	2	2	2	-	-	-	-	-	1	3	2	-
CO 5	3	2	2	2	2	2	-	-	-	-	-	1	3	2	-
CO	3	2	2	2	2	2	-	-	-	-	-	1	3	2	-

YEAR	4	SEMESTER	7	L	Т	Р	C
COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE-IV 191BM738-PATTERN RECOGNITION AND NEURAL NETWORKS		3	0	0	3

At the end of the course, the student should be able to:

- Explain the fundamentals of pattern recognition and neural networks.
- Design and apply different pattern recognition techniques to the applications of interest.
- Analyze the concept of neural networks
- Explain about clustering technique
- Analyze supervised and unsupervised neural networks.

	CO, PO, PSO MAPPING														
Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO q	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO 1	3	1	1	1	1	-	-	-	-	-	-	2	3	-	-
CO 2	3	3	3	3	3	-	-	-	-	-	-	3	3	3	-
CO 3	3	2	2	2	2	-	-	-	-	-	-	3	3	3	-
CO 4	3	2	2	2	2	-	-	-	-	-	-	3	3	3	-
CO 5	3	2	2	2	2	-	-	-	-	-	-	3	3	3	-
СО	3	2	2	2	2	-	-	-	-	-	-	3	3	3	-

YEAR	4	SEMESTER	8	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM831-ASSIST DEVICES		3	0	0	3

- Describe the circulatory mechanics associated with prosthetic heart valves.
- Describe the functions of dialyser
- Apply DSP in hearing aids
- Develop aids for hand, standing and walking function
- Explain new challenges in assist devices.

	CO, PO, PSO 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	PSO1	PSO2	PSO3
CO 1	3	2	2	3	2	2	2	1	-	-	-	3	3	3	3
CO 2	3	3	3	3	2	2	2	1	-	-	-	3	3	2	2
CO 3	3	2	3	2	2	2	3	1	-	-	-	3	3	1	3
CO 4	3	2	2	2	2	1	2	1	-	-	-	3	2	2	2
CO 5	3	2	2	2	2	1	3	1	-	-	-	3	3	2	3
CO	3	2	2	2	2	2	2	1	-	-	-	3	3	2	3

YEAR	4	SEMESTER	8	L	Т	Р	С
COURSECODE/ COURSE TITLE		191BM832-NEURAL ENGINEERING		3	0	0	3

- Revise anatomy and physiology of nervous system
- Identify various techniques for evaluating the function of central and peripheral nervous system.
- Apply nerve excitability in neurological disorders.
- Distinguish between a normal and abnormal signal coming from a healthy and a diseased nervous system respectively.
- Apply different electrophysiological evaluation in neuronal disorders.

	CO, PO, PSO MAPPING														
Cos	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	РО	PSO1	PSO2	PSO3
	1	2	3	4	5	6	7	8	9	10	11	12			
CO 1	3	2	2	2	1	2	1	-	1	1	1	3	3	3	3
CO 2	3	2	2	3	2	2	1	-	1	1	1	3	3	3	2
CO 3	3	2	2	2	2	2	1	-	1	1	1	3	3	3	3
CO 4	3	2	2	2	2	2	1	-	1	1	1	3	2	2	2
CO 5	3	2	2	2	2	2	1	-	1	1	1	3	3	3	3
CO	3	2	2	2	2	2	1	-	1	1	1	3	3	3	3

YEAR	4	SEMESTER	8	L	Т	Р	C
COURSECODE/ COURSE TITLE		191BM833-PRINCIPLES OF MANAGEMENT		3	0	0	3

- Elucidate basics of organization and management
- Gain knowledge on managerial function planning
- Gain basic knowledge on organizing skills
- Acquire knowledge on leadership qualities
- Gain knowledge on managerial function controlling.

	CO, PO, PSO 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	PSO1	PSO2	PSO3
CO 1	3	-	-	-	-	3	3	3	3	2	2	2	-	-	-
CO 2	3	-	-	-	-	3	3	3	3	2	2	2	-	-	-
CO 3	3	-	-	-	-	3	3	3	3	2	2	2	-	-	-
CO 4	3	-	-	-	-	3	3	3	3	2	2	2	-	-	-
CO 5	3	-	-	-	-	3	3	3	3	2	2	2	-	-	-
CO	3	-	-	-	-	3	3	3	3	2	2	2	-	-	-

YEAR	4	SEMESTER	8	L	Т	Р	С
COURSECODE/ COURSE TITLE		191BM834-SOFT COMPUTING TECHNIQUES		3	0	0	3

- To use various types of neural network algorithms for training a system
 To elucidate the significance of various genetic algorithms
 To explain the principle of machine learning
 To elucidate various fuzzy measure algorithms for driving a system.

- To apply soft computing techniques in real time applications.

	CO, PO, PSO 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	PSO1	PSO2	PSO3
CO 1	2	-	2	2	2	-	-	1	-	-	-	3	3	1	3
CO 2	2	-	1	2	1	-	-	3	-	-	2	3	3	1	2
CO 3	1	-	1	-	-	-	-	-	2	-	1	3	3	1	3
CO 4	2	-	2	-	2	-	-	2	-	-	-	3	2	1	2
CO 5	2	-	1	-	-	-	-	-	3	-	-	3	3	1	3
СО	2	-	1	2	2	-	-	2	2	-	1	3	3	1	3

YEAR	4	SEMESTER	8	L	Т	Р	C
COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE-VI 191BM835-ELECTRICAL SAFETY AND QUALITY ASSURANCE		3	0	0	3

- Demonstrate various techniques to shield patient from electrical hazardous
- Develop knowledge on medical safety standards
- Gain knowledge on safety measures to be followed in hospitals
- Insight into the procedures used in quality control
- Implement the various methods to monitor and assess quality in healthcare.

	CO, PO, PSO 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	PSO1	PSO2	PSO3
CO 1	3	3	3	3	3	2	3	1	2	2	3	3	3	3	3
CO 2	3	3	3	3	3	2	2	1	1	1	3	3	3	3	2
CO 3	3	2	3	3	2	2	3	1	1	1	2	3	3	3	3
CO 4	3	2	2	3	2	1	2	1	2	2	2	3	2	2	2
CO 5	3	3	3	3	2	1	3	2	2	2	3	3	3	3	3
СО	3	3	3	3	2	2	3	1	2	2	3	3	3	3	3

YEAR	4	SEMESTER	8	L	Т	Р	C
COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE-VI 191BM836- EMBEDDED AND REAL TIME SYSTEMS		3	0	0	3

- Acquire Knowledge about embedded systems and design analysis
- Develop new architectures of ARM processor and its peripheral devices
- Demonstrate sound knowledge on embedded software tool
- Develop advanced real time techniques in embedded systems. Demonstrate multiple tasks and multiprocessor.

CO-PO and PSO Mapping															
Cos	PO	PO 12	PSO1	PSO2	PSO3										
	1		3	4	5	0	1	δ	9	10	11	12			
CO 1	3	2	3	2	2	2	2	1	1	1	1	3	3	3	3
CO 2	3	2	2	2	3	2	2	1	1	1	1	3	3	3	2
CO 3	3	2	2	2	3	2	2	1	1	1	1	3	3	3	3
CO 4	3	2	2	2	3	2	2	1	1	1	1	3	2	2	2
CO 5	3	2	3	2	3	2	2	1	1	1	1	3	3	3	3
CO	3	2	3	2	3	2	2	1	1	1	1	3	3	3	3

YEAR	4	SEMESTER	8	L	Т	Р	С
COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE-VI 191BM837- REHABILITATION ENGINEERING		3	0	0	3

- Acquire Knowledge about embedded systems and design analysis
- Develop new architectures of ARM processor and its peripheral devices
- Demonstrate sound knowledge on embedded software tool
- Develop advanced real time techniques in embedded systems. Demonstrate multiple tasks and multiprocessor

CO-PO and PSO Mapping															
Cos	PO	PO 12	PSO1	PSO2	PSO3										
	1		3	4	5	0	1	δ	9	10	11	12			
CO 1	3	2	3	2	2	2	2	1	1	1	1	3	3	3	3
CO 2	3	2	2	2	3	2	2	1	1	1	1	3	3	3	2
CO 3	3	2	2	2	3	2	2	1	1	1	1	3	3	3	3
CO 4	3	2	2	2	3	2	2	1	1	1	1	3	2	2	2
CO 5	3	2	3	2	3	2	2	1	1	1	1	3	3	3	3
CO	3	2	3	2	3	2	2	1	1	1	1	3	3	3	3

YEAR	4	SEMESTER	8	L	Т	Р	C
COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE-VI 191BM837- REHABILITATION ENGINEERING		3	0	0	3

- Explain the roles of rehabilitation team and decide quality and safety standards in design of devices for user needs.
- Interpret the techniques and aids for impairments related in rehabilitation.
- Compare and know the different therapeutic exercises to improve person's health
- Explore the use of Robots and Virtual Reality tool in rehabilitative curative care.
- Describe the applications of different orthosis and prosthesis for various disabilities.

	CO-PO and PSO 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	PSO1	PSO2	PSO3
CO 1	1	1	2	1	-	2	1	1	1	1	3	3	3	-	2
CO 2	3	3	3	2	2	2	2	1	1	1	3	3	3	-	2
CO 3	3	3	3	2	2	2	3	1	1	1	2	3	3	-	2
CO 4	3	3	3	3	2	1	2	1	2	2	2	3	2	-	2
CO 5	2	2	2	2	3	1	3	2	2	2	3	3	3	-	2
CO	2	2	3	2	2	2	3	1	2	2	3	3	3	-	2

YEAR	4	SEMESTER	8	L	Т	Р	C
COURSECODE/ COURSE TITLE		PROFESSIONAL ELECTIVE-VI 191BM838-WEARABLESYSTEMS		3	0	0	3

- Use smart sensors to monitor vital parameters
- Demonstrate knowledge on the basic principles of signal conditioning in wearable system
- Explain sources of energy for wearable devices
- Develop advanced techniques of BAN architecture for more medical applications.
- Design various safe and user friendly wearable devices for patients.

CO-PO and PSO 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	PSO1	PSO2	PSO 3
CO 1	3	3	3	2	3	-	1	1	1	1	-	2	3	3	3
CO 2	3	3	3	2	2	-	1	1	1	1	-	2	2	3	3
CO 3	3	3	3	2	2	-	1	1	1	1	-	2	2	3	3
CO 4	3	3	3	2	2	1	1	1	1	1	-	2	3	1	1
CO 5	3	3	3	2	2	1	1	1	1	1	-	2	3	1	1
CO	3	3	3	2	2	1	1	1	1	1	-	2	3	3	3

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PROGRAMME OUTCOMES (POs) PROGRAMME SPECIFIC OUTCOMES (PSOs) PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING PROGRAMME OUTCOMES (POS)

POs	Programme Outcomes (POs)
PO1	Apply knowledge of mathematics, natural science , engineering fundamentals and system fundamentals, software development, networking & communication, and information assurance & security to the solution of complex engineering problems in computer science and engineering.
PO2	Ability to identify , formulate and analyze complex Computer Science and Engineering problems in the areas of hardware, software, theoretical Computer Science and applications to reach significant conclusions by applying Mathematics, Natural sciences, Computer Science and Engineering principles.
PO3	Design solutions for complex computer science and engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
PO4	Ability to use research based knowledge and research methods to perform literature survey, design experiments for complex problems in designing, developing and maintaining a computing system, collect data from the experimental outcome, analyze and interpret valid/interesting patterns and conclusions from the data points.
PO5	Ability to create, select and apply state of the art tools and techniques in designing, developing and testing a computing system or its component.
PO6	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice in system development and solutions to complex engineering problems related to system fundamentals, software development, networking & communication, and information assurance & security.
PO7	Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems related to system fundamentals, software development, networking & communication, and information assurance & security in societal and environmental contexts.
PO8	Apply ethical principles and commit to professional ethics and responsibilities and norms of computer science and engineering practice.
PO9	Ability to function as an individual and as a team player or leader in multidisciplinary teams and strive towards achieving a common goal .

	Communicate effectively on complex engineering activities with the engineering community and						
PO10	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.						
	Demonstrate knowledge and understanding of engineering management principles and economic						
PO11	decision making and apply these to one's own work, as a member and leader in a team, to manage						
	projects and in multidisciplinary environments.						
DO12	Recognize the need for, and have the preparation and ability to engage in independent and lifelong						
POIZ	learning in the broadest context of technological change.						

PSO's	PROGRAMME SPECIFIC OUTCOMES (PSOs)
PSO1	An ability to apply, design and development of application oriented software systems and to test and document in accordance with Computer Science and Engineering.
PSO2	The design techniques, analysis and the building, testing, operation and maintenance of networks, databases, security and computer systems (both hardware and software).
PSO3	An ability to identify, formulate and solve hardware and software problems using sound computer engineering principles.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	Programme Educational Objectives (PEOs)
PEO1	Ability to identify, formulate and analyze complex Computer Science and Engineering problems in the areas of hardware, software, theoretical Computer Science and applications to reach significant conclusions by applying Mathematics, Natural sciences, Computer Science and Engineering principles.
PEO2	Apply knowledge of mathematics, natural science, engineering fundamentals and system fundamentals, software development, networking & communication, and information security to the solution of complex engineering problems in computer science and engineering to get benefits in their professional career or higher education and research or technological entrepreneur.
PEO3	Design solutions for complex computer science and engineering problems using state of the art tools and techniques, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CURRICULUM VERTICALS

Vel Tech Multi Tech

Dr. Rangarajan Dr. Sagunthala Engineering College

An Autonomous Institution

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B.E-COMPUTER SCIENCE AND ENGINEERING

CURRICULUM SYLLABUS – Regulation 2019

SEMESTER I

Course Code	Name of the Course	Category	L	Т	Р	Credits
191MA101	Engineering Mathematics – I	BS	2	2	0	3
191PH101	Engineering Physics	BS	3	0	0	3
191CH101	Engineering Chemistry	BS	3	0	0	3
191HS101	English for Engineering Students	HSS	3	0	0	3
191ME111	Basic Civil and Mechanical Engineering	ES	3	0	0	3
191EE111	Basic Electrical and Electronics Engineering	ES	3	0	0	3
191PH10A	Physics Laboratory	BS	0	0	2	1
191CH10A	Chemistry Laboratory	BS	0	0	2	1
191ME11A	Engineering Practices Laboratory	ES	0	0	4	2
		Total	17	2	8	22

SEMESTER II

Course Code	Name of the Course	Category	L	Т	Р	Credits
191MA201	Engineering Mathematics II	BS	2	2	0	3
191EC211	Electron Devices and Circuits	ES	3	0	0	3
191EC212	Digital System Design	ES	3	0	0	3
191ME211	Engineering Graphics	ES	2	2	0	3
191CS221	Problem Solving and Python Programming	PC	3	0	0	3
191HS201	Environmental Science and Engineering	HSS	3	0	0	3
191EC21A	Circuits and Devices Laboratory	ES	0	0	2	1
191EC21B	Digital System Design Laboratory	ES	0	0	2	1
191CS22A	Problem Solving and Python Programming Laboratory	PC	0	0	2	1
		Total	16	4	6	21

Course Code	Name of the Course	Category	L	Т	Р	Credits
191MA303	Probability and statistics	BS	2	2	0	3
191CS321	Data Structures	PC	3	0	0	3
191CS322	Computer Architecture	PC	3	0	0	3
191CS323	Object oriented Programming	PC	3	0	0	3
191CS324	Software Engineering	PC	3	0	0	3
191EC311	Communication Engineering	ES	3	0	0	3
191CS32A	Data Structures Laboratory	PC	0	0	2	1
191CS32B	Object oriented Programming Laboratory	PC	0	0	2	1
191HS30A	Advanced Reading and Writing skill Laboratory	HSS	0	0	2	1
		Total	17	2	6	21

SEMESTER III

SEMESTER IV

Course Code	Name of the Course	Category	L	Т	Р	Credits
191MA403	Discrete Mathematics	BS	2	2	0	3
191CS424	Computer Networks	PC	3	0	0	3
191CS422	Database Management Systems	PC	3	0	0	3
191CS421	Design and Analysis of Algorithms	PC	3	0	0	3
191CS423	Operating Systems	PC	3	0	0	3
191CS425	Theory of Computation	PC	3	0	0	3
191CS42A	Database Management Systems Laboratory	PC	0	0	2	1
191CS42C	Networks Laboratory	PC	0	0	2	1
191CS42B	Operating Systems Laboratory	PC	0	0	2	1
191MC46A	Internship / Training - I	MC	0	0	0	**
		Total	17	2	6	21

SEMESTER V

Course Code	Name of the Course	Category	L	Т	Р	Credits
191MA501	Numerical Methods and Number Theory	BS	2	2	0	3
191CS521	Mobile Computing	PC	3	0	0	3
191EC511	Microprocessors and Microcontrollers	ES	3	0	0	3
	Professional Elective – I	PE	3	0	0	3
	Professional Elective – II	PE	3	0	0	3
	Open Elective – I	OE	3	0	0	3
191CS52A	Mobile Application Development Laboratory	PC	0	0	2	1
191EC51A	Microprocessors and	ES	0	0	2	1
	Microcontrollers Laboratory	10			-	-
191HS50A	Professional Communication	HSS	0	0	2	1
191MC56A	Technical Seminar	MC	0	0	0	**

Total				2	6	21			
SEMESTER VI									
Course Code	Name of the CourseCategoryLT		Т	Р	Credits				
191IT621	Artificial Intelligence	PC	3	0	0	3			
191CS621	Compiler Design	PC	3	0	0	3			
191CS622	Internet Programming	PC	3	0	0	3			
	Professional Elective - III	PE	3	0	0	3			
	Open Elective - II	OE	3	0	0	3			
191CS62A	Compiler Design Laboratory	PC	0	0	2	1			
191CS62B	Internet Programming Laboratory	PC	0	0	2	1			
191CS67A	Miniproject	PROJ	0	0	4	2			
191MC66A	Internship / Training - II	MC	0	0	0	**			
		Total	15	0	8	19			

SEMESTER VII

Course Code	Name of the Course	Category	L	Т	Р	Credits
191CS722	Cryptography and Network Security	PC	3	0	0	3
191CS721	Cloud Computing	PC	3	0	0	3
	Professional Elective – IV	PE	3	0	0	3
	Professional Elective – V	PE	3	0	0	3
	Open Elective – III	OE	3	0	0	3
191CS72B	Security Lab	PC	0	0	2	1
191CS72A	Cloud Computing Laboratory	PC	0	0	2	1
191CS77A	Project Work - Phase I	PROJ	0	0	2	2
		Total	15	0	6	19

SEMESTER VIII

Course Code	Name of the Course	Category	L	Т	Р	Credits
	Professional Elective - VI	PE	3	0	0	3
	Open Elective - IV	OE	3	0	0	3
191CS87A	Project Work - Phase II	PROJ	0	0	20	10
		Total	6	0	20	10

Semester	Profession al Elective	ourse Cod	Name of the Course	Category	L	Т	Р	С
V		191CS531	Big Data Analytics	PE	3	0	0	3
V		191CS533	Digital Signal Processing	PE	3	0	0	3
V	I	191CS534	Graph Theory and Applications	PE	3	0	0	3
V		191CS535	Intellectual Property Rights	PE	3	0	0	3
V		191CS536	Software Testing	PE	3	0	0	3
V		191CS532	Computer Graphics	PE	3	0	0	3
V		191CS537	Agile Methodologies	PE	3	0	0	3
V		191CS538	Distributed Systems	PE	3	0	0	3
V	II	191CS539	Internet-of-Things	PE	3	0	0	3
V		191CS5310	Machine Learning Techniques	PE	3	0	0	3
V		191CS5311	Software Project Management	PE	3	0	0	3
V		191CS5312	Speech Processing	PE	3	0	0	3
VI		191CS631	Adhoc and Sensor Networks	PE	3	0	0	3
VI		191CS632	C# and .Net Programming	PE	3	0	0	3
VI	III	191CS633	Data Warehousing and Data Mining	PE	3	0	0	3
VI		191CS634	Fundamentals of Nano Science	PE	3	0	0	3
VI		191CS635	Human Computer Interaction	PE	3	0	0	3
VI		191CS636	Information Retrieval Techniques	PE	3	0	0	3
VII		191CS731	Advanced Computer Architecture	PE	3	0	0	3
VII		191CS735	Principles of Management	PE	3	0	0	3
VII		191CS732	Digital Image Processing	PE	3	0	0	3
VII	IV	191CS733	Embedded Systems	PE	3	0	0	3
VII		191CS734	Natural Language Processing	PE	3	0	0	3
VII		191CS736	Service Oriented Architecture	PE	3	0	0	3
VII		191CS737	Social Network Analysis	PE	3	0	0	3
VII		191CS738	Cyber Forensics	PE	3	0	0	3
VII		191CS739	Grid and Cloud Computing	PE	3	0	0	3
VII	V	191CS740	Information Security	PE	3	0	0	3
VII	v	191CS741	Neural Networks and Deep Learning	PE	3	0	0	3
VII		191CS742	Soft Computing	PE	3	0	0	3
VII		191CS743	Software Defined Networks	PE	3	0	0	3
VII		191HS701	Total Quality Management	PE	3	0	0	3
VIII		191HS801	Professional Ethics in Engineering	PE	3	0	0	3
VIII	VI	191CS832	Green Computing	PE	3	0	0	3
VIII		191CS833	Information Theory and Coding	PE	3	0	0	3
VIII		191CS834	Multi-Core Architectures and Programming	PE	3	0	0	3
VIII		191CS835	Parallel Algorithms	PE	3	0	0	3
VIII		191CS836	Real Time Systems	PE	3	0	0	3
VIII		191CS831	GPU Architecture and Programming	PE	3	0	0	3

LIST OF PROFESSIONAL ELECTIVES
PROFESSIONAL ELECTIVE COURSES: VERTICALS Offered By CSE Department for B.E (Hons) Programme

Vertical I Data Science	Vertical II Full Stack Development	Vertical III Cloud Computing and Data Center	Vertical IV Cyber Security and Data Privacy	Vertical V Creative Media	Vertical VI Emerging Technologies	Vertical VII Artificial Intelligence and Machine Learning
Exploratory Data Analysis	Web Technologies	Cloud Computing	Ethical Hacking	Augmented Reality/Virtual Reality	Augmented Reality/Virtual Reality	Knowledge Engineering
Recommender Systems	App Development	Virtualization	Digital and Mobile Forensics	Multimedia and Animation	Robotic Process Automation	Soft Computing
Neural Networks and Deep Learning	Cloud Services Management	Cloud Services Management	Social Network Security	Video Creation and Editing	Neural Networks and Deep Learning	Neural Networks and Deep Learning
Text and Speech Analysis	UI and UX Design	Data Warehousing	Modern Cryptography	UI and UX Design	Cyber security	Text and Speech Analysis
Business Analytics	Software Testing and Automation	Storage Technologies	Engineering Secure Software Systems	Digital marketing	Quantum Computing	Optimization Techniques
Image and Video Analytics	Web Application Security	Software Defined Networks	Cryptocurrency and Blockchain Technologies	Visual Effects	Cryptocurrency and Blockchain Technologies	Game Theory
Computer Vision	DevOps	Stream Processing	Network Security	Game Development	Game Development	Cognitive Science
Big Data Analytics	Principles of Programming Languages	Security and Privacy in Cloud	Security and Privacy in Cloud	Multimedia Data Compression and Storage	3D Printing and Design	Ethics And AI

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CO Mapping with PO'S

Vel Tech Multi Tech Dr. Rangarajan Dr. Sakupikata Engineering College (An Autonomous Institution affiliated to Anna University) B.E. - Computer Science and Engineering CO Mapping with PO'S

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Course	_		lies	- Ient	IPO4	IPOS	PO6	P07	108	109	POIR	1109	PO12
cade	Course	101	102	17	1 .,	<u> </u>	1-	- 1	F -	2	2	-	2
C101	English for Englacering Students	<u>'</u>	<u> </u>	<u> </u> <u>+</u> −	<u> </u>	╞╶╺╴	1 2	2	-	-	-	-	2
C102	Engineering Chemistry	<u> </u>		<u>⊢</u> ÷-	łŧ		ŀ÷:	<u> </u>		- ,	-		1
C103	Engineering Mathematics - I	3	3	I.÷-	₩÷-	 _	5	2	2	2		-	2
C104	Engineering Physics	3	3-	+ - <u>-</u>	<u> </u>			-			-	-	2
C111	Basic Civil and Mechanical Engitteering	3	3		┝╌╴╽		-				- <u>-</u> -		
C112	Basic Electrical and Electronics Engineering	3	2	1		-'-	÷	ļ.	- 	2			2
C101A	Chemistry Laboratory	3	3	2		<u> </u>	-	<u>-</u>	- 5	-			2
C102A	Physics Laboratory	3	1	2	2		<u>+</u>	<u> </u>	<u>^</u>	- <u>-</u> -	_	1	- 3
C111A	Engineering Practices Laboratory	3	3	2	1		<u> </u>				÷	-	
C201	Environmental Science and Engineering		2	2	<u>z</u>	÷			<u></u>	-	_	-	
C202	Engineering Mathematics It	3	1	2	Z	<u> </u>	<u> </u>	-	-			• •	-
C211	Digital System Design	3	2	Z		-	-		H		-, 1		-2
CZ1Z	Electron Devices and Circuits	3	3	2		<u> </u>	$\left \cdot \right $	<u> </u>			÷	- 1	
C213	Engineering Graphics	3	1	3	· ·	- 2 -	+	7	-,		-;		- 2
C221	Problem Solving and Python Programming	3	3		-		4		÷		<u> </u>		
C211A	Circuits and Devices Laboratory	3	1	2	<u> </u>	-	-	<u> </u>		-			
C212A	Digital System Design Laboratory	1	2	L <u>2</u>		4	-		-		<u> </u>	_ 1	
C221A	Problem Solving and Python Programming Laboratory	1	2		<u> </u>			-		<u> </u>		<u> </u>	<u> </u>
C301	Probability and Statistics	3	3	<u>Z</u>	2		<u> </u>			-		- +	- <u>-</u>
C311	Communication Engineering	1	3	$\begin{bmatrix} 2 \\ 2 \end{bmatrix}$	2		-		-; +	-	÷		╼┼╼┥
C321	Computer Architecture	1	<u> </u>	+	4	7	-;		÷	-:-+	<u>.</u> .+		–;–∣
C322	Dava Structures	1					~	-÷∤	+		-		<u>-</u>
C323	Object Oriented Programming	1	2	4	┝┿┤	-÷-1	-	÷	- : 	÷ł	-	÷ł	- <u>-</u> -!
C324	Software Engineering	7			7	÷	÷	÷	÷	┽┼	÷t	. +	—; 1
C301A	Advanced Reading and Writing	·	2	+		÷	╧┤		++	÷t	. †	÷ł	_; {
C322A	Data Structures Laboratory	<u>د</u>	- 7	$\frac{1}{1}$	╡	-	+	-; {	÷t	÷ł	÷		
C323A	Object Oriented Programming Laboratory	<u>+</u> ++	ر ۲	2	;	╧┨	-	÷	÷	÷+	- +	-	1
C401	Discrete Malbernatics	1	2	- 2	+++	÷ł		-		╤┼	$\dot{\cdot}$		- i -i
C421	Computer Networks			2	;	-	÷t	$\frac{1}{1}$	- †	+ +		2	
C422	Database Management Systems	3	1	5	÷-		÷	╡┥	- <u>-</u> +	-	÷	╶╌┤	<u> </u>
C423	Design and Analysis of Algorithms		ż	1	-	2	2	2	2	<u>, †</u>		÷	TT.
C424	Operating Systems	3	2	2			-	÷	╶╤╌┼	÷ł	- 1	-	<u></u>
C425	Theory of Computation		2	2				_	<u> </u>	<u></u> +	-	┯┼	<u> </u>
C421A	Database Management Systems Laboratory	<u> </u>	3	3	3	3	÷	-; 		-f	-1	<u>.</u> +	- 7 -1
C422A	Networks Laboratory	1	1	3	1	2	2	2	2		╶╤┥	- <u>;</u>	<u></u>
CAZSA	Operating Systems Lawrency	3	1	3	<u></u>	3	-		÷t				
C461A	Internship / Triumag / I	3	5	2	$\frac{1}{2}$	-í t	-	<u> </u>	. †	<u>+</u>		, [
C601	Nemocrical Methods and Microsovermillers	- <u>j</u> -	1	1	<u>-</u> - <u>-</u> -		_ 1	-	╧┿	<u>-</u> +	╺╦╺┾╸		÷
C811	Meroprocessors and minore and the	1	1	1	2	-; f	21	2	 +	÷t	╧╈		
C821	Moore Compount	3	3	2	2	2	╦╉	. +	-; +	÷t	÷t	╤┽	
C84111		3	3	3	2		÷	÷t	÷+	÷t	÷ ŀ	<u></u> +	1
C6412	Cofficient Testinte	3	3	3	2	2	2	$\frac{1}{2}$	21	3	<u>;</u>	3	
CIN118	Terror of Things	3	3	┝╷┨	- - +	<u></u> ††	Ť	÷	-+	÷	-	<u> </u>	1
G6323	A Jacking Learning Techniques	3	2	2	-i t	÷t	÷	-+	-+	1	•	- †	1
00324		3	-	•	_	<u>.</u>	- 1	-	- +	3	3	<u></u>	ī
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C511A	Microprocessors and Microcontrollers Laboration	1 3	1	3	3	3	12	2	-		1	1.	
C521B	Mobile Application Development Laboratory	1	3	1	3	3	1	1	-		-	1	1
C551A	Technical Seminar	2	2	1	3	3	3	1	1	1	2	-	-
C621	Artificial Intelligence	3	2	2	2	1	Ť	1	1	1	1	3	3
C622	Compiler Design	3	2	1	2	2	2	2	1		1	+	1
C623	Internet Programming	3	3	3	-	-	-	-	1	1	1	-	2
C6332	C# and .Net Programming	3	2	1	1	1	T	1	2	1	1	1	3
C6335	Human Computer Interaction	3	2	1	2	2	1	1	-	1		2	2
C621A	Compiler Design Laboratory	3	3	3	1	2	÷	1		i		-	4
C622A	Internet Programming Laboratory	3	2	2	2	1	2	2	3	3	3	2	1
C671A	Miniproject	3	3	2	3	3	2	1	3	3	3	3	3
C661A	Internship / Training - II	3	3	3	2	3	3	3	3	3	2	2	3
C721	Cloud Computing	3	2	2	1	1	1.		-				3
C722	Cryptography and Network Security	3	2	2	1						-	2	1 i
C721A	Cloud Computing Laboratory	3	1	1	1	1 I	1	1		1	-	-	
C722B	Security Laboratory	1	2	2	1						-	2	1
C771A	Project Work - Phase I	1	1	3	3	2	1	3	3	2	2	2	2
C871A	Project Work - Phase II	3	3	3	3	3	3	3	3	3	3	3	3

*NOTE: Slight (Low) 2-Moderate (Medium) 3-Substantial (High) -

Prepared by

N. HOD

HEAD OF THE BAR THENT Department of Computer Science and Engineering VEL TECH MULTITECH College VEL TECH MULTITECH College VEL TECH MULTITECH College Avadi, Chennai - 600 062.

			-	T	P	Credit
Course	None of the Course	Category	L	2	0	3
Code	Name of the control	BS	2	4	0	3
191MA101	Engineering Mathematics - 1	BS	3	0	0	3
191PH101	Engineering Physics	BS	3	0	0	3
191CH101	Engineering Chemistry	HSS	3	0	0	-
191HS101	English for Engineering Students	1100		0	0	3
ININELLI	Basic Civil and Mechanical	ES	3	0		-
PIMEIII	Engineering	-		0	0	3
	Basic Electrical and Electronics	ES	3	0	· ·	-
191EE111	Engineering	DC	0	0	2	1
91PH10A	Physics Laboratory	BS	0	0	2	1
01CH10A	Chemistry Laboratory	BS	0	0	4	2
OIMELLA	Engineering Practices Laboratory	ES	0	0		22
PIMEIIA	Engineering Practices Date	Total	17	2	8	11

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SEMESTER I



YEAR	1	SEMESTER	1	L	т	Р	с
COURSE CODE / COURSE TITLE	191MA	101 / ENGINEERING MA	THEMATICS - I	2	2	0	3

	COURSE OUTCOMES
On con	apletion of the course, students will be able to
CO1	Analyze the characteristics equation of a linear system with Eigen values and vectors for practical application,
CO2	Determine the bending of family of curves using differential calculus which deals in various disciplines.
CO3	Apply partial derivatives in various engineering problems.
CO4	Identify and solve the real time problems using higher order differential equations.

co	Ima	1 Contraction				C	O-PO	&PSO	Mappi	ng					
co	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO	PO1 0	PO1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	2	-	-	-	-	-	-	1	-	-	1
CO 2	3	3	2	2	1						1	T			1
CO 3	3	3	2	2	1							1		-	1
CO 4	3	3	2	2	1				-		-	1			1
CO	3	3	2	2	T	-		-	-		-	1			1
CO	3	3	2	2	1	-		1			-	1			1

COURSE IN-CHARGE(S)

HOD

HEAD OF THE DEPARTMENT Department of Computer Science and Engineering VEL TECH MULTI TECH Dr. Rangarajan Dr. Sakunthala Engg. College Avadi, Chennai - 600 062.



			L	T	P	C
YEAR	1	SEMESTER	1.	0	0	3
COURSE CODE / COURSE TITLE		191711101 / ENGINEERING PHYSICS	1	-		

	COURSE OUTCOMES
On con	pletion of the course, students will be able to
coi	Demonstrate the proficiency on the properties of matter and treat in industrial and medical applications
CO2	Describe the working principles of Laser and its neverophications
C03	Explain the propagation of waves in optical fibers and their opposition applications
CO4	Apply the theory of wave nature of particles in various interesting
C05	Analyze the structure of materials and its crystal growth recently

		C	O -P(APS0	OMap	ping									
со	POI	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	P 0 10	P 0 11	PO1 2	PSO 1	PSO 2	PSO 3
COI	2	3	2	2		2	2	2	2			2	1	•	-
CO2	3	3	2	2		2	2	2	2	4		2	1	-	•
C03	3	3	2	2		2	2	2	2			2	1		-
CO4	3	3	2	2		2	2	2	2			2	1	-	-
C05	3	3	2	2		2	2	2	2			2	1		•
CO	13	12	2	2	-	2	2	2	2		-	2	1	-	-

COURSE IN-CHARGE(S)

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HEAD OF THE DEPARTMENT

Department of Computer Science and Engineering VEL TECH MULTI TECH Dr. Ranyarajan Dr. Sakurithala Engg. College Avadi, Chennal - 600 062.



			L	т	P	C
YEAR	1	SEMESTER		0	0	3
COURSE CODE / COURSE TITLE	191CH	101 / ENGINEERING CHEMISTRY	3			

	COURSE OUTCOMES
On con	apletion of the course, students will be able to
COI	Analyse microscopic chemistry in terms of atomic, molecular and mechanism
CO2	Investigate the various water treatment and softening methods.
CO3	Appraise the types and mechanism of electrochemical reaction in batteries and fuel cells.
CO4	Explain the basic principle, types and mechanism of polymerization process and techniques.
C05	Assess the properties, characterization and applications of advanced materials for energy storage.

						C	O - PO	D&PSO	Mappi	ng	1	1 001	DEO	DSO	PSO
со	PO 1	PO 2	PO	PO	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	2	1	2	3
co	3	3	2	2		2	2	-			-	2	-1	1	1
CO 2	3	3	2	2	-	2	2	-	-	-	-	2	1	1	1
CO 3	3	3	2	2		2	2	-	-	-	-	2	1	1	1
CO	3	3	2	2	-	2	2	-	•	-	-	2	1	1	1
2	3	3	2	2	+	2	2	-	-	•	•	2	1	1	1
co	3	3	2	2		2	2	-	-		-	2			

SOURSE IN-CHARGE(S)

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HEAD OF THE DEPARTment Department of Computer Science and Engineering VEL TECH MULTI TECH Dr. Rangarajan Dr. Sakunthala Engg. Collega Avadi, Chennai - 600 062.



		1	L	Т	P	C
YEAR	1	SEMESTER THE FOR ENGINEERING	3	0	0	3
COURSE CODE / COURSE TITLE	1	9111S101 / ENGLISH FOR STUDENTS	-	-		

-	COURSE OUTCOMES
On com	pletion of the course, students will be able to
COI	Infer meanings of unfamiliar words from context
CO2	Enable to achieve linguistic competence and discourse efficiently according to the sterior deas comprehension and creation of oral and written discourse efficiently according to the sterior deas comprehension and creation of oral and written discourse efficiently according to the sterior dease to the sterior dease of the s
C03	Write cohesively, coherently and flawlessly while a logically on a topic.
C04	Activate and reinforce the habit of reading and writing
C05	Collaborate with multicultural environment.

						CO-	PO &	PSO M	lapping	g		-	DC	DEO	PS
c0	POI	POZ	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PO12	PS 01	2	03
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COI	3	2	1	-	-		-	-	-	2		2	1		
	3	2	1				+	-	2	2			1		-
COZ	-	-		-	-				2	2	-	2	1		
CO3	3	2	1	-	1			-	-	-			1		-
	2	2	1			•	-	-	2	2		2	4		1.1
CO4	1 3	~	1.1		-	-	-	-	2	2		2	1	-	-
COS	3	2	1	-	•	-	-	-	2	2		2	1.1	-	-
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CO	3	2	1-3-				-							-	

COURSE IN-CHARGE(S)

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			L	т	Р	С
YEAR	1	SEMESTER	3	0	0	3
COURSE CODE / COURSE TITLE	191	METLI / BASIC CIVIL AND MECHANICA ENGINEERING	L			

	COURSE OUTCOMES
On con	apletion of the course, students will be able to
coi	Learn the usage of construction material and proper selection of construction material
CO2	Identify about water resources, sewage treatment and transportation systems
C03	Design the components use in power plants
CO4	Describe the internal combustion engines
C05	Analyzeabout the renewable energy sources and refrigeration cycles

						C	O-PO	& PSO	Mapp	ing		-			ncon
	POL	POT	POL	POI	POS	PO6	PO7	POS	PO9	PO10	PO11	PO12	PSO1	PSO2	PSUS
0	FOI	PO2	105	104	105	2	2	1			-	2	2	1	1
COI	3	3	1			-	-					2	2	1	T
CO2	3	3	1	1	•	2	2	1	-		-	-		1	1
CO3	3	3	1	1	-	2	2	1		-	-	2	2	1	1
CO4	3	3	1	1		2	2	1	-	-	-	2	2	1	1
COS	3	3	1	1	-	2	2	1	+	-	13	2	2	1	1
	3	3	1	1	-	2	2	1	-	-	+	2	2	1	1

COURSE IN-CHARGE(S)

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MEAD OF THE DEPARTMENT. Department of Computer Science and Engineering VEL TECH / VELTI TECH Dr. Rangarajan Dr. Sakunthala Engg. College Avadi, Chennai - 600 062.



YEAR	1	SEMESTER	1	.8.	т	P	C
COURSE CODE /	BIER	111 / BASIC ELECTRICAL RONGS ENGINEERING	AND	3	. 0	0	ł,

	COURSE OUTCOMES
Oxen	repletion of the course, students will be able to
001	Summarizes about different atractures of Power system and safety measures.
co:	Englain about the basics of Electricity
cos	Discuss on various electric circuits and use of measuring instruments
004	Clarify the working of basic electronic devices such as diode, transistor and operational amplifiers
C05	Infer about Digital Electronics and Communication System

					CO	-FO S	e PSO	Mapp	ang		_			_	
co	PO 1	PO 2	PO	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO1 2	PS O1	PS O2	PSOS
COL	3	2	2									-	2	1	1
CO2	3	2	2								-		2	1	1
CO3	2	1	1									4.	2	1	1
CO4	2	1	1	1	1								2	1	1
COS	2	1	1	1			+			+		-	2	1	1
CO	3	2	2	1	1	-	-		+	-	-		2	1	1

COURSE/IN-CHARGE(S)

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NEAD OF THE DEPARTMENT Department of Computer Science and Engineering VEL TECH MULTI TECH Dr. Rangarajan Dr. Sakunthala Engg. College Avadi, Chennai - 600 062.

	_		L	т	P	C	ł
YEAR	1	SEMESTER		0	2	1	
COURSE CODE / COURSE TITLE	191PH	10A / PHYSICS LABORATORY		_		-	1

	COURSE OUTCOMES	
On con	apletion of the course, students will be able to	
COI	Apply the principles of properties of matter in determining the	
CO2	Attains the practical knowledge, to apply principles of optics of optics of	_
CO3	Demonstrate the technical knowledge on Quantum Mechanical concer-	

					-				no	POL	PO1	PO1	PSO	PSO	PSC
CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	0	1	2	1	2	3
-	1	2	3	4	5	6	7	8	9	-		2	1		-
00	3	3	2	2	-	2	2	2	2	-	1.00	1.1			-
co	5	-		-		1.11			-	-		2	1	-	-
1	2	2	2	2		2	2	2	2	-	-	~			
co	3	3	-	-				-			-	2	1		-
2		-	-	1 0		2	2	2	2	-	-	4			
CO	3	3	2	2		-	~		1.1						-
3			-		-	-	2	2	2			2		-	-
CO	3	3	2	2	-	2	2	4	-		1.1				

COURSE IN-CHARGE(S)

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-		1	L	Т	Р	С
YEAR	I	SEMESTER	0	0	2	1
COURSE CODE / COURSE TITLE	191CH	110A / CHEMISTRY LABORATORY		-	-	

	COURSE OUTCOMES
On con	apletion of the course, students will be able to
C01	Acquire knowledge on quantitative chemical analysis of notassium content, dissolved oxygen etc.
CO2	Analyse the water sample for hardness, chloride, source photometer for the identification and quantification
CO3	Solve analytical problems in spectrometer and frame protonice

O-PC	&PSC	Mapp	oing			-	-	pO	PO	PO	PO	PO1	PSO	2	3
CO	PO	PO	PO	PO	PO 5	PO 6	PO 7	8	9	10	11	2	2	1	1
CO	3	3	2	2	-	2	2	2	2				-	1	1
1	-	-		2	-	2	2	2	2	-	-	2	2	1	
CO 2	3	د	2	4				_	-	-	-	2	2	I	1
co	3	3	2	2	-	2	2	2	2	-					-
3	-	2	2	2		2	2	2	2	-	1	2	2	1	

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			L	Т	P	C
YEAR	1	SEMESTER I	-	0	4	2
COURSE CODE / COURSE TITLE	1	91ME11A / ENGINEERING PRACTICES LABORATORY	0	0	-	

-	COURSE OUTCOMES
On com	upletion of the course, students will be able to
COI	Use mechanical and civil engineering equipments to join the super- operations and fabricate models in sheet meta
CO2	Use electrical and electronics engineering equipment to test the tart

			CO)-PO8	PSON	lappin	g				0.011	PO12	PSO1	PSO2	PSO:
col	PO	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	POIL	1012			-
	1		2.20				-	-	-	1	1	3	1	1	
CO	3	3	2	1	1	1	-	-					-		-
1			-		-	-	-	-		1	1	3	1	1	1.1
co	3	3	2	1	1		-					1.1			-
2				-	-		-			1	1	3	1	1	
co	3	3	2	1	1	1	-	-							-

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SEMESTER II

Course Code	Name of the Course	Category	L	Т	P	Credits
191MA201	Engineering Mathematics II	BS	2	2	0	3
191EC211	Electron Devices and Circuits	ES	3	0	0	3
191EC212	Digital System Design	ES	3	0	0	3
191ME211	Engineering Graphics	ES	2	2	0	3
191CS221	Problem Solving and Python Programming	PC	3	0	0	3
191HS201	Environmental Science and Engineering	HSS	3	0	0	3
191EC21A	Circuits and Devices Laboratory	ES	0	0	2	1
191EC21B	Digital System Designs Laboratory	ES	0	0	2	1
191CS22A	Problem Solving and Python Programming Laboratory	ving and Python PC 0			2	1
		Total	16	4	6	21



YEAR	1	SEMESTER	п	L	Т 2	P	e
COURSE CODE / COURSE TITLE	191MA2	01 / ENGINEERING MA	THEMATICS II	2		-8	3

	COURSE OUTCOMES
On col	upletion of the course, students will be able to
COI	Evaluate multiple integrals using change of variables.
CO2	Apply various integral theorems for solving engineering problems involving cubes and rectangular parallelepipeds.
CO3	Construct analytic functions of complex variables and transform functions using conformal mappings.
CO4	Estimate the real and complex integrals over suitable closed paths and contours.
CO5	Compute linear differential equations using Laplace transform techniques

						co	-PO &	PSO N	Lappin	g					
со	PO1	PO2	PO3	PO4	PO5	P06	P07	POS	P09	PO10	PO11	P012	PS 01	PSO 2	PS 03
CO1	3	3	2	2	2		-		-	-	-	1.			
CO2	3	3	2	2	2	-	+	-				1		-	-
CO3	3	3	2	2	2	-		-			-	1	-		
CO4	3	3	2	2	2	-	-		-			i	-		-
CO5	3	3	2	2	2							+	-		-
CO	3	3	2	2	2	-	-			-		1	-	-	-

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COURSE IN-CHARGE (S)

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	-		п	L	T	P	С
YEAR	1	SEMESTER			0	0	3
COURSE CODE / COURSE TITLE	191EC	211 / ELECTRON DEVICE	ES AND CIRCUITS	3			

C01	Analyze PN junctions in semiconductor devices under various conditions
CO2	Understand the Characteristics of current flow in BJT with CB,CE and CC course
CO3	Realize the characteristics of MOS and FET amplifier
CO4	Discuss the characteristics of power and display devices.
CO5	Employ the acquired knowledge in design and analysis of feedback amplifiers and oscillators

									-	010	POIL	PO12	PSO1	PSO2	PSO3
CO	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	P09	POID	TOH	2	3	1	1
C01	3	3	1	1	-	-		-	1	1	-	1	3	2	1
CO2	3	3	2	2	-	-	•	-	1	1		2	2	2	1
CO3	3	2	2	2	-	-	-	-	-	1	1	1	2	2	1
CO4	3	2	1	1	-	-	-		1	-	1	2	3	1	1
COS	3	3	3	1	+	-		-	1	1		-		2	1
			2	2	1.	-	=	-	1	1	1	2	3	2	

COURSE IN-CHARGE (S)

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II T P	N 3 0	
SEMESTER	DIGITAL SYSTEM DESIG	
-	191EC212/	
KEAR	COURSE CODE /	

On con	COURSE OUTCOMES Pletion of the course students will be able to
	The second set students with or another
COI	Apply the theorems and postulates of Boolean algebra, the recumptees of theorem and postulates of Boolean algebra. The recumptees of the recurptees of the r
C02	Design combinational logic circuits for various applications and implement them using logic gates or
CO3	Design synchronous sequential logic circuits like counters and shift registers and implement them using different flip flows
C04	Analyze the given Asynchronous sequential logic circuit to determine its function.
COS	Review the various memory and programmable logic devices.

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						Ö	0-PO	& PSO	Mapp	Bui	ľ				
										0100	1000	010a	ps01	PS02	PS03
00	POI	P02	PO3	P04	P05	P06	P07	P08	P09	PUIU	FUIL	TOT T			
COL		0	•					•		•	1	•	4		1
	,		4										H		
C02	m	2	5	•	•	•	•	•					'		
CO3		6	0					•		•	•	•	d	•	•
2	,	1	1										-		
C04	3	2	2		•	•	•		•		•	•	+		
													1		•
C05	~	2	2		•	•	•	•				•			
1	-		100	1000		-							4		•
00-	-	2	2									-			

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Department of Computer Science and Engineering VEL TECH MULTI TECH Dr. Rangarajan Dr. Sakunthata Engg. College Avadi, Chennai-600 062.

College

HEAD OF THE DEPARTMENT

				L	Т	P	С
YEAR	1	SEMESTER	п	-			
COURSE CODE / COURSE TITLE	191ME	211 / ENGINEERING GR/	APHICS	2	2	0	3

	COURSE OUTCOMES
On con	apletion of the course, students will be able to
COI	Draw engineering curves and apply the concepts of free hand sketching
CO2	Draw orthographic views of points, lines and surfaces
CO3	Draw visualizations of simple solid objects as per orthographic projections
CO4	Draw sections and developments made in drawing
C05	Draw pictorial drawings of simple objects

					(CO - P	0 & PS	SO Ma	pping						
со	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	-	2	1	-	-		1	1	1	I	1	1
CO 2	3	3	3	-	2	1	•		-	1	I	1	1	1	1
CO 3	3	3	3	•	2	1	-	-	-	1	1	1	1	Ţ	1
CO 4	3	3	3		2	1	-	-	-	1	1	1	1	1	1
CO 5	3	3	3	-	2	1	-	-	-	1	1	1	1	1	t
CO	3	3	3	-	2	1	-	-		1	1	1	1	1	1

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				L.	T	P	C
YEAR	1	SEMESTER	п				
COURSE CODE / COURSE TITLE	1910	CS221 / PROBLEM SOLVE PROGRAMME	NG AND PYTHON NG	3	0	0	3

	COURSE OUTCOMES	
On con	npletion of the course, students will be able to	
COI	Describe the Algorithmic solutions for simple computational problems.	-
CO2	Identify the various data expressions, statements in python programming.	
CO3	Use control flow and function for solving problems in python.	-
CO4	Distinguish list tuples and dictionaries in python programming.	-
C05	Develop simple programs using files, modules, packages in python	-

						(O-PO	&PSO	Mappi	ng					0.00
со	PO	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
co	3	3	2	2		2	3	3	-	•	÷	2	3	3	1
CO 2	3	3	2	2	÷	2	3		-	-	+	2	3	2	1
0	3	3	2	2	+	2	3	-	8	-		2	3	2	1
CO	3	3	2	2	-	2	3	-	+			2	3	2	1
CO 5	3	3	2	2	-	2	3	3	-		-	2	3	2	1
co	3	3	2	2		2	3	3	. 5	-	-	2	3	2	1

COURSE IN-CHARGE (S)

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	-				-	D	C
YEAR	1	SEMESTER	11	L	т	P	· ·
COURSE CODE / COURSE TITLE	191	HS201 / ENVIRONMENTA ENGINEERIN	L SCIENCE AND G	3	0	0	3

	COURSE OUTCOMES
On com	pletion of the course, students will be able to
COI	Interpret the concept of ecosystem, biodiversity and its conservation
CO2	Demonstrate the environmental impacts of energy development.
CO3	Categorize the various environmental pollutions and select suitable preventive measures.
CO4	Perceive the environmental effects of human population and the implementation of welfare programs
C05	Recall the environmental ethics and legal provisions.

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CO 1	3	3	2	2	-	2	3	3	-	-		2	1		
CO 2	3	3	2	2	-	2	3		-	-		2	1	•	•
CO 3	3	3	2	2	-	2	3	-	-		-	2	1		
CO 4	3	3	2	2	-	2	3	-		+	-	2	1		
CO 5	3	3	2	2	-	2	3	3	-	-	-	2	1	•	
co	3	3	2	2	1.	2	3	3		+	-	2	1		

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			L	Т	Р	c
YEAR	1	SEMESTER	0	0	2	1
COURSE CODE / COURSE TITLE		191EC21A / CIRCUITS AND DEVICE LABORATORY		1	-	

On co	COURSE OUTCOMES mpletion of the course, students will be able to
COI	Construct and Analyze the characteristics of PN Julicion of PN Julicio of PN Julicion of PN Juli
CO2	Design and Implement the various Amplifiers fike Community frequency responses.
CO3	Verify different network theorems

						C	O-PO	& PSO	Mappi	ng		-		PSO2	PSO3
		-	-	-	-		-	POS	P09	PO10	PO11	PO12	PSOI	1002	-
co	P01	PO2	PO3	PO4	PO5	PO6	P0/	100	(T) CAU			-	2	-	-
C01	3	2	2	-		•	•	-	-	-			2		•
CO2	3	2	2	-	-	•	•	•	•		-	-	2	-	-
CO3	3	2	2	-	-		-	·	-	-			2	-	-
co	3	2	2	-	-	-	-	-	-	-	-	-			-

COURSE IN-CHARGE (S)

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YEAR	1	SEMESTER	11	L.	T	P	C
COURSE CODE / COURSE TITLE		191EC218 / DIGITAL SYS LABORATOR	TEM DESIGN	0	0	2	1

	COURSE OUTCOMES
Onem	upletion of the course, students will be able to
coi	Build combinational logic circuits for a given application using logic gates, multiplexers, decoders and encoders.
CO2	Build sequential logic circuits for a given application using the given type of flip flops.
CO3	Simulate and test simple combinational logic circuits using Hardware Description Language (HDL).

	_					C	0-PO	& PSO	Mappi	ing					
co	PO1	PO2	PO3	PO4	POS	PO6	PO7	POS	PO9	PO10	POII	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-								-	2		
CO2	3	2	2	-									2		
CO3	3	2	2		2								2		
co	3	2	2		2					Carlo III	-	-	-		-

3 COURSE IN-CHARGE (S)

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YEAR	1	SEMESTER	П	L	т	Р	с
COURSE CODE / COURSE TITLE	191CS22	A / PROBLEM SOLVING	AND PYTHON	0	0	2	1

)n com	COURSE OUTCOMES pletion of the course, students will be able to	
C01	Solve problems using conditionals and loops in Python.	
CO2	Develop Python programs by defining functions.	
CO3	Use lists, Tuples and dictionaries for solving complex program in python.	
CO4	Create Python programs using files.	

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co	PO 1	PO 2	PO 3	PO 4	PO 5	PO	PO 7	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
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CO	-	-				-	-	-	-		-		3	2	1
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COURSE IN-CHARGE (S)

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HEAD OF THE DEPARTMENT

Department of Computer Science and Engineering VEL TECH MULTI TECH Dr. Rangarajan Dr. Sakunthala Engg. College Avadi, Chennai - 600 062.



SEMESTER III

Course Code	Name of the Course	Category	L	т	Р	Credits
191MA303	Probability and statistics	BS	2	2	0	3
191CS321	Data Structures	PC	3	0	0	3
191CS322	Computer Architecture	PC	3	0	0	3
191CS323	Object oriented Programming	PC	3	0	0	3
191CS324	Software Engineering	PC	3	0	0	3
191EC311	Communication Engineering	ES	3	0	0	3
191CS32A	Data Structures Laboratory	PC	0	0	2	1
191CS32B	Object oriented Programming Laboratory	PC	0	0	2	1
191HS30A	Advanced Reading and Writing skill laboratory	HSS	0	0	2	1
		Total	17	2	6	21



YEAR	п	II SEMESTER III				Р	C
COURSE CODE / COURSE TITLE	191MA30	A PROBABILITY AND S	TATISTICS	2	2	0	

On com	COURSE OUTCOMES pletion of the course, students will be able to
COI	Demonstrate and apply the basic probability axioms and concepts in their core areas
CO2	Analyze the concepts of probability distributions in an appropriate place of science and Engineering
CO3	Calculate the relationship of two dimensional random variables using correlation techniques and to study the properties of two dimensional random variables.
CO4	Apply the concept of testing of hypothesis for small and large samples in real life packing
C05	Identify the classification of design of experiment in their respective fields.

co's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P010	POIL	P012	1 OSd	PSO 2	\$03
COI	3	3	2	2	1	-			-			1	-	-	-
CO2	3	3	2	2	1				-	-	-		1	0	0
CO3	2	2	2	2	-	-		-	-	•	-	1	1	0	0
	-	-	4	4	1	-	-	-	-	-	-	1	1	0	0
CO4	3	3	2	2	.1	-	-					1	1	0	
CO5	3	3	2	2	1					-	-			0	0
CO	2	2	2	-			-	-	•	•	-	1	1	0	0
	-	3/	4	2	1	•	-	-	-	-	-	1	1	0	0

OF THE DEPARTMENT Department of Computer Science and Engineerin VEL TECH MULTI TECH Dr. Rangsminn Computer Science Avau, Uten J-Bud 052

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YEAR	н	SEMESTER	 L	т	P	C
COURSE CODE / COURSE TITLE	191CS321	DATA STRUCTURE	3	0	0	3

On con	COURSE OUTCOMES apletion of the course, students will be able to	
C01	Describe the basics of C programming language	
CO2	Practice the concepts of functions, pointers, structures and unions for the given application	
C03	Interpret and implement linear data structure operations in C	
C04	Analyze and evaluate non linear data structure for the given application	
C05	Apply the hashing concepts an choose the appropriate sorting algorithm for an application	_

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CO 4	3	3	3	3	3	3			-	•	3	3	3	3	2
5	3	3	3	3	3	3	-	•		+	3	3	3	3	2
	3	3	3	3	3	3	•	•	•		3	3	3	3	2

COURSE IN-CHARGE(S)

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Department of Computer Science and Enginitering VEL TECH MULTI TECH Dr. Rangarajan Dr. Selunthala Engg. College Avadi, Chennai - 600 062.



YEAR	11	SEMESTER	III	L	т	P	c
COURSE CODE / COURSE TITLE	1910	S322 / COMPUTER ARCI	HITECTURE	3	0	0	3

	COURSE OUTCOMES		
On comp	n completion of the course, students will be able to CO1 Define the basics concepts of fundamental component, architecture, register organization and performance metrics of a computer. CO2 Illustrate the efficient algorithm for binary arithmetic operations. CO3 Construct an efficient data path for an instruction format for a given architecture. CO4 Categorize various parallel processors.		
COI	Define the basics concepts of fundamental component, architecture, register organization and performance metrics of a computer.		
CO2	Illustrate the efficient algorithm for binary arithmetic operations.		
CO3	Construct an efficient data path for an instruction format for a given architecture.		
CO4	Categorize various parallel processors.		
C05	Analyze the memory, I/O devices and cache structures for processor.		

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CO 2	3	3	2	2	1	I.	1	1	1	1	-		3	3	2
CO 3	3	3	2	2	1	1	1	-	1	-	1	1	3	3	2
CO 4	3	3	2	2	1	1		1	1		1	1	3	3	2
CO 5	3	3	2	2	1	1	1	1	1	1	1	1	3	3	2
co	3	3	2	2	1	1	1	1	1	1	1	1	3	1	2

COURSE IN-CHARGE(S)

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HEAD OF THE DEPARTMENT

Department of Computer Science and Engineering VEL TECH MULTI TECH Dr. Rangarajan Dr. Sakunthala Engg. College Avadi, Chennai - 600 052.



YEAR	п	SEMESTER	111	L	т	P	c
COURSE CODE /COURSETITLE	191CS323/0	BJECTORIENTEDPROG	RAMMING	3	0	0	3

	COURSE OUTCOMES
On cos	npletion of the course ,students will be able to
C01	Acquire knowledge in OOPS concept and define the structure of Java programs.
CO2	Identify the concept of inheritance, interfaces and illustrate the Java Programs.
CO3	Develop Java applications using Exceptions and I/O streams
C04	Analyze and evaluate the concept of threads and generic classes to develop Java applications
C05	Create interactive Java programs using AWT and Swings

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CO 4	3	2	2	1			1	1				1	-	2	3
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COURSE IN-CHARGE(S)

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HEAD OF THE DEPARTMENT

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YEAR		п	SEMESTER	111	1,	T	8	1
COUR	SE CODE / SE TITLE	191CS324	SOFTWARE ENGINEER	IING	3	8	0	3
On con	apletion of the c	course, studen	COURSE OUTCOMES					
-	Identify diffe	rent process r	nodels and the approach adopt	ect ed in gathering re	quiremen	ita		
CO2								
CO2	Apply system	natic procedur	e for software design and depl	oyment.				
CO2 CO3 CO4	Apply system Analyze , Co	matic procedur	e for software design and depl ntrast the various testing and r	oyment.				

COs	PO 1	PO2	103	P04	POS	106	PO7	PO8	PO9	PO10	PO11	PO12	PSOI	2502	2503
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CO 2	3	2	1	1				1			-	-	- 4	2	1
CO3	3	2	2	1	1		-	-	-	-			1	2	2
CO 4	3	2	1	-	-		-		1	4	-	1	2	1	2
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00	3	2	1	1	1	1	1	1	1	- F	1	1	1	1	1



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HEAD OF THE DEPARTMENT

Department of Computer Science and Engineering VEL TECH MULTI TECH Dr. Rangerajan Dr. Sakunthata Engg. College Avadi, Chennai - 600 062.



YEAR	н	SEMESTER	III	L	T	P	c.
COURSE CODE / COURSE TITLE	191EC2	STI / COMMUNICATION	ENGINEERING	3	0	0	3

At the	Course Outcomes end of the course, the student should be able to:
coi	Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
CO2	Apply analog and digital communication techniques.
CO3	Use data and pulse communication techniques.
CO4	Analyze Source and Error control coding.
COS	Use Various Spectrum and Multiple access methods

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COURSE IN-CHARGE(5)

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HEAD OF THE DEPARTMENT Department of

Computer Science and Engineering VEL TECH MULTI TECH Dr. Rangarajan Dr. Sakunthala Engg. College Avadi, Chennai - 600 062.



Vel Tech Multi Tech

Dr.Rangarajan Dr.Sagunthala Engineering College

An Autonomous Institution

Department of Electrical and Electronics Engineering

B.E Electrical and Electronics Engineering

CHOICE BASED CREDIT SYSTEM

CURRICULAM & SYLLABI - REGULATION 2019

THE VISION

To emerge as a centre of academic excellence in Electrical and Electronics engineering and related fields through knowledge acquisition and propagation meeting global practices.

THE MISSION

* To nurture the talent and to facilitate the students with research ambience in Electrical and Electronics Engineering.

* To propagate life-long learning.

* To impart the right proportion of knowledge, attitudes and ethics in students, to enable them take up positions of responsibility in the society and make significant contributions.

PEO	PROGRAMME EDUCATIONAL OBJECTIVES
PEO1	To prepare graduates to have successful and flourishing carrier in the electrical and electronics industry.
PEO2	To make students able to excel in their carrier with ethical values and managerial skills to solve real life technical problems.
PEO3	To make students capable of solving problems in Electrical and Electronics Engineering which are found in utilities and industries.
PEO4	To help students to engage in quest for self – learning and life - long learning.

PO's	PROGRAMME OUTCOMES
PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	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.
PO3	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.
PO4	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.
PO5	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.
PO6	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.
PO7	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.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	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.
PO11	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.
PO12	Lifelong learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.
PSO's	PROGRAM SPECIFIC OUTCOMES
PSO1	Inspect the systems using the fundamental knowledge of Engineering.
PSO2	Evaluate and apply logical skills to solve technical problems for the progression of society.
PSO 3	Design and quantify solutions using the knowledge gained from inter-disciplinary skills.
PSO 4	Recognize the dynamic nature of Electrical Engineering, and create advanced electrical systems.

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An Autonomous Institution

B.E – ELECTRICAL AND ELECTRONICS ENGINEERING CURRICULUM SYLLABUS Regulation 2019 CHOICE BASED CREDIT SYSTEM

SEMESTER – I

S. No	Course Code	Name of the Course	Cotogomy	l Hou	No of Hours/Week		
THEOI	RY		Category	L	Т	Р	C
1	191HS101	English for Engineering Students	HSS	3	0	0	3
2	191MA101	Engineering Mathematics - I	BS	2	2	0	3
3	191CH101	Engineering Chemistry	BS	3	0	0	3
4	191PH101	Engineering Physics	BS	3	0	0	3
5	191ME111	Basic Civil and Mechanical Engineering	ES	3	0	0	3
6	191EE111	Basic Electrical and Electronics Engineering	ES	3	0	0	3
7	191ME112	Engineering Graphics	ES	2	2	0	3
PRACT	TICAL						
8	191PH10A	Physics Laboratory	BS	0	0	2	1
9	191CH10A	Chemistry Laboratory	BS	0	0	2	1
		Total		19	4	4	23

SEMESTER - II

S. No	Course Code	Name of the Course	Catagory	l Hou	No of Hours/Week		
THEOI	RY		Category	L	Т	Р	C
1	191HS201	Environmental Science and Engineering	HSS	3	0	0	3
2	191MA201	Engineering Mathematics II	BS	2	2	0	3
3	191PH203	Material Science for Electrical Engineering	BS	3	0	0	3
4	191CS211	Problem Solving and Python Programming	ES	3	0	0	3
5	191EC211	Electronic Devices and Circuits	ES	3	0	0	3
6	191EE221	Electric Circuit Analysis	PC	2	2	0	3
PRACT	TICAL						
7	191CS21A	Problem Solving and Python Programming Laboratory	ES	0	0	2	1
8	191ME21A	Engineering Practices Laboratory	ES	0	0	4	2
9	191EE22A	Circuits and Devices Laboratory	PC	0	0	4	2
		Total		16	4	10	23

SEMESTER - III

S. No	Course Code	Name of the Course	Category	Ho	No of Hours/Week		
THEO	RY		Category	L	Т	Р	Ŭ
1	191MA301	Linear Algebra and Numerical Methods	BS	2	2	0	3
2	191CS312	Object Oriented Programming	ES	3	0	0	3
3	191EE321	Network Analysis and Synthesis	PC	2	2	0	3
4	191EE322	Integrated Electronics	PC	3	2	0	4
5	191EE323	DC Machines and Transformers	PC	3	2	0	3
PRACT	FICAL						
6	191CS31B	Object Oriented Programming Laboratory	ES	0	0	2	1
7	191EE32A	DC Machines and Transformers Laboratory	PC	0	0	2	1
8	191EE32B	Integrated Circuits Laboratory	PC	0	0	2	1
		Total		13	8	6	19

SEMESTER - IV

S. No	Course Code	Name of the Course	Catagoriu	No of Hours/Week			C
THEOI	RY		Category	L	Т	Р	C
1	191MA404	Fourier Series and Transforms	BS	2	2	0	3
2	191EE421	Electromagnetic Theory	PC	3	0	0	3
3	191EE422	Control Systems	PC	2	2	0	3
4	191EE423	AC Rotating Machines	PC	3	0	0	3
5	191EE424	Microprocessors and Microcontrollers	PC	3	0	0	3
6	191EE425	Measurement and Instrumentation	PC	3	0	0	3
PRACT	FICAL						
7	191EE42A	AC Rotating Machines Laboratory	PC	0	0	2	1
8	191EE42B	Microprocessors and Microcontrollers		0	0	2	1
		Laboratory	PC	0	0	2	1
9	191MC46A	Internship 1	MC	0	0	0	0
		Total		16	4	4	20

SEMESTER - V

S. No	Course Code	Name of the Course	Catagory	Ho	No of Hours/Week		
THEOI	RY		Category	L	Т	Р	C
1	191EE511	Embedded System	ES	3	0	0	3
2	191EE521	Analog Electronics and Applications	PC	3	0	0	3
3	191EE522	Power Electronics	PC	3	0	0	3
4	191EE523	Transmission and Distribution	PC	3	0	0	3
5		Program Elective – I	PE	3	0	0	3
6		Open elective I	OE	3	0	0	3
PRACT	FICAL						
7	191EE51A	Embedded Laboratory	ES	0	0	2	1
8	191EE52A	Control and Instrumentation Laboratory	PC	0	0	2	1
9	191MC56A	Circuit Simulation Laboratory	MC	0	0	2	0
		Total		18	0	8	20

SEMESTER-VI

S. No	Course Code	Name of the Course	Category	No of Hours/Week			С
THEORY			Category	L	Т	Р	
1	191HS601	Industrial Management and Economics	HSS	3	0	0	3
2	191EE621	Digital Signal Processing	PC	3	0	0	3
3	191EE622	Power System Analysis	PC	3	0	0	3
4	191EE623	Solid State Drives	PC	3	0	0	3
5		Program Elective -II	PE	3	0	0	3
6		Open Elective-II	OE	3	0	0	3
PRACTICAL							
6	191HS60A	Professional Communication	HSS	0	0	2	1
7	191EE62A	Power Systems Laboratory	PC	0	0	2	1
8	191EE62B	Power Electronics Laboratory	PC	0	0	2	1
9	191MC66A	Internship 2	MC	0	0	0	0
Total				18	6	6	21
SEMESTER-VII

S. No	Course Code	Name of the Course	Cotogowy	No of Hours/Week			C
THEOI	RY		Category	L	Т	Р	C
1	191HS701	Professional Ethics in Engineering	HSS	3	0	0	3
2	191EE721	High Voltage Engineering	PC	3	0	0	3
3	191EE722	Protection and Switchgear	PC	3	0	0	3
4		Program Elective – III	PE	3	0	0	3
5		Open elective III	OE	3	0	0	3
6		Open Elective - IV	OE	3	0	0	3
PRACT	FICAL						
7	191EE72A	Renewable Energy Systems Laboratory	PC	0	0	2	1
8	191EE77A	Project Work Phase I	PROJ	0	0	4	2
		Total		18	3	8	21

SEMESTER-VIII

S. No	Course Code	Name of the Course	Category	No of Hours/Week		С	
THEOI	RY			L	Т	Р	
1		Program Elective - IV	PE	3	0	0	3
2		Program Elective - V	PE	3	0	0	3
PRACT	ГІСАL						
3	191EE87A	Project Work Phase II	PROJ	0	0	20	10
		Total		6	0	20	16

S. No	Course Code	Name of the Course	Catagory	l Hou	ek	C	
THEOI	RY		Category	L	Т	Р	C
1	191HS531	Principles of Management	PE	3	0	0	3
2	191EE531	Communication Engineering	PE	3	0	0	3
3	191EE532	Digital Instrumentation	PE	3	0	0	3
4	191EE533	Electrical Machine Design	PE	3	0	0	3
5	191EE534	Theories of Power plant	PE	3	0	0	3
6	191EE535	Visual Languages and Applications	PE	3	0	0	3

PROGRAM ELECTIVE – I (V SEMESTER)

PROGRAM ELECTIVE - II (VI SEMESTER)

S. No	Course Code	Name of the Course	Cotogowy	l Hou	C		
THEOI	RY		Category	L T P		Р	
1	191EE631	Computer Aided Design for Electrical Apparatus	PE	3	0	0	3
2	191EE632	Fundamentals of Nano - science	PE	3	0	0	3
3	191EE633	Human Rights and Duties: Conceptual Perspectives	PE	3	0	0	3
4	191EE634	Microcontroller Based System Design	PE	3	0	0	3
5	191EE635	SMPS and UPS	PE	3	0	0	3
6	191EE636	Special Electrical Machines	PE	3	0	0	3

PROGRAM ELECTIVE – III (VII SEMESTER)

S. No	Course Code	Name of the Course	Catagory] Hou	C		
THEOI	RY		Category	L T P		Р	C
1	191EE731	Alternative Energy Systems	PE	3	0	0	3
2	191EE732	Electric Energy Generation Utilization and	PE	3	0	0	3
		Conservation					
3	191EE733	Electric Traction	PE	3	0	0	3
4	191EE734	Energy Resources and Utilization	PE	3	0	0	3
5	191EE735	Modern Power Converters	PE	3	0	0	3
6	191EE736	Power Electronics for Renewable Energy	PE	3	0	0	3
		Systems					

S. No	Course Code	Name of the Course	Catagory	l Hou			
THEOI	RY		Category	L	Т	Р	С
1	191EE831	Energy Efficiency in Buildings	PE	3	0	0	3
2	191EE832	HVDC Transmission	PE	3	0	0	3
3	191EE833	Industrial Automation	PE	3	0	0	3
4	191EE834	Intellectual Property Rights	PE	3	0	0	3
5	191EE835	Power Systems Operation and Control	PE	3	0	0	3
6	191EE836	Power System Transients	PE	3	0	0	3
7	191EE837	Real Time Systems	PE	3	0	0	3

PROGRAM ELECTIVE – IV (VIII SEMESTER)

PROGRAM ELECTIVE - V (VIII SEMESTER)

S. No	Course Code	Name of the Course] Hou			
			Category	пои	С		
THEOI	RY		gJ	L	Т	Р	-
1	191EE838	Electrical and Hybrid Vehicles	PE	3	0	0	3
2	191EE839	Electrical Energy Audit	PE	3	0	0	3
3	191ES8310	Embedded Control of Electric Drives	PE	3	0	0	3
4	191EE8311	Flexible AC Transmission Systems	PE	3	0	0	3
5	191EE8312	Micro Electro Mechanical Systems	PE	3	0	0	3
6	191EE8313	Power Quality	PE	3	0	0	3
7	191EE8314	Power System Stability	PE	3	0	0	3

HUMANITIES AND SOCIAL SCIENCE (HSS)

S. No	Course Code	Course Title	Category	Contact Periods	L	Т	Р	С
1	191HS101	English for Engineering Students	HSS	3	3	0	0	3
2	191HS201	Environmental Science and Engineering	HSS	3	3	0	0	3
3	191HS601	Industrial Management and Economics	HSS	3	3	0	0	3
4	191HS60A	Professional Communication	HSS	2	0	0	2	1
5	191HS701	Professional Ethics in Engineering	HSS	3	3	0	0	3

BASIC SCIENCES (BS)

S. No	Course Code	Course Title	Category	Contact Periods	L	Т	Р	С
1	191MA101	Engineering Mathematics - I	BS	4	2	2	0	3
2	191CH101	Engineering Chemistry	BS	3	3	0	0	3
3	191PH101	Engineering Physics	BS	3	3	0	0	3
4	191PH10A	Physics Laboratory	BS	2	0	0	2	1
5	191CH10A	Chemistry Laboratory	BS	2	0	0	2	1
6	191MA201	Engineering Mathematics II	BS	4	2	2	0	3
7	191PH203	Material Science for Electrical Engineering	BS	3	3	0	0	3
8	191MA301	Linear Algebra and Numerical Methods	BS	4	2	2	0	3
9	191MA404	Fourier Series and Transforms	BS	4	2	2	0	3

ENGINEERING SCIENCES (ES)

S. No	Course Code	Course Title	Category	Contact Periods	L	Т	Р	С
1	191ME111	Basic Civil and Mechanical Engineering	ES	3	3	0	0	3
2	191EE111	Basic Electrical and Electronics Engineering	ES	3	3	0	0	3
3	191ME112	Engineering Graphics	ES	4	2	2	0	3
4	191CS211	Problem Solving and Python Programming	ES	3	3	0	0	3
5	191EC211	Electronic Devices and Circuits	ES	3	3	0	0	3
6	191CS21A	Problem Solving and Python Programming	ES	2	0	0	2	1
		Laboratory						
7	191ME21A	Engineering Practices Laboratory	ES	4	0	0	4	2
8	191CS312	Object Oriented Programming	ES	3	3	0	0	3
9	191CS31B	Object Oriented Programming Laboratory	ES	2	0	0	2	1
10	191EE511	Embedded System	ES	3	3	0	0	3
11	191EE51A	Embedded Laboratory	ES	2	0	0	2	1

PROFESSIONAL CORE (PC)

S. No	Course Code	Course Title	Category	Contact Periods	L	Т	Р	С
1	191EE221	Electric Circuit Analysis	PC	4	2	2	0	3
2	191EE22A	Circuits and Devices Laboratory	PC	4	0	0	4	2
3	191EE321	Network Analysis and Synthesis	PC	4	2	2	0	3
4	191EE322	Integrated Electronics	PC	5	3	2	0	4
5	191EE323	DC Machines and Transformers	PC	5	3	2	0	3
6	191EE32A	DC Machines and Transformers Laboratory	PC	2	0	0	2	1
7	191EE32B	Integrated Circuits Laboratory	PC	2	0	0	2	1
8	191EE421	Electromagnetic Theory	PC	3	3	0	0	3
9	191EE422	Control Systems	PC	4	2	2	0	3
10	191EE423	AC Rotating Machines	PC	3	3	0	0	3
11	191EE424	Microprocessors and Microcontrollers	PC	3	3	0	0	3
12	191EE425	Measurement and Instrumentation	PC	3	3	0	0	3
13	191EE42A	AC Rotating Machines Laboratory	PC	2	0	0	2	1
14	191EE42B	Microprocessors and Microcontrollers Laboratory	PC	2	0	0	2	1
15	191EE521	Analog Electronics and Applications	PC	3	3	0	0	3
16	191EE522	Power Electronics	PC	3	3	0	0	3
17	191EE523	Transmission and Distribution	PC	3	3	0	0	3
18	191EE52A	Control and Instrumentation Laboratory	PC	2	0	0	2	1
19	191EE621	Digital Signal Processing	PC	3	3	0	0	3
20	191EE622	Power System Analysis	PC	3	3	0	0	3
21	191EE623	Solid State Drives	PC	3	3	0	0	3
22	191EE62A	Power Systems Laboratory	PC	2	0	0	2	1
23	191EE62B	Power Electronics Laboratory	PC	2	0	0	2	1
24	191EE721	High Voltage Engineering	PC	3	3	0	0	3
25	191EE722	Protection and Switchgear	PC	3	3	0	0	3
26	191EE72A	Renewable Energy Systems Laboratory	PC	2	0	0	2	1

CREDIT DISTRIBUTION

S. NO	CATEGORY	CREDIT				
		REGULAR	LATERAL			
1	BS (Basic Science)	23	06			
2	HSS (Humanities and Social Science)	13	07			
3	ES (Engineering Science)	26	8			
4	PC (Professional Core Courses)	62	57			
5	PE (Professional Elective Courses)	15	15			
6	OE (Open Elective Courses)	12	12			
7	MC (Mandatory Courses)	00	00			
8	PROJ(Project)	12	12			
	TOTAL	163	117			

SUMMARY

S. NO	SUBJECT AREA		(CREDI	TS AS	PER	SEME	STER		CREDITS
	AREA	Ι	II	III	IV	V	VI	VII	VIII	TOTAL
1	HSS	3	3	-	-	-	4	3	-	13
2	BS	11	6	3	3	-	-	-	-	23
3	ES	9	9	4	-	4	-	-	-	26
4	PC	-	5	12	17	10	11	7	-	62
5	PE	-	-	-	-	3	3	3	6	15
6	OE	-	-	-	-	3	3	6	-	12
7	MC	-	-	-	0	0	0	-	-	-
8	PROJ	-	-	-	-	•	-	2	10	12
	TOTAL	23	23	19	20	20	21	21	16	163

		VEL TECH MULTI TECH DR RANGARAJAN DR SAKUNTHALA ENGINEERING COLLEGE,AVADI,CHENNAI DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING																
		DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING 2019-2023 BATCH																
					COUR	SE-PO	MAPPI	NG										
SL NO	COURSE CODE	COURSE	P01	PO2	PO3	P04	P05	P06	P07	P08	PO9	P010	P011	P012	PSO1	PSO2	PSO3	PSO4
1	191HS101	English for Engineering Students	-	-	-	-	2	2	-	-	2	3	2	3	1	3	2	-
2	191MA101	Engineering Mathematics - I	3	3	2	2	2	-	-	-	-	-	1	2	3	2	1	1
3	191CH101	Engineering Chemistry	3	3	2	2	1	0			2	2	1	2	2	2	1	2
4	191PH101	Engineering Physics	3	3	2	2	1				1	1	1	3	3	2	2	3
5	191ME111	Basic Civil and Mechanical Engineering	3	3	3	2	2	1	1			1	1	2	3	2	1	2
6	191EE111	Basic Electrical and Electronics Engineering	3	3	3	2	2	-	-	-	-	1	2	2	2	2	2	1
7	191ME112	Engineering Graphics	3	2	2	2	2	1			1	1	1	2	3	2	1	2
8	191PH10A	Physics Laboratory	3	2	2	2	2	1	1			1	1	2	2	2	1	2
9	191CH10A	Chemistry Laboratory	3	2	2	1	-	-	-	-	1	1	2	2	2	2	2	1
10	191HS201	Environmental Science and Engineering	2	2	-	1	1	-	1	-	1	2	-	2	1	2	2	1
11	191MA201	Engineering Mathematics II	3	2	2	2	2	2	2	-	1	1	1	1	2	2	2	2
12	191PH203	Material Science for Electrical Engineering	3	2	2	2	2	-	-	-	-	1	1	1	2	2	1	2
13	191CS211	Problem Solving and Python Programming	3	3	2	2	2	2	1	-	-	1	2	2	2	2	2	1
14	191EC211	Electronic Devices and Circuits	3	3	3	3	3	2	2	1	1	2	1	3	3	2	3	2
15	191EE221	Electric Circuit Analysis	3	3	3	3	3	2	2	-	1	2	2	2	3	2	2	3
16	191CS21A	Problem Solving and Python Programming Laboratory	3	2	2	2	2	1	-	-	-	2	1	2	2	2	1	2
17	191ME21A	Engineering Practices Laboratory	3	2	2	2	1	1	-	-	-	2	1	2	2	1	2	1
18	191EE22A	Circuits and Devices Laboratory	3	2	2	2	2	1	-	-	-	1	2	1	2	1	2	1
19	191MA301	Linear Algebra and Numerical Methods	3	3	2	2	2	2	1	-	-	2	1	2	3	2	2	1
20	191CS312	Object Oriented Programming	3	3	3	3	3	2	1	-	-	1	2	2	3	2	1	3
21	191EE321	Network Analysis and Synthesis	3	3	3	2	1	2	1	-	-	1	2	2	3	2	1	2
22	191EE322	Integrated Electronics	3	2	2	2	2	2	2	-	-	1	1	2	2	2	1	2
23	191EE323	DC Machines and Transformers	3	3	3	3	3	2	2	1	1	2	1	2	3	3	3	2
24	191CS31B	Object Oriented Programming Laboratory	3	2	2	2	2	2	1	2	-	-	1	1	3	2	1	2
25	191EE32A	DC Machines and Transformers Laboratory	3	2	2	2	1	1	-	-	-	-	2	1	2	2	2	1
26	191EE32B	Integrated Circuits Laboratory	2	2	2	2	1	1	1	-	-	-	2	1	2	1	2	1
27	191MA404	Eourier Series and Transforms	3	3	2	2	2	2	1	-	-	-	2	1	3	2	2	1
28	191EE421	Electromagnetic Theory	3	3	3	3	3	1	2	1	1	2	1	3	3	3	2	2
29	191FF422	Control Systems	3	3	3	3	3	2	2	-	-	2	3	3	3	3	3	3
30	191FF423	AC Botating Machines	3	3	3	3	3	3	3	-	1	-	1	2	3	2	1	2
31	191EE424	Microprocessors and Microcontrollers	3	3	3	3	3	2	-	-	2	1	3	3	3	2	2	2
32	191EE425	Measurement and Instrumentation	3	3	3	3	3	1	1	-	-	1	2	3	3	2	3	2
33	191EE42A	AC Rotating Machines Laboratory	3	2	2	1	1	1	-	-		-	1	1	1	2	1	1
34	191EE42B	Microprocessors and Microcontrollers Laboratory	3	2	2	2	1	1	-	-	-	-	1	1	2	2	2	1
35	191MC46A	Internship 1	2	2	2	2	1	1	-	-	-	1	1	2	3	2	1	2
36	191FE511	Embedded System	3	3	3	3	3	2	2	-	2	2	2	3	3	3	3	3
37	191EE521	Analog Electronics and Applications	3	2	2	2	2	1	1	-	-	1	1	2	2	2	1	2
38	191EE522	Power Electronics	3	3	3	3	3	2	2	-	-	2	1	3	3	2	3	2
39	191EE523	Transmission and Distribution	3	3	3	3	3	1	2	-	-	2	3	3	3	3	3	3
40	191BM543	Biomedical Instrumentation	3	2	2	2	2	2	2	-	-	1	2	3	2	2	1	2
41	191CE544	Foundation course in entrepreneurship	3	2	2	2	2	3	2	-	-	2	2	2	3	2	2	1
42	191FF51Δ	Embedded Laboratory	3	2	2	2	2		2	_	-	1	1	2	3	2	1	1
43	191FE52A	Control and Instrumentation Laboratory	2	2	2	2	2	1	1	-	-	1	1	2	1	2	1	2
44	19100564		2	2	2	2	2	2	1	_	-	2	2	2	2	2	2	1
45	19145601	Industrial Management and Economics	2	2	2	1	2	1	2	_	-	2	2	2	2	1	2	1
46	191FF621	Digital Signal Processing	3	3	3	2	3	2	1	-	-	1	2	2	3	2	1	2
47	191FF622	Power System Analysis	3	3	3	3	3	2	2	-	-	2	3	3	3	3	3	2
48	191EE622	Solid State Drives	2	2	2	2	2	2	2	_	2	2	2	2	2	2	2	2
.0	1710000		5	5	5	5	5		~		~	~	5	5	5	-		-

49	191CE545	Disaster management	-	-	-	-	1	-	2	1	2	2	1	1	2	2	2	1
50	191CE541	Advance course in entrepreneurship	2	2	2	2	2	2	2	-	-	3	2	2	2	2	3	2
51	191HS60A	Professional Communication	2	2	2	1	2	1	1	-	-	1	1	1	2	1	2	1
52	191EE62A	Power Systems Laboratory	3	2	2	2	1	2	1	-	-	2	2	3	2	1	1	1
53	191EE62B	Power Electronics Laboratory	3	2	2	2	2	1	1	-	-	-	1	2	1	2	1	2
54	191MC66A	Internship 2	2	2	2	2	2	1	1	-	-	2	2	1	2	1	2	2
55	191HS701	Professional Ethics in Engineering	-	-	-	-	-	-	2	3	2	1	1	3	2	1	2	1
56	191EE721	High Voltage Engineering	3	3	2	3	2	1	2	-	-	-	2	2	1	2	2	2
57	191EE722	Protection and Switchgear	3	3	3	2	2	1	2	2	2	2	2	3	3	2	2	2
58	191CS544	Human computer interaction	2	2	2	2	1	1	-	-	-	2	2	2	3	1	2	1
59	191ME543	Energy conservation and management	3	2	2	2	2	2	3	1	1	1	2	1	2	1	2	1
60	191EE736	Power Electronics for Renewable Energy Systems	3	3	2	2	2	1				2	2	2	2	2	1	2
61	191EE72A	Renewable Energy Systems Laboratory	3	3	3	3	2	1	2		1		2	2	3	1	2	2
62	191EE77A	Mini project	3	2	1	1	2	2				2	2	1	2	2	1	2
63	191EE8313	Power Quality	3	3	2	2	2	1	1		1	2	2	2	3	2	2	1
64	191ES8310	Embedded Control of Electric Drives	3	2	2	2	2	1				2	2	2	3	2	2	3
65	191EE834	Intellectual Property Rights	3	2	1	1	-	2	1	2	2	2	2	2	3	2	2	2
66	191EE837	Real Time Systems	3	2	2	1	3	1			1	2	2	2	3	2	1	1
67	191EE87A	Project	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

DEPARTMENT OF INFORMATION TECHNOLOGY

PROGRAMME OUTCOMES (POs) PROGRAMME SPECIFIC OUTCOMES (PSOs) PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) COURSE OUTCOMES (COs)

POs	Program Outcomes (POs)
PO1	Engineering Knowledge: Apply knowledge of mathematics, science, engineering fundamentals and an Engineering Specialization to the solution of complex engineering problems.
PO2	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.
PO3	Design / Development of solutions: Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
PO4	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.
PO5	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.
PO6	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.
PO7	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.
PO8	Ethics : Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work : Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	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
PO11	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.
PO12	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.

PROGRAMME OUTCOMES (POs)

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO's	PROGRAMME SPECIFIC OUTCOMES (PSOs)
PSO1	An ability to apply design and development principles in the construction of software systems of varying complexity.
PSO2	The use of current application software, the design and use of operating systems and the analysis, design, testing, and documentation of computer programs for the use in information engineering technologies.
PSO3	The design techniques, analysis and the building, testing, operation and maintenance of networks, databases, security and computer systems (both hardware and software).

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)
PEO1	Graduates will demonstrate technical competency and leadership skills to lead a successful career in the field of IT & ITES.
PEO2	Graduate will exhibit a commitment to communicate effectively in diverse environment and apply proficiency towards societal issue with human values.
PEO3	Graduates will pursue lifelong learning in generating innovative solutions to the changing industrial needs using research and problem solving skills.

S.NO	CATEGORY	CREDITS (Regular)	CREDITS (Lateral)
	Foundation Courses		
	Humanities and Social Science (HSS)	13	9
A.	Basic Science (BS)	23	7
	Engineering Science (ES)	22	7
B.	Professional Core Courses (PC)	60	52
C.	Professional Elective courses (PE)	18	18
D.	Open Elective Courses (OE)	12	12
	Project, Seminar, Internship in industry or at		
E.	Higher Learning institutions (PROJ)	13	13
	Mandatory Courses prescribed by AICTE/UGC		
F.	Not to be included for CGPA (MC)		
	TOTAL	161	118

CURRICULUM STRUCTURE

CURRICULUM SYLLABUS – Regulation 2019

SEMESTER - I

S No.	Compaton	Course	Nome of the Course	Cotogowy	No of I	Hours/V	Veek	C
5. N0	Semester	Code	Name of the Course	Category	L	Т	Р	C
1	Ι	191HS101	English for Engineering Students	HSS	3	0	0	3
2	Ι	191CH101	Engineering Chemistry	BS	3	0	0	3
3	Ι	191MA101	Engineering Mathematics - I	BS	2	2	0	3
4	Ι	191PH101	Engineering Physics	BS	3	0	0	3
5	Ι	191ME111	Basic Civil and Mechanical Engineering	ES	3	0	0	3
6	Ι	191EE111	Basic Electrical and Electronics Engineering	ES	3	0	0	3
7	Ι	191CH10A	Chemistry Laboratory	BS	0	0	2	1
8	Ι	191PH10A	Physics Laboratory	BS	0	0	2	1
9	Ι	191ME11A	Engineering Practices Laboratory	ES	0	0	4	2
				17	2	8	22	

SEMESTER – II

S No	Someston	Course	Nome of the Course	Catagony	No of 1	Hours/V	Veek	C
5.110	Semester	Code	Name of the Course	Category	L	Т	Р	C
1	II	191HS201	Environmental Science and Engineering	HSS	3	0	0	3
2	II	191MA201	Engineering Mathematics - II	BS	2	2	0	3
3	II	191EC212	Digital System Design	ES	2	2	0	3
4	II	191ME211	Engineering Graphics	ES	2	2	0	3
5	II	191CS211	Problem Solving and Python Programming	PC	3	0	0	3
6	II	191IT221	Information Technology Essentials	PC	3	0	0	3
7	II	191EC21B	Digital Systems Laboratory	ES	0	0	2	1
8	II	191CS21A	Problem Solving and Python Programming Laboratory	PC	0	0	2	1
9	II	191IT22A	Information Technology Essentials Laboratory	PC	0	0	2	1
				15	6	6	21	

SEMESTER – III

C No	Comoston	Course	Nome of the Course	Catagory	No of I	Hours/V	Veek	C
5. 1NO	Semester	Code	Name of the Course	Category	L	Т	Р	C
1	III	191HS301	Management Science	HSS	2	0	0	2
2	III	191MA306	Differential Calculus	BS	2	2	0	3
3	III	191EC312	Analog and Digital communication	ES	3	0	0	3
4	III	191CS321	Data Structures	PC	3	0	0	3
5	III	191CS322	Computer Architecture	PC	2	2	0	3
6	III	191CS323	Object Oriented Programming	PC	2	2	0	3
7	III	191HS30B	Inter Personal Skills Listening & Speaking	HSS	0	0	2	1
8	III	191CS32A	Data Structures Laboratory	PC	0	0	2	1
9	III	191CS32B	Object Oriented Programming Laboratory	PC	0	0	2	1
	Total					6	6	20

S No	Somestan	Course	Nome of the Course	Catagory	No of l	Hours/V	Veek	C
3. 110	Semester	Code	Name of the Course	Category	L	Т	Р	C
1	IV	191MA403	Discrete Mathematics	BS	2	2	0	3
2	IV	191CS421	Design and Analysis of Algorithms	PC	3	0	0	3
3	IV	191CS422	Database Management Systems	PC	3	0	0	3
4	IV	191CS423	Operating Systems	PC	2	2	0	3
5	IV	191IT421	Software Engineering and Design	PC	3	0	0	3
6	IV	191HS40C	Professional Communication	HSS	0	0	2	1
7	IV	191CS42A	Database Management Systems Laboratory	PC	0	0	2	1
8	IV	191CS42B	Operating Systems Laboratory	PC	0	0	2	1
9	IV	191MC45A	Internship /Training - I	MC				**
			13	4	6	18		

SEMESTER - IV

SEMESTER - V

S No	Someston	Course	Nome of the Course	Cotogowy	No of 1	Veek	C	
5. N0	Semester	Code	Name of the Course	Category	L	Т	Р	C
1	V	191HS501	Total Quality Management	HSS	3	0	0	3
2	V	191MA502	Probability and Statistics	BS	2	2	0	3
3	V	191EC511	Micro Processor & Micro Controller	ES	3	0	0	3
4	V	191IT521	Computer Networks	PC	3	0	0	3
5	V	191IT522	Web Technology	PC	3	0	0	3
6	V		Open Elective - I	OE	3	0	0	3
7	V	191EC51A	Micro Processor & Micro Controller Laboratory	ES	0	0	2	1
8	V	191IT52A	Web Technology Laboratory	PC	0	0	2	1
9	V	191IT52B	Networks Laboratory	PC	0	0	2	1
10	V	191MC56A	Technical Seminar	MC				**
			Total		17	2	6	21

SEMESTER – VI

S No	Someston	Course	Name of the Course	Catagony	No of I	Hours/V	Veek	C
5. N0	Semester	Code	Name of the Course	Category	L	Т	Р	C
1	VI	191CS621	Artificial Intelligence	PC	3	0	0	3
2	VI	191IT622	Cloud Computing	PC	3	0	0	3
3	VI	191IT623	Internet of Things	PC	3	0	0	3
4	VI		Professional Elective - I	PE	3	0	0	3
5	VI		Professional Elective - II	PE	3	0	0	3
6	VI		Open Elective - II	OE	3	0	0	3
7	VI	191IT62A	Cloud Computing Laboratory	PC	0	0	2	1
8	VI	191IT62B	Software Engineering Practices Laboratory	PC	0	0	2	1
9	VI	191IT67A	Mini Project	PW	0	0	2	1
10	VI	191MC66A	Internship - II	MC				**
				18	0	6	21	

		Course			No of I	Hours/V	Veek	
S.No	Semester	Code	Name of the Course	Category	L	Т	Р	С
1	VII	191IT721	Mobile Application Development	PC	3	0	0	3
2	VII	191CS722	Cryptography and Network Security	PC	3	0	0	3
3	VII		Professional Elective - III	PE	3	0	0	3
4	VII		Professional Elective - IV	PE	3	0	0	3
5	VII		Professional Elective - V	PE	3	0	0	3
6	VII		Open Elective - III	OE	3	0	0	3
7	VII	191IT72A	Mobile Application Development Laboratory	РС	0	0	2	1
8	VII	191CS72B	Security Laboratory	PC	0	0	2	1
9	VII	191IT77A	Project Work - Phase I	PW	0	0	4	2
			Total		18	0	8	22

SEMESTER - VII

SEMESTER – VIII

C N-	G	Course	Norrow of the Comme	Catal	Ног	C		
5.INO	Semester	Code	Name of the Course	Category	L	Т	Р	C
1	VIII		Professional Elective - VI	PE	3	0	0	3
2	VIII		Open Elective - IV	OE	3	0	0	3
3	VIII	191IT87A	Project Work - Phase II	PW	0	0	20	10
			Total		6	0	20	16

Total Credits 161

Semester	Professional Elective	Course Code	Name of the Course	Category	L	Т	Р	C
VI		191IT631	Advance Database Technologies	PE	3	0	0	3
VI		191IT632	Big Data Analytics	PE	3	0	0	3
VI	т	191IT633	C# & .Net Programming	PE	3	0	0	3
VI	1	191IT634	Embedded Systems	PE	3	0	0	3
VI		191IT635	Information Theory & Coding	PE	3	0	0	3
VI		191IT636	Open Source Programming	PE	3	0	0	3
VI		191IT637	Advanced Java Programming	PE	3	0	0	3
VI	II	191IT638	Digital Image Processing	PE	3	0	0	3
VI		191IT639	Information Retrieval Systems	PE	3	0	0	3
VI		191IT6310	Mobile Computing	PE	3	0	0	3
VI		191IT6311	Multimedia Databases	PE	3	0	0	3
VI		191IT6312	Wireless Sensor and Mesh Networks	PE	3	0	0	3
VII		191IT731	Block chain Technologies	PE	3	0	0	3
VII		191IT732	Human Computer Interaction	PE	3	0	0	3
VII	TT	191IT733	Semantic Web	PE	3	0	0	3
VII	111	191IT734	Service Oriented Architecture	PE	3	0	0	3
VII		191IT735	Soft Computing	PE	3	0	0	3
VII	191IT736 Visualization Techniques		Visualization Techniques	PE	3	0	0	3
VII	19111730 Visualization Techniques 1911T737 Computational Linguistics		PE	3	0	0	3	
VII	191IT737 Comput 191IT738 Data M		Data Mining Techniques	PE	3	0	0	3
VII		191IT739	Deep Learning	PE	3	0	0	3
VII	IV	191IT7310	Machine Learning	PE	3	0	0	3
VII		191IT7311	Network Programming and Management	PE	3	0	0	3
VII		191IT7312	Software Testing	PE	3	0	0	3
VII		191EEC731	Professional Readiness For Innovation Employability And Entrepreneurship	PE	3	0	0	3
VII		191IT7313	Ethical Hacking	PE	3	0	0	3
VII		191IT7314	Full Stack Software Development	PE	3	0	0	3
VII	V	191IT7315	Game Programming	PE	3	0	0	3
VII	v	191IT7316	IoT Based Smart Systems	PE	3	0	0	3
VII		191IT7317	Pattern Recognition	PE	3	0	0	3
VII		191IT7318	Quantum Computing	PE	3	0	0	3
VIII		191IT831	Cognitive Computing	PE	3	0	0	3
VIII		191IT832	Computer Forensics	PE	3	0	0	3
VIII	_	191IT833	Enterprise Resource Planning	PE	3	0	0	3
VIII	VI	191IT834	Industrial Economics and Corporate Management	PE	3	0	0	3
VIII		191IT835	Next Generation Networks	PE	3	0	0	3
VIII		191HS801	Professional Ethics in Engineering	PE	3	0	0	3

IT- Professional Electives

Course Code	Name of the Course	Category	L	Т	Р	С
191IT541	Artificial Intelligence	OE	3	0	0	3
191IT542	Block Chain Technologies	OE	3	0	0	3
191IT543	C# and .NET Programming	OE	3	0	0	3
191IT544	Cloud Computing	OE	3	0	0	3
191IT545	Database Management Systems	OE	3	0	0	3
191IT546	Machine Learning	OE	3	0	0	3
191IT547	Mobile Computing	OE	3	0	0	3
191IT548	Software Engineering and Design	OE	3	0	0	3

LIST OF OPEN ELECTIVES OFFERED BY IT

SEMESTER - I

YEAR	I	SEMESTER	I	L	Т	Р	C
COURSE CODE / COURSE TITLE	191MA101 / 1	ENGINEERING MATHEM	IATICS - I	2	2	0	3

	COURSE OUTCOMES
On con	pletion of the course, students will be able to
CO1	Analyze the characteristics equation of a linear system with Eigen values and vectors for practical application.
CO2	Determine the bending of family of curves using differential calculus which deals in various disciplines.
CO3	Apply partial derivatives in various engineering problems.
CO4	Identify and solve the real time problems using Linear differential equations.
CO5	Identify and solve the real time problems using higher order differential equations.

	CO PO&PSO Mapping														
СО	РО 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
CO 1	3	3	2	2	2	-	-	-	-	-	-	1	-	-	-
CO 2	3	3	2	2	1	-	-	-	-	-	-	1	-	-	-
CO 3	3	3	2	2	1	-	-	-	-	-	-	1	-	-	-
CO 4	3	3	2	2	1	-	-	-		-	-	1	-	-	-
CO 5	3	3	2	2	1	-	-	-	-	-	-	1	-	-	-
CO	3	3	2	2	1	-	-	-	-	-	-	1	-	-	-

YEAR	Ι	SEMESTER	I	L	Т	Р	С
COURSE CODE / COURSE TITLE	191PH101 / F	ENGINEERING PHYSICS		3	0	0	3

	COURSE OUTCOMES									
On con	On completion of the course, students will be able to									
CO1	Demonstrate the proficiency on the properties of matter and its applications									
CO2	Describe the working principles of Laser and its developments in industrial and medical applications									
CO3	Explain the propagation of waves in optical fibers and their applications									
CO4	Apply the theory of wave nature of particles in various microscopic applications									
CO5	Analyze the structure of materials and its crystal growth techniques									

	CO-PO & PSO Mapping														
СО	РО	РО	РО	РО	РО	РО	РО	PO8	PO9	PO 10	PO 11	РО	PSO	PSO	PSO
	1	2	3	4	5	6	7			10	11	12	1	2	3
CO1	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO2	3	3	2	2	_	2	2	2	2	-	-	2	1	-	-
CO3	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO4	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO5	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
СО	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-

YEAR	I	SEMESTER	I	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CH101/I	ENGINEERING CHEMIST	RY	3	0	0	3

	COURSE OUTCOMES										
On con	On completion of the course, students will be able to										
CO1	Analyse microscopic chemistry in terms of atomic, molecular and Intermolecular forces for real time applications of semiconductors.										
CO2	Investigate the various water treatment and softening methods.										
CO3	Appraise the types and mechanism of electrochemical reaction in batteries and fuel cells.										
CO4	Explain the basic principle, types and mechanism of polymerization process and techniques.										
CO5	Assess the properties, characterization and applications of advanced materials for energy storage.										

	CO-PO & PSO Mapping														
СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	-	-	-	-	-	-	1	-	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	1	-	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	1	-	-
CO4	3	3	2	2	-	-	-	-	-	-	-	-	1	-	-
CO5	3	3	2	2	-	-	-	-	-	-	-	-	1	-	-
СО	3	3	2	2	-	-	-	-	-	-	-	-	1	-	-

YEAR	Ι	SEMESTER	I	L	Т	Р	С
COURSE CODE / COURSE TITLE	191HS	101/ENGLISH FOR ENGIN STUDENTS	EERING	3	0	0	3

	COURSE OUTCOMES
On con	npletion of the course, students will be able to
CO1	Infer meanings of unfamiliar words from context
CO2	Enable to achieve linguistic competence and be able to use grammar as a tool or resource in the comprehension and creation of oral and written discourse efficiently according to the situation.
CO3	Write cohesively, coherently and flawlessly with a wide range of vocabulary and organizing their ideas logically on a topic.
CO4	Activate and reinforce the habit of reading and writing effectively in their discipline.
CO5	Collaborate with multicultural environment.

	CO-PO & PSO Mapping														
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	3	-	-	-	2	2	-	2	1	-	-
CO 2	-	-	-	-	3	-	-	-	2	2	-	2	1	-	-
CO 3	-	-	-	-	3	-	-	-	2	2	-	2	1	-	-
CO 4	-	-	-	-	3	-	-	-	2	2	-	2	1	-	-
CO 5	-	-	-	-	3	-	-	-	2	2	-	2	1	-	-
СО	-	-	-	-	3	-	-	-	2	2	-	2	1	-	-

YEAR	Ι	SEMESTER	I	L	Т	Р	С
COURSE CODE / COURSE TITLE	191ME11	1 / BASIC CIVIL AND ME ENGINEERING	CHANICAL	3	0	0	3

	COURSE OUTCOMES									
On con	On completion of the course, students will be able to									
CO1	Explain the usage of construction material and proper selection of construction materials									
CO2	Explain about water resources, sewage treatment and transportation systems									
CO3	Explain about the components use in power plants									
CO4	Describe the internal combustion engines									
CO5	Explain about the renewable energy sources and refrigeration cycles									

	CO-PO & PSO Mapping														
СО	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 O 2	PS O3
CO 1	3	3	1	1	-	2	2	1	-	-	-	2	-	-	-
CO 2	3	3	1	1	-	2	2	1	-	-	-	2	-	-	-
CO 3	3	3	1	1	-	2	2	1	-	-	-	2	-	-	-
CO 4	3	3	1	1	-	2	2	1	-	-	-	2	-	-	-
CO 5	3	3	1	1	-	2	2	1	-	-	-	2	-	-	-
со	3	3	1	1	-	2	2	1	-	-	-	2	-	-	-

YEAR	Ι	SEMESTER	I	L	Т	Р	С
COURSE CODE /	191E	191EE111 / BASIC ELECTRICAL AND					3
COURSE TITLE	E	ELCTRONICS ENGINEERING					

	COURSE OUTCOMES										
On con	npletion of the course, students will be able to										
CO1	Summarizes about different structures of Power system and safety measures.										
CO2	Explain about the basics of Electricity										
CO3	Discuss on various electric circuits and use of measuring instruments										
CO4	Clarify the working of basic electronic devices such as diode, transistor and operational amplifiers										
CO5	Infer about Digital Electronics and Communication System										

	CO-PO & PSO Mapping														
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	2	1	1	1	1	-	-	-	-	-	-	-	-	-	-
CO 5	2	1	1	1	-	-	-	-	-	-	-	-	-	-	-
СО	3	2	2	1	1	-	-	-	-	-	-	-	-	-	-

YEAR	Ι	SEMESTER	I	L	Т	Р	С
COURSE CODE / COURSE TITLE	191P	H10A / PHYSICS LABORA	ATORY	0	0	2	1

	COURSE OUTCOMES								
On cor	On completion of the course, students will be able to								
1	Apply the principles of properties of matter in determining the various elastic properties								
2	Determine Young's modulus by non-uniform bending method.								
3	Applying Photo electric effect to determine Planks Constant.								
4	Determination of wavelength of mercury spectrum – spectrometer grating.								
5	Attain the practical knowledge to apply principles of optics for various engineering applications								

							CO-I M	PO & I Iapping	PSO g						
СО	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	PSO3
CO1	3	2	2	2	-	-	-	-	-	-	-	1	1	-	-
CO2	3	2	2	2	-	-	-	-	-	-	-	1	1	-	-
CO3	3	2	2	2	-	-	-	-	-	-	-	1	1	-	-
CO4	3	2	2	2	-	-	-	-	-	-	-	1	1	-	-
CO5	3	2	2	2	-	-	-	-	-	-	-	1	1	-	-
СО	3	3	2	2	-	-	-	-	-	-	-	1	1	-	-

YEAR	Ι	SEMESTER	I	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CH	10A / CHEMISTRY LABOI	RATORY	0	0	2	1

	COURSE OUTCOMES								
On co	On completion of the course, students will be able to								
CO1	Acquire knowledge on quantitative chemical analysis by instrumentation and volumetric method.								
CO2	Analyse the water sample for hardness, chloride, sodium /potassium content, dissolved oxygen etc.								
CO3	Solve analytical problems in spectrometer and flame photometer for the identification and quantification.								
CO4	Estimate Copper in ore and Nickel in Steel								
CO5	Analyse rate of corrosion by weight loss method.								

					(CO-PC) & PS	SO Maj	pping						
СО	PO1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO 1	3	2	2	1	-	-	-	-	-	-	-	1	1	-	-
CO 2	3	2	2	1	-	-	-	-	-	-	-	1	1	-	-
CO 3	3	2	2	1	-	-	-	-	-	-	-	1	1	_	-
CO 4	3	2	2	1	-	-	-	-	-	-	-	1	1	_	-
CO 5	3	2	2	1	-	-	-	-	-	-	-	1	1	-	-
СО	3	2	2	1	-	-	-	-	-	-	-	1	1	-	-

YEAR	Ι	SEMESTER	I	L	Т	Р	С
COURSE CODE / COURSE TITLE	191MF	211A / ENGINEERING PRA LABORATORY	ACTICES	0	0	4	2

	COURSE OUTCOMES														
On co	On completion of the course, students will be able to														
CO1	Hand	Hands on experience on welding, sheet metal and lathe works													
CO2	Expe work	rience ing pri	the plu nciples	mping	and ca	rpentry	/ work	and de	emonstr	ation or	ı centrif	ugal pui	np and a	air condi	tioning
CO3	Meas	sureme	nt of E	lectrica	ıl quan	tities, e	earthing	g proce	dures,	wiring r	nethods	etc			
CO4	Study parar	y of Ele neter, (ectroni Gates ,	c comp Circuit	onents ts etc	and ec	luipme	nts – R	Resistor	, color c	oding n	neasurer	ment of A	AC signa	al
CO5	Provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.														
						C	0-PO (& PSO) Mapp	oing					
СО	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	1	-	-	-	-	-	2	-	-	-
CO2	3	3	1	1	1	1	-	-	-	-	-	1	-	-	-
CO3	3	3	2	2	2	2	-	-	-	-	-	2	-	-	-
CO4	3	3	1	2	1	1	-	-	-	-	-	1	-	-	-
CO5	3	3	2	2	2	2	-	-	-	-	-	2	-	-	-
СО	3	3	2	2	2	1	-	-	-	-	-	2	-	-	-

SEMESTER – II

YEAR	Ι	SEMESTER	Ш	L	Т	Р	С
COURSE CODE / COURSE TITLE	191MA202	I / ENGINEERING MATHI	EMATICS II	2	2	0	3

On com	COURSE OUTCOMES On completion of the course, students will be able to								
CO1	Evaluate multiple integrals using change of variables.								
CO2	Apply various integral theorems for solving engineering problems involving cubes and rectangular parallelepipeds.								
CO3	Construct analytic functions of complex variables and transform functions using conformal mappings.								
CO4	Estimate the real and complex integrals over suitable closed paths and contours.								
CO5	Compute linear differential equations using Laplace transform techniques								

						C	O-PO	& PSO) Mapp	oing					
СО	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	-	-	-	-	-	-	1	-	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-	1	-	-	-
CO3	3	3	2	2	2	-	-	-	-	-	-	1	-	-	-
CO4	3	3	2	2	2	-	-	-		-	-	1	-	-	-
CO5	3	3	2	2	2	-	-	-	-	-	-	1	-	-	-
СО	3	3	2	2	2	-	-	-	-	-	-	1	-	-	-

YEAR	Ι	SEMESTER	Ш	L	Т	Р	С
COURSE CODE / COURSE TITLE	191E)	C212/ DIGITAL SYSTEM I	DESIGN	2	2	0	3

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Apply the theorems and postulates of Boolean algebra, the techniques of Karnaugh Maps and Quine-McCluskey tabulation techniques for simplification of logic functions.
CO2	Design combinational logic circuits for various applications and implement them using logic gates or other devices like multiplexers, decoders and simulate them using Hardware Description Language (HDL).
CO3	Design synchronous sequential logic circuits like counters and shift registers and implement them using different flip flops.
CO4	Analyze the given Asynchronous sequential logic circuit to determine its function.
CO5	Implementation of PLD's and Reviewing of memory devices.

							CO-I	PO & I	PSO N	/Iapping	g				
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
СО	3	2	2	-	2	-	-	-	-	-	-	-	-	-	-

YEAR	Ι	SEMESTER	П	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT22	21/ INFORMATION TECH ESSENTIALS	NOLOGY	3	0	0	3

	COURSE OUTCOMES On completion of the course, students will be able to					
CO1	Design and deploy websites					
CO2	Design and deploy simple web application					
CO3	Create simple database application					
CO4	Develop information system					
CO5	Describe the basics of networking and mobile communication					

						С	O-PO	& PSO) Mapp	ing					
СО	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	-	-	-	-	-	-	-	2	2	2
CO2	3	3	2	1	1	-	-	-	-	-	-	-	2	2	2
CO3	3	2	3	1	3	-	-	-	2	-	-	2	2	1	2
CO4	3	2	2	1	2	-	-	-	2	-	-	2	2	1	1
CO5	3	2	2	1	2	-	-	-	-	-	-	2	2	-	2
со	3	2	2	1	2	-	-	-	2	-	-	2	2	2	2

YEAR	Ι	SEMESTER	II	L	Т	Р	С
COURSE CODE / COURSE TITLE	191M	E211 / ENGINEERING GR	APHICS	2	2	0	3

On con	COURSE OUTCOMES On completion of the course, students will be able to						
CO1	Draw engineering curves and apply the concepts of free hand sketching						
CO2	Draw orthographic views of points, lines and surfaces						
CO3	Draw visualizations of simple solid objects as per orthographic projections						
CO4	Draw sections and developments made in drawing						
CO5	Draw pictorial drawings of simple objects						

							CO-I	PO & I Iappin	PSO g						
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	РО 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	2	-	3	1	-	-	-	1	1	1	1	1	1
CO2	1	1	2	-	3	1	-	-	-	1	1	1	1	1	1
CO3	1	1	2	-	3	1	-	-	-	1	1	1	1	1	1
CO4	1	1	2	-	3	1	-	-	-	1	1	1	1	1	1
CO5	1	1	2	-	3	1	-	-	-	1	1	1	1	1	1
СО	1	1	2	-	3	1	-	-	-	1	1	1	1	1	1

YEAR	Ι	SEMESTER	Ш	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CS211	/ PROBLEM SOLVING AN PROGRAMMING	ND PYTHON	3	0	0	3

On con	COURSE OUTCOMES On completion of the course, students will be able to						
CO1	Describe the Algorithmic solutions for simple computational problems.						
CO2	Identify the various data expressions, statements in python programming.						
CO3	Use control flow and function for solving problems in python.						
CO4	Distinguish list tuples and dictionaries in python programming.						
CO5	Develop simple programs using files, modules, packages in python						

	CO-PO&PSO Mapping														
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	1	1	1	-	-	-	-	-	-	1	3	2	1
CO2	3	3	1	1	1	-	-	-	-	-	-	1	3	2	1
CO3	3	3	2	2	2	-	-	-	-	-	-	2	3	2	2
CO4	3	3	2	2	2	-	-	-	-	-	-	2	3	2	2
CO5	3	3	2	2	2	-	-	-	-	-	-	2	3	2	2
СО	3	3	2	2	2	-	-	-	-	-	-	2	3	2	2

YEAR	Ι	SEMESTER	Ш	L	Т	Р	С
COURSE CODE / COURSE TITLE	191HS201	/ ENVIRONMENTAL SCI ENGINEERING	ENCE AND	3	0	0	3

On cor	COURSE OUTCOMES On completion of the course, students will be able to							
CO 1	Interpret the concept of ecosystem, biodiversity and its conservation.							
CO 2	Demonstrate the environmental impacts of energy development.							
CO3	Categorize the various environmental pollutions and select suitable preventive measures.							
CO4	Perceive the environmental effects of human population and the implementation of welfareprograms.							
CO 5	Recall the environmental ethics and legal provisions.							

	CO-PO&PSO Mapping														
СО	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 0 1	PS O 2	PS O 3
CO1	3	3	2	2	-	2	3	3	-	-	-	2	1	-	-
CO2	3	3	2	2	-	2	3	-	-	-	-	2	1	-	-
CO3	3	3	2	2	-	2	3	-	-	-	-	2	1	-	-
CO4	3	3	2	2	-	2	3	-	-	-	-	2	1	I	-
CO5	3	3	2	2	-	2	3	3	-	-	-	2	1	-	-
СО	3	3	2	2	-	2	3	3	-	-	-	2	1	_	-

YEAR	Ι	SEMESTER	II	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT22 I	0	0	2	1		

	COURSE OUTCOMES											
On completion of the course, students will be able to												
CO1	Design interactive websites using basic HTML tags, different styles, links and with all.											
CO2	To Know about Basic control elements and To Create client side and server side programs using scripts using PHP.											
CO3	Design web sites and handle multimedia components											
CO4	Create applications with PHP connected to database.											
CO5	Create Personal Information System and Implement the technologies behind computer networks and mobile communication.											

	CO-PO & PSO Mapping														
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	2	2	2	1	2	-	-	-	-	-	-	-	3	3	3
CO 2	2	2	2	1	2	2	-	-	-	2	-	-	2	3	3
CO 3	3	2	2	1	2	3	-	-	-	1	2	2	3	2	2
CO 4	3	2	2	1	2	3	-	-	-	2	2	2	3	2	3
CO 4	3	2	2	1	2	2	-	-	-	1	-	2	3	2	2
CO 5	3	2	2	1	2	2	-	-	-	1	-	2	3	3	2
CO	3	2	2	1	2	2	-	-	-	1	2	2	3	2	2

YEAR	I	SEMESTER	II	L	Т	Р	С
COURSE CODE / COURSE TITLE	191EC21H	0	0	2	1		

	COURSE OUTCOMES										
On co	On completion of the course, students will be able to										
CO1	Apply Boolean simplification techniques to construct combinational logic circuits.										
CO2	Build combinational logic circuits to perform arithmetic operations.										
CO3	Implement combinational circuits using MSI devices.										
CO4	Construct Sequential circuits like registers and counters.										
CO5	Simulate combinational and sequential circuits using HDL.										

	CO-PO & PSO Mapping														
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	-	-	-	-	-	-	-	-	-	1	-	-
CO 2	3	2	2	-	-	-	-	-	-	-	-	-	1	-	-
CO 3	3	2	2	-	2	-	-	-	-	-	-	-	1	_	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	1	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	1	1	-
со	3	2	2	-	2	-	-	-	-	-	-	-	1	1	-
YEAR	Ι	SEMESTER	II	L	Т	Р	С								
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COURSE CODE / COURSE TITLE	191CS21A PR	/ PROBLEM SOLVING AN OGRAMMING LABORAT	ND PYTHON ORY	0	0	2	1								

	COURSE OUTCOMES											
On con	On completion of the course, students will be able to											
CO1	Develop simple Python programs to test and debug.											
CO2	Solve problems using conditionals and loops in Python.											
CO3	Develop Python programs by defining functions.											
CO4	Represent lists, Tuples and dictionaries for compound data.											
CO5	Perform file operations using Python.											

							CO- N	PO & /Iappir	PSO 1g						
СО	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	-	-	-	1	-	-	1	3	3	2
CO2	3	3	2	2	2	-	-	-	1	-	-	1	3	2	2
CO3	3	3	2	2	2	-	-	-	1	-	-	1	3	2	2
CO4	3	3	2	2	2	-	-	-	-	-	-	1	3	2	2
CO5	3	3	2	2	2	-	-	-	2	-	-	1	3	2	2
СО	3	3	2	2	2	-	-	-	1	-	-	1	3	2	2

SEMESTER-III

YEAR	II	SEMESTER	ш	L	Т	Р	С
COURSE CODE / COURSE TITLE	191H	S301 / MAGAGEMENT SO	CIENCE	2	0	0	2

	COURSE OUTCOMES												
On completion of the course, students will be able to													
CO1	Overcome the stress in their respective field												
CO2	Be an active listener so as to respond accurately and effectively												
CO3	Raise and respond to the queries without any hesitation												
CO4	Write effectively and to draft letters, E-mails impressively.												
CO5	Deliver presentations confidently												

	CO- PO & PSO Mapping														
СО	PO 10 11 PO										РО	PSO	PSO	PSO	
	1	2	3	4	5	6	7	8	9	10		12	1	2	3
CO1	-	-	-	-	-	-	-	2	2	3	2	3	-	-	-
CO2	-	-	-	-	-	-	-	2	2	3	2	3	-	-	-
CO3	-	-	-	-	-	-	-	2	2	3	2	3	-	-	-
CO4	-	-	-	-	-	-	-	2	2	3	2	3	-	-	-
CO5	-	-	-	-	-	-	-	2	2	3	2	3	-	-	-
СО	-	-	-	-	-	-	-	2	2	3	2	3	-	-	-

YEAR	II	SEMESTER	ш	L	Т	Р	С
COURSE CODE / COURSE TITLE	191MA	306 / DIFFERENTIAL CA	LCULUS	2	2	0	3

	COURSE OUTCOMES											
On completion of the course, students will be able to												
CO1	Compare and contrast the ideas of limits, continuity and differentiability.											
CO2	Apply the basic concept of differentiation in their engineering fields.											
CO3	Apply the basic differentiation rules to find derivatives of composite functions.											
CO4	Explain the derivative as the slope of the tangent line to a function at a point and calculate limits in inderminate forms by a repeated use of L' Hospital rule.											
CO5	Analyze the extremum and behaviour of functions.											

	CO-PO&PSOMapping														
СО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PO 10	PO 11	РО	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10		12	1	2	3
CO1	3	3	2	2	1	-	-	-	-	-	-	1	2	-	1
CO2	3	3	2	2	1	-	-	-	-	-	-	1	2	-	1
CO3	3	3	2	2	1	-	-	-	-	-	-	1	2	-	1
CO4	3	3	2	2	1	-	-	-	-	-	-	1	2	-	1
CO5	3	3	2	2	1	-	-	-	-	-	-	1	2	-	1
СО	3	3	2	2	1	-	-	-	-	-	-	1	2	-	1

YEAR	II	SEMESTER	Ш	L	Т	Р	С
COURSE CODE / COURSE TITLE	191E(C312 / ANALOG AND DI COMMUNICATION	GITAL	3	0	0	3

On con	COURSE OUTCOMES On completion of the course, students will be able to											
On con												
CO1	Apply analog and digital communication techniques.											
CO2	Describe pulse modulation techniques.											
CO3	Analyze the various digital modulation techniques.											
CO4	Evaluate information and coding techniques.											
CO5	Identify concepts behind multiuser radio communication.											

	CO-PO & PSO Mapping														
СО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO1	PSO2	PSO3
	1	2	3	4	5	6	7	8	9	10	11	12			
CO1	3	3	2	1	2	1	-	-	-	2	1	2	-	-	-
CO2	3	2	2	1	1	-	-	-	-	1	1	1	-	-	-
CO3	3	2	2	2	2	1	-	-	-	2	2	1	-	-	-
CO4	3	2	2	2	1	-	-	-	-	2	1	1	-	-	-
CO5	3	2	3	1	2	1	1	1	-	1	2	2	-	-	-
СО	3	2	2	1	2	1	1	1	-	2	1	1	-	-	-

YEAR	II	SEMESTER	Ш	L	Т	Р	С
COURSE CODE / COURSE TITLE	19	1CS321 / DATA STRUCTU	RES	3	0	0	3

	COURSE OUTCOMES											
On com	On completion of the course, students will be able to											
CO1	Develop the solutions for simple problems using basics of C programming language.											
CO2	Apply the concepts of functions, pointers, structures and unions practical applications.											
CO3	Interpret and implement linear data structure operations in C											
CO4	Analyze and evaluate nonlinear data structure for the given application											
CO5	Apply the hashing concepts an choose the appropriate sorting algorithm for an application											

	CO-PO & PSO Mapping														
СО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PO 10	PO 11	РО	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10		12	1	2	3
CO1	3	2	1	1	1	-	-	-	1	-	1	-	3	2	2
CO2	3	2	2	1	2	-	-	-	1	1	-	2	3	2	2
CO3	3	2	2	2	2	1	-	-	2	1	-	1	3	2	2
CO4	3	2	2	2	2	1	-	-	2	1	1	1	3	2	2
CO5	3	2	2	1	1	-	-	-	2	-	-	1	3	2	2
СО	3	2	2	1	2	1	-	-	2	1	1	1	3	2	2

YEAR	II	SEMESTER	Ш	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CS3	22 / COMPUTER ARCHIT	ECTURE	2	2	0	3

	COURSE OUTCOMES												
On cor	On completion of the course, students will be able to												
CO1	Infer the basics concepts of fundamental component, architecture, register organization and performance metrics of a computer.												
CO2	Illustrate the efficient algorithm for binary arithmetic operations.												
CO3	Construct an efficient data path for an instruction format for a given architecture.												
CO4	Apply parallel processing concepts for efficient data processing.												
CO5	Analyze the memory, I/O devices and cache structures for processor.												

	CO-PO & PSO Mapping														
СО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PO 10	PO 11	РО	PSO1	PSO2	PSO3
	1	2	3	4	5	6	7	8	9	10	**	12			
CO1	3	2	-	-	-	-	-	-	-	-	-	1	2	1	2
CO2	3	2	2	-	-	-	-	-	2	1	-	1	2	1	2
CO3	3	2	2	1	-	-	-	-	-	-	-	1	2	1	3
CO4	3	2	2	1	-	-	-	-	2	1	-	1	2	1	2
CO5	3	2	2	1	-	-	-	-	1	1	-	1	2	2	3
СО	3	2	2	1	-	-	-	-	2	1	-	1	2	1	2

YEAR	II SEMESTER III		III	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CS323 / (OBJECT ORIENTED PRO	GRAMMING	2	2	0	3

	COURSE OUTCOMES											
On con	On completion of the course, students will be able to											
CO1	Describe OOPS concept and define the structure of Java programs.											
CO2	Identify the concept of inheritance, interfaces and illustrate the Java Programs.											
CO3	Develop a applications using Exceptions and I/O streams											
CO4	Analyze and evaluate the concept of threads and generic classes to develop Java applications											
CO5	Create interactive Java programs using AWT and Swings											

	CO-PO & PSO Mapping														
СО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PO 10	PO 11	РО	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10		12	1	2	3
C01	3	3	2	1	-		-	1	-	-	-	1	3	2	2
CO2	3	3	3	-	2	-	-	-	-	-	-	2	3	3	-
CO3	3	3	2	1	2	-	-	1	-	-	-	2	3	3	2
CO4	3	3	3	-	2	-	-	-	-	1	-	2	3	2	1
CO5	3	3	3	-	2	-	-	1	1	1	-	2	3	3	2
СО	3	3	3	1	2	-	-	1	1	1	-	2	3	3	2

YEAR	II	SEMESTER	Ш	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CS32A /	' DATA STRUCTURES LA	BORATORY	0	0	2	1

	COURSE OUTCOMES									
On con	On completion of the course, students will be able to									
CO1	Develop the solutions for simple problems basic using C programming language.									
CO2	Apply the concepts of functions, pointers, structures and unions practical applications.									
CO3	Interpret and implement linear data structure operations in C									
CO4	Analyze and evaluate nonlinear data structure for the given application									
CO5	Apply the hashing concepts an choose the appropriate sorting algorithm for an application									

							CO- N	PO & Iappir	PSO 1g						
СО	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	1	1	-	-	-	-	-	-	-	3	2	1
CO2	2	2	1	1	1	-	-	-	1	-	-	-	3	2	2
CO3	3	3	3	2	2	1	-	-	-	-	-	1	3	2	1
CO4	3	3	3	2	2	1	-	-	1	-	1	1	3	2	2
CO5	3	3	3	2	2	1	-	-	1	-	1	1	3	2	2
со	3	3	2	2	2	1	-	-	1	-	1	1	3	2	2

YEAR	II	SEMESTER	III	L	Т	Р	С
COURSE CODE / COURSE TITLE	191 PRC	CS32B /OBJECT ORIEN OGRAMMING LABORAT	TED FORY	0	0	2	1

	COURSE OUTCOMES
On con	npletion of the course, students will be able to
CO1	Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects.
CO2	Analyze the concept of function overloading, operator overloading, virtual functions and polymorphism.
CO3	Implement Java programs for simple applications that make use of classes, packages and interfaces.
CO4	Develop and implement Java programs with array list, exception handling and multithreading.
CO5	Design applications using file processing, generic programming and event handling.

							CO-P Ma	O & P apping	SO						
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	3	1	1	-	1	2	2	2	3	2	2
CO2	3	3	3	2	3	1	1	1	-	2	2	2	2	2	1
CO3	3	3	3	2	3	1	1	-	1	2	2	2	3	2	2
CO4	3	3	3	2	3	-	1	1	1	2	3	2	2	3	2
C05	3	3	3	2	3	1	1	1	1	2	3	2	3	3	2
СО	3	3	3	2	3	1	1	1	1	2	2	2	3	2	2

Course Code	COURSE TITLE	L	Т	Р	С
191HS30B	INTERPERSONAL SKILLS	0	0	2	1
	LABORATORY				
COURSE OU	ΓCOMES:				
On successful c	completion of this course, the students will be able to,				
Listen and resp	ond appropriately.				
Converse in an	efficient manner following accurate stress and intonation.				
-					
Participate in f	ormal as well as informal conversations confidently.				
Participate in g	roup discussions				
Make effective	presentations				
Н					

SEMESTER-IV

YEAR	II	SEMESTER	IV	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT421/	SOFTWARE ENGINEERI DESIGN	NG AND	3	0	0	3

	COURSE OUTCOMES
On com	pletion of the course, students will be able to
CO1	Analyze the software development life cycle.
CO2	Identify different approaches adopted in gathering requirements.
CO3	Demonstrate the various software design concepts and understand different designs like architectural, structured, object oriented and user interface.
CO4	Model the event driven state of object and transform them into implementation specific layouts.
CO5	Apply software validation and testing for real time applications. Discuss software maintenance issues and challenges.

						C)-PO	& PSO	Mapp	oing					
СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO11	PO 12	PSO 1	PSO2	PSO 3
C01	3	2	2	-	-	1	1	2	2	2	2	2	3	3	2
CO2	3	3	2	2	-	1	1	1	2	2	1	1	3	3	3
CO3	3	3	3	2	2	2	2	1	2	2	1	1	2	3	3
CO4	3	3	2	1	3	1	1	1	2	-	-	-	3	3	3
CO5	3	3	3	2	2	2	2	1	1	1	2	2	3	3	3
СО	3	3	2	2	2	1	1	1	2	2	2	2	3	3	3

YEAR	II	SEMESTER	IV	L	Т	Р	С
COURSE CODE / COURSE TITLE	191MA4	03 / DISCRETE MATH	EMATICS	2	2	0	3

	COURSE OUTCOMES
On con	pletion of the course, students will be able to
CO1	Use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, functions, and integers and apply it in their fields.
CO2	Apply counting principles and estimate probabilities and also to analyze algorithms and programs by recurrence relation.
CO3	Analyze the different types of graphs and hence know about the application of graph theory in their field.
CO4	Analyze the algebraic structures and their application
CO5	Evaluate Boolean functions and simplify expression using the properties of Boolean algebra.

							CO-P() &PS	O Maj	pping					
СО	PO1	PO 2	PO3	PO 4	PO5	PO 6	PO7	PO 8	PO9	PO 10	PO 11	PO12	PSO1	PSO2	PSO 3
CO1	3	3	2	2	1	-	-	-	-	-	-	1	2	-	1
CO2	3	3	2	2	1	-	-	-	-	-	-	1	2	-	1
CO3	3	3	2	2	1	-	-	-	-	-	-	1	2	-	1
CO4	3	3	2	2	1	-	-	-	-	-	-	1	2	-	1
CO5	3	3	2	2	1	-	-	-	-	-	-	1	2	-	1
СО	3	3	2	2	1	-	-	-	-	-	-	1	2		1

YEAR	II	SEMESTER	IV	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CS421 /	DESIGN AND ANALYSI ALGORITHMS	SOF	3	0	0	3

	COURSE OUTCOMES								
On con	On completion of the course, students will be able to								
CO1	Identify the fundamental needs of algorithms in problem solving								
CO2	Design algorithm for various computing problems								
CO3	Analyze the different algorithm design techniques for a given problem								
CO4	Modify existing algorithms to improve efficiency								
CO5	Evaluate the time and space complexity of various algorithms								

							C	D-PO Mapp	&PSO oing)					
СО	РО	РО	PO 10	PO 11	РО	PSO	PSO	PSO							
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	1	-	-	-	-	-	-	-	1	2	2	1
CO2	3	3	2	2	2	-	-	-	1	1	-	1	2	2	1
CO3	3	3	2	2	-	-	-	-	1	1	-	1	2	2	1
CO4	3	3	2	2	1	-	-	-	1	1	-	-	2	2	1
CO5	2	2	2	2	1	-	_	-	_	-	-	1	2	2	1
СО	3	3	2	2	1	-	-	-	1	1	-	1	2	2	1

YEAR	II	SEMESTER	IV	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CS4 2	22 / DATA BASE MANA SYSTEMS	GEMENT	3	0	0	3

	COURSE OUTCOMES							
On con	On completion of the course, students will be able to							
CO1	Apply queries for manipulation of data.							
CO2	Make use of ER diagram and normalization techniques to perform database design effectively.							
CO3	Implement the transaction processing, concurrency control techniques and recovery procedures.							
CO4	Compare and contrast various indexing strategies and query processing and optimization in different database systems.							
CO5	Appraise how advanced databases differ from traditional databases and Information retrieval.							

							C	CO-PO Map	&PS ping	0					
СО	PO	РО	РО	РО	РО	PO	РО	PO	РО	PO 10	PO 11	РО	PSO1	PSO2	PSO3
	1	2	3	4	5	6	7	8	9	10		12			
CO1	3	2	1	1	1	-	-	-	1	1	-	2	2	3	2
CO2	3	2	1	2	1	-	-	-	2	1	-	2	3	3	2
CO3	3	2	2	1	1	-	-	-	2	1	-	1	2	3	2
CO4	3	2	2	2	2	-	-	-	1	1	-	2	3	3	2
CO5	3	2	2	2	2	-	-	-	2	2	-	3	3	3	2
СО	3	2	2	2	1	-	-	-	2	1	-	2	3	3	2

YEAR	II	SEMESTER	IV	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CS4	23 / OPERATING S	SYSTEMS	3	0	0	3

	COURSE OUTCOMES								
On cor	On completion of the course, students will be able to								
CO1	Creating new Process and apply the basic OS concepts.								
CO2	Compare various scheduling algorithms and Understand deadlock prevention and avoidance algorithms.								
CO3	Design and implement memory management schemes								
CO4	Analyze the functionality of file systems								
CO5	Review the administrative tasks on Linux Servers and to Compare iOS and Android Operating Systems								

							CO- N	-PO & Mappii	PSO ng						
СО	PO1	РО 2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	-	1	-	1	1	-	1	2	2	1
CO2	3	3	2	2	2	-	1	-	1	1	-	1	3	3	2
CO3	3	2	2	2	1	-	1	-	1	1	-	1	3	3	2
CO4	3	3	2	2	2	-	1	-	1	1	-	1	3	2	2
CO5	3	2	2	2	1	-	1	-	1	1	-	1	2	2	1
СО	3	3	2	2	1	-	1	-	1	1	-	1	3	2	2

YEAR	II	SEMESTER	IV	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CS4	2A/ DATABASE MANAGE SYSTEMS LABORATOR	MENT Y	0	0	2	1

	COURSE OUTCOMES						
On com	On completion of the course, students will be able to						
CO1	Apply data definitions and manipulation commands to simple problems.						
CO2	Identify the design applications to test Nested and Join Queries.						
CO3	Apply simple applications that use Views.						
CO4	Analyze applications that require a Front-end Tool.						
CO5	Evaluate and analyze the use of Tables, Views, Functions and Procedures.						

							CO-I M	PO & I Iappin	PSO g						
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	2	1	-	1	-	-	-	-	1	3	3	2	1
CO2	3	2	2	1	-	1	-	-	-	-	1	3	2	3	1
CO3	3	2	2	2	-	1	-	-	-	-	1	3	2	2	2
CO4	3	2	2	2	2	2	-	-	-	-	1	3	3	2	2
CO5	3	2	2	2	2	2	-	-	-	-	1	3	3	2	2
СО	3	2	2	2	2	1	-	-	-	-	1	3	3	2	2

YEAR	II	SEMESTER	IV	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CS42B/ C	DPERATING SYSTEMS LAI	BORATORY	0	0	2	1

	COURSE OUTCOMES								
On co	On completion of the course, students will be able to								
CO1	Compare the performance of various CPU Scheduling Algorithms.								
CO2	Implement Deadlock avoidance and Detection Algorithms.								
CO3	Demonstrate Semaphores.								
CO4	Create processes and implement IPC.								
CO5	Analyze the performance of the various Page Replacement Algorithms and Implement File Organization and File Allocation Strategies								

	CO-PO & PSO Mapping														
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	3	1	1	-	-	-	-	-	-	1	2	2	2
CO2	3	3	3	2	2	-	-	-	2	-	-	1	3	3	2
CO3	3	3	3	2	2	-	-	-	-	-	-	1	3	3	2
CO4	3	3	3	3	2	-	-	-	1	-	-	1	3	2	2
CO5	3	3	3	3	3	2	2	2	2	1	2	2	3	3	3
СО	3	3	3	2	2	2	2	2	2	1	2	1	3	3	2

YEAR	II	SEMESTER	IV	L	Τ	Р	С
COURSE CODE /	19	1HS40C / PROFE	SSIONAL	0	0	2	1
COURSE TITLE		COMMUNICA	ΓΙΟΝ				

COURSE OUTCOMES At the end of the course Learners will be able to:									
CO1	Develop hard skills, soft skills and career skills for grooming as a professional.								
CO2	Make effective presentations								
CO3	Participate confidently in Group Discussions								
CO4	Attend job interviews and be successful in them.								
CO5	Develop adequate Soft Skills required for the workplace								

SEMESTER-V

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE	191MA50	02/ PROBABILITY AND ST	ATISTICS	3	0	0	3

	COURSE OUTCOMES
On con	pletion of the course, students will be able to
CO1	Demonstrate and apply the basic probability axioms and concepts in their core areas.
CO2	Apply the concepts of probability distributions in an appropriate place of science and Engineering.
CO3	Calculate the relationship of two dimensional random variables using correlation techniques and to study the properties of two dimensional random variables.
CO4	Apply the concept of testing of hypothesis for small and large samples in real life problems
CO5	Identify the classification of design of experiment in their respective fields.

	CO-PO&PSO Mapping														
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	-	-	-	-	-	-	1	2	1	1
CO2	3	3	2	2	1	-	-	-	-	-	-	1	2	1	1
CO3	3	3	2	2	1	-	-	-	-	-	-	1	2	1	1
CO4	3	3	2	2	1	-	-	-	-	-	-	1	2	1	1
CO5	3	3	2	2	1	-	-	-	-	-	-	1	2	1	1
СО	3	3	2	2	1	-	-	-	-	-	-	1	2	1	1

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE	191E	C511 / MICROPROCES MICROCONTROLLI	SSORS AND ERS	3	0	0	3

	COURSE OUTCOMES										
On con	On completion of the course, students will be able to										
CO1	Analyze and implement programs on 8086 microprocessor.										
CO2	Interface the peripherals and I/O devices with 8086 microprocessor.										
CO3	Interpret 8051 microcontrollers' architectures and its functionalities.										
CO4	Design and development of 8051 microcontroller based systems for real time applications										
CO5	Interface the peripherals and I/O devices using 8051 microcontroller.										

	CO-PO & PSO Mapping														
СО	РО	РО	РО	РО	РО	РО	РО	РО	PO9	PO 10	PO 11	РО	PSO1	PSO2	PSO3
	1	2	3	4	5	6	7	8		10		12			
CO1	3	2	2	2	-	-	-	-	-	-	-	-	2	2	2
CO2	3	3	2	2	-	-	-	-	-	-	-	-	2	2	2
CO3	3	3	3	2	-	-	-	-	-	-	-	-	2	2	2
CO4	3	3	2	1	-	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	2	-	-	-	-	1	1	2	2	3	3	3
СО	3	3	3	2	-	-	-	-	1	1	2	2	2	2	2

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE	191HS501	/ TOTAL QUALITY MAN	AGEMENT	3	0	0	3

	COURSE OUTCOMES											
On con	On completion of the course, students will be able to											
CO1	Describe and evaluate the basic concepts of quality management.											
CO2	Apply motivation parameter to build the continuous quality process management.											
CO3	Prepare the applications of quality tools and techniques in both manufacturing and service industry.											
CO4	Develop analytical skills for investigating and analyzing quality management issues in management sectors.											
CO5	Analyze the various quality systems in manufacturing and service sector.											

	CO-PO & PSO Mapping														
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P O 10	P O 11	PO 12	PS O 1	PSO 2	PSO3
CO1	-	-	-	-	-	-	1	1	3	3	2	1	-	-	-
CO2	-	-	-	-	-	-	2	3	3	3	2	-	-	-	-
CO3	-	-	-	-	-	-	3	2	2	1	1	-	-	-	-
CO4	-	-	-	-	-	-	2	2	2	2	1	-	-	-	-
CO5	-	-	-	-	-	-	3	2	2	3	3	-	-	-	2
СО	-	-	-	-	-	-	2	3	3	3	3	1	-	-	2

YEAR	ш	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE	1911	T522/WEB TECHNOLOG	Y	3	0	0	3

	COURSE OUTCOMES
On con	npletion of the course, students will be able to
CO1	Design simple web pages using markup languages like HTML and XHTML.
CO2	Create dynamic web pages using DHTML and java script that is easy to navigate and use.
CO3	Develop server side web pages that have to process request from client side web pages.
CO4	Represent web data using XML and develop web pages using JSP.
CO5	Analyse various web services and their interaction with other web services.

	CO-PO & PSO Mapping														
СО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PO 10	PO 11	РО	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10		12	1	2	3
CO1	3	3	3	-	3	-	-	-	-	-	-	2	3	2	2
CO2	3	3	3	-	3	-	-	-	2	-	-	2	3	3	2
CO3	3	3	3	2	3	-	-	-	2	-	-	2	3	3	2
CO4	3	3	3	2	2	-	-	-	2	2	-	3	3	2	2
CO5	3	3	3	2	2	-	-	-	-	2	-	3	3	3	2
СО	3	3	3	2	3	-	-	-	2	2	-	3	3	3	2

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE	19117	521 / COMPUTER NETW	ORKS	3	0	0	3

	COURSE OUTCOMES
On con	npletion of the course, students will be able to
CO1	Identify the basic layers and its functions of computer networks
CO2	Analyze the data flows from one node to another.
CO3	Analyze and design routing algorithms.
CO4	Design protocols for various functions in the network.
CO5	Analyze the working principles of various application layer protocols.

	CO-PO & PSO Mapping														
СО	CO PO PO<													PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	1	2	-	-	-	2	-	1	-	3	1	1
CO2	3	2	1	1	2	-	-	-	2	1	2	1	3	2	1
CO3	3	2	2	2	3	2	-	-	-	-	1	1	3	2	2
CO4	3	2	2	2	2	-	-	2	2	2	1	1	3	2	2
CO5	3	2	2	2	3	2	-	2	2	1	2	1	3	3	2
СО	3	2	2	2	3	2	-	2	2	1	1	1	3	2	2

YEAR	III	SEMESTER	v	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT52A	WEB TECHNOLOGY LAI	BORATORY	0	0	2	1

	COURSE OUTCOMES
On cor	npletion of the course, students will be able to
CO1	Design web pages using markup languages like HTML and XHTML.
CO2	Create dynamic web pages using DHTML and java script.
CO3	Implementation of client side web pages and server side web pages.
CO4	Represent web data using XML and develop web pages using JSP.
CO5	Implement various web services and their communication with other web services.

	CO-PO & PSO Mapping														
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	РО 7	PO 8	PO 9	PO10	PO11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	2	1	-	2	2	1	-	2	3	2	2
CO2	3	2	2	2	2	1	-	2	2	1	-	2	3	2	2
CO3	3	2	2	2	2	1	-	2	2	1	-	2	3	2	2
CO4	3	2	2	2	2	1	-	2	2	1	-	2	3	2	2
CO5	3	2	2	2	2	1	-	2	2	1	-	2	3	2	2
СО	3	2	2	2	2	1	-	2	2	1	-	2	3	2	2

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT52	B / NETWORKS LABO	ORATORY	0	0	2	1

	COURSE OUTCOMES									
On con	On completion of the course, students will be able to									
CO1	Identify various protocols using TCP and UDP.									
CO2	Compare the performance of different transport layer protocols.									
CO3	Use simulation tools to measure the performance of various network protocols.									
CO4	Implement various routing algorithms.									
CO5	Interpret error correction codes.									

	CO-PO & PSO Mapping														
СО	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	2	2	1	1	-	1	1	1	1	3	2	2
CO2	3	3	3	3	2	2	2	-	1	1	1	1	3	2	2
CO3	3	3	3	3	3	2	1	-	1	1	1	1	3	2	2
CO4	3	3	3	3	3	2	2	-	1	1	1	1	3	2	2
CO5	3	3	3	3	3	1	2	-	1	1	1	1	3	2	2
со	3	3	3	3	3	2	2		1	1	1	1	3	2	2

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE	191EC: MICR	51A / MICROPROCESS OCONTROLLERS LABOR	ORS AND RATORY	0	0	2	1

	COURSE OUTCOMES											
On completion of the course, students will be able to												
CO1	Write ALP Programmes for fixed and Floating Point and Arithmetic operations											
CO2	Interface different I/Os with processor											
CO3	Generate waveforms using Microprocessors											
CO4	Execute Programs in 8051.											
CO5	Compare the difference between simulator and Emulator.											

	CO-PO & PSO Mapping														
CO	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	2	2	1	1	-	1	1	1	1	3	2	2
CO2	3	3	3	3	2	2	2	-	1	1	1	1	3	2	2
CO3	3	3	3	3	3	2	1	-	1	1	1	1	3	2	2
CO4	3	3	3	3	3	2	2	-	1	1	1	1	3	2	2
CO5	3	3	3	3	3	1	2	-	1	1	1	1	3	2	2
со	3	3	3	3	3	2	2		1	1	1	1	3	2	2

SEMESTER-VI

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT6	23 / INTERNET OF	THINGS	3	0	0	3

	COURSE OUTCOMES											
On completion of the course, students will be able to												
CO1	Analyze various protocols for IoT											
CO2	Develop web services to access/control IoT devices.											
CO3	Design a portable IoT using Rasperry Pi											
CO4	Deploy an IoT application and connect to the cloud.											
CO5	Analyze applications of IoT in real time scenario											

	CO-PO & PSO Mapping														
СО	PO 1	PO 2	PO 3	PO 4	РО 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	1	1	-	-	-	-	1	1	-	3	2	2
CO2	3	2	2	1	-	-	-	-	-	-	-	-	3	2	-
CO3	3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	3	2	1	2	2	1	2	2	-	2	3	3	2
CO5	3	3	3	2	1	2	2	1	1	1	1	2	3	3	3
СО	3	3	3	2	1	2	2	1	1	1	1	2	3	3	2

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT6	22 / CLOUD COMPUTING	3	3	0	0	3

	COURSE OUTCOMES											
On cor	On completion of the course, students will be able to											
CO1	Articulate the main concepts, key technologies, strengths and limitations of cloud computing.											
CO2	Compare the key enabling technologies that help in the development of cloud.											
CO3	Make use of NIST cloud computing architecture to solve architecture design challenges.											
CO4	Explore the core issues of cloud computing such as resource management and security.											
CO5	Review the emergence of cloud as the next generation computing paradigm.											

	CO-PO & PSO Mapping														
СО	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO 11	PO	PSO 1	PSO 2	PSO 3
001												14	1	4	
COI	3	2	2	1	1	-	-	-	1	-	-	1	3	2	2
CO2															
	3	2	2	2	2	-	-	-	-	-	2	1	3	2	2
CO3	3	2	2	2	2	1	_	-	-	-	2	1	2	2	2
CO4															
	3	2	2	2	-	1	-	-	-	-	2	1	3	2	2
CO5															
	3	2	2	2	1	1	1	-	2	-	2	1	3	2	2
СО	3	2	2	2	1	1	1	-	2	-	2	1	3	2	2

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT6	521/ ARTIFICIAL INTELL	IGENCE	3	0	0	3

	COURSE OUTCOMES											
On completion of the course, students will be able to												
CO1	Discuss agent types with its characteristics.											
CO2	Apply appropriate search algorithms for any AI problem											
CO3	Represent a problem using first order and predicate logic											
CO4	Design software agents to solve a problem											
CO5	Develop applications for NLP that use Artificial Intelligence.											

	CO-PO & PSO Mapping														
со	РО	РО	РО	РО	РО	РО	РО	РО	РО	PO 10	PO 11	PO12	PSO1	PSO2	PSO3
	1	2	3	4	5	6	7	8	9						
CO															
1	3	3	2	3	2	-	-	-	2	-	-	2	3	2	1
CO				•	•								-		
2	3	3	3	2	2	-	-	-	2	-	-	2	3	2	2
CO 3	3	3	3	2	2	1	-	-	1	-	_	1	3	2	1
CO 4	3	2	3	2	2	1	-	-	-	-	-	1	3	2	2
CO 5	3	3	3	2	2	1	-	-	1	_	-	1	3	2	2
СО	3	3	3	2	2	1	-	-	1	-	-	1	3	2	2

Professional Elective - I Semester - VI

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	1911T636 / OPEN SOURCE PROGRAMMING			3	0	0	3

COURSE OUTCOMES				
On completion of the course, students will be able to				
CO1	Understand the basics of Open Source Software's.			
CO2	Gain Knowledge on Linux Installation and File systems.			
CO3	Develop simple program suing FOSS			
CO4	Develop QT programming			
CO5	Gain knowledge on various to use Open Source software's.			

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	1911T635 / INFORMATION THEORY AND CODING		3	0	0	3	

COURSE OUTCOMES						
On con	ompletion of the course, students will be able to					
CO1	Apply lossless source codes for discrete memoryless source to improve the efficiency of information.					
CO2	Apply information theory and linear algebra in channel coding.					
CO3	Implement the various types of source coding techniques for data compression.					
CO4	Review various error control encoding and decoding techniques.					
CO5	Analyze the performance of convolutional codes.					

TEXT BOOKS

1.R Bose, "InformationTheory, Coding and Crptography", TMH 2007

2.Fred Halsall, "Multidedia Communications: Applications, Networks, Protocols and Standardsrason Education Asia

REFERENCES

K Sayood, "Introduction to Data Compression" 3/e, Elsevier 2006
S Gravano, "Introduction to Error Control Codes", Oxford University Press 2007
Amitabha Bhattacharya, "Digital Communication", TMH 2006
YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	19	191IT634 / EMBEDDED SYSTEM		3	0	0	3

	COURSE OUTCOMES				
On con	On completion of the course, students will be able to				
CO1	Ability to understand and analyze Embedded systems.				
CO2	Ability to study about the bus Communication in processors.				
CO3	Ability to operate various Embedded Development Strategies				
CO4	Ability to acquire knowledge on various processor scheduling algorithms.				
CO5	Ability to suggest an embedded system for a given application.				

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT633 / C# AND .NET PROGRAMMING		3	0	0	3	

	COURSE OUTCOMES				
On con	On completion of the course, students will be able to				
CO1	Analyze the basic structure of a C# application				
CO2	Implement Object Oriented concepts using C#				
CO3	Build an windows application using .NET				
CO4	Design and develop Web based applications on .NET				
CO5	Discuss CLR.				

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	1911T632 / BIG DATA ANALYTICS		3	0	0	3	

	COURSE OUTCOMES					
On con	On completion of the course, students will be able to					
CO1	Analyzing the usage of modern data analytic tools and usage of statistical concepts.					
CO2	To apply several key big data technologies used for storage, analysis and manipulation of data.					
CO3	Apply Stream data concept to real time applications.					
CO4	To Use various clustering methods to evaluate the analytic process in bigdata.					
CO5	Use Visualization techniques for Data Analytical problems					

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT631 / ADVANCED DATABASE TECHNOLOGY		3	0	0	3	

	COURSE OUTCOMES				
On con	On completion of the course, students will be able to				
CO1	Develop transaction processing systems with concurrency control.				
CO2	Create object database for real time applications.				
CO3	Apply query evaluation techniques and query optimization techniques.				
CO4	Develop web applications using web forms.				
CO5	Design and develop a database application system as part of a team.				

REFERENCES

1. Henry F Korth, Abraham Silberschatz and S. Sudharshan, "Database System Concepts", Sixth Edition, McGraw F 2011.

2. C.J.Date, A.Kannan and S.Swamynathan,"An Introduction to Database Systems", Eighth Edition, Pearson Educat 2006.

3. R.Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson Education/Addison W 2007.

4. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Third Edition, Pearson Education, 2007.

5. Subramaniam, "Multimedia Databases", Morgan Kauffman Publishers, 2008.

Program Elective - II Semester - VI

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT639/I	1911T639 / INFORMATION RETRIEVAL SYSTEMS		3	0	0	3

	COURSE OUTCOMES					
On con	On completion of the course, students will be able to					
CO1	Understanding the different techniques for compression of an index including the dictionary and its posting list					
CO2	To implement retrieval systems for web search tasks.					
CO3	Analyze the language models for information retrieval.					
CO4	Apply Support vector machines and machine learning on documents.					
CO5	To use different information retrieval techniques in various application areas					

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT63	1911T638 / DIGITAL IMAGE PROCESSING		3	0	0	3

	COURSE OUTCOMES					
On cor	On completion of the course, students will be able to					
CO1	Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.					
CO2	Operate on images using the techniques of smoothing, sharpening and enhancement.					
CO3	Understand the restoration concepts and filtering techniques.					
CO4	Understand the basics of segmentation, features extraction					
CO5	Apply various compression and recognition methods for images.					

TEXT BOOKS

- Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson India, Fourth Edition, 2018
- Anil K. Jain, "Fundamentals of Digital Image Processing ", **Pearson India**, 2015.

REFERENCES

- Sridhar.S, "Digital Image Processing", Second Edition, oxford university press, 2016.
- Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,"Digital Image Processing using MATLAB", Pearson, Inc., 2011.

YEAR	III	SEMESTER	L	Т	Р	С	
COURSE CODE / COURSE TITLE	191IT637	/ ADVANCED JAVA PROG	RAMMING	3	0	0	3

	<u>COURSE OUTCOMES</u>								
On con	pletion of the course, students will be able to								
CO1	Design and deploy websites								
CO2	Design and deploy simple web application								
CO3	Create simple database application								
CO4	Develop information system								
CO5	Describe the basics of networking and mobile communication								

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT63	12 / WIRELESS SENSOR A NETWORKS	ND MESH	3	0	0	3

	COURSE OUTCOMES
On con	npletion of the course, students will be able to
CO1	Understand the concept about Wireless networks, protocol stack and standards
CO2	Implement different type of applications for smart phones and mobile devices with latest network strategies
CO3	Conversant with the latest 3G networks and its architecture
CO4	Design and implement wireless network environment for any application using latest wireless protocols and standards
CO5	Conversant with the latest 4G networks and its architecture

YEAR	III	L	Т	Р	С		
COURSE CODE / COURSE TITLE	191	IT6310 / MOBILE COMPU	TING	3	0	0	3

	COURSE OUTCOMES
On con	npletion of the course, students will be able to
CO1	Analyze basics of mobile telecommunication systems
CO2	Illustrate the generations of telecommunication systems in wireless networks.
CO3	Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network.
CO4	Analyze the functionalities of Transport and Application layers
CO5	Develop a mobile application using android/blackberry/ios/Windows SDK

YEAR	III	SEMESTER	L	Т	Р	С	
COURSE CODE / COURSE TITLE	191IT(6311 / MULTIMEDIA DAT	ABASES	3	0	0	3

	COURSE OUTCOMES										
On completion of the course, students will be able to											
C01	Create parallel and distributed databases for real time applications To develop skills on databases to optimize their performance in practice.										
CO2	Develop applications using Active database and Spatial database.										
CO2	Understand the need for XML database.										
CO3	To design faster algorithms in solving practical database problems										
CO4	Analyze the Effect of Mobility on Data Management										
CO5	Design a multimedia database using Multidimensional Data Structures.										

REFERENCES

- 1. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
- 2. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass, V.S.Subrahmanian, Roberto Zicari, "Advanced Database Systems", Morgan Kaufmann publishers,2006.
- 3. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", Sixth Edition, McGraw Hill, 2011.
- 4. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Sixth Edition, Pearson Education/Addison Wesley, 2010.
- 5. Vijay Kumar, "Mobile Database Systems", John Wiley & Sons, 2006

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	1911T6	2A / CLOUD COMPUTING LABAROTORY	ł	0	0	2	1

	COURSE OUTCOMES								
On con	On completion of the course, students will be able to								
CO1	Install various virtualization tools such as Virtual Box, VMware workstation.								
CO2	Use Cloud SIM to run a various scheduler								
CO3	Design a web application in an IaaS environment.								
CO4	Develop a generic cloud environment which can be used as a private cloud								
CO5	Implement version control systems with various command repositories								

	CO-PO & PSO Mapping														
СО	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
CO 1	3	2	3	2	2	2	1	-	2	-	-	2	2	2	2
CO 2	3	3	3	2	2	2	1	-	2	-	-	2	2	2	2
CO 3	3	3	3	2	2	2	1	2	2	2	2	2	2	2	2
CO 4	3	3	3	2	2	2	1	2	2	2	2	2	2	2	2
CO 5	3	3	3	2	2	2	1	-	2	-	-	2	2	2	1
СО	3	3	3	2	2	2	1	2	2	2	2	2	2	2	2

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT6 PI	2B/SOFTWARE ENGINEE RACTICES LABORATORY	RING	0	0	2	1

	COURSE OUTCOMES										
On con	On completion of the course, students will be able to										
CO1	Build a fully functional, interactive, layered, distributed, database-backed software system										
CO2	Use skills such as distributed version control, unit testing, integration testing, build management, and deployment										
CO3	Draw standard UML diagrams using an UML modeling tool for a given case study and map design to code and implement a 3 layered architecture										
CO4	Test the developed code and validate whether the SRS is satisfied										
CO5	Implement the modified system and test it for various scenarios										

	CO-PO & PSO Mapping														
СО	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
CO 1	3	2	2	1	-	-	-	-	-	-	-	-	3	2	2
CO 2	3	2	2	1	-	-	-	-	-	-	1	-	3	2	2
CO 3	3	2	2	2	2	-	-	-	1	2	1	1	3	2	2
CO 4	3	2	2	2	2	-	1	1	2	2	2	2	3	2	2
CO 5	3	2	2	2	2	2	1	1	2	1	2	2	3	2	2
СО	3	2	2	2	2	1	1	1	1	1	1	1	3	2	2

SEMESTER-VII

YEAR	IV	IV SEMESTER VII		L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT721 /M	1911T721 /MOBILE APPLICATION DEVELOPMENT					3

On con	COURSE OUTCOMES On completion of the course, students will be able to								
CO1	Identify the requirements of various mobile applications								
CO2	Elucidate the challenges in developing mobile applications using basic design specification								
CO3	Designing and accessing mobile application in a cloud computing environment								
CO4	Implement the design using Android SDK								
CO5	Implement the design using Objective C and iOS.Deploy mobile applications in Android and iOS								

	CO-PO & PSO Mapping														
СО	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO8	PO 9	PO10	PO1 1	PO1 2	PSO1	PSO2	PSO 3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2
CO2	3	3	2	2	2	1	-	-	2	-	-	2	3	3	3
CO3	3	3	3	3	3	1	-	-	2	-	-	2	3	3	3
CO4	3	3	3	3	3	2	-	-	2	-	-	2	2	2	2
CO5	3	3	3	2	2	2	-	-	2	-	-	2	2	2	2
СО	3	3	3	3	3	2	-	-	2	-	-	2	2	2	2

YEAR	IV	SEMESTER	L	Т	Р	С	
COURSE CODE / COURSE TITLE	191CS722	-CRYPTOGRAPHY AND N SECURITY	NETWORK	3	0	0	3

On con	COURSE OUTCOMES On completion of the course, students will be able to									
CO1	Interpret the fundamentals of networks security, security architecture, threats and vulnerabilities.									
CO2	Analyze the different cryptographic operations of symmetric cryptographic algorithms.									
CO3	Identify the commonly used cryptographic operations of public key cryptography.									
CO4	Demonstrate the various Authentication schemes to simulate different applications.									
CO5	Articulate various Security practices and System security standards.									

	CO-PO & PSO Mapping														
СО	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO8	PO 9	PO10	PO1 1	PO1 2	PSO1	PSO2	PSO 3
CO1	3	3	3	2	1	1	-	2	-	-	2	1	3	2	2
CO2	3	3	3	2	1	-	-	2	1	-	2	1	3	3	2
CO3	2	2	2	1	1	1	-	2	1	-	2	1	3	3	2
CO4	3	3	3	1	-	2	-	2	1	2	2	1	3	2	2
CO5	3	3	3	2	2	2	2	2	-	1	2	1	3	2	2
СО	3	3	3	2	1	2	2	2	1	1	1	3	3	2	2

Program Elective -III (Semester - VII)

YEAR	IV	IV SEMESTER VII		L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT73	31/ BLOCKCHAIN TECHN	3	0	0	3	

COURSE OUTCOMES On completion of the course, students will be able to								
CO1	Identify different approaches to developing decentralized applications.							
CO2	Summarize Bitcoin and its limitations by comparing with other alternative coins.							
CO3	Use solution using the Ethereum model.							
CO4	Use Hyperledger and its development framework.							
CO5	Discuss alternative Blockchains and analyze the emerging trends.							

TEXT BOOKS

1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Second Edition, Packt Publishing, 2018.

REFERENCES

- 1. Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands On Approach", VPT, 2017.
- 2. Andreas Antonopoulos, Satoshi Nakamoto, "Mastering Bitcoin", O'Reilly, 2014.
- 3. Roger Wattenhofer, "The Science of the Blockchain" CreateSpace Independent Publishing, 2016.
- 4. A. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.
- 5. Alex Leverington, "Ethereum Programming" Packt Publishing, 2017.

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE		1911T733 / SEMANTIC WI	3	0	0	3	

COURSE OUTCOMES On completion of the course, students will be able to									
CO1	Create ontology for a given domain.								
CO2	Develop an application using ontology languages and tools.								
CO3	Discuss the concepts of semantic web.								
CO4	Use ontology related tools and technologies for application creation.								
CO5	Design and develop applications using semantic web.								
TEXT BOOKS									

1. Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, "Foundations of Semantic Web Technologies", Chapman & Hall/CRC, 2009.

2. Asuncion Gomez-Perez, Oscar Corcho, Mariano Fernandez-Lopez "Ontological Engineering: with Examples from the Areas of Knowledge Management, E-Commerce and the Semantic Web", Springer, 2004.

REFERENCES

1. Grigoris Antoniou, Frank van Harmelen, "A Semantic Web Primer (Cooperative Information Systems)", The MIT Press, 2004.

2. Alexander Maedche, "Ontology Learning for the Semantic Web", Springer, 2002.

3. John Davies, Dieter Fensel, Frank Van Harmelen, "Towards the Semantic Web: Ontology –Driven Knowledge Management", John Wiley, 2003.

4. John Davies, Rudi Studer, Paul Warren, "Semantic Web Technologies: Trends and Research in Ontology-based Systems", Wiley, 2006.

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	1911T736 / VISUALIZATION TECHNIQUES		3	0	0	3	

On con	COURSE OUTCOMES On completion of the course, students will be able to					
CO1	Collect data ethically and identify engineering problem in visualising the information.					
CO2	Analyze various data representation methods.					
CO3	Implement the data presentations for various applications.					
CO4	Designing real time interactive Information visualization system.					
CO5	Analyze and design systems to visualize multidisciplinary multivariate Data individually or in teams. Develop a cost effective and a scalable information visualization system.					

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	1911T734 / SERVICE ORIENTED ARCHITECTURE		3	0	0	3	

On con	COURSE OUTCOMES On completion of the course, students will be able to					
CO1	Express the fundamental concepts of XML technologies					
CO2	Identify the characteristics and benefits of SOA					
CO3	Discuss web services and WS standards					
CO4	Use web services extensions to develop solutions					
CO5	Apply service modeling, service oriented analysis and design for application development.					

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	1911T732 / HUMAN COMPUTER INTERACTION		3	0	0	3	

On cor	COURSE OUTCOMES On completion of the course, students will be able to				
CO1	Learn the fundamentals of Human Computer Interaction.				
CO2	Apply HCI techniques and methods to the design of software.				
CO3	Design an interface using different models.				
CO4	Analyze various Statistical methods of HCI in different applications.				
CO5	Design and develop real time Human Computer Interaction system.				

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	19	1911T735 / SOFT COMPUTING		3	0	0	3

	COURSE OUTCOMES						
On con	On completion of the course, students will be able to						
CO1	Identify and describe soft computing techniques and their roles in building intelligent machines						
CO2	Recognize the feasibility of applying a soft computing methodology for a particular problem.						
CO3	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.						
CO4	Apply genetic algorithms to optimization problems						
CO5	Design neural networks for pattern classification and regression problems. Compare different neural network approaches						

Program Elective -IV SEMESTER-VII

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	191	191IT7312 / SOFTWARE TESTING		3	0	0	3

	COURSE OUTCOMES					
On con	On completion of the course, students will be able to					
CO1	Obtain an insight to software testing.					
CO2	Apply both black box testing and white box testing.					
CO3	Understand and apply multiple levels of testing.					
CO4	Understand the role of a tester as an individual and as a team member.					
CO5	Apply software testing for large projects using automated testing tools. Maintain documentation on testing.					

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT737	1911T737 / COMPUTATIONAL LINGUISTICS		3	0	0	3

	COURSE OUTCOMES				
On con	On completion of the course, students will be able to				
CO1	Understand basic principles behind formal language theory and grammar.				
CO2	Apply statistical language processing for domain specific applications.				
CO3	Recognize and represent knowledge semantics using parsing.				
CO4	Use linguistic models for analyzing text data.				
CO5	Develop simple applications using language models.				

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	191	1911T7310 / MACHINE LEARNING		3	0	0	3

	COURSE OUTCOMES
On con	pletion of the course, students will be able to
CO1	Choose and implement classification or regression algorithms for an application using an open source tool.
CO2	Implement probabilistic discriminative and generative algorithms for an application and analyze the results.
CO3	Use a tool to implement typical clustering algorithms for different types of applications
CO4	Design and implement an HMM for a sequence model type of application.
CO5	Implement appropriate learning algorithms for any real time application using an open source tool.

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT739 / DEEP LEARNING		3	0	0	3	

	COURSE OUTCOMES				
On con	On completion of the course, students will be able to				
CO1	Understand the role of deep learning in machine learning applications.				
CO2	Get familiar with the use of TensorFlow and Keras in deep learning applications.				
CO3	Critically analyze different deep learning models in image related projects.				
CO4	Design and implement convolutional neural networks.				
CO5	Know about applications of deep learning in NLP and image processing.				

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	1911T7311 / NETWORK PROGRAMMING AND MANAGEMENT		3	0	0	3	

0	COURSE OUTCOMES					
On con	ipletion of the course, students will be able to					
C01	Implement client/server communications using TCP and UDP Sockets.					
CO2	Describe the usage of socket options for handling various Sockets in programming.					
CO3	Understand handling of raw sockets, functionalities of SNMP and MIB structure.					
CO4	Experiment with various tools available to manage a network.					
CO5	Handle technical issues in a network.					

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT7	1911T738 / DATA MINING TECHNIQUES		3	0	0	3

	COURSE OUTCOMES				
On con	On completion of the course, students will be able to				
CO1	Understand background of data mining.				
CO2	Analyze the various Data Mining algorithms				
CO3	Apply classification techniques to different problems.				
CO4	Proficiency with the data mining techniques.				
CO5	Proficiency with the ARM and visualization				

Program Elective -V SEMESTER-VII

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT7.	1911T7316 / IOT BASED SMART SYSTEMS		3	0	0	3

	COURSE OUTCOMES					
On con	On completion of the course, students will be able to					
CO1	Understand the concept and architecture of IoT.					
CO2	Choose the right sensors and actuators for an application.					
CO3	Analyze various protocols for IoT.					
CO4	Apply data analytics and use cloud/fog offerings related to IoT.					
CO5	Analyze applications of IoT in real time scenario. Design an IoT based smart system.					

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT7313 / ETHICAL HACKING		3	0	0	3	

	COURSE OUTCOMES
On cor	npletion of the course, students will be able to
CO1	Use the various security tools to assess the computing system.
CO2	Predict the vulnerabilities across any computing system using penetration testing.
CO3	Identify prediction mechanism to prevent any kind of attacks.
CO4	Ability to protect the system from being attacked by metasploit users.
CO5	Evaluate the wireless network flaws and able to apply security patches.

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	1911T7314 / FULL STACK SOFTWARE DEVELOPMENT		3	0	0	3	

	COURSE OUTCOMES				
On completion of the course, students will be able to					
CO1	Understand the object oriented approach in Python.				
CO2	Develop GUI applications with Python.				
CO3	Use the collaborative version control system, git.				
CO4	Package the developed code in Linux and Windows environment.				
CO5	Deploy the developed web application using Flask in real time scenarios such as				

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	1911T7318 / QUANTUM COMPUTING		3	0	0	3	

<u>COURSE OUTCOMES</u>				
CO1	Understand the basics of quantum computing.			
CO2	Understand the background of Quantum Mechanics.			
CO3	Analyze the computation models.			
CO4	Implement Quantum operations for real time applications.			
CO5	Understand Noisy channels and Quantum Cryptography.			

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	1911T7315 / GAME PROGRAMMING		3	0	0	3	

COURSE OUTCOMES							
On completion of the course, students will be able to							
CO1	Have knowledge on the concepts of 2D and 3D graphics.						
CO2	Know about games and their genres with their origin and history.						
CO3	Prepare game design documents.						
CO4	Understand the implementation of gaming engines.						
CO5	Implement a simple game in Pygame.						
YEAR	IV	SEMESTER	L	Т	Р	С	
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COURSE CODE / COURSE TITLE	19117	7317 / PATTERN RECOGN	NITION	3	0	0	3

	COURSE OUTCOMES								
On con	On completion of the course, students will be able to								
CO1	Implement basic pattern classifier algorithms.								
CO2	Have knowledge about the working principle of unsupervised algorithms.								
CO3	Have knowledge about functionality of classifiers.								
CO4	Perceive the recent advancement in pattern recognition.								
CO5	Apply SVM and HMM algorithms for real time applications								

YEAR	IV	SEMESTER	VII	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT DEV	72A / MOBILE APPLICAT /ELOPMENT LABORATO	ION RY	0	0	2	1

	COURSE OUTCOMES
On co	mpletion of the course, students will be able to
CO1	Develop mobile applications using GUI and Layouts.
CO2	Develop mobile applications using Event Listener.
CO3	Develop mobile applications using Databases.
CO4	Develop mobile applications using RSS feed, Internal/External storage, SMS, Multi-threading and GPS.
CO5	Analyze and discover own mobile app for simple needs.

	CO-PO & PSO Mapping														
СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
C01	3	3	3	2	3	-	-	-	2	-	-	1	2	2	2
CO2	3	3	3	3	3	-	-	-	2	-	-	1	3	3	2
CO3	3	3	3	3	3	-	-	-	-	-	-	1	3	3	2
CO4	3	3	3	3	3	-	-	-	1	-	-	1	3	2	2
CO5	3	3	3	3	3	2	2	2	2	1	2	2	3	3	3
СО	3	3	3	3	3	2	2	2	2	1	2	1	3	3	2

	YEAR	IV	IV SEMESTER VII			Т	Р	С			
COUI COU	RSE CODE / RSE TITLE	1	191CS72B / SECURITY LABORATORY				2	1			
COURSE OUTCOMES											
On completion of the course, students will be able to											
CO1	Identify the use of programming languages to implement Symmetric cryptography										
CO2	Build cryptosys	stems by applyi	ng symmetric and public key o	encryption algorit	hms.						
CO3	Construct code	for authenticat	ion algorithms.								
CO4	Develop a signature scheme using Digital signature standard.										
CO5	Demonstrate th	e network secu	rity system using open source	tools.							

	CO-PO & PSO Mapping														
CO	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
C01	3	3	3	2	2	2	-	2	2	-	-	1	2	2	2
CO2	3	3	3	2	2	2	-	2	2	-	-	1	3	3	2
CO3	3	3	3	2	2	2	-	2	-	-	-	1	3	3	2
CO4	3	3	3	3	2	2	-	2	1	-	-	1	3	2	2
CO5	3	3	3	3	3	2	2	2	2	1	2	2	3	3	3
СО	3	3	3	2	2	2	2	2	2	1	2	1	3	3	2

SEMESTER-VIII

Program Elective -VI SEMESTER-VIII

YEAR	IV	SEMESTER	VIII	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT83 C	4 / INDUSTRIAL ECONON CORPORATE MANAGEME	MICS AND ENT	3	0	0	3

	COURSE OUTCOMES								
On con	npletion of the course, students will be able to								
CO1	Analyze the demand and supply and sketch ademand and supply curve.								
CO2	Analyze stock market, identify, and devise investment plan.								
CO3	Analyze the inflation rate of India, specify the causes and provide the solution to each cause.								
CO4	Formulate the steps involved in a selection process as a chart and interpret it.								
CO5	Determine the Break even and find out the strength and weakness of the Market Structure.								

YEAR	IV	SEMESTER	VIII	L	Т	Р	С
COURSE CODE / COURSE TITLE	191IT833/	ENTERPRISE RESOURCE	E PLANNING	3	0	0	3

	COURSE OUTCOMES
On cor	npletion of the course, students will be able to
CO1	Describe the operational aspects of ERP system and its related technologies.
CO2	Implement ERP project Management process by choosing the right vendors/consultants, employee training and monitoring.
CO3	Analyze business modules of an ERP package
CO4	Analyze the ERP marketplace and its vendors, and assess how Enterprise Application Integration (EAI), e-business help the company use ERP to its utmost benefit
CO5	Understand SAP and its Architecture.

YEAR		IV	SEMESTER	VIII	L	Т	Р	С				
COURS COURS	SE CODE / SE TITLE	191IT831 / COGNITIVE COMPUTING			3	0	0	3				
	COURSE OUTCOMES											
On con	On completion of the course, students will be able to											
CO1	Understand the	underlying the	ory behind cognition.									
CO2	Connect to the	cognition eleme	ents computationally.									
CO3	Implement mathematical functions through WebPPL.											
CO4	Develop a cognitive inference and learning model.											

Explore the recent trends in cognitive computing.

CO5

YEAR	IV	SEMESTER	VIII	L	Т	Р	С
COURSE CODE / COURSE TITLE	191HS	191HS801 / PROFESSIONAL ETHICS INENGINEERING		3	0	0	3

	COURSE OUTCOMES					
On cor	On completion of the course, students will be able to					
CO1	Apply ethics to the society with moral values and ethical theories					
CO2	Discuss the ethical issues related to engineering					
CO3	Realize the responsibilities and rights to engineering					
CO4	Identify the assessment of safety and risk and respect for authority					
CO5	Analyze the global issues in engineering					

YEAR	IV	SEMESTER	VIII	L	Т	Р	С
COURSE CODE / COURSE TITLE	1911	T832 / COMPUTER FORE	NSICS	3	0	0	3

	COURSE OUTCOMES				
On completion of the course, students will be able to					
CO1	Recognize attacks on systems.				
CO2	Design a counter attack incident response and incident response methodology.				
CO3	Illustrate the methods for data recovery, evidence collection and data seizure.				
CO4	Understand network and email attacks and forensic investigation with tools.				
CO5	Use forensic tools and collect evidences of a computer crime. Analyze various image				

YEAR	IV	SEMESTER	VIII	L	Т	Р	С
COURSE CODE / COURSE TITLE	URSE CODE / 1911T835 / NEXT GENERATION NETWORKS		3	0	0	3	

	COURSE OUTCOMES						
On con	On completion of the course, students will be able to						
CO1	Compare the 5G network with older generations of networks.						
CO2	Identify suitable small cells for different applications in 5G networks.						
CO3	Simulate 5G network scenarios.						
CO4	Connect applications to mobile cloud.						
CO5	Design applications with 5G network support. Analyze the security risks in 5G networks.						

OPEN ELECTIVE

OPEN ELECTIVE-I

S.No	Course Code	Name of the Course	Category	No of Hours/Week		С	
THEO	RY			L	Т	Р	
1	191CE542	Air Pollution and Control Engineering	OE	3	0	0	3
2	191EE541	Basics of Electric Power Generation	OE	3	0	0	3
3	191ME542	Design Thinking	OE	3	0	0	3
4	191CE544	Foundational Course in Entrepreneurship	OE	3	0	0	3
5	191EC544	Medical Electronics	OE	3	0	0	3
6	191BM545	Principles Of Telemedicine	OE	3	0	0	3

OPEN ELECTIVE-II

S.No	Course Code	Name of the Course	~	N 1	No of	_	a
			Category	Hours/Week			C
THEO	RY			L	Т	Р	
1	191CE541	Advanced Course in Entrepreneurship	OE	3	0	0	3
2	191BM541	Basic Of Bioinformatics	OE	3	0	0	3
3	191EE543	Electrical Machines and Applications	OE	3	0	0	3
4	191ME543	Energy Conservation and Management	OE	3	0	0	3
5	191BM543	Introduction To Biomedical Devices	OE	3	0	0	3
6	191EC541	Robotics and Automation	OE	3	0	0	3

OPEN ELECTIVE-III

S.No	Course Code	Name of the Course		ľ	No of		
			Category	Hours/Week			С
THEO	RY			L	Т	Р	
1	191BM544	Introduction To Human Anatomy	OE	3	0	0	3
		Systems					
2	191EE546	Introduction to Smart Grid	OE	3	0	0	3
3	191ME546	Renewable Energy Sources	OE	3	0	0	3
4	191EC548	Satellite Communication	OE	3	0	0	3
5	191EC5410	Telecommunication Network	OE	3	0	0	3
		Management					
6	191CE5411	Traffic Engineering and Management	OE	3	0	0	3

OPEN ELECTIVE-IV

S.No	Course Code	Name of the Course	Category	No of Hours/Week		С	
THEO	RY			L	Т	Р	
1	191EC541	Cognitive Radio	OE	3	0	0	3
2	191BM542	Electronics In Medicine	OE	3	0	0	3
3	191ME544	Lean Six Sigma	OE	3	0	0	3
4	191CE548	Municipal Solid Waste Management	OE	3	0	0	3
5	191EE548	Power Electronics and Applications	OE	3	0	0	3
6	191EC546	Speech Signal Processing	OE	3	0	0	3

VEAR		ш	SEMESTER	V	т	т	р	С
			SEMILSTER	v	L	1	1	C
COURSE C COURSE T	TITLE	191CE544/	Foundational Course in Entr	repreneurship	3	0	0	3
			COURSE OBJECTIVE	S				
• Emp entr	oower studer epreneurship	nts with entreproved and long term	reneurial mindset and business a entrepreneurship.	skills leading to s	superior	; job pro	ospects,	
• Sup entr	port aspiring epreneurial e	entrepreneurs ecosystems and	with validated ideas to start m l customized learning program	eaningful venture s.	es by co	onnectir	ng them	to
• Dev	elop an entre	epreneurial out	look and mindset, critical skill	s and knowledge.				
			SYLLABUS					
UNIT-I			SELF-DISCOVE	RY				9
Find your floor floor formation St	ow-Effectua trategy-Shar	tion Principles ed Leadership-	-Case Study-Identify your Ent Hiring& Fitment-Team Role a	trepreneurial Style and Responsibilitie	e- Vent es.	ure and	l Team	
UNIT-II			OPPORTUNITY DISC	COVERY				12
Identifying J Venture star	problems wo t up Strategy	orth solving-De /.	sign Thinking-Look for Soluti	ons-Identify pers	onalize	d idea f	or start	up -
UNIT-III			CUSTOMER AND SO	LUTION				8
Customers a Value Propo	and Markets- osition-Outco	Identify your come driven inn	customer segment and Niche-Io ovation-Basics of business reg	dentify jobs, pains ulation	s, gains	and ea	rly adoj	pters-
UNIT-IV		BUS	SINESS MODEL AND SALI	ES MARKETIN	G			8
Basis of bus model-Posit	Basis of business model and lean approach-Lean Canvas-Risks and Assumptions-strategic pitching of business model-Positioning and Branding-Channels-Sales Planning-Selling Skills							
UNIT-V			VALIDATION AND N	MONEY				8
Blue ocean s Bootstrappin	Blue ocean strategy-Problem and Solution fit-Product& Market fit-Revenue and Pricing-Profitability checks- Bootstrapping and Initial Financing-Practice pitching-Case Study							

	COURSE OUTCOMES							
On comp	On completion of the course, students will be able to							
CO1	Empower students with entrepreneurial mindset and business skills							
CO2	Making students to get exposed to superior job prospects, entrepreneurship and long term entrepreneurship.							
CO3	Support aspiring entrepreneurs with validated ideas to start meaningful ventures							
CO4	Connecting students to connecting them toentrepreneurial ecosystems and customized learning programs.							
CO5	Develop an entrepreneurial outlook and mindset, critical skills and knowledge.							

TEXT BOOKS

1. Khanka S.S."Entrepreneural Develoment' S.Chand & Co.Ltd.New Delhi 2013.

2. Donald F Kuratko,"Entrpreneurship -Theory, Process and practice", 9th Edition, Cengage Learning, 2014.

REFERENCES

1. Hisrich R D,Peters M.P.,'Entreprenurship' 8th Edition, tata McGraw-Hill,201

2. Rajeev Roy, 'Entrepreneurship', II Edition, Oxford University Press, 2011.

YEAR	YEAR III SEMESTER VI		L	Т	Р	С	
COURSE CODE / COURSE TITLE	COURSE CODE / 191CE5411/ TRAFFIC ENGINEERING AND COURSE TITLE MANAGEMENT				0	0	3
	COURSE OBJECTIVES						
• To give an overv integrated approx	view of Traffic o ach in traffic pla	engineering, traffic regulation, anning as well.	, management and	d traffic	safety	with	
		SYLLABUS					

UNIT-I		9
	TRAFFIC PLANNING AND CHARACTERISTICS	
Road Charac	cteristics – Road user characteristics – PIEV theory – Vehicle – Performance characteristics –	
Fundamenta	ls of Traffic Flow – Urban Traffic problems in India – Integrated planning of town ,country ,regior	nal
and all urba	infrastructure – Towards Sustainable approach. – land use & transport and modal integration.	
UNIT-II	TRAFFIC SURVEYS	12
Traffic Surv	eys - Speed, journey time and delay surveys - Vehicles Volume Survey including non- motorized	
transports -	Methods and interpretation - Origin Destination Survey - Methods and presentation - Parking Survey	vey
– Accident a	nalyses -Methods, interpretation and presentation – Statistical applications in traffic studies and tra-	affic
forecasting -	- Level of service – Concept, applications and significance.	
UNIT-III	TRAFFIC DESIGN AND VISUAL AIDS	8
Intersection	Design - channelization, Rotary intersection design - Signal design - Coordination of signals	
Grade separa	ation - Traffic signs including VMS and road markings – Significant roles of traffic control person	nel -
Networking	pedestrian facilities & cycle tracks.	
UNIT-IV	TRAFFIC SAFETY AND ENVIRONMENT	8
Road accide	nts – Causes, effect, prevention, and cost – Street lighting – Traffic and environment hazards – Air	and
Noise Pollut	ion, causes, abatement measures - Promotion and integration of public transportation - Promotion	of
non-motoriz	ed transport.	
UNIT-V	TRAFFIC MANAGEMENT	8
Area Traffic	Management System - Traffic System Management (TSM) with IRC standards - Traffic Regulated	ory
Measures-Tr	avel Demand Management (TDM) - Direct and indirect methods- Congestion and parking pricing	3 –
All segregat	ion methods- Coordination among different agencies – Intelligent Transport System for traffic	
management	a, enforcement and education.	

On completion of the course, students will be able to

On com	piction of the course, students will be uble to
CO1	Analysis traffic problems and plan for traffic systems various uses.
CO2	Design Channels, Intersections, signals and parking arrangements.
CO3	Design visual Aids for traffic.
CO4	Understand Traffic safety and Environment.
CO5	Develop Traffic management Systems.

TEXT BOOKS

 Kadiyali, L.R, "Traffic Engineering and Transport Planning", KhannaPublishers, Delhi, 2013
 Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management.

3. Salter. R.I and Hounsell N.B, "Highway Traffic Analysis and design", Macmillan Press Ltd. 1996.

REFERENCES

1. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, "Principles of Highway Engineering and Traffic Analysis", Wiley India Pvt. Ltd., New Delhi, 2011

2. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 2010

3. SP:43-1994, IRC Specification, "Guidelines on Low-cost Traffic Management Techniques" for Urban Areas, 1994

4. John E Tyworth, "Traffic Management Planning, Operations and control", Addison Wesly Publishing Company, 1996

5. Hobbs.F.D. "Traffic Planning and Engineering", University of Brimingham, Peragamon Press Ltd, 2005

6. Taylor MAP and Young W, "Traffic Analysis – New Technology and New Solutions", Hargreen Publishing Company, 1998.

YEAR		III	SEMESTER	•	V	L	Т	Р	С
COURS	SE CODE / SE TITLE	191CE54	2/ AIR POLLUTION AN ENGINEERING	D C(ONTROL	3	0	0	3
			COURSE OBJECTI	VES					
•	To impart knowl and its emerging	ledge on the pring trends.	nciple and design of contro	l of Iı	ndoor/ particula	ate/ gas	eous air	r polluta	ant
			SYLLABUS						
UNIT	-I		INTRODUCT	ION					7
Structur classific visibility and Gas	Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution – Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility- Ambient Air Quality and Emission standards –Ambient and stack sampling and Analysis of Particulate and Gaseous Pollutants.				and ulate				
UNIT	·II		METEOROL	OGY	ζ				6
Effects plume p	Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Atmospheric Diffusion Theories – Dispersion models, Plume rise.					l stack			
UNIT-	III	CONT	TROL OF PARTICULAT	E CO	ONTAMINAN	TS			11
Factors perform Electros	affecting Selection ance equations of atatic Precipitator	on of Control E f Gravity Separ s – Operational	quipment – Gas Particle Ir ators, Centrifugal separato Considerations.	teract rs Fal	tion – Working bric filters, Par	princip ticulate	ole, Des Scrubb	sign and bers,	l
UNIT-	IV	CO	NTROL OF GASEOUS	CON	TAMINANTS	•			11
Factors absorpti Operatio	affecting Selection on, Adsorption, of onal Consideration	on of Control Econdensation, In	quipment – Working princ ncineration, Bio scrubbers,	ple, I Bio f	Design and per ilters – Process	formano contro	ce equa l and M	tions of Ionitori	ng —
UNIT	·V	I	NDOOR AIR QUALITY	MAN	NAGEMENT				10
Sources and Effe	Sources, types and control of indoor air pollutants, sick building syndrome and Building related illness- Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventive measures.					rces			
	COURSE OUTCOMES								
On com	On completion of the course, students will be able to								
CO1	An understandi air quality man	An understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management					pts of		
CO2	Ability to ident	ify, formulate a	nd solve air and noise polle	tion	problems				
CO3	Ability to desig	n stacks and pa	rticulate air pollution contr	ol dev	vices to meet a	pplicabl	e stand	ards	
CO4	Ability to select control equipment.								

Ability to ensure quality, control and preventive measures.

TEXT BOOKS

1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, "Air Pollution Control Engineering", Tokyo, Springer Science + Science Media LLC, 2004.

2. Noel de Nevers, "Air Pollution Control Engineering", Waveland press, Inc 2017.

3. Anjaneyulu. Y, "Air Pollution and Control Technologies", Allied Publishers (P) Ltd., India 2002.

REFERENCES

1. David H.F. Liu, Bela G. Liptak, "Air Pollution", Lweis Publishers, 2000.

2. Arthur C. Stern, "Air Pollution (Vol.I – Vol.VIII)", Academic Press, 2006.

3. Wayne T.Davis, "Air Pollution Engineering Manual", John Wiley & Sons, Inc, 2000.

4. M.N Rao and HVN Rao, "Air Pollution", Tata Mcgraw Hill Publishing Company limited, 2007.

5. C.S.Rao, "Environmental Pollution Control Engineering", New Age International (P) Limited Publishers, 2006.

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	191BM	544/ INTRODUCTION TO ANATOMY SYSTEMS	HUMAN	3	0	0	3

• Students will have clear knowledge of anatomy and physiology of every vital organ.

	SYLLABUS	
UNIT-I	Cell	9
Structure ar transport ac Neuron.Clas neuron - syn	ad organelles - Functions of each component in the cell. Different types of cells. Cellmembra ross membrane – origin of cell membrane potential – Action potential components.Structure sification of neurons.Parts of brain cortical localization of functions. Conduction of action potenti aptic transmission. Parts of spinalcord, simplereflex, with drawl reflex and autonomic nervous syst	ne – xof a al in em.
UNIT-II	Blood	9
Composition their function its functions	n –functions of blood -RBCstructure-production of RBC.WBCtypes–productionsof WBC cells ns. Blood groups –importance of blood groups –identification of blood groups. Platelet production	and 1 and
UNIT-III	Digestive system	9
Digestive glands).Dige Kidney. Mee	system parts (oral cavity, stomach, intestine, large intestine and access estionandabsorptionofcarbohydrates, lipids and proteins. Structure of Kidney and nephron. Blood supple chanism of urine formation. Structure of eye and ear, auditory and visual pathways.	ssory y to
UNIT-IV	Bones and muscle	9
Orientation smooth mus rneuron and changes.) Et	of body planes. Classification of bones and types of joints. Types of muscles:skeletal, cardiac cle structure and their differences. Motor unit - Structure of neuro muscular junction.Excitation I skeletal muscle contraction(change in potential - mechanical – energy changes- thermal – ffect of second stimulus-fasciculation– fibrillation-EMG	and moto pH
UNIT-V	Respiratory system	9
Parts of resp of resp andoxygenti –ECG-Hear	piratory system (Trachea, Bronchi, muscle of respiration, thoracic cage, pleuralmembranes). Mecha piration - Volumes and capacities of lung. Carbon dic cansport.Typesofhypoxia.Regulationofrespiration.Structureofheart-Cardiac cycle t sound-volume and pressurechanges	inics inics

On com	pletion of the course, students will be able to
CO1	Explain basic structure and functions of cell
CO2	Summarize the functioning and components of blood and identification of systems
CO3	Explain interconnect of various systems
CO4	Describe skeletal and muscular system
CO5	Describe about anatomy and physiology of various systems of human body

TEXT BOOKS

1.Elaine.N. Marieb, 'Essentials of Human Anatomy and Physiology', 8th edition, PearsonEducation, NewDelhi ,2007.

REFERENCES

1.WilliamF.Ganong, 'ReviewofMedicalPhysiology', 22nd edition, McGrawHill, NewDelhi, 2005. 2.A.K. Jain, 'Text book of Physiology', volume I and II, Third edition, Avichal Publishing company, NewDelhi, 2005.

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	191BM543	/ INTRODUCTION TO BIO DEVICES	OMEDICAL	3	0	0	3

- To study the basic characteristics of measurement system.
- The students will be exposed to electrical and non-electrical physiological measurements and bioamplifiers.

SYLLABUS

UNIT-I

TRANSDUCERS

Characteristics- Static, Dynamic, Errors in the measurements, Classification of transducers - Resistive, Capacitive, Inductive, Photoelectric, piezoelectric and mechano electronics.

UNIT-II

ELECTRODES & AMPLIFIERS

Types of electrodes Half cell potential, Reference electrodes, polarization effects, Polarisable and nonpolarisable electrodes, Micro electrodes, Equivalent Circuits, Signal Conditioning circuits- Characteristics of Amplifiers, Differential Amplifiers, Filters, Bridge circuits, A/D Converters. surface, needle and micro electrodes and their equivalent circuits.

UNIT-III

CHEMICAL AND OPTICAL TRANSDUCERS

Biochemical sensors - PH, PO2 electrodes, Ion sensor, An-ion and Cat-ion sensor, Liquid and solid ion exchange membrane electrode, Enzyme electrode, Principle of fiber optic cable, fiber optic sensors.

UNIT-IV

BIO-CHEMICAL MEASUREMENT

Biochemical sensors - pH, pO2 and pCO2, Ion selective Field effect Transistor (ISFET), Immunologically sensitive FET (IMFET), Blood glucose sensors - Blood gas analyzers, colorimeter, flame photometer, spectrophotometer, blood cell counter.

UNIT-V

RECORDERS AND DISPLAY

Types of recorders, Ink jet, heated stylus, Photographic recorder, Multicolor dot scanners, CRO, storage type, long persistence, digital scope, magnetic tape recorders.

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On completion of the course, students will be able to

On com	pretton of the course, students will be able to
CO1	Measure various electrical parameters with accuracy, precision, resolution.
CO2	Elucidate the origin of bio potentials and various bio electrodes.
CO3	Select appropriate light sensors for measurement of physical phenomenon.
CO4	Develop measurement systems for non-electrical parameter measurements.
CO5	Employ CRO and different types of recorders for appropriate measurement.

TEXT BOOKS

Khandpur R.S, "Handbook of Biomedical Instrumentation", 3rd edition, Tata McGraw-HillNew Delhi, 2014
 Leslie Cromwell, "Biomedical Instrumentation and measurement", 2nd edition, Prentice hallof India, New Delhi, 2015.

REFERENCES

1. Rangan C.S., Sarma G.R., and Mani V.S.V., Instrumentation devices and system, Tata McGraw hill Publishing Company limited, New Delhi, 1983.

2. John G.Webster, Medical Instrumentation, Application and Design, Third Edition, John willey and sons, 1999.

3. Jacob Kline., Handbook of Bio Medical Engineering, Academic press Inc., Sandiego, 1988.

4. J.B.Gupta, A course in electronic and electrical measurement and instrumentation, S.K.Kataria& Sons, 1999.5. Tatsuo Togawa, Toshiyo Tamura, P.Ake Oberg, Biomedical Transducers and Instruments, CRC Press, New

York, 1997. 6. Joseph J.Carr and John M Brown, Introduction To Biomedical Equipment Technology, 4/E, pearson education India.2001.

YEAR	IV	SEMESTER	VIII	L	Т	Р	С
COURSE CODE / COURSE TITLE	191CF	191CE548/ MUNICIPAL SOLID WASTE MANAGEMENT		3	0	0	3

• To make the students conversant with the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste.

SYLLABUS

UNIT-I SOURCES AND CHARACTERISTICS 9 Sources and types of municipal solid wastes- Public health and environmental impacts of improper disposal of solid wastes- sampling and characterization of wastes - factors affecting waste generation rate and characteristics -Elements of integrated solid waste management - Requirements and salient features of Solid waste management rules (2016) -- Role of public and NGO"s- Public Private participation - Elements of Municipal Solid Waste Management Plan. **UNIT-II** SOURCE REDUCTION, WASTE STORAGE AND RECYCLING 8 Waste Management Hierarchy - Reduction, Reuse and Recycling - source reduction of waste - On- site storage methods - Effect of storage, materials used for containers - segregation of solid wastes- Public health and economic aspects of open storage - case studies under Indian conditions - Recycling of Plastics and Construction/Demolition wastes. **UNIT-III** COLLECTION AND TRANSFER OF WASTES 8 Methods of Residential and commercial waste collection - Collection vehicles - Manpower - Collection routes -Analysis of waste collection systems; Transfer stations -location, operation and maintenance; options under Indian conditions - Field problems- solving. **UNIT-IV** PROCESSING OF WASTES 12 Objectives of waste processing - Physical Processing techniques and Equipment; Resource recovery from solid waste composting and biomethanation; Thermal processing options - case studies under Indian conditions. **UNIT-V** WASTE DISPOSAL 8 Land disposal of solid waste- Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners - Management of leachate and landfill gas- Landfill bioreactor - Dumpsite Rehabilitation

On completion of the course, students will be able to

CO1	Understanding of the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management.
CO2	Reduction, reuse and recycling of waste.
CO3	Ability to plan and design systems for storage, collection, transport, processing and disposal of municipal solid waste.
CO4	Design and operation of sanitary landfill.
CO5	Knowledge on the issues on solid waste management from an integrated and holistic perspective, as well as in the local and international context.

TEXT BOOKS

1. William A. Worrell, P. Aarne Vesilind, "Solid Waste Engineering", Cengage Learning, 2012.

2. John Pitchel, "Waste Management Practices-Municipal, Hazardous and industrial" CRC Press, Taylor and Francis, New York, 2014.

REFERENCES

 CPHEEO, "Manual on Municipal Solid Waste Management", Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi, 2014.
 George Tchobanoglous and Frank Kreith, Handbook of Solid waste management, McGraw Hill, New York, 2002

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	191	191BM541/ Basics of Bio informatics		3	0	0	3

	COURSE OBJECTIVES		
 To understand the genesis of bioinformatics, comparison with its allied disciplines and data bases. Know about the data processing and methods of analysis. The students are exposed to the applications and software of bioinformatics. 			
	SYLLABUS		
UNIT-I	INTRODUCTION	9	
Introduction overview H Genome pr biological s in bioinforr	Introduction to bioinformatics, biological information, the Central Dogma, Bioinformatics: Definition and overview Bioinformatics, Branches of Bioinformatics, Aim, Scope and Research areas of Bioinformatics. Genome projects, human genome project- Databases and human chromosomes, role of Bioinformatics in biological sequences. Biological data- DNA sequence protein sequence, macro molecular structure. Challenges in bioinformatics.		
UNIT-II	DATABASES	9	
Identifying p Venture star	problems worth solving-Design Thinking-Look for Solutions-Identify personalized idea for startup t up Strategy.	-	
UNIT-III	DATAPROCESSING	9	
Data–Access SRS; Subn Distancemet	Data–Access, Retrieval and Submission: Standard search engines; Data retrieval tools– Entrez, DBGET and SRS; Submission of (new and revised) data; Sequence Similarity Searches:Local versus global. Distancemetrics. Similarity and homology. Scoringmatrices.		
UNIT-IV	METHODS OF ANALYSIS	9	
Dynamic programming algorithms, Needleman-wunsch and Smith-waterman. Heuristic Methods of sequence alignment, FASTA, and PSIBLAST.Multiple Sequence Alignment and software tools for pair wise and multiple sequence alignment;			
UNIT-V	APPLICATIONS AND SOFTWARES	9	
Genome Annotation and Gene Prediction; ORF finding; Phylogenetic Analysis:Comparative genomics, orthologs, paralogs. Genome analysis – Genome annotation Basic software tools used in bioinformatics - Sequence analysis- GCG, Emboss - Cn3D viewer- Rasmol, Swiss pdb viewer, Pymol, Jmol.Modeling-Discovery studio2.0,Docking –Auto dock,HEX.			

On completion of the course, students will be able to

CO1	Elucidate the genesis of bioinformatics, comparison with its allied disciplines.
CO2	Explain primary sequence databases, prone in sequence and structure databases, Organism specific
02	databases
CO3	Elucidate the processing of acquired data
CO4	Describe various Methods of sequence alignment
CO5	Explain applications of bio informatics in the area of biological and biomedical sciences

REFERENCES

1. IntroductiontoBioinformaticsbyArthurK.Lesk, OxfordUniversityPress.

2. AlgorithmsonStrings, TreesandSequencesbyDanGusfield, CambridgeUniversityPress.

3. Biological Sequence Analysis Probabilistic Models of proteins and nucleic acids by Durbin, S.Eddy,

A.Krogh, G.Mitchison.

4. Bioinformatics Sequence and Genome Analysis by David W. Mount, Cold Spring HarborLaboratory Press.

5. Beginning Perl for Bioinformatics: An introduction to Perl for Biologists by James Tindall, O'Reilley Media

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE		191BM545/ PRINCIPLES O TELEMEDICINE	θF	3	0	0	3

- Know Scope, Benefits and Limitations of Telemedicine.
- Know Security and Standards and their use in Telemedicine Applications

SYLLABUS

HISTORY AND FUNDAMENTALS OF TELEMEDICINE

History and Evolution of telemedicine, definition of telemedicine, Functional diagram of telemedicine system, Telemedicine, Tele health, Tele care, benefits & limitations of telemedicine, Introduction of Ethical and legal aspects of Telemedicine - Confidentiality, Social and legal issues, Safety and regulatory issues.

UNIT-II

UNIT-I

TYPES OF COMMUNICATION

Types of Communication and Network: PSTN, POTS, ATN, ISDN, Internet, Wireless Communications: GSM, satellite and Micro Wave. Types of information: Audio, Video, still Images, text and data, Fax.

UNIT-III

DATA EXCHANGES

Network Configuration, Circuit and packet switching, H.320 series (Video phone based ISBN) T.120, h.324 (Video phone based PSTN), Video Conferencing.

UNIT-IV

DATA SECURITY AND STANDARD

Encryption, Cryptography, Mechanisms of encryption, Phases of Encryption. Photocols: TCP/IP, ISO-OSI, Standards to followed DICOM, HL7. Ethical and legal aspects of Telemedicine: Confidentiality and Law, patient rights and consent, access to medical Records, Consent treatment.

UNIT-V

APPLICATIONS OF TELEMEDICINE

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Teleradiology, telepathology, telecardiology, teleoncology, teledermatology, telesurgery, e- Health care, Telemedicine in neurosciences.

On completion of the course, students will be able to

CO1	Apply ethical and legal aspects of Telemedicine in Telehealth and Telecare.
CO2	Identify the fundamentals of the many forms of telemedicine communication
CO3	Choose the various multimedia conferencing standards for data exchanges
CO4	Make use of data security standards and protocols behind encryption techniques for secure transmission of data in telemedicine
CO5	Apply telemedicine's multimedia technology in the medical field

TEXTBOOKS

1.A.C.Norris, Essentials of Telemedicine and Telecare, John Wiley & Sons, 2002.

REFERENCES

1. Olga Ferrer-Roca, M.SosaLudicissa, Handbook of Telemedicine, IOS press 2002.

YEAR		SEMESTER		L	Т	Р	С
COURSE CODE / COURSE TITLE	191BM542/	ELECTRONICS IN MEDI	CINE	3	0	0	3

At the end of the course the students will have clear knowledge of electronics in medicine inmedical field

	SYLLABUS	
UNIT-I	BASICSOFELECTRONICSINMEDICINE	9
Fields of Ap ElectronicSe	plication - Designing Electronics in Medicine-Medical Electronics Specific Requirements- ensing-HealthConditionMonitoring-BiosignalsandTransducers	
UNIT-II	ELECTRONICSFORWIRELESSHEALTHMONITORI NG	9
Requiremen	ts for Wireless Devices -Data Acquisition-System Integration-Wireless Communications	
UNIT-III	POWERSUPPLY	9
Battery Pow PowerCharg	er Budget Considerations- Wireless Power- Wireless Power Link Analysis-Wireless er-Energy Harvesting	
UNIT-IV	WEARABLEMEDICALELECTRONICS	9
Wearable Sy Sensing Met	stems- Categories of Wearable Systems-Design Requirements- Sensors for Wearable Systems- hodologies	
UNIT-V	ELECTRONICSIN MEDICINEATWORK	9
Wireless and Recording- (Applications	d Wearable Low-Power-Health Monitoring Systems-Sensors-Wireless Link-Optical Bio potential Optical Electrodes -Optical Signal Acquisition –Localization Solutions-Ambient AssistedLiving s-Wireless Link Design for Biomedical Applications.	

COUDSE	OUTCOMES
COURSE	OUTCOMES

CO1	Describe the basics of electronics in medicine.
CO2	Describe the wireless electronics used in healthcare
CO3	Explain the power supplies of electronics in medicine
CO4	Explain the basis of wearable devices
CO5	Use smart systems to monitor vital parameters

TEXTBOOKS

 $1\ J.C. Schuh: Medical device regulations and testing for toxicologic pathologists, Toxicol. Pathol. 36, 63-69 (2008)$

REFERENCES

1.D.Lapedes: McGraw-HillDictionary of Scientificand Technical Terms (McGraw-Hill, New York 2000)

SEMESTE	2 V	L	Т	Р	С	
COURSE CODE/	191EC541/ COGNITIVE RADIO 3		0	0	3	
TITLE				L		
	COURSE OBJECTIVES					
• To un funct	• To understand the evolving software defined radio and cognitive radio techniques and their essential functionalities					
• To stu	dy the basic architecture and standard for cognitive radio					
• To un	derstand the physical, MAC and Network layer design of cognitive radio					
• To ex	pose the student to evolving applications and advanced features of cognitive	radio				
	INTRODUCTION TO SOFTWARE-DEFINED RADIO AND COGNITIV	E		0		
UNII-I	RADIO			9		
Evolution of S with other rad	oftware Defined Radio and Cognitive radio: goals, benefits, definitions, architec ios, issues, enabling technologies, radio frequency spectrum and regulations.	tures,	relat	tions		
UNIT-II	I COGNITIVE RADIO ARCHITECTURE 9					
Cognition cyc Hardware and bands.	Cognition cycle – orient, plan, decide and act phases, Organization, SDR as a platform for Cognitive Radio – Hardware and Software Architectures, Overview of IEEE 802.22 standard for broadband wireless access in TV bands.				T	
UNIT-III	UNIT-III SPECTRUM SENSING AND DYNAMIC SPECTRUM ACCESS 9					
Introduction – Primary user detection techniques – energy detection, feature detection, matched filtering, cooperative detection and other approaches, Fundamental Tradeoffs in spectrum sensing, Spectrum Sharing Models of Dynamic Spectrum Access - Unlicensed and Licensed Spectrum Sharing, Fundamental Limits of Cognitive Radio.						
UNIT-IV	MAC AND NETWORK LAYER DESIGN FOR COGNITIVE RADIO					
MAC for cog routing in cog	nitive radios – Polling, ALOHA, slotted ALOHA, CSMA, CSMA / CA, Network nitive radios, flow control and error control techniques.	layer	r desi	gn –		
UNIT-V	ADVANCED TOPICS IN COGNITIVE RADIO	9				
Overview of security issues in cognitive radios, auction based spectrum markets in cognitive radio networks, public safety and cognitive radio, cognitive radio for Internet of Things.						

On completion of the course, students will be able to

on com	
CO1	Understand the evolving software defined radio and cognitive radio techniques and their essential functionalities
CO2	Gain knowledge on the design principles on software defined radio and cognitive radio
CO3	Develop the ability to design and implement algorithms for cognitive radio spectrum sensing and dynamic spectrum access
CO4	Understand the physical, MAC and Network layer design of cognitive radio
CO5	Apply the knowledge of advanced features of cognitive radio for real world applications

TEXT BOOKS

1. Alexander M. Wyglinski, MaziarNekovee, Thomas Hou, -Cognitive Radio Communications and Networks, Academic Press, Elsevier, 2010. (Unit I to IV)

2. Huseyin Arslan (Ed.), -Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems, Springer, 2007. (Unit V)

REFERENCES

1. Bruce Fette,-Cognitive Radio Technologyl, Newnes, 2006.

2. Kwang-Cheng Chen, Ramjee Prasad, - Cognitive Radio Networks, John Wiley and Sons, 2009.

3. EzioBiglieri, Professor Andrea J. Goldsmith, Dr Larry J. Greenstein, Narayan B.Mandayam, H.Vincent

Poor, Principles of Cognitive Radio, Cambridge University Press, 2012.

SEMESTE	R V	L	Т	Р	С				
COURSE CODE/ TITLE	191EC544/MEDICAL ELECTRONICS	3	0	0	3				
 To gain knowledge about the various physiological parameters both electron non electrical and the methods of recording and also the method of trat these parameters To study about the various assist devices used in the hospitals To gain knowledge about equipment used for physical medicine and recently developed diagnostic and therapeutic techniques. 									
UNIT-I	ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING		9						
Sources of bio medical signals, Bio-potentials, Bio potential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics									
UNIT-II	BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT		9						
pH, PO2, PCO2, Colorimeter, Blood flow meter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.									
UNIT-III	ASSIST DEVICES			9					
Cardiac pacemakers, DC Defibrillator, Dialyzer, Ventilators, Magnetic Resonance Imaging Systems, Ultrasonic Imaging Systems.									
UNIT-IV	PHYSICAL MEDICINE AND BIOTELEMETRY			9					
Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry.									
UNIT-V	RECENT TRENDS IN MEDICAL INSTRUMENTATION		9						
Telemedicine, Insulin Pumps, Radio pill, Endomicroscopy, Brain machine interface, Lab on a chip.									
OUTCOME	 Know the human body electro- physiological parameters and recording of bio-potentials Comprehend the non-electrical physiological parameters and their measurement – body temperature, blood pressure, pulse, blood cell count, blood flow meter etc. Interpret the various assist devices used in the hospitals viz. pacemakers, defibrillators, dialyzers and ventilators 								
	 Comprehend physical medicine methods eg. ultrasonic, shortwave, microwave surgical diathermies, and bio-telemetry principles and methods Know about recent trends in medical instrumentation 								
	TEXT BOOKS								
1 Leslie Cron (UNIT I – V)	well, -Biomedical Instrumentation and Measurement, Prentice Hall of India, New	Delh	i, 200)7.					
	REFERENCES								
 Khandpu John G.V 2007 Joseph J. Sons 	r, R.S., —Handbook of Biomedical Instrumentation, TATA McGraw-Hill, New D Vebster, —Medical Instrumentation Application and Design, 3rd Edition, Wild Carr and John M.Brown, —Introduction to Biomedical Equipment Technology New York, 2004)elhi, ey In 4, Joł	2003 dia E 1n W	Editio iley a	n, and				
50115, INGW 101K, 2004.									

On completion of the course, students will be able to

on completion of the course, students will be usic to					
CO1	Know the human body electro- physiological parameters and recording of bio-potentials				
CO2	Comprehend the non-electrical physiological parameters and their measurement –body temperature, blood pressure, pulse, blood cell count, blood flow meter etc.				
CO3	Interpret the various assist devices used in the hospitals viz. pacemakers, defibrillators, dialyzers and ventilators				
CO4	Comprehend physical medicine methods eg. ultrasonic, shortwave, microwavesurgical diathermies, and bio-telemetry principles and methods				
CO5	Know about recent trends in medical instrumentation				

TEXT BOOKS

1 Leslie Cromwell, -Biomedical Instrumentation and Measurement, Prentice Hall of India, New Delhi, 2007. (UNIT I-V)

REFERENCES

 Khandpur, R.S., —Handbook of Biomedical Instrumentation, TATA McGraw-Hill, New Delhi, 2003.
 John G.Webster, —Medical Instrumentation Application and Design, 3rd Edition, Wiley India Edition, 2007
 Joseph J.Carr and John M.Brown, —Introduction to Biomedical Equipment Technology, John Wiley andSons, New York, 2004.

SEMESTER	V	L	Т	Р	C			
COURSE CODE/ TITLE	191EC546/SPEECH SIGNAL PROCESSING	3	0	0	3			
 To introduce speech production and related parameters of speech. To show the computation and use of techniques such as short time Fourier transfolinear predictive coefficients and other coefficients in the analysis of speech. To understand different speech modeling procedures such as Markov and their implementation issues. 								
UNIT-I	BASIC CONCEPTS			9				
Speech Fundame Phonetics – Acou Transform, Filter	ntals: Articulatory Phonetics – Production and Classification of Speech Sounds istics of speech production; Review of Digital Signal Processing concepts; Sho -Bank and LPC Methods.	s; Ac ort-T	ousti ime F	c Fourie	er			
UNIT-II	SPEECH ANALYSIS			9				
Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures- mathematical and perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.								
UNIT-III	SPEECH MODELING			9				
Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation and Implementation issues.								
UNIT-IV	SPEECH RECOGNITION			9				
Large Vocabulary Continuous Speech Recognition: Architecture of large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units; Applications and present status.								
UNIT-V	SPEECH SYNTHESIS			9				
Text-to-Speech S and naturalness –	ynthesis: Concatenative and waveform synthesis methods, sub-word units for role of prosody, Applications and present status.	TTS	, inte	lligib	ility			
OUTCOMES	 Upon completion of the course, students will be able to: Model speech production system and describe the fundamentals of speech. Extract and compare different speech parameters. Choose an appropriate statistical speech model for a given application. Design a speech recognition system. Use different speech synthesis techniques. 							
	TEXT BOOKS							
 Lawrence Rab Daniel Jurafsk Language Proces Frederick Jelin 	iner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson y and James H Martin, "Speech and Language Processing – An Introduction to sing, Computational Linguistics, and Speech Recognition", Pearson Education nek, "Statistical Methods of Speech Recognition", MIT Press, 1997.	Edu 5 Nat , 200	catio tural 02.	n, 200	03.			
	REFERENCES							
 Steven W. Smith Publishing, 1997. Thomas F Quath 2004. Claudio Beccher 4. Ben Gold and Music?" Wiley- In 	th, "The Scientist and Engineer"s Guide to Digital Signal Processing", California tieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pears etti and LucioPrinaRicotti, "Speech Recognition", John Wiley and Sons, 1999. Nelson Morgan, "Speech and Audio Signal Processing, Processing and Perception adia Edition 2006	Techi on Eo of Sp	nical ducat	ion, and				
SEMESTER	ESTER V L T P							
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COURSE CODE/TITLE	191EC541/ ROBOTICS AND AUTOMATION	3	0	0	3			
 To understand the basic concepts associated with the design, if applications and social aspects of robots To study about the electrical drive systems and sensors used in robotics applications To learn about analyzing robot kinematics, dynamics through methodologies and study various design aspects of robot arm manipula effector To learn about various motion planning techniques and the associarchitecture To understand the implications of AI and other trending concepts of robot 					g, 1s nt d- ntrol			
UNIT-I	FOUNDATION FOR BEGINNERS			9				
Introduction role and need o issues; industria arm manipulato	brief history, definition, anatomy, types, classification, specification and need b of robots for the immediate problems of the society, future of mankind and all scenario local and global, case studies on mobile robot research platform and r	based autor autor	appl natio dustri	icatic n-eth al ser	ons; ical rial			
UNIT-II	BUILDING BLOCKS OF A ROBOT			9				
Types of electric circuitry, Selec navigation, obs thermal, chemic Case study on c	c motors - DC, Servo, Stepper; specification, drives for motors - speed & direction criterion for actuators, direct drives, non-traditional actuators; Sensors tacle avoidance and path planning in known and unknown environments – ral, biosensor, other common sensors; hoice of sensors and actuators for maze solving robot and self-driving cars	for 1 optio	conti locali cal, i	rol an zation nertia	ıd n, ıl,			
UNIT-III	KINEMATICS, DYNAMICS AND DESIGN OF ROBOTS & END- EFFECTORS			9				
Robot kinemati representation, of a 2R manipu	cs - Geometric approach for 2R, 3R manipulators, homogenous transformation us kinematics of WMR, Lagrangian formulation for 2R robot dynamics; Mechanica ator, WMR; End-effector - common types and design case study.	using al de	g D-H sign a	ispect	ts			
UNIT-IV	NAVIGATION, PATH PLANNING AND CONTROL ARCHITECTURE	r		9				
Mapping & Nav control, Force c fuzzy logic, opt	vigation – SLAM, Path planning for serial manipulators; types of control archite ontrol and hybrid position/force control, Behavior based control, application of mization algorithms for navigation problems, programming methodologies of a	cture Neu robe	es - C al ne	artesi tworl	ian k,			
UNIT-V	AI AND OTHER RESEARCH TRENDS IN ROBOTICS			9				
Application of I Unmanned vehi	Application of Machine learning - AI, Expert systems; Tele-robotics and Virtual Reality, Micro & Nano robots, Unmanned vehicles, Cognitive robotics, Evolutionary robotics, Humanoids							
 Explain the concepts of industrial robots in terms of classification, specifications and coordinate systems, along with the need and application of robots &automatio Examine different sensors and actuators for applications like maze solving and self-driving cars. Design a 2R robot & an end-effector and solve the kinematics and dynamics of motion for robots. Explain navigation and path planning techniques along with the control architectures adopted for robot motion planning. Describe the impact and progress in AI and other research trends in the field robotics. 					1 of			

TEXT BOOKS

1.Saeed. B. Niku, Introduction to Robotics, Analysis, system, Applications, Pearson educations,2002
2.Roland Siegwart, Illah Reza Nourbakhsh, Introduction to Autonomous Mobile Robots, MIT Press,2011

REFERENCES

1. Richard David Klafter, Thomas A. Chmielewski, Michael Negin, Robotic engineering: an integrated approach, Prentice Hall, 1989

2. Craig, J. J., Introduction to Robotics: Mechanics and Control, 2nd Edition, Addison-Wesley, 1989.

3. K.S. Fu, R.C. Gonzalez and C.S.G. Lee, Robotics: Control, Sensing, Vision and Intelligence,McGraw-Hill, 1987.

4. Wesley E Snyder R, Industrial Robots, Computer Interfacing and Control, Prentice Hall International Edition, 1988.

5. Robin Murphy, Introduction to AI Robotics, MIT Press, 2000

6. Ronald C. Arkin, Behavior-based Robotics, MIT Press, 1998

7. N. P. Padhy, Artificial Intelligence and Intelligent Systems, Oxford University Press, 2005

8. Stefano Nolfi, Dario Floreano, Evolutionary Robotics – The Biology, Intelligence and Technology of Self– Organizing Machines (Intelligent Robotics and Autonomous Agents series), MIT Press, 2004.

SEMESTE	R V	L	Т	Р	С	
COURSE CODE/ TITLE	191EC548/SATELLITE COMMUNICATION	3	0	0	3	
Objectives	 Understand the basics of satellite orbits Understand the satellite segment and earth segment Analyze the various methods of satellite access Understand the applications of satellites Understand the basics of satellite Networks 					
UNIT-I	SATELLITE ORBITS			9		
Kepler"s Lav Geo-stationa outage-Laun	vs, Newton"s law, orbital parameters, orbital perturbations, station keeping, geo cy orbits – Look Angle Determination- Limits of visibility – eclipse-Sub satellite ching Procedures - launch vehicles and propulsion.	statio poin	nary t –Su	and 1 n trai	non nsit	
UNIT-II	SPACE SEGMENT			9		
Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsic communication Payload and supporting subsystems, Telemetry, Tracking and command-Transponders-The Antenna Subsystem						
Unit-III	SATELLITE LINK DESIGN			9		
Basic link an Link Design	alysis, Interference analysis, Rain induced attenuation and interference, Ionosphe with and without frequency reuse.	eric cl	narac	terist	ics,	
UNIT IV	SATELLITE ACCESS AND CODING METHODS					
Modulation a Broadcast, m Coding Sche	nd Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digit ultiple access: FDMA, TDMA, CDMA, DAMA Assignment Methods, compressiones.	al vid on – e	eo encryj	otion	,	
UNIT-V	SATELLITE APPLICATIONS					
INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. GPS Position Location Principles, Differential GPS, Direct Broadcast satellites (DBS/DTH).						
 Analyze the satellite orbits Analyze the earth segment and space segment Analyze the satellite Link design Understand the basics of satellite Networks Design various satellite applications 						
	TEXT BOOKS					
1. Dennis Roddy,-Satellite Communication, 4thEdition, McGrawHill International, 2006.						
2. Timothy,Pratt,Charles,W.Bostain,JeremyE.Allnutt,"SatelliteCommunication ¹ ,2 nd Edition, WileyPublications,2002						

REFERENCES

- 1. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, -Satellite Communication Systems Engineering, Prentice Hall/Pearson, 2007.
- 2. N.Agarwal, 'Design of Geo synchronous Space Craft', PrenticeHall, 1986.
- 3. Bruce R. Elbert, -The Satellite Communication Applications, Hand Book, Artech House Bostan London, 1997.
- 4. TriT.Ha,-Digital Satellite Communication,IIndedition,1990.
- 5. Emanuel Fthenakis, -Manual of Satellite Communications, McGrawHillBook Co., 1984.
- 6. Robert G. Winch, -Telecommunication Trans Mission Systems, McGraw-Hill Book Co., 1983.

SEMESTER	V	L	Т	Р	C		
COURSE CODE/ TITLE	191EC5410/ TELECOMMUNICATION NETWORK MANAGEMENT	3	0	0	3		
Objectives	 To understand the concept of network management standards. To design the common management information service element model. To understand the various concept of information modelling. To analyze the concept of SNMPv1 and SNMPv2 protocol. To analyze the concept of examples of network management 						
UNIT-I	FOUNDATIONS			9			
Network mana abstract syntax application fu management–E management–re community def notations.	Network management standards-network management model- organization model- information mode abstract syntax notation 1 (ASN.1) – encoding structure- macros-functional model. Network management application functional requirements: Configuration management- fault management-performance management-Error correlation technology- security management-accounting management- common management-report management- polity based management-service level management-management service- community definitions- capturing the requirements- simple and formal approaches-semi formal and formations.						
UNIT-II	COMMON MANAGEMENT INFORMATION SERVICE ELEMENT			9			
CMISE model- association serv	service definitions–errors–scooping and filtering features– synchronization–f ices– common management information protocol specification.	uncti	onal	units			
UNIT-III	INFORMATION MODELING FOR TMN			9			
Rationale for in structure of man	formation modeling-management information model-object oriented modelinagement information-managed object class definition-management informat	ng pa ion b	radig ase.	gm—			
UNIT IV	SIMPLE NETWORK MANAGEMENT PROTOCOL			9			
SNMPv1: mana communication MIB–SNMPv2 remote monitor	SNMPv1: managed networks–SNMP models– organization model–information model–SNMPv2 communication model–functional model–major changes in SNMPv2–structure of management information, MIB–SNMPv2 protocol– compatibility with SNMPv1– SNMPv3– architecture–applications–MIB security, remote monitoring–SMI and MIB– RMON1 and RMON2						
UNIT-V	NETWORK MANAGEMENT EXAMPLES						
ATM integrated local management interface–ATM MIB–M1– M2–M3– M4– interfaces–ATM digital exchange interface management–digita1 subscriber loop and asymmetric DSL technologies–ADSL configuration management–performance management Network management tools: Network statistics management–network management system–management platform case studies: OPENVIEW–ALMAP.							
OUTCOMES Upon completion of the course, students should able to: • Design and analyze of fault management information protocol specifications. • Design and analyze of management information model. • Design the simple network management protocol. • Design the various types of network management tools.							

TEXT BOOKS

1. Mani Subramanian, "Network Management: Principles and Practice" Pearson Education, Second edition, 2010

2. Lakshmi G Raman, "Fundamentals of Telecommunications Network Management", Wiley, 1999

REFERENCES

 Henry Haojin Wang, "Telecommunication Network Management", Mc- Graw Hill ,1999
 Salah Aidarous & Thomas Plevyak, "Telecommunication Network Management: Technologies and Implementations", Wiley,1997

YEAR	III	SEMESTER	V	L	Т	Р	С
COURSE CODE / COURSE TITLE	191EE54	1/ BASICS OF ELECTRIC GENERATION	POWER	3	0	0	3

- To provide the knowledge about the electrical power generation
- To know about various conventional energy sources
- To find out the cost of Electrical Energy

	SYLLABUS	
UNIT-I	INTRODUCTION	9
Electric p Advantag	ower generation scenario in INDIA from Conventional and non conventional sources of energy es and disadvantages with conventional and non-conventional energy sources.	•
UNIT-II	STEAM POWER STATION	9
Schematic power sta	c arrangement, selection of site, Environmental aspects for selecting the sites and locations of therma tions, advantages and disadvantages	1
UNIT-III	HYDRO POWER STATION	9
Schematic disadvant	arrangement, choice of site selection of hydro power, Environmental aspects advantages and ages	
UNIT-IV	NUCLEAR POWER STATION	9
Schematic and disad	c arrangement, choice of site selection of Nuclear power station, Environmental aspects advantages vantages	
UNIT-V	TARIFF	9
Electrical flat rate, b	energy calculation in units, Cost of electrical energy, load factor and demand factor, tariff method- block rate, two parts.	

COURSE OUTCOMES On completion of the course, students will be able to CO1 Describe sources of energy and types of power plants. CO2 Enumerate the factors effecting choice of thermal ,hydal and nuclear power generation.

CO3	Illustrate the advantages and disadvantages of thermal ,hydel and nuclear power generation.
CO4	Illustrate the advantages and disadvantages of nuclear power generation.
CO5	Estimate the cost of electrical energy consumed.

TEXTBOOKS

1. M.L.Soni, P.V Gupta, U.S Bhatnagar and A.Chakraborti "A text book on Power System Engineering" Dhanpat Rai & Co.Pvt.Ltd.1999.

2. V.K Mehta and Rohit Mehta "Principles of Power Systems" S.Chand & company LTD, New Delhi2004.

REFERENCES

1. S.N.Singh "Electrical Power Generation, Transmission and Distribution", PHI, 2003.

2. GD Rai "Non Conventional Energy Sources "Khanna Publishers, 4th edition 2000.

3. Dr. S.L. Uppal," Electrical Power", Khanna Publishers

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	191EE5 4	191EE543/ Electrical Machines and Applications		3	0	0	3

- To know various types of electrical machines
- To learn about various types of characteristics of electric machines
- To find out suitable electric machines for specific applications

	SYLLABUS	
UNIT-I	DC MOTORS	9
Construction production, o	1 & operating principle, types of DC motors, PMDC motors, back-EMF and its importance, to characteristics, various losses & performance estimation, speedcontrol, applications	rque
UNIT-II	TRANSFORMERS	9
Construction circuit, vario	1 & operating principle-single phase and three phase, types of transformer, turn- ratio, equivations bus losses & performance estimation, parallel operation, applications	alent
UNIT-III	INDUCTION MOTORS	9
Construction slip characte phase ac mo	1 & operating principle of three phase machines, types of induction motors, torqueproduction, tor cristic, equivalent circuit representation, various losses & performance estimation, speed control, s tors, universal motors and applications	rque- ingle
UNIT-IV	PERMANENT MAGNET BRUSHLESS DC (PMBLDC) MOTORS	9
Constructior efficiency,co	and operating principle, torque and EMF equations, torque/speed characteristic: performance a controllers for PMBLDC motors, applications	and
UNIT-V	STEPPER AND SERVO MOTORS	9
Basics of sto micro steppi and working servo motor	epper motor, construction, working and characteristics of variable reluctance (VR) stepper motor ng control of stepper motor, construction and working of multistack VR stepper motor, construction g of permanent magnet (PM) stepper motor, construction and working of hybrid stepper motor types, construction and operation of servo motors, servo motor controllers, applications	rs, on or,

COURSE OUTCOMES

On completion of the course, students will be able to

011 001	
CO1	Analyze constructional aspects and operational aspects of electric machines
	Evaluate performance parameters of electric machines
CO2	
CO3	Adopt suitable control methods for operating electric machines
CO4	Select appropriate electric machines based on constructional & operational characteristics
CO5	Understand the construction and working of Stepper Motor and Servo Motors

TEXTBOOKS

1. A. E. Fitzerald, Charles Kingsley and Stephen D Umans, "Electric Machinery", TMH Publication, 2017

- 2. B.L.Theraja, A.K. Theraja, "A Textbook of Electrical Technology"- Volume-II, S. Chand & Co,2015
- 3. P. S. Bhimbra, Electrical Machinery, Dhanpatrai Publishers, 2016.

REFERENCES

- 1. Miller T. J. E., "Brushless Permanent Magnet and Reluctance Motor Drives", Clarendon Press, 1985.
- 2. V. V. Athani, "Stepper Motors: Fundamentals, Applications and Design", New Age International Pvt. Ltd, 1997.
- 3. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley and Sons, 2013
- 4. Y. Dote and S. Kinoshita, Brushless Servomotors-Fundamentals and Applications, Clarendon Press, Oxford, 1990.

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	19	191EE546/ Introduction to Smart Grid		3	0	0	3

• To gain insights about the importance of lean manufacturing and six sigma practices

SYLLABUS

UNIT-I INTRODUCTION TO CONVENTIONAL AND FUTURISTIC ELECTRICAL POWER SYSTEMS

Basics of electrical systems, laws of physics, applicability of KVL and KCL, formation of grid and concept of infinite bus, control of active and reactive power, control of voltage and frequency, generators and loads and their requirements, Infrastructure of conventional electrical networks, Main characteristics of conventional electrical networks, generation – transmission and distribution – Indian scenario, EHVAC and HVDC systems etc.

UNIT-II COMPARISON BETWEEN SMART GRID AND CONVENTIONAL ELECTRICAL NETWORKS

Evolution of ElectricGrid, motives behind developing the Smart Grid Network, Definitions, Characteristics and Benefits of the Smart Grid, Functions of Smart Grid Components, Key challenges for Smart Grid, Present development and International practices in Smart Grid

UNIT-III

SMART GRID SYSTEMS

Renewable Energy Resources, Sustainable Energy Options for the Smart Grid, Issues Associated with Sustainable Energy Technology, Electric Vehicles and Plug-in Hybrids, Impact of PHEV on the Grid, Environmental Implications – Climate Change, Implications of Climate Change. Storage Technologies, Benefits of Energy Storage Systems (ESS), prediction requirements in power systems and role of smart grids, analytics and data processing requirements, relevant case studies

UNIT-IV

SMART GRID MEASUREMENTS AND COMMUNICATION TECHNOLOGIES

Smart Meters – Key Components of Smart Metering, Smart Appliances, Advanced Metering Infrastructure (AMI), GIS and Google Mapping Tools, Communications Infrastructure and Protocols for Smart Metering, IoT and smart grids, Wireless Sensor Networks, Smart Grid Communication Technologies – Wireless and Wired, Cyber Attacks and Power System Security, Smart Grid Cyber Security, Protection in power systems and recent developments

UNIT-V

MACHINE LEARNING AND BIG DATA IN SMART GRIDS

Concepts such as MINLP Approach for Network Reconfiguration and Dispatch in Distribution Systems, Multi-Objective Optimization Methods for Solving the Economic Emission Dispatch Problem, State Estimation Paradigm Based on Artificial Dynamic Models, Cloud Computing for Smart Grid, Data Storage, Data Access and Data Analysis, The State-of-the-Art Processing Techniques of Big Data etc

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COURSE OUTCOMES

On completion of the course, students will be able to

	inpletion of the course, students will be use to
CO1	Compare conventional and smart power grid characteristics
	Apply engineering concepts to smart electrical grid
CO2	
CO3	Select and employ various sensing technologies, networking and communication technologies to electrical power grid
CO4	Identify problems and offer solution using computational techniques
CO5	Implement Cloud Computing for Smart Grids

TEXTBOOKS

- 1. Salman K. Salman, Introduction to the Smart Grid: Concepts, Technologies and Evolution, The Institution of Engineering and Technology (IET).
- 2. Ahmed F Zobaa (ed.), Alfredo Vaccaro (ed.), Computational Intelligence Applications In Smart Grids -Enabling Methodologies For Proactive and Self-Organizing Power Systems, Imperial College Press
- 3. Robert C. Qiu and Paul Antonik, Smart Grid using Big Data Analytics A Random Matrix TheoryApproach, Wiley
- 4. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu, Smart Grid: Technology and Applications, John Wiley & Sons.
- 5. James Momoh, Smart Grid: Fundamentals of Design and Analysis, John Wiley & Sons, IEEE Press

REFERENCES

- 1. Clark W. Gellings, The Smart Grid, Enabling Energy Efficiency and Demand Response, CRC m Press.
- 2. Ali Keyhani, Design of smart power grid renewable energy systems, Wiley IEEE
- 3. Siddhartha Kumar Khaitan, James D. McCalley, Chen-Ching Liu (ed.), Cyber Physical Systems Approach to Smart Electric Power Grid, Springer

4. Relevant recent literature, journal articles, web resources, standards and codes

COURSE CODE		191EE548						
COURSE TITLE		POWER ELECTRONICS & APPLICATIONS						
 COURSE OBJECTIVES To study the constructional structures of Power semi-conductor devices. To calculate and compare output average expressions for rectifiers and choppers. To understand the concepts of inverters, dual converters and cyclo converters. To know the power semiconductor applications in electric vehicle and power system. To provide the knowledge about power electronics in industrial applications. 								
		S	CHEME AND CREDITS	5				
SEMESTER	L	Т	Р	CREI	DITS			
	3	0	0		3			
UNIT-1		POWER SEMI C	CONDUCTOR DEVICES	b	9			
Power Diode, SCR, TRIAC: Construction, working,VI characteristics and switching characteristics. Power MOSFET and IGBT: Construction,working,transfer characteristics and output characteristics.								
UN11-2		<i>y</i>						
AC to DC Rectifiers: single phase and three phase fully controlled rectifiers, DC choppers: Types-Control strategies of choppers- Single quadrant, two quadrant and four quadrant choppers.								
UNIT-3	INVERTER CIRCUITS ,DUAL CONVERTERS AND CYCLO CONVERTERS							
Voltage driven and C circulatory and non cir and three phase cyclo c	Current driven is culatory current onverters.	nverters-Three phase mode operations-Cycl-	bridge inverter-Dual con o converters: Principle and	verters: Principle 1 types, single phas	and types with se to single phase			
UNIT-4	APPLICA	TIONS IN ELECTRI	C VEHICLE AND POW	ER SYSTEMS	9			
Battery charging control and electric motor speed control in Electric Vehicles-Power conversions in solar PV system, HVDC and HVAC transmission systems-Static VAR compensation system.								
UNIT-5		INDUSTRIA	L APPLICATIONS		9			
Static circuit breaker (speed control of AC and	DC and AC) - 1 d DC servo moto	Induction heating-Elec rs.	tric welding control-AC v	oltage stabilizer-U	IPS, Closed loop			

COURSE OUTCOMES

After the completion of the course, Students will be able to

- Describe the construction, principle of operation and performance of thyristors and Power transistors.
- Demonstrate the working principle and control of rectifiers and choppers.
- Discuss about the working principle of inverters, dual converters and cyclo converters.
- Apply the power electronics control techniques in electric vehicle and power systems.
- Analyze about various industrial applications related to power electronics.

TEXT BOOKS

- **1.** M.H. Rashid, Power Electronics: Circuits, Devices and Application, Fourth edition, PrenticeHall of India, 2017.
- 2. MukundR.Patel, Introduction to Electrical Power and Power Electronics, First edition, CRCPress, 2017.
- 3. Jain Alok, Power electronics and its applications, Penram International publishing, Third edition, 2016.

REFERENCE BOOKS

- 1. P.S. Bimbra, Power Electronics, Khanna Publishers, 6th Edition, 2018.
- 2. Joseph Vithayathil, Power Electronics, Principles and Applications', McGraw Hill Series, 6thReprint, 2013.
- 3. Ned Mohan, Tore M. Undeland and William P.Robbins, Power Electronics: Converters, Applications and Design, John Wiley and Sons, Third edition, 2002.
- 4. V.R.Moorthi, 'Power Electronics- Devices, Circuits and Industrial Applications', OxfordUniversity Press, 1st Edition, 2005.
- 5. John.G.Hayes, Electric Power train: Energy systems, Power Electronics and Drives for Hybrid electric and fuel cell vehicles, 2018.

YEAR	III	SEMESTER	VIII	L	Т	Р	С
COURSE CODE / COURSE TITLE		191ME544/ LEAN SIX SIGMA		3	0	0	3

• To gain insights about the importance of lean manufacturing and six sigma practices

SYLLABUS

UNIT-I

LEAN & SIX SIGMA BACKGROUND AND FUNDAMENTAL

Historical Overview – Definition of quality – What is six sigma -TQM and Six sigma – lean manufacturing and six sigma - six sigma and process tolerance – Six sigma and cultural changes –six sigma capability – six sigma need assessments - implications of quality levels, Cost of Poor Quality (COPQ), Cost of Doing Nothing – assessment questions.

UNIT-II

THE SCOPE OF TOOLS AND TECHNIQUES

Tools for definition – IPO diagram, SIPOC diagram, Flow diagram, CTQ Tree, Project Charter – Tools for measurement, Flow process charts, Process Capability Measurement, Tools for analysis – interrelationship diagram, overall equipment effectiveness, innovative problem solving – Tools for improvement — Tools for control.

UNIT-III

SIX SIGMA METHODOLOGIES

Design For Six Sigma (DFSS), Design For Six Sigma Method - Failure Mode Effect Analysis (FMEA), FMEA process - Risk Priority Number (RPN)- Six Sigma and Leadership, committed leadership – Change Acceleration Process (CAP)- Developing communication plan – Stakeholder

UNIT-IV

SIX SIGMA IMPLEMENTATION AND CHALLENGES

Tools for implementation – Supplier Input Process Output Customer (SIPOC) – Quality Function Deployment or House of Quality (QFD) – alternative approach –implementation – leadership training, close communication system, project selection – project management and team –champion training – customer quality index – challenges – program failure, CPQ Vs six sigma, structure the deployment of six sigma – cultural challenge – customer/internal metrics

UNIT-V

SAP

Evaluation strategy – the economics of six sigma quality, Return on six Sigma (ROSS), ROI, poor project estimates – continuous improvement – lean manufacturing – value, customer focus, Perfection, focus on waste, overproduction – waiting, inventory in process (IIP), processing waste, transportation, motion, making defective products, underutilizing people – Kaizen – 5S.

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COURSE OUTCOMES

- 1. Relate the tools and techniques of lean sigma
- 2. Apply tools and techniques of lean sigma to increase productivity
- 3. Relate the techniques and methodologies of lean sigma
- 4. Explain about the six sigma implementation and challenges
- 5. Explain about evaluation and continuous improvement methods

REFERENCES

- 1. Michael L.George, David Rownalds, Bill Kastle, What is Lean Six Sigma, McGraw Hill, 2003
- 2. Thomas Pyzdek, The Six Sigma Handbook, McGraw-Hill, 2000
- 3. Fred Soleimannejed, Six Sigma, Basic Steps and Implementation, AuthorHouse, 2004

4. Forrest W. Breyfogle, III, James M. Cupello, Becki Meadows, Managing Six Sigma: A Practical Guide to Applying, Assessing, and Implementing the Strategy That Yields Bottom-Line Success, John Wiley & Sons, 2000

5. James P. Womack, Daniel T.Jones, Lean Thinking, Free Press Business, 2003

YEAR	III	SEMESTER	VI	L	Т	Р	С
COURSE CODE / COURSE TITLE	191ME543/ ENERGY CONSERVATION AND MANAGEMENT			3	0	0	3

• To expose students to analysis the energy data of industries, carryout energy accounting and balancing, conduct energy audit and suggest methodologies for energy savings and utilize the available resources in optimal ways.

SYLLABUS UNIT-I INTRODUCTION 9 Energy - Power – Past & Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization – Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing. 9 UNIT-II ELECTRICAL SYSTEMS 9 Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

UNIT-III

THERMAL SYSTEMS

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and encon measures. Steam: Distribution &U sage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators& Refractories

UNIT-IV

ENERGY CONSERVATION IN MAJOR UTILITIES

ECONOMICS

Energy conservation inPumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets.

UNIT-V

Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing – ESCO concept .

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COURSE OUTCOMES

- 1. Relate the analyze the energy data of industries and carry out energy accounting and balancing
- 2. Calculate the energy savings in electrical systems.
- 3. Calculate the energy savings in thermal systems
- 4. Carry out energy conservation procedures in major utilities
- 5. Suggest methodologies for energy savings

REFERENCES

1. Energy Manager Training Manual (4 Volumes) available at www.energymanager training.com, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India, 2004.

2. Witte. L.C., P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilisation" Hemisphere Pub., Washington, 1988.

- 3. Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford, 1981.
- 4. Dryden. I.G.C., "The Efficient Use of Energy" Butterworths, London, 1982
- 5. Turner. W.C., "Energy Management Hand book", Wiley, New York, 1982.
- 6. Murphy. W.R. and G. Mc KAY, "Energy Management", Butterworths, London 1987

YEAR		SEMESTER		L	Т	Р	С
COURSE CODE / COURSE TITLE	191ME542/ DESIGN THINKING		3	0	0	3	

• To provide step by step in-depth understanding on various aspects of innovation, creativity and evolving business models to students.

SYLLABUS

UNIT-I

INTRODUCTION TO DESIGN THINKING

Introduction - Create Thinking - Generating Design Ideas - Lateral Thinking – Analogies – Brainstorming - Mind mapping - National Group Technique – Synectics - Development of work - Analytical Thinking.

UNIT-II

Identifying a design challenge- ways to conduct design research by observing and engaging-Deliverables for the Empathy Stage-A framework for empathy in design.

UNIT-III

ANALYZE PHASE

EMPATHIZE PHASE

Use of empathy map, Organization of design concept and design methods, Engineering Design - Descriptive and prescriptive model, Design decisions and development of design.

UNIT-IV

IDEATION PHASE

Steps in Ideate Phase, creative process and creative principles, Creativity techniques, Evaluation of ideas, How to prototype, Prototype Phase, Lean Startup Method for Prototype Development, Visualization and presentation techniques.

UNIT-V

TEST PHASE

Steps in test Phase, Tips for interviews, Tips for surveys, Kano Model, Desirability Testing, ways to conduct a workshop, Requirements for the space, Material requirements, Agility for Design Thinking.

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COURSE OUTCOMES

1. Apply the basic techniques for design thinking

2. Apply the techniques for empathizing a design thinking.

3. Apply the techniques of design thinking for analysis

4. Apply the techniques of design thinking for Ideation

5. Apply the techniques of design thinking for testing

REFERENCES

1. John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition) Second Edition, 2013.

2. Yousef Haik and Tamer M.Shahin, "Engineering Design Process", Cengage Learning, Second Edition, 2011.

3. Otto. K and Wood, K, Product Design, Pearson Education, 2001.

4. Pahl. G and Beitz. G, Engineering Design, Springer, 1996.

YEAR		SEMESTER		L	Т	Р	С
COURSE CODE / COURSE TITLE	191ME546/ RENEWABLE ENERGY SOURCES		3	0	0	3	

To introduce the new methodologies technologies for effective utilization of renewable energy sources.

SYLLABUS

INTRODUCTION

SOLAR ENERGY

WIND ENERGY

BIO ENERGY

World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilisation – Renewable Energy Scenario in Tamil Nadu, India and around the World – Potentials – Achievements Applications – Economics of renewable energy systems.

UNIT-II

UNIT-I

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

UNIT-III

Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance – Site Selection – Details of Wind Turbine Generator – Safety and Environmental Aspects

UNIT-IV

Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Bio diesel – Cogeneration - Biomass Application, Biomass Feedstocks, Biomass to Biofuel Supply Chain

UNIT-V

OTHER RENEWABLE ENERGY SOURCES

Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro-Geothermal Energy – Hydrogen and Storage - Fuel Cell Systems – Hybrid Systems, Greenhouse Gas and its effect on climate change

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COURSE OUTCOMES

On completion of the course, students will be able to

	inpletion of the course, students will be use to
CO1	Identify the ways for effective utilization of renewable energy sources.
CO2	Relate and analyze the various solar energy based renewable energy generation.
CO3	Relate and analyze the various wind energy based renewable energy generation
CO4	Relate and analyze the various Bio-energy based renewable energy generation
CO5	Identify the merits of new methodologies and technologies for renewable energy generation

REFERENCES

1. Rai. G.D., "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 2011.

2. Twidell, J.W. & Weir, A., "Renewable Energy Sources", EFN Spon Ltd., UK, 2006.

3. Sukhatme. S.P., "Solar Energy", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.

4. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 1996.

5. Tiwari. G.N., Solar Energy – "Fundamentals Design, Modelling & Applications", Narosa Publishing House, New Delhi, 2002.

6. Freris. L.L., "Wind Energy Conversion Systems", Prentice Hall, UK, 1990.

7. Johnson Gary, L. "Wind Energy Systems", Prentice Hall, New York, 1985

8. David M. Mousdale – "Introduction to Biofuels", CRC Press, Taylor & Francis Group, USA 2010

9. Chetan Singh Solanki, Solar Photovoltaics, "Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi, 2009.

VERTICAL 1 ARTIFICIAL INTELLIGENCE

COURSE NAME : APP DEVELOPMENT	L	Т	Р	С
COURSE CODE: 1911TV11	2	0	2	3

COURSE OBJECTIVES:

- To learn development of native applications with basic GUI Components
- To develop cross-platform applications with event handling
- To develop applications with location and data storage capabilities
- To develop web applications with database access

UNIT I FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT 6

Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, What is Progressive Web App, Responsive Web design

UNIT II NATIVE APP DEVELOPMENT USING JAVA

Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Development Frameworks, Java & Kotlin for Android, Swift & Objective-C for iOS, Basics of React Native, Native Components, JSX, State,Props

UNIT III HYBRID APP DEVELOPMENT

Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks, Ionic, Apache Cordova

UNIT IVCROSS-PLATFORM APP DEVELOPMENT USING REACT-NATIVE6

What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross Platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native, Native Components, JSX, State, Props

UNIT V NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS

Comparison of different App frameworks, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Development, UI/UX, Reusability

30 PERIODS

COURSE OUTCOMES:

CO1:Develop Native applications with GUI Components.

CO2:Develop hybrid applications with basic event handling.

CO3: Implement cross-platform applications with location and data storage capabilities.

CO4:Implement cross platform applications with basic GUI and event handling.

CO5:Develop web applications with cloud database access.

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PRACTICAL EXERCISES:

30 PERIODS

1. Using react native, build a cross platform application for a BMI calculator.

2. Build a cross platform application for a simple expense manager which allows entering expenses and income on each day and displays category wise weekly income and expense.

3. Develop a cross platform application to convert units from imperial system to metric system (km to miles, kg to pounds etc.,)

4. Design and develop a cross platform application for day to day task (to-do) management.

5. Design an android application using Cordova for a user login screen with username, password, reset button and a submit button. Also, include header image and a label. Use layout

managers.

6. Design and develop an android application using Apache Cordova to find and display the current location of the user.

7. Write programs using Java to create Android application having Databases

- For a simple library application.
- For displaying books available, books lend, book reservation. Assume that student information is available in a database which has been stored in a database server.

TOTAL:60 PERIODS

TEXT BOOKS

1. Head First Android Development, Dawn Griffiths, O'Reilly, 1st edition

2. Apache Cordova in Action, Raymond K. Camden, Manning. 2015

3. Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, Anthony

Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, FullStack publishing

REFERENCES

1. Android Programming for Beginners, John Horton, Packt Publishing, 2nd Edition

2. Native Mobile Development by Shaun Lewis, Mike Dunn

3. Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach, Pawan Lingras, Matt Triff, Rucha Lingras

4. Apache Cordova 4 Programming, John M Wargo, 2015

5. React Native Cookbook, Daniel Ward, Packt Publishing, 2nd Edition

COURSE NAME: BIO-INSPIRED OPTIMIZATION TECHNIQUES

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COURSE CODE:191ITV12

COURSE OBJECTIVES:

- To understand fundamental topics in bio-inspired optimization techniques
- To Learn the collective systems such as ACO, PSO, and BCO

To develop skills in biologically inspired algorithm design with an emphasis on solving real world problems

To understand the most appropriate types of algorithms for different data analysis problems and to introduce some of the most appropriate implementation strategies.

To implement the Bio-inspired technique with other traditional algorithms.

UNIT I **INTRODUCTION**

Optimization Techniques: Introduction to Optimization Problems - Single and Muti- objective Optimization - Classical Techniques - Overview of various Optimization methods - Evolutionary Computing: Genetic Algorithm and Genetic Programming: Basic concept - encoding - representation - fitness function -Reproduction - differences between GA and Traditional optimization methods - Applications - Bio- inspired Computing (BIC): Motivation – Overview of BIC – usage of BIC – merits and demerits of BIC.

UNIT II SWARM INTELLIGENCE

Introduction - Biological foundations of Swarm Intelligence - Swarm Intelligence in Optimization - Ant Colonies: Ant Foraging Behavior - Towards Artificial Ants - Ant Colony Optimization (ACO) - S-ACO -Ant Colony Optimization Metaheuristic: Combinatorial Optimization - ACO Metaheuristic - Problem solving using ACO - Other Metaheuristics - Simulated annealing - Tabu Search - Local search methods -Scope of ACO algorithms

UNIT III NATURAL TO ARTIFICIAL SYSTEMS

Biological Nervous Systems – artificial neural networks – architecture – Learning Paradigms – unsupervised learning - supervised learning - reinforcement learning - evolution of neural networks - hybrid neural systems - Biological Inspirations in problem solving - Behavior of Social Insects: Foraging -Division of Labor - Task Allocation - Cemetery Organization and Brood Sorting - Nest Building - Cooperative transport.

SWARM ROBOTICS UNIT IV

Foraging for food - Clustering of objects - Collective Prey retrieval - Scope of Swarm Robotics - Social Adaptation of Knowledge: Particle Swarm – Particle Swarm Optimization (PSO) – Particle 165 Swarms for Dynamic Optimization Problems - Artificial Bee Colony (ABC) Optimization biologically inspired algorithms in engineering.

UNIT V **CASE STUDIES**

Other Swarm Intelligence algorithms: Fish Swarm – Bacteria foraging – Intelligent Water Drop Algorithms – Applications of biologically inspired algorithms in engineering. Case Studies: ACO and PSO for NP-hard

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problems – Routing problems – Assignment problems – Scheduling problems – Subset problems – Machine Learning Problems – Traveling Salesman problem.

TOTAL:45 PERIODS COURSE OUTCOMES:

CO1: Familiarity with the basics of several biologically inspired optimization techniques.

CO2: Familiarity with the basics of several biologically inspired computing paradigms.

CO3: Ability to select an appropriate bio-inspired computing method and implement it for any application and data set.

CO4: Theoretical understanding of the differences between the major bio-inspired computing methods.

CO5: Learn Other Swarm Intelligence algorithms and implement the Bio-inspired technique with other traditional algorithms.

TEXT BOOK

1. A. E. Elben and J. E. Smith, "Introduction to Evolutionary Computing", Springer, 2010.

2.Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.

3. Leandro Nunes de Castro, "Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007

REFERENCES

1. Eric Bonabeau, Marco Dorigo, Guy Theraulaz, "Swarm Intelligence: From Natural to Artificial Systems", Oxford University press, 2000.

2. Christian Blum, Daniel Merkle (Eds.), "Swarm Intelligence: Introduction and Applications", Springer Verlag, 2008.

3. Leandro N De Castro, Fernando J Von Zuben, "Recent Developments in Biologically Inspired Computing", Idea Group Inc., 2005.

4. Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.

5. C. Eberhart et al., "Swarm Intelligence", Morgan Kaufmann, 2001.

COURSE NAME: BUSINESS ANALYTICS

COURSE CODE:191ITV13

COURSE OBJECTIVES:

- To understand the Analytics Life Cycle.
- To comprehend the process of acquiring Business Intelligence
- To understand various types of analytics for Business Forecasting
- To model the supply chain management for Analytics. •
- To apply analytics for different functions of a business

INTRODUCTION TO BUSINESS ANALYTICS UNIT I

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection - Data Preparation - Hypothesis Generation - Modeling - Validation and Evaluation - Interpretation - Deployment and Iteration

UNIT II BUSINESS INTELLIGENCE

Data Warehouses and Data Mart - Knowledge Management - Types of Decisions - Decision Making Process -Decision Support Systems - Business Intelligence - OLAP - Analytic functions

UNIT III BUSINESS FORECASTING

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models - Data Mining and Predictive Analysis Modelling -Machine Learning for Predictive analytics.

UNIT IV HR & SUPPLY CHAIN ANALYTICS

Human Resources - Planning and Recruitment - Training and Development - Supply chain network - Planning Demand, Inventory and Supply - Logistics - Analytics applications in HR & Supply Chain - Applying HR Analytics to make a prediction of the demand for hourly employees for a year.

UNIT V **MARKETING & SALES ANALYTICS**

Marketing Strategy, Marketing Mix, Customer Behavior -selling Process - Sales Planning - Analytics applications in Marketing and Sales - predictive analytics for customers' behavior in marketing and sales.

LIST OF EXPERIMENTS:

Use MS-Excel and Power-BI to perform the following experiments using a Business data set, and make presentations. Students may be encouraged to bring their own real-time socially relevant data set. I Cycle - MS Excel

1. Explore the features of Ms-Excel.

2.(i) Get the input from the user and perform numerical operations (MAX, MIN, AVG, SUM, SQRT, ROUND)

ii) Perform data import/export operations for different file formats.

3. Perform statistical operations - Mean, Median, Mode and Standard deviation, Variance, Skewness, **Kurtosis**

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30 PERIODS

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- 4. Perform Z-test, T-test & ANOVA
- 5. Perform data pre-processing operations
- i) Handling Missing data
 - ii) Normalization
- 6. Perform dimensionality reduction operation using PCA, KPCA & SVD
- 7. Perform bivariate and multivariate analysis on the dataset.
- 8. Apply and explore various plotting functions on the data set. II Cycle Power BI Desktop
- 9. Explore the features of Power BI Desktop
- 10. Prepare & Load data
- 11. Develop the data model
- 12. Perform DAX calculations
- 13. Design a report
- 14. Create a dashboard and perform data analysis
- 15. Presentation of a case study

COURSE OUTCOMES:

CO1: Explain the real world business problems and model with analytical solutions.

- CO2: Identify the business processes for extracting Business Intelligence
- CO3 : Apply predictive analytics for business fore-casting
- CO4: Apply analytics for supply chain and logistics management

CO5: Use analytics for marketing and sales.

TEXT BOOKS

- 1. R. Evans James, Business Analytics, 2nd Edition, Pearson, 2017
- 2. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2nd Edition, Wiley, 2016
- 3. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
- 4. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
- 5. Mahadevan B, "Operations Management Theory and Practice", 3rd Edition, Pearson Education, 2018

30 PERIODS

TOTAL: 60 PERIODS

COURSE NAME: COGNITIVE SCIENCE

COURSE CODE:1911TV14

COURSE OBJECTIVES:

- To know the theoretical background of cognition.
- To understand the link between cognition and computational intelligence.
- To explore probabilistic programming language.
- To study the computational inference models of cognition.
- To study the computational learning models of cognition.

UNIT I PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE

Philosophy: Mental-physical Relation – From Materialism to Mental Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing – Cognitive Neuroscience – Perception – Decision – Learning and Memory – Language Understanding and Processing.

UNIT II COMPUTATIONAL INTELLIGENCE

Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making –Learning – Language – Vision.

UNIT III PROBABILISTIC PROGRAMMING LANGUAGE

WebPPL Language – Syntax – Using Javascript Libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Coroutines: Functions that receive continuations – Enumeration

UNIT IV INFERENCE MODELS OF COGNITION

Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence – Data Analysis – Algorithms for Inference.

UNIT V LEARNING MODELS OF COGNITION

Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models– Learning (Deep) Continuous Functions – Mixture Models.

30 PERIODS

30 PERIODS

PRACTICAL EXERCISES :

- 1. Demonstration of Mathematical functions using WebPPL.
- 2. Implementation of reasoning algorithms.
- 3. Developing an Application system using generative model.
- 4. Developing an Application using conditional inference learning model.
- 5. Application development using hierarchical model. 6. Application development using Mixture model.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

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CO1:Understand the underlying theory behind cognition.

CO2:Connect to the cognition elements computationally.

CO3:Implement mathematical functions through WebPPL.

CO4:Develop applications using cognitive inference models.

CO5:Develop applications using cognitive learning models.

TOTAL: 60 PERIODS

TEXT BOOK:

1. Vijay V Raghavan, Venkat N. Gudivada, VenuGovindaraju, C.R. Rao, Cognitive Computing: Theory and Applications: (Handbook of Statistics 35), Elsevier publications, 2016

2. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley Publications, 2015

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

4. Jose Luis Bermúdez, Cognitive Science - An Introduction to the Science of the Mind, Cambridge University Press 2020

REFERENCES:

1. Noah D. Goodman, Andreas Stuhlmuller, "The Design and Implementation of Probabilistic Programming Languages", Electronic version of book, <u>https://dippl.org/</u>.

2. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, "Probabilistic Models of Cognition", Second Edition, 2016, https://probmods.org/.

COURSE NAME: COMPUTER VISION

COURSE CODE:191ITV15

COURSE OBJECTIVES:

- To understand the fundamental concepts related to Image formation and processing.
- To learn feature detection, matching and detection
- To become familiar with feature based alignment and motion estimation
- To develop skills on 3D reconstruction
- To understand image based rendering and recognition

UNIT I INTRODUCTION TO IMAGE FORMATION AND PROCESSING 6

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

UNIT II FEATURE DETECTION, MATCHING AND SEGMENTATION

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

UNIT III FEATURE-BASED ALIGNMENT & MOTION ESTIMATION

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.

UNIT IV 3D RECONSTRUCTION

Shape from X - Active range finding - Surface representations - Point-based representationsVolumetric representations - Model-based reconstruction - Recovering texture maps and albedos

UNIT V IMAGE-BASED RENDERING AND RECOGNITION

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.

30 PERIODS

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PRACTICAL EXERCISES:

30 PERIODS

TOTAL : 60 PERIODS

LABORATORY EXPERIMENTS:

Software needed: OpenCV computer vision Library for OpenCV in Python / PyCharm or C++ / Visual Studio or or equivalent

• OpenCV Installation and working with Python

• Basic Image Processing - loading images, Cropping, Resizing, Thresholding, Contour analysis, Blob detection

• Image Annotation - Drawing lines, text circle, rectangle, ellipse on images

• Image Enhancement - Understanding Color spaces, color space conversion, Histogram equalization, Convolution, Image smoothing, Gradients, Edge Detection

• Image Features and Image Alignment – Image transforms – Fourier, Hough, Extract ORB Image features, Feature matching, cloning, Feature matching based image alignment

- Image segmentation using Graph Cut / Grabcut
- Camera Calibration with circular grid
- Pose Estimation
- 3D Reconstruction Creating Depth map from stereo images

•Object Detection and Tracking using Kalman Filter, Camshift 1. docs.opencv.org 2. https://opencv.org/opencv-free-course/

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1:To understand basic knowledge, theories and methods in image processing and computer vision. CO2:To implement basic and some advanced image processing techniques in OpenCV.

CO3:To apply 2D feature- based image alignment, segmentation and motion estimations.

CO4: To apply 3D image reconstruction techniques

CO5:To design and develop innovative image processing and computer vision applications.

TEXT BOOKS:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, Second Edition, 2022.

2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.

REFERENCES:

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.

2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006

3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

COURSE NAME: ETHICS AND AI

LTPC

COURSE CODE: 191ITV16

COURSE OBJECTIVES:

- Study the morality and ethics in AI •
- Learn about the Ethical initiatives in the field of artificial intelligence •
- Study about AI standards and Regulations
- Study about social and ethical issues of Robot Ethics •
- Study about AI and Ethics- challenges and opportunities

UNIT I **INTRODUCTION**

Definition of morality and ethics in AI-Impact on society-Impact on human psychology-Impact on the legal system-Impact on the environment and the planet-Impact on trust

UNIT II ETHICAL INITIATIVES IN AI

International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles, Warfare and weaponization.

UNIT III **AI STANDARDS AND REGULATION**

Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems-Data Privacy Process- Algorithmic Bias Considerations - Ontological Standard for Ethically Driven **Robotics and Automation Systems**

UNIT IV ROBOETHICS:SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS 6 Robot-

Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional ResponsibilityRoboethics Taxonomy.

UNIT V **AI AND ETHICS- CHALLENGES AND OPPORTUNITIES**

Challenges - Opportunities- ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in industries-National and International Strategies on AI.

30 PERIODS

PRACTICAL EXERCISES:

- 1. Recent case study of ethical initiatives in healthcare, autonomous vehicles and defense
- 2. Exploratory data analysis on a 2 variable linear regression model
- 3. Experiment the regression model without a bias and with bias
- 4. Classification of a dataset from UCI repository using a perceptron with and without bias
- 5. Case study on ontology where ethics is at stake
- 6. Identification on optimization in AI affecting ethics

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TOTAL:60 PERIODS

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:Learn about morality and ethics in AI

CO2:Acquire the knowledge of real time application ethics, issues and its challenges.

CO3:Understand the ethical harms and ethical initiatives in AI

CO4:Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems

CO5:Understand the concepts of Roboethics and Morality with professional responsibilities.

CO6:Learn about the societal issues in AI with National and International Strategies on AI

TEXT BOOKS:

1. y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield,"The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020

2. Patrick Lin, Keith Abney, George A Bekey," Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014

REFERENCES:

1. Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017 2. Mark Coeckelbergh," AI Ethics", The MIT Press Essential Knowledge series, April 2020

WEB LINK:

1.https://sci-hub.mksa.top/10.1007/978-3-540-30301-5_65

2.https://www.scu.edu/ethics/all-about-ethics/artificial-intelligence-and-ethics-sixteenchallenges-and-opportunities/

3.https://www.weforum.org/agenda/2016/10/top-10-ethical-issues-in-artificial-intelligence/

4. https://sci-hub.mksa.top/10.1159/000492428

COURSE NAME: KNOWLEDGE ENGINEERING

COURSE CODE:1911TV17

COURSE OBJECTIVES:

- To understand the basics of Knowledge Engineering.
- To discuss methodologies and modeling for Agent Design and Development.
- To design and develop ontologies.
- To apply reasoning with ontologies and rules.
- To understand learning and rule learning

UNIT I REASONING UNDER UNCERTAINTY

Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering.

UNIT II METHODOLOGY AND MODELING

Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquirydriven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill- Down Analysis, Assumption-based Reasoning, and What-If Scenarios.

UNIT III ONTOLOGIES – DESIGN AND DEVELOPMENT

Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching. Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and ConceptElicitation – Modeling-based Ontology Specification.

UNIT IV REASONING WITH ONTOLOGIES AND RULES

Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge.

UNIT V LEARNING AND RULE LEARNING

Machine Learning – Concepts – Generalization and Specialization Rules –Types – Formal definition of Generalization. Modeling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning.

30 PERIODS

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PRACTICAL EXERCISES:

- 1. Perform operations with Evidence Based Reasoning.
- 2. Perform Evidence based Analysis.
- 3. Perform operations on Probability Based Reasoning.
- 4. Perform Believability Analysis.
- 5. Implement Rule Learning and refinement.
- 6. Perform analysis based on learned patterns.
- 7. Construction of Ontology for a given domain.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the semester the students can be able to:

CO1 Understand the basics of Knowledge Engineering.

CO2 Apply methodologies and modeling for Agent Design and Development.

CO3 Design and develop ontologies.

CO4 Apply reasoning with ontologies and rules.

CO5 Understand learning and rule learning.

TEXT BOOK:

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016. (Unit 1 – Chapter 1 / Unit 2 – Chapter 3,4 / Unit 3 – Chapter 5, 6 / Unit 4 - 7, Unit 5 – Chapter 8,

REFERENCES:

1. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.

2. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.

3. John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000.

4. King, Knowledge Management and Organizational Learning, Springer, 2009.

5. Jay Liebowitz, Knowledge Management Learning from Knowledge Engineering, 1st Edition, 2001.
COURSE NAME:SOFT COMPUTING

COURSE CODE:191ITV18

COURSE OBJECTIVES:

- To introduce the ideas of fuzzy sets, fuzzy logic and the use of heuristics based on human experience.
- To provide the mathematical background for carrying out the optimization associated with neural network learning
- To learn various evolutionary Algorithms.
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
- To introduce case studies utilizing the above and illustrate the Intelligent behavior of programs based on soft computing

UNIT 1 INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC

Introduction - Fuzzy Logic - Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems

UNIT II NEURAL NETWORKS

Supervised Learning Neural Networks – Perceptrons - Back Propagation -Multilayer Perceptrons – Unsupervised Learning Neural Networks – Kohonen Self-Organizing Networks

UNIT III GENETIC ALGORITHMS

Chromosome Encoding Schemes -Population initialization and selection methods - Evaluation function - Genetic operators- Crossover – Mutation - Fitness Function – Maximizing function

UNIT IV NEURO FUZZY MODELING

ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling – Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum - Analysis of Adaptive Learning Capability

UNIT V APPLICATIONS

Modeling a two input sine function - Printed Character Recognition – Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition - Soft Computing forColor Recipe Prediction.

30 PERIODS

COURSE OUTCOMES:

CO1: Understand the fundamentals of fuzzy logic operators and inference mechanisms

CO2: Understand neural network architecture for AI applications such as classification and clustering

CO3: Learn the functionality of Genetic Algorithms in Optimization problems

- CO4: Use hybrid techniques involving Neural networks and Fuzzy logic
- CO5: Apply soft computing techniques in real world applications

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PRACTICAL EXERCISES

- 1. Implementation of fuzzy control/ inference system
- 2. Programming exercise on classification with a discrete perceptron
- 3. Implementation of XOR with backpropagation algorithm
- 4. Implementation of self organizing maps for a specific application
- 5. Programming exercises on maximizing a function using Genetic algorithm
- 6. Implementation of two input sine function
- 7. Implementation of three input nonlinear function

TOTAL:60 PERIODS

TEXT BOOKS:

1. SaJANG, J.-S. R., SUN, C.-T., & MIZUTANI, E. (1997). Neuro-fuzzy and soft computing: A computational approach to learning and machine intelligence. Upper Saddle River, NJ, Prentice Hall,1997

2. Himanshu Singh, Yunis Ahmad Lone, Deep Neuro-Fuzzy Systems with Python

3. With Case Studies and Applications from the Industry, Apress, 2020

REFERENCES

1. roj Kaushik and Sunita Tiwari, Soft Computing-Fundamentals Techniques and Applications, 1st Edition, McGraw Hill, 2018.

2. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.

3. Samir Roy, Udit Chakraborthy, Introduction to Soft Computing, Neuro Fuzzy and Genetic Algorithms, Pearson Education, 2013.

4. S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Third Edition, Wiley India Pvt Ltd, 2019.

5. R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence - PC Tools", AP Professional, Boston, 1999

VERTICAL 2 CLOUD COMPUTING

LTP **COURSE NAME : CLOUD SERVICES AND MANAGEMENT** С **COURSE CODE:191ITV21** 2 0 2 3

COURSE OBJECTIVES:

- Introduce Cloud Service Management terminology, definition & concepts
- Compare and contrast cloud service management with traditional IT service management
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services
- Select appropriate structures for designing, deploying and running cloud-based services in a business Environment
- Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

UNIT I **CLOUD SERVICE MANAGEMENT FUNDAMENTALS**

Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models

CLOUD SERVICES STRATEGY UNIT II

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture

UNIT III **CLOUD SERVICE MANAGEMENT**

Cloud Service Reference Model, Cloud Service LifeCycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management

UNIT IV **CLOUD SERVICE ECONOMICS**

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models

UNIT V **CLOUD SERVICE GOVERNANCE & VALUE**

Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership **30 PERIODS**

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COURSE OUTCOMES:

CO1:Exhibit cloud-design skills to build and automate business solutions using cloud technologies.

CO2: Possess Strong theoretical foundation leading to excellence and excitement towards adoption of cloudbased services

CO3: Solve the real world problems using Cloud services and technologies

PRACTICAL EXERCISES:

30 PERIODS

TOTAL: 60 PERIODS

1. Create a Cloud Organization in AWS/Google Cloud/or any equivalent Open Source cloud softwares like Openstack, Eucalyptus, OpenNebula with Role-based access control

2. Create a Cost-model for a web application using various services and do Cost-benefit analysis

- 3. Create alerts for usage of Cloud resources
- 4. Create Billing alerts for your Cloud Organization
- 5. Compare Cloud cost for a simple web application across AWS, Azure and GCP and suggest the best one

TEXT BOOKS

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by Enamul Haque, Enel Publications

2. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, Zaigham Mohammad 2013

3. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour

REFERENCES

1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing

2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi

COURSE NAME: DATA WAREHOUSING

COURSE CODE:191ITV22

COURSE OBJECTIVES:

- To know the details of data warehouse Architecture
- To understand the OLAP Technology
- To understand the partitioning strategy
- To differentiate various schema
- To understand the roles of process manager & system manager

UNIT I INTRODUCTION TO DATA WAREHOUSE

Data warehouse Introduction - Data warehouse components- operational database Vs data warehouse - Data warehouse Architecture - Three-tier Data Warehouse Architecture - Autonomous Data Warehouse-Autonomous Data Warehouse Vs Snowflake - Modern Data Warehouse

ETL AND OLAP TECHNOLOGY UNIT II

What is ETL – ETL Vs ELT – Types of Data warehouses - Data warehouse Design and Modeling - Delivery Process - Online Analytical Processing (OLAP) - Characteristics of OLAP - Online Transaction Processing (OLTP) Vs OLAP - OLAP operations- Types of OLAP- ROLAP Vs MOLAP Vs HOLAP.

UNIT III METADATA, DATA MART AND PARTITION STRATEGY

Meta Data – Categories of Metadata – Role of Metadata – Metadata Repository – Challenges for Meta Management - Data Mart - Need of Data Mart- Cost Effective Data Mart- Designing Data Marts- Cost of Data Marts- Partitioning Strategy – Vertical partition – Normalization – Row Splitting – Horizontal Partition

UNIT IV DIMENSIONAL MODELING AND SCHEMA

Dimensional Modeling- Multi-Dimensional Data Modeling – Data Cube- Star Schema- Snowflake schema-Star Vs Snowflake schema- Fact constellation Schema- Schema Definition - Process Architecture- Types of Database Parallelism – Data Warehouse Tools

UNIT V SYSTEM & PROCESS MANAGERS

Data Warehousing System Managers: System Configuration Manager- System Scheduling Manager - System Event Manager - System Database Manager - System Backup Recovery Manager - Data Warehousing Process Managers: Load Manager – Warehouse Manager- Query Manager – Tuning – Testing

30 PERIODS

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PRACTICAL EXERCISES:

30 PERIODS

- 1. Data exploration and integration with WEKA
- 2. Apply weka tool for data validation
- 3. Plan the architecture for real time application
- 4. Write the query for schema definition
- 5. Design data warehouse for real time applications
- 6. Analyze the dimensional Modeling
- 7. Case study using OLAP
- 8. Case study using OLTP
- 9. Implementation of warehouse testing.

COURSE OUTCOMES:

- At the end of the course the students should be able to
- CO1: Design data warehouse architecture for various Problems
- CO2: Apply the OLAP Technology
- CO3: Analyze the partitioning strategy
- CO4: Critically analyze the differentiation of various schema for given problem
- CO5: Frame roles of process manager & system manager

TOTAL: 60 PERIODS

TEXT BOOKS

1. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Thirteenth Reprint 2008.

2. Ralph Kimball, "The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling", Third edition, 2013.

REFERENCES

1. Paul Raj Ponniah, "Data warehousing fundamentals for IT Professionals", 2012.

2. K.P. Soman, ShyamDiwakar and V. Ajay ``Insight into Data mining Theory and Practice'', Easter Economy Edition, Prentice Hall of India, 2006.

COURSE NAME: PRINCIPLES OF CLOUD COMPUTING L T P C

COURSE CODE:1911TV23

COURSE OBJECTIVES

- To understand the basic concepts and architecture of Cloud Computing.
- To understand virtualization and Data Storage in cloud computing.
- To introduce the various levels of services that can be achieved by cloud and security in cloud computing
- To analyze the various tools and technologies in the Cloud.
- To implement the applications in the Cloud.

UNIT I CLOUD COMPUTING FOUNDATION AND ARCHITECTURE

Foundations: Introduction to Cloud Computing – Move to Cloud Computing – Types of Cloud – Working of Cloud Computing – Architecture: Cloud computing Technology – Cloud Architecture – Cloud Modeling and Design.

UNIT II VIRTUALIZATION AND DATA STORAGE IN CLOUD COMPUTING 6

Virtualization:Foundation – Grid, Cloud and Virtualization – Virtualization and Cloud Computing – Storage: Data Storage – Cloud Storage – Cloud Storage from LANs and WANs.

UNIT III CLOUD COMPUTING SERVICES AND SECURITY

Cloud Computing Services: Cloud Computing Elements – Understanding Services and Applicationsby Type -Cloud Services – Cloud Computing at Work – Security: Risks in Cloud Computing – Data Security in Cloud – Cloud Security Services.

UNIT IV CLOUD COMPUTING TOOLS

Cloud Computing Tools: Tools and Technologies for Cloud – Cloud Mashaps – Apache Hadoop – Cloud Tools.

UNIT V CLOUD APPLICATIONS

Moving Applications to the Cloud – Microsoft Cloud Services – Google Cloud Applications – Amazon Cloud Services – Cloud Applications.

30 PERIODS

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PRACTICAL EXERCISES

1. Install Virtualbox/VMware/ Equivalent open source cloud Workstation with different flavours of Linux or Windows OS on top of windows 8 and above.

2. Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs

3. Install Google App Engine. Create a hello world app and other simple web applications using python/java.

4. Use the GAE launcher to launch the web applications.

5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

- 6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
- 7. Install Hadoop single node cluster and run simple applications like word count.
- 8. Creating and Executing Your First Container Using Docker.
- 9. Run a Container from Docker Hub

COURSE OUTCOMES:

- CO Course Outcomes Statements
- CO1 Describe the basic concept and architecture of cloud computing
- CO2 Identify the virtualization and data storage in cloud computing
- CO3 Categorize varies levels of services can be achieved by cloud and cloud computing security
- CO4 Analyze the various tools and technologies in Cloud
- CO5 Develop the implementation of applications in Cloud

TEXT BOOKS:

1. A.Srinivasan and J.Suresh, "Cloud Computing – A Practical Approach for Learning and Implementation", Pearson India Publications 2014.

REFERENCES:

- 1. Kai Hwang, Geoffrey C.Fox, Jack G.Dongarra, "Distributed and Cloud Computing, from Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
- 2. Rajkumar Buyya, James Broberg, Andrzej, "Cloud Computing: Principles and Paradigms", Wiley India Publications 2011.
- Kumar Saurabh, "Cloud Computing, Architecting Next Gen Transformation Paradigms", Wiley India Publications, Fourth Edition, 2018.

30 PERIODS

TOTAL:60 PERIODS

COURSE NAME: SECURITY AND PRIVACY IN CLOUD

COURSE CODE:1911TV24

COURSE OBJECTIVES:

- To Introduce Cloud Computing terminology, definition & concepts
- To understand the security design and architectural considerations for Cloud
- To understand the Identity, Access control in Cloud
- To follow best practices for Cloud security using various design patterns
- To be able to monitor and audit cloud applications for security

UNIT I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Nonrepudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II SECURITY DESIGN AND ARCHITECTURE FOR CLOUD

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key

UNIT III ACCESS CONTROL AND IDENTITY MANAGEMENT

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention

UNIT IV CLOUD SECURITY DESIGN PATTERNS

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud

UNIT V MONITORING, AUDITING AND MANAGEMENT

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management

30 PERIODS

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PRACTICAL EXERCISES:

1. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm not present in Cloud Sim

- 2. simulate resource management using cloud sim
- 3. simulate log forensics using cloud sim
- 4. simulate a secure file sharing using a cloud sim
- 5. Implement data anonymization techniques over the simple dataset (masking, k-anonymization,etc)
- 6. Implement any encryption algorithm to protect the images
- 7. Implement any image obfuscation mechanism
- 8. Implement a role-based access control mechanism in a specific scenario
- 9. implement an attribute-based access control mechanism based on a particular scenario
- 10. Develop a log monitoring system with incident management in the cloud

COURSE OUTCOMES:

CO1: Understand the cloud concepts and fundamentals.

CO2: Explain the security challenges in the cloud.

CO3: Define cloud policy and Identity and Access Management.

CO4: Understand various risks and audit and monitoring mechanisms in the cloud.

CO5: Define the various architectural and design considerations for security in the cloud.

TOTAL:60 PERIODS

TEXTBOOKS

1. Raj Kumar Buyya , James Broberg, andrzejGoscinski, -Cloud Computing: I, Wiley 2013

- 2. Dave shackleford, —Virtualization Security, SYBEX a wiley Brand 2013.
- 3. Mather, Kumaraswamy and Latif, -Cloud Security and Privacyl, O'REILLYSSSSS 2011

REFERENCES

1. Mark C. Chu-Carroll —Code in the Cloud, CRC Press, 2011

2. Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya, Christian Vechhiola, S. ThamaraiSelvi

30 PERIODS

COURSE NAME:SOFTWARE DEFINED NETWORKS LTPC

COURSE CODE:1911TV25

COURSE OBJECTIVES:

- To understand the need for SDN and its data plane operations
- To understand the functions of control plane
- To comprehend the migration of networking functions to SDN environment
- To explore various techniques of network function virtualization
- To comprehend the concepts behind network virtualization

UNIT I **SDN: INTRODUCTION**

Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane, Control plane and Application Plane

SDN DATA PLANE AND CONTROL PLANE UNIT II

Data Plane functions and protocols - OpenFLow Protocol - Flow Table - Control Plane Functions - South bound Interface, Northbound Interface - SDN Controllers - Ryu, OpenDaylight, ONOS - Distributed Controllers

UNIT III SDN APPLICATIONS

SDN Application Plane Architecture - Network Services Abstraction Layer - Traffic Engineering Measurement and Monitoring – Security – Data Center Networking

NETWORK FUNCTION VIRTUALIZATION UNIT IV

Network Virtualization - Virtual LANs - OpenFlow VLAN Support - NFV Concepts - Benefits and Requirements – Reference Architecture

UNIT V **NFV FUNCTIONALITY**

NFV Infrastructure - Virtualized Network Functions - NFV Management and Orchestration - NFV Use cases – SDN and NFV

PRACTICAL EXERCISES:

1) Setup your own virtual SDN lab

i) Virtualbox/Mininet Environment for SDN - http://mininet.org

ii) https://www.kathara.org

iii) GNS3

2) Create a simple mininet topology with SDN controller and use Wireshark to capture and

visualize the OpenFlow messages such as OpenFlow FLOW MOD, PACKET IN, PACKET OUT etc.

30 PERIODS 30 PERIODS

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3) Create a SDN application that uses the Northbound API to program flow table rules on the switch for various use cases like L2 learning switch, Traffic Engineering, Firewall etc.

4) Create a simple end-to-end network service with two VNFs using vim-emu https://github.com/containernet/vim-emu

5) Install OSM and onboard and orchestrate network service.

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

CO1: Describe the motivation behind SDN

CO2: Identify the functions of the data plane and control plane

CO3: Design and develop network applications using SDN

CO4: Orchestrate network services using NFV

CO5: Explain various use cases of SDN and NFV

TOTAL :60 PERIODS

TEXTBOOKS:

1. William Stallings, "Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud", Pearson Education, 1st Edition, 2015.

REFERENCES:

1. Ken Gray, Thomas D. Nadeau, "Network Function Virtualization", Morgan Kauffman, 2016.

2. Thomas D Nadeau, Ken Gray, "SDN: Software Defined Networks", O'Reilly Media, 2013.

3. Fei Hu, "Network Innovation through OpenFlow and SDN: Principles and Design", 1st Edition, CRCPress, 2014.

4. Paul Goransson, Chuck Black Timothy Culver, "Software Defined Networks: A ComprehensiveApproach", 2nd Edition, Morgan Kaufmann Press, 2016.

5. Oswald Coker, Siamak Azodolmolky, "Software-Defined Networking with OpenFlow", 2nd Edition, O'Reilly Media, 2017.

CO's- PO's & PSO's MAPPING

COURSE NAME:STORAGE TECHNOLOGIES

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COURSE CODE:1911TV26

COURSE OBJECTIVES:

- Characterize the functionalities of logical and physical components of storage
- Describe various storage networking technologies
- Identify different storage virtualization technologies
- Discuss the different backup and recovery strategies
- Understand common storage management activities and solutions

UNIT I STORAGE SYSTEMS

Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center, Compute systems and compute virtualization and Software-defined data center.

UNIT II INTELLIGENT STORAGE SYSTEMS AND RAID

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and scaleout storage Architecture.

UNIT III STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION

Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage. Fibre Channel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol, connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture

UNIT IV BACKUP, ARCHIVE AND REPLICATION

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service(DRaaS).

UNIT V SECURING STORAGE INFRASTRUCTURE

Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance, Storage infrastructure management functions, Storage infrastructure management processes.

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COURSE OUTCOMES:

CO1: Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment

CO2: Illustrate the usage of advanced intelligent storage systems and RAID

CO3: Interpret various storage networking architectures - SAN, including storage subsystems and virtualization

CO4: Examine the different role in providing disaster recovery and remote replication technologies

CO5: Infer the security needs and security measures to be employed in information storage management

TOTAL:45 PERIODS

TEXTBOOKS

1. EMC Corporation, Information Storage and Management, Wiley, India

2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017

3. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein ,Storage Networks Explained, Second Edition, Wiley, 2009

COURSE NAME:STREAM PROCESSING

COURSE CODE:191ITV27

COURSE OBJECTIVES:

- Introduce Data Processing terminology, definition & concepts
- Define different types of Data Processing
- Explain the concepts of Real-time Data processing
- Select appropriate structures for designing and running real-time data services in a business environment
- Illustrate the benefits and drive the adoption of real-time data services to solve real world problems

UNIT I FOUNDATIONS OF DATA SYSTEMS

Introduction to Data Processing, Stages of Data processing, Data Analytics, Batch Processing, Stream processing, Data Migration, Transactional Data processing, Data Mining, Data Management Strategy, Storage, Processing, Integration, Analytics, Benefits of Data as a Service, Challenges

UNIT II **REAL-TIME DATA PROCESSING**

Introduction to Big data, Big data infrastructure, Real-time Analytics, Near real-time solution, Lambda architecture, Kappa Architecture, Stream Processing, Understanding Data Streams, Message Broker, Stream Processor, Batch & Real-time ETL tools, Streaming Data Storage

UNIT III DATA MODELS AND QUERY LANGUAGES

Relational Model, Document Model, Key-Value Pairs, NoSQL, Object-Relational Mismatch, Manyto- One and Many-to-Many Relationships, Network data models, Schema Flexibility, Structured Query Language, Data Locality for Queries, Declarative Queries, Graph Data models, Cypher Query Language, Graph Queries in SQL, The Semantic Web, CODASYL, SPARQL

UNIT IV **EVENT PROCESSING WITH APACHE KAFKA**

Apache Kafka, Kafka as Event Streaming platform, Events, Producers, Consumers, Topics, Partitions, Brokers, Kafka APIs, Admin API, Producer API, Consumer API, Kafka Streams API, Kafka Connect API

UNIT V REAL-TIME PROCESSING USING SPARK STREAMING 6

Structured Streaming, Basic Concepts, Handling Event-time and Late Data, Fault-tolerant Semantics, Exactlyonce Semantics, Creating Streaming Datasets, Schema Inference, Partitioning of Streaming datasets, Operations on Streaming Data, Selection, Aggregation, Projection, Watermarking, Window operations, Types of Time windows, Join Operations, Deduplication

30 PERIODS

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PRACTICAL EXERCISES

30 PERIODS

- 1. Install MongoDB
- 2. Design and Implement Simple application using MongoDB
- 3. Query the designed system using MongoDB
- 4. Create a Event Stream with Apache Kafka
- 5. Create a Real-time Stream processing application using Spark Streaming
- 6. Build a Micro-batch application
- 7. Real-time Fraud and Anomaly Detection,
- 8. Real-time personalization, Marketing, Advertising

COURSE OUTCOMES:

CO1:Understand the applicability and utility of different streaming algorithms.

CO2:Describe and apply current research trends in data-stream processing.

CO3: Analyze the suitability of stream mining algorithms for data stream systems.

CO4:Program and build stream processing systems, services and applications.

CO5:Solve problems in real-world applications that process data streams.

TOTAL:60 PERIODS

TEXT BOOKS

1. Streaming Systems: The What, Where, When and How of Large-Scale Data Processing by Tyler Akidau, Slava Chemyak, Reuven Lax, O'Reilly publication

2. Designing Data-Intensive Applications by Martin Kleppmann, O'Reilly Media

3. Practical Real-time Data Processing and Analytics : Distributed Computing and Event Processing using Apache Spark, Flink, Storm and Kafka, Packt Publishing

REFERENCES

1. https://spark.apache.org/docs/latest/streaming-programming-guide.html

2. Kafka.apache.org

COURSE NAME: VIRTUALIZATION

COURSE CODE:191ITV28

COURSE OBJECTIVES:

- To Learn the basics and types of Virtualization
- To understand the Hypervisors and its types
- To Explore the Virtualization Solutions
- To Experiment the virtualization platforms

UNIT I INTRODUCTION TO VIRTUALIZATION

Virtualization and cloud computing - Need of virtualization - cost, administration, fast deployment, reduce infrastructure cost - limitations- Types of hardware virtualization: Full virtualization - partial virtualization -Paravirtualization-Types of Hypervisors

SERVER AND DESKTOP VIRTUALIZATION UNIT II

Virtual machine basics- Types of virtual machines- Understanding Server Virtualization- types of server virtualization- Business Cases for Server Virtualization - Uses of Virtual Server Consolidation - Selecting Server Virtualization Platform-Desktop Virtualization-Types of Desktop Virtualization

NETWORK VIRTUALIZATION UNIT III

Introduction to Network Virtualization-Advantages- Functions-Tools for Network Virtualization-VLAN-WAN Architecture-WAN Virtualization

UNIT IV **STORAGE VIRTUALIZATION**

Memory Virtualization-Types of Storage Virtualization-Block, File-Address space Remapping-Risks of Storage Virtualization-SAN-NAS-RAID

UNIT V VIRTUALIZATION TOOLS

VMWare-Amazon AWS-Microsoft HyperV- Oracle VM Virtual Box - IBM PowerVM- Google Virtualization- Case study.

PRACTICAL EXERCISES: 30 PERIODS

1.Create type 2 virtualization in VMWARE or any equivalent Open Source Tool. Allocate memory and storage space as per requirement. Install Guest OS on that VMWARE.

2.a.Shrink and extend virtual disk

- b. Create, Manage, Configure and schedule snapshots
- c. Create Spanned, Mirrored and Striped volume
- d. Create RAID 5 volume

30 PERIODS

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3.a.Desktop Virtualization using VNC
b.Desktop Virtualization using Chrome Remote Desktop
4.Create type 2 virtualization on ESXI 6.5 server
5.Create a VLAN in CISCO packet tracer
6.Install KVM in Linux
7.Create Nested Virtual Machine(VM under another VM)

COURSE OUTCOMES:

CO1: Analyze the virtualization concepts and Hypervisor

CO2: Apply the Virtualization for real-world applications

CO3: Install & Configure the different VM platforms

CO4: Experiment with the VM with various software

TOTAL :60 PERIODS

TEXT BOOKS

1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw-Hill , New Delhi – 2010

2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011

3. David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach

4. Chris Wolf, Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", APress, 2005.

5. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.

6. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006.

VERTICAL 3 CYBER SECURITY

COURSE NAME: CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIESL T P С

COURSE CODE:1911TV31

COURSE OBJECTIVES:

- To understand the basics of Blockchain
- To learn Different protocols and consensus algorithms in Blockchain •
- To learn the Blockchain implementation frameworks •
- To understand the Blockchain Applications •
- To experiment the Hyperledger Fabric, Ethereum networks •

UNIT I INTRODUCTION TO BLOCKCHAIN

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree

UNIT II BITCOIN AND CRYPTOCURRENCY

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay

UNIT III BITCOIN CONSENSUS

Bitcoin Consensus, Proof of Work (PoW)- HashcashPoW, Bitcoin PoW, Attacks on PoW, monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases.

UNIT IV HYPERLEDGER FABRIC & ETHEREUM

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

BLOCKCHAIN APPLICATIONS UNIT V

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Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance, etc- Case Study.

30 PERIODS

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COURSE OUTCOMES:

CO1: Understand emerging abstract models for Blockchain Technology

CO2: Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.

CO3: It provides conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they are enabled.

CO4: Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.

PRACTICAL EXERCISES

1. Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.

2. Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.

3. Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules.

4. Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric network.

5. Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabric to track and trace member rewards.

6. Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chain code while storing results and data in the starter plan

TOTAL: 60 PERIODS

TEXT BOOKS

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.

2. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly 2014.

REFERENCES:

1. Daniel Drescher, "Blockchain Basics", First Edition, Apress, 2017.

2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.

3. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015

4. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain", Packt Publishing

5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

30 PERIODS

COURSE NAME: CRYPTOGRAPHY AND CYBER SECURITY

COURSE CODE:191ITV32

COURSE OBJECTIVES:

- Learn to analyze the security of in-built cryptosystems.
- Know the fundamental mathematical concepts related to security.
- Develop cryptographic algorithms for information security.
- Comprehend the various types of data integrity and authentication schemes
- Understand cyber crimes and cyber security.

UNIT I INTRODUCTION TO SECURITY

Computer Security Concepts – The OSI Security Architecture – Security Attacks – Security Services and Mechanisms – A Model for Network Security – Classical encryption techniques: Substitution techniques, Transposition techniques, Steganography – Foundations of modern cryptography: Perfect security – Information Theory – Product Cryptosystem – Cryptanalysis.

UNIT II SYMMETRIC CIPHERS

Number theory – Algebraic Structures – Modular Arithmetic - Euclid's algorithm – Congruence and matrices – Group, Rings, Fields, Finite Fields SYMMETRIC KEY CIPHERS: SDES – Block Ciphers DES, Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Pseudorandom Number Generators – RC4 – Key distribution.

UNIT III ASYMMETRIC CRYPTOGRAPHY

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem – Chinese Remainder Theorem – Exponentiation and logarithm ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange – Elliptic curve arithmetic – Elliptic curve cryptography.

UNIT IV INTEGRITY AND AUTHENTICATION ALGORITHMS

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function: HMAC, CMAC – SHA – Digital signature and authentication protocols – DSS – Schnorr Digital Signature Scheme – ElGamal cryptosystem – Entity Authentication: Biometrics, Passwords, Challenge Response protocols – Authentication applications – Kerberos MUTUAL TRUST: Key management and distribution – Symmetric key distribution using symmetric and asymmetric encryption – Distribution of public keys – X.509 Certificates.

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UNIT V CYBER CRIMES AND CYBER SECURITY 9

Cyber Crime and Information Security – classifications of Cyber Crimes – Tools and Methods – Password Cracking, Keyloggers, Spywares, SQL Injection – Network Access Control – CloudSecurity – Web Security – Wireless Security

TOTAL:45 PERIODS

COURSE OUTCOMES:

CO1: Understand the fundamentals of networks security, security architecture, threats and vulnerabilities

CO2: Apply the different cryptographic operations of symmetric cryptographic algorithms

CO3: Apply the different cryptographic operations of public key cryptography

CO4: Apply the various Authentication schemes to simulate different applications.

CO5: Understand various cyber crimes and cyber security.

TEXT BOOKS

- 1. William Stallings, "Cryptography and Network Security Principles and Practice", Seventh Edition, Pearson Education, 2017.
- 2. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber crimes, Computer Forensics and Legal Perspectives", First Edition, Wiley India, 2011

REFERENCES

- 1. Behrouz A. Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata Mc Graw Hill, 2015.
- 2. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 2015.

COURSE NAME: DIGITAL AND MOBILE FORENSIC

COURSE CODE:191ITV33

COURSE OBJECTIVES:

- To understand basic digital forensics and techniques.
- To understand digital crime and investigation. •
- To understand how to be prepared for digital forensic readiness.
- To understand and use forensics tools for iOS devices.
- To understand and use forensics tools for Android devices.

INTRODUCTION TO DIGITAL FORENSICS UNIT I

Forensic Science - Digital Forensics - Digital Evidence - The Digital Forensics Process - Introduction - The Identification Phase - The Collection Phase - The Examination Phase - The Analysis Phase - The **Presentation Phase**

UNIT II DIGITAL CRIME AND INVESTIGATION

Digital Crime - Substantive Criminal Law - General Conditions - Offenses - Investigation Methods forCollecting Digital Evidence - International Cooperation to Collect Digital Evidence

UNIT III DIGITAL FORENSIC READINESS

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics

UNIT IV iOS FORENSICS

Mobile Hardware and Operating Systems - iOS Fundamentals - Jailbreaking - File System - Hardware iPhone Security - iOS Forensics - Procedures and Processes - Tools - OxygenForensics - MobilEdit - iCloud

UNIT V ANDROID FORENSICS

Android basics - Key Codes - ADB - Rooting Android - Boot Process - File Systems - Security - Tools -Android Forensics - Forensic Procedures - ADB - Android Only Tools - Dual Use Tools - Oxygen Forensics - MobilEdit - Android App Decompiling

COURSE OUTCOMES:

On completion of the course, the students will be able to:

- CO1: Have knowledge on digital forensics.
- CO2: Know about digital crime and investigations.
- CO3: Be forensic ready.
- CO4: Investigate, identify and extract digital evidence from iOS devices.
- CO5: Investigate, identify and extract digital evidence from Android devices.

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LAB EXPERIMENTS:

- 1. Installation of Sleuth Kit on Linux. List all data blocks. Analyze allocated as well as unallocated blocks of a disk image.
- 2. Data extraction from call logs using Sleuth Kit.
- 3. Data extraction from SMS and contacts using Sleuth Kit.
- 4. Install Mobile Verification Toolkit or MVT and decrypt encrypted iOS backups.
- 5. Process and parse records from the iOS system.
- 6. Extract installed applications from Android devices.
- 7. Extract diagnostic information from Android devices through the adb protocol.
- 8. Generate a unified chronological timeline of extracted records,

TOTAL : 60 PERIODS

TEXT BOOK:

- 1. Andre Arnes, "Digital Forensics", Wiley, 2018.
- 2. Chuck Easttom, "An In-depth Guide to Mobile Device Forensics", First Edition, CRCPress, 2022.

REFERENCES

1. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

30 PERIODS

COURSE CODE:1911TV34

COURSE OBJECTIVES:

- To understand the basics of computer based vulnerabilities. •
- To explore different foot printing, reconnaissance and scanning methods. ۲
- To expose the enumeration and vulnerability analysis methods.
- To understand hacking options available in Web and wireless applications.
- To explore the options for network protection. •
- To practice tools to perform ethical hacking to expose the vulnerabilities. •

UNIT I **INTRODUCTION**

Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer -The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security

UNIT II FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS

Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering - Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall

UNIT III ENUMERATION AND VULNERABILITY ANALYSIS

Enumeration Concepts - NetBIOS Enumeration - SNMP, LDAP, NTP, SMTP and DNS Enumeration -Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities-Vulnerabilities of Embedded Os

UNIT IV SYSTEM HACKING

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network - Wardriving- Wireless Hacking - Tools of the Trade -

UNIT V NETWORK PROTECTION SYSTEMS

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network- Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams - Honeypots.

PRACTICAL EXERCISES:

30 PERIODS 30 PERIODS

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- 1. Install Kali or Backtrack Linux / Metasploitable/ Windows XP
- 2. Practice the basics of reconnaissance.
- 3. Using FOCA / SearchDiggity tools, extract metadata and expand the target list.
- 4. Aggregates information from public databases using online free tools like Paterva's Maltego.
- 5. Information gathering using tools like Robtex.
- 6. Scan the target using tools like Nessus.
- 7. View and capture network traffic using Wireshark.
- 8. Automate dig for vulnerabilities and match exploits using Armitage

FOCA : http://www.informatica64.com/foca.aspx.

Nessus : http://www.tenable.com/products/nessus.

Wireshark : http://www.wireshark.org.

Armitage : http://www.fastandeasyhacking.com/.

Kali or Backtrack Linux, Metasploitable, Windows XP

COURSE OUTCOMES:

At the end of this course, the students will be able:

CO1: To express knowledge on basics of computer based vulnerabilities

CO2: To gain understanding on different foot printing, reconnaissance and scanning methods.

CO3 To demonstrate the enumeration and vulnerability analysis methods

CO4: To gain knowledge on hacking options available in Web and wireless applications.

CO5: To acquire knowledge on the options for network protection.

CO6: To use tools to perform ethical hacking to expose the vulnerabilities.

TOTAL:60 PERIODS

TEXTBOOKS

- 1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
- 2. The Basics of Hacking and Penetration Testing Patrick Engebretson, SYNGRESS, Elsevier, 2013.
- 3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

REFERENCES

1. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

COURSE NAME: MODERN CRYPTOGRAPHY

COURSE CODE:1911TV35

COURSE OBJECTIVES:

- To learn about Modern Cryptography.
- To focus on how cryptographic algorithms and protocols work and how to use them. ۲
- To build a Pseudorandom permutation.
- To construct Basic cryptanalytic techniques. •
- To provide instruction on how to use the concepts of block ciphers and message authentication ۲ codes.

UNIT I **INTRODUCTION**

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations.

UNIT II FORMAL NOTIONS OF ATTACKS

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM-CPA and NMCCA2,

Inter-relations among the attack model

UNIT III RANDOM ORACLES

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudorandom Functions (PRF)

UNIT IV BUILDING A PSEUDORANDOM PERMUTATION

The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction

MESSAGE AUTHENTICATION CODES UNIT V

Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes: Oneway functions Imply Secure One-time Signatures. Shamir's Secret Sharing Scheme. Formally Analyzing Cryptographic Protocols. Zero Knowledge Proofs and Protocols.

30 PERIODS

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PRACTICAL EXERCISES:

30 PERIODS

- 1. Implement Feige-Fiat-Shamir identification protocol.
- 2. Implement GQ identification protocol.
- 3. Implement Schnorr identification protocol.
- 4. Implement Rabin one-time signature scheme.
- 5. Implement Merkle one-time signature scheme.
- 6. Implement Authentication trees and one-time signatures.
- 7. Implement GMR one-time signature scheme

COURSE OUTCOMES:

CO1: Interpret the basic principles of cryptography and general cryptanalysis.

- CO2: Determine the concepts of symmetric encryption and authentication.
- CO3: Identify the use of public key encryption, digital signatures, and key establishment.
- CO4: Articulate the cryptographic algorithms to compose, build and analyze simple cryptographic solutions.

CO5: Express the use of Message Authentication Codes.

TOTAL:60 PERIODS

TEXT BOOKS:

- 1.Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications, Springer Verlag.
- 2. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low Priced Edition)

REFERENCES:

- 1.ShaffiGoldwasser and MihirBellare, Lecture Notes on Cryptography, Available at http://citeseerx.ist.psu.edu/.
- 2. OdedGoldreich, Foundations of Cryptography, CRC Press (Low Priced Edition Available), Part 1 and Part 23
- 3. William Stallings, "Cryptography and Network Security: Principles and Practice", PHI 3rd Edition, 2006.

COURSE NAME:NETWORK SECURITY

COURSE CODE:191ITV36

COURSE OBJECTIVES:

- To learn the fundamentals of cryptography. •
- To learn the key management techniques and authentication approaches. •
- To explore the network and transport layer security techniques.
- To understand the application layer security standards.
- To learn the real time security practices. •

UNIT I **INTRODUCTION**

Basics of cryptography, conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II KEY MANAGEMENT AND AUTHENTICATION

Key Management and Distribution: Symmetric Key Distribution, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure. User Authentication: Remote User-Authentication Principles, Remote User-Authentication Using Symmetric Encryption, Kerberos Systems, Remote User Authentication Using Asymmetric Encryption.

UNIT III ACCESS CONTROL AND SECURITY

Network Access Control: Network Access Control, Extensible Authentication Protocol, IEEE 802.1X Port-Based Network Access Control - IP Security - Internet Key Exchange (IKE). Transport-Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS standard, Secure Shell (SSH) application.

UNIT IV APPLICATION LAYER SECURITY

Electronic Mail Security: Pretty Good Privacy, S/MIME, DomainKeys Identified Mail. Wireless Network Security: Mobile Device Security

UNIT V SECURITY PRACTICES

Firewalls and Intrusion Detection Systems: Intrusion Detection Password Management, Firewall Characteristics Types of Firewalls, Firewall Basing, Firewall Location and Configurations. Blockchains, Cloud Security and IoT security

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PRACTICAL EXERCISES:

30 PERIODS

- 1. Implement symmetric key algorithms
- 2. Implement asymmetric key algorithms and key exchange algorithms
- 3. Implement digital signature schemes
- 4. Installation of Wire shark, tcpdump and observe data transferred in client-server communication using UDP/TCP and identify the UDP/TCP datagram.
- 5. Check message integrity and confidentiality using SSL
- 6. Experiment Eavesdropping, Dictionary attacks, MITM attacks
- 7. Experiment with Sniff Traffic using ARP Poisoning
- 8. Demonstrate intrusion detection system using any tool.
- 9. Explore network monitoring tools
- 10. Study to configure Firewall, VPN

COURSE OUTCOMES:

At the end of this course, the students will be able:

- CO1: Classify the encryption techniques
- CO2: Illustrate the key management technique and authentication.
- CO3 Evaluate the security techniques applied to network and transport layer

CO4: Discuss the application layer security standards.

CO5: Apply security practices for real time applications.

TOTAL:60 PERIODS

TEXT BOOKS:

1.Cryptography and Network Security: Principles and Practice, 6th Edition, William Stallings, 2014, Pearson, ISBN 13:9780133354690.

REFERENCES:

1. Network Security: Private Communications in a Public World, M. Speciner, R. Perlman, C. Kaufman, Prentice Hall, 2002.

- 2. Linux ip tables Pocket Reference, Gregor N. Purdy, O'Reilly, 2004, ISBN-13: 978-0596005696.
- 3. Linux Firewalls, by Michael Rash, No Starch Press, October 2007, ISBN: 978-1-59327-141-1.
- 4. Network Security, Firewalls And VPNs, J. Michael Stewart, Jones & Bartlett Learning, 2013, ISBN-10: 1284031675, ISBN-13: 978-1284031676.
- 5.The Network Security Test Lab: A Step-By-Step Guide, Michael Gregg, Dreamtech Press, 2015, ISBN-10:8126558148, ISBN-13: 978-8126558148.

COURSE NAME :SECURITY AND PRIVACY IN CLOUD

LTPC

COURSE CODE:1911TV37

COURSE OBJECTIVES:

- To Introduce Cloud Computing terminology, definition & concepts
- To understand the security design and architectural considerations for Cloud
- To understand the Identity, Access control in Cloud
- To follow best practices for Cloud security using various design patterns
- To be able to monitor and audit cloud applications for security

UNIT I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Nonrepudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II SECURITY DESIGN AND ARCHITECTURE FOR CLOUD

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key

UNIT III ACCESS CONTROL AND IDENTITY MANAGEMENT

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention

UNIT IV CLOUD SECURITY DESIGN PATTERNS

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud

UNIT V MONITORING, AUDITING AND MANAGEMENT

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management

30 PERIODS

PRACTICAL EXERCISES:

- 1. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm not present in Cloud Sim
- 2. simulate resource management using cloud sim
- 3. simulate log forensics using cloud sim

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- 4. simulate a secure file sharing using a cloud sim
- 5. Implement data anonymization techniques over the simple dataset (masking, k-anonymization,etc)
- 6. Implement any encryption algorithm to protect the images
- 7. Implement any image obfuscation mechanism
- 8. Implement a role-based access control mechanism in a specific scenario
- 9. implement an attribute-based access control mechanism based on a particular scenario
- 10. Develop a log monitoring system with incident management in the cloud

COURSE OUTCOMES:

CO1: Understand the cloud concepts and fundamentals.

- CO2: Explain the security challenges in the cloud.
- CO3: Define cloud policy and Identity and Access Management.
- CO4: Understand various risks and audit and monitoring mechanisms in the cloud.
- CO5: Define the various architectural and design considerations for security in the cloud.

TOTAL:60 PERIODS

TEXTBOOKS

- 1. Raj Kumar Buyya , James Broberg, andrzejGoscinski, -Cloud Computing: I, Wiley 2013
- 2. Dave shackleford, —Virtualization Security, SYBEX a wiley Brand 2013.
- 3. Mather, Kumaraswamy and Latif, -Cloud Security and Privacy, O'REILLY 2011

REFERENCES

1. Mark C. Chu-Carroll —Code in the Cloudl, CRC Press, 2011

2.Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyyaChristian Vecchiola, S. ThamaraiSelvi

COURSE NAME:SOCIAL NETWORK SECURITY

COURSE CODE:191ITV38

COURSE OBJECTIVES:

- To develop semantic web related simple applications
- To explain Privacy and Security issues in Social Networking
- To explain the data extraction and mining of social networks
- To discuss the prediction of human behavior in social communities
- To describe the Access Control, Privacy and Security management of social networks

UNIT I FUNDAMENTALS OF SOCIAL NETWORKING

Introduction to Semantic Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Social Network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis, Historical overview of privacy and security, Major paradigms, for understanding privacy and security

UNIT II SECURITY ISSUES IN SOCIAL NETWORKS

The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networked world

UNIT III EXTRACTION AND MINING IN SOCIAL NETWORKING DATA

Extracting evolution of Web Community from a Series of Web Archive, Detecting communities in social networks, Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Big data and Privacy

UNIT IV PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES

Understanding and predicting human behavior for social communities, User data Management, Inference and Distribution, Enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment, What is Neo4j, Nodes, Relationships, Properties.

UNIT V ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT 6

Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning

30 PERIODS

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COURSE OUTCOMES:

- CO1: Develop semantic web related simple applications
- CO2 : Address Privacy and Security issues in Social Networking
- CO3: Explain the data extraction and mining of social networks
- CO4: Discuss the prediction of human behavior in social communities
- CO5: Describe the applications of social networks

PRACTICAL EXERCISES:

- 1. Design own social media application
- 2. Create a Network model using Neo4j
- 3. Read and write Data from Graph Database
- 4. Find "Friend of Friends" using Neo4j
- 5. Implement secure search in social media
- 6. Create a simple Security & Privacy detector

TOTAL:60 PERIODS

TEXT BOOKS

- 1. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
- 2. BorkoFurht, Handbook of Social Network Technologies and Application, First Edition, Springer, 2010.
- 3. Learning Neo4j 3.x Second Edition By Jérôme Baton, Rik Van Bruggen, Packt publishing
- 4. David Easley, Jon Kleinberg, Networks, Crowds, and Markets: Reasoning about a Highly Connected Worldl, First Edition, Cambridge University Press, 2010.

REFERENCES

- 1. Easley D. Kleinberg J., Networks, Crowds, and Markets Reasoning about a Highly Connected Worldl, Cambridge University Press, 2010.
- 2. Jackson, Matthew O., Social and Economic Networksl, Princeton University Press, 2008.
- 3. GuandongXu ,Yanchun Zhang and Lin Li, —Web Mining and Social Networking -Techniques and applications, First Edition, Springer, 2011.
- 4. Dion Goh and Schubert Foo, Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively^{||}, IGI Global Snippet, 2008.
- 5. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modeling^I, IGI Global Snippet, 2009.
- 6. John G. Breslin, Alexander Passant and Stefan Decker, The Social Semantic Webl, Springer, 2009.

30 PERIODS

VERTICAL IV - CREATIVE MEDIA

COURSE NAME: AUGMENTED REALITY/VIRTUAL REALITY

COURSE CODE: 191ITV41

COURSE OBJECTIVES:

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications

INTRODUCTION

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System.

UNIT II

UNIT I

VR MODELING

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants –Object Hierarchies – Viewing the 3D World – Physical Modeling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.

UNIT III VR PROGRAMMING 6

APPLICATIONS

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

UNIT IV

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications - Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education.

UNIT V

AUGMENTED REALITY

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation-Navigation-Wearable devices.

30 PERIODS

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PRACTICAL EXERCISES:

- 1. Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.
- 2. Use the primitive objects and apply various projection types by handling camera.
- 3. Download objects from asset store and apply various lighting and shading effects.
- 4. Model three dimensional objects using various modelling techniques and apply textures over them.
- 5. Create three dimensional realistic scenes and develop simple virtual reality enabled mobileapplications which have limited interactivity.
- 6. Add audio and text special effects to the developed application.
- 7. Develop VR enabled applications using motion trackers and sensors incorporating fullhaptic interactivity.
- 8. Develop AR enabled applications with interactivity like E learning environment, Virtualwalkthroughs and visualization of historic places.
- 9. Develop AR enabled simple applications like human anatomy visualization, DNA/RNA structure visualization and surgery simulation.
- 10. Develop simple MR enabled gaming applications.

30 PERIODS

COURSE OUTCOMES:

On completion of the course, the students will be able to:

- CO1: Understand the basic concepts of AR and VR
- CO2: Understand the tools and technologies related to AR/VR
- CO3: Know the working principle of AR/VR related Sensor devices
- CO4: Design of various models using modeling techniques
- **CO5:** Develop AR/VR applications in different domains

TOTAL: 60 PERIODS

TEXTBOOKS:

- 1. Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VRexperiences for mobile", Packt Publisher, 2018
- 2. Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles & Practice", AddisonWesley, 2016
- 3. John Vince, "Introduction to Virtual Reality", Springer-Verlag, 2004.
- 4. William R. Sherman, Alan B. Craig: Understanding Virtual Reality Interface, Application, Design", Morgan Kaufmann, 2003.
COURSE NAME: DIGITAL MARKETING

COURSE CODE: 191ITV42

COURSE OBJECTIVES:

- The primary objective of this module is to examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
- It also focuses on how digital marketing can be utilized by organizations and howits effectiveness can be measured.

UNIT I INTRODUCTION TO ONLINE MARKET

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

UNIT II SEARCH ENGINE OPTIMISATION 6

Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement.

UNIT III E- MAIL MARKETING 6

E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation - Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting.

UNIT IV SOCIAL MEDIA MARKETING

Social Media Marketing - Social Media Channels- Leveraging Social media for brandconversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.

UNIT V DIGITAL TRANSFORMATION 6

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

30 PERIODS

PRACTICAL EXERCISES:

- 1. Subscribe to a weekly/quarterly newsletter and analyze how its content and structure aidwith the branding of the company and how it aids its potential customer segments.
- 2. Perform keyword search for a skincare hospital website based on search volume and competition using Google keyword planner tool.
- 3. Demonstrate how to use the Google WebMasters Indexing API
- 4. Discuss an interesting case study regarding how an insurance company manages leads.
- 5. Discuss negative and positive impacts and ethical implications of using social media forpolitical advertising.
- 6. Discuss how Predictive analytics is impacting marketing automation.

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COURSE OUTCOMES:

CO1: To examine and explore the role and importance of digital marketing in today'srapidly changing business environment.

CO2: To focuses on how digital marketing can be utilized by organizations and how itseffectiveness can be measured.

CO3: To know the key elements of a digital marketing strategy.

CO4: To study how the effectiveness of a digital marketing campaign can be measured

CO5: To demonstrate advanced practical skills in common digital marketing tools such as SEO,SEM, Social media and Blogs.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education;

2. First edition (July 2017);ISBN-10: 933258737X;ISBN-13: 978-9332587373.

Digital Marketing by Vandana Ahuja ;Publisher: Oxford University Press (April 2015). ISBN-10: 0199455449

3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler; Publisher: Wiley; 1st edition (April 2017); ISBN10: 9788126566938; ISBN 13: 9788126566938; ASIN: 8126566930.

4. Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited..

5. Barker, Barker, Bormann and Neher(2017), Social Media Marketing: A Strategic Approach, 2E South-Western ,Cengage Learning.

6. Pulizzi, J Beginner's Guide to Digital Marketing, Mcgraw Hill Education.

COURSE NAME: GAME DEVELOPMENT COURSE CODE: 1911TV43

L T P C 2 0 2 3

COURSE OBJECTIVES:

- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of a game engine.
- To survey the gaming development environment and tool kits.
- To learn and develop simple games using Pygame environment

UNIT I 3D GRAPHICS FOR GAME DESIGN 6

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation – Controller Based Animation.

UNIT II GAME DESIGN PRINCIPLES 6

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.

UNIT III GAME ENGINE DESIGN 6

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Pathfinding.

UNIT IV OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS 6

Pygame Game development – Unity – Unity Scripts – Mobile Gaming, Game Studio, UnitySingle player and Multi-Player games.

UNIT VGAME DEVELOPMENT USING PYGAME6

Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based arcade Games – Puzzle Games.

COURSE OUTCOMES:

CO1:Explain the concepts of 2D and 3d Graphics

CO2:Design game design documents.

CO3:Implementation of gaming engines.

CO4:Survey gaming environments and frameworks.

CO5:Implement a simple game in Pygame.

30 PERIODS

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EXPERIMENTS:

- 1. Installation of a game engine, e.g., Unity, Unreal Engine, familiarization of the GUI.Conceptualize the theme for a 2D game.
- 2. Character design, sprites, movement and character control
- 3. Level design: design of the world in the form of tiles along with interactive and collectibleobjects.
- 4. Design of interaction between the player and the world, optionally using the physicsengine.
- 5. Developing a 2D interactive using Pygame
- 6. Developing a Puzzle game
- 7. Design of menus and user interaction in mobile platforms.
- 8. Developing a 3D Game using Unreal
- 9. Developing a Multiplayer game using unity

30 PERIODS TOTAL: 60 PERIODS

REFERENCES

- 1. Sanjay Madhav, "Game Programming Algorithms and Techniques: A Platform AgnosticApproach", Addison Wesley, 2013.
- 2. Will McGugan, "Beginning Game Development with Python and Pygame: From Novice toProfessional", Apress,2007.
- 3. Paul Craven, "Python Arcade games", Apress Publishers, 2016.
- 4. David H. Eberly, "3D Game Engine Design: A Practical Approach to Real-Time ComputerGraphics", Second Edition, CRC Press,2006.
- 5. Jung Hyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC, 2011.

COURSE NAME: MULTIMEDIA AND ANIMATION COURSE CODE: 191ITV44 COURSE OBJECTIVES:

• To grasp the fundamental knowledge of Multimedia elements and systems

- To get familiar with Multimedia file formats and standards
- To learn the process of Authoring multimedia presentations
- To learn the techniques of animation in 2D and 3D and for the mobile UI
- To explore different popular applications of multimedia

UNIT I INTRODUCTION TO MULTIMEDIA 6

Definitions, Elements, Multimedia Hardware and Software, Distributed multimedia systems, challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata, Multimedia databases, Hypermedia, Multimedia Learning.

UNIT II MULTIMEDIA FILE FORMATS AND STANDARDS 6

File formats – Text, Image file formats, Graphic and animation file formats, Digital audio and Videofile formats, Color in image and video, Color Models. Multimedia data and file formats for the web.

UNIT III MULTIMEDIA AUTHORING 6

Authoring metaphors, Tools Features and Types: Card and Page Based Tools, Icon and ObjectBased Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools, Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing Tools, audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning, simulations.

UNIT IV ANIMATION 6

Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D,2 ½ D, and 3D animation, Animation techniques: Keyframe, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, , Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.

UNIT V MULTIMEDIA APPLICATIONS

Multimedia Big data computing, social networks, smart phones, surveillance, Analytics, Multimedia Cloud Computing, Multimedia streaming cloud, media on demand, security and forensics, Online social networking, multimedia ontology, Content based retrieval from digital libraries.

30 PERIODS

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LIST OF EXPERIMENTS:

Working with Image Editing tools:

Install tools like GIMP/ InkScape / Krita / Pencil and perform editing operations:

Ø Use different selection and transform tools to modify or improve an image

Ø Create logos and banners for home pages of websites.

Working with Audio Editing tools:

Ø Install tools like, Audacity / Ardour for audio editing, sound mixing and special effects like fade-in or fade-out etc.,

 \emptyset Perform audio compression by choosing a proper codec.

Working with Video Editing and conversion tools:

Install tools like OpenShot / Cinelerra / HandBrake for editing video content.

Ø Edit and mix video content, remove noise, create special effects, add

captions.

Ø Compress and convert video file format to other popular formats.

Working with web/mobile authoring tools:

Adapt / KompoZer/ BlueGriffon / BlueFish / Aptana Studio/ NetBeans / WordPress /ExpressionWeb:

Ø Design simple Home page with banners, logos, tables quick links etc

 \emptyset Provide a search interface and simple navigation from the home page to the inside pages of thewebsite.

 \emptyset Design Responsive web pages for use on both web and mobile interfaces.

Working with Animation tools:

Install tools like, Krita, Wick Editor,

Blender:

Ø Perform a simple 2D animation with

sprites

Ø Perform simple 3D animation with keyframes, kinematics

• Working with Mobile UI animation tools: Origami studio / Lottie / Framer etc.,

Working with E-Learning authoring tools:

Install tools like EdApp / Moovly / CourseLab/ IsEazy and CamStudio/Ampache, VideoLAN:

Ø Demonstrate screen recording and further editing for e-learning content.

Ø Create a simple E-Learning module for a topic of your choice.

Creating VR and AR applications:

Ø Any affordable VR viewer like Google Cardboard and any development platform like Openspace 3D / ARCore etc.

Note: all tools listed are open source. Usage of any proprietary tools in place of open source tools is not restricted.

30 PERIODS TOTAL: 60 PERIODS

WEB REFERENCES:

- 1. https://itsfoss.com/
- 2. https://www.ucl.ac.uk/slade/know/3396
- 3. https://handbrake.fr/
- 4. https://opensource.com/article/18/2/open-source-audio-visualproduction-tools <u>https://camstudio.org/</u>
- 5. <u>https://developer.android.com/training/animation/overview</u>
- 6. https://developer.android.com/training/animation/overview (UNIT-IV)

COURSE OUTCOMES:

- Get the bigger picture of the context of Multimedia and its applications
- Use the different types of media elements of different formats on content pages
- Author 2D and 3D creative and interactive presentations for different target multimediaapplications.
- Use different standard animation techniques for 2D, 21/2 D, 3D applications
- Understand the complexity of multimedia applications in the context of cloud, security, bigdata streaming, social networking, CBIR etc.,

TEXT BOOKS:

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of Multimedia", Third Edition, Springer Texts in Computer Science, 2021. (UNIT-I, II, III)

REFERENCES:

- 1. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC press, 3rd Edition, 2016.
- 2. Gerald Friedland, Ramesh Jain, "Multimedia Computing", Cambridge University Press, 2018.
- 3. Prabhat K.Andleigh, Kiran Thakrar, "Multimedia System Design", Pearson Education, 1st Edition, 2015.
- Mohsen Amini Salehi, Xiangbo Li, "Multimedia Cloud Computing Systems", SpringerNature, 1st Edition, 2021.
- 5. Mark Gaimbruno, "3D Graphics and Animation", Second Edition, New Riders, 2002.
- Rogers David, "Animation: Master A Complete Guide (Graphics Series)", Charles RiverMedia, 2006.
- Rick parent, "Computer Animation: Algorithms and Techniques", Morgan Kauffman, 3rdEdition, 2012.

COURSE NAME: MULTIMEDIA DATA COMPRESSION AND STORAGE L T P C

COURSE CODE: 191ITV45

COURSE OBJECTIVES:

- To understand the basics of compression techniques
- To understand the categories of compression for text, image and video
- To explore the modalities of text, image and video compression algorithms
- To know about basics of consistency of data availability in storage devices
- To understand the concepts of data streaming services

UNIT I BASICS OF DATA COMPRESSION

Introduction —Lossless and LossyCompression– Basics of Huffmann coding- Arithmetic coding- Dictionary techniques- Context based compression – Applications

UNIT II IMAGE COMPRESSION

Lossless Image compression – JPEG-CALIC-JPEG LS-Prediction using conditional averages – Progressive Image Transmission – Lossless Image compression formats – Applications – Facsimile encoding

UNIT III VIDEO COMPRESSION 6

Introduction – Motion Compensation – Video Signal Representation – H.261 – MPEG-1-MPEG-2- H.263.

UNIT IVDATA PLACEMENT ON DISKS6Statistical placement on Disks – Striping on Disks – Replication Placement on Disks –
Constraint allocation on Disks – Tertiary storage Devices – Continuous Placement on
Hierarchical storage system – Statistical placement on Hierarchical storage system6

UNIT VDISK SCHEDULING METHODS6Scheduling methods for disk requests – Feasibility conditions of concurrent streams–

Scheduling methods for disk requests – Feasibility conditions of concurrent streams– Scheduling methods for request streams

LIST OF EXPERIMENTS

- 1. Construct Huffman codes for given symbol probabilities.
- 2. Encode run lengths with fixed-length code.
- 3. Lempel-Ziv algorithm for adaptive variable-length encoding
- 4. Compress the given word using arithmetic coding based on the frequency of the letters.
- 5. Write a shell script, which converts all images in the current directory in JPEG.
- 6. Write a program to split images from a video without using any primitives.
- 7. Create a photo album of a trip by applying appropriate image dimensions and format.
- 8. Write the code for identifying the popularity of content retrieval from media server.
- 9. Write the code for ensuring data availability in disks using strip based method.
- 10. Program for scheduling requests for data streams.

30 PERIODS

30 PERIODS

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TOTAL: 60 PERIODS

COURSE OUTCOMES:

- CO1: Understand the basics of text, Image and Video compression
- CO2: Understand the various compression algorithms for multimedia content
- CO3: Explore the applications of various compression techniques
- **CO4**: Explore knowledge on multimedia storage on disks
- **CO5**: Understand scheduling methods for request streams

TEXT BOOKS

- 1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Series in MultimediaInformation and Systems, 2018, 5th Edition.
- 2. Philip K.C.Tse, Multimedia Information Storage and Retrieval: Techniques andTechnologies, 2008

REFERENCES

- 1. David Salomon, A concise introduction to data compression, 2008.
- 2. Lenald Best, Best's Guide to Live Stream Video Broadcasting, BCB Live Teaching series, 2017.
- 3. Yun-Qing Shi, Image And Video Compression For Multimedia Engineering FundamentalsAlgorithms And Standards, Taylor& Francis,2019
- 4. Irina Bocharova, Compression for Multimedia, Cambridge University Press; 1st edition,2009.

COURSE NAME: UI AND UX DESIGN

COURSE CODE: 1911TV46

COURSE OBJECTIVES:

- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- To understand the various Research Methods used in Design
- To explore the various Tools used in UI & UX
- Creating a wireframe and prototype

UNIT I FOUNDATIONS OF DESIGN

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy

UNIT II FOUNDATIONS OF UI DESIGN

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides

UNIT III FOUNDATIONS OF UX DESIGN

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals

UNIT IV WIREFRAMING, PROTOTYPING AND TESTING

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration

UNIT V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE 6

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods -Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture

30 PERIODS

LIST OF EXPERIMENTS

- 1. Designing a Responsive layout for an societal application
- 2. Exploring various UI Interaction Patterns
- 3. Developing an interface with proper UI Style Guides
- 4. Developing Wireflow diagram for application using open source software
- 5. Exploring various open source collaborative interface Platform
- 6. Hands on Design Thinking Process for a new product
- 7. Brainstorming feature for proposed product
- 8. Defining the Look and Feel of the new Project
- 9. Create a Sample Pattern Library for that product (Mood board, Fonts, Colors based on Ulprinciples)

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- 10. Identify a customer problem to solve
- 11. Conduct end-to-end user research User research, creating personas, Ideation process (Userstories, Scenarios), Flow diagrams, Flow Mapping
- 12. Sketch, design with popular tool and build a prototype and perform usability testing andidentify improvements

30 PERIODS TOTAL: 60 PERIODS

COURSE OUTCOMES:

On completion of the course, the students will be able to:

CO1:Build UI for user Applications

CO2:Evaluate UX design of any product or application

CO3:Demonstrate UX Skills in product development

CO4:Implement Sketching principles

CO5:Create Wireframe and Prototype

TEXT BOOKS

- 1. Joel Marsh, "UX for Beginners", O'Reilly, 2022
- Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" O'Reilly2021

REFERENCES

- Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3 rd Edition ,O'Reilly 2020
- 2. Steve Schoger, Adam Wathan "Refactoring UI", 2018
- Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web &Mobile", Third Edition, 2015
- 4. https://www.nngroup.com/articles/
- 5. <u>https://www.interaction-design.org/literature</u>.

30 PERIODS

COURSE NAME: VIDEO CREATION AND EDITING COURSE CODE: 191ITV47 COURSE OBJECTIVES:

- To introduce the broad perspective of linear and nonlinear editing concepts. •
- To understand the concept of Storytelling styles. •
- To be familiar with audio and video recording. To apply different media tools.
- To learn and understand the concepts of AVID XPRESS DV 4.

UNIT I FUNDAMENTALS 6

Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression risks associated with altering reality through editing.

UNIT II STORYTELLING

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - mechanics of digital editing - pointer files - media management.

UNIT III USING AUDIO AND VIDEO 6

Capturing digital and analog video importing audio putting video on exporting digital video to tape recording to CDs and VCDs.

UNIT IV WORKING WITH FINAL CUT PRO 6

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas -Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques - Working with Audio - Using Media Tools - Viewing and Setting Preferences.

UNIT V WORKING WITH AVID XPRESS DV 4 6

Starting Projects and Working with Project Window - Using Basic Tools and Logging -Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode - Working with Audio - Output Options.

30 PERIODS

LIST OF EXPERIMENTS

- 1. Write a Movie Synopsis (Individual/Team Writing)
- 2. Present team stories in class.
- 3. Script/Storyboard Writing(Individual Assignment)
- 4. Pre-Production: Personnel, budgeting, scheduling, location scouting, casting, contracts & agreements
- 5. Production: Single camera production personnel & equipment, Documentary Production
- 6. Writing The Final Proposal: Overview, Media Treatments, Summary, Pitching
- 7. Write Documentary & Animation Treatment
- 8. Post-production: Editing, Sound design, Finishing

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COURSE OUTCOMES:

On completion of the course, the students will be able to:

CO1:Compare the strengths and limitations of Nonlinear editing.

CO2:Identify the infrastructure and significance of storytelling.

CO3:Apply suitable methods for recording to CDs and VCDs. CO4:Address the core issues of advanced editing and training techniques.

CO5:Design and develop projects using AVID XPRESS DV 4

TEXT BOOKS

- 1. Avid Xpress DV 4 User Guide, 2007.
- 2. Final Cut Pro 6 User Manual, 2004.
- 3. Keith Underdahl, "Digital Video for Dummies", Third Edition, Dummy Series, 2001.
- 4. Robert M. Goodman and Partick McGarth, "Editing Digital Video: The Complete Creativeand Technical Guide", Digital Video and Audio, McGraw Hill 2003.

COURSE NAME: VISUAL EFFECTS COURSE CODE: 1911TV48

COURSE OBJECTIVES

- To get a basic idea on animation principles and techniques
- To get exposure to CGI, color and light elements of VFX
- To have a better understanding of basic special effects techniques
- To have a knowledge of state of the art vfx techniques
- To become familiar with popular compositing techniques

UNIT I ANIMATION BASICS

VFX production pipeline, Principles of animation, Techniques: Keyframe, kinematics, Full animation, limited animation, Rotoscoping, stop motion, object animation, pixilation, rigging, shape keys, motion paths.

UNIT II CGI, COLOR, LIGHT 6

CGI – virtual worlds, Photorealism, physical realism, function realism, 3D Modeling and Rendering: color - Color spaces, color depth, Color grading, color effects, HDRI, Light – Area and mesh lights, image based lights, PBR lights, photometric light, BRDF shading model

UNIT III SPECIAL EFFECTS

Special Effects – props, scaled models, animatronics, pyrotechniques, Schüfftan process, Particleeffects – wind, rain, fog, fire

UNIT IV VISUAL EFFECTS TECHNIQUES

Motion Capture, Matt Painting, Rigging, Front Projection.Rotoscoping, Match Moving – Tracking, camera reconstruction, planar tracking, Calibration, Point Cloud Projection, Ground plane determination, 3D Match Moving

UNIT V COMPOSITING

Compositing – chroma key, blue screen/green screen, background projection, alpha compositing, deep image compositing, multiple exposure, matting, VFX tools - Blender, Natron, GIMP.

Laboratory Experiments:

Using Natron:

- Understanding Natron Environment:
- Working with color and using color grading
- using Channels
- Merging images
- Using Rotopaint

30 PERIODS

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- performing Tracking and stabilizing
- Transforming elements
- Stereoscopic compositing

Using Blender:

- Ø Motion Tracking camera and object tracking
- Ø Camera fx, color grading, vignettes
- Ø Compositing images and video files
- Ø Multilayer rendering

30 PERIODS TOTAL: 60 PERIODS

COURSE OUTCOMES

At the end of the course, the student will be able to:

CO1:To implement animation in 2D / 3D following the principles and techniques
CO2:To use CGI, color and light elements in VFX applications
CO3:To create special effects using any of the state of the art tools
CO4:To apply popular visual effects techniques using advanced tools
CO5:To use compositing tools for creating VFX for a variety of applications

TEXT BOOKS:

- 1. Chris Roda, Real Time Visual Effects for the Technical Artist, CRC Press, 1st Edition, 2022.
- 2. Steve Wright, Digital Compositing for film and video, Routledge, 4th Edition, 2017.
- 3. John Gress, Digital Visual Effects and Compositing, New Riders Press, 1st Edition, 2014.

REFERENCES:

- 1. Jon Gress, "Digital Visual Effects and Compositing", New Riders Press, 1st Edition, 2014.
- 2. Robin Brinkman, The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics", Morgan Kauffman, 2008.
- 3. Luiz Velho, Bruno Madeira, "Introduction to Visual Effects A Computational Approach", Routledge, 2023.

4. Jasmine Katatikarn, Michael Tanzillo, "Lighting for Animation: The art of visual storytelling

, Routledge, 1st Edition, 2016.

- 5. Eran Dinur, "The Complete guide to Photorealism, for Visual Effects, Visualization
- Jeffrey A. Okun, Susan Zwerman, Christopher McKittrick, "The VES Handbook of Visual Effects: Industry Standard VFX Practices and Procedures", Third Edition, 2020.and Games", Routledge, 1st Edition, 2022.
- 7. https://www.blender.org/features/vfx/
- 8. https://natrongithub.github.io/

VERTICAL V

COURSE NAME: PHYSICS TO QUANTUM COMPUTING

COURSE CODE: 191ITV51

	SYLLABUS		T	P	C	
UNIT-I	PHOTONS AND WAVE-PARTICLE DUALITY	3	0	0	<u> 3</u> 9	
Introduction–Young's Double Slit Experiment– Photoelectric effect: Einstein's Quanta – Experiment of Aspect and Collaborators-Properties of Photon-A Diffraction Experiments with Photons-Young's Double-Slit Experiment Revisited- Three Rules of Quantum Mechanics- Two-Slit Which-Way Experiment.						
UNIT-II	THE MACHINERY OF QUANTUM MECHANICS				9	
Introduction–Schrodinger's Equation–Observables-Spectral Theory–Dirac Notation.						
UNIT-III	MEASUREMENT				9	
Introduction–VON Neumann Measurement-Uncertainty Principle–No-Cloning Theorem– Quantum Zero Effect.						
UNIT-IV	INTERACTION FREE MEASUREMENTS				9	
Introduction-Seeing in the Dark: Conceptual Scheme-Elitzur-Vaidman Scheme- Optimal Interaction-Free Measurements						
UNIT-V	EPR PARADOX				9	
Introduction–Hallmarks of Physical Theories–EPR and Reality–Bell's Theorem- Mermin's Reality Machine.						

TEXTBOOKS

1. Reinhold Blumel., "Foundations of Quantum Mechanics-From Photons to Quantum Computers" formation", Jones nad Bartlett Publishers, Sudbury, Massachusetts, 2010

COURSE NAME: QUANTUM CIRCUITS

COURSE CODE: 1911TV52

	SYLLABUS	L	Τ	P	С		
		3	0	0	3		
UNIT-I	INTRODUCTION				9		
Introduction-	Quantum Mechanics and Quantum Logic- Quantum Computation and Circuit Desgn-	Bool	ean	Log	gic –		
Quantum Log	gic- Qubits and Measurements- Quantum Operations-Quantum Circuit and Gate Librari	es.					
UNIT-II	REPRESENTATION OF QUANTUM FUNCTIONALITY				9		
From Conver	tional to Quantum Logic–Decision Diagrams for Quantum Logic – Binary Decision Di	agra	m-				
Quantum Decision Diagram- Characteristics Function- Quantum Multiple Valued Decision Diagrams- Basic							
concepts- Formal Definition- Canonicity- Construction and Manipulation-Changing the variable order.							
UNIT-III	CHALLENGES AND INITIAL APPROACHES				9		
Design Chall	enges–Initial Synthesis Approaches- Synthesis of Boolean Components- Synthesis of A	rbitr	ary				
Quantum Fur	nctionality.						
UNIT-IV	SYNTHESIS OF QUANTUM CIRCUIT				9		
Synthesis of	Boolean Components, Embedding: Handling Irreversible Function Descriptions- Constr	ructio	ons o	of			
QMDDs for I	Boolean Functions- QMDD-Based Synthesis of Reversible Circuits-Synthesis of Cliffor	rd Gr	roup				
Operatons-Co	oncepts of the Synthesis Approach- Algorithm- Theoretical Analysis- Experimental Res	ults.					
UNIT-V	CORRECTNESS OF MULTIPLE-VALUED IMPLEMENTATION	S			9		
Multi-lelvel Quantum Systems-Equivalence Checking in Multi-level Quantum Systems- Functional Equivalence of							
Quantum Op	erations-Proposed Equivalence Checking Schemen- Implementation Using QMDDs.						

TEXTBOOKS	S
1. Philip .2017	p iemann, Robert Wille,"Compact Representations for the Design of Quantum Logic", Springer

COURSE NAME: QUANTUM COMPUTER SYSTEMS DESIGN

COURSE CODE: 191ITV53

COURSE OBJECTIVES:

- To know the background of classical computing and quantum computing.
- To learn the fundamental concepts behind quantum computation.
- To study the details of quantum mechanics and its relation to Computer Science.
- To gain knowledge about the basic hardware and mathematical models of quantumcomputation.
- To learn the basics of quantum information and the theory behind it.

	SYLLABUS	L	Т	P	С
		3	0	0	3
UNIT-I	QUANTUM COMPUTING BASIC CONCEPTS				6
Complex Nur	mbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of				
Quantum Me	chanics – Quantum Bits - Representations of Qubits - Superpositions				
UNIT-II	QUANTUM GATES AND CIRCUITS				5
Universal log	gic gates - Basic single qubit gates - Multiple qubit gates - Circuit development -				
Quantum erro	or correction				
UNIT-III	QUANTUM ALGORITHMS				7
Quantum par	allelism - Deutsch's algorithm - The Deutsch-Jozsa algorithm - Quantum Fourier			•	
transform and	l its applications - Quantum Search Algorithms: Grover's Algorithm				
UNIT-IV	QUANTUM INFORMATION THEORY				6
Data compres	ssion - Shannon's noiseless channel coding theorem - Schumacher's quantumnoiseless			•	
channel codir	ng theorem - Classical information over noisy quantum channels				
UNIT-V	QUANTUM CRYPTOGRAPHY				6
Classical cry	ptography basic concepts - Private key cryptography - Shor's Factoring Algorithm -	Quar	ntum	Ke	у
Distribution -	BB84 - Ekart 91.				

30 PERIODS

PRACTICAL EXERCISES

- 1. Single qubit gate simulation Quantum Composer
- 2. Multiple qubit gate simulation Quantum Composer
- 3. Composing simple quantum circuits with q-gates and measuring the output into classicalbits.
- 4. IBM Qiskit Platform Introduction
- 5. Implementation of Shor's Algorithms
- 6. Implementation of Grover's Algorithm
- 7. Implementation of Deutsch's Algorithm
- 8. Implementation of Deutsch-Jozsa's Algorithm
- 9. Integer factorization using Shor's Algorithm
- 10. QKD Simulation
- 11. Mini Project such as implementing an API for efficient search using Grover's Algorithms

COURSE OUTCOMES:

On completion of the course, the students will be able to:

CO1: Understand the basics of quantum computing.

CO2: Understand the background of Quantum Mechanics.

CO3: Analyze the computation models.

CO4: Model the circuits using quantum computation.environments and frameworks.

CO5: Understand the quantum operations such as noise and error-correction.

TEXTBOOKS:

- 1. Parag K Lala, Mc Graw Hill Education, "Quantum Computing, A Beginners Introduction", First edition (1 November 2020).
- 2. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, 2010.
- 3. Chris Bernhardt, The MIT Press; Reprint edition (8 September 2020), "Quantum Computingfor Everyone".

REFERENCES

1. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013.

2. N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge UniversityPress, 2007.

COURSE NAME: QUANTUM COMPUTING ARCHITECTURE AND ALGORITHMS

	CN71 I ADIG	T	m	D		
	SILLABUS	L 3	1	P 0		
UNIT-I	QUANTUM ARCHITECTURES	5	U		9	
Bits Vs Qubits–Reliable and realistic implementation technology– Robust Error Correction and Fault –Tolerant Structures-Quantum Resource Distribution-Simulation of Error Propagation- Stabilizer Method for Quantum Simulation.						
UNIT-II	ARCHITECTURAL ELEMENTS				9	
Quantum Processing Elements–Quantum Memory Hierarchy–Quantum Addressing Scheme for Classica Memory-Error Correction and Quantum Architecture Design-Teleportation-Based Quantum Architectures.					al	
UNIT-III	QUANTUM ALGORITHMS				9	
Quantum Integer Factorization–Order Finding- Quantum Phase Estimation–Eigenvalue Estimation–The Hidden Subgroup Problem- Grover's Algorithm for Quantum Search-Quantum Adiabatic Algorithms.						
UNIT-IV	PROGRAMMING THE QUANTUM ARCHITECTURE				9	
Physical Level Instruction Scheduling- High Level Compiler Design- Architecture Independent Circuit Synthesis- Mapping Circuits to Architecture- Optimization of the Logical Qubit Tiles.						
UNIT-V	ION-TRAP QUANTUM COMPUTER				9	
Introduction–Linear Radio-Frequency Ion Trap–Laser Cooling–Cirac-Zoller Scheme-Ca+ Quantum Computere.						

TEXTBOOKS

1. Tzvetan. Metodi , Arvin I. Faruque, Frederic T. Chong, "Quantum Computing for Computer Architects", Springer Nature Switzerland, Morgan & Claypool, 2011

COURSE NAME: QUANTUM INFORMATION

	SYLLABUS	L	Τ	P	С	
		3	0	0	3	
UNIT-I	CLASSICAL INFORMATION THEORY				9	
A very short history–Probabilities and conditional probabilities– Entropy and Information – Information and Thermodynamics-Communication Theory.						
UNIT-II	QUANTUM COMMUNICATION AND QUANTUM KEY DISTRIBU	TIO	N		9	
Qubits-Information security-Quantum copying-Optical polarization-Quantum cryptography.						
UNIT-III	GENARALIZED MEASUREMENTS				9	
Ideal vonNeumann measurements–Non-Ideal measurements-Probability operator measures–Optimized measurements– Operations and the post-measurement state.						
UNIT-IV	ENTANGLEMENT AND ITS APPLICATIONS				9	
Entangled states and non-locality-Quantum magic tricks-Ebits and shared entanglement, Quantum dense coding- Teleportation.						
UNIT-V	QUANTUM COMPUTATION				9	
Digital electronics–Principles of quantum computation–Quantum algorithms–Errors and decoherence						

TEXTBOOKS

1. Stephen M. Barnett.,"Introduction to Quantum Information", Oxford University Press,

COURSE NAME: QUANTUM INTERNET

	SYLLABUS L T P				
UNIT-I	QUANTUM NETWORKS	9			
Quantum Channels– Quantum Processes- Quantum Process Matrices- Quantum Processes in Quantum Networks-Characterizing Quantum States and Channels-Optical Encoding of Quantum Information- Single Photons- Photon Number- Spatiotemporal- Phase Space- Nonoptical Encoding-Error in Quantum Networks.					
UNIT-II	QUANTUM COST VECTOR ANALYSIS AND ROUTING STRATEGIES	9			
Quantum Cost Vector Analysis– Costs- Costs as Distance Metrics- Routing Strategies- Single User- Multiple User- Interconnecting and Interfacing Quantum Networks- Optical Interfacing.					
UNIT-III	PROTOCOLS FOR QUANTUM INTERNET	9			
Optical Routers–Mechanical Switches- Interferometric Switches- Two Channel Two Port Swiches- Multiplexers and Demultiplexers- Single Channel Multiport Swithes- Multichannel Multiport Switches- Crossbar Switches- Optical Stability-State Preparation-Measurement-Evolution- High level Protocols					
UNIT-IV	ENTANGLEMENT DISTRIBUTION	9			
Entanglemer Networks- F Repeaters- T	nt- The Ultimate Quantum Resource- Bell States- GHZ States- Cluster States- Quantum Repeater irst Generation Repeaters- Second Generation Repeaters and Error Correction- Third Generation 'he Transition to Quantum Netwroks-The Irrelevance of Latency- The Quantum Sneakernet				
UNIT-V	QUANTUM CRYPTOGRAPHYAND QUANTUM CLOUD	9			
Quantum Cryptography- Quantum Key Distribution- Hybrid Quantum Classical Cryptography- Quantum Anonymous Broadcasting- Quantum Voting- Attacks on Quantum Cryptograpy - Beam Splitter and Photon Number Splitting Attacks- Trojan Horse and Flashback Attacks- Detector Attacks-Quantum Cloud- Outsourced Quantum Computation- Distributed Quantum Computing- Delegated Quantum Computation					

TEXTBOOKS

1. Peter P. Rohde, "The Quantum Internet: The Second Quantum Revolution", Cambridge University Press ,2021

COURSE NAME: QUANTUM MECHANICS AND ATOMS

		-			
	SYLLABUS				
UNIT-I	INTRODUCTION	5	U	9	
Introduction– The Mass and Size of the Atom- Isotopes- The Nucleus of the AtomRobust Error Correction and Fault–Tolerant Structures-Quantum Resource Distribution-Simulation of Error Propagation- Stabilizer Method for Quantum Simulation.					
UNIT-II	THE PHOTN, ELECTRON AND WAVES			9	
Wave Character of Light–Thermal Radiation- The Photoelectric Effect, The Compton Effect, Production of Free Electrons, The Charge of Electron, Wave Character of Electron- Some Basic Properties of Matter Waves					
UNIT-III	MATHEMATICAL FRAMEWORK OF QUANTUM THEORY			9	
The Particle of the Hydro	in a Box–The Schrodinger Equation-The Conceptual Basis of Quantum Theory- Bohr' ogen Atom.	s Mo	del		
UNIT-IV	QUANTUM MECHANICS OF ATOM			9	
Quantum Mechanics of the Hydrogen Aton, Motion in a central Field, Angular Momentum Eigen functions- The radial Wave functions in a central field, The Radial Wave functions of Hydrogen-Lifting of the Orbital Degeneracy in the Spectra of Alkalai Atoms- Shell Structure, Screening, The Term Diagram- Inner shells.					
UNIT-V	ATOMS IN MAGNETIC FIELD AND ELECTRIC FIELD			9	
Directional Quantization in a Magnetic Field- Electron Spin Resonance–The Zeeman Effect-Quantum Theory of the Ordinary Zeeman Effect, Quantum Theoretical Treatment of the Electron and Proton Spins-Atoms in Electric Field-Observation of the Stark Effect- Quantum Theory of the Linear and Quadratic Stark Effects-Spin and Photon Echoes.					

TEXTBOOKS

1. H.Haken, H.C. Wolf, "Atomic and Quantum Physics: An Introduction to the Fundamentals of Experiment and Theory", Springer – Verlag, Berlin Heidelberg , New York , Tokyo, 1984

COURSE NAME: QUANTUM ML

	SYLLABUS L T 3 0	P C				
UNIT-I	CLUSTERING STRUCTURE AND QUANTUM COMPUTING	9				
Quantum Random Access Memory- Calculating Dot Products- Quantum Principal Component Analysis- Toward Quantum Manifold Embedding- Quantum K-Means- Quantum K-Medians- Quantum Hierarchical Clustering- Computational Complexity.						
UNIT-II	QUANTUM PATTERN RECOGNITION	9				
Quantum Associative Memory- The Quantum Perception- Quantum Neural Networks- Physical Realizations- Computational Complexity.						
UNIT-III	QUANTUM CLASSIFICAITON	9				
Nearest Neigh Speedup- Cor	bors- Support Vector Machines with Grover's Search- Support Vector Machines with Exponent nputational Complexity	ial				
UNIT-IV	QUANTUM PROCESS TOMOGRAPHY AND REGRESSION	9				
Quantum State Duality- Quantum Process Tomography- Groups- Representation Theory- Parallel Application and Storage of the Unitary- Optimal State for Learning.						
UNIT-V	BOOSTING AND ADIABATIC QUANTUM COMPUTING	9				
Quantum Ar	nnealing- Quadratic Unconstrained Binary Optimization- Ising Model- QBoost- Nonconvexity-					

Sparsity- Bit Depth- Generalization Performance- Mapping to Hardware- Computational Complexity

TEXTBOOKS

1. Peter Wittek,"Quantum Machine Learning: What Quantum Computing Means to Data Mining ", Elsevier ,2014

VERTICLE VI – DATA SCIENCE

COURSE NAME: BUSINESS ANALYTICS

COURSE CODE: 191ITV61

COURSE OBJECTIVES:

- To understand the Analytics Life Cycle.
- To comprehend the process of acquiring Business Intelligence
- To understand various types of analytics for Business Forecasting
- To model the supply chain management for Analytics.
- To apply analytics for different functions of a business

	SYLLABUS	L	Τ	Р	С
		2	0	2	3
UNIT-I	INTRODUCTION TO BUSINESS ANALYTICS				6
Analytics and	Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definit	tion -	-		
Data Collecti	on - Data Preparation - Hypothesis Generation - Modeling - Validation and Evaluat	ion -	-		
Interpretation – Deployment and Iteration					
UNIT-II	BUSINESS INTELLIGENCE				6
Data Wareho	uses and Data Mart - Knowledge Management -Types of Decisions - Decision M	akinş	3		
Process - Dec	ision Support Systems – Business Intelligence – OLAP – Analytic functions				
UNIT-III	BUSINESS FORECASTING				6
Introduction	Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models - Data				
Mining and P	redictive Analysis Modelling – Machine Learning for Predictive analytics.				
UNIT-IV	HR & SUPPLY CHAIN ANALYTICS				6
Human Reso	urces – Planning and Recruitment – Training and Development - Supply chain netw	ork ·	-		
Planning Den	nand, Inventory and Supply - Logistics - Analytics applications in HR & Supply Cl	nain	-		
Applying HR	Analytics to make a prediction of the demand for hourly employees for a year.				
UNIT-V	MARKETING & SALES ANALYTICS				6
Marketing Str	rategy, Marketing Mix, Customer Behaviour -selling Process - Sales Planning - Ana	lytics	s		
applications in Marketing and Sales - predictive analytics for customers' behaviour in marketing and					
sales.					
1					

30 PERIODS

LIST OF EXPERIMENTS:

Use MS-Excel and Power-BI to perform the following experiments using a Business data set, and make presentations. Students may be encouraged to bring their own real-time socially relevant data set. I Cycle – MS Excel 1. Explore the features of Ms-Excel. 2. (i) Get the input from user and perform numerical operations (MAX, MIN, AVG, SUM, SQRT, ROUND) ii) Perform data import/export operations for different file formats. 3. Perform statistical operations - Mean, Median, Mode and Standard deviation, Variance, Skewness. Kurtosis 4. Perform Z-test, T-test & ANOVA 5. Perform data pre-processing operations i) Handling Missing data ii) Normalization 6. Perform dimensionality reduction operation using PCA, KPCA & SVD 7. Perform bivariate and multivariate analysis on the dataset. 8. Apply and explore various plotting functions on the data set. II Cycle – Power BI Desktop 9. Explore the features of Power BI Desktop 10. Prepare & Load data 11. Develop the data model 12. Perform DAX calculations 13. Design a report 14. Create a dashboard and perform data analysis 15. Presentation of a case study

30 PERIODS TOTAL: 60 PERIODS

COURSE OUTCOMES:

CO1: Explain the real world business problems and model with analytical solutions.

CO2: Identify the business processes for extracting Business Intelligence

CO3: Apply predictive analytics for business fore-casting

CO4: Apply analytics for supply chain and logistics management

CO5: Use analytics for marketing and sales.

TEXT BOOKS

- 1. <u>R. Evans James</u>, Business Analytics, 2nd Edition, Pearson, 2017
- <u>R N Prasad</u>, <u>Seema Acharya</u>, Fundamentals of Business Analytics, 2nd Edition, Wiley, 2016
- 3. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
- 4. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
- 5. Mahadevan B, "Operations Management -Theory and Practice", 3rd Edition, Pearson Education, 2018.

COURSE NAME: COMPUTER VISION

COURSE CODE: 191ITV62

COURSE OBJECTIVES:

- To understand the fundamental concepts related to Image formation and processing.
- To learn feature detection, matching and detection
- To become familiar with feature based alignment and motion estimation
- To develop skills on 3D reconstruction
- To understand image based rendering and recognition

	SYLLABUS	L 2	T 0	P 2	C 3
UNIT-I	INTRODUCTION TO IMAGE FORMATION AND PROCESSING		U		6
Computer Via camera - Poir and wavelets	sion - Geometric primitives and transformations - Photometric image formation - The c at operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyra - Geometric transformations - Global optimization.	ligital amids			
UNIT-II	FEATURE DETECTION, MATCHING AND SEGMENTATION				6
Points and p and mode fine	atches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean ding - Normalized cuts - Graph cuts and energy-based methods.	nshift			
UNIT-III	FEATURE-BASED ALIGNMENT & MOTION ESTIMATION				6
2D and 3D fo Two-frame st Translational	eature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangula ructure from motion - Factorization - Bundle adjustment - Constrainedstructure and mo alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.	tion - tion -	•		
UNIT-IV	3D RECONSTRUCTION				6
Shape from X representation	K - Active rangefinding - Surface representations - Point-based representations- Volur as - Model-based reconstruction - Recovering texture maps and albedosos.	netric	,		
UNIT-V	IMAGE-BASED RENDERING AND RECOGNITION				6
View interpo based render Context and s	lation Layered depth images - Light fields and Lumigraphs - Environment mattes - V ing-Object detection - Face recognition - Instance recognition - Category recognition scene understanding- Recognition databases and test sets.	'ideo- tion -			
	30 PERIODS				
LABORAT	DRY EXPERIMENTS:				
Software nee	eded:				

OpenCV computer vision Library for OpenCV in Python / PyCharm or C++ / Visual Studio or orequivalent

• OpenCV Installation and working with Python

- Basic Image Processing loading images, Cropping, Resizing, Thresholding, Contouranalysis, Bolb detection
- Image Annotation Drawing lines, text circle, rectangle, ellipse on images

- Image Enhancement Understanding Color spaces, color space conversion, Histogram equialization, Convolution, Image smoothing, Gradients, Edge Detection
- Image Features and Image Alignment Image transforms Fourier, Hough, Extract ORBImage features, Feature matching, cloning, Feature matching based image alignment
- Image segmentation using Graphcut / Grabcut
- Camera Calibration with circular grid
- Pose Estimation
- 3D Reconstruction Creating Depth map from stereo images
- Object Detection and Tracking using Kalman Filter, Camshift
 - 1. docs.opencv.org
 - 2. https://opencv.org/opencv-free-course/

30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: To understand basic knowledge, theories and methods in image processing and

computervision.

CO2: To implement basic and some advanced image processing techniques in OpenCV.

CO3: To apply 2D a feature-based based image alignment, segmentation and motion estimations.

CO4: To apply 3D image reconstruction techniques

CO5: To design and develop innovative image processing and computer vision applications.

TEXT BOOKS:

- 1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts inComputer Science, Second Edition, 2022.
- 2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.

REFERENCES:

1.Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.

2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006

3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

COURSE NAME: EXPLORATORY DATA ANALYSIS

COURSE CODE: 191ITV63

COURSE OBJECTIVES:

- To outline an overview of exploratory data analysis.
- To implement data visualization using Matplotlib.
- To perform univariate data exploration and analysis.
- To apply bivariate data exploration and analysis.
- To use Data exploration and visualization techniques for multivariate and time series data.

	SYLLABUS	L	Τ	Р	C	
		2	0	2	3	
UNIT-I	EXPLORATORY DATA ANALYSIS				6	
EDA fundam	nentals – Understanding data science – Significance of EDA – Making sense of d	ata -	-			
Comparing E	DA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for I	EDA	-			
Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques.						
UNIT-II	EDA USING PYTHON				6	
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	n and grouping – Pivot Tables – Vectorized String Operations.					
UNIT-III	UNIVARIATE ANALYSIS				6	
Introduction	to Single variable: Distribution Variables - Numerical Summaries of Level and Spre	ad -	Scal	ling	and	
Standardizing	g – Inequality.			-		
UNIT-IV	BIVARIATE ANALYSIS				6	
Relationships	between Two Variables - Percentage Tables - Analysing Contingency Tables - Han	dlin	<u>y</u>			
Several Batch	nes - Scatterplots and Resistant Lines.		-			
					(
UNIT-V	MULTIVARIATE AND TIME SERIES ANALYSIS				6	
Introducing a	Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyo	ond -	-			
Fundamentals	s of TSA - Characteristics of time series data - Data Cleaning - Time- based index	ing -	-			
Visualizing – Grouping – Resampling.						

30 PERIODS

PRACTICAL EXERCISES:

- 1. Install the data Analysis and Visualization tool: R/ Python /Tableau Public/ Power BI.
- 2. Perform exploratory data analysis (EDA) with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.
- 3. Working with Numpy arrays, Pandas data frames, Basic plots using Matplotlib.
- 4. Explore various variable and row filters in R for cleaning data. Apply various plot features in R on sample data sets and visualize.
- 5. Perform Time Series Analysis and apply the various visualization techniques.
- 6. Perform Data Analysis and representation on a Map using various Map data sets with Mouse Rollover effect, user interaction, etc..

- 7. Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc.
- 8. Perform EDA on Wine Quality Data Set.
- 9. Use a case study on a data set and apply the various EDA and visualization techniquesand present an analysis report.

30 PERIODS TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the fundamentals of exploratory data analysis.

CO2: Implement the data visualization using Matplotlib.

CO3: Perform univariate data exploration and analysis.

CO4: Apply bivariate data exploration and analysis.

CO5: Use Data exploration and visualization techniques for multivariate and time series data.

TEXT BOOKS:

- 1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020. (Unit 1)
- 2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", First Edition, O Reilly, 2017. (Unit 2)
- 3. Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social Scientists", Wiley Publications, 2nd Edition, 2008.(Unit 3,4,5)

REFERENCES:

- 1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
- 2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
- 3. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.

COURSE NAME: IMAGE AND VIDEO ANALYTICS

COURSE CODE: 191ITV64

COURSE OBJECTIVES:

- To understand the basics of image processing techniques for computer vision.
- To learn the techniques used for image pre-processing.
- To discuss the various object detection techniques.
- To understand the various Object recognition mechanisms.
- To elaborate on the video analytics techniques.

	SYLLABUS	L	Τ	P	C
		2	0	2	3
UNIT-I	INTRODUCTION				6
Computer Vis	sion – Image representation and image analysis tasks - Image representations – digitiza	ation	ı —		
properties - o	color images - Data structures for Image Analysis - Levels of image data representation	ation	1 -		
Traditional ar	nd Hierarchical image data structures.				
UNIT-II	IMAGE PRE-PROCESSING				6
Local pre-pro	ocessing - Image smoothing - Edge detectors - Zero-crossings of the second derivati	ve -			
Scale in imag	ge processing - Canny edge detection - Parametric edge models - Edges in multi-sper	ralct			
images - Lo	cal pre-processing in the frequency domain - Line detection by local pre-process	sing			
operators - In	nage restoration.				
UNIT-III	OBJECT DETECTION USING MACHINE LEARNING				6
Object detect	ion- Object detection methods - Deep Learning framework for Object detection- bou	undiı	ng		
box approach	n-Intersection over Union (IoU) –Deep Learning Architectures-R-CNN-Faster R-CNI	N-Yo	ou		
Only Look O	nce(YOLO)-Salient features-Loss Functions-YOLO architectures				
UNIT-IV	FACE RECOGNITION AND GESTURE RECOGNITION				6
Face Recogni	ition-Introduction-Applications of Face Recognition-Process of Face Recognition- Dee	epFa	ce	•	
solution by Fa	acebook-FaceNet for Face Recognition- Implementation using FaceNet- Gesture Recog	nitio	m.		
UNIT-V	VIDEO ANALYTICS				6
Video Proces RestNet arc Improvement	ssing – use cases of video analytics-Vanishing Gradient and exploding gradient pro- chitecture-RestNet and skip connections-Inception Network-GoogleNet archite in Inception v2-Video analytics-RestNet and Inception v3.	obler ectur	n- e-		

30 PERIODS

LIST OF EXERCISES

1. Write a program that computes the T-pyramid of an image.

2. Write a program that derives the quad tree representation of an image using thehomogeneity criterion of equal intensity

3. Develop programs for the following geometric transforms: (a) Rotation (b) Change of scale (c) Skewing (d) Affine transform calculated from three pairs of corresponding points (e)Bilinear transform calculated from

four pairs of corresponding points.

4. Develop a program to implement Object Detection and Recognition

5. Develop a program for motion analysis using moving edges, and apply it to your image sequences.

6. Develop a program for Facial Detection and Recognition

7. Write a program for event detection in video surveillance system

30 PERIODS TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the basics of image processing techniques for computer vision and video analysis.

CO2: Explain the techniques used for image pre-processing.

CO3: Develop various object detection techniques.

CO4: Understand the various face recognition mechanisms.

CO5: Elaborate on deep learning-based video analytics.

TEXT BOOK:

- 1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4nd edition, Thomson Learning, 2013.
- 2. Vaibhav Verdhan,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras,Apress 2021(UNIT-III,IV and V)

REFERENCES

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited, 2011.

2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence", Springer, 2012.

3. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2003.

4. E. R. Davies, (2012), "Computer & Machine Vision", Fourth Edition, Academic Press.

COURSE NAME: NETWORK SECURITY

COURSE CODE: 191ITV65

COURSE OBJECTIVES:

- To learn the fundamentals of cryptography.
- To learn the key management techniques and authentication approaches.
- To explore the network and transport layer security techniques.
- To understand the application layer security standards.
- To learn the real time security practices.

	SYLLABUS	L	Τ	Р	С
		2	0	2	3
UNIT-I	INTRODUCTION				8
Basics of cry	ptography, conventional and public-key cryptography, hash functions, authentication	, and			
digital signatu	ires.				
UNIT-II	KEY MANAGEMENT AND AUTHENTICATION				7
Key Manage	ment and Distribution: Symmetric Key Distribution, Distribution of Public Keys, 2	K.509	9		
Certificates,	Public-Key Infrastructure. User Authentication: Remote User-Authentication Princ	iples	5,		
Remote Use	er-Authentication Using Symmetric Encryption, Kerberos Systems, Remote	Use	r		
Authenticatio	n Using Asymmetric Encryption.				
UNIT-III	ACCESS CONTROL AND SECURITY				4
Network Acc	ess Control: Network Access Control, Extensible Authentication Protocol, IEEE 80)2.17	K		
Port-Based N	Network Access Control - IP Security - Internet Key Exchange (IKE). Transport-	Leve	l		
Security: We	eb Security Considerations, Secure Sockets Layer, Transport Layer Security, H	TTPS	S		
standard, Sec	ure Shell (SSH) application.				
UNIT-IV	APPLICATION LAYER SECURITY				5
Electronic Ma	ail Security: Pretty Good Privacy, S/MIME, DomainKeys Identified Mail. Wireless Net	worl	k		
Security: Mol	bile Device Security				
UNIT-V	SECURITY PRACTICES				6
Firewalls and	 d Intrusion Detection Systems: Intrusion Detection Password Management Fit	ewal	1		
Characteristic	res Types of Firewalls Firewall Basing Firewall Location and Configurations Blockel	e wai hains	2		
Cloud Securit	ty and IoT security		,		
	30 PERIODS				

LIST OF EXERCISES

- 1. Implement symmetric key algorithms
- 2. Implement asymmetric key algorithms and key exchange algorithms
- 3. Implement digital signature schemes
- 4. Installation of Wire shark, tcpdump and observe data transferred in client-server communication using UDP/TCP and identify the UDP/TCP datagram.
- 5. Check message integrity and confidentiality using SSL
- 6. Experiment Eavesdropping, Dictionary attacks, MITM attacks
- 7. Experiment with Sniff Traffic using ARP Poisoning
- 8. Demonstrate intrusion detection system using any tool.
- 9. Explore network monitoring tools
- 10. Study to configure Firewall, VPN

30 PERIODS TOTAL:60 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able:

CO1: Classify the encryption techniques

CO2: Illustrate the key management technique and authentication.

CO3 Evaluate the security techniques applied to network and transport layer

CO4: Discuss the application layer security standards.

CO5: Apply security practices for real time applications.

TEXT BOOKS:

1. Cryptography and Network Security: Principles and Practice, 6th Edition, William Stallings, 2014, Pearson, ISBN 13:9780133354690.

REFERENCES:

- 1. Network Security: Private Communications in a Public World, M. Speciner, R. Perlman, C. Kaufman, Prentice Hall, 2002.
- 2. Linux iptables Pocket Reference, Gregor N. Purdy, O'Reilly, 2004, ISBN-13: 978-0596005696.
- 3. Linux Firewalls, by Michael Rash, No Starch Press, October 2007, ISBN: 978-1-59327-141-1.
- 4. Network Security, Firewalls And VPNs, J. Michael Stewart, Jones & Bartlett Learning, 2013, ISBN-10: 1284031675, ISBN-13: 978-1284031676.
- 5. The Network Security Test Lab: A Step-By-Step Guide, Michael Gregg, Dreamtech Press, 2015, ISBN-10:8126558148, ISBN-13: 978-8126558148.

COURSE NAME: NEURAL NETWORKS AND DEEP LEARNING

COURSE CODE: 191ITV66

COURSE OBJECTIVES:

- To understand the basics in deep neural networks
- To understand the basics of associative memory and unsupervised learning networks
- To apply CNN architectures of deep neural networks
- To analyze the key computations underlying deep learning, then use them to build and traindeep neural networks for various tasks.
- To apply autoencoders and generative models for suitable applications.

	SYLLABUS		Т	Р	С
		2	0	2	3
UNIT-I	INTRODUCTION				6
Neural Netw	orks-Application Scope of Neural Networks-Artificial Neural Network: An Introdu	ction	-		
Evolution of	Neural Networks-Basic Models of Artificial Neural Network- Important Terminolog	ies of	f		
ANNs-Superv	vised Learning Network.				
UNIT-II	THIRD-GENERATION NEURAL NETWORKS				6
Training Alg	gorithms for Pattern Association-Autoassociative Memory Network-Heteroassociation	iative			
Memory N	Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iter	rative			
Autoassociati	ve Memory Networks-Temporal Associative Memory Network-Fixed Weight Compe	titive			
Nets-Kohone	n Self-Organizing Feature Maps-Learning Vector Quantization-Counter propag	ation			
Networks-Ad	aptive Resonance Theory Network.				
UNIT-III	ACCESS CONTROL AND SECURITY				6
Spiking Neu	ral Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Ex	treme	e		
Learning Ma	chine Model-Convolutional Neural Networks: The Convolution Operation - Motiva	tion -	_		
Pooling – Va	ariants of the basic Convolution Function - Structured Outputs - Data Types - Eff	ficien	t		
Convolution	Algorithms - Neuroscientific Basis - Applications: Computer Vision, Image Gener	ration	,		
Image Compr	ession.				
UNIT-IV	DEEP FEEDFORWARD NETWORKS				6
History of De	ep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Ru	ileand	1		
Backpropagat	tion - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Ba	ugging	5		
and Dropout -	- batch normalization- VC Dimension and Neural Nets.				
UNIT-V	RECURRENT NEURAL NETWORKS				6
Recurrent Ne	ural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs –	Deep	5		
Recurrent Net	tworks – Applications: Image Generation, Image Compression, Natural Language Proce	essing			
Complete Au	to encoder, Regularized Autoencoder, Stochastic Encoders and Decoders, Contr	active	e		
Encoders.					

LAB EXPERIMENTS:

- 1. Implement simple vector addition in TensorFlow.
- 2. Implement a regression model in Keras.
- 3. Implement a perceptron in TensorFlow/Keras Environment.
- 4. Implement a Feed-Forward Network in TensorFlow/Keras.
- 5. Implement an Image Classifier using CNN in TensorFlow/Keras.
- 6. Improve the Deep learning model by fine tuning hyper parameters.
- 7. Implement a Transfer Learning concept in Image Classification.
- 8. Using a pre trained model on Keras for Transfer Learning
- 9. Perform Sentiment Analysis using RNN
- 10. Implement an LSTM based Autoencoder in TensorFlow/Keras.
- 11. Image generation using GAN

Additional Experiments:

- 12. Train a Deep learning model to classify a given image using pre trained model
- 13. Recommendation system from sales data using Deep Learning
- 14. Implement Object Detection using CNN
- 15. Implement any simple Reinforcement Algorithm for an NLP problem

30 PERIODS TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Apply Convolution Neural Network for image processing.

CO2: Understand the basics of associative memory and unsupervised learning networks.

CO3: Apply CNN and its variants for suitable applications.

CO4: Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks.

CO5: Apply autoencoders and generative models for suitable applications.

TEXT BOOKS:

- 1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
- 2. Francois Chollet, "Deep Learning with Python", Second Edition, Manning Publications,
- 2021.

REFERENCES:

- 1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", Oreilly, 2018.
- 2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'ReillyMedia, 2017.
- 3. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 1st Edition, 2018.
- 4. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress, 2018
- 5. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
- 6. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND, 2017.
- 7. S Rajasekaran, G A Vijayalakshmi Pai, "Neural Networks, FuzzyLogic and GeneticAlgorithm, Synthesis and Applications", PHI Learning, 2017.
- 8. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress, 2017
- 9. James A Freeman, David M S Kapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003.
COURSE NAME: RECOMMENDER SYSTEMS

COURSE CODE: 1911TV67 COURSE OBJECTIVES:

- To understand the foundations of the recommender system.
- To learn the significance of machine learning and data mining algorithms forRecommender systems
- To learn about collaborative filtering
- To make students design and implement a recommender system.
- To learn collaborative filtering.

	SYLLABUS L		Τ	Р	С
		2	0	2	3
UNIT-I	INTRODUCTION				6
Introduction	and basic taxonomy of recommender systems - Traditional and non-personalized				
Recommend	er Systems - Overview of data mining methods for recommender systems- similarity				
measures- D	imensionality reduction – Singular Value Decomposition (SVD)				
Suggested A	ctivities:				
Prac	tical learning – Implement Data similarity measures.				
• Exte	rnal Learning – Singular Value Decomposition (SVD) applications				
Suggested E	valuation Methods:				
Quiz	on Recommender systems.				
Quiz	of python tools available for implementing Recommender systems				
UNIT-II	CONTENT-BASED RECOMMENDATION SYSTEMS			6	
High-level a	rchitecture of content-based systems - Item profiles, Representing item profiles, Method	s for			
learning user	profiles, Similarity-based retrieval, and Classification algorithms.				
Suggested A	ctivities:				
Assi	gnment on content-based recommendation systems				
Assi	gnment of learning user profiles				
Suggested E	valuation Methods:				
Quiz	on similarity-based retrieval.				
Ouiz	z of content-based filtering				
UNIT-III	COLLABORATIVE FILTERING			6	
A systematic	approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF,	,			
components	of neighborhood methods (rating normalization, similarity weight computation, and				
neighborhoo	d selection				
Suggested A	ctivities:				
Prac	tical learning – Implement collaborative filtering concepts				
Assi	gnment of security aspects of recommender systems				
Suggested E	valuation Methods:				
Quiz	z on collaborative filtering				
• Sem	inar on security measures of recommender systems				
UNIT-IV	ATTACK-RESISTANT RECOMMENDER SYSTEMS			6	
Introduction	- Types of Attacks - Detecting attacks on recommender systems - Individual attack -	Grou	ip att	ack	
Strategies for	r robust recommender design - Robust recommendation algorithms.				

Suggested Activities:

- Group Discussion on attacks and their mitigation
- Study of the impact of group attacks
- External Learning Use of CAPTCHAs

Suggested Evaluation Methods:

• Quiz on attacks on recommender systems

• Seminar on preventing attacks using the CAPTCHAs

EVALUATING RECOMMENDER SYSTEMS

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design - Design Issues – Accuracy metrics – Limitations of Evaluation measures

Suggested Activities:

UNIT-V

- Group Discussion on goals of evaluation design
- Study of accuracy metrics

Suggested Evaluation Methods:

- Quiz on evaluation design
- Problems on accuracy measures

30 PERIODS

6

PRACTICAL EXERCISES:

- 1. Implement Data similarity measures using Python
- 2. Implement dimension reduction techniques for recommender systems
- 3. Implement user profile learning
- 4. Implement content-based recommendation systems
- 5. Implement collaborative filter techniques
- 6. Create an attack for tampering with recommender systems
- 7. Implement accuracy metrics like Receiver Operated Characteristic curves

30 PERIODS TOTAL 60 PERIODS

COURSE OUTCOMES:

On completion of the course, the students will be able to:

CO1:Understand the basic concepts of recommender systems.

CO2:Implement machine-learning and data-mining algorithms in recommender systemsdata sets.

CO3:Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.

CO4:Design and implement a simple recommender system.

CO5:Learn about advanced topics of recommender systems.

CO6:Learn about advanced topics of recommender systems applications

TEXTBOOKS:

- 1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
- 2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
- 3. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Sytems Handbook, 1sted, Springer (2011),
- 4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rdedition, Cambridge University Press, 2020.

COURSE NAME: TEXT AND SPEECH ANALYSIS

COURSE CODE: 191ITV68

COURSE OBJECTIVES:

- Understand natural language processing basics
- Apply classification algorithms to text documents
- Build question-answering and dialogue systems
- Develop a speech recognition system
- Develop a speech synthesizer

	SYLLABUS			
UNIT-I	NATURAL LANGUAGE BASICS	6		
Foundations	of natural language processing – Language Syntax and Structure- Text Preprocessing and			
Wrangling –	- Text tokenization – Stemming – Lemmatization – Removing stop- words – Feature			
Engineering	for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model			
Suggested A	ctivities			
Flipp	bed classroom on NLP			
• Impl	ementation of Text Preprocessing using NLTK			
• Impl	ementation of TF-IDF models			
Suggested E	valuation Methods			
Quiz	on NLP Basics			
• Dem	onstration of Programs			
UNIT-II	TEXT CLASSIFICATION	6		
Vector Sema	ntics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText			
model – Ove	rview of Deep Learning models – RNN – Transformers – Overview of Text summarization			
and Topic M	odels			
Suggested A	ctivities			
Flipp	bed classroom on Feature extraction of documents			
• Impl	ementation of SVM models for text classification			
• Exter	rnal learning: Text summarization and Topic models			
Suggested E	valuation Methods			
Assi	gnment on above topics			
Quiz	on RNN, Transformers			
Impl	ementing NLP with RNN and Transformers			
UNIT-III	QUESTION ANSWERING AND DIALOGUE SYSTEMS	6		
Information	retrieval IP based question answering knowledge based question answering language			
models for ($\Delta = classic \Delta \Delta$ models = chatbots = Design of dialogue systems evaluating dialogue			
eveteme	erassie erandens – chaloois – Design of dialogue systems – evaluating dialogue			
Suggested A	ctivities.			
• Flinr	red classroom on language models for OA			
Deve	cloping a knowledge-based question-answering system			
Class	sic OA model development			
- 0105	Xi model de velopment			

Suggested Evaluation Methods

• Ass	ignment on the above topics							
• Qui	z on knowledge-based question answering system							
• Dev	elopment of simple chatbots							
UNIT-IV	TEXT-TO-SPEECH SYNTHESIS	6						
Overview. 7	Pext normalization. Letter-to-sound. Prosody, Evaluation. Signal processing - Concatenative							
and paramet	ric approaches, WaveNet and other deep learning-based TTSsystems							
Suggested A	Activities:							
• Flip	ped classroom on Speech signal processing							
 Exploring Text normalization 								
Data collection								
Implementation of TTS systems								
Suggested 1	Evaluation Methods							
• Ass	ignment on the above topics							
• Qui	z on wavenet, deep learning-based TTS systems							
• Fine	ling accuracy with different TTS systems							
UNIT-V	AUTOMATIC SPEECH RECOGNITION	6						
Speech reco	gnition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems							
Suggested A	Activities:							
• Flip	ped classroom on Speech recognition.							
• Exp	Exploring Feature extraction							
Suggested I	Evaluation Methods							
Ass	ignment on the above topics							
1								

Quiz on acoustic modelling

30 PERIODS

PRACTICAL EXERCISES

- 1. Create Regular expressions in Python for detecting word patterns and tokenizing text
- 2. Getting started with Python and NLTK Searching Text, Counting Vocabulary, Frequency Distribution, Collocations, Bigrams
- 3. Accessing Text Corpora using NLTK in Python
- 4. Write a function that finds the 50 most frequently occurring words of a text that are not stop words.
- 5. Implement the Word2Vec model
- 6. Use a transformer for implementing classification
- 7. Design a chatbot with a simple dialog system
- 8. Convert text to speech and find accuracy
- 9. Design a speech recognition system and find the error rate

30 PERIODS TOTAL: 60 PERIODS

COURSE OUTCOMES:

On completion of the course, the students will be able to

- CO1: Explain existing and emerging deep learning architectures for text and speech processing
- CO2: Apply deep learning techniques for NLP tasks, language modelling and machine translation
- **CO3:** Explain coreference and coherence for text processing

CO4: Build question-answering systems, chatbots and dialogue systems

CO5: Apply deep learning models for building speech recognition and text-to-speech systems

ТЕХТВООК

1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Third Edition, 2022.

REFERENCES:

- 1. Dipanjan Sarkar, "Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data", APress,2018.
- 2. Tanveer Siddiqui, Tiwary U S, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
- 3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, "Fundamentals of Speech Recognition" 1st Edition, Pearson, 2009.
- 4. Steven Bird, Ewan Klein, and Edward Loper, "Natural language processing with Python", O'REILLY.

VERTICLE VII – MACHINE LEARNING

COURSE NAME: COGNITIVE SCIENCE

COURSE CODE: 191ITV71

COURSE OBJECTIVES:

- To know the theoretical background of cognition.
- To understand the link between cognition and computational intelligence.
- To explore probabilistic programming language.
- To study the computational inference models of cognition.
- To study the computational learning models of cognition.

•	to study the computational learning models of cognition.				
	SYLLABUS	L	Т	Р	C
		2	0	2	3
UNIT-I	PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE				6
Philosophy: N	Mental-physical Relation – From Materialism to Mental Science – Logic and the Science	es of	the	Mir	nd –
Psychology: I	Place of Psychology within Cognitive Science – Science of Information Processing –Co	ogniti	ve		
Neuroscience	- Perception - Decision - Learning and Memory - Language Understanding and Proce	essing	g.		
UNIT-II	COMPUTATIONAL INTELLIGENCE				6
Machines and	Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based S	yster	ns –		
Logical Repre	esentation and Reasoning – Logical Decision Making –Learning – Language – Vision.				
UNIT-III	PROBABILISTIC PROGRAMMING LANGUAGE				6
WebPPL Lan	guage – Syntax – Using Javascript Libraries – Manipulating probability types and distri	butio	ons -	-	
Finding Infer	ence – Exploring random computation – Coroutines: Functions that receive continuation	ns —E	Enum	nera	tion
UNIT-IV	INFERENCE MODELS OF COGNITION				6
Generative M	odels – Conditioning – Causal and statistical dependence – Conditional dependence – D	ata A	Anal	ysis	_
Algorithms fo	or Inference.			•	
UNIT-V	LEARNING MODELS OF COGNITION				6
Learning as C	Conditional Inference – Learning with a Language of Thought – Hierarchical Models–Le	earni	ng (Dee	p)
Continuous F	unctions – Mixture Models.		U V		
	30 F	'ERI	OD	S	
PRACTICA	LEXERCISES				
1. Demo	onstration of Mathematical functions using WebPPL.				

- 2. Implementation of reasoning algorithms.
- 3. Developing an Application system using generative model.
- 4. Developing an Application using conditional inference learning model.
- 5. Application development using hierarchical model.
- 6. Application development using Mixture model.

COURSE OUTCOMES:

At the end of this course, the students will be able to: **CO1:**Understand the underlying theory behind cognition.

30 PERIODS

CO2:Connect to the cognition elements computationally.

CO3:Implement mathematical functions through WebPPL.

CO4:Develop applications using cognitive inference model.

CO5:Develop applications using cognitive learning model.

TOTAL: 60 PERIODS

TEXT BOOK:

- 1. Vijay V Raghavan, Venkat N.Gudivada, VenuGovindaraju, C.R. Rao, Cognitive Computing: Theory and Applications: (Handbook of Statistics 35), Elsevier publications, 2016
- 2. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley Publications, 2015
- 3. Robert A. Wilson, Frank C. Keil, "The MIT Encyclopedia of the Cognitive Sciences", The MIT Press, 1999.
- 4. Jose Luis Bermúdez, Cognitive Science An Introduction to the Science of the Mind, Cambridge University Press 2020

REFERENCES:

- 1. Noah D. 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 ProbMods Contributors, "Probabilistic Models of Cognition", Second Edition, 2016, https://probmods.org/.

COURSE NAME: DATA EXPLORATION AND VISUALIZATION

COURSE CODE: 191ITV72

OBJECTIVES:

- To outline an overview of exploratory data analysis.
- To implement data visualization using Matplotlib.
- To perform univariate data exploration and analysis.
- To apply bivariate data exploration and analysis.
- To use Data exploration and visualization techniques for multivariate and time series data.

	SYLLABUS	L	Т	Р	C
		2	0	2	3
UNIT-I	EXPLORATORY DATA ANALYSIS				6
EDA fundan	nentals – Understanding data science – Significance of EDA – Making sense of data	ta –			
Comparing E	EDA with classical and Bayesian analysis - Software tools for EDA - Visual Aids	for			
EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation					
techniques -	Grouping Datasets - data aggregation – Pivot tables and cross-tabulations.				
UNIT-II	VISUALIZING USING MATPLOTLIB				6
Importing M	atplotlib – Simple line plots – Simple scatter plots – visualizing errors – density	and		•	
contour plots	s – Histograms – legends – colors – subplots – text and annotation – customizatio	n –			
three dimensi	onal plotting - Geographic Data with Basemap - Visualization with Seaborn.				
UNIT-III	UNIVARIATE ANALYSIS				6
Introduction	to Single variable: Distributions and Variables - Numerical Summaries of Level	and		•	
Spread - Scal	ling and Standardizing – Inequality - Smoothing Time Series.				
UNIT-IV	BIVARIATE ANALYSIS				6
Relationship	s between Two Variables - Percentage Tables - Analyzing Contingency Table	es -			
Handling Sev	veral Batches - Scatterplots and Resistant Lines – Transformations.				
UNIT-V	MULTIVARIATE AND TIME SERIES ANALYSIS				6
Introducing	a Third Variable - Causal Explanations - Three-Variable Contingency Tables	and			
Beyond - Lo	ongitudinal Data – Fundamentals of TSA – Characteristics of time series data – D)ata			
Cleaning – T	Time-based indexing – Visualizing – Grouping – Resampling.				
	30 P	ERI	OD	S	

PRACTICAL EXERCISES

- 1. Install the data Analysis and Visualization tool: R/ Python /Tableau Public/ Power BI.
- 2. Perform exploratory data analysis (EDA) on with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.
- 3. Working with Numpy arrays, Pandas data frames, Basic plots using Matplotlib.
- 4. Explore various variable and row filters in R for cleaning data. Apply various plot features in R on sample data sets and visualize.
- 5. Perform Time Series Analysis and apply the various visualization techniques.
- 6. Perform Data Analysis and representation on a Map using various Map data sets with Mouse Rollover effect, user interaction, etc..
- 7. Build cartographic visualization for multiple datasets involving various countries of the

world;states and districts in India etc.

- 8. Perform EDA on Wine Quality Data Set.
- 9. Use a case study on a data set and apply the various EDA and visualization techniques and present an analysis report.

30 PERIODS TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the fundamentals of exploratory data analysis.

CO2: Implement the data visualization using Matplotlib.

CO3: Perform univariate data exploration and analysis.

CO4: Apply bivariate data exploration and analysis.

CO5: Use Data exploration and visualization techniques for multivariate and time series data.

TEXT BOOKS:

- **1.** Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis withPython", Packt Publishing, 2020. (Unit 1)
- 2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working withData", Oreilly, 1st Edition, 2016. (Unit 2)
- **3.** Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for SocialScientists", Wiley Publications, 2nd Edition, 2008. (Unit 3,4,5)

REFERENCES:

- 1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
- 2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
- **3.** Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.

COURSE NAME: GAME THEORY

COURSE CODE: 191ITV73

COURSE OBJECTIVES:

- To introduce the student to the notion of a game, its solutions concepts, and other basic notions and tools of game theory, and the main applications for which they are appropriate, including electronic trading markets.
- To formalize the notion of strategic thinking and rational choice by using the tools of game theory, and to provide insights into using game theory in 41odeIIing applications.
- To draw the connections between game theory, computer science, and economics, especially emphasizing the computational issues.
- To introduce contemporary topics in the intersection of game theory, computer science, and economics.
- To apply game theory in searching, auctioning and trading.

SYLLABUS		L	Τ	Р	С		
		2	0	2	3		
UNIT-I	INTRODUCTION				6		
Introduction -	- Making rational choices: basics of Games - strategy - preferences - payoffs -	— N	lathe	ema	tical		
basics — Gar	ne theory — Rational Choice — Basic solution concepts-non- cooperative versus versus cooperative versus versus versus versus cooperative versus	erativ	ve ga	ame	es —		
Basic comput (e.g. Google's	ational issues — finding equilibria and learning in games- Typical application areas sponsored search, eBay auctions, electricity trading markets).	for g	game	e the	eory		
UNIT-II	GAMES WITH PERFECT INFORMATION				6		
Games with l	Perfect Information — Strategic games — prisoner's dilemma, matching pennies - Na	ısh					
equilibria —r	nixed strategy equilibrium — zero-sum games						
UNIT-III	GAMES WITH IMPERFECT INFORMATION				6		
Games with	Imperfect Information — Bayesian Games — Motivational Examples — General						
Definitions –	- Information aspects - Illustrations - Extensive Games with Imperfect - Information	ation					
-Strategies -	– Nash Equilibrium – Repeated Games – The Prisoner's Dilemma – Bargaining						
UNIT-IV	NON-COOPERATIVE GAME THEORY				6		
Non-cooperat	ive Game Theory — Self-interested agents — Games in normal form — Analyzing						
games: from	optimality to equilibrium — Computing Solution Concepts of Normal — Form Games						
— Computin	g Nash equilibria of two-player, zero-sum gamesComputing Nash equilibria of t	wo-					
player, genera	al- sum games — Identifying dominated strategies						
UNIT-V	MECHANISM DESIGN				6		
Aggregating	Preferences — Social Choice — Formal Model — Voting — Existence of social func	tions	5				
— Ranking s	ystems — Protocols for Strategic Agents: Mechanism Design — Mechanism design	with	1				
unrestricted preferences							

30 PERIODS

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

CO1:Discuss the notion of a strategic game and equilibria and identify the characteristics ofmain applications of these concepts.

CO2:Discuss the use of Nash Equilibrium for other problems.

CO3:Identify key strategic aspects and based on these be able to connect them to appropriategame theoretic concepts given a real world situation.

CO4:Identify some applications that need aspects of Bayesian Games.

CO5:Implement a typical Virtual Business scenario using Game theory.

LABORATORY EXERCISES:

- 1. Prisoner's dilemma
- 2. Pure Strategy Nash Equilibrium
- 3. Extensive Form Graphs and Trees, Game Trees
- 4. Strategic Form Elimination of dominant strategy
- 5. Minimax theorem, minimax strategies
- 6. Perfect information games: trees, players assigned to nodes, payoffs, backward Induction, subgame perfect equilibrium,
- 7. imperfect-information games Mixed Strategy Nash Equilibrium Finding mixed-strategy Nash equilibria for zero sum games, mixed versus behavioral strategies.
- 8. Repeated Games
- 9. Bayesian Nash equilibrium

30 PERIODS TOTAL: 60 PERIODS

TEXT BOOKS:

1. M. J. Osborne, An Introduction to Game Theory. Oxford University Press, 2012.

2. M. Machler, E. Solan, S. Zamir, Game Theory, Cambridge University Press, 2013.

3. N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani, Algorithmic Game Theory.Cambridge University Press, 2007.

4. A.Dixit and S. Skeath, Games of Strategy, Second Edition. W W Norton & Co Inc, 2004.

5. YoavShoham, Kevin Leyton-Brown, Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, Cambridge University Press 2008.

6. Zhu Han, DusitNiyato, WalidSaad, TamerBasar and Are Hjorungnes, "Game Theory inWireless and Communication Networks", Cambridge University Press, 2012.

7. Y.Narahari, "Game Theory and Mechanism Design", IISC Press, World Scientific.

8. William Spaniel, "Game Theory 101: The Complete Textbook", CreateSpace Independent Publishing, 2011.

COURSE NAME: MACHINE LEARNING FOR SIGNAL PROCESSING

COURSE CODE: 1911TV75

	SYLLABUS L T I	<u> </u>					
	3 0 0) 3					
0111-1	MACHINE LEARNING THEORY	,					
Introduction	-Continuous-time signals and systems- Discrete-time signals and systems- Random signals ar	ıd					
stochastic processes-Sampling and Quantization- FIR and IIR filter design- Digital filter structure and							
transforms- Frames Parameter estimation- Adaptive filtering- Machine Learning review and trends- Signal							
Processing over graphs- Tensor methods in deep learning. Nonconvex graph learning: sparsity, heavy tails, and							
clustering.							
UNIT-II	DIGITAL FILTER STRUCTURES AND THEIR IMPLEMENTATION	9					
Properties of	f digital filters– Synthesis of digital FIR filters-FIR structures- Frequencey Response Masking Filt	ers-					
The analog a	approximation problem- Doubly resistively terminated lossless networks- IIR filters- Wave digital						
filtersSchroo	linger's Equation–Observables-Spectral Theory–Dirac Notation.						
UNIT-III	MODERN TRANSFORM DESIGN FOR PRACTICAL	9					
	AUDIO/IMAGE/ VIDEO CODING APPLICATIONS	<u> </u>					
Approximat	ions approach via direct scaling–Approximations approach via structural design Wavelet filter						
design via s	bectral factorization- Higher order design approach via optimizationt.						
IINIT_IV	DATA DEPRESENTATION FROM MULTISCALE TRANSFORMS TO	0					
	NEURAL NETWORKS						
Wavelets: a	multiscale analysis tool-Curvlet and their applications- Contourlets and their applications- Shearle	ts					
and their app	plications- Incorporating wavelets into neural networks: Conceptual Scheme-Elitzur-Vaidman Sch	eme-					
Optimal Inte	eraction-Free Measurements						
UNIT-V	MACHINE LEARNING	9					
Learning concepts- Unsupervised Learning- Supervised Learning-Ensemble Learning-Deep Learning- CNN							
visualization	n- Deep reinforcement learning- current trends.						

TEXTBOOKS

1. Reinhold Blumel., "Signal Processing and Machine Learning Theory" Academic Press Library (Elsevier), 20230

COURSE NAME: MACHINE LEARNING WITH BIGDATA

COURSE CODE: 191ITV76

	SYLLABUS	L	ΓΙ	C		
		3	0 () 3		
UNIT-I	BIG DATA			9		
Introduction – Big Data Evaluation with its Tools- Architecture of Big Data- Issues and Challenges-Big Data Analytics Tools – Big Data Use Cases – Role of Machine Learning for Big Data and IoT.						
UNIT-II	BIG DATA AND PATTERN RECOGNITION			9		
Data Cleanir Clustering.	g–Data Integration– Data Transformation- Data Reduction–Classifier- Feature Process	sing-				
UNIT-III	MACHINE LEARNING ALGORITHMS AND APPLICATIONS			9		
History and Purpose of Machine Learning– Concept Well-Defined Learning Problem –General to specific Ordering Over Hypotheses. Version Space and Candidate Elimination Algorithm.						
UNIT-IV	REINFORCEMENT LEARNING			9		
Reinforcement Learning- Model Free RL- Q-Learning- R-Learning- Model Based RL-SARSA Learning – Dyna-Q Learning- Temporal Difference- Monte Carlo Method.						
UNIT-V	APPLICATION OF BIG DATA AND MACHINE LEARNING			9		
Application of Big Data and ML- Healthcare- Banking and Insurance- Transpotation- Media and Entertainment- Education- Ecosystem Conservation- Manufacturing– Agriculture- Issues and Chanllenges.						

45 PERIODS

TEXTBOOKS

1. Uma N.Dulhar, Khaleel Ahmad, Khairol Amali Bin Ahmad, "Machine Learning and Big Data"., John and Wiley and Scrivener Publishing LLC, 2020

COURSE NAME: MACHINE LEARNING WITH PYTHON

COURSE CODE: 191ITV74

2 0 2 3 COURSE OBJECTIVES: To impart Knowledge on the following topics: • To understand the basic concepts and techniques of Machine Learning. • To have a thorough understanding of the Supervised and Unsupervised learning techniques. • To use Python data structures — lists, tuples, dictionaries. • To define Python programs with conditionals and functions • To define Python files, modules and packages. UNIT · 1 BASICS OF MACHINE LEARNING 6 Introduction , Components of Learning , Learning Models , Geometric Models, Probabilistic Models, Logic Models, Grouping and Grading, Designing a Learning System, Types of Learning, Supervised, Unsupervised, Reinforcement, Perspectives and Issues, Version Spaces, PAC Learning, VC Dimension-Applications Of Machine Learning: Image Recognition – Speech Recognition – Email spam and Malware Filtering – Online fraud detection – Medical Diagnosis. UNIT · 1 SUPERVISED AND UNSUPERVISED LEARNING 6 Decision Trees: ID3, Classification and Regression Trees, Regression: Linear Regression, Multiple Linear Regression, Logistic Regression, Neural Networks: Introduction, Perception, Multiple 6 UNIT · 11 INTRODUCTION TO PYTHON PROGRAMMING 6 Python interpreter and interactive mode; values and types: int, float, boolean, string, list, tuple and dictionaries; variables, expressions, statements, tuple assignment, precedence of operators			SYLLABUS	L	Т	P	C
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30 PERIODS

Lab Programs

1. Develop Logistic Regression Model for a given dataset.

2. Implement Simple and Multiple Linear Regression Models.

3. Develop Decision Tree Classification model for a given dataset and use it to classify a new sample.

Build the Gradient Descent model.

5. Perceptron Learning Algorithm [Predict accuracy and Misclassified values]

6. Implement K-Means clustering Algorithm for Malware Analysis.

7. Spam classification using SVM.

8. Sentiment analysis in Machine Learning [How to process and analyze the data]

30 PERIODS

TOTAL: 60 PERIODS

Oncor	COURSEOUTCOMES Oncompletionofthecourse, students will beableto				
CO1	Apply specific machine learning algorithm for a particular problem.				
CO2	Differentiate between supervised, unsupervised, semi-supervised machine learning approaches.				
CO3	Identify the various data expressions, statements in python programming.				
CO4	Use control flow and function for solving problems in python.				
CO5	Read and write data from /to files in Python programs.				

TEXTBOOKS

1. EthemAlpaydin, "Introduction to Machine Learning", MIT Press, Prentice Hall of India, 3rd Edition2014.

2. MehryarMohri, AfshinRostamizadeh, AmeetTalwalkar "Foundations of Machine Learning", MIT Press, 2012.

3. Tom Mitchell, "Machine Learning", McGraw Hill, 3rdEdition, 1997.

4. MACHINE LEARNING - An Algorithmic Perspective, Second Edition, Stephen Marsland, 2015.

5. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3 Shroff/O'Reilly Publishers, 2016(http://greenteapress.com/wp/think-python/)
6. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python3.2 Network Theory Ltd., 2011.

REFERENCE BOOKS:

1. CharuC.Aggarwal, "DataClassificationAlgorithmsandApplications", CRCPress, 2014.

2. Charu C. Aggarwal, "DATA CLUSTERING Algorithms and Applications", CRC Press, 2014.

3. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012.

4. John V Guttag, —Introduction to Computation and Programming Using Python", Revised and expanded Edition, MITPress, 2013

5. Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Inter disciplinaryApproach, Pearson India Education Services Pvt. Ltd.,2016.

6. Timothy A.Budd,—Exploring Python, Mc-GrawHill Education(India) PrivateLtd., 2015.

COURSE NAME: NEURAL NETWORKS AND DEEP LEARNING

COURSE CODE: 191ITV77

COURSE OBJECTIVES:

- To understand the basics in deep neural networks
- To understand the basics of associative memory and unsupervised learning networks
- To apply CNN architectures of deep neural networks
- To analyze the key computations underlying deep learning, then use them to build and traindeep neural networks for various tasks.
- To apply auto encoders and generative models for suitable applications.

	SYLLABUS	L T	P	C
	2	2 0	2	3
UNIT-I	INTRODUCTION			6
Neural Netwo	orks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction-			
Evolution of	Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of			
ANNs-Super	vised Learning Network.			
UNIT-II	ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS			6
Training Algo	orithms for Pattern Association-Autoassociative Memory Network-Heteroassociative			
Memory Netw	work-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative			
Autoassociati	ive Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive	e		
Nets-Kohone	n Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation			
Networks-Ad	laptive Resonance Theory Network.			
UNIT-III	THIRD-GENERATION NEURAL NETWORKS			6
Spiking Neur	al Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme			
Learning Ma	chine Model-Convolutional Neural Networks: The Convolution Operation – Motivation –			
Pooling – Va	riants of the basic Convolution Function – Structured Outputs – Data Types – Efficient			
Convolution .	Algorithms – Neuroscientific Basis – Applications: Computer Vision, Image Generation,			
Image Comp	ression.			
UNIT-IV	DEEP FEEDFORWARD NETWORKS			6
History of De	eep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rulear	nd		
Backpropaga	tion - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging	5		
and Dropout	- batch normalization- VC Dimension and Neural Nets.			
UNIT-V	RECURRENT NEURAL NETWORKS			6
Recurrent Ne	ural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep			
Recurrent Ne	tworks - Applications: Image Generation, Image Compression, Natural Language Process	ing.		
Complete Au	to encoder, Regularized Autoencoder, Stochastic Encoders and Decoders, Contractive			
Encoders.				

30 PERIODS

LABORATORY EXERCISES:

- 1. Implement simple vector addition in TensorFlow.
- 2. Implement a regression model in Keras.
- 3. Implement a perceptron in TensorFlow/Keras Environment.
- 4. Implement a Feed-Forward Network in TensorFlow/Keras.
- 5. Implement an Image Classifier using CNN in TensorFlow/Keras.
- 6. Improve the Deep learning model by fine tuning hyper parameters.
- 7. Implement a Transfer Learning concept in Image Classification.
- 8. Using a pre trained model on Keras for Transfer Learning
- 9. Perform Sentiment Analysis using RNN
- 10. Implement an LSTM based Autoencoder in TensorFlow/Keras.
- 11. Image generation using GAN

Additional Experiments:

- 12. Train a Deep learning model to classify a given image using pre trained model
- 13. Recommendation system from sales data using Deep Learning
- 14. Implement Object Detection using CNN
- 15. Implement any simple Reinforcement Algorithm for an NLP problem

30 PERIODS TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Apply Convolution Neural Network for image processing.

CO2: Understand the basics of associative memory and unsupervised learning networks.

CO3: Apply CNN and its variants for suitable applications.

CO4: Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks.

CO5: Apply autoencoders and generative models for suitable applications.

TEXT BOOKS:

- 1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
- 2. Francois Chollet, "Deep Learning with Python", Second Edition, Manning Publications, 2021.

REFERENCES:

- 1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", Oreilly, 2018.
- 2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'ReillyMedia, 2017.

- 3. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 1st Edition, 2018.
- 4. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress, 2018
- 5. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
- 6. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND, 2017.
- 7. S Rajasekaran, G A Vijayalakshmi Pai, "Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications", PHI Learning, 2017.
- 8. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress, 2017
- 9. James A Freeman, David M S Kapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003.

COURSE NAME: TEXT AND SPEECH ANALYSIS

COURSE CODE: 1911TV78

COURSE OBJECTIVES:

- Understand natural language processing basics
- Apply classification algorithms to text documents
- Build question-answering and dialogue systems
- Develop a speech recognition system
- Develop a speech synthesizer

SYLLABUS		Т	P	С	
	2	0	2	3	
UNIT-I NATURAL LANGUAGE BASICS				6	
Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing an	d				
Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop- words – Feature					
Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model.					
Suggested Activities					
Flipped classroom on NLP					
Implementation of Text Preprocessing using NLTK					
• Implementation of TF-IDF models					
Suggested Evaluation Methods					
Quiz on NLP Basics					
Demonstration of Programs					
UNIT-II TEXT CLASSIFICATION				6	
Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText					
model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization	on				
and Topic Models.					
Suggested Activities					
Flipped classroom on Feature extraction of documents					
Implementation of SVM models for text classification					
External learning: Text summarization and Topic models					
Suggested Evaluation Methods					
Assignment on above topics					
Quiz on RNN, Transformers					
Implementing NLP with RNN and Transformers					
UNIT-III QUESTION ANSWERING AND DIALOGUE SYSTEMS				6	
Information retrieval – IR-based question answering – knowledge-based question answering – langua	ge				
models for OA – classic OA models – chatbots – Design of dialogue systems – evaluating dialog	ue				
systems					
Suggested Activities:					
Flipped classroom on language models for QA					
• Developing a knowledge-based question-answering system					
Classic QA model development					
Suggested Evaluation Methods					
Assignment on the above topics					
Quiz on knowledge-based question answering system					
Development of simple chatbots					

UNIT-IV	TEXT-TO-SPEECH SYNTHESIS	6
Overview. Te	ext normalization. Letter-to-sound. Prosody, Evaluation. Signal processing - Concatenative	
and parametri	ic approaches, WaveNet and other deep learning-based TTSsystems	
Suggested A	ctivities:	
Flipp	ed classroom on Speech signal processing	
Explo	pring Text normalization	
• Data	collection	
Imple	ementation of TTS systems	
Suggested Ev	valuation Methods	
Assig	gnment on the above topics	
• Quiz	on wavenet, deep learning-based TTS systems	
• Findi	ng accuracy with different TTS systems	
UNIT-V	AUTOMATIC SPEECH RECOGNITION	6
Speech recog	nition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems	
Suggested A	ctivities:	
Flipp	ed classroom on Speech recognition.	
• Explo	oring Feature extraction	
Suggested Ev	valuation Methods	
Assig	anment on the above topics	

• Quiz on acoustic modelling

30 PERIODS

PRACTICAL EXERCISES

- 1. Create Regular expressions in Python for detecting word patterns and tokenizing text
- 2. Getting started with Python and NLTK Searching Text, Counting Vocabulary, Frequency Distribution, Collocations, Bigrams
- 3. Accessing Text Corpora using NLTK in Python
- 4. Write a function that finds the 50 most frequently occurring words of a text that are not stop words.
- 5. Implement the Word2Vec model
- 6. Use a transformer for implementing classification
- 7. Design a chatbot with a simple dialog system
- 8. Convert text to speech and find accuracy
- 9. Design a speech recognition system and find the error rate

30 PERIODS TOTAL: 60 PERIODS

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:Explain existing and emerging deep learning architectures for text and speech processing

CO2:Apply deep learning techniques for NLP tasks, language modelling and machine translation

CO3:Explain coreference and coherence for text processing

CO4:Build question-answering systems, chatbots and dialogue systems

CO5: Apply deep learning models for building speech recognition and text-to-speech systems

ТЕХТВООК

1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Third Edition, 2022.

REFERENCES:

- 1. Dipanjan Sarkar, "Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data", APress,2018.
- 2. Tanveer Siddiqui, Tiwary U S, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
- 3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, "Fundamentals of Speech Recognition" 1st Edition, Pearson, 2009.
- 4. Steven Bird, Ewan Klein, and Edward Loper, "Natural language processing with Python", O'REILLY.

VERTICAL 8 MANAGEMENT

COURSE NAME: BEHAVIORAL ECONOMICS LTPC 3 0 0 **COURSE CODE:1911TV81** 3

COURSE OBJECTIVES:

• To familiarize the students to the basic concepts of management in order to aid in understanding how an organization function

• To understand the complexity and wide variety of issues managers face in today's business firms.

• To To acquaint the students with the fundamentals of managing business

• To understand individual and group behavior at the workplace so as to improve the effectiveness of an organization.

UNIT I NATURE AND THEORIES OF MANAGEMENT

Evolution of management Thought-Classical, Behavioral and Management Science Approaches Management- meaning, levels, management as an art or science, Managerial functions and Roles, Evolution of Management Theory- Classical era- Contribution of F.W.Taylor, Henri Fayol, Neo- Classical-Mayo & Hawthorne Experiments. • Modern era – system & contingency approach Managerial Skills.

UNIT II PLANNING AND ORGANIZING

Planning - Steps in Planning Process - Scope and Limitations - Forecasting and types of Planning-Characteristics of a sound Plan - Management by Objectives (MBO) - Policies and Strategies - Scope and Formulation - Decision Making - Types, Techniques and Processes. Organisation Structure and Design -Authority and Responsibility Relationships - Delegation of Authority and Decentralisation -Interdepartmental Coordination - - Impact of Technology on Organizational design - Mechanistic vs Adaptive Structures - Formal and Informal Organisation.Control: meaning, function, Process and types of Control

UNIT III **INDIVIDUAL BEHAVIOR**

Meaning of Organizational behavior, contributing disciplines, importance of organizational behavior, Perception and Learning - Personality and Individual Differences - Motivation theories and Job Performance - Values, Attitudes and Beliefs - Communication Types-Process - Barriers - Making Communication Effective.

UNIT IV GROUP BEHAVIOR

Groups and Teams: Definition, Difference between groups and teams, Stages of Group Development, Group Cohesiveness, Types of teams, Group Dynamics - Leadership - Styles - Approaches - Power and Politics -Organizational Structure - Organizational Climate and Culture, Conflict: concept, sources, Types, Stages of conflict, Management of conflict Organizational Change and Development.

UNIT V EMERGING ASPECTS OF ORGANIZATIONAL BEHAVIOR

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Comparative Management Styles and approaches - Japanese Management Practices Organizational Creativity and Innovation - Organizational behavior across cultures - Conditions affecting cross cultural organizational operations, Managing International Workforce, Productivity and cultural contingencies, Cross cultural communication, Management of Diversity.

TOTAL:45 PERIODS

COURSE OUTCOMES:

CO1: Understanding of various management concepts and skills required in the business world

CO2: In-depth knowledge of various functions of management in a real time management context

CO3: Understanding of the complexities associated with management of individual behavior in the organizations

CO4: Develop the skill set to have manage group behavior in Organizations

CO5: Insights about the current trends in managing organizational behavior

TEXT BOOK:

1. Andrew J. Dubrin, Essentials of Management, Thomson Southwestern, 10th edition, 2016.

2. Samuel C. Certo and S.Trevis Certo, Modern Management: Concepts and Skills, Pearson education, 15th edition, 2018.

REFERENCES:

1. Harold Koontz and Heinz Weihrich, Essentials of Management: An International, Innovation, And Leadership Perspective, 10th edition, Tata McGraw-Hill Education, 2015.

2. Charles W.L Hill and Steven L McShane, "Principles of Management, McGraw Hill Education, Special Indian Edition, 2017.

3. Stephen P. Robbins, Timothy A.Judge, Organizational Behavior, PHI Learning / Pearson Education, 16th edition, 2014.

4. Fred Luthans, Organizational Behavior, McGraw Hill, 12th Edition, 2013.

5. Don Hellriegel, Susan E. Jackson and John W,Jr Slocum, Management: A competency- Based Approach, Thomson South Western,11th edition, 2008.

6. Heinz Weihrich, Mark V Cannice and Harold Koontz, Management- A global entrepreneurial perspective, Tata McGraw Hill, 12th edition, 2008.

7. Stephen P. Robbins, David De Cenzo and Mary Coulter, Fundamentals Of Management, Prentice Hall of India,9 th edition 2016.

8. McShane, Mary V. Glinow, Organizational Behavior, 8th Edition, Tata Mc Graw Hill, 2017.

9. Nelson, Quick, Khandelwal. ORGB – An innovative approach to learning and teaching. Cengage learning. 2nd edition. 2012.

10. Robert Konopaske, John M Ivancevich, Michael T Matteson, Organizational Behavior and Management, 11th edition, Tata McGraw Hill, 2017.

11. Udai Pareek, Understanding Organizational Behavior, 3rd Edition, Oxford Higher Education, 2011.

12. Jerald Greenberg, Behavior in Organizations, PHI Learning. 10th edition. 2011.

COURSE CODE:191ITV82

COURSE OBJECTIVES:

- To Learn the fundamentals of strategic and operational of CRM
- To understand operational methods of CRM
- To understand different analytical methods of CRM to enhance customer experience.
- To Learn the fundamentals of analytical CRM
- To Understand and apply the elements and tools of CRM to manage customer portfolios.

UNIT I UNDERSTANDING CUSTOMER RELATIONSHIPS

CRM definition and constituencies, understanding and misunderstanding CRM, the social CRM fit, commercial contexts, the third sector- not-for-profit, CRM models. Relationship quality, customer lifetime value, relationships with customers and suppliers. Managing the customer lifecycle - customer acquisition, retention and development.

UNIT II STRATEGIC CRM

Customer portfolio management (CPM) - Customer portfolio, basic disciplines of CPM, CPM in B2B context, CPM models, tools for CPM, strategically significant customers, seven core customer management strategies.

UNIT III OPERATIONAL CRM

Sales force automation (SFA) - SFA and its ecosystem, SFA software functionality, SFA adaptation. Marketing automation (MA) – definition of MA, benefits and software applications. Service Automation (SA) –customer service definition, modeling service quality, software for SA, benefits of SA, customer service excellence certification.

UNIT IV ANALYTICAL CRM

Customer database management -corporate customer data, structured and unstructured data, developing a customer database, data - integration, warehousing and marts in the CRM context, knowledge management, Analytics for - CRM strategy and tactics, customer lifecycle, structured and unstructured data, Big data analytics in CRM, analytical insights.

UNIT V MANAGING CUSTOMER EXPERIENCE AND VALUE

Understanding Value and when do customers experience value, Modelling customer-perceived value, Sources of customer value, Value through the marketing mix, Customisation for customer value.Understanding customer experience and concepts, how to manage customer experience, CRM vs CEM. Use of CRM software in CEM

TOTAL:45 PERIODS

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COURSE OUTCOMES:

CO1: Understand the elements of CRM

CO2: Apply the elements of CRM to manage customer portfolios.

CO3 : Understand the tools of CRM

CO4: Apply the tools of CRM to manage customer portfolios.

CO5: Understand different analytical methods of CRM to enhance customer experience

TEXT BOOKS:

1. Buttle Francis and Maklan Stan, Customer Relationship Management – Concepts and Technologies, Special Indian edition, Fourth edition, Routledge, 2019.

2. Gerardus Blokdyk, Customer Relationship Management – A complete guide 2020 edition, 5starcooks, 2019.

REFERENCES :

1. Henry Assael, Consumer Behavior, Cengage Learning, 6th Edition, 2008

2. Kumar, Customer Relationship Management - A Database Approach, Wiley India, 2012.

3. Kumar and Werner Reinartz, Customer Relationship Management, Concept, Strategy and Tools, Springer 2018.

4. Zikmund, Customer Relationship Management, Wiley 2012.

5. G. Shainesh, J. Jagdish N Seth. Customer Relationship Management : Emerging Concepts, Tools and Application, McGraw Hill Education, 2017.

COURSE NAME: ENTREPRENEURSHIP DEVELOPMENT

COURSE CODE:191ITV83

COURSE OBJECTIVES:

To equip and develop the learners entrepreneurial skills and qualities essential to undertake business.

• To impart the learners entrepreneurial competencies needed for managing business efficiently and effectively.

UNIT I ENTREPRENEURIAL COMPETENCE

Entrepreneurship concept - Entrepreneurship as a Career - Entrepreneurial Personality - Characteristics of Successful Entrepreneurs - Knowledge and Skills of an Entrepreneur.

UNIT II ENTREPRENEURAL ENVIRONMENT

Business Environment - Role of Family and Society - Entrepreneurship Development Training and Other Support Organizational Services - Central and State Government Industrial Policies and Regulations.

BUSINESS PLAN PREPARATION UNIT III

Sources of Product for Business - Pre Feasibility Study - Criteria for Selection of Product - Ownership -Budgeting- Project Profile Preparation - Matching Entrepreneur with the Project - Feasibility Report Capital Preparation and Evaluation Criteria

UNIT IV LAUNCHING OF SMALL BUSINESS

Finance and Human Resource Mobilisation - Operations Planning - Market and Channel Selection- Growth Strategies - Product Launching – Incubation, Venture capital, Start-ups.

UNIT V MANAGEMENT OF SMALL BUSINESS

Monitoring and Evaluation of Business - Business Sickness - Prevention and Rehabilitation of Business Units - Effective Management of Small Business - Case Studies.

PRACTICAL EXERCISES:

1. Discuss a Business Plan on /Small scale industry/Food Processing Industry/Agriculture units/Hospital . 2.Undertake SWOT analysis to arrive at your business idea of a product/service

COURSE OUTCOMES:

CO1: The learners will gain entrepreneurial competence to run the business efficiently.

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30 PERIODS

30 PERIODS

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CO2: The learners are able to undertake businesses in the entrepreneurial environment

CO3: The learners are capable of preparing business plans and undertaking feasible projects.

CO4 :The learners are efficient in launching and develop their business ventures successfully

CO5: The learners shall monitor the business effectively towards growth and development.

TOTAL :60 PERIODS

TEXTBOOKS

1.S.S.Khanka, Entrepreneurial Development, S.Chand and Company Limited, New Delhi, 2016.

2.R.D.Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2018.

3. Rajeev Roy, Entrepreneurship, Oxford University Press, 2nd Edition, 2011.

4. Donald F Kuratko, T.V Rao. Entrepreneurship: A South Asian perspective. Cengage Learning, 2012.

5.Dr. Vasant Desai, "Small Scale Industries and Entrepreneurship", HPH,2006.

6. Arya Kumar. Entrepreneurship, Pearson, 2012.

7. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill, 8 th edition ,2017

COURSE CODE:1911TV84

COURSE OBJECTIVES:

- Understand the fundamental concepts of financial management
- Understand valuation of securities.
- Analyse operating and financial leverages.
- Comprehend and apply the concepts of capital budgeting.
- Understand cash management.

UNIT I INTRODUCTION

Introduction: Introduction to Financial Management - Goals of the firm - Financial Environments.Time Value Of Money: Simple and Compound Interest Rates, Amortization, Computing more than once a year, Annuity Factor.

UNIT II VALUATION OF SECURITIES

Valuation of Securities: Bond Valuation, Preferred Stock Valuation, Common Stock Valuation, Concept of Yield and YTM. Risk & Return: Defining Risk and Return, Using Probability Distributions to Measure Risk, AttitudesToward Risk, Risk and Return in a Portfolio Context, Diversification, The Capital Asset Pricing Model (CAPM).

UNIT III OPERATING & FINANCIAL LEVERAGE

Operating & Financial Leverage: Operating Leverage, Financial Leverage, Total Leverage, Indifference Analysis in leverage study. Cost of Capital: Concept, Computation of Specific Cost of Capital for Equity - Preference – Debt, Weighted Average Cost of Capital – Factors affecting Cost of Capital 4L.

UNIT IV CAPITAL BUDGETING

Capital Budgeting: The Capital Budgeting Concept & Process - An Overview, Generating Investment Project Proposals, Estimating Project, After Tax Incremental Operating Cash Flows, Capital Budgeting Techniques, Project Evaluation and Selection - Alternative Methods. Working Capital Management: Overview, Working Capital Issues, Financing Current Assets (Short Term and Long Term- Mix), Combining Liability Structures and Current Asset Decisions, Estimation of Working Capital.

UNIT V CASH MANAGEMENT

Cash Management: Motives for Holding cash, Speeding Up Cash Receipts, Slowing Down Cash Payouts, Electronic Commerce, Outsourcing, Cash Balances to maintain, Factoring. Accounts Receivable Management: Credit & Collection Policies, Analyzing the Credit Applicant, Credit References, Selecting optimum Credit period.

TOTAL:45 PERIODS

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COURSE OUTCOMES:

CO1: Understand the fundamental concepts of financial management

CO2: Apply valuation of securities and calculate the risk & return in portfolio management.

CO3: Analyse the cost structure of a company using operating and financial leverages.

CO4: Develop capital budgets and to estimate working capital. CO5: Apply cash management in Business.

TEXTBOOKS

1. Chandra, Prasanna - Financial Management - Theory & Practice, Tata McGraw Hill, 2007.

2. Srivastava, Misra: Financial Management, OUP, 2011.

3. Van Horne and Wachowicz : Fundamentals of Financial Management, Prentice Hall/ Pearson Education.

4. Financial Management: Theory & Practice: by Brigham and Ernhardt, 14th edition, Cengage, 2015.

5. M.Y. Khan and P.K.Jain Financial management, Text, Problems and cases Tata McGraw Hill, 6th edition, 2011.

6. M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd., 10th edition, 2012.

COURSE CODE:191ITV85

COURSE OBJECTIVES:

- To familiarize the students the basic concepts of Management
- To understand the history, evolution and growth of management concepts
- To learn the applications of different functions of Management
- To study the different issues handled by modern managers
- To understand the different challenges faced by modern managers

UNIT I INTRODUCTION TO MANAGEMENT

Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management; Evolution of Management-Classical Approach-Scientific and Administrative Management; The Behavioral approach; The Quantitative approach; The Systems Approach; Contingency Approach, IT Approach.

UNIT II PLANNING AND DECISION MAKING

General Framework for Planning -Planning Process, Types of Plans, Management by Objectives; Development of Business Strategy. Decision making and Problem Solving -Programmed and Non-Programmed Decisions, Steps in Problem Solving and Decision Making; Bounded Rationality and Influences on Decision Making; Group Problem Solving and Decision Making, Creativity and Innovation in Managerial Work.

UNIT III ORGANIZATION AND HRM

Principles of Organization: Organizational Design & Organizational Structures; Departmentalization, Delegation; Empowerment, Centralization, Decentralization, Recentralization; Organizational Culture; Organizational Climate and Organizational Change. Human Resource Management & Business Strategy: Talent Management, Talent Management Models and Strategic Human Resource Planning; Recruitment and Selection; Training and Development; Performance Appraisal.

UNIT IV LEADERSHIP AND MOTIVATION

Leadership, Power and Authority, Leadership Styles; Behavioral Leadership, Situational Leadership, Leadership Skills, Leader as Mentor and Coach, Leadership during adversity and Crisis; Handling Employee and Customer Complaints, Team Motivation -Types of Motivation; Relationship between Motivation, Performance and Engagement, Content Motivational Theories - Needs Hierarchy Theory, Two Factor Theory, Theory X and Theory Y.

UNIT V CONTROLLING

Control, Types and Strategies for Control, Steps in Control Process, Budgetary and Non-Budgetary Controls.Characteristics of Effective Controls, Establishing control systems, Control frequency, and Methods.

TOTAL:45 PERIODS

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COURSE OUTCOMES:

CO1: Understand the different elements of effective management

- CO2: Apply the concepts of planning and decision making in organizations
- CO3: Describe the concepts of organization and need for staffing process
- CO4: Adopt the concept of directing through motivation and leadership
- CO5: Demonstrate the use of control methods in changing business environment

TEXT BOOK:

- 1. Management Fundamentals, Robert N Lussier, 5e, Cengage Learning, 2013.
- 2. Fundamentals of Management, Stephen P. Robbins, Pearson Education, 2009.

REFERENCES :

- 1. Essentials of Management, Koontz Kleihrich, Tata McGraw Hill.
- 2. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012
- 3. Management: Principles, Processes and Practices, Anil Bhat, Arya Kumar –Oxford UniversityPress-, 2008

COURSE NAME: HUMAN RESOURCE MANAGEMENT FOR ENTREPRENEURS L T P C

COURSE CODE:191ITV86

COURSE OBJECTIVES:

• To introduce the basic concepts, structure and functions of human resource management for entrepreneurs.

- To create an awareness of the roles, functions and functioning of human resource department.
- To understand the methods and techniques followed by Human Resource Management practitioners.

UNIT I INTRODUCTION TO HRM

Concept, Definition, Objectives- Nature and Scope of HRM - Evolution of HRM - HR Manager Roles-Skills - Personnel Management Vs. HRM - Human Resource Policies - HR Accounting -HR Audit - Challenges in HRM.

UNIT II HUMAN RESOURCE PLANNING

HR Planning - Definition - Factors- Tools - Methods and Techniques - Job analysis- Job rotation-Job Description - Career Planning - Succession Planning - HRIS - Computer Applications in HR -Recent Trends

UNIT III RECRUITMENT AND SELECTION

Sources of recruitment- Internal Vs. External - Domestic Vs. Global Sources -eRecruitment - Selection Process- Selection techniques -eSelection- Interview Types- Employee Engagement.

UNIT IV TRAINING AND EMPLOYEE DEVELOPMENT

Types of Training - On-The-Job, Off-The-Job - Training Needs Analysis – Induction and Socialisation Process - Employee Compensation - Wages and Salary Administration – Health and Social Security Measures- Green HRM Practices

UNIT V CONTROLLING HUMAN RESOURCES

Performance Appraisal – Types - Methods - Collective Bargaining - Grievances Redressal Methods – Employee Discipline – Promotion – Demotion - Transfer – Dismissal - Retrenchment - Union Management Relationship - Recent Trends

TOTAL 45 : PERIODS

COURSE OUTCOMES:

Upon completion of this course the learners will be able:

CO 1 To understand the Evolution of HRM and Challenges faced by HR Managers

CO 2 To learn about the HR Planning Methods and practices.

CO 3 To acquaint about the Recruitment and Selection Techniques followed in Industries.

CO 4 To known about the methods of Training and Employee Development.

CO 5 To comprehend the techniques of controlling human resources in organizations.

TEXT BOOKS

1. Gary Dessler and Biju Varkkey, Human Resource Management, 14e, Pearson, 2015.

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2. Mathis and Jackson, Human Resource Management, Cengage Learning 15e, 2017.

3. David A. Decenzo, Stephen.P.Robbins, and Susan L. Verhulst, Human Resource Management, Wiley, International Student Edition, 11th Edition, 2014

4. R. Wayne Mondy, Human Resource Management, Pearson, 2015.

5. Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy. Managing Human Resource. PHI Learning. 2012

6. John M. Ivancevich, Human Resource Management, 12e, McGraw Hill Irwin, 2013.

7. K. Aswathappa, Sadhna Dash , Human Resource Management - Text and Cases , 9th Edition,McGraw Hill, 2021.

8. Uday Kumar Haldar, Juthika Sarkar. Human Resource management. Oxford. 2012

COURSE CODE:191ITV87

COURSE OBJECTIVES:

- To learn the concepts of managing IT projects.
- To learn more about planning
- To understand resource allocation, control, and completion
- To learn software quality management
- To understand budgeting and scheduling

UNIT I INTRODUCTION TO PROJECT MANAGEMENT

Project Management - Definition - Goal - Lifecycles. Project Selection Methods. Project-Portfolio Process-Project Formulation. Project Manager - Roles- Responsibilities and Selection - Project Teams, Project support activities, Types of project organizations.

UNIT II PLANNING AND BUDGETING

The Planning Process – Work Breakdown Structure – Role of Multidisciplinary teams, Critical path analysis. Budget the Project – Methods. Cost Estimating and Improvement. Budget uncertainty and risk management.

UNIT III SCHEDULING & RESOURCE ALLOCATION

PERT & CPM Networks - Crashing - Project Uncertainty and Risk Management - Simulation Gantt Charts-Expediting a project – Resource loading and leveling. Allocating scarce resources Goldratt"s Critical Chain.

UNIT IV CONTROL AND COMPLETION

The Plan-Monitor-Control cycle – Data Collecting and reporting – Project Control – Designing the control system. Project Evaluation, Earned Value Analysis, Auditing and Termination, RiskManagement, - Conflict - Origin & Consequences. Managing conflict - Team methods for solving conflict

UNIT V SOFTWARE QUALITY MANAGEMENT

Product quality and software quality, quality management systems, principles and features System quality specification and measurement, Process and product quality approaches, Quality assurance and quality control, project audit and quality audit, Methods of enhancing quality: the different types of testing, inspections, reviews, standards, Management and control of testing.

TOTAL:45 PERIODS

COURSE OUTCOMES:

CO1: Apply project management principles in business situations

CO2: Learn more about planning, budgeting and scheduling

CO3: Optimize resource utilization and time optimization

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CO4: Understand resource allocation, control, and completion

CO5: Learn software quality management

TEXT BOOK:

1. Clifford Gray and Erik Larson, Project Management, Tata McGraw Hill Edition, 2005.

2. John M. Nicholas, Project Management for Business and Technology - Principles and Practice, Second Edition, Pearson Education, 2006.

3. Hughes B, Project Management for IT-related Projects. BCS Publications, 2012.

REFERENCES:

1. Gido and Clements, Successful Project Management, Second Edition, Thomson Learning, 2003.

2. Harvey Maylor, Project Management, Third Edition, Pearson Education, 2006.
COURSE NAME: SUPPLY CHAIN MANAGEMENT

COURSE CODE:191ITV88

COURSE OBJECTIVES:

- To understand the importance of supply chain management
- To learn decisions in supply chain management for gaining competitive advantage
- To design supply chain networks to enhance supply chain performance
- To plan demand based on inventory and supply
- To understanding the role of logistics in supply chain performance

UNIT I INTRODUCTION

Supply Chain – Fundamentals, Evolution, Role in Economy, Importance, Decision Phases, Enablers & Drivers of Supply Chain Performance; Supply chain strategy; Supply Chain Performance Measures.

UNIT II SUPPLY CHAIN NETWORK

Distribution Network Design – Role in supply chain, Influencing factors, design options, online sales and distribution network, Distribution Strategies; Network Design in supply chain – Role, influencing factors, framework for network design, Impact of uncertainty on Network Design.

UNIT III PLANNING DEMAND, INVENTORY AND SUPPLY

Managing supply chain cycle inventory and safety inventory - Uncertainty in the supply chain-, Analyzing impact of supply chain redesign on the inventory, Risk Pooling, Managing inventory for short life-cycle products, multiple item -multiple location inventory management; Pricing and Revenue Management.

UNIT IV LOGISTICS

Transportation – Role, Modes and their characteristics, infrastructure and policies, transport documentation, design options, trade-offs in transportation design, intermodal transportation. Logistics outsourcing – catalysts, benefits, value proposition. 3PL, 4PL, 5PL, 6PL; International Logistics -objectives, importance in global economy, Characteristics of global supply chains, Incoterms.

UNIT V SUPPLY CHAIN INNOVATIONS

Supply Chain Integration, SC process restructuring, IT in Supply Chain; Agile Supply Chains, Legible supply chain, Green Supply Chain, Reverse Supply chain; Supply chain technology trends – AI, Advanced analytics, Internet of Things, Intelligent things, conversational systems, robotic process automation, immersive technologies, Block chain.

TOTAL:45 PERIODS

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COURSE OUTCOMES:

CO1: Understanding of supply chain fundamentals

CO2: Ability to design supply chain networks to enhance supply chain performance

CO3 : Ability to plan demand based on inventory and supply

CO4: Understanding the role of logistics in supply chain performance

CO5: Awareness of innovations for sustainable supply chains

TEXT BOOKS:

1. Chopra, Sunil, Meindl, Peter and Kalra, D. V.; Supply Chain Management: Strategy, Planning and Operation; Pearson Education, 2015.

2. Altekar, Rahul V.; Supply Chain Management: Concepts and Cases; PHI Learning, 2005.

REFERENCES

1. Sunil Chopra, Peter Meindl and DharamVirKalra, Supply Chain Management-Strategy Planning and Operation, Pearson Education, Sixth Edition, 2016.

2. Janat Shah, Supply Chain Management - Text and Cases, Pearson Education, 2009

3. Ballou Ronald H, Business Logistics and Supply Chain Management, Pearson Education, 5thEdition, 2007

Education, 5thEdition, 2007.

4. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, Designing and Managing the SupplyChain: Concepts, Strategies, and Cases, Tata McGraw-Hill, 2005.

5. Pierre David, International Logistics, Biztantra, 2011.

VERTICAL 9 MARKETING

COURSE NAME: CONVERSATIONAL SYSTEMS

COURSE CODE:1911TV91

COURSE OBJECTIVES:

- Enable attendees to acquire knowledge on chatbots and its terminologies
- Work with ML Concepts and different algorithms to build custom ML Model
- Better understand on Conversational experiences and provide better customer experiences

UNIT I FUNDAMENTALS OF CONVERSATIONAL SYSTEMS

Introduction: Overview, Case studies, Explanation about different modes of engagement for a human being, History and impact of AI. Underlying technologies: Natural Language Processing, Artificial Intelligence and Machine Learning, NLG, Speech-To-Text, Text-To-Speech, Computer Vision etc. Introduction to Top players in Market – Google, MS, Amazon & Market trends. Messaging Platforms (Facebook, WhatsApp) and Smart speakers – Alexa, Google Home and other new channels. Ethical and Legal Considerations in AI Overview.

UNIT II FOUNDATIONAL BLOCKS FOR PROGRAMMING AND NATURAL LANGUAGE 9 PROCESSING

Introduction: Brief history, Basic Concepts, Phases of NLP, Application of chat bots etc. General chatbot architecture, Basic concepts in chatbots: Intents, Entities, Utterances, Variables and Slots, Fulfillment. Lexical Knowledge Networks (WordNet, Verbnet, PropBank, etc). Lexical Analysis, Part-of-Speech Tagging, Parsing/Syntactic analysis, Semantic Analysis, Word Sense Disambiguation. Information Extraction, Sentiment Analysis.

UNIT III BUILDING A CHATBOT / CONVERSATIONAL AI SYSTEMS

Fundamentals of Conversational Systems (NLU, DM and NLG) - Chatbot framework & Architecture, Conversational Flow & Design, Intent Classification (ML and DL based techniques), Dialogue Management Strategies, Natural Language Generation. UX design, APIs and SDKs, Usage of Conversational Design Tools. Introduction to popular chatbot frameworks – Google Dialog flow, Microsoft Bot Framework, Amazon Lex, RASA Channels: Facebook Messenger, Google Home, Alexa, WhatsApp, Custom Apps. Overview of CE Testing techniques, A/B Testing, Introduction to Testing Frameworks - Botium /Mocha ,Chai. Security & Compliance – Data Management, Storage, GDPR, PCI.

UNIT IV ROLE OF ML/AI IN CONVERSATIONAL TECHNOLOGIES AND CONTACT CENTERS 9

Brief Understanding on how Conversational Systems uses ML technologies in ASR, NLP, Advanced Dialog management, Language Translation, Emotion/Sentiment Analysis, Information extraction ,etc. to effectively converse, Introduction to Contact centers – Impact & Terminologies. Case studies & Trends, How does a Virtual Agent/Assistant fit in here?

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UNIT V CONVERSATIONAL ANALYTICS AND FUTURE

Conversation Analytics : The need of it - Introduction to Conversational Metrics - Summary, Robots and Sensory Applications overview - XR Technologies in Conversational Systems, XRCommerce- What to expect next? – Future technologies and market innovations overview.

COURSE OUTCOMES:

CO1: Familiarize in the NLTK tool kit and the pre-processing techniques of natural language processing.

CO2: Familiarize with the basic technologies required for building a conversational system.

CO3: Build a Chatbot for any application and deploy it

CO4: Involve AI in building conversational system and build advanced systems that can be cognitively inclined towards human behavior.

CO5: Build a real time working conversational system for social domain that can intelligently process inputs and generate relevant replies.

TOTAL :45 PERIODS

TEXTBOOKS:

1. Michael McTear, "Conversational AI: Dialogue Systems, Conversational Agents, and Chatbots", Second Edition, Moran and Claypool Publishers, 2020.

2. Cathy Pearl, "Designing Voice User Interfaces: Principles of Conversational Experiences", O'REILLY,2016.

COURSE NAME: DIGITAL MARKETING

COURSE CODE:191ITV92

COURSE OBJECTIVES:

- The primary objective of this module is to examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
- It also focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.

UNIT I INTRODUCTION TO ONLINE MARKET

Online Market space- Digital Marketing Strategy- Components -Opportunities for building Brand Website -Planning and Creation- Content Marketing.

UNIT II SEARCH ENGINE OPTIMISATION

Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement

UNIT III E- MAIL MARKETING

E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation - Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing-Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting

UNIT IV SOCIAL MEDIA MARKETING

Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships -Creating Loyalty drivers - Influencer Marketing.

UNIT V DIGITAL TRANSFORMATION

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

30 PERIODS

PRACTICAL EXERCISES:

1. Subscribe to a weekly/quarterly newsletter and analyze how it's content and structure aid with the branding of the company and how it aids its potential customer segments.

2. Perform keyword search for a skincare hospital website based on search volume and competition using Google keyword planner tool.

3. Demonstrate how to use the Google WebMasters Indexing API

4. Discuss an interesting case study regarding how an insurance company manages leads.

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5. Discuss negative and positive impacts and ethical implications of using social media for political advertising.

6. Discuss how Predictive analytics is impacting marketing automation

COURSE OUTCOMES:

CO1: To examine and explore the role and importance of digital marketing in today's rapidly changing business environment.

CO2: To focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.

CO3: To know the key elements of a digital marketing strategy.

CO4: To study how the effectiveness of a digital marketing campaign can be measured

CO5: To demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs

TOTAL:60 PERIODS

TEXT BOOKS:

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education; First edition (July 2017);ISBN-10: 933258737X;ISBN-13: 978-9332587373.

2. Digital Marketing by Vandana Ahuja ;Publisher: Oxford University Press (April 2015). ISBN-10: 0199455449

3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler; Publisher: Wiley; 1st edition (April 2017); ISBN10: 9788126566938; ISBN13: 9788126566938; ASIN: 8126566930.

4. Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited..

5. Barker, Barker, Bormann and Neher(2017), Social Media Marketing: A Strategic Approach, 2E South-Western ,Cengage Learning.

6. Pulizzi, J Beginner's Guide to Digital Marketing, Mcgraw Hill Education

COURSE CODE:1911TV93

COURSE OBJECTIVES:

- To understand enterprise security in today's world.
- To learn how to evaluate business processes related to risk management
- To learn business continuity
- To understand auditing and security issues in software development.

UNIT I **INTRODUCTION**

Developing a Secure Foundation-threat and vulnerabilities-Security Categorization Applied to Information Types & Information Systems-Minimum Security Requirements-Infrastructure Security Model Components-Systems Security Categorization-Business Impact Analysis-Risk Management.

UNIT II PLANNING, MANAGEMENT AND MONITORING

Phases of Security-Focused Configuration Management-Security Configuration Management Plan-Baseline Identification-Roles and Responsibilities-Measurements-Configuration Audits-Types of Plans-Continuous Monitoring Strategy-Continuous Monitoring Program-Monitoring and Assessment Frequencies.

UNIT III SECURITY ARCHITECTURE

The Meaning of Security - Measuring and Prioritizing Business Risk-Empowering the Customers- Protecting Relationships and Leveraging Trust-The Meaning of Architecture-Information Systems Architecture -Enterprise Security Architecture-Security Architecture Model-The SABSA Model- Contextual and Conceptual Security Architecture

UNIT IV SECURITY POLICY , OPERATIONAL RISK AND ASSURANCE MANAGEMENT 9

Structuring the Content of a Security Policy-Policy Hierarchy and Architecture-Policy Principles- Types of Security Policies-Complexity of Operational Risk Management-Approaches to Risk Assessment-Risk Mitigation-Risk Financing-Assurance of Operational Continuity-Security Audits- Functional & Penetration Testing.

SECURITY ADMINISTRATION, OPERATIONS AND VALIDATION UNIT V

Introduction-Managing the People-Managing Physical and Environmental Security-Managing ICT Operations and Support-Access Control Management-Compliance Management-Security-Specific Operations- Managed Security Services-Product Evaluation and Selection-Business Continuity Management-Certification and Accreditation Process-General Process Phase I & II.

TOTAL:45 PERIODS

COURSE OUTCOMES:

CO1: Design appropriate security architecture with an understanding of the technology

- CO2: Create and deploy enterprise solutions in support of organizational goals
- CO3: Plan and implement projects related to infrastructure, security, software development.
- CO4: Interpret governance policies.
- CO5: Manage IT governance policies.

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TEXT BOOK:

1. James A. Scholz, Enterprise Architecture and Information Assurance Developing a Secure Foundation, CRC Press, 2013.(UNIT –I &II) 107

2. John Sherwood, Andrew Clark, David Lynas, Enterprise Security Architecture A Business- Driven Approach, CRC Press, 2005. (UNIT-III,IV and V)

REFERENCES :

1. John R.Vacca, Computer and Information Security Handbook, Second Edition, Elsevier 2013.

2. Michael E. Whitman, Herbert J. Mattord, Principal of Information Security, Fourth Edition, Cengage Learning, 2012.

COURSE CODE:191ITV94

COURSE OBJECTIVES:

- To understand modern analytical tools that specifically target finance applications.
- To understand different management aspects •
- To learn financial analysis for decision making
- To understand human resource management
- To learn different business strategy

UNIT I **CORPORATE FINANCE ANALYSIS**

Basic corporate financial predictive modeling- Project analysis- cash flow analysis- cost of capital, Financial Break even modeling, Capital Budget model-Payback, NPV, IRR.

UNIT II FINANCIAL MARKET ANALYSIS

Estimation and prediction of risk and return (bond investment and stock investment) - Time series - examining nature of data, Value at risk, ARMA, ARCH and GARCH.

UNIT III PORTFOLIO ANALYSIS

Portfolio Analysis - capital asset pricing model, Sharpe ratio, Option pricing models- binomial model for options, Black Scholes model and Option implied volatility.

UNIT IV TECHNICAL ANALYSIS

Prediction using charts and fundamentals - RSI, ROC, MACD, moving average and candle charts, simulating trading strategies. Prediction of share prices.

UNIT V CONTROLLING

Credit Risk analysis- Data processing, Decision trees, logistic regression and evaluating credit risk model.

COURSE OUTCOMES:

CO1: Understand different management techniques

CO2: Applyanalytical tools that specifically target finance applications.

CO3: Describefinancial analysis for decision making

CO4:Understand human resource management

CO5:Adopt different business strategy

TEXT BOOK:

1. Financial analytics with R by Mark J. Bennett, Dirk L. Hugen, Cambridge university press.

2. Haskell Financial Data Modeling and Predictive Analytics Paperback - Import, 25 Oct 2013 by Pavel Ryzhov.

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TOTAL: 45 PERIODS

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REFERENCES :

1. Quantitative Financial Analytics: The Path To Investment Profits Paperback –Import, 11 Sep 2017 by Edward E Williams (Author), John A Dobelman.

- 2. Python for Finance Paperback Import, 30 Jun 2017 by Yuxing Yan (Author).
- 3. Mastering Python for Finance Paperback Import, 29 Apr 2015 by James Ma Weiming.

COURSE NAME: MARKETING RESEARCH AND MARKETING MANAGEMENT L ТР С

COURSE CODE:191ITV95

COURSE OBJECTIVES:

- To understand the changing business environment and the fundamental premise underlying market driven strategies.
- To identify the indicators of management thoughts and practices.
- To analyze the nature of consumer buying behavior
- To understanding the marketing research
- To new trends in the arena of marketing

UNIT I **INTRODUCTION**

Defining Marketing – Core concepts in Marketing – Evolution of Marketing – Marketing Planning Process – Scanning Business environment: Internal and External - Value chain - Core Competencies - PESTEL -SWOT Analysis – Marketing interface with other functional areas – Production, Finance, Human Relations Management, Information System – Marketing in global environment – International Marketing – Rural Marketing – Prospects and Challenges

UNIT II MARKETING STRATEGY

Marketing strategy formulations - Key Drivers of Marketing Strategies - Strategies for Industrial Marketing -Consumer Marketing - Services marketing - Competition Analysis - Analysis of consumer and industrial markets - Influence of Economic and Behavioral Factors - Strategic Marketing Mix components.

UNIT III MARKETING MIX DECISIONS

Product planning and development – Product life cycle – New product Development and Management – Defining Market Segmentation – Targeting and Positioning – Brand Positioning and Differentiation – Channel Management - Managing Integrated Marketing Channels - Managing Retailing, Wholesaling and Logistics -Advertising and Sales Promotions – Pricing Objectives, Policies and Methods.

UNIT IV BUYER BEHAVIOR

Understanding Industrial and Consumer Buyer Behaviour - Influencing factors - Buyer Behavior Models -Online buyer behaviour - Building and measuring customer satisfaction - Customer relationships management - Customer acquisition, Retaining, Defection - Creating Long Term Loyalty Relationships. Do case studies on understanding consumer Decision-making Styles in India - Domestic Vs Foreign brand clothing.

UNIT V **MARKETING RESEARCH & TRENDS IN MARKET**

Marketing Information System – Marketing Research Process – Concepts and applications: Product – Advertising – Promotion – Consumer Behaviour – Retail research – Customer driven organizations - Cause related marketing – Ethics in marketing – Online marketing trends - social media and digital marketing. Do an analysis on Amazon in India.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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CO1: Applied knowledge of contemporary marketing theories to the demands of business and management practice

CO2: Enhanced knowledge of marketing strategies for consumer and industrial marketing

CO3 : Deep understanding of choice of marketing mix elements and managing integrated marketing channels

CO4: Ability to analyze the nature of consumer buying behaviour

CO5: Understanding of the marketing research and new trends in the arena of marketing

TEXT BOOKS

1. Philip. T. Kotler and Kevin Lane Keller, Marketing Management, Prentice Hall India, 15th Edition, 2017

2. KS Chandrasekar, "Marketing management-Text and Cases", Tata McGraw Hill Education, 2012

REFERENCES

1. Lamb, Hair, Sharma, Mc Daniel– Marketing – An Innovative approach to learning and teaching- A south Asian perspective, Cengage Learning, 2012.

2. Paul Baines, Chris Fill, Kelly Page, Marketing, Asian edition, Oxford University Press, 5 th edition, 2019.

3. Ramasamy, V.S, Namakumari, S, Marketing Management: Global Perspective Indian Context, Macmillan Education, New Delhi, 6 th edition, 2018.

4. NAG, Marketing successfully- A Professional Perspective, Macmillan 2008.

5. Micheal R.Czinkota, Masaaki Kotabe, Marketing Management, Vikas Thomson Learning, 2nd edition 2006.

COURSE NAME:RECOMMENDER SYSTEMS COURSE NAME:1911TV96 COURSE OBJECTIVES:

- To understand the foundations of the recommender system.
- To learn the significance of machine learning and data mining algorithms for Recommender systems
- To learn about collaborative filtering
- To make students design and implement a recommender system.
- To learn collaborative filtering.

UNIT I INTRODUCTION

Introduction and basic taxonomy of recommender systems - Traditional and non-personalized Recommender Systems - Overview of data mining methods for recommender systems- similarity measures- Dimensionality reduction – Singular Value Decomposition (SVD)

Suggested Activities:

Practical learning – Implement Data similarity measures.

External Learning - Singular Value Decomposition (SVD) applications

Suggested Evaluation Methods:

Quiz on Recommender systems.

Quiz of python tools available for implementing Recommender systems

UNIT II CONTENT-BASED RECOMMENDATION SYSTEMS

High-level architecture of content-based systems - Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

Suggested Activities:

Assignment on content-based recommendation systems

Assignment of learning user profiles

Suggested Evaluation Methods:

Quiz on similarity-based retrieval.

Quiz of content-based filtering

UNIT III COLLABORATIVE FILTERING

A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF, components of neighborhood methods (rating normalization, similarity weight computation, and neighborhood selection

Suggested Activities:

- Practical learning Implement collaborative filtering concepts
- Assignment of security aspects of recommender systems

Suggested Evaluation Methods:

- Quiz on collaborative filtering
- Seminar on security measures of recommender systems

UNIT IV ATTACK-RESISTANT RECOMMENDER SYSTEMS

Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack – Group attack – Strategies for robust recommender design - Robust recommendation algorithms.

Suggested Activities:

• Group Discussion on attacks and their mitigation

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- Study of the impact of group attacks
- External Learning Use of CAPTCHAs

Suggested Evaluation Methods:

- Quiz on attacks on recommender systems
- Seminar on preventing attacks using the CAPTCHAs

UNIT V EVALUATING RECOMMENDER SYSTEMS

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – Design Issues – Accuracy metrics – Limitations of Evaluation measures

Suggested Activities:

- Group Discussion on goals of evaluation design
- Study of accuracy metrics

Suggested Evaluation Methods:

- Quiz on evaluation design
- Problems on accuracy measures

PRACTICAL EXERCISES

- 1. Implement Data similarity measures using Python
- 2. Implement dimension reduction techniques for recommender systems
- 3. Implement user profile learning
- 4. Implement content-based recommendation systems
- 5. Implement collaborative filter techniques
- 6. Create an attack for tampering with recommender systems
- 7. Implement accuracy metrics like Receiver Operating Characteristic curves

COURSE OUTCOMES:

On completion of the course, the students will be able to:

CO1:Understand the basic concepts of recommender systems.

CO2:Implement machine-learning and data-mining algorithms in recommender systems data sets.

CO3:Implementation of Collaborative Filtering in carrying out performance evaluation of recommend systems based on various metrics.

CO4:Design and implement a simple recommender system.

CO5:Learn about advanced topics of recommender systems.

CO6:Learn about advanced topics of recommender systems applications

TEXTBOOKS:

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.

2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich , Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.

3. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Sytems Handbook, 1st ed, Springer (2011),

4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition,

Cambridge University Press, 2020.

TOTAL 60 PERIODS

30 PERIODS 30 PERIODS

COURSE NAME: RISK ANALYTICS COURSE CODE:1911TV97 COURSE OBJECTIVES:

- To develop a basic understanding of risk assessment and its role within the risk management process. •
- To understand risk assessment and its role within the risk management process. •
- To differentiate between risk assessment and risk management. •

To develop a basic understanding of how to conduct and evaluate an uncertainty analysis for a risk assessment

UNIT I **INTRODUCTION**

Introduction, Fundamentals of Risk- Risk Planning, Assessment and Management Process and the Systems Approach-Types of Risk Assessment- Risk, Hazard, Performance and Engineering Risk Assessment.

RISK IDENTIFICATION UNIT II

Preliminary Hazard Analysis (PHA), Hazards and Operability Analysis (HAZOP) - Job Safety Analysis (JSA) - Failure Modes and Effects Analysis (FMEA)- Fault Tree Analysis (FTA), Event Tree Analysis (ETA), Decision Trees- Cause-Consequence Analysis (CCA)

RISK PRIORITIZATION & TREATMENT UNIT III

Preliminary Hazard Analysis (PHA), Hazards and Operability Analysis (HAZOP) - Job Safety Analysis (JSA) - Failure Modes and Effects Analysis (FMEA)- Fault Tree Analysis (FTA), Event Tree Analysis (ETA), Decision Trees- Cause-Consequence Analysis (CCA).

RISK PRIORITIZATION & TREATMENT UNIT IV

Risk Probability and Impact Assessment, Risk Index and Risk Ranking - - Risk Matrix, EV Analysis, Sensitivity and Tradeoff Analysis, Modeling and Simulation- Risk Attitude and Risk Tolerance, As Low As Reasonably Practicable (ALARP)- Avoidance, Separation, Reduction, Transfer, Acceptance- Detection, Control, Response and Recovery- Performance Monitoring.

UNIT V SPECIAL TOPICS AND APPLICATION

ISO3100, Quality and Reliability- Supply Chain Risk Management- Project Risk Management- Positive Risk/ Opportunities Management- Risk and TOC.

COURSE OUTCOMES:

CO1: Identify the core types of project risks.

CO2: Use qualitative and quantitative risk assessment methods.

CO3: Competently use risk simulation techniques

CO4: Use risk analysis tools/methods and work in a group to create a risk management plan based on the ISO 31000:2009.

CO5: Identify a range of risk management issues/challenges and the risks as complex systems cascade and be competent to initiate potential actions in response

TEXT BOOK:

1. Marvin Rausand Stein Haugen, Risk Assessment: Theory, Methods, and Applications, Wiley, 2020. **REFERENCES**:

1. Mohammad Modarres, Risk Analysis in Engineering Techniques, Tools, and Trends, CRC Press, 2006.

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TOTAL:45 PERIODS

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COURSE CODE:191ITV98

COURSE OBJECTIVES:

- To understand the basic issues and types of social,text and media mining
- Familiarize the learners with the concept of social, text and media analytics and understand its significance.
- Familiarize the learners with the tools of social, text and media analytics.
- Enable the learners to develop skills required for analyzing the effectiveness of social, text and media for business purposes
- To know the applications in real time systems.

INTRODUCTION TO SOCIAL MEDIA ANALYSIS UNIT I

Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas. Network fundamentals and models: The social networks perspective nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization.

OVERVIEW OF TEXT MINING AND DATA MINING UNIT II

Overview of text mining- Definition- General Architecture- Algorithms- Core Operations -Preprocessing-Types of Problems- basics of document classification- information retrieval clustering

and organizing documents- information extraction- prediction and evaluation- Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing - Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

UNIT III **TEXT MINING FOR INFORMATION RETRIEVAL AND INFORMATION EXTRACTION**

Information retrieval and text mining- keyword search- nearest-neighbor methods- similarity- web based document search- matching- inverted lists- evaluation. Information extraction- Architecture - Co-reference -Named Entity and Relation Extraction- Template filling and database construction – Applications. Inductive -Unsupervised Algorithms for Information Extraction. Text Summarization Techniques - Topic Representation - Influence of Context - Indicator Representations - Pattern Extraction - Apriori Algorithm - FP Tree algorithm.

WEB ANALYTICS TOOLS UNIT IV

Click stream analysis, A/B testing, online surveys, Web crawling and Indexing. Natural Language Processing Techniques for Micro-text Analysis. Do a case study on Google analytics.

UNIT V **MARKETING RESEARCH & TRENDS IN MARKET**

Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Postperformance on FB. Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis. Case study : Identify Consumer Preferences and Market Positioning of a New Product.

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COURSE OUTCOMES:

CO1: Understand about social, text and media mining

CO2: Understand the significance of social text and media analytics

CO3: Learn tools of social, text and media analytics.

CO4: Develop skills required for analyzing the effectiveness of social text and media for business purposes

CO5: Know the applications in real time systems.

TEXT BOOK :

1. Marshall Sponder, Social Media Analytics, McGraw Hill ,2011

2. Charu C. Aggarwal , ChengXiang Zhai, Mining Text Data, Springer; 2012

REFERENCES :

1. Matthew Ganis, Avinash Kohirkar, Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media, Pearson, 2016.

2. Jim Sterne, Social Media Metrics: How to Measure and Optimize Your Marketing Investment, Wiley, 2010.

3. Oliver Blanchard ,Social Media ROI: Managing and Measuring Social Media Efforts in Your Organization (Que Biz-Tech), 2019

4. Sholom Weiss, Nitin Indurkhya, Tong Zhang, Fred Damerau "The Text Mining Handbook:Advanced Approaches in Analyzing Unstructured Data", Springer, paperback 2010

5. Ronen Feldman, James Sanger -" The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data", Springer, paperback 2010.

6. Tracy L. Tuten, Michael R. Solomon, Social Media Marketing, Sage, 2016.

TOTAL :45 PERIODS



Department of Mechanical Engineering

REGULATION 2019

PO-PSO STATEMENTS

CURRICULUM

CO - PO MAPPINGS

PO's	PROGRAMME OUTCOMES
PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	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.
PO3	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.
PO4	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.
PO5	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.
PO6	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.
PO7	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.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	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.
PO11	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.
PO12	Lifelong learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.
PSO's	PROGRAM SPECIFIC OUTCOMES
PSO1	Ability to understand the principles and working of machines.
PSO2	Ability to understand the structural development methodologies of machines & Possess knowledge of design process.
PSO 3	Ability to use knowledge in various domains to identify research gaps & to provide solution to new ideas and innovations related to Mechanical Engineering

SI.No	Course	Name of the Course	Category	No.	Credi		
	Code			L	Т	Р	ts
		THEORY					
1	191MA101	Engineering Mathematics I	BS	2	2	0	3
2	Course CodeName of the CourseCategTHEORY191MA101Engineering Mathematics IBS191PH101Engineering PhysicsBS191CH101Engineering ChemistryBS191HS101English for Engineering StudentsHS191ME111Basic Civil and Mechanical EngineeringES191EE111Basic Electrical and Electronics EngineeringES191PH10APhysics LaboratoryBS191CH10AChemistry laboratoryBSTotal			3	0	0	3
3	191CH101	Engineering Chemistry	BS	3	0	0	3
4	191HS101	English for Engineering Students	HSS	3	0	0	3
5	191ME111	Basic Civil and Mechanical Engineering	ES	3	0	0	3
6	191EE111	Basic Electrical and Electronics Engineering	ES	3	0	0	3
		PRACTICAL					
1	191PH10A	Physics Laboratory	BS	0	0	2	1
2	191CH10A	Chemistry laboratory	BS	0	0	2	1
		Total		17	2	4	20

SEMESTER – I

SEMESTER – II

SI.	Course	Name of the Course	Category	No.	Credi		
INO			L	Т	Р	ts	
		THEORY					
1	191MA201	Engineering Mathematics II	BS	2	2	0	3
2	191PH204	Materials Science for Mechanical Engineering	BS	3	0	0	3
3	191HS201	Environmental Science and Engineering	HSS	3	0	0	3
4	191ME211	Engineering Graphics	ES	2	2	0	3
5	191ME212	Engineering Mechanics	ES	2	2	0	3
6	191ME221	Manufacturing Technology I	PC	3	0	0	3
		PRACTICAL					
1	191ME21						2
	A	Engineering Practices Laboratory	ES	0	0	4	2
		Total		15	6	4	20

Sl. No	Course	Name of the Course	Category	No	Credit		
	Code			L	Т	Р	8
		THEORY					
1	191MA305	Transforms and Partial Differential Equations	BS	2	2	0	3
2	191ME311	Fluid Mechanics and Machinery	2	2	0	3	
3	191EE311	Electrical Drives and Controls	3	0	0	3	
4	191ME321	Engineering Thermodynamics	РС	2	2	0	3
5	191ME322	Manufacturing Technology II	PC	3	0	0	3
6	191ME323	Engineering Metallurgy	PC	3	0	0	3
		PRACTICAL	Ĺ				
1	191EE31A	Electrical Engineering Laboratory	ES	0	0	4	2
2	191ME31B	Fluid Mechanics and ES		0	0	4	2
3	3 191ME32A Manufacturing Technology PC Laboratory		PC	0	0	4	2
		Total		15	6	12	24

SEMESTER – III

SEMESTER-IV

	Course		a .	No.	Credits		
SI. No	Code	Name of the Course	Category				
	Coue			L	Т	Р	
		THEORY					
1	10114402	Statistics and Numerical	BS	2	2	0	3
1	191MA402	Methods					
2	101 10 41 1	Strength of materials for	ES	3	0	0	3
2	191ME411	Mechanical Engineers					Credits 3 3 3 3 1 2 2 0 20
3	3 191ME421 Kinematics of Machinery PC					0	3
4 19	1011400	Computer Aided Design and	PC	3	0	0	3
	191ME422	Manufacturing					
5	191ME423	Thermal Engineering	PC	3	0	0	3
	-	PRACTICA	Ĺ				•
1	101110400	Interpersonal Skills	UCC	0	0	2	1
	19165408	Laboratory	пээ	0	0	Z	1
2	101 1041 4	Strength of materials	EC	0	0	1	2
	191ME41A	Laboratory	ES	0	0	P 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 2 1 4 2 4 2 0 0 10 20	
3	3 191ME42A CAD/ CAM Laboratory PC		PC	0	0	4	2
		INTERNSHI	Ρ				•
1 191MC46A Internship/ Training -I MC 0 0 0 0							0
		Total		13	4	10	20

SI.N	Course	Name of the Course	Category	No. o	Credits					
0	Code			L	Т	Р				
	THEORY									
1	191ME521	Design of Machine Elements	PC	3	0	0	3			
2	191ME522	Metrology and Measurements PC			0	0	3			
3	191ME523	Dynamics of Machines	2	2	0	3				
4	-	Professional Elective-I	PE	3	0	0	3			
5	191CS5410	CS5410 Open Elective-I Problem Solving and Python Programming OE		3	0	0	3			
		PRACTIC	AL							
1	1 191ME52A Metrology and Measurements PC Laboratory		PC	0	0	4	2			
2	2 191ME52B Kinematics and Dynamics PC Laboratory			0	0	4	2			
		Total		14	2	8	19			

SEMESTER – V

SEMESTER – VI

SI.N	Course	Name of the Course	Category	No. o	of Peri Week	Credits	
υ	Coue			L	Т	Р	
		THEORY					
1	191ME621	rse le Name of the Course THEORY 3621 Design of Transmission Systems 3622 Heat and Mass Transfer 3623 Finite Element Analysis Professional Elective-II Professional Elective-III Open Elective-III Open Elective-III PRACTICA 362A Finite Element Method Laboratory 362B Thermal Engineering Laboratory INTERNSH 366A Internship/Training-II		3	0	0	3
2	191ME622	Heat and Mass Transfer	3	0	0	3	
3	191ME623	Finite Element Analysis	nite Element Analysis PC				3
4	-	rofessional Elective-II PE		3	0	0	3
5	-	Professional Elective-III	PE	3	0	0	3
6	-	Open Elective-II	OE	3	0	0	3
		PRACTICA	A L				
1	191ME62A	Finite Element Method Laboratory	PC	0	0	4	2
2	191ME62B	Thermal Engineering Laboratory	PC	0	0	4	2
	INTERNSHIP						
1	191MC66A	PRACTICAL E62A Finite Element Method Laboratory PC E62B Thermal Engineering Laboratory PC INTERNSHIP C66A Internship/Training-II MC Total				0	0
		Total		18	0	8	22

Sl. No	Course Code	Name of the Course	Category	No.	Credits			
				L	Τ	Р		
		THEOR	RY					
1	191HS701	Principles of Management	HSS	3	0	0	3	
2	191ME721	Power Plant Engineering	3	0	0	3		
3	-	Professional Elective-IV	PE	3	0	0	3	
4	-	Professional Elective-V	PE	3	0	0	3	
5	-	Open Elective-III	OE	3	0	0	3	
		PRACTI	CAL					
1 191ME75A Design and Fal Project		Design and Fabrication Project	PROJ	0	0	4	2	
	SEMINAR							
1	191MC76A	Technical Seminar	MC	0	0	0	0	
		Total		15	0	8	17	

SEMESTER – VII

SEMESTER – VIII

Sl. No	Course Code	Name of the Course	ne of the Course Category			No. of Periods / Week				
						Р				
THEORY										
1	-	Professional Elective-VI	PE	3	0	0	3			
2	-	Open Elective-IV	OE	3	0	0	3			
3	-	Open Elective-V	OE	3	0	0	3			
PROJECT										
1	191ME85A	Project Work	PROJ	0	0	20	10			
		9	0	20	19					

Total Credits : 161

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COURSE OUTCOME STATEMENTS, MAPPING OF COOPO, COOPSO WITH JUSTIFICATION C101 ENGINEERING MATHEMATICS-1 191MA101

After the completion of the course, Students will be able to Ca. a.t. — — —

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CORRELATION BETWEEN CO-PO

) 26												
	POI	PO2	PO3	204	POs	box						
CI01.1	3	3			103	<u>rus</u>	P07	POS	PO9	POIO	POII	P012
C101.2	1	<u> </u>	- <u>-</u> -	<u> </u>		0	0	0	0	0	0	
C101 2			<u> </u>	2	0	0	0	0		<u> </u>	<u> </u>	· <u>~</u>
C101.5	_ د	3	2	2	0	0			<u> </u>	- <u>v</u> _	<u>v</u>	2
C101.4	3	3	2	2	0		<u> </u>	<u> </u>			0	2
C101.5	3	3	-, -		- <u>-</u> -	<u> </u>	0	0	0	0	0	2
00		<u>-</u>	÷ -	- 4 -	0	_ 0 _	0	0	0	0	0	2
			2	2	Ū Ū	0	0	•	0	-0-	0	

C0	PSO1	PSO2	PSO3
C101.1	0	1	2
C101.2	0	1	2
C101.3	ō –	1	2
C101.4	Ō	1	2
C101.5			2
CO	Ö	1	2

C102 ENGINEERING PILYSICS 191190101

After the completion of the course, Students will be able to

SL.NO	STATEMENTS
C192.1	Demonstrate the proficiency on the basics of properties of matter and its applications
(*102.2	Expose the basic principles and working of Laser and for modern developments in
	industrial and medical applications
ciez.3	Acquire the essentials on the concepts of propagation of waves in optical fibres and
	their applications
C102.4	Assimilate the physics concepts of quantum theory and its applications in electron microscope
C102.5	Analyze the structure of materials and different crystal growth techniques

CORRELATION BETWEEN CO-PO

CO	POi	PO2	P03	P04	105	P06	107	PO6	P09	PO10	PO 11	PO12
C102.1	3	3	2	2	0	•	Û	0	0	0	0	2
C102.2	3	3	2	2	Û	0	Ó	0	Ö	0	Û	2
C102.3	3	3	2	2	0	0	0	0	0	Û	•	2
C102.4	3	3	2	2	0	0	0	•	0	Q	0	2
C192.5	3	3	2	2	•	Ō	0	Û	0	0	0	2
CO	3	3	2	2	•	•	•	•	•	•	•	2

CO	PSO1	PSO2	PSO3
C102.1	1	2	2
C102.2	1	2	2
C102.3	1	2	2
C142.4	1	2	2
C102.5	1	2	2
00	l	2	2

C103 ENGINEERING CHEMISTRY 191CH101

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After the completion of the course, Students will be able to

SL.NO	STATEMENTS
C103.1	Analyze microscopie chemistry in terms of atomic, molecular orbital and intermolecular forces
C103.2	Investigate the water treatment and softening methods
C103.3	Appraise the types and mechanism of electrochemical reaction in batteries and fuel cells
C103.4	Explain the basic principle, types and mechanism of polymerization process and techniques
C103.5	Assess the advanced materials properties, characterization and application of energy storage

CORRELATION BETWEEN CO.PO

CO	PO1	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	PO11	P012
C103,1	3	3	2	2	0	2	2	2	0	Û	0	2
C103.2	3	3	2	2	0	2	2	2	0	0	0	2
C163.3	3	3	2	2	0	2	2	2	0	0	0	2
C103.4	3	3	2	2	0	2	2	2	Ð	0	0	2
C103.5	3	3	2	2	0	2	2	2	0	0	0	2
CO	3	3	2	2	0	2	2	2		•	0	2

ĊO	P\$01	PSO2	PSO3
C103.1	0	1	0
C103.2	Û	1	0
C103.3	Ū	-	0
C103.4	0	-	0
C103.5	0	1	0
co	0	1	0

C104 ENGLISH FOR ENGINEERING STUDENTS 191HS101

After the completion of the course, Students will be able to

SL.NO	STATEMENTS
C104.1	Listen and comprehend scientific and technical lectures as well as online video lectures such as TED and NPTEL
C104.2	Speak confidently and efficiently on day to day occurrences and formal presentations
C104.3	Read technical and no technical verbal and visual texts and comprehend messages by applying appropriate reading strategies
C104.4	Write clearly and coherently various types of reports, job applications, minutes recommendations and check lists, graphs, analytical essays to meet specific ills of academic and professional needs
C104.5	Effectively communicate to keep up with professional standards

CORRELATION BETWEEN CO-PO

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C104.1	1	0	0	0	0	0	0	3	3	3	3	2
C104.2	1	0	0	0	0	0	0	3	3	3	3	2
C104.3	1	0	0	0	0	0	0	3	3	3	3	2
C104.4	1	0	0	0	0	0	0	3	3	3	3	2
C104.5	1	0	0	0	0	0	0	3	3	3	3	2
CO	1	0	0	0	0	0	0	3	3	3	3	2

CO	PSO1	PSO2	PSO3
C104.1	0	0	0
C104.2	0	0	0
C104.3	0	0	0
C104.4	0	0	0
C104.5	0	0	0
CO	0	0	0

C105 BASIC CIVIL AND MECHANICAL ENGINEERING (9)ME111

SL.NO	STATEMENTS
C105.I	Explain the usage of construction material and proper selection of construction materials
C105.2	Explain about water resources, sewage treatment and transportation systems
C105.3	Explain about the components use in power plants
C105.4	Describe the internal combustion engines
C105.5	Explain about the renewable energy sources and refrigeration cycles

CORRELATION BETWEEN CO-PO

CO	PŌ1	PO2	P03	PO4	POS	P06	P07	108	P09	PO10	POII	POIZ
C105.1	3	3	1	3	0	2	2		2	0	0	3
C105.2	3	3	- <u>,</u>	3	-0	2	2	$\frac{1}{1}$	2			
C105.3	3	3	-	3	0	2	2	1	2	0	- <u>-</u>	- <u>°</u>
C105.4	3	3	 	3	0	2	2		2		0	
C105.5	3	3	<u></u>	3	0	2	2		2	_ • 0		-
<u>co</u>	3	3	1	3	•	2	2	1	2	-	-	

CO	PSO1	PSO2	PSO3
C105.1		0	0
C105.2	1	0	0
C105.3	1	0	Ö
C105.4	1	0	0
C105.5	t	0	0
C0	1	0	0

CI66 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING 19EE111

SL.NO	STATEMENTS						
C166.1	Summarizes about different structures of Power system and safety measures.						
C166.2	Explain about the basics of Electricity						
C166.3	Discuss on various electric circuits and use of measuring instruments						
C1 66.4	Clarify the working of basic electronic devices such as diode, transistor and operational amplifiers						
C106.5	Infer about Digital Electronics and Communication System						

CORRELATION BETWEEN CO-PO

CO	PO 1	702	103	P04	P05	106	PO7	101	P09	1010	PO 11	7012
C166.1	3	3	3	2	0	0	0	•	Û	0	0	2
C106.2	3	3	3	2	•	Ð	Û	0	0	0	0	2
C1063	3	3	3	2	Û	•	0	0	0	0	•	2
C166.4	3	3	3	2	0	0	0	0	0	Ō	0	2
C166.5	3	3	3	2	•	0	0	0	0	0	Q	2
CO	3	3	3	2	•	•	•	•	•	•	•	2

CO	PSO1	PSO2	PSO3
C166.j	1	2	Q
C196.2	l	2	0
C1663	1	2	0
C186.4	1	2	0
Č166.5	1	2	0
CO	1	2	•

C107 PHYSICS CARORATORY 191PH10A

STATEMENTS
Apply the principles of properties of matter in determining the various elastic
properties
Have the hands on exercises which helps them to apply principles of optics
Attains the basic understanding of concepts of quantum mechanics

CORRELATION BETWEEN CO-PO

CO (PO 1	POZ	PO 3	PO4	POS	P06	PO7	PO	PO9	PO10	PO11	PO12
C107.1	3	3	2	2	0	2	2	2	2	0	Q	2
C197.2	3	3	2	2	0	2	2	2	2	0	0	2
Ci#7.3	3	3	2	Z	0	2	2	2	2	0	0	[2
CO	3	3	2	2	Ď	2	2	2	2	•	•	2

<u> </u>	PSO1	PS02	P5O3
C197.1	1	2	2
C107.2	<u> </u>	2	2
C107.3	- ,	2	2
co	1	2	1

C108 CHEMISTRY LABORATORY 191CH10A

SL.NO	STATEMENTS
C108.1	Acquire knowledge on quantitative chemical analysis by instrumentation and volumetric method
C108.2	Analyze the water sample for hardness, chloride, sodium /potassium content, dissolved oxygen etc.
C108.3	Solve analytical problems in spectrometer and flame photometer for the identification and quantification

CORRELATION BETWEEN CO-PO

co	POI	PO2	PO3	PO4	PO5	PO6	PO7	POS	PO9	PO10	PO11	PO12
C108.1	3	3	2	2	0	2	2	1	2	0	0	2
C108.2	3	3	2	2	0	2	2	1	2	0	0	2
C108.3	3	3	2	2	0	2	2	1	2	0	0	2
CO	3	3	2	2	0	2	2	1	2	0	0	2

CO	PSO1	PSO2	PSO3
C108.1	1	2	2
C108.2	1	2	2
C108.3	1	2	2
CO	1	2	2

C109 ENGINEERING MATHEMATICS 11 191MA201

Car 110	
SPHA	
C109.1	Obtain the multiple integrals in Cartesian and Polar coordinates
C189.2	Eximpolate the concepts of vector calculus and apply in various fields like field flow and heat problems
C109.3	Analyze the properties of analytic functions by Cauchy0 Riemann equation and evaluate the problems harmonic function and conformal mapping
C109.4	Estimate complex line integrals and real integrals by Cauchy's integral formula and Cauchy's residue theorem
C109.5	Apply Laplace transform of different types of functions, derivatives, integrals and differential equation which finds its application in various engineering fields

CORRELATION BETWEEN CO-PO

00	101	POZ	103	POI	105	PO6	P07	POS	POS	P016	PO11	P012
C199.1	3	3	3	3	D	0	•	Ð	•	0	C	2
C109.2	3	3	3	3	0	0	•	¢	0	0	0	2
C109.3	3	3	3	3	0	0	•	Ð	0	0	•	2
C103.4	3	3	3	3	0	Q	•	Ū.	0	•	•	2
C109.5	3	3	3	3	0	0	0	0	0	¢	0	2
CO	3	3	3	3	Ü		٠	0	•	•	•	1

CO	P\$01	1902	PSO3
C169.1	0	2	L.
C169.2	0	2	1
C109.3	0	2	
C169.4	0	2	Ι
C109.5	0	2	<u> </u>
8	•	3	1

CITO MATERIALS SCIENCE FOR MECHANICAL ENGINEERING 1919H204

After the completion of the course, Students will be able to	

SL.NO	STATEMENTS
C110.1	Analyse strength of material and mechanical properties of materials
C(10.2	Apply the concepts of magnetic properties of materials in engineering applications
CI 10.3	Use dielectrics of materials for engineering applications
C118.4	Evaluate the thermal properties of materials for developing mechanical components
C119.5	Apply the concepts of shape memory alloys and super conductors for engineering
	opplications

CORRELATION BETWEEN CO-PO

C0	PO 1	102	POS	104	105	106	107	105	P09	P010	1011	1012
C110.1	3	3	2	1	0	2	2	0	٠	0	0	1
C110.2	3	3	2	1	0	2	2	Ô	٠	0	0	1
C[10.3	3	3	2	1	•	2	2	9	٠	Ó	Ó	1
C110.4	3	3	2	1	٠	2	2	•	٠	•	0	1
C116.5	3	3	2	-	٠	2	2	0	•	Û	0	-
C0	3	3	1	1	Ĩ Î	1	1		•		•	1

00	PSO1	PSO2	PSO3
C110.1	0	1	1
C110.2	0	1	1
C114.3	Û	1	1
C1104	Ō	1	1
CI14.5	0	1	1
C0	•	1	1

CLILENVIRONMENTAL SCIENCE AND ENGINEERING 19(1)(32)

After the completion of the course, Students will be able to

SE-NO	STATEMENTS
сны	Assess the scope and importance of environmental science, various types of
	covey stem, bindiversity and conservation strategies
- ciii a	Appraise the imperative concept of hazardous reture, sources, effects and control
	measures of environmental pollution caused by alternative energy sources
CHEJ	Recognize the environmental impacts of various types of natural resources on
	climate change and importance of solid waste management
ंटॉग.4	Evaluate the impacts of population growth and its impacts on the environment
cins	Relate the Indian environmental laws in the scenario of value systems and ethics

CORRELATION BETWEEN CO-PO

CO	POL	PO2	PO3	Pü4	PO5	P06	P07	108	P09	POIO	2011	P012
CIILJ	2	1	2	I	0	3	3	2	0	0	0	3
C111.2	7	ن	2	I	0	3	3	2	Ð	Q	0	2
C111.3	7	F	2	I	0	3	3	2	0	0	0	2
CIIIA	2	1	2	1	0	3	3	2	0	0	0	2
CIHS	2	i i	2	1	Q	3	3	2	0	0	Ó	Z
C0	2	1	2	I	Ð	3	3	2	¢	•	•	2

CO T	P\$01	7602	P80 3
CIH.I	1 0	0	0
cina -	0	0	0
CIII.3	0	0	Ö,
CIIIA	10	' A '	0
C111.5	i i i	- o	0
CO ^	÷	Ō	ė

C112 ENGINEERING GRAPHICS 191ME211

SL.NO	STATEMENTS
C112.1	Draw engineering curves and apply the concepts of free hand sketching
C112.2	Draw orthographic views of points, lines and surfaces
C112.3	Draw visualizations of simple solid objects as per orthographic projections
C112.4	Draw sections and developments made in drawing
C112.5	Draw pictorial drawings of simple objects

After the completion of the course, Students will be able to

CORRELATION BETWEEN COPO

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C112.1	3	3	3	3	0	0	0	2	0	2	0	2
C112.2	3	3	3	3	0	0	0	2	0	2	0	2
C112.3	3	3	3	3	0	0	0	2	0	2	0	2
C112.4	3	3	3	3	0	0	0	2	0	2	0	2
C112.5	3	3	3	3	0	0	0	2	0	2	0	2
со	3	3	3	3	0	0	0	2	0	2	0	2

CO	PSO1	PSO2	PSO3
C112.1	1	2	0
C112.2	1	2	0
C112.3	1	2	0
C112.4	1	2	0
C112.5	1	2	0
со	1	2	0

C113 ENGINEERING MECHANICS 191ME212

After the completion of the course, Students will be able to

SL.NO	STATEMENTS
C113.1	Apply the vectorial and scalar representation of forces and moments to practical problems
C113.2	Solve the equilibrium of rigid bodies in practical applications
C113.3	Relate the moment related properties for simple surfaces and simple problems
C113.4	Find dynamic forces exerted in rigid body in practical problems
C113.5	Identify the conditions of static and dynamic bodies using laws of friction in practical problems

CORRELATION BETWEEN CO-PO

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C113.1	3	3	3	3	0	0	0	0	0	0	0	2
C113.2	3	3	3	3	0	0	0	0	0	0	0	2
C113.3	3	3	3	3	0	0	0	0	0	0	0	2
C113.4	3	3	3	3	0	0	0	0	0	0	0	2
C113.5	3	3	3	3	0	0	0	0	0	0	0	2
CO	3	3	3	3	0	0	0	0	0	0	0	2

CO	PSO1	PSO2	PSO3
C113.1	2	3	0
C113.2	2	3	0
C113.3	2	3	0
C113.4	2	3	0
C113.5	2	3	0
CO	2	3	0
CH4 MANUFACTURING TECHNOLOGY E191ME221

After the completion of the course, Students will be able to

SLNO	STATEMENTS
C114.1	Explain different metal casting processes, associated defects, merits and demerits
C114.2	Compare different metai joining processes
CI143	Summarize various bot working and cold working methods of metals
C114.4	Explain various sheet metal making processes.
C114.5	Distinguish various methods of manufacturing plastic components

CORRELATION BETWEEN CO-PO

CO	POI	P02	203	P04	PO5	PO6	P07	POs	PO 9	PO10	PO11	P012
C114.1	3	3	2	0	2	1	0	0	O	0	0	2
C114.2	3	3	2	0	2	t I	0	0	0	<u> </u>		2
C114.3	3	3	2	0	2	ī	0	0	0	0		2
C114.4	3	3	2	Q	2	1	0	0	0	0	- 0	2
C114.5	3	3	2	0	2		0	ò	0	0	0	2
CO	3	3	2	0	2	t	•	0	Ú	•	0	2

СО	PSOI	PSO2	PSO3
C114.1	3	3	2
C114.2	3	3	2
C114.3	3	3	2
C114.4	3	3	2
C114.5	3	3	2
CO	3	ï	2

C115 ENGINEERING PRACTICES LABORATORY 191ME21A

After the completion of the course, Students will be able to

SL.NO	STATEMENTS
C115.1	Use mechanical and civil engineering equipment to join the structures and perform basic machining operations and fabricate models in sheet meta
C115.2	Use electrical and electronics engineering equipment to test the respective electrical and electronic parameters

CORRELATION BETWEEN CO-PO

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C115.1	3	1	2	0	1	1	0	0	2	0	0	0
C115.2	3	1	2	0	1	1	0	0	2	0	0	0
CO	3	1	2	0	1	1	0	0	2	0	0	0

CO	PSO1	PSO2	PSO3	
C115.1	1	1	1	
C115.2	1	1	1	
CO	1	1	1	

C201 - TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS 191MA305

After the completion of the course, Students will be able to

SL.NO	STATEMENTS
C201.1	Solve the given standard partial differential equations
C201.2	Solve differential equations using Fourier series analysis for engineering applications
C201.3	Apply mathematical principles on transforms and partial differential equations
C201.4	Solve one- and two-dimensional heat flow problems and wave equations using Fourier series
C201.5	Solve partial differential equations by using Z transform techniques for discrete time systems

CORRELATION BETWEEN CO-PO

CO	PO1	PO2	PO3	PO4	PO5	P06	PO7	PO8	P09	PO20	PO11	POIZ
C201.1	3	3	3	2	0	0	0	0	0	0	0	1
C201.2	3	3	3	2	0	0	0	0	0	0	0	1
C201.3	3	3	3	2	0	0	0	0	0	0	0	1
C201.4	3	3	3	2	0	0	0	0	0	0	0	3
C201.5	3	3	3	2	0	0	0	0	0	0	0	3
CO	3	3	3	2	0	0	0	0	0	0	0	1

со	PSO1	PSO2	PSO3
C201.1	0	1	0
C201.2	0	1	0
C201.3	0	1	0
C201.4	0	1	0
C201.5	0	- 1	0
CO	0	1	0

C202 FLUID MECHANICS AND MACHINERY 19ME311

SL.NO	STATEMENTS
C202.1	Apply mathematical knowledge to predict the properties and characteristics of a fluid.
C202.2	Analyse and calculate major and minor losses associated with incompressible fluid flow in piping networks.
C202.3	Calculate mathematically and predict the nature of physical quantities.
C202.4	Analyse the performance of hydraulic pumps.
C202.5	Analyse the performance of hydraulic turbines.

After the completion of the course, Students will be able to

CORRELATION BETWEEN CO-PO

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO20	PO11	PO12
C202.1	3	3	3	3	0	0	1	0	0	0	0	2
C202.2	3	3	3	3	0	0	1	0	0	0	0	2
C202.3	3	3	3	3	0	0	1	0	0	0	0	2
C202.4	3	3	3	3	0	0	1	0	0	0	0	2
C202.5	3	3	3	3	0	0	1	0	0	0	0	2
CO	3	3	3	3	0	0	1	0	0	0	0	2

CO	PSO1	PSO2	PSO3
C202.1	3	2	2
C202.2	3	2	2
C202.3	3	2	2
C202.4	3	2	2
C202.5	3	2	2
со	3	2	2

C203 ELECTRICAL DRIVES AND CONTROLS 191EE311

After the completion of the course, Students will be able to

SL.NO	STATEMENTS
C203.1	Analyze the rating and class of duty of machines for particular application of electrical drive and draw the heating and cooling curves.
C203.2	Explain the mechanical & electrical characteristics of DC & AC machines for application on electrical drive.
C203.3	Describe the starting methods of both DC and AC machines
C203.4	Classify conventional control and solid state speed control for DC drives.
C203.5	Apply speed control on DC and AC drive by conventional and solid state methods.

CORRELATION BETWEEN CO-PO

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO20	PO11	PO12
C203.1	3	3	2	1	1	0	0	0	0	0	0	1
C203.2	3	3	2	1	1	0	0	0	0	0	0	1
C203.3	3	3	2	1	1	0	0	0	0	0	0	1
C203.4	3	3	2	1	1	0	0	0	0	0	0	1
C203.5	3	3	2	1	1	0	0	0	0	0	0	1
CO	3	3	2	1	1	0	0	0	0	0	0	1

CO	PSO1	PSO2	PSO3
C203.1	2	2	0
C203.2	2	2	0
C203.3	2	2	0
C203.4	2	2	0
C203.5	2	2	0
CO	2	2	0

C204 ENGINEERING THERMODYNAMICS 191ME321

After the completion of the course, Students will be able to

SL-NO	STATEMENTS
C204.1	Apply the first law of thermodynamics for simple open and closed systems under steady.
C204.2	Apply second law of thermodynamics to open and closed systems and calculate entropy.
C204.3	Apply Rankine cycle to steam power plant and compare few cycle improvement methods:
C204.4	Derive simple thermodynamic relations of ideal and real gases.
C204.5	Calculate the properties of gas mixtures and moist air and its use in psychometrics.

CORRELATION BETWEEN CO-PO

				_		T max	007	DAN	PO9	PO20	PO11	PO1
00	POI	PO2	PO3	PO4	PO5	P06	P07	rua	107	0	D	7
			2	2	1	0	1	1	0	u	V	-
C204.1	3	3	3	5		0	1	1	0	0	0	-2
C204.2	3	3	3	3	- 1	0	1	1	0	0	0	2
C204 3	3	3	3	3	1	0	1	1	0	0	D	2
0004.0	2	1	3	3	1	0	1	1	0	0	0	2
C204.4	3		-	2	1	0	1	1	0	0	U	-
C204.5	3	3	3	3	-	0	1	1	0	0	0	- 2
CO	3	3	3	3	1	0				-		

0	PSO1	PSO2	PSO3
CONT	2	1	0
C204.1	2	1	0
C204.2	2	1	0
C204.5	2	1	0
C204.4	2	1	0
C04.5	2	1	0

C205 MANUFACTURING TECHNOLOGY0 II 191ME322

After the completion of the course, Students will be able to

SL.NO	STATEMENTS	
C205.1	Apply the concepts on theory of metal cutting.	
C205.2	Analyse various operation in turning.	
C205.3	Explain the working principles of machine tools	
C205.4	Elaborate on various surface finishing operations.	
C205.5	Apply the knowledge of fundamentals of CNC Machine tools	

CORRELATION BETWEEN CO-PO

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO20	PO11	PO12
C205.1	3	2	2	2	2	1	0	0	0	0	0	2
C205.2	3	2	2	2	2	1	0	0	0	0	0	2
C205.3	3	2	2	2	2	1	0	0	0	0	0	2
C205.4	3	2	2	2	2	1	0	0	0	0	0	2
C205.5	3	2	2	2	2	1	0	0	0	0	0	2
CO	3	2	2	2	2	1	0	0	0	0	0	2

CO	PSO1	PSO2	PSO3
C205.1	3	2	1
C205.2	3	2	1
C205.3	3	2	1
C205.4	3	2	1
C205.5	3	2	1
CO	3	2	1

C206 Engineering Metallurgy 191ME323

After the completion of the course, Students will be able to

SL.NO	Andrea a management of the second s
C206 1	STATEMENTS
0200.1	Explain the basics of phase diagram and apply the knowledge of FeC diagram to understand the relationship between microstructure, properties and application of steel and cast iron.
C206.2	Apply the various heat treatment processor
C206.3	Explain the effect of alloving elements of f
C206.4	Elaborate the properties and pupilication of terrous alloys and non ferrous alloys.
C206.5	Explain the mechanisms of dofe and application of polymers, ceramics and composites.
	methods to determine the mechanical properties

CORRELATION BETWEEN CO-PO

CO	PO1	PO2	PO3	PO4	POS	POG	PO7	POP	POA	BOSS	DOIL	I P C L
C206.1	3	2	2	2		100	101	100	ruy	PO20	POII	PO12
(206 2	-	-	4	4	1	1	0	0	0	0	0	2
C200.2	3	2	2	2	1	1	0	0	0	0	0	2
C206.3	3	2	2	2	1	1	0	0	0	0	0	4
C206.4	3	2	2	2	1	÷	0	0	0	U	0	2
CADCE	-	4	4	4	1	1	0	0	0	0	0	2
C200.5	3	2	2	2	1	1	0	0	0	0	0	2
CO	3	2	2	2	1	1	0	0	0	0	0	2

CO	PSO1	PSO2	PSO3
C206.1	0	2	1
C206.2	0	2	1
C206.3	0	2	1
C206.4	0	2	1
C206.5	0	2	1
CO	0	2	1

C207 ELECTRICAL ENGINEERING LABORATORY 191EE31B

After the completion of the course, Students will be able to

SL.NO	STATEMENTS
C207.1	Observe the performance of various DC machines and Transformer by conducting
	no lond, lond test and OC, SC test respectively
C207.2	Estimate the losses occurring on machines
C247.3	Elaborate about starters based on the machine and power rating

CORRELATION BETWEEN CO-PO

8	101	F02	103	PO4	POS	106	PO 7	706	109	P028	P011	PO12
C207.1	11	3.	3	2	2	0	0	0	2	0	0	1
C207.2	3	3	3	2	2	0	0	0	2	0	0	1
C207.3	3	3	3	2	2	0	0	0	2	Q	0	1
00	3	3	3	2	2	•	•	•	2	•	٠	1

CO	P501	PSO 2	P\$ 03
C207.1	0	1	0
C207.2	Û	1	0
C2073	0	1	0
Č0	•		٠

C208 FLUID MECHANICS AND MACHINERY LABORATORY 191ME31A

After the completion of the course, Students will be able to

SL.NO	STATEMENTS
C208.1	Use the measurement equipments for flow measurement
C208.2	Perform test on different pumps and turbines

CORRELATION BETWEEN CO-PO

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO20	PO11	PO12
C208.1	0	2	2	0	0	0	1	1	0	0	0	2
C208.2	0	2	2	0	0	0	1	1	0	0	0	2
CO	0	2	2	0	0	0	1	1	0	0	0	2

со	PSO1	PSO2	PSO3
C208.1	2	1	1
C208.2	2	1	1
со	2	1	1

C209 MANUFACTURING TECHNOLOGY LABORATORY 19ME33A

After the completion of the course, Students will be able to

SLINO	STATEMENTS
C209.1	Demonstrate the safety precautions exercised in the mechanical workshop.
C209.2	Make the workpiece as per given shape and size using Lethe.
C209.3	Join two metals using are welding.
C289.4	Use sheet metal fabrication tools and make simple trey and famoel.
C209.5	Use different moulding tools, patterns and prepare sand moulds.

CORRELATION BETWEEN CO-PO

CŌ	P01	PO2	PO3	104	105	206	PO7	101	109	1020	P011	P012
C209.1	3	2	0	0	1 -	1	a	0	2	0	<u>^</u>	
C209.2	3	2	•	0	 	1	0	Ð	2	ů ř		- <u>,</u> -
C209.3	3	2	•	•	-	1	0	0	2	0		3
C209.4	3	2	0	0		1	0	0	2	0	- <u>-</u> -	1
C209.5	3	2	0	0	1	1	0	0	2	0	0	3
ĊO	\$	2	•	•	1	1	•	•	1	•	•	3

CO	PS 01	PSO2	1803
C209.1	3	2	0
C289,2	3	2	0
C209.3	3	2	0
C249.4	3	2	Ö
C289.5	3	2	- O
<u>co</u>	3	2	•

C219 STATISTICS AND NUMERICAL METHODS (91MA402

SL.NO	STATEMENTS
C210.f	Apply the concept of testing of hypothesis for small and large samples in real life problems
C210.2	Analyse the basic concepts of Design of Experimenta
C210.3	Solve algebraic and transcendental equations and EigenOvalue problems
C210.4	Apply the numerical techniques of differentiation and integration for engineering problems
C210.5	Apply various techniques and methods for solving first and second order ordinary differential equations

After the completion of the course, Students will be able to

CORRELATION BETWEEN CO-PO

<u> </u>	P01	PO2	PO3	PO4	POS	P06	PO7	POS	PO 9	P024	2011	FO12
C210,1	3	3	3	3	0	0	0	0	0	0	0	2
C210.2	3	3	3	3	0	Û	0	0	0	ō	0	2
C210.3	3	3	3	3	0	o	0	0	0	0		<u> </u>
C210.4	3	3	3	3	0	0	0	0	ō	0	0	2
C210.5	3	3	3	3	Ö	0	0	0	0	0	0	2
Ċ0	t	3	3	3	Q	0	9	0	•	•	Ō	2

ĊO	PS01	PSO2	PSO3
C210.1	0	0	0
C210.2	0	0	0
C210.3	0	0	0
C210.4	0	0	0
C210.5	0	Q	0
ĊŌ	0	0	0

C211 STRENGTH OF MATERIALS FOR MECHANICAL ENGINEERS 191ME411

After the completion of the course, Students will be able to

SLNO. STATEMENTS

- C211.1 Apply the concepts of stress, strain, principal stresses and principal planes.
- C211.2 Explain the concept of shearing furce and hunding moment due to external loads in determinate beams and their effect on stresses
- C211.3 Determine stresses and deformation in circular shafts and belical spring due to torsion :
- C211.4 Compute slopes and deflections in determinate beams by various methods.
- C211.5 Analyze the stresses and deformations induced in thin and thick shells.

CORRELATION BETWEEN CO-PO

co	P01	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO20	POII	PO12
C211.1	3	3	2	2	0	0	0	0	0	0	0	2
C211.2	3	3	2	2	0	0	0	0	0	0	0	2
C211.3	3	3	2	2	0	0	0	0	0	Ó	0	2
C211.4	3	3	2	2	0	0	0	0	0	0	0	2
C211.5	3	3	2	2	0	0	0	0	0	0	0	2
CO	3	3	2	2	0	0	0	0	0	0	0	2

CO	PSO1	PSO2	PSO3
C211.1	0	3	t
C211.2	0	3	1
(211.3	0	3	1
C211.4	0	3	1
C211.5	0	3	1
co	0	.3	1

C212 KINEMATICS OF MACHINERY 19ME421

After the completion of the course, Students will be able to

SI_NO	STATEMENTS
C212.1	Discuss the basics of mechanisms.
C212.2	Calculate velocity and occeleration in simple mechanisms.
C212.3	Develop CAM pmfiles.
C212.4	Solve problems on gener and gear trains.
C212.5	Examine friction in machine elements.
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CORRELATION BETWEEN CO-PO

CO	POI	PO1	PO3	PO4	PO5	P06	PO 7	POS	P09	PO20	P011	PO12
C212.1	3	3	ż	È	0	0	Ō	0	0	0	0	2
C212.2	3	ż	3	3	0	0	0	Ö	0	Ö	0	2
C212.3	3	3	3	3	0	0	0	0	0	Ó	0	2
C212.4	3	3	3	3	0	0	0	0	0	0	0	2
C212.5	3	3	3	3	0	0	0	0	0	Û	Ó	2
CO	3	3	3	3	0	0	0	0	0		0_	2

CO	P\$01	PSO2	PSO3
C212.1	3	3	2
C212.2	3	3	2
C212.3	3	3	2
C212.4	3	3	2
C212.5	3	3	2
co	3	3	2

C213 COMPUTER AIDED DESIGN AND MANUFACTURING 191ME422

After the completion of the course, Students will be able to

SL.NO	STATEMENTS
C213.1	Describe the product life cycle and understand the fundamentals of CAD/CAM
C213.2	Explain the representation of synthetic curves, surface modeling and solid modeling
C213.3	Explain the various CAD standards and data exchange formate
C213.4	Apply CNC principles for manufacturing of components
C213.5	Apply CNC principles for manufacturing of components

CORRELATION BETWEEN CO-PO

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	POS	PO9	PO20	POII	POI
C213.1	2	2	0	0	2	0	0	0	0	0	10m	POIZ
C213.2	2	1	0	0	2	0	0	0	0	0	0	1
213.3	2	1	0	0	2	0	0	0	0	0	0	1
C213.4	2	2	0	0	2	0	0	0	0	0	0	1
C213.5	2	1	0	0	2	0	0	0	0	0	0	1
CO	2	2	0	0	2	0	0	0	0	0	0	1
	-	-			4	0	0	0	0	0	0	1

CO	PSO1	PSO2	PSO3	
C213.1	2	2	1	
C213.2	2	1	1	
C213.3	2	1	1	
C213.4	2	2	1	
C213.5	2	1	1	
CO	2	1	1	

C214 THERMAL ENGINEERING 19ME423

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After the completion of the canrae, Studenia will be able to

SL.NO	STATEMENTS
C214.1	Apply thermodynamic concepts to different air standard cycles and steam power cycles to solve problems.
C214.2	Solve problems related to single stage and multistage air compressors.
C214.3	Explain the functioning and features of IC engines, its components and its auxiliaries.
CZ14.4	Calculate performance parameters of IC Engines.
C214.5	Explain the flow in gas turbines and solve problems.

CORRELATION BETWEEN CO-PO

CO	POI	PO2	PO3	P04	P05	PO6	PO7	PO9	P09	PO10	PO11	PO12
C214.1	3	2	Û	Û	1	0	1	0	0	0	0	2
C214.2	3	2	0	0	1		I	0	0	0	0	2
C214.3	3	2	9	0	1	0	2	0	0	0	0	2
C214.4	3	2	0	Û	1	0	I	0		0	0]
C214.5	3	2	0	0	1	0	1	Ö	Q	0	0	1
co	3	2	0	0	i	0			0	Ð	0	1

<u></u>	PSOI	PSO2	PSO3
C214.1	3	2	
C214.2	3	3	2
C214.3	3	1	L
C214.4	3	2	<u> </u>
C2145	3	1	1
co	3	1	1