

# B.E – ELECTRONICS AND COMMUNICATION ENGINEERING

## CURRICULUM & SYLLABI

### *Regulation 2020*

*(Applicable to candidates (Batch 2021 – 25) admitted in the academic year 2021 - 2022)*



## **K.S.R. College of Engineering** (Autonomous)

K.S.R. Kalvi Nagar, Tiruchengode – 637 215  
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**K.S.R. COLLEGE OF ENGINEERING: TIRUCHENGODE - 637 215 (Autonomous)**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
 (REGULATIONS 2020)

**Vision of the Institution**

<b>IV</b>	We envision to achieve status as an excellent educational institution in the global knowledge hub, making self-learners, experts, ethical and responsible engineers, technologists, scientists, managers, administrators and entrepreneurs who will significantly contribute to research and environment friendly sustainable growth of the nation and the world.
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**Mission of the Institution**

<b>IM 1</b>	To inculcate in the students self-learning abilities that enable them to become competitive and considerate engineers, technologists, scientists, managers, administrators and entrepreneurs by diligently imparting the best of education, nurturing environmental and social needs.
<b>IM 2</b>	To foster and maintain a mutually beneficial partnership with global industries and institutions through knowledge sharing, collaborative research and innovation.

**Vision of the Department / Programme: (Electronics and Communication Engineering)**

<b>DV</b>	We envision as a center of excellence in the field of Electronics and Communication Engineering to produce technically competent graduates with diverse teaching and research environments.
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**Mission of the Department / Programme: (Electronics and Communication Engineering)**


<b>DM 1</b>	To educate the students with the state of art technologies to meet the growing challenges of the industries.
<b>DM 2</b>	To develop an innovate, competent and ethical Electronics and Communication Engineer with strong foundations to enable them for continuing education.

**Programme Educational Objectives (PEOs) : (Electronics and Communication Engineering)**

<b>The graduates of the programme will be able to</b>	
<b>PEO 1</b>	<b>Employability and Higher Education:</b> Excel in Professional career and higher education by acquiring knowledge in mathematical, social, scientific & engineering principles.
<b>PEO 2</b>	<b>Core Competence:</b> Analyze, design and develop/implement core engineering problems in communication systems that are technically sound, economically feasible and socially acceptable.
<b>PEO 3</b>	<b>Interpersonal Skills and Team Work:</b> Exhibit professionalism, ethical communicating skills and team work by engaging in lifelong learning for sustainable development of the society.

## Programme Outcomes (POs) of B.E. - Electronics and Communication Engineering

Program Outcomes (POs)	
PO1	<b>Engineering Graduates will be able to:</b> <b>Engineering Knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	<b>Problem Analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	<b>Design/Development of Solutions:</b> 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	<b>Conduct Investigations of Complex Problems:</b> 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	<b>Modern Tool Usage:</b> Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	<b>The Engineer and Society:</b> 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	<b>Environment and Sustainability:</b> understand the impact of the professional engineering solutions in societal and environmental contexts, demonstrate the knowledge of, and need for sustainable development.
PO8	<b>Ethics:</b> Apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice.
PO9	<b>Individual and Team Work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	<b>Communication:</b> 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	<b>Project Management and Finance:</b> 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	<b>Life-long Learning:</b> 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.
Program Specific Outcomes (PSOs)	
PSO1	<b>Professional Skill:</b> Specify, design and test modern electronic systems that perform analog and digital processing functions.
PSO2	<b>Problem – Solving Skills:</b> Design essential elements (circuits and antennas) of modern RF/Wireless communication systems.

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Department		Department of Electronics and Communication Engineering								
Programme		B.E - Electronics and Communication Engineering								
SEMESTER – I										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P		C	CA	ES
<b>THEORY</b>										
1.	20EN151	Technical English – I (Common to All Branches)	HSMC	2	0	1	3	40	60	100
2.	20MA151	Engineering Mathematics – I (Common to All Branches)	BSC	3	1	0	4	40	60	100
3.	20PH051	Engineering Physics (Common to AU, EC,EE,ME,SF & PT)	BSC	3	0	0	3	40	60	100
4.	20CS142	Problem solving Techniques	ESC	3	0	0	3	40	60	100
<b>PRACTICAL</b>										
5.	20AU127	Engineering Graphics Laboratory (Common to CE,CS,EC,EE,IT & PT)	ESC	0	0	3	1	60	40	100
6.	20PH028	Physics Laboratory (Common to AU, EC,EE,ME,SF & PT)	BSC	0	0	3	1	60	40	100
7.	20CS171	Problem solving Techniques laboratory	ESC	0	0	3	1	60	40	100
Total				12	1	9	16	700		
<b>MANDATORY COURSE</b>										
8.	20MC151	Induction Programme * (Common to All Branches)	MC	3	-	-	-	*	*	*
9.	20MC052	Environmental Science and Engineering (Common to All Branches)	MC	3	0	0	0	*	*	*


\*Induction Programme will be conducted for three weeks as per AICTE guidelines

SEMESTER – II										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P		C	CA	ES
<b>THEORY</b>										
1.	20EN251	Technical English – II (Common to All Branches)	HSMC	2	0	1	3	40	60	100
2.	20MA242	Applied Mathematics (Common to EC & EE)	BSC	3	1	0	4	40	60	100
3.	20CH051	Engineering Chemistry (Common to All Branches)	BSC	3	0	0	3	40	60	100
4.	20CS241	Python Programming (Common to AU,CE,CS,EC,EE,ME,PT & SF)	BSC	3	0	0	3	40	60	100
5.	20EC215	Electric Circuits	ESC	3	0	0	3	40	60	100
<b>PRACTICAL</b>										
6.	20CH028	Chemistry Laboratory (Common to All Branches)	BSC	0	0	3	1	60	40	100
7.	20CS227	Python Programming Laboratory (Common to AU,CE,CS,EC,EE,ME,PT & SF)	ESC	0	0	3	1	60	40	100
8.	20GE028	Manufacturing Practices Laboratory (Common to All Branches)	ESC	0	0	3	1	60	40	100


9.	20EC221	Electric Circuits Laboratory	ESC	0	0	3	1	60	40	100
Total				15	1	12	20	900		

SEMESTER – III										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
<b>THEORY</b>										
1.	20MA342	Differential Equations and Numerical Methods (Common to EC & EE)	BSC	3	1	0	4	40	60	100
2.	20CS332	C++ and Data Structures	ESC	3	0	0	3	40	60	100
3.	20EC311	Electronic Devices	PCC	3	0	0	3	40	60	100
4.	20EC312	Digital Electronics	PCC	3	0	0	3	40	60	100
5.	20EC313	Electromagnetic Theory	PCC	3	1	0	4	40	60	100
6.	20EE331	Electrical Machines	ESC	3	0	0	3	40	60	100
<b>PRACTICAL</b>										
7.	20CS326	C++ and Data Structures Laboratory	ESC	0	0	3	1	60	40	100
8.	20EC321	Electronic Devices Laboratory	PCC	0	0	3	1	60	40	100
9.	20EC322	Digital Electronics Laboratory	PCC	0	0	3	1	60	40	100
10.	20HR351	Career Development Skill I (Common to All Branches)	EEC	0	2	0	0	60	40	100
Total				18	4	9	23	1000		

SEMESTER – IV										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
<b>THEORY</b>										
1.	20MA433	Probability and Stochastic Process	BSC	3	0	0	3	40	60	100
2.	20EC411	Signals and Systems	PCC	3	1	0	4	40	60	100
3.	20EC412	Electronic Circuits	PCC	3	0	0	3	40	60	100
4.	20EC413	Linear Integrated Circuits	PCC	3	0	0	3	40	60	100
5.	20EC414	Microprocessors and Microcontrollers	PCC	3	0	0	3	40	60	100
6.	20EC415	Transmission Lines and Wave Guides	PCC	3	0	0	3	40	60	100
<b>PRACTICAL</b>										
7.	20EC421	Electronic Circuits and Simulation Laboratory	PCC	0	0	3	1	60	40	100
8.	20EC422	Linear Integrated Circuits Laboratory	PCC	0	0	3	1	60	40	100
9.	20EC423	Microprocessors and Microcontrollers Laboratory	PCC	0	0	3	1	60	40	100
10.	20HR442	Career Development Skill II	EEC	0	2	0	0	60	40	100
Total				18	3	9	22	1000		


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Department		Department of Electronics and Communication Engineering									
Programme		B.E - Electronics and Communication Engineering									
<b>SEMESTER – V</b>											
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit C	Maximum Marks			
				L	T	P		CA	ES	Total	
<b>THEORY</b>											
1.	20EC511	Analog Communication Systems	PCC	3	0	0	3	40	60	100	
2.	20EC512	Digital Signal Processing	PCC	3	1	0	4	40	60	100	
3.	20EC513	Computer Networks	PCC	3	0	0	3	40	60	100	
4.	20EC514	Embedded Systems	PCC	3	0	0	3	40	60	100	
5.		Professional Elective – I	PEC	3	0	0	3	40	60	100	
6.		Open Elective – I	OEC	3	0	0	3	40	60	100	
<b>PRACTICAL</b>											
7.	20EC521	Digital Signal Processing Laboratory	PCC	0	0	3	1	60	40	100	
8.	20EC522	Computer Networks Laboratory	PCC	0	0	3	1	60	40	100	
9.	20EC523	Embedded System Design Laboratory	PCC	0	0	3	1	60	40	100	
10.	20HR543	Career Development Skill III	EEC	0	2	0	0	60	40	100	
Total				18	3	9	22	1000			

<b>SEMESTER – VI</b>										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit C	Maximum Marks		
				L	T	P		CA	ES	Total
<b>THEORY</b>										
1.	20HS051	Universal human values and understanding harmonics (Common to All Branches)	HSMC	3	0	0	3	40	60	100
2.	20EC611	Digital Communication Systems	PCC	3	0	0	3	40	60	100
3.	20EC612	Digital Image Processing	PCC	3	0	0	3	40	60	100
4.	20EC613	VLSI Design	PCC	3	0	0	3	40	60	100
5.	20EC614	Antenna and Wave Propagation	PCC	3	0	0	3	40	60	100
6.		Professional Elective – II	PEC	3	0	0	3	40	60	100
<b>PRACTICAL</b>										
7.	20EC621	Communication Systems Laboratory	PCC	0	0	3	1	60	40	100
8.	20EC622	VLSI Laboratory	PCC	0	0	3	1	60	40	100
9.	20HR644	Career Development Skill IV	EEC	0	2	0	0	60	40	100
Total				18	2	6	20	900		

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Department		Department of Electronics and Communication Engineering									
Programme		B.E - Electronics and Communication Engineering									
<b>SEMESTER – VII</b>											
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks			
				L	T	P	C	CA	ES	Total	
<b>THEORY</b>											
1.	20EC711	Wireless and Cellular Communication	PCC	3	0	0	3	40	60	100	
2.	20EC712	RF and Microwave Engineering	PCC	3	0	0	3	40	60	100	
3.	20EC713	Fiber Optic Communication	PCC	3	0	0	3	40	60	100	
4.		Professional Elective – III	PEC	3	0	0	3	40	60	100	
5.		Professional Elective – IV	PEC	3	0	0	3	40	60	100	
6.		Open Elective – II	OEC	3	0	0	3	40	60	100	
<b>PRACTICAL</b>											
7.	20EC721	RF, Microwave and Optic Laboratory	PCC	0	0	3	1	60	40	100	
8.	20EC722	Project Work Phase – I	PW	0	0	6	3	60	40	100	
Total				18	0	9	22	800			

<b>SEMESTER – VIII</b>										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
<b>THEORY</b>										
1.		Professional Elective – V	PEC	3	0	0	3	40	60	100
2.		Professional Elective – VI	PEC	3	0	0	3	40	60	100
3.		Open Elective – III	OEC	3	0	0	3	40	60	100
<b>PRACTICAL</b>										
4.	20EC821	Project Work Phase - II	PW	0	0	18	6	60	40	200
Total				9	0	18	15	500		



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	Department	Department of Electronics and Communication Engineering		
Programme	B.E - Electronics and Communication Engineering			
<b>List of Electives</b>				

<b>PROFESSIONAL ELECTIVE – I (SEMESTER – V)</b>										
Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P		C	CA	ES
1.	20IE591	Augmented Intelligence Led Managed Services (AIMS) – I (Common To CS,EC,EE & IT)	IE	3	0	0	3	40	60	100
2.	20HS001	Principles of Management (Common to CE, CS, EE, EC, IT & ME)	HSMC	3	0	0	3	40	60	100
3.	20EC561	Advanced Digital Systems Design	S3	3	0	0	3	40	60	100
4.	20EC562	Electronic Instrumentation	S1	2	0	1	3	40	60	100
5.	20CS501	Artificial Intelligence	S5	3	0	0	3	40	60	100

<b>PROFESSIONAL ELECTIVE – II (SEMESTER – VI)</b>										
Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P		C	CA	ES
1.	20EC661	Electronic System Design	S4	3	0	0	3	40	60	100
2.	20EC662	Medical Electronics	S4	3	0	0	3	40	60	100
3.	20EC663	Advanced Microprocessors and Microcontrollers	S3	3	0	0	3	40	60	100
4.	20EC664	Information Theory and Coding	S1	3	0	0	3	40	60	100
5.	20CS601	C# and .NET Framework Technologies (Common to CS & EC)	S6	3	0	0	3	40	60	100
6.	20IE691	Augmented Intelligence Led Managed Services (AIMS) – II (Common To CS,EC,EE & IT)	IE	3	0	0	3	40	60	100
7.	20CS601	Machine Learning	S5	3	0	0	3	40	60	100

<b>PROFESSIONAL ELECTIVE – III (SEMESTER – VII)</b>										
Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P		C	CA	ES
1.	20EC761	Communication and Switching Networks	S1	3	0	0	3	40	60	100
2.	20EC762	Digital Communication Systems - II	S1	3	0	0	3	40	60	100
3.	20EC763	PC Hardware, Installation, Troubleshooting and Servicing	S6	3	0	0	3	40	60	100
4.	20EC764	Embedded System Design	S3	3	0	0	3	40	60	100
5.	20EC765	Wireless Networks	S6	3	0	0	3	40	60	100
6.	20EC770	Pattern Recognition	S5	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – IV (SEMESTER – VII)										
Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P		C	CA	ES
1.	20EC766	CMOS Analog Circuits	S2	3	0	0	3	40	60	100
2.	20EC767	Fundamentals of Nano electronics	S1	3	0	0	3	40	60	100
3.	20EC768	High Performance Networks	S6	3	0	0	3	40	60	100
4.	20EC769	Robotics	S4	3	0	0	3	40	60	100
5.	20HR791	Professional Readiness for Innovation, Employability and Entrepreneurship	S4	3	0	0	3	40	60	100
6.	20EC771	Soft computing techniques	S5	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – V (SEMESTER – VIII)										
Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P		C	CA	ES
1.	20EC861	Satellite Communication	S1	3	0	0	3	40	60	100
2.	20EC862	Optical Networks	S6	3	0	0	3	40	60	100
3.	20EC863	Multimedia Compression and Communication	S5	3	0	0	3	40	60	100
4.	20EC864	Embedded Networks	S3	3	0	0	3	40	60	100
5.	20EC865	VLSI Signal Processing	S2	3	0	0	3	40	60	100
6.	20EC866	CAD for VLSI	S2	3	0	0	3	40	60	100
7.	20EC867	Advanced Signal Processing	S5	3	0	0	3	40	60	100
8.	20EC868	Wireless Sensor Networks	S6	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – VI (SEMESTER – VIII)										
Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P		C	CA	ES
1.	20EC867	MEMS Technology	S1	3	0	0	3	40	60	100
2.	20EC868	ADHOC Networks	S6	3	0	0	3	40	60	100
3.	20EC869	Telecommunication System Modeling and Simulation	S1	3	0	0	3	40	60	100
4.	20EC870	ARM System Architecture	S3	3	0	0	3	40	60	100
5.	20EC871	Architecture of DSPs	S5	3	0	0	3	40	60	100
6.	20EC872	Cryptography and Network Security	S6	3	0	0	3	40	60	100
7.	20EC873	Deep Learning and Neural network	S5	3	0	0	3	40	60	100
8.	20EC874	ASIC Design	S2	3	0	0	3	40	60	100

S1. Communication

S2. VLSI

S3. Embedded

S4. Electronics

S5. Signal Processing

S6. Networks

**K.S.R. COLLEGE OF ENGINEERING: TIRUCHENGODE - 637 215**

(Autonomous)

(REGULATIONS 2020)

**OPEN ELECTIVE COURSES**

**OPEN ELECTIVE COURSES OFFERED BY OTHER BRANCHES**

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		C	CA	ES
<b>Automobile Engineering</b>											
1.	20AU901	Basics of Automobile Engineering	AE	OEC	3	0	0	3	40	60	100
2.	20AU902	Automotive Engine Technology	AE	OEC	3	0	0	3	40	60	100
3.	20AU903	Automotive Vehicle Technology	AE	OEC	3	0	0	3	40	60	100
4.	20AU904	Automotive Safety	AE	OEC	3	0	0	3	40	60	100
5.	20AU905	Hybrid Vehicles	AE	OEC	3	0	0	3	40	60	100
6.	20AU906	Off Highway Vehicles	AE	OEC	3	0	0	3	40	60	100
7.	20AU907	Modern and Intelligent Vehicle System	AE	OEC	3	0	0	3	40	60	100
8.	20AU908	Vehicle Maintenance	AE	OEC	3	0	0	3	40	60	100
<b>CIVIL ENGINEERING</b>											
9.	20CE901	Architectural Heritage of India	CE	OEC	3	0	0	3	40	60	100
10.	20CE902	Building Planning and Construction	CE	OEC	3	0	0	3	40	60	100
11.	20CE903	Elementary Civil Engineering	CE	OEC	3	0	0	3	40	60	100
12.	20CE904	Energy and Environment	CE	OEC	3	0	0	3	40	60	100
13.	20CE905	Environmental Laws and Policies	CE	OEC	3	0	0	3	40	60	100
14.	20CE906	Global Warming and Climate Change	CE	OEC	3	0	0	3	40	60	100
15.	20CE907	Introduction to Disaster Management and Mitigation	CE	OEC	3	0	0	3	40	60	100
16.	20CE908	Introduction to Earthquake Engineering	CE	OEC	3	0	0	3	40	60	100
17.	20CE909	Solid Waste Management	CE	OEC	3	0	0	3	40	60	100
18.	20CE910	Water and Air Pollution Management	CE	OEC	3	0	0	3	40	60	100
<b>Computer Science and Engineering</b>											
19.	20CS901	Programming in Java	CSE	OEC	3	0	0	3	40	60	100
20.	20CS902	Basic concepts of Data Structure	CSE	OEC	3	0	0	3	40	60	100
21.	20CS903	Fundamentals of Database Concepts	CSE	OEC	3	0	0	3	40	60	100
22.	20CS904	Internet Programming	CSE	OEC	3	0	0	3	40	60	100
23.	20CS905	Fundamentals of Mobile Application Development	CSE	OEC	3	0	0	3	40	60	100
24.	20CS906	Principles of Ethical Hacking	CSE	OEC	3	0	0	3	40	60	100
25.	20CS907	Green Technology	CSE	OEC	3	0	0	3	40	60	100
26.	20CS908	Artificial Intelligence and Robotics	CSE	OEC	3	0	0	3	40	60	100
27.	20CS909	Big Data and Analytics	CSE	OEC	3	0	0	0	40	60	100
28.	20CS910	Hardware and Trouble Shooting	CSE	OEC	3	0	0	3	40	60	100

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		C	CA	ES
<b>Electrical and Electronics Engineering</b>											
29.	20EE901	Electrical Drives and Control	EE	OEC	3	0	0	3	40	60	100
30.	20EE902	Power Semiconductor Devices	EE	OEC	3	0	0	3	40	60	100
31.	20EE903	Electrical Power Generation Systems	EE	OEC	3	0	0	3	40	60	100
32.	20EE904	Control Engineering	EE	OEC	3	0	0	3	40	60	100
33.	20EE905	Industrial Automation	EE	OEC	3	0	0	3	40	60	100
34.	20EE906	Electrical Instruments and Measurements	EE	OEC	3	0	0	3	40	60	100
35.	20EE907	Energy Conservation and Management	EE	OEC	3	0	0	3	40	60	100
36.	20EE908	Electrical Wiring, Estimation and Costing	EE	OEC	3	0	0	3	40	60	100
37.	20EE909	Fundamentals of Electrical Machinery	EE	OEC	3	0	0	3	40	60	100
38.	20EE910	Principles of Soft Computing Techniques	EE	OEC	3	0	0	3	40	60	100
39.	20EE911	Embedded System Technology	EE	OEC	3	0	0	3	40	60	100
<b>Electronics and Communication Engineering</b>											
40.	20EC901	Basics of Medical Electronics	EC	OEC	3	0	0	3	40	60	100
41.	20EC902	NANO Technology	EC	OEC	3	0	0	3	40	60	100
42.	20EC903	Electronics and Microprocessor	EC	OEC	3	0	0	3	40	60	100
43.	20EC904	Analog and Digital Communication	EC	OEC	3	0	0	3	40	60	100
44.	20EC905	Principles of Communication	EC	OEC	3	0	0	3	40	60	100
45.	20EC906	Fundamentals of Robotics	EC	OEC	3	0	0	3	40	60	100
46.	20EC907	Internet of Things Sensing and Actuator Devices	EC	OEC	3	0	0	3	40	60	100
47.	20EC908	Consumer Electronics	EC	OEC	3	0	0	3	40	60	100
<b>Information Technology</b>											
48.	20IT901	Data Science using R	IT	OEC	3	0	0	3	40	60	100
49.	20IT902	Principles of Cyber Security	IT	OEC	3	0	0	3	40	60	100
50.	20IT903	Fundamentals of Business Intelligence	IT	OEC	3	0	0	3	40	60	100
51.	20IT904	Blockchain Technologies	IT	OEC	3	0	0	3	40	60	100
52.	20IT905	Internet of Things and Applications	IT	OEC	3	0	0	3	40	60	100
53.	20IT906	Principles of Software Testing	IT	OEC	3	0	0	3	40	60	100
54.	20IT907	Foundation Skills in Logic Building	IT	OEC	3	0	0	3	40	60	100
55.	20IT908	Principles of Cloud Computing	IT	OEC	3	0	0	3	40	60	100
56.	20IT909	Open Source Technologies	IT	OEC	3	0	0	3	40	60	100
57.	20IT910	Principles of Software Engineering	IT	OEC	3	0	0	3	40	60	100

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		C	CA	ES
<b>Mechanical Engineering</b>											
58.	20ME901	Basic Mechanical Engineering	ME	OEC	3	0	0	3	40	60	100
59.	20ME902	Solar Energy Utilization	ME	OEC	3	0	0	3	40	60	100
60.	20ME903	Production Technology of Agricultural Machinery	ME	OEC	3	0	0	3	40	60	100
61.	20ME904	Selection of Materials	ME	OEC	3	0	0	3	40	60	100
62.	20ME905	Marine Vehicles	ME	OEC	3	0	0	3	40	60	100
63.	20ME906	Sensors and Transducers	ME	OEC	3	0	0	3	40	60	100
64.	20ME907	Energy Auditing	ME	OEC	3	0	0	3	40	60	100
65.	20ME908	Fiber Reinforced Plastics	ME	OEC	3	0	0	3	40	60	100
66.	20ME909	Lean Manufacturing	ME	OEC	3	0	0	3	40	60	100
67.	20ME910	Surface Engineering	ME	OEC	3	0	0	3	40	60	100
<b>Safety and Fire Engineering</b>											
68.	20SF901	Occupational Health and Hygiene	SF	OEC	3	0	0	3	40	60	100
69.	20SF902	Construction Safety	SF	OEC	3	0	0	3	40	60	100
70.	20SF903	Building Fire Safety	SF	OEC	3	0	0	3	40	60	100
71.	20SF904	Safety in Electrical Engineering	SF	OEC	3	0	0	3	40	60	100
72.	20SF905	Legal Aspects of Safety	SF	OEC	3	0	0	3	40	60	100
73.	20SF906	Safety in Industries	SF	OEC	3	0	0	3	40	60	100
74.	20SF907	Food Safety	SF	OEC	3	0	0	3	40	60	100
75.	20SF908	Safety Management and its Principles	SF	OEC	3	0	0	3	40	60	100
76.	20SF909	Safety in Automobile Engineering	SF	OEC	3	0	0	3	40	60	100
77.	20SF910	Safety in Transportation	SF	OEC	3	0	0	3	40	60	100
<b>Science and Humanities</b>											
78.	20SH901	Applications of Statistics	FYA	OEC	3	0	0	3	40	60	100
79.	20SH902	Combinatorics and Graph Theory	FYA	OEC	3	0	0	3	40	60	100
80.	20SH903	Optimization Techniques	FYA	OEC	3	0	0	3	40	60	100
81.	20SH904	Basic Military Education and Training	FYA	OEC	3	0	0	3	40	60	100
82.	20SH905	Professional Communication	FYA	OEC	3	0	0	3	40	60	100
83.	20SH906	Fundamentals of Nanoscience and Technology	FYA	OEC	3	0	0	3	40	60	100

**LIST OF PROPOSED VALUE-ADDED COURSES**

Sl.No.	Course Name	Number of hours	Offered by Internal / External
1.	PCB Circuit Design	20 Hours	Internal / External
2.	Programming PIC Microcontrollers	20 Hours	Internal / External
3.	Real Time Applications of Arduino	20 Hours	Internal / External
4.	LABVIEW	20 Hours	Internal / External
5.	MATLAB – Signal and Image Processing Tool box	20 Hours	Internal / External
6.	Industrial Automation using PLC and SCADA	20 Hours	Internal / External
7.	Network Simulator – 2	20 Hours	Internal / External
8.	CCNA Fundamentals (Module 1)	20 Hours	Internal / External
9.	CCNA - Routing and Switching (Module 2)	20 Hours	Internal / External
10.	C and C++ Programming	20 Hours	Internal / External
11.	Java Programming	20 Hours	Internal / External
12.	.Net and PHP	20 Hours	Internal / External
13.	Data Base Management Systems	20 Hours	Internal / External
14.	VHDL Programming	20 Hours	Internal / External
15.	Tanner Tool	20 Hours	Internal / External
16.	Mentor Graphics	20 Hours	Internal / External
17.	Programming in Digital Signal Processors	20 Hours	Internal / External

S.No	Subject Area	Credits Per Semester								Credits Total	Percentage Credits	Suggested Breakup of credits
		I	II	III	IV	V	VI	VII	VIII			
1	HSMC	3	3				3			9	5.60	12
2	ESC	5	6	7						18	11.25	25
3	BSC	8	11	4	3					26	16.25	24
4	PCC			12	19	16	14	10		71	44.37	48
5	PEC					3	3	6	6	18	11.25	18
6	OEC					3		3	3	9	5.60	18
7	PW							3	6	9	5.60	15
<b>Total</b>		16	20	23	22	22	20	22	15	160	100	160

Total Credits for Regular Student – 160

Total Credits for Lateral Student- 124

**SEMESTER - I**

<b>20EN151</b>	<b>TECHNICAL ENGLISH – I</b> (Common to all branches)	L	T	P	C
		2	0	1	3

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Objectives: On successful completion of the course, the student will be able to** **Cognitive Level**

CO1: Comprehend and apply Grammar in context for professional communication	Understand
CO2: Infer the gist and specific information.	Apply
CO3: Discuss, express and interact in the society and place of study.	Create
CO4: Critically interpret and comprehend a given text.	Evaluate
CO5: Prioritize the listening skills for academic and professional purposes.	Apply

**UNIT - I** **[ 09 ]**

Synonyms & Antonyms — Use of Modal Auxiliaries – Infinitive and Gerund - Parts of Speech -Intensive Reading – Predicting Content – Interpretation - Active Listening - Listening for the main idea - Need based Correspondence (request for joining hostel, bonafide certificate)-Self Introduction- Introducing others

**UNIT - II** **[ 09 ]**

British & American Terminology — Tenses (Simple Present, Present Continuous, Present Perfect, Simple Past, and Simple Future) -Predicting Content - Drawing inferences - Listening for specific details - Listening to News – Job Application and Resume – Writing Instructions- Delivering Welcome Address

**UNIT - III** **[ 09 ]**

Standard Abbreviations and Acronyms -Preposition of Time, Place and Movement – Active Voice & Passive Voice – Consonant Sounds – Pronunciation guidelines related to Vowels and Consonant – Skimming & Scanning - Inference – Context Based Meaning – Recommendation Writing - Proposing Vote of Thanks.

**UNIT - IV** **[ 09 ]**

Vocabulary Building – Phrasal Verbs (Put, Give, Look, Take, Get, Call)- Impersonal passive -Newspaper Reading — Note making – Listening to Dialogues – E Mail Etiquettes & E-mail Writing.- MoC – Anchoring – Role play in academic context

**UNIT - V** **[ 09 ]**

Homonyms - Concord (Subject & Verb Agreement)- Rearranging the jumbled sentences - Listening to Telephonic Conversation - Letter of Invitation (inviting, accepting and declining) – Paragraph writing - Letter to the Editor of a News paper – Drills using Minimal pairs – Presentation Skills.

**Total (L= 40, T = 5 ) = 45 Periods**

**Text Books :**

- 1 Meenakshi Raman, Technical Communication, Oxford University Press, New Delhi, First Edition, 2017
- 2 S.Sumant, Technical English – I, Vijay Nicole, Chennai, Second Edition, 2018

**Reference Books :**

- 1 Dr.P.Rathna, English Work Book – I, VRB Publishers Pvt. Ltd., Chennai, Second Edition,2018
- 2 Seely, The Oxford Guide to Writing and Speaking, Oxford University Press, New Delhi, First Edition, 2016
- 3 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition,2005
- 4 P.Kiranmani Dutt, A course in Communication Skills, Cambridge University Press, New Delhi, First Edition, 2014

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF SCIENCE AND HUMANITIES**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EN151

Course Name : Technical English – I

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Comprehend and apply Grammar in context for professional communication.</i>	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO2	<i>Infer the gist and specific information.</i>	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO3	<i>Discuss, express and interact in the society and place of study.</i>	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO4	<i>Critically interpret and comprehend a given text.</i>	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO5	<i>Prioritize the listening skills for academic and professional purposes.</i>	-	-	-	-	-	-	-	-	2	3	-	1	-	-
<b>Average</b>		-	-	-	-	-	-	-	-	<b>2</b>	<b>3</b>	-	<b>1</b>	-	-

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



**SEMESTER – I**

20MA151

**ENGINEERING MATHEMATICS – I**  
(Common to All Branches)

L	T	P	C
3	1	0	4

**Prerequisite:** No prerequisites are needed for enrolling into the course**Course Outcomes :** On Completion of this course, the student will be able to**Cognitive Level**

CO1	<i>Interpret the concepts of Matrix applications in the field of engineering.</i>	Understand
CO2	<i>Acquire knowledge in solving ordinary differential equations.</i>	Evaluate
CO3	<i>Extend and apply the concepts of differential calculus problems.</i>	Apply
CO4	<i>Develop the skills in solving the functions of several variables.</i>	Remember
CO5	<i>Applying the concepts and solving the Vector Calculus problems.</i>	Apply

**UNIT – I LINEAR ALGEBRA [12]**

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors (Excluding proof) – Cayley Hamilton theorem (excluding proof) – Quadratic forms – Reduction of quadratic form to canonical form by orthogonal transformation.

**UNIT – II ORDINARY DIFFERENTIAL EQUATIONS [12]**

Linear differential equations of second and higher order with constant coefficients – Differential equations with variable coefficients – Cauchy's and Legendre's linear equations – Method of variation of parameters.

**UNIT – III DIFFERENTIAL CALCULUS [12]**

Curvature – Radius of curvature (Cartesian co-ordinates only) – Centre of curvature and Circle of curvature – Involute and Evolute.

**UNIT – IV FUNCTIONS OF SEVERAL VARIABLES [12]**

Partial derivatives – Total derivatives – Euler's theorem for homogenous functions – Taylor's series expansion – Maxima and Minima for functions of two variables – Method of Lagrangian multipliers.

**UNIT – V VECTOR CALCULUS [12]**

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Green's theorem in plane, Gauss divergence theorem and Stoke's theorem – Problems in Cube, Cuboid and Rectangular parallelepiped only.

**Total (L: 45 T:15) = 60 Periods****Text Books :**

- 1 Ravish R Singh and Mukul Bhatt, Engineering Mathematics – I, McGraw Hill Publications, Fourth Edition, New Delhi 2016.
- 2 Grewal B.S, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company, Forty Third Edition, New Delhi, 2015.

**Reference Books :**

- 1 Bali N. P and Manish Goyal, Textbook on Engineering Mathematics, Laxmi Publications (p) Ltd., Seventh Edition, 2016.
- 2 H.K. Dass, Advance Engineering Mathematics, S. Chand and company, Eleventh Edition, 2015.
- 3 Jain R.K. and Iyengar S.R.K., - Advanced Engineering Mathematics, Narosa Publicaitons, Eighth Edition, 2012.
- 4 Narayanan.S and Manicavachagom Pillai. T.K. – Calculasvol I and Vol II, S.chand& Co. Sixth Edition, 2014.

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**DEPARTMENT OF SCIENCE AND HUMANITIES**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20MA151

Course Name : Engineering Mathematics – I

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Interpret the concepts of Matrix applications in the field of engineering.</i>	3	3	3	3										
CO2	<i>Acquire knowledge in solving ordinary differential equations.</i>	3	3	3	3										
CO3	<i>Extend and apply the concepts of differential calculus problems.</i>	3	3	3	3										
CO4	<i>Develop the skills in solving the functions of several variables.</i>	3	3	3	3										
CO5	<i>Applying the concepts and solving the Vector Calculus problems.</i>	3	3	3	3										
<b>Average</b>		3	3	3	3										

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**SEMESTER – I**

20PH051

**ENGINEERING PHYSICS**

(Common to All Branches)

L	T	P	C
3	0	0	3

**Prerequisite:** NIL**Course Outcomes: On Completion of this course, the student will be able to****Cognitive level**

CO1	Describe the impact of engineering solutions in the constructional and designing environment.	Remember
CO2	Categorize the types of laser and utilize it for specific application based on their desirable requisite.	Analyze
CO3	Utilize the conceived concepts and techniques for synthesizing novel crystals with enhanced multifunctional properties.	Apply
CO4	Enumerate the preambles of quantum physics and implement its concepts to tackle the cumbersome engineering problems.	Apply
CO5	Comprehend the fundamental ideas of optoelectronic materials and to fabricate it for the potential applications	Understand

**UNIT – I ACOUSTICS AND ULTRASONICS [ 9 ]**

Acoustics–Introduction – Classification of sound – Characteristics of musical sound – Loudness – Weber – Fechner law – Decibel – Absorption coefficient – Reverberation – Reverberation time – Sabine’s formula: growth and decay (derivation) – Factors affecting acoustics of buildings and their remedies. Ultrasonics – Production –piezoelectric method – Properties – Velocity measurement: acoustical grating –Engineering applications– SONAR.

**UNIT – II LASER TECHNOLOGY [ 9 ]**

Introduction – Principle of Spontaneous emission and stimulated emission – Population inversion, pumping – Einstein’s A and B coefficients (derivation). Types of lasers – Nd-YAG, CO<sub>2</sub> and Semiconductor lasers (homo-junction and hetero-junction) – Qualitative Industrial Applications: Lasers in welding, heat treatment and cutting – Medical applications – Holography (construction and reconstruction of images).

**UNIT – III CRYSTAL PHYSICS [ 9 ]**

Introduction to crystalline and amorphous solids – lattice and unit cell – seven crystal system and Bravais lattices – Miller indices(hkl) –d-spacing in cubic lattice – atomic radius – coordination number – packing factor calculation for sc, bcc, fcc and hcp– crystal defects – point, line and surface defects.

**UNIT – IV QUANTUM PHYSICS [ 9 ]**

Black body radiation – Planck’s theory (derivation) – Deduction of Wien’s displacement law and Rayleigh – Jeans’ Law from Planck’s theory – Compton effect - Theory and experimental verification – Matter waves – Schrödinger’s wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box.

**UNIT – V OPTOELECTRONIC DEVICES [ 9 ]**

Photoconductive materials – Light Dependent Resistor (LDR) – Working – Applications – Photovoltaic materials – Solar cell – Construction, working and applications – Light Emitting Diode (LED) – Principle, construction and working - Liquid crystal Display (LCD) – Types and applications.

**Total = 45 Periods****Text Books :**

- 1 M.N. Avadhanulu and P.G. Kshirsagar, A text book of Engineering Physics, S. Chand and Company, New Delhi, seventh Edition, 2014.
- 2 R.K.Gaur & S.L.Gupta, Engineering Physics, Dhanpat Rai Publication, New Delhi, seventh Edition, 2014.

**Reference Books :**

- 1 D. Halliday, R. Resnick and J. Walker, Fundamentals of Physics, John Wiley & sons, USA, ninth Edition, 2011.
- 2 V. Rajendran, Engineering Physics, Tata McGraw Hill, New Delhi, first Edition, 2011.
- 3 R. A. Serway and J. W. Jewett, Physics for Scientists and Engineers with Modern Physics, ninth edition, Cengage Learning, USA, 2013.
- 4 Arthur Beiser, Concepts of Modern Physics, Tata McGraw Hill, New Delhi, sixth Edition, 2010.

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**DEPARTMENT OF SCIENCE AND HUMANITIES**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20PH051

Course Name : Engineering Physics

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Describe the impact of engineering solutions in the constructional and designing environment.</i>	3	3			2			1		2		2		
CO2	<i>Categorize the types of laser and utilize it for specific application based on their desirable requisite.</i>	3	3			2			1		2		2		
CO3	<i>Utilize the conceived concepts and techniques for synthesizing novel crystals with enhanced multifunctional properties.</i>	3	3			2			1		2		2		
CO4	<i>Enumerate the preambles of quantum physics and implement its concepts to tackle the cumbersome engineering problems.</i>	3	3			2			1		2		2		
CO5	<i>Comprehend the fundamental ideas of optoelectronic materials and to fabricate it for the potential applications</i>	3	3			2			1		2		2		
<b>Average</b>		3	3			2			1		2		2		

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**SEMESTER – I**

<b>20CS142</b>	<b>PROBLEM SOLVING TECHNIQUES</b>	L	T	P	C
	(Common To CS & EC)	3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course.

**Course Outcomes : On Completion of this course, the student will be able to** **Cognitive Level**

CO1: Identify the basic concepts of computer and internet.	Understand
CO2: Recognize the problem solving strategies.	Understand
CO3: Design the fundamental algorithm.	Understand
CO4: Factorize the numbers using methods.	Understand
CO5: Process the array for different operations.	Understand

**UNIT – I FUNDAMENTALS OF COMPUTER AND INTERNET [ 9 ]**

Introduction and Organization of Computer – History and Generation of Computer – Types of Computer – Components of Computer (Hardware, Software and Firmware) – Classification of Software – Introduction to Algorithms, Pseudo code and Flowchart – Introduction to Network and Internet – Terminologies in Internet – WWW.

**UNIT – II COMPUTER PROBLEM SOLVING [ 9 ]**

Introduction – Problem solving aspect – Top Down Design – Implementation of Algorithm – Program Verification – Efficiency of Algorithm – Analysis of Algorithm

**UNIT – III FUNDAMENTAL ALGORITHMS [ 9 ]**

Exchanging the Values – Counting – Summation of Set of Number – Factorial Computation – Sine Function Computation – Generation of the Fibonacci Sequence – Reversing the Digits of an Integer – Base conversion – Character to Number conversion.

**UNIT – IV FACTORING METHODS [ 9 ]**

Finding the Square Root of a Number – Smallest Divisor of an Integer – GCD of Two Integers – Generating Prime Numbers – Computing Prime Factors of an Integer – Generation of Pseudo random numbers – Raising a number to a larger power – Computing the  $n^{\text{th}}$  Fibonacci number.

**UNIT – V ARRAY TECHNIQUES [ 9 ]**

Array order reversal – Array counting – Finding the maximum number in the set – Removal of duplicates from an ordered array – Finding the  $k^{\text{th}}$  smallest element – Longest monotone subsequence.

**Total = 45 Periods**

**Text Books :**

- 1 R.G.Dromey, How to Solve it by Computer, Pearson Education, India, Fifth Edition, 2008.
- 2 Shelly, Freund, Vermaat, Introduction to Computers, Shelly Cashman Series, Course Technology Inc, United States, Eighth Edition, 2010.

**Reference Books :**

- 1 ITL Educational Solutions Limited, Introduction to Information Technology, Pearson Education, India, Second Edition, India, 2012.
- 2 G. Polya, How to Solve It : A New Aspect of Mathematical Method, Princeton University Press, New Jersey, Second Edition, 2008
- 3 Ellis Horowitz, Fundamentals of Programming languages, Galgotia Publications, New Delhi, Second Edition, 2012.
- 4 [www.nptel.ac.in/courses/106104074](http://www.nptel.ac.in/courses/106104074)

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20CS142

Course Name: PROBLEM SOLVING TECHNIQUES

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Identify the basic concepts of computer and internet.</i>	3	3	3	2	1	-	-	-	1	-	-	1	-	-
CO2	<i>Recognize the problem solving strategies.</i>	3	3	2	1	2	-	-	-	1	-	-	1	-	-
CO3	<i>Design the fundamental algorithm.</i>	3	3	2	2	1	-	-	-	1	-	-	1	-	-
CO4	<i>Factorize the numbers using methods.</i>	3	3	3	1	2	-	-	-	1	-	-	1	-	-
CO5	<i>Process the array for different operations.</i>	3	3	3	2	1	-	-	-	1	-	-	1	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**SEMESTER - I**

<b>20AU127</b>	<b>ENGINEERING GRAPHICS LABORATORY</b>	L	T	P	C
	(Common To CE,CS,EC,EE, & IT)	0	0	3	1

**Prerequisite: -****Course Outcomes: On Completion of this course , the student will be able to****Cognitive level**

CO1	Create and modify two-dimensional drawings using AutoCAD software	Understand
CO2	Construct various planes and do orthographic projection of lines and plane surfaces.	Remember
CO3	Draw projections of solids and development of surfaces.	Understand
CO4	Create the sections of solids and surfaces.	Understand
CO5	Sketch two dimensional isometric projections of simple solids.	Understand

**List of Experiments:**

1. Study of basic tools, commands and coordinate system (absolute, relative, polar, etc.) used in 2D software.
2. Draw the conic curves and special curves by using AutoCAD.
3. Draw the front view, top view, side view of objects from the given pictorial view.
4. Draw the projections of straight lines.
5. Draw the projections of polygonal surface.
6. Draw the projections of simple solid objects.
7. Draw the sectional view and the true shape of the given section.
8. Draw the development of surfaces like prism, pyramids, cylinders and cone.
9. Draw the isometric projections of simple solids, truncated prism and pyramids.
10. Draw the isometric projections of cylinder and cone.

**Total : 45 Periods**

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF AUTOMOBILE ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20AU127

Course Name : Engineering Graphics Laboratory

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Create and modify two-dimensional drawings using AutoCAD software	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO2	Construct various planes and do orthographic projection of lines and plane surfaces.	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO3	Draw projections of solids and development of surfaces.	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO4	Create the sections of solids and surfaces.	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO5	Sketch two dimensional isometric projections of simple solids.	3	3	3	2	2	-	-	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



**SEMESTER – I**

<b>20PH028</b>	<b>PHYSICS LABORATORY</b> (Common to All Branches)	L	T	P	C
		0	0	3	1

**Prerequisite:** NIL

<b>Course Outcomes: On Completion of this course , the student will be able to</b>		<b>Cognitive level</b>
CO1	Comprehend the different physical parameters of optics.	Analyze
CO2	Perceive the production of ultrasonic waves through inverse piezoelectric effect and to determine the velocity of sound waves in the given liquid.	Remember
CO3	Explore the principle of thermal conductivity thereby to calculate the thermal conductivity of various bad conductors like cardboard, mica, etc.	Apply
CO4	Confer the experimental counterparts of materials properties such as modulus, solar cell, and energy gap.	Understand
CO5	Imbibe the concept of capillary action in fluid dynamics and to compare the coefficient of viscosity of the given liquid.	Analyze

**List of Experiments in Physics Laboratory**

1. Determination of wavelength of Laser using grating and the Size of the Particles.
2. Determination of thickness of the given material by Air – wedge method.
3. Determination of velocity of Ultrasonic waves and compressibility using Ultrasonic interferometer.
4. Spectrometer grating - Determination of wavelength of mercury spectrum.
5. Determination of thermal conductivity of a bad conductor by Lee's disc method.
6. Determination of Young's modulus of the material of a uniform bar by Non – Uniform bending method.
7. Determination of Band gap energy of a semiconductor.
8. Determination of Viscosity of a given liquid by Poiseuille's method.
9. Torsional pendulum - Determination of rigidity modulus of a given wire.
10. V-I Characteristics of Solar Cell .

**Total : 30 Periods****Text Book :**

1. Faculty Members of Physics, Physics Lab manual, Department of Physics, K.S.R. College of Engineering, Namakkal, seventeenth Edition, 2018.
2. Dr. P. Mani, Physics Lab Manual & Observation Book, Dhanam Publications, tweleth Edition Chennai 2017.

**References :**

1. Dr. G. Senthilkumar, Physics Lab manual, VRB Publications Pvt. Ltd., Chennai, tenth Edition, 2006.
2. R Suresh & Dr. C. Kalyanasundaram, Physics Laboratory, Sri Krishna Hitech Publishing Company Pvt. Ltd., Chennai, fifth Edition, 2017.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF SCIENCE AND HUMANITIES**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20PH028

Course Name : Physics Laboratory

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Comprehend the different physical parameters of optics.</i>	3	3			2			1		2		2		
CO2	<i>Perceive the production of ultrasonic waves through inverse piezoelectric effect and to determine the velocity of sound waves in the given liquid</i>	3	3			2			1		2		2		
CO3	<i>Explore the principle of thermal conductivity thereby to calculate the thermal conductivity of various bad conductors like cardboard, mica, etc.</i>	3	3			2			1		2		2		
CO4	<i>Confer the experimental counterparts of materials properties such as modulus, solar cell, and energy gap.</i>	3	3			2			1		2		2		
CO5	<i>Imbibe the concept of capillary action in fluid dynamics and to compare the coefficient of viscosity of the given liquid.</i>	3	3			2			1		2		2		
<b>Average</b>		3	3			2			1		2		2		

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**SEMESTER – I**

<b>20CS171</b>	<b>PROBLEM SOLVING TECHNIQUES LABORATORY</b>	L	T	P	C
	(Common To CS & EC)	0	0	3	1

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes: On Completion of this course, the student will be able to**

**Cognitive level**

CO1: Illustrate the basic concepts of MS Office.	Understand
CO2: Build the knowledge of flowchart.	Apply
CO3: Create the fundamentals of algorithm.	Create
CO4: Demonstrate the simple problems using factorizing concepts.	Understand
CO5: Analyze the simple problems using array and string operations.	Analyze

**LIST OF EXPERIMENTS:**

1. Prepare a Bio-data using MS Word with appropriate page, text and table formatting options and send the same to many recipients using mail merge.
2. Prepare a mark sheet with five subjects for five students in MS Excel File using Formulas, Functions and Charts.
3. i) Prepare a Power Point presentation for your organization with varying animation effects using timer.  
ii) Prepare a Student Database in MS Access, manipulate the data and generate report.
4. Design an algorithm and execute the flowchart for implement the concept of exchange of values.
5. Design an algorithm and execute the flowchart for count the digits and character of the input.
6. Design an algorithm to execute the flowchart for implement the factorization of given number.
7. Design an algorithm to execute the flowchart for produce various sequence of numbers like Fibonacci.
8. Design an algorithm to execute the flowchart for base conversion of numbers.
9. Design an algorithm to execute the flowchart for evaluates any one mathematical expression.
10. Design an algorithm to execute the flowchart for finding the LCM and GCD of the given input.
11. Design an algorithm to execute the flowchart for processing of Prime number.
12. Design an algorithm to execute the flowchart for array processing of set numbers.

**Total : 45 Periods**

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20CS171

Course Name: PROBLEM SOLVING TECHNIQUES LABORATORY

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Illustrate the basic concepts of MS Office.</i>	3	3	2	1	1	-	-	-	1	-	-	1	-	-
CO2	<i>Build the knowledge of flowchart.</i>	3	3	3	2	1	-	-	-	1	-	-	1	-	-
CO3	<i>Create the fundamentals of algorithm.</i>	3	3	2	2	1	-	-	-	1	-	-	1	-	-
CO4	<i>Demonstrate the simple problems using factorizing concepts.</i>	3	3	2	1	2	-	-	-	1	-	-	1	-	-
CO5	<i>Analyze the simple problems using array and string operations.</i>	3	3	2	2	1	-	-	-	1	-	-	1	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

SEMESTER-I

20MC151	INDUCTION PROGRAMME	L	T	P	C
	(COMMON TO ALL BRANCHES)	3	0	0	0

**Course outcomes: On Completion of this course, the student will be able to**

**Cognitive Level**

CO1 *Involve in physical activity, creative arts and culture and feel comfortable in the new environment.*

*Understand*

CO2 *Build relationship between teachers and students and make familiarizing with departments.*

*Understand*

CO3 *Concentrate on literary activities.*

*Apply*

CO4 *Develop the required skills through lectures and workshops.*

*Remember*

CO5 *Acquire skills in extracurricular activities.*

*Analyze*

**List of activities during the three weeks Students Induction Programme (SIP):**

**3 weeks**

MODULE I : PHYSICAL ACTIVITY

- This would involve a daily routine of physical activity with games and sports. There would be games in the evening. These would help develop team work besides health.

MODULE II : CREATIVE ARTS & CULTURE

- Every student would chose one skill related to the arts whether visual arts or performing arts such as painting, music, dance, pottery, sculpture etc. The student would pursue it every day for the duration of the program.
- These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would help in engineering design later.

MODULE III : MENTORING AND CONNECTING THE STUDENTS WITH FACULTY

- Mentoring takes place in the context and setting of *Universal Human Values*. It gets the student to explore oneself and experience the joy of learning, prepares one to stand up to peer and take decisions with courage, be aware of relationships and be sensitive to others.
- Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program.

MODULE IV: FAMILIRIZATION WITH COLLEGE/DEPARTMENTS & BRANCHES

- They should be shown their department, and told what it means to get into the branch or department. Describe what role the technology related to their department plays in society and after graduation what role the student would play in society as an engineer in that branch. A lecture by an alumnus of the Dept. would be very helpful in this regard. They should also be shown the laboratories, workshops and other facilities.

MODULE V: LITERARY ACTIVITIES

- Literary activity would encompass reading a book, writing a summary, debating, enacting a play etc.

MODULE VI: PROFICIENCY MODULES:

- The induction program period can be used to overcome some critical lacunas that students might have difficulties in communication skills. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially.

MODULE VII: LECTURES & WORKSHOPS

- Lectures by eminent people to be organized, say, once a week. It would give the students exposure to people who are eminent, in industry or engineering, in social service, or in public life. Alumni could be invited as well.
- Motivational lectures about life, meditation, etc. by Ramakrishna Mission, Art of Living, Vivekanand Kendras, S-VYASA, etc. may be organized. (3 sessions, 9 hours).

MODULE VIII: EXTRA CURRICULAR ACTIVITIES

- The new students should be introduced to the extra-curricular activities at the college.
- They should be shown the facilities and informed about activities related to different clubs etc. This is when selected senior students involved in or leading these activities can give presentations, under faculty supervision.

MODULE IX: FEED BACK & REPORT ON THE PROGRAMMES:

- Students should be asked to give their mid-program feedback. They should be asked to write their opinions about the program at the end of the first week.
- Finally, at the end of the program, each group (of 20 students) should be asked to prepare a single report on their experiences of the program. On the second last day, each group should present their report in front of other groups. Immediately after their presentation, they should submit their written report. This will also serve as a *closure* to the program.
- Finally, a formal written or online anonymous feedback should be collected at the end of the program.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF SCIENCE AND HUMANITIES**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20MC151

Course Name : Induction Programme

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Involve in physical activity, creative arts and culture and feel comfortable in the new environment.</i>	3					3	3	2	3	2		3		
CO2	<i>Build relationship between teachers and students and make familiarizing with departments.</i>	3					3	3	3	1	3		3		
CO3	<i>Concentrate on literary activities.</i>	3					2	3	3	3	3		3		
CO4	<i>Develop the required skills through lectures and workshops</i>	3					3	3	3	2	3		3		
CO5	<i>Acquire skills in extracurricular activities.</i>	3					3	3	3	3	3		3		
<b>Average</b>		<b>3</b>					<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>		<b>3</b>		

1: Slight (Low)    2: Moderate (Medium)    3: Substantial (High)

**K.S.R. COLLEGE OF ENGINEERING (Autonomous)**  
**SEMESTER – I**

**R 2020**

<b>20MC052</b>	<b>ENVIRONMENTAL SCIENCE AND ENGINEERING</b> (Common to All Branches)	L	T	P	C
		3	0	0	0

**Prerequisite:** NIL

<b>Course Outcomes: On Completion of this course , the student will be able to</b>	<b>Cognitive level</b>
CO1 Interpret the importance in conservation of resources for future generation.	Understand
CO2 Relate the importance of ecosystem and biodiversity.	Remember
CO3 Analyze the impact of pollution and hazardous waste in a global and societal context.	Understand
CO4 Identify the contemporary issues that result in environmental degradation that would attempt to provide solutions to overcome the problems.	Understand
CO5 Predict the concept of Sustainability and Green Chemistry.	Understand

**UNIT – I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES [ 9 ]**

Environment – definition – scope and importance – need for public awareness; Forest resources – use – over exploitation – deforestation; Water resources – over–utilization of surface and ground water; Mineral resources –environmental effects of extracting and using mineral resources; Food resources – overgrazing – effects of modern agriculture – fertilizer–pesticide problems – water logging – salinity; Role of an individual in conservation of natural resources. **Activity:** Slogan making event on conserving natural resources or plantation of trees.

**UNIT – II ECOSYSTEM AND BIODIVERSITY [ 9 ]**

Concept of an ecosystem – structure and function of an ecosystem – producers – consumers and decomposers – Food chain – food web – energy flow in the ecosystem – ecological pyramids – Ecological succession; Forest ecosystem and Aquatic ecosystems (Estuary and marine ecosystem); Biodiversity – introduction – definition – Values of biodiversity; Hot-spots of biodiversity; Endangered and Endemic Species of India. **Activity:** Arrange a trip to visit different varieties of plants.

**UNIT– III ENVIRONMENTAL POLLUTION [ 9 ]**

Pollution – introduction and different types of pollution; Causes – effects and control measures of air pollution and water pollution – water quality parameters – hardness – definition – types; Alkalinity – definition – types; BOD and COD (definition and significance); Noise pollution – solid waste management – hazardous waste – medical and e-wastes; Role of an individual in prevention of pollution. **Activity:** Drive for segregation of waste or cleanliness drive.

**UNIT– IV SOCIAL ISSUES AND ENVIRONMENT [ 9 ]**

Water conservation – rain water harvesting and watershed management; Environmental ethics – Issues and possible solutions; Climate change – global warming and its effects on flora and fauna – acid rain – ozone layer depletion; Disaster Management – earth quake – cyclone – tsunami – disaster preparedness – response and recovery from disaster. **Activity:** Poster making event on water management or Climate change.

**UNIT– V SUSTAINABILITY AND GREEN CHEMISTRY [ 9 ]**

Sustainable development – from unsustainable to sustainable development – Environmental Impact Assessment (EIA); Human rights; Value education; HIV/AIDS; Role of information technology in environment and human health; 12 Principles of Green Chemistry. **Activity:** Group discussion on Sustainability or Lecture from an expert on Green chemistry.

**Total = 45 Periods**

**Text Book :**

- 1 Dr. T. Arun Luiz, Environmental Science and Engineering, S. Chand & Company Private Limited, New Delhi, First Edition, 2016.
- 2 Anubha Kaushik and C. P. Kaushik, Environmental Science and Engineering, New Age International Publishers, Chennai, Fifth Edition, 2016.

**Reference Books :**

- 1 G. Tyler Miller and Scott E. Spoolman, Environmental Science, Cengage Learning India Private Limited, New Delhi, Fourteenth Edition, 2014.
- 2 Dr. A. Ravikrishnan, Environmental Science and Engineering, Sri Krishna Hi-tech Publishing Company Private Limited, Chennai, Tenth Edition, 2014.
- 3 Raman Sivakumar, Introduction to Environmental Science and Engineering, Tata McGraw Hill Education Private Limited, Fourth Edition, 2012.
- 4 S S. Dara, A Text book of Environmental Chemistry and pollution control, S. Chand & Company Limited, New Delhi, Tenth Edition, 2005.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF SCIENCE AND HUMANITIES**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20MC052

Course Name : Environmental Science and Engineering

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Interpret the importance in conservation of resources for future generation.</i>	3	2	2			3	3	2				1		
CO2	<i>Relate the importance of ecosystem and biodiversity.</i>	3	2	2			3	3	2				1		
CO3	<i>Analyze the impact of pollution and hazardous waste in a global and societal context.</i>	3	2	2			3	3	2				1		
CO4	<i>Identify the contemporary issues that result in environmental degradation that would attempt to provide solutions to overcome the problems.</i>	3	2	2			3	3	2				1		
CO5	<i>Predict the concept of Sustainability and Green Chemistry.</i>	3	2	2			3	3	2				1		
<b>Average</b>		<b>3</b>	<b>2</b>	<b>2</b>			<b>3</b>	<b>3</b>	<b>2</b>				<b>1</b>		

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



## SEMESTER - II

20EN251

TECHNICAL ENGLISH – II  
(Common to all branches)

L	T	P	C
2	0	1	3

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Objectives :** On successful completion of the course, the student will be able to

**Cognitive Level**

CO1: Infer and apply the enriched vocabulary, by knowing the basic grammatical structure, in academic and professional contexts.

Understand

CO2: Identify and use Standard English in diverse situations.

Apply

CO3: Interpret by reading a text and comprehend a given text.

Create

CO4: Organize and compose business letters.

Evaluate

CO5: Prioritize the listening skill for academic and personal development purposes.

Apply

**UNIT - I****[ 09 ]**

Technical Vocabulary – Changing words from one form to another - Articles – Compound Nouns - Introducing Oneself – Biased Listening- Critical reading - Need based Correspondence (In plant training & Industrial Visit) - Context based meaning - Writing short Essays.

**UNIT - II****[ 09 ]**

Prefixes & Suffixes - Numerical Adjectives – If Conditionals – Making Requests – Seeking Information - Listening for main ideas –Intensive Reading - E-mail Writing– Describing Likes & Dislikes - Report Writing.

**UNIT - III****[ 09 ]**

Types of Collocations - Framing Questions – ‘Wh’ Question – Yes / No Question –Cause and Effect Expression - Greetings and Introductions — Inviting People - Listening and Note taking - Critical reading- Making inference - Transcoding (Interpretation of Charts).

**UNIT - IV****[ 09 ]**

Common English idioms and phrases - Expression of Purpose – Editing text for Spelling and Punctuation - Oral Presentation – Extensive Listening - Short Comprehension Passages - Business Correspondence – Calling for Quotations, Seeking Clarification, placing order and Complaint .

**UNIT - V****[ 09 ]**

Confused and misused words - Discourse markers – Redundancies - Instructions – Describing – Listening to fill up forms and gapped texts - Reading Short texts from Journals and Newspapers - Telephone Etiquette - Check list – Essay Writing.

**Total (L= 40, T = 5) = 45 Periods**

**Text Books :**

- 1 Dr.S.Sumant, Technical English II, Tata McGraw Hill, New Delhi, Second Edition, 2016
- 2 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2004.

**Reference Books :**

- 1 Michael Swan, Practical English Usage, Oxford University Press, New Delhi, First Edition, 2015.
- 2 Dept. of Humanities and social sciences, Anna University, Chennai, English for Engineers and Technologists, Orient Longman, First Edition, 2014
- 3 Hory Sankar Mukerjee, Business Communication, Oxford University Press, New Delhi, First Edition, 2013.
- 4 Department of English, English for Technologists and Engineers, Orient Black Swan, Chennai, First Edition, 2016

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF SCIENCE AND HUMANITIES**

**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EN251

Course Name : Technical English – II

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Infer and apply the enriched vocabulary, by knowing the basic grammatical structure, in academic and professional contexts.</i>	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO2	<i>Identify and use Standard English in diverse situations.</i>	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO3	<i>Interpret by reading a text and comprehend a given text.</i>	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO4	<i>Organize and compose business letters.</i>	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO5	<i>Prioritize the listening skill for academic and personal development purposes.</i>	-	-	-	-	-	-	-	-	2	3	-	1	-	-
<b>Average</b>		-	-	-	-	-	-	-	-	<b>2</b>	<b>3</b>	-	<b>1</b>	-	-

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**SEMESTER – II**

<b>20MA242</b>	<b>APPLIED MATHEMATICS</b> (Common to EC and EE)	L	T	P	C
		3	1	0	4

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes : On Completion of this course, the student will be able to**

		<b>Cognitive Level</b>
CO1	<i>Solving the Laplace and inverse Laplace transform problems</i>	<i>Solve</i>
CO2	<i>Apply the ideas of analytic functions, conformal mapping and bilinear transformations.</i>	<i>Apply</i>
CO3	<i>Develop their skills in double and triple integrals</i>	<i>Remember</i>
CO4	<i>Solving the Fourier series problems.</i>	<i>Solve</i>
CO5	<i>Interpret the concepts of Fourier Transforms.</i>	<i>Understand</i>

**UNIT – I LAPLACE TRANSFORMATION [12]**

Laplace transform: Conditions for existence – Transform of elementary functions – Basic Properties – Transform of derivatives and integrals – Transform of periodic functions. Inverse Laplace transform: Partial Fraction Method - Convolution theorem (excluding proof) – Solution of linear ordinary differential equations of second order with constant coefficients.

**UNIT – II COMPLEX VARIABLES [12]**

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proof) – Harmonic functions – Harmonic conjugate – Conformal mapping :  $w = cz, c+z, 1/z$  and bilinear transformations - Complex integration - Residues – Cauchy's residue theorem.

**UNIT – III MULTIPLE INTEGRALS [12]**

Double integration – Cartesian coordinates – Triple integration in Cartesian co-ordinates – Area as double integral – Volume as triple integral.

**UNIT – IV FOURIER SERIES [12]**

Dirichlet's conditions – General Fourier series - Odd and even functions – Half range sine and cosine series parseval's theorem – Harmonic analysis.

**UNIT – V FOURIER TRANSFORMS [12]**

Fourier integral theorem (without proof) - Fourier Transform pair – Sine and cosine transforms - Properties – Transforms of simple functions – Parseval's identity.

**Total (L: 45 T:15) = 60 Periods**

**Text Books :**

- 1 Veerarajan.T , Engineering Mathematics III, Tata McGraw Hill Publications, New Delhi, Fourth edition, 2016.
- 2 Dr.Grewal B.S, Higher Engineering Mathematics, Tata McGraw Hill Pub. Co, New Delhi , Forty fourth edition, 2018.

**Reference Books :**

- 1 Ravish R Singh and Mukul Bhatt, Engineering Mathematics II", McGraw Hill Publications, New Delhi, Third edition 2016.
- 2 Dr.P.Kandasamy, Dr.Thilagavathy and Dr.K.Gunavathy, Engineering Mathematics , S.Chand publication, New Delhi , 2006.
- 3 E.Kreyszig Advanced Engineering Mathematics , Wiley Publishers, Tenth edition, Reprint 2017.
- 4 Veerarajan. T , Engineering Mathematics For semester I and II, Tata McGraw Hill Publications, New Delhi, 2015

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF SCIENCE AND HUMANITIES**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20MA242

Course Name : Applied Mathematics

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Solving the Laplace and inverse Laplace transform problems</i>	3	3	3	3										
CO2	<i>Apply the ideas of analytic functions, conformal mapping and bilinear transformations.</i>	3	3	3	3										
CO3	<i>Develop their skills in double and triple integrals</i>	3	3	2	3										
CO4	<i>Solving the Fourier series problems.</i>	3	3	3	3										
CO5	<i>Interpret the concepts of Fourier Transforms.</i>	3	3	3	3										
<b>Average</b>		3	3	3	3										

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**SEMESTER – I**

20CH051

**ENGINEERING CHEMISTRY**  
(Common to All Branches)

L	T	P	C
3	0	0	3

**Prerequisite:** NIL**Course Outcomes :** On Completion of this course, the student will be able to**Cognitive Level**

CO1	Make use of the manufacture, properties and uses of advanced engineering materials.	Understand
CO2	Explain the concept of corrosion and its control.	Understand
CO3	Use the concept of thermodynamics in engineering applications.	Understand
CO4	Recall the periodic properties such as ionization energy, electron affinity and electro negativity.	Remember
CO5	Analyze the usage of various spectroscopic techniques.	Understand

**UNIT – I ADVANCED ENGINEERING MATERIALS [ 9 ]**

Abrasives – Moh's scale of hardness – types – natural [Diamond] – synthetic [SiC]; Refractories – characteristics – classifications [Acidic, basic and neutral refractories] – properties – refractoriness – RUL – porosity – thermal spalling; Lubricants – definition – function – characteristics – properties – viscosity index, flash and fire points, cloud and pour points, oiliness; Solid lubricants – graphite and MoS<sub>2</sub>; Nano materials – CNT– synthesis [CVD, laser evaporation, pyrolysis] – applications – medicine, electronics, biomaterials and environment.

**UNIT – II ELECTROCHEMISTRY AND CORROSION [ 9 ]**

Introduction – electrode potential – Nernst equation – EMF series and its significance – types of cells (Electrolytic & electrochemical); Corrosion – causes, consequences – classification – chemical corrosion – electro chemical corrosion – mechanism; Galvanic & differential aeration corrosion – factors influencing corrosion – corrosion control – corrosion inhibitors.

**UNIT – III CHEMICAL THERMODYNAMICS [ 9 ]**

Terminology of thermodynamics – second law; Entropy – entropy change for an ideal gas – reversible and irreversible processes – entropy of phase transition – Clausius inequality; Free energy and work function – Helmholtz and Gibb's free energy functions – criteria of spontaneity; Gibb's – Helmholtz equation (Problems); Maxwell's relations – Van't Hoff isotherm and isochore.

**UNIT – IV ATOMIC STRUCTURE AND CHEMICAL BONDING [ 9 ]**

Effective nuclear charge – orbitals – variations of s, p, d and f orbital – electronic configurations – ionization energy – electron affinity and electro negativity; Types of bonding – ionic, covalent and coordination bonding – hydrogen bonding and its types; Crystal field theory – the energy level diagram for transition metal complexes ([Fe(CN)<sub>6</sub>]<sup>3-</sup>, [Ni(CN)<sub>4</sub>]<sup>2-</sup> and [CoCl<sub>4</sub>]<sup>2-</sup> only); Role of transition metal ions in biological system; Band theory of solids.

**UNIT – V PHOTOCHEMISTRY AND SPECTROSCOPIC TECHNIQUES [ 9 ]**

Laws of photochemistry – Grotthuss Draper law – Stark-Einstein law – Beer-Lambert law – phosphorescence – fluorescence and its applications in medicine – chemiluminescence; Colorimetry – principle – instrumentation (block diagram only) – estimation of iron by colorimetry; principles of spectroscopy – selection rules – vibrational and rotational spectroscopy – applications; Flame photometry – principle – instrumentation (block diagram only) – estimation of sodium; Atomic absorption spectroscopy – principle – instrumentation (block diagram only) – estimation of nickel.

**Total = 45 Periods****Text Books :**

- 1 Dr. A. Ravikrishnan, Engineering Chemistry, Srikrishna Hi-tech Publishing Company Private Limited, Chennai, Seventeenth Edition, 2016.
- 2 P.C. Jain and Monica Jain, Engineering Chemistry, Dhanpat Rai Publishing company, New Delhi, Seventeenth Edition, 2015.

**Reference Books :**

- 1 S S. Dara and S. S. Umare, A Text book of Engineering Chemistry, S. Chand & Company Limited, New Delhi, Fifth Edition, 2015.
- 2 N. Krishnamurthy, P. Vallinayagam and D. Madhavan, Engineering Chemistry, PHI Learning Private Limited, New Delhi, Third Edition, 2014.
- 3 S. Vairam, P. Kalyani and Suba Ramesh, Engineering Chemistry, Wiley India Private Limited, New Delhi, First Edition, 2013.
- 4 B. Sivasankar, Engineering Chemistry, Tata McGraw – Hill Education Private Limited, New Delhi, First Edition, 2008.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF SCIENCE AND HUMANITIES**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20CH051

Course Name : Engineering Chemistry

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Make use of the manufacture, properties and uses of advanced engineering materials.</i>	3	3	2				2					1		
CO2	<i>Explain the concept of corrosion and its control.</i>	3	3	2				3					2		
CO3	<i>Use the concept of thermodynamics in engineering applications.</i>	3	3	2				2					2		
CO4	<i>Recall the periodic properties such as ionization energy, electron affinity and electro negativity.</i>	3	3	2				2					1		
CO5	<i>Analyze the usage of various spectroscopic techniques.</i>	3	3	2				3					1		
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>				<b>2</b>					<b>1</b>		

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**SEMESTER – II****20CS241****PYTHON PROGRAMMING**  
(Common to AU, CE, EE, EC, ME & SF)

L	T	P	C
3	0	0	3

**Prerequisite:** Basic knowledge of C programming.

<b>Course Outcomes : On successful completion of the course, the student will be able to</b>	<b>Cognitive Level</b>
CO1: Illustrate basic concepts of python programming.	Understand
CO2: Apply the necessary data structures includes list, tuple and dictionary in the required fields.	Apply
CO3: Analyze, design and implement the problems using OOPs technology	Analyze
CO4: Demonstrate the simple file operations	Evaluate
CO5: Design web site using GUI.	Create

**UNIT – I FUNDAMENTALS OF PYTHON [ 9 ]**

Introduction to Python – Advantages of Python programming – Variables and Data types – Comments – I/O function – Operators – Selection control structures – Looping control structures – Functions: Declaration – Types of arguments – Anonymous functions: Lambda.

**UNIT – II DATA STRUCTURES AND PACKAGES [ 9 ]**

Strings – List – Tuples – Dictionaries – Sets – Exception Handling: Built-in Exceptions – User-defined exception– Modules and Packages.

**UNIT – III OBJECT ORIENTED PROGRAMMING [ 9 ]**

Object Oriented Programming basics – Inheritance and Polymorphism – Operator Overloading and Overriding – Get and Set Attribute Values – Name Mangling – Duck Typing – Relationships.

**UNIT – IV FILES AND DATA BASES [ 9 ]**

File I/O operations – Directory Operations – Reading and Writing in Structured Files: CSV and JSON – Data manipulation using Oracle, MySQL and SQLite.

**UNIT – V GUI AND WEB [ 9 ]**

UI design: Tkinter – Events – Socket Programming – Sending email – CGI: Introduction to CGI Programming, GET and POST Methods, File Upload.

**Total = 45 Periods****Text Books :**

- 1 Mark Lutz, "Learning Python", O'Reilly Media, Fifth Edition, 2013
- 2 Wesley J.Chun, "Core Python Programming", Pearson Education, Second Edition, 2017

**References :**

- 1 Bill Lubanovic, "Introducing Python Modern Computing in Simple Packages", O'Reilly Media, First Edition, 2014.
- 2 David Beazley, Brian K. Jones, "Python Cookbook", O'Reilly Media, Third Edition, 2013
- 3 Mark Lutz, "Python Pocket Reference", O'Reilly Media, Fifth Edition, 2014
- 4 [www.python.org](http://www.python.org) and [www.diveintopython3.net](http://www.diveintopython3.net)
- 5 To practice: [www.codecademy.com](http://www.codecademy.com) and <https://codingbat.com/python>

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20CS241

Course Name : Python Programming

CO	Course Outcomes	Programme Outcomes														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	<i>Illustrate basic concepts of python programming.</i>	3	3	2	2	1									3	2
CO2	<i>Apply the necessary data structures includes list, tuple and dictionary in the required fields.</i>	3	3	3	2	2									3	2
CO3	<i>Analyze, design and implement the problems using OOPs technology</i>	3	3	3	2	2									3	2
CO4	<i>Demonstrate the simple file operations</i>	3	3	3	3	2									3	3
CO5	<i>Design web site using GUI.</i>	3	3	3	3	2									3	3
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>									<b>3</b>	<b>2</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



**SEMESTER - II**

20EC215

**ELECTRIC CIRCUITS**

L	T	P	C
3	0	0	3

**Prerequisite:** Engineering Mathematics-I, Engineering Physics**Course Outcomes: On Completion of this course, the student will be able to****Cognitive level**

CO1	Apply KCL, KVL to solve the electric circuits and to find current and voltage at particular node or branch.	Apply
CO2	Apply network theorems to convert complex circuits into simple circuits to find voltage, current and power for DC circuits.	Apply
CO3	Interpret the circuit response for RL, RC, and RLC for AC circuits with its phasor diagram.	Apply
CO4	Apply the transient behavior for RL, RC, and RLC for DC and Sinusoidal inputs.	Apply
CO5	Identify the phase response for three phase circuits employing balanced and unbalanced loads.	Apply

**UNIT - I DC NETWORK ANALYSIS****[9 ]**

Basic components and electric networks, charge, current, voltage and power, voltage and current sources, Ohms law, Kirchhoff's laws, analysis of series and parallel networks, voltage and current division, networks reduction, nodal and mesh analysis for linear resistive networks, an introduction to network topology.

**UNIT - II NETWORK THEOREMS AND DUALITY****[9 ]**

Linearity and Non-Linearity, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem, Star - Delta Transformation. Duals, Dual Networks.

**UNIT - III SINUSOIDAL STEADY STATE ANALYSIS****[9 ]**

Sinusoidal Steady State analysis, Characteristics of Sinusoids, AC Network Power Analysis, Instantaneous Power, Average Power, Apparent Power and Power Factor. Phase Relationship for R, L, and C, Analysis of Simple Series and Parallel AC Networks with Phasor Diagram.

**UNIT - IV TRANSIENTS AND RESONANCE IN RLC NETWORKS****[9 ]**

Transient Response of RL, RC and RLC Networks for DC Input and Sinusoidal Inputs, Series and Parallel Resonance, Frequency Response, Quality Factor, Bandwidth, Half Power Frequencies.

**UNIT - V COUPLED NETWORKS AND THREE PHASE SYSTEMS****[9 ]**

Magnetically Coupled Networks: Self-Inductance, Mutual Inductance, Co-efficient of Coupling, Single and Double Tuned Networks, Analysis and Applications, Analysis of 3 Phase 3 Wire and 4 Wire Systems with Star and Delta Connected Loads (balanced & Unbalanced), 3 Phase Power Measurement by Two-Watt Meter Method.

**Total (L: 45 ) = 45 Periods****Text Books :**

- 1 Joseph A.Edminister, Mahmood Nahri, Electric Circuits, Schaum's Series, Tata McGraw-Hill, New Delhi, 2001.
- 2 David A. Bell, Fundamentals of Electric Circuits, Oxford University press, Seventh edition 2009.

**Reference Books :**

- 1 W.H.Hayt, J.E.Kemmarly, S.M.Durbin, Engineering Circuit Analysis, McGraw- Hill, New Delhi, Eighth Edition 2013.
- 2 Charles K. Alexander & Mathew N.O.Sadiku, Fundamentals of Electric Networks, McGraw- Hill New Delhi, Fifth edition, 2013.
- 3 A.Sudhakar and S.P.Shyam Mohan, Circuits and Network Analysis and Synthesis, Tata McGraw Hill, Fifth edition 2017.
- 4 Chakrabati A, Circuits Theory Analysis and synthesis, Dhanpath Rai & Sons, New Delhi, Sixth edition 2018.
- 5 NPTEL Course Link : <http://nptel.ac.in/courses/108102042/>

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC215

Course Name : Electric Circuits

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Apply KCL, KVL to solve the electric circuits and to find current and voltage at particular node or branch.</i>	3	3	3			2						2	1	
CO2	<i>Apply network theorems to convert complex circuits into simple circuits to find voltage, current and power for DC circuits.</i>	3	3	3			2						2	1	
CO3	<i>Interpret the circuit response for RL, RC, and RLC for AC circuits with its phasor diagram.</i>	3	3	3			2						2	1	
CO4	<i>Apply the transient behavior for RL, RC, and RLC for DC and Sinusoidal inputs.</i>	3	3	3			2						2	1	
CO5	<i>Identify the phase response for three phase circuits employing balanced and unbalanced loads.</i>	3	3	3			2						2	1	
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>			<b>2</b>						<b>2</b>	<b>1</b>	

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**SEMESTER – II**

20CH028

**CHEMISTRY LABORATORY**  
(Common To All Branches)

L	T	P	C
0	0	3	1

**Prerequisite:** NIL**Course Outcomes: On Completion of this course, the student will be able to**

- CO1 Apply the principle of conductometric titration.  
 CO2 Relate the role of pH in quantitative analysis of a solution.  
 CO3 Perceive the knowledge of the concentration of Iron by electrochemical methods.  
 CO4 Analyze the application of water in various fields.  
 CO5 Recall the nature of corrosion process.

**Cognitive level**

- Understand  
 Understand  
 Understand  
 Understand  
 Remember

**LIST OF EXPERIMENTS:**

1. Conductometric Titration – Strong Acid Vs. Strong Base.
2. Conductometric Titration – Mixture of Weak and Strong Acids Vs. Strong Base.
3. Conductometric Titration – Precipitation, BaCl<sub>2</sub> Vs. Na<sub>2</sub>SO<sub>4</sub>.
4. Estimation of Ferrous ion by Potentiometry – Fe<sup>2+</sup> Vs K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>.
5. Estimation of Hydrochloric Acid by pH metry.
6. Estimation of Iron by Spectrophotometry.
7. Estimation of hardness in water by EDTA method.
8. Estimation of chloride in water sample by Argentometry.
9. Estimation of dissolved oxygen (DO) in water by Winkler's method.
10. Determination of rate of corrosion of mild steel by weight loss method.

**Total : 30 Periods****Text Book :**

- 1 Department of Chemistry Staff members, Chemistry Laboratory Manual, K.S.R. College of Engineering, Tiruchengode, Fourth Edition, 2020.
- 2 I. Vogel, Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & sons, Newyork, Eighth Edition, 2014.

**Reference Books :**

- 1 S. K. Bhasin and Sudha Rani, Laboratory Manual of Engineering Chemistry, Dhanpat Rai Publishing Company Private Limited, New Delhi, Third Edition, 2012.
- 2 I. Vogel and J. Mendham, Vogel's Textbook of Quantitative Chemical Analysis, Harlow, Prentice Hall, Sixth Edition, 2000.
- 3 G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denny, Vogel's Text book of quantitative analysis chemical analysis, Longman, Singapore publishers, Singapore, ELBS Fifth Edition, 1996.
- 4 B.S. Furniss, A.J. Hannaford, P.W.G. Smith and A.R. Tatchel, Vogels Textbook of practical organic chemistry, John Wiley & sons, Newyork, Fifth Edition, 1989.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF SCIENCE AND HUMANITIES**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20CH028

Course Name : Chemistry Laboratory

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Apply the principle of conductometric titration.</i>	3	3	3			2		1	2			1		
CO2	<i>Relate the role of pH in quantitative analysis of a solution.</i>	3	2	3			1		1	2			1		
CO3	<i>Perceive the knowledge of the concentration of Iron by electrochemical methods.</i>	3	1	3			1		1	2			1		
CO4	<i>Analyze the application of water in various fields.</i>	3	2	2			1		1	2			1		
CO5	<i>Recall the nature of corrosion process.</i>	3	2	3			1		1	2			1		
<b>Average</b>		<b>3</b>	<b>2</b>	<b>3</b>			<b>1</b>		<b>1</b>	<b>2</b>			<b>1</b>		

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**SEMESTER – II**

<b>20CS227</b>	<b>PYTHON PROGRAMMING LABORATORY</b> (Common to AU, CE, EE, EC, ME & SF)	L	T	P	C
		0	0	3	1

**Prerequisite:** Basic knowledge of C programming.

<b>Course Outcomes : On successful completion of the course, the student will be able to</b>	<b>Cognitive Level</b>
CO1: Design simple programs using conditionals and loops.	Apply
CO2: Write functions to solve mathematical problems.	Understand
CO3: Demonstrate the use of files in python.	Analyze
CO4: Develop simple applications using python.	Create
CO5: Construct GUI applications using python programming.	Create

**List of Experiments**

1. Write a program to display the largest number among three numbers.
2. Write a program to check the prime number and to display the twin prime numbers.
3. Write a program to display the Fibonacci series and multiplication table by using looping constructs.
4. Write a program for converting decimal to octal, hexadecimals and vice versa by using functions.
5. Write a function to compute the GCD of two numbers.
6. Write a function to perform sorting list of numbers.
7. With the help of string array or list, display a simple calendar in python program without using the calendar module.
8. Demonstrate class and inheritance in python.
9. Create a text file using python file I/O. Read the content of the file and change them from lower to upper case characters. Write the updated content in another file and display it.
10. Write a program to demonstrate the user-defined exception handling mechanism in Python.
11. Design and implement a graphical user interface to perform any arithmetic operation.
12. Write a python program to insert and retrieve data using MySQL.

**Total : 45 Periods**

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20CS227

Course Name : Python Programming Laboratory

CO	Course Outcomes	Programme Outcomes														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	<i>Design simple programs using conditionals and loops.</i>	2	3	3	2	2									3	1
CO2	<i>Write functions to solve mathematical problems.</i>	3	3	3	2	2									3	1
CO3	<i>Demonstrate the use of files in python.</i>	3	3	3	2	2									3	1
CO4	<i>Develop simple applications using python.</i>	3	3	3	1	3									3	1
CO5	<i>Construct GUI applications using python programming.</i>	3	3	3	1	3									3	1
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>									<b>3</b>	<b>1</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**SEMESTER - II**

20GE028

**MANUFACTURING PRACTICES LABORATORY**  
(Common to All Branches)L T P C  
0 0 3 1**Prerequisite:** No Prerequisites are needed for enrolling into the course.**Course Outcomes :** On successful completion of the course, the student will be able to**Cognitive Level**

CO1: Prepare green sand mould for simple patterns and carpentry components with simple joints.

Create

CO2: Perform welding practice to join simple structures.

Apply

CO3: Practice simple operations in lathe and drilling machine.

Understand

**GROUP A (CIVIL & MECHANICAL)****LIST OF EXPERIMENTS**

1. Study of fitting, smithy, plastic moulding and glass cutting.
2. Prepare a mould using solid/split patterns in Foundry.
3. Make Lap joint / Butt joint / T joint from the given wooden pieces using carpentry tools.
4. Make a Butt joint / Lap joint / Tee joints using arc / gas welding equipment.
5. Perform simple Facing and Turning operation using Centre Lathe.
6. Make holes as per the given dimensions using drilling machine.

**LIST OF EQUIPMENT**

1. Fitting tools and its accessories - 15 Sets
2. Smithy tools and Open hearth furnace setup - 2 Sets
3. Foundry tools and its accessories - 5 Sets
4. Carpentry tools and its accessories - 15 Sets
5. Arc Welding equipments and its accessories - 5 Sets
6. Oxy Acetylene welding setup and its accessories - 1 Set
7. Centre Lathe with its accessories - 2 Nos.
8. Pillar type drilling machine - 1 No.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215

DEPARTMENT OF AUTOMOBILE ENGINEERING

**CO-PO MAPPING**

Regulation : R 2020

Course Name : Manufacturing Practices Laboratory Group A

Course Code: 20GE028

(Civil &amp; Mechanical)

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Prepare green sand mould for simple patterns and carpentry components with simple joints.	2	-	-	3	-	-	-	3	1	-	-	3	3	1
CO2:	Perform welding practice to join simple structures.	2	-	-	3	-	-	-	3	1	-	-	3	3	1
CO3:	Practice simple operations in lathe and drilling machine.	2	-	-	3	-	-	-	3	1	-	-	3	3	1
<b>Average</b>		<b>2</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>1</b>			<b>3</b>	<b>3</b>	<b>1</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**SEMESTER – II**

<b>20GE028</b>	<b>GROUP B (ELECTRICAL &amp; ELECTRONICS)</b>	L	T	P	C
	(Common to all Branches)	0	0	3	1

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes:** On Completion of this course, the student will be able to

**Cognitive level**

CO1	Construct different types of wiring used in house.	Understand
CO2	Calibrate single phase Energy meter.	Understand
CO3	Demonstrate different electronic components, logic gates and CRO.	Understand

**List of Experiments:**

**ELECTRICAL ENGINEERING**

1. Fluorescent lamp wiring & Stair-case wiring.
2. Residential house wiring using switches, fuse, indicator, lamp and fan.
3. Calibration of Single phase Energy meter

**ELECTRONICS ENGINEERING**

1. Study of Electronic components and Soldering practice.
2. Study of logic gates AND, OR, EX-OR, NOT, Half and Full Adder.
3. Study of CRO

**Total : 45 Periods**

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Name : Manufacturing Practices Laboratory

Course Code: 20GE028

Group B (Electrical & Electronics)

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Construct different types of wiring used in house	3	2	3	-	-	-	-	1	1	-	-	3	-	-
CO2	Calibrate single phase Energy meter	3	1	2	-	-	-	-	1	1	-	-	3	-	-
CO3	Demonstrate different electronic components, logic gates and CRO	3	2	3	-	-	-	-	1	1	-	-	3	-	-
<b>Average</b>		<b>3</b>	<b>2</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



SEMESTER – II

	L	T	P	C
20EC221	0	0	3	1

**ELECTRIC CIRCUITS LABORATORY**

**Prerequisites:** Engineering Mathematics-I, Engineering Physics

**Course Outcomes: On Completion of this course , the student will be able to**

**Cognitive level**

CO1: Apply KCL, KVL to solve electric circuits and verify with theoretical value.	Apply
CO2: Translate the complex circuit into simple circuit to find voltage, current and power for DC circuits using network theorems and verify with theoretical value	Apply
CO3: Construct a series and parallel resonant circuit and plot its frequency response.	Apply
CO4: Analyze the transient behavior for RL, RC with DC and sinusoidal input.	Analyze
CO5: Analyze single phase AC circuits to measure voltage, current, power and power factor.	Analyze

**List of Experiments:**

1. Verification of ohm's laws and Kirchhoff's laws
2. Verification of mesh and nodal analysis.
3. Verification of Thevenin's and Norton's theorems
4. Verification of Superposition theorem
5. Verification of Maximum power transfer theorem
6. Verification of Reciprocity theorem.
7. Transient response of RL and RC circuits for DC and AC inputs
8. Frequency response of series and parallel resonance circuits
9. Measurement of self-inductance of a coil
10. Measurement of voltage, current power and power factor in single phase AC circuits
11. Measurement of energy using single phase energy meter.
12. Study of frequency response of single tuned coupled circuits.

**Total = 45 Periods**

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC221

Course Name : Electric Circuits Laboratory

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Apply KCL, KVL to solve electric circuits and verify with theoretical value.</i>	3	3	3						3			2	1	
CO2	<i>Translate the complex circuit into simple circuit to find voltage, current and power for DC circuits using network theorems and verify with theoretical value.</i>	3	3	3						3			2	1	
CO3	<i>Construct a series and parallel resonant circuit and plot its frequency response.</i>	3	3	3						3			2	1	
CO4	<i>Analyze the transient behavior for RC, RL with DC and AC input.</i>	3	3	3						3			2	1	
CO5	<i>Analyze single phase AC circuits to measure voltage, current, power and power factor.</i>	3	3	3						3			2	1	
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>						<b>3</b>			<b>2</b>	<b>1</b>	

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**SEMESTER – III**

20MA342	DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS (Common to EE & EC)	L	T	P	C
		3	1	0	4

**Prerequisite:** No prerequisites are needed for enrolling into the course.

**Course Outcomes:** On Completion of this course, the student will be able to

**Cognitive level**

CO1	Apply the concepts of partial differential equations.	Apply
CO2	Solving polynomial, transcendental equations, simultaneous linear equations numerically	Understand
CO3	Apply the Interpolation techniques.	Apply
CO4	Developing their skills in numerical differentiation and integration.	Apply
CO5	Determine the numerical solutions to boundary value problems.	Remember

**UNIT – I PARTIAL DIFFERENTIAL EQUATIONS [ 12 ]**

Formation of partial differential equations – Lagrange's linear equation - Homogeneous Linear Partial Differential Equations of second and higher order with constant coefficients.

**UNIT – II SOLUTION OF EQUATIONS AND INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS [ 12 ]**

Solutions to polynomials and transcendental equations – Newton's method - Solutions to simultaneous linear equations - Gauss Elimination - Gauss-Seidel method. Solving first order Ordinary Differential Equations (Single step) by Taylor series method - Euler method and Modified Euler Method for first order equation - Fourth order Runge-Kutta for solving first order equations.

**UNIT – III INTERPOLATION AND APPROXIMATION [ 12 ]**

Lagrange's interpolation, Inverse Lagrange's interpolation and Divided difference – Newton's forward and backward difference interpolation techniques (equal intervals) - Cubic Splines.

**UNIT – IV NUMERICAL DIFFERENTIATION AND INTEGRATION [ 12 ]**

Numerical differentiation using Newton's forward and backward interpolation methods - Numerical integration by trapezoidal and Simpson's 1/3<sup>rd</sup> and 3/8<sup>th</sup> rules – double integrals

**UNIT – V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS [ 12 ]**

Finite difference solution of one dimensional heat equation by Crank Nicholson and Bender Schmidt method - One dimensional wave equation and two dimensional Laplace and Poisson equations

**Total (L: 45 T: 15) = 60 Periods**

**Text Books :**

- 1 Dr. B.S. Grewal, Numerical Methods in Engineering and Science, Khanna Publishers, New Delhi, Ninth Edition, 2016.
- 2 Veerarajan.T, Engineering Mathematics, Tata McGraw Hill Publications, New Delhi, Third edition, 2009.

**Reference Books :**

- 1 Dr. M.K. Venkataraman, Numerical Methods in Science and Engineering, National Publishing Co, Fifteenth Edition, 2016
- 2 Ramana.B.V, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company Limited, New Delhi, Fourth Edition, 2016.
- 3 Dr.P.Kandasamy, Dr.Thilagavathy and Dr.K.Gunavathy, Numerical Methods, S.Chand & company Ltd, Third edition, New Delhi, 2003
- 4 C.F.Gerald & P.O.Wheatley, Applied Numerical Analysis, Pearson Education (Asia), Seventh Edition, 2007.

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**DEPARTMENT OF SCIENCE AND HUMANITIES**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20MA342

Course Name : Differential Equations and Numerical Methods

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Apply the concepts of partial differential equations.</i>	3	3	3	3										
CO2	<i>Solving polynomial, transcendental equations, simultaneous linear equations numerically</i>	3	3	3	3										
CO3	<i>Apply the Interpolation techniques.</i>	3	3	3	3										
CO4	<i>Developing their skills in numerical differentiation and integration.</i>	3	3	3	3										
CO5	<i>Determine the numerical solutions to boundary value problems.</i>	3	3	3	3										
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>										

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

SEMESTER – III

20CS332	<b>C++ AND DATA STRUCTURES</b>	L	T	P	C
		3	0	0	3

**Prerequisite:** Basic Knowledge of C programming

<b>Course Outcomes: On Completion of this course , the student will be able to</b>	<b>Cognitive level</b>
CO1: Outline the concepts of object oriented programming.	Remember
CO2: Demonstrate the ideas of constructors, inheritance and operator overloading	Understand
CO3: Analyze the concept of list ADT and its implementation.	Analyze
CO4: Summarize the knowledge in trees and graphs.	Understand
CO5: Evaluate various sorting, Hashing and searching techniques.	Evaluate

**UNIT– I FUNDAMENTALS OF C++ [ 9 ]**

Object Oriented Programming Concepts – Difference between object oriented and Procedure oriented – Benefits – Applications – Introduction to C++ – Tokens – Data types – Operators – Classes – Objects – Default arguments – Static member functions – Static data members – Friend Functions

**UNIT– II CONSTRUCTORS AND INHERITANCE [ 9 ]**

Constructors – Destructors – Operator Overloading: Unary Operator Overloading – Binary operator Overloading – Inheritance – Virtual Functions – Pure Virtual Functions – Exception Handling.

**UNIT – III LINEAR DATA STRUCTURES [ 9 ]**

Abstract Data Types (ADT) – List ADT – Array Based Implementation – Linked List Implementation – Singly Linked Lists – Doubly Linked Lists – Stack ADT – Implementation of Stack using Array and Linked List. Queue ADT – Implementation of Queue using Array and Linked List.

**UNIT – IV NON LINEAR DATA STRUCTURES [ 9 ]**

Tree ADT – Binary Tree ADT – Binary Tree Traversal – Binary Search Tree – AVL Trees – Binary Heaps – Graphs and its Types – Breadth First Traversal – Depth First Traversal – Topological Sort – Minimum Spanning Tree: Prim's and Kruskal's algorithms – Shortest Path Algorithms : Dijkstra's Algorithm.

**UNIT – V SEARCHING,HASHING AND SORTING [ 9 ]**

Searching: Linear and Binary Search – Hashing: Hash function – Separate Chaining – Open Addressing – Linear Probing – Sorting: Bubble Sort – Selection Sort – Insertion Sort – Merge Sort – Quick Sort.

**Total = 45 Periods**

**Text Books :**

- 1 E. Balagurusamy, Object Oriented Programming with C++, McGraw-Hill Education, New Delhi, Seventh Edition, 2018.
- 2 M. A. Weiss, Data Structures and Algorithm Analysis in C, Pearson Education, New Delhi, Second Edition, 2015.

**References :**

- 1 Robert Lafore, Object Oriented Programming in-C++, Galgotia Publication, New Delhi, Fourth Edition, 2014.
- 2 B. Trivedi, Programming with ANSI C++, Oxford University Press, England, Second Edition, 2007.
- 3 A.K. Sharma, Data Structures using C, Pearson Education, New Delhi, First Edition 2011.
- 4 [Rhttp://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html](http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html).

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**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20CS332

Course Name : C++ and Data Structures

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Outline the concepts of object oriented programming.</i>	3	2	3	2	2				1		2	1		
CO2	<i>Demonstrate the ideas of constructors, inheritance and operator overloading</i>	3	2	3	2	2				1		3	1		
CO3	<i>Analyze the concept of list ADT and its implementation.</i>	3	3	2	2	2				1		2	1		
CO4	<i>Summarize the knowledge in trees and graphs.</i>	3	2	2	2	2				1		3	1		
CO5	<i>Evaluate various sorting, Hashing and searching techniques.</i>	3	2	2	2	2				1		2	1		
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>				<b>1</b>		<b>2</b>	<b>1</b>		

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**SEMESTER - III**

20EC311

**ELECTRONIC DEVICES**

L	T	P	C
3	0	0	3

**Prerequisite:** Electric Circuits**Course Outcomes :** On successful completion of the course, the student will be able to**Cognitive Level**

CO1: Understand the operation and characteristics of PN diode	Understand
CO2: Analyze the Bipolar Junction Transistor characteristics and the biasing techniques	Analyze
CO3: Analyze the characteristics of Field Effect Transistor.	Analyze
CO4: Examine the characteristics of rectifier, filter and regulator circuits.	Analyze
CO5: Illustrate the relationship between voltage and current for various special semiconductor devices	Understand

**UNIT - I SEMICONDUCTOR DIODES [09]**

Types of semiconductor: Intrinsic, extrinsic semiconductor, P-type and N- type semiconductos: Carrier concentration, Fermi energy level, variation of fermi level with temperature, electrical conductivity – Drift & diffusion current – PN Junction: forward bias, reverse bias – Diode current equation – Capacitance.

**UNIT - II TRANSISTORS [09]**

NPN and PNP Operations – Configurations – Biasing methods – Bias compensation techniques – Hybrid parameter for CE amplifier – Miller’s theorem – Darlington amplifier and bootstrapping emitter follower – Hybrid  $\pi$  equivalent model – Low and high frequency response of CE amplifier.

**UNIT - III FET [09]**

JFET types and operation of N-Channel and P-channel – MOSFET types and operation – CMOS operation, inverter voltage transfer curve and threshold voltage - Latch up problem and prevention.

**UNIT - IV RECTIFIERS AND POWER SUPPLIES [09]**

Analysis of half wave, full wave and bridge rectifiers with resistive load – Analysis of ripple voltage with C, L, LC and CLC filters – Voltage regulators: Zener diode regulator, transistor series and shunt regulator - Current limiting and over voltage protection circuit –SMPS

**UNIT - V SPECIAL SEMICONDUCTOR DEVICES [09]**

Zener diode, Tunnel diode, PIN diode, Varactor diode, LED, LCD, LASER, Photodiode, Phototransistor, Photoconductive and Photovoltaic cells. SCR, DIAC, TRIAC and UJT.

**Total (L: 45 ) = 45 Periods****Text Books :**

- 1 Sedra / Smith, “Micro Electronic Circuits” Oxford University Press, Seventh edition united kingdom 2017.
- 2 Anil K Maini, Varsha Agarwal, “Electronic Devices & Circuits”, John Wiley United States, Reprint 2012.

**Reference Books :**

- 1 Robert L. Boylestad and Louis Nasheresky, “Electronic Devices and Circuit Theory”, Eleventh edition, PHI, Delhi 2015.
- 2 David A. Bell, “Solid State Pulse Circuits”, Fourth edition PHI, Delhi 2012.
- 3 Donald .A. Neamen, “Electronic Circuit Analysis and Design”, Second edition, Tata McGraw Hill, Delhi 2009.
- 4 Millman.J. and Halkias C.C, “Integrated Electronics”, Tata McGraw Hill, Forty eight Reprint Delhi 2008.
- 5 NPTEL Course Link: <http://nptel.ac.in/courses/117101106/7>

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC311

Course Name : **Electronic Devices**

CO	Course Outcomes	Programme Outcomes													
		P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
CO1	<i>Understand the operation and characteristics of PN diode</i>	3	3	3	3	3							3	3	2
CO2	<i>Analyze the Bipolar Junction Transistor characteristics and the biasing techniques</i>	3	3	3	3	3							3	3	2
CO3	<i>Analyze the characteristics of Field Effect Transistor.</i>	3	3	3	3	3							3	3	2
CO4	<i>Examine the characteristics of rectifier, filter and regulator circuits.</i>	3	3	3	3	3							3	3	2
CO5	<i>Illustrate the relationship between voltage and current for various special semiconductor devices</i>	2	3	3	2	3							3	3	2
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>							<b>3</b>	<b>3</b>	<b>2</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



SEMESTER - III

20EC312	DIGITAL ELECTRONICS	L	T	P	C
		3	0	0	3

**Prerequisite:** Nil

**Course Outcomes :** On successful completion of the course, the student will be able to **Cognitive Level**

CO1:	Analyze different methods used for simplification of boolean expressions.	Analyze
CO2:	Construct the different types of combinational circuits.	Apply
CO3:	Explain the nomenclature and technology in memory devices: ROM, RAM and PLD.	Apply
CO4:	Analyze sequential circuits like flip-flops, registers and counters.	Analyze
CO5:	Describe types of sequential circuits and develop HDL models for digital circuits.	Apply

**UNIT - I MINIMIZATION TECHNIQUES AND LOGIC GATES [ 09 ]**

**Minimization Techniques:** Boolean postulates and laws - De-Morgan's theorem - Principle of duality - Boolean expression: Minterm, maxterm, Sum of Products, Product of Sums - Minimization of boolean expression: Algebraic method, Karnaugh map method, Don't care conditions, Quine – McCluskey method.

**Logic gates:** AND, OR, NOT, NAND, NOR, Exclusive-OR and Exclusive-NOR - Implementation of logic functions using basic gates, NAND-NOR implementations - TTL and CMOS digital logic families – Tristate gates.

**UNIT - II COMBINATIONAL CIRCUITS [ 09 ]**

Introduction - Design procedure - Half adder - Full adder - Half subtractor - Full subtractor - Parallel binary adder, Parallel binary subtractor - Fast adder: Carry look ahead adder - Serial adder/subtractor - BCD adder Binary multiplier - Binary divider – Magnitude Comparator-Code converters - Parity generator - Parity checker - Decoders - Encoders - Multiplexers –Demultiplexers.

**UNIT - III MEMORY AND PROGRAMMABLE LOGIC DEVICES [ 09 ]**

Classification of memories – ROM: ROM organization, PROM, EPROM, EEPROM, EAPROM, RAM: RAM organization - Memory expansion - Static RAM cell - Bipolar RAM cell - MOSFET RAM cell - Dynamic RAM cell - Programmable Logic Devices: Programmable Logic Array - Programmable Array Logic - Field Programmable Gate Arrays - Implementation of combinational logic circuits using ROM, PLA and PAL

**UNIT - IV SEQUENTIAL CIRCUITS [ 09 ]**

**Latches and Flip-flops:** SR, JK, D, T, and Master-Slave - Characteristic table and equation - Application Table – Edge triggering - Level Triggering - Realization of one flip flop using other flip-flops.

**Counters:** Asynchronous and synchronous counter: Up, Down and Up/Down counter - Design of synchronous counter - Modulo-n counter - Registers: Shift registers, universal shift register - Shift register counters: Ring counter, Johnson counter – Sequence generator.

**UNIT - V SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS [ 09 ]**

**Synchronous Sequential Circuits:** General model, classification, analysis and design of synchronous sequential circuit - Use of algorithmic state machine. **Asynchronous Sequential Circuits:** Analysis and design of fundamental mode and pulse mode circuits Incompletely specified state machines - Problems in asynchronous sequential circuit - Hazards: Types of hazard, design of hazard free switching circuits. **Hardware Description Language:** Introduction to VHDL, VHDL model for combinational and sequential circuits.

**Total (L= 45) = 45 Periods**

**Text Books :**

- 1 Soumitra Kumar Mandal, "Digital Electronics Principles and Applications", McGraw Hill, Seventh Reprint, 2014.
- 2 M.Morris Mano, "Digital Design", Prentice Hall of India Pvt.Ltd, Fourth edition, 2012.

**Reference Books :**

- 1 Donald P. Leach, Albert Paul Malvino and Goutam Saha, "Digital Principles and Applications", McGraw Hill Education, Eight edition, 2015.
- 2 John M. Yarbrough, "Digital Logic Applications and Design", Thomson Learning, Ninth Edition Reprint, 2012.
- 3 Donald D. Givone, "digital Principles and Design", Tata McGraw, Twenty first Reprint 2012.
- 4 John F. Wakerly, "Digital Design Principles and Practices", Pearson Education, Ninth Impression, 2013.
- 5 Stephen Brown, Zvonko Vranesic, "Fundamentals of Digital Logic with VHDL Design", TMH, Third edition 2012

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

**Regulation : R 2020**

**Course Code: 20EC312**

**Course Name : Digital Electronics**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Analyze different methods used for simplification of boolean expressions.	3	3	3	2	-	-	-	-	-	-	-	2	3	-
CO2	Construct the different types of combinational circuits.	3	3	3	2	3	-	-	-	-	-	-	2	3	2
CO3	Explain the nomenclature and technology in memory devices: ROM, RAM and PLD.	3	3	3	2	-	-	-	-	-	-	-	2	3	2
CO4	Analyze sequential circuits like flip-flops, registers and counters.	3	3	3	2	3	-	-	-	-	-	-	2	3	-
CO5	Describe types of sequential circuits and develop HDL models for digital circuits.	3	3	3	2	3	-	-	-	-	-	-	2	3	2
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>3</b>	<b>2</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**SEMESTER - III****ELECTROMAGNETIC THEORY**

20EC313

L	T	P	C
3	1	0	4

**Prerequisite:** Nil**Course Outcomes : On successful completion of the course, the student will be able to** **Cognitive Level**

CO1:	Solve static electric field for various types of static charges and their potentials.	Apply
CO2:	Apply basic static magnetic field laws to find magnetic field intensity for various types of magnetic charges	Apply
CO3:	Describe the interaction of electric/magnetic fields with materials and solve simple electrostatic and magneto static boundary value problems	Apply
CO4:	Analyze the behavior of time varying field using Maxwell's equation and derive Maxwell's equation from fundamental laws and poynting vector	Analyze
CO5:	Apply the evaluation of wave equation from Maxwell's equation for different mediums with different boundaries.	Apply

**UNIT - I                      STATIC ELECTRIC FIELD** **[ 12 ]**

Rectangular, cylindrical and spherical coordinate systems – Line, surface and volume integrals –Gradient, divergence and curl – Stokes and Divergence theorem – Coulomb's law – Electric field intensity – Principle of superposition Electric field due to discrete and continuous charges –Charges distributed uniformly on an finite and infinite line, axis of a uniformly charged circular disc – Electric scalar potential – Relationship between potential and electric field – Potential due to infinite uniformly charged line and electric dipole –Electric flux density–Proof of Gauss's law.

**UNIT - II                      STATIC MAGNETIC FIELD** **[ 12 ]**

The Biot-Savart's law–Magnetic field intensity due to a finite and infinite wire, the axis of a circular and rectangular loop–Ampere's circuital law and its applications – Magnetic flux density – The Lorentz force equation for a moving charge and its applications – Force on a current carrying wire placed in a magnetic field – Torque on a loop carrying a current – Magnetic moment – Magnetic vector potential.

**UNIT - III                      ELECTRIC AND MAGNETIC FIELDS IN MATERIALS** **[ 12 ]**

Poisson's and Laplace's equation – Nature of dielectric materials – Definition of capacitance – Capacitance of various geometrics using Laplace's equation – Electrostatic energy and energy density – Boundary conditions for electric fields– Electric current – Current density – Point form of Ohm's law – Continuity equation for current – Definition of inductance Inductance of loops and solenoids – Energy density in magnetic fields – Nature of magnetic materials – Magnetization and Permeability – Magnetic boundary conditions.

**UNIT - IV                      TIME VARYING ELECTRIC AND MAGNETIC FIELDS** **[ 12 ]**

Ampere's circuital law – Maxwell's first equation from Ampere's circuital law – Equation expressed in point form - Faraday's law – Maxwell's second equation from Faraday's law – Equation expressed in point form – Maxwell's four equations in integral form and differential form – Poynting vector and Poynting theorem – Power flow in a co-axial cable - Instantaneous average and complex Poynting vector.

**UNIT - V                      ELECTROMAGNETIC WAVES** **[ 12 ]**

Wave equation – Uniform plane waves – Wave equation in phasor form – Plane waves in free space – Wave equation for a conducting medium – Plane waves in lossy dielectrics – Propagation in good conductors – Skin effect – Linear, Elliptical and Circular polarization – Reflection of plane wave from a conductor – Normal incidence – Reflection of plane waves by a perfect dielectric – Normal incidence – Brewster's angle.

**Total (L= 45, T = 15 ) = 60 Periods**

**Text Books :**

- 1 W.H. Hayt & J.A. Buck, "Engineering Electromagnetics", TATA McGraw-Hill, New Delhi, Ninth edition, 2020.
- 2 E.C. Jordan & K.G. Balmain, "Electromagnetic Waves and Radiating Systems", Pearson Education/PHI, India, Fourth edition, 2015.

**Reference Books :**

- 1 Matthew N.O. Sadiku, "Elements of Engineering Electromagnetics", Oxford University Press, New York, Fourth edition, 2009.
- 2 Narayana Rao, N "Elements of Engineering Electromagnetics", Pearson Education, USA, Sixth edition, 2017.
- 3 Ramo, Whinnery and Van Duzer, "Fields and Waves in Communications Electronics", John Wiley & Sons, New York, Third edition, 2003.
- 4 David K. Cheng, "Field and Wave Electromagnetics", Pearson Edition, Hong Kong, Second edition, 2013.
- 5 G.S.N. Raju, "Electromagnetic Field Theory & Transmission Lines", Pearson Edition, New Delhi, First edition, 2013.

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC313

Course Name : Electromagnetic Theory

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Solve static electric field for various types of static charges and their potentials.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	3
CO2	<i>Apply basic static magnetic field laws to find magnetic field intensity for various types of magnetic charges</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	3
CO3	<i>Describe the interaction of electric/magnetic fields with materials and solve simple electrostatic and magneto static boundary value problems</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	3
CO4	<i>Analyze the behavior of time varying field using Maxwell's equation and derive Maxwell's equation from fundamental laws and poynting vector</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	3
CO5	<i>Apply the evaluation of wave equation from Maxwell's equation for different mediums with different boundaries.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	3
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	-	-	-	-	-	-	-	-	-	-	<b>3</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**SEMESTER – III**

<b>20EE331</b>	<b>ELECTRICAL MACHINES</b>	L	T	P	C
		3	0	0	3

**Prerequisite:** Nil

**Course Outcomes: On completion of this course, the student will be able to** **Cognitive Level**

CO1: Explain the construction, operating principle, performance, starting and speed control of DC machines.	Remember
CO2: Describe the construction, working principle and performance of transformers.	Remember
CO3: Explain the constructional details, characteristics and starting methods of induction motor.	Remember
CO4: Describe the constructional details, regulation characteristics and starting methods of synchronous machines.	Remember
CO5: Explain the working principle of special electrical machines.	Remember

**UNIT – I D.C. MACHINES [ 09 ]**

Laws of Electromagnetism – Construction of DC machines – DC generator: EMF equation – Methods of excitation – Types – Armature reaction – Characteristics – DC Motor: Principle of operation, types – Back EMF – Torque equation – Characteristics – Starting and speed control of D.C series and shunt motors.

**UNIT – II TRANSFORMERS [ 09 ]**

Constructional details – Principle of operation – EMF equation – Transformation ratio – Transformer on no load and load – Equivalent circuit – Load test, open circuit and short circuit test – Voltage regulation – Auto transformer.

**UNIT – III INDUCTION MOTORS [ 09 ]**

Three phase induction motor: Construction, principle of operation, types, torque equation, torque slip characteristic, starting and speed control - Single phase induction motor: Split phase motor, capacitor start capacitor run motor, shaded pole motor.

**UNIT – IV SYNCHRONOUS MACHINES [ 09 ]**

Construction of Synchronous Machines – Alternator: Working principle, types, EMF equation, OC and SC characteristics – Voltage regulation – EMF methods – Brushless alternators – Synchronous motor: Working principle – Starting methods – Effect of change of excitation.

**UNIT – V SPECIAL MACHINES [ 09 ]**

Stepper motor – Hysteresis motor – Reluctance Motor – AC series motor – Universal motor – Linear induction motor – Brushless DC motor.

**Total = 45 Periods**

**Text Books:**

- 1 Nagrath, I.J., Kothari, D. P., Electric Machines, Tata McGraw Hill Publishing Company Ltd, Fifth Reprint, 2012.
- 2 Theraja, B.L., Theraja, A.K., A Text Book of Electrical Technology, S.Chand Publishing, First Multicolor Edition, 2015.

**Reference Books:**

- 1 Fitzgerald, A.E., Charles Kingsely Jr and Stephen D. Umans, Electric Machinery, McGraw Hill Books Company, Seventh Edition, 2013.
- 2 Murugesh Kumar. K., Electric Machines, Vikas publishing house Pvt Ltd, First Edition, 2003.
- 3 Bhimbhra, P.S., Electrical Machinery, Khanna Publishers, Seventh Edition, 2013.
- 4 Samarajit Ghosh, Electrical Machines, Pearson Education, Second Edition, 2012.
- 5 NPTEL Course Link: <http://nptel.ac.in/courses/108106071/>

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**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EE331

Course Name : Electrical Machines

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Explain the construction, operating principle, performance, starting and speed control of DC machines.</i>	3	2	-	-	-	1	2	-	-	-	-	1	-	-
CO2	<i>Describe the construction, working principle and performance of transformers.</i>	3	2	-	-	-	1	2	-	-	-	-	1	-	-
CO3	<i>Explain the constructional details, characteristics &amp; starting methods of induction motor.</i>	3	2	-	-	-	1	2	-	-	-	-	1	-	-
CO4	<i>Describe the constructional details, regulation characteristics and starting methods of synchronous machines.</i>	3	2	-	-	-	1	2	-	-	-	-	1	-	-
CO5	<i>Explain the working principle of special electrical machines.</i>	3	2	-	-	-	1	2	-	-	-	-	1	-	-
<b>Average</b>		<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

SEMESTER – III

20CS326

**C++ AND DATA STRUCTURES LABORATORY**

L	T	P	C
0	0	3	1

**Prerequisite:** Basic knowledge of C programming**Course Outcomes: On Completion of this course , the student will be able to****Cognitive level**

CO1: Apply the concepts of classes and objects.

Understand

CO2: Apply the concept of singly and doubly linked list.

Apply

CO3: Design the balanced tree concepts.

Create

CO4: Construct the minimum spanning tree.

Create

CO5: Demonstrate the sorting algorithm techniques.

Understand

**List of Experiments:**

1. Implementation of classes and objects.
2. Implementation of static member functions
3. Implementation of friend function.
4. Implementation of single and multiple inheritance
5. Implementation of virtual function.
6. Implementation of Singly Linked List.
7. Implementation of Doubly linked list
8. Array implementation of Stack and Queue
9. Implementation of Binary Search Tree.
10. Implementation of AVL Tree.
11. Implementation of graph traversal and MST algorithms: a) DFS Algorithm b) Prims Algorithm.
12. Implementation of sorting methods to arrange a list of integers in ascending order:
  - a) Insertion sort
  - b) Merge sort

**Total : 45 Periods**

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF Computer Science and Engineering**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20CS326

Course Name : C++ and Data Structures Laboratory

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Apply the concepts of classes and objects.</i>	2	3	3	2	2	-	-	-	1	-	2	2		
CO2	<i>Apply the concept of singly and doubly linked list.</i>	2	3	3	2	2	-	-	-	1	-	2	2		
CO3	<i>Design the balanced tree concepts.</i>	2	3	3	2	2	-	-	-	1	-	2	2		
CO4	<i>Construct the minimum spanning tree.</i>	2	3	3	2	2	-	-	-	1	-	2	2		
CO5	<i>Demonstrate the sorting algorithm techniques.</i>	2	2	3	2	2	-	-	-	1	-	2	2		
<b>Average</b>		<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>2</b>	<b>2</b>		

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



SEMESTER - III

20EC321

ELECTRONIC DEVICES LABORATORY

L	T	P	C
0	0	3	1

*Prerequisite: Electric Circuits laboratory***Course Outcomes : On successful completion of the course, the students will be able to****Cognitive Level**

CO1: Demonstrate the characteristics of diode , transistor and FET.

Understand

CO2: Demonstrate the characteristics of triggering devices.

Understand

CO3: Construct various amplifier circuits and plot their frequency response characteristics.

Applying

CO4: Examine the characteristics of various rectifier, filter and regulator circuits.

Analyzing

CO5: Interpret the characteristics of diode and transistor using SPICE tool.

Understand

**List of Experiments:**

Design and verification of

1. Characteristics of PN and Zener diode
2. Characteristics of CE, CB and CC configuration
3. Characteristics of JFET
4. Characteristics of UJT and SCR
5. Design and construct CE amplifier using voltage divider bias with and without bypass emitter capacitance
6. Design and construct CC amplifier using voltage divider bias
7. Design and construct CS Amplifier
8. Power supply circuit – Half, Full wave rectifier with simple capacitor filter and shunt regulator
9. Simulation using SPICE tool for any four device characteristics.

**Total = 45 Periods**

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC321

Course Name : Electronic Devices Laboratory

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Demonstrate the characteristics of diode , transistor and FET.</i>	3	3	3	3	3	-	-	-	1	-	-	2	3	2
CO2	<i>Demonstrate the characteristics of triggering devices.</i>	3	3	3	3	3	-	-	-	1	-	-	2	3	2
CO3	<i>Construct various amplifier circuits and plot their frequency response characteristics.</i>	3	3	3	3	3	-	-	-	1	-	-	2	3	2
CO4	<i>Examine the characteristics of various rectifier, filter and regulator circuits.</i>	3	3	3	3	3	-	-	-	1	-	-	2	3	2
CO5	<i>Interpret the characteristics of diode and transistor using SPICE tool.</i>	3	3	3	3	3	-	-	-	1	-	-	2	3	2
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>2</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

SEMESTER – III

<b>20EC322</b>	<b>DIGITAL ELECTRONICS LABORATORY</b>	L	T	P	C
		0	0	3	1
<b>Course Outcomes: On completion of this course, the student will be able to</b>					<b>Cognitive Level</b>
CO1: Analyze the concept of universal logic gates.					Analyze
CO2: Construct simple arithmetic circuits.					Apply
CO3: Construct basic combinational circuits and verify their functionalities.					Apply
CO4: Apply the design procedure to design basic sequential circuits such as counters and shift registers.					Apply
CO5: Develop HDL models for combinational and sequential circuits.					Apply

**Prerequisites:** NIL

**Objective:**

- Implement basic gates using Universal gates
- Design and Implement combinational circuits using logic gates.
- Construct and study the functionality of multiplexer, demultiplexer, encoder and decoder
- Analyze and verify the performance of synchronous counter, asynchronous counter and shift registers.
- Understand how Hardware Description Language is used to simulate the combinational and sequential logic circuits.

**List of Experiments:**

1. Realization of gates using universal gates.
2. Construction of simple arithmetic circuits- adder and subtractor.
3. Construction of Code converters using logic gates
  - i). BCD to Excess-3 code and vice versa
  - ii). Binary to Gray code and vice-versa
4. Construction of parity checker, generator and magnitude comparator circuits.
5. Construction of Multiplexer, Demultiplexer, Encoder and Decoder using logic gates.
6. Construct and verify the functionality of 4-bit Ripple counter and Modulo N counter.
7. Design and implementation of 3-bit synchronous up / down counter.
8. Implementation of SISO, SIPO, PISO and PIPO shift registers using flip-flops.
9. Simulation of combinational logic circuits and sequential logic circuits using HDL.
10. Design a Digital System.(Any Hardware/ Simulation circuit).

**Total = 45 Periods**

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC322

Course Name : Digital Electronics Laboratory

CO	Course Outcomes	Programme Outcomes														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	Analyze the concept of universal logic gates.	2	3	3	3	3								2	3	
CO2	Construct simple arithmetic circuits.	2	3	3	3	2								2	3	2
CO3	Construct basic combinational circuits and verify their functionalities.	2	3	2	3	2								2	3	2
CO4	Apply the design procedure to design basic sequential circuits such as counters and shift registers.	2	3	3	3	3								2	3	
CO5	Develop HDL models for combinational and sequential circuits.	2	3	3	3	3								2	3	2
<b>Average</b>		<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>								<b>2</b>	<b>3</b>	<b>2</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

SEMESTER - III

20HR351

CAREER DEVELOPMENT SKILLS - I

L	T	P	C
0	2	0	0

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes :** On successful completion of the course, the student will be able to

**Cognitive Level**

CO1: Have competent knowledge on grammar with an understanding of its basic rules.	Understand
CO2: Communicate effectively and enhance interpersonal skills with renewed self – confidence	Apply
CO3: Construct sentence in English and make correction	Apply
CO4: Perform oral communication in any formal situation	Create
CO5: Develop their LSRW skills.	Understand

**UNIT - I EFFECTIVE ENGLISH – SPOKEN ENGLISH [ 06 ]**

Basic Rules of Grammar – Parts of Speech – Tenses – Verbs – Sentences construction - Vocabulary – idioms & phrases – Synonyms – Antonyms – Dialogues and conversation – Exercise(Speaking).

**UNIT - II ESSENTIAL COMMUNICATION [ 06 ]**

Verbal communication – Effective communication – Active Listening – Paraphrasing – Feedback, Non Verbal Communication – Body language of self and Others, Important of feelings in communication – Dealing with feelings in communication practice – Exercise.

**UNIT - III WRITTEN COMMUNICATION – PART 1 [ 06 ]**

Usage of noun, pronoun, adjective (Comparative Forms), Verb, Adjectives, Adverb, Tenses, Articles and Preposition – Change of Voice – Change of Speech – One word Substitution – Using the same word as different parts of speech – Odd Man Out – Spelling & Punctuation (Editing).

**UNIT - IV WRITTEN COMMUNICATION – PART – 2 [ 06 ]**

Analogies – Sentences Formation – Sentence Completion – Sentence Correction – idioms & Phrases – Jumbled Sentences, Letter Drafting (Formal Letters) – Reading Comprehension (Level 1) – Contextual Usage – Foreign Languages Words used in English – Exercise.

**UNIT - V ORAL COMMUNICATION – PART – 1 [ 06 ]**

Self-introduction – Situational Dialogues / Role Play (Telephonic Skills) – Oral Presentations – Prepared –‘Just A Minute’ Sessions (JAM) – Presentation Skills – Exercise.

**Total (L= 0, T = 30) = 30 Periods**

**Text Books :**

- 1 Anne Laws, Writing Skills, Orient Black Swan., Hyderabad, 2011.
- 2 Sarah Freeman, Written Communication in English, Orient Black Swan, Hyderabad, First Edition, 2015

**Reference Books :**

- 1 Raj N Bakshmi, English Grammar Practice, Orient Black Swan, Hyderabad, First Edition, 2009.
- 2 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2005.
- 3 Thakur K B Sinha, Enrich Your English, Vijay Nicole, Chennai, First Edition, 2005.
- 4 Norman Lewis. W.R., “Word Power Made Easy”, Goyal Publications

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**DEPARTMENT OF SCIENCE AND HUMANITIES**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20HR351

Course Name : Career Development Skills - I

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Have competent knowledge on grammar with an understanding of its basic rules.</i>	-	-	-	-	1	-	-	-	3	3	-	3	-	-
CO2	<i>Communicate effectively and enhance interpersonal skills with renewed self – confidence</i>	-	-	-	-	1	-	-	-	3	3	-	3	-	-
CO3	<i>Construct sentence in English and make correction</i>	-	-	-	-	1	-	-	-	3	3	-	3	-	-
CO4	<i>Perform oral communication in any formal situation</i>	-	-	-	-	1	-	-	-	3	3	-	3	-	-
CO5	<i>Develop their LSRW skills.</i>	-	-	-	-	1	-	-	-	3	3	-	3	-	-
<b>Average</b>		-	-	-	-	1	-	-	-	3	3	-	3	-	-

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

## SEMESTER - IV

20MA433	PROBABILITY AND STOCHASTIC PROCESSES (B.E – EC)	L 3	T 0	P 0	C 3
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**Prerequisite:** No prerequisites are needed for enrolling into the course.

**Course Outcomes :** On successful completion of the course , the student will be able to

**Cognitive Level**

CO1: Apply one dimensional discrete and continuous random variables for Engineering Applications	Apply
CO2: Analyze the importance of two-dimensional random variables.	Analyze
CO3: Identify the knowledge of Stationary, Markov, Poisson, Sine wave processes	Apply
CO4: Interpreting the ideas of various power spectrums.	Understand
CO5: Design and implement the concept of linear system and white noise	Create

**UNIT - I RANDOM VARIABLES [9]**

Discrete and continuous random variables – Moments - Moment generating functions and their properties. Binomial, Poisson, Uniform and Normal distributions.

**UNIT - II TWO DIMENSIONAL RANDOM VARIABLES [9]**

Joint distributions - Marginal and conditional distributions – Covariance - Correlation and Regression - Central limit theorem (for two dimensional random variables).

**UNIT - III CLASSIFICATION OF RANDOM PROCESSES [9]**

Definition and examples - first order, second order, strictly stationary, wide-sense stationary and ergodic processes - Markov process - Binomial, Poisson and Normal processes.

**UNIT - IV CORRELATION AND SPECTRAL DENSITIES [9]**

Auto correlation - Cross correlation - Properties – Power spectral density – Cross spectral density - Properties – Wiener-Khintchine relation – Relationship between cross power spectrum and cross correlation function.

**UNIT - V LINEAR SYSTEMS WITH RANDOM INPUTS [9]**

Linear time invariant system - System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output – white noise.

**Total (L:45 T:0 ) = 45 Periods**

**Text Books :**

- 1 Oliver C. Ibe, Fundamentals of Applied probability and Random processes, Elsevier, Second edition , 2014.
- 2 J.Ravichandran, Probability and Random Processes for Engineers, WILEY India Publications, Fifth edition, 2014.

**Reference Books :**

- 1 Miller,S.L and Childers, S.L, Probability and Random Processes with applications to Signal Processing and Communications, Elsevier , Second edition, 2012.
- 2 Leon-Garcia,A, Probability and Random Processes for Electrical Engineering, Pearson Education Asia, Third edition, 2012.
- 3 Yates and D.J. Goodman, Probability and Stochastic Processes, John Wiley and Sons, Second edition, 2011.
- 4 www.probabilitycourse.com

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**DEPARTMENT OF SCIENCE AND HUMANITIES**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20MA433

Course Name : **Probability and Stochastic Processes**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Apply one dimensional discrete and continuous random variables for Engineering Applications</i>	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2	<i>Analyze the importance of two-dimensional random variables.</i>	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	<i>Identify the knowledge of Stationary, Markov, Poisson, Sine wave processes</i>	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	<i>Interpreting the ideas of various power spectrums.</i>	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	<i>Design and implement the concept of linear system and white noise</i>	3	3	3	3	-	-	-	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

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



## SEMESTER - IV

20EC411

SIGNALS AND SYSTEMS

L	T	P	C
3	1	0	4

**Prerequisites:** No prerequisites are needed for enrolling into the course.

**Course Outcomes: On successful completion of the course, students will be able to**

**Cognitive Level**

CO1 : Demonstrate the basic concept of classification of signals and systems.	Understand
CO2 : Analyze continuous time signals using Fourier and Laplace Transforms.	Analyze
CO3 : Apply Fourier and Laplace Transform techniques to find the response of CT systems.	Apply
CO4 : Analyze discrete time signals using DTFT and Z-Transforms.	Analyze
CO5 : Analyze system using DTFT and Z-Transforms and realize the structure for DT systems.	Analyze

**UNIT - I CLASSIFICATION OF SIGNALS AND SYSTEMS [12]**

Continuous and Discrete time signals: Step, ramp, pulse, impulse, exponential - Classification of CT and DT signals and systems - Linear time invariant systems and its properties.

**UNIT - II ANALYSIS OF CONTINUOUS TIME SIGNALS [12]**

Fourier series analysis - Spectrum of CT Signals - Fourier transform and its properties - Laplace transform: ROC and properties.

**UNIT - III LINEAR TIME INVARIANT – CONTINUOUS TIME SYSTEMS [12]**

Differential equations: Frequency response, impulse response, Fourier and Laplace transform in analysis of CT systems - Block diagram representation - Convolution integral - State variable equations and matrix representation of CT systems.

**UNIT - IV ANALYSIS OF DISCRETE TIME SIGNALS [12]**

Sampling of continuous time signals - Aliasing - DTFT and its properties - Z Transform: ROC and properties, Inverse Z Transform.

**UNIT - V LINEAR TIME INVARIANT - DISCRETE TIME SYSTEMS [12]**

Difference equations: Impulse response, LTI systems analysis using DTFT and Z Transform - Block diagram representation - Convolution sum - State variable equations and matrix representation of DT systems.

**Total (L= 45, T=15) = 60 Periods**

**Text Books:**

- Allan V. Oppenheim, S. Willsky and S. H. Nawab, "Signals and Systems", Pearson Education, Second edition, 2017.
- Edward W Kamen and Bonnie's Heck, "Fundamentals of Signals and Systems", Pearson Education, Third edition, 2014.

**Reference Books:**

- H P Hsu, Rakesh Ranjan "Signals and Systems", Schaums Outlines, Tata McGraw Hill, Indian Reprint 2013.
- P. Ramesh Babu, R. Anandanatarajan, "Signals and Systems", Scitech Publications, Fourth edition, Reprint 2015.
- Simon Haykins and Barry Van Veen, "Signals and Systems", John Wiley & Sons, Second edition, 2012.
- Robert A. Gabel and Richard A. Roberts, "Signals & Linear Systems", John Wiley, Third edition, 2014.
- NPTL course Link: <http://nptel.ac.in/courses/117104074>

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC411

Course Name : Signals and systems

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Demonstrate the basic concept of classification of signals and systems.	3	3	3	3	-	-	-	-	-	-	-	2	2	2
CO2	Analyze continuous time signals using Fourier and Laplace Transforms.	3	3	3	3	3	-	-	-	-	-	2	2	-	2
CO3	Apply Fourier and Laplace Transform techniques to find the response of CT systems.	3	3	3	3	3	1	-	-	-	-	2	2	2	2
CO4	Analyze discrete time signals using DTFT and Z-Transforms.	3	3	3	3	3	-	-	-	-	-	2	2	-	2
CO5	Analyze system using DTFT and Z-Transforms and realize the structure for DT systems.	3	3	3	3	3	1	-	-	-	-	2	2	2	2
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**20EC412**

**ELECTRONIC CIRCUITS**

L	T	P	C
3	0	0	3

**Prerequisite: Electronic Devices**

**Course Outcomes : On successful completion of the course, the student will be able to**

**Cognitive Level**

CO1: Classify a power amplifier based on the Q point and calculate its efficiency.	Understand
CO2: Compare the various types of negative feedback amplifiers.	Understand
CO3: Construct various types of tuned amplifier.	Applying
CO4: Build oscillator circuits for different frequencies.	Applying
CO5: Develop various wave shaping circuits and multivibrators for different applications.	Applying

**UNIT - I                      LARGE SIGNAL AMPLIFIERS                      [ 09 ]**

Classification of amplifiers – RC coupled Class A amplifier – Transformer coupled class A amplifier, efficiency – Second and higher order harmonic distortions – Class B amplifier, push–pull amplifier and efficiency, complementary symmetry and efficiency – Distortion in amplifiers – Class C, Class D and Class E amplifiers – Thermal stability and heat sink.

**UNIT - II                      FEEDBACK AMPLIFIERS                      [ 09 ]**

Introduction – Classification – Block diagram – Loop gain – Gain with feedback – Effects of negative feedback: Sensitivity, desensitivity of gain, Cut–off frequencies, Distortion, Noise, Input impedance and output impedance with feedback – Negative feedback topologies – Method of identifying feedback topology and feedback factor – Nyquist criterion for stability of feedback amplifiers

**UNIT - III                      TUNED AMPLIFIERS                      [ 09 ]**

Coil losses – Loaded and unloaded Q of tank circuit – Small signal tuned amplifier – Analysis of capacitor coupled single tuned and double tuned amplifiers – Effect of cascading single tuned and double tuned amplifiers on bandwidth – Stagger tuned amplifier – Large signal tuned amplifier: Class C tuned amplifier, efficiency and applications – Stability of tuned amplifier: Neutralization, Hazeltine neutralization method.

**UNIT - IV                      OSCILLATORS                      [ 09 ]**

Barkhausen criterion – Mechanism for start of oscillation and stabilization of amplitude – Classification – General form of an LC oscillator – LC oscillators: Hartley, Colpitts and Clapp oscillators – RC oscillators: Phase shift, Wien bridge and Twin-T oscillators – Frequency range of RC and LC oscillators – Quartz crystal – Miller and Pierce crystal oscillators – Frequency stability of oscillators.

**Blocking Oscillators:** Free running blocking oscillator – Monostable blocking oscillator with base timing and emitter timing.

**UNIT - V                      MULTIVIBRATORS AND TIME BASE CIRCUITS                      [ 09 ]**

RC, RL Integrator and Differentiator circuits – Diode: Clippers and Clampers – Astable, monostable and Bistable multivibrators – Triggering methods for bistable multivibrator – Schmitt trigger circuit – UJT saw tooth waveform generator – Time base circuits.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :**

- 1 Sedra / Smith, "Micro Electronic Circuits" Oxford University Press, Eighth edition 2019.
- 2 Anil K Maini, Varsha Agarwal, "Electronic Devices & Circuits", John Wiley India, Reprint 2012

**Reference Books :**

- 1 Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", Eleventh edition, PE / PHI, 2015.
- 2 David A. Bell, "Electronic Devices and Circuits", Fifth edition, Oxford University Press, 2008.
- 3 Millman.J. and Halkias C.C, "Integrated Electronics", McGraw Hill, Forty eighth Reprint 2017.
- 4 Schilling.D.L and Belove.C "Electronic Circuits", Third edition, McGraw Hill 2012
- 5 NPTEL Course Link:<http://nptel.ac.in/courses/117108107/32>

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC412

Course Name : Electronic Circuits

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Classify a power amplifier based on the Q point and calculate its efficiency.	3	3	3	3	3	-	-	-	-	-	-	2	3	2
CO2	Compare the various types of negative feedback amplifiers.	3	3	3	3	3	-	-	-	-	-	-	2	3	2
CO3	Construct various types of tuned amplifier.	3	3	3	3	3	-	-	-	-	-	-	2	3	2
CO4	Build oscillator circuits for different frequencies.	3	3	3	3	3	-	-	-	-	-	-	2	3	2
CO5	Develop various wave shaping circuits and multivibrators for different applications.	3	3	3	3	3	-	-	-	-	-	-	2	3	2
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>3</b>	<b>2</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

SEMESTER - IV

20EC413

LINEAR INTEGRATED CIRCUITS

L	T	P	C
3	0	0	3

**Prerequisite: Electronic devices****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1: Interpret the different steps involved in fabrication of IC's and analyze the DC and AC characteristics of OP-AMP.	Remember
CO2: Construct various operational amplifier circuits.	Analyze
CO3: Understand the analog multiplier and PLL circuits.	Understand
CO4: Classify and comprehend the working principle of ADC and DAC.	Understand
CO5: Identify the special function ICs.	Remember

**UNIT - I MONOLITHIC IC [ 09 ]**

Advantages of ICs over discrete components – Manufacturing process of monolithic ICs – Construction of monolithic bipolar transistor – Monolithic diodes – Integrated resistors – Monolithic capacitors – Inductors – Current mirror and current sources – BJT Differential amplifier with active loads – General operational amplifier stages – DC and AC characteristics – Open and closed loop configurations.

**UNIT - II APPLICATIONS OF OPERATIONAL AMPLIFIERS [ 09 ]**

Sign changer – Scale changer – Phase shift circuits – Voltage follower – V-to-I and I-to-V converters – Adder – Subtractor – Instrumentation amplifier – Integrator – Differentiator – Logarithmic amplifier – Antilogarithmic amplifier – Comparators, schmitt trigger – Precision rectifier, peak detector, clipper and clamper – First order low-pass, high-pass filters – Phase shift and wein bridge oscillator – Astable and monostable multivibrator.

**UNIT - III ANALOG MULTIPLIER AND PLL [ 09 ]**

Analog multiplier using emitter coupled transistor pair – Gilbert multiplier cell – Variable transconductance technique – Analog multiplier IC and their applications – PLL: Closed loop analysis, voltage controlled oscillator, monolithic PLL IC 565 - Applications of PLL: AM/FM detection, FSK modulation/demodulation and frequency synthesizing.

**UNIT - IV DAC AND ADC [ 09 ]**

Analog and digital data conversions - D/A converter: Specifications, Types: Weighted resistor type, R-2R ladder type, voltage and current mode R - 2R ladder types – Switches for D/A converters – A/D Converters: Specifications, Types: Flash, successive approximation, single slope, dual slope

**UNIT - V SPECIAL FUNCTION ICs [ 09 ]**

Timer IC 555 - IC voltage regulators – Three terminal fixed and adjustable voltage regulators – IC 723 general purpose regulator – Monolithic switching regulator – Switched capacitor filter IC MF10 - ICL8038 function generator - Audio power amplifier – Video amplifier – Isolation amplifier – Opto-couplers and fibre optic IC.

**Total (L= 45, T = 0) = 45 Periods****Text Books :**

- 1 Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", TMH, Fourth edition, 2017.
- 2 D. Roy Choudhry and Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd , Fifth edition, 2018.

**Reference Books :**

- 1 S. Salivahanan & V.S. Kanchana Bhaskaran, "Linear Integrated Circuits", TMH, Third edition, 2018.
- 2 Ramakant A. Gayakwad, "OP- AMP and Linear ICs", Prentice Hall, Fourth edition, 2009.
- 3 Gray and Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley International, Fifth edition, 2009.
- 4 B.S. Sonde, "Introduction to System Design using Integrated Circuits", New Age Pub, Second edition, 2013.
- 5 NPTEL Course Link:<http://nptel.ac.in/video.php?subjectId=108106068>.

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC413

Course Name : Linear Integrated Circuits

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Interpret the different steps involved in fabrication of IC's and analyze the DC and AC characteristics of OP-AMP.</i>	3	3	3	3	2	-	-	-	1	1	2	1	3	2
CO2	<i>Construct various operational amplifier circuits.</i>	3	3	3	3	2	-	-	-	1	1	2	1	3	2
CO3	<i>Understand the analog multiplier and PLL circuits.</i>	3	3	3	3	2	-	-	-	1	1	2	1	3	2
CO4	<i>Classify and comprehend the working principle of ADC and DAC.</i>	3	3	3	3	2	-	-	-	1	1	2	1	3	2
CO5	<i>Identify the special function ICs.</i>	3	3	3	3	2	-	-	-	1	1	2	1	3	2
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>2</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

SEMESTER - IV

20EC414

MICROPROCESSORS AND MICROCONTROLLERS

L	T	P	C
3	0	0	3

**Prerequisite: Digital Electronics****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1: Describe the architecture of 8085 microprocessor and know the assembly language programming skill using 8085 microprocessor.	Understand
CO2: Explain the architecture of 8086 microprocessor and know the assembly language programming skill using 8086 microprocessor.	Understand
CO3: Describe the microprocessor peripheral interfacing.	Understand
CO4: Explain the architecture of 8051 microcontroller and know the assembly language programming skill using 8051 microcontroller.	Understand
CO5: Design a microcontroller based system.	Apply

**UNIT – I 8 BIT MICROPROCESSOR ARCHITECTURE AND PROGRAMMING [ 09 ]**

Evolution – Introduction: Address, data and control bus, Clock generation – 8085: Hardware architecture, addressing modes, instruction set, timing diagrams, interrupts, assembly language programming.

**UNIT - II 16 BIT MICROPROCESSOR ARCHITECTURE AND PROGRAMMING [ 09 ]**

8086: Hardware architecture, signals, addressing modes, maximum and minimum mode configurations, assembler directives, instruction set, timing diagram, interrupts, assembly language programming.

**UNIT - III MICROPROCESSOR PERIPHERAL INTERFACING [ 09 ]**

Introduction - Programmable peripheral interface (Intel 8255) – Serial communication interface (8251) - Keyboard and display controller (8279) – Programmable interval timers (Intel 8253, 8254) – Programmable interrupt controller (8259) - Analog to digital converter, Digital to analog converter - Printer interface.

**UNIT - IV 8 BIT MICROCONTROLLER ARCHITECTURE AND PROGRAMMING [ 09 ]**

8051 Microcontroller: Hardware architecture, special function register, I/O ports and circuits, external memory, timers and counters, serial data input/output, interrupts, addressing modes, instruction set, assembly language programming.

**UNIT - V MICROCONTROLLER PERIPHERAL INTERFACING [ 09 ]**

8051 Interfacing: DC motor, stepper motor, sensors, relay, keyboard, switches, seven segment display, RTC and LCD. Case study: Traffic light control.

**Total (L= 45, T = 0 ) = 45 Periods****Text Books :**

- 1 Krishna Kant, "Microprocessors and microcontrollers architecture, programming and system design using 8085, 8086, 8051 and 8096", PHI, Second edition, 2014.
- 2 Douglas V Hall, "Microprocessors and interfacing, Programming and Hardware" TMH, Third edition, 2012.

**Reference Books :**

- 1 Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D.MCKinlay "The 8051 Microcontroller and Embedded systems", Pearson Education, Second edition, 2011.
- 2 Ramesh S Gaonkar, "Microprocessor architecture programming and application with 8085" – Penram publications pvt., Sixth edition, 2013.
- 3 Kenneth J. Ayala, "The 8086 Microprocessor: programming & interfacing the PC", Delmar Publishers, 2007.
- 4 A K Ray, K M Bhurchandi, "Advanced Microprocessors and Peripherals", TMH, Third edition, 2012.

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC414

Course Name : Microprocessors And Microcontrollers

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Describe the architecture of 8085 microprocessor and know the assembly language programming skill using 8085 microprocessor.</i>	3	3	3	2	-	-	-	-	-	-	-	1	3	2
CO2	<i>Explain the architecture of 8086 microprocessor and know the assembly language programming skill using 8086 microprocessor.</i>	3	3	3	2	-	-	-	-	-	-	-	1	3	2
CO3	<i>Describe the microprocessor peripheral interfacing.</i>	3	3	3	2	-	-	-	-	-	-	-	1	3	2
CO4	<i>Explain the architecture of 8051 microcontroller and know the assembly language programming skill using 8051 microcontroller.</i>	3	3	3	2	-	-	-	-	-	-	-	1	3	2
CO5	<i>Design a microcontroller based system.</i>	3	3	3	2	-	-	-	-	-	-	-	1	3	2
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>3</b>	<b>2</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



SEMESTER - IV

20EC415

TRANSMISSION LINES AND WAVE GUIDES

L	T	P	C
3	0	0	3

**Prerequisite:** Engineering Electromagnetics**Course Outcomes :** On successful completion of the course, the student will be able to**Cognitive Level**

CO1: Develop a transmission line from filter concepts.

Remember

CO2: Discuss the propagation of signals through transmission lines.

Understand

CO3: Analyze signal propagation at radio frequencies.

Analyze

CO4: Explain radio propagation in parallel planes and waveguides.

Understand

CO5: Design and analyze cavity resonators.

Analyze

**UNIT - I FUNDAMENTALS OF TRANSMISSION LINES****[ 09 ]**

The neper - The decibel - Characteristic impedance of symmetrical networks - Current and voltage ratios - Propagation constant - Properties of symmetrical networks - A line of cascaded T sections - Equivalent circuit - General solution of the transmission line - Physical significance of the equations - The infinite line.

**UNIT - II TRANSMISSION LINE THEORY****[ 09 ]**

Wavelength - Velocity of propagation - Distortion line - Distortion less line condition - Loading - The telephone cable - Loaded telephone cable – Campbel's formula - Open and short circuited lines - Input impedance of open and short circuited lines - Reflection on a line not terminated in  $Z_0$  - Reflection coefficient - Reflection factor and reflection loss - Insertion loss - Standing waves - Nodes - Standing wave ratio.

**UNIT - III THE LINE AT RADIO FREQUENCY****[ 09 ]**

Parameters of open wire line and coaxial cable at RF - Line constants for dissipation - Voltages and currents on the dissipation less line - Power and impedance measurement on lines - Section of transmission line:  $\lambda/2$ ,  $\lambda/4$ ,  $\lambda/8$  line - Impedance matching - Single and double stub matching - Circle diagram - Smith chart and its applications - Stub matching problems using smith chart.

**UNIT - IV GUIDED WAVES BETWEEN PARALLEL PLANES****[ 09 ]**

Waves between parallel planes of perfect conductors - Field components of TM, TE & TEM waves between parallel planes - Manner of wave travel - Characteristics of TM, TE & TEM waves - Wave impedance - Attenuation factor of TM, TE & TEM waves.

**UNIT - V WAVEGUIDES AND RESONANT CAVITIES****[ 09 ]**

Waves between rectangular waveguide - TM and TE waves in rectangular guide - Bessel functions - Waves between circular waveguide - TM and TE waves in circular waveguide - Characteristics of TM and TE waves in rectangular and circular wave guides - Excitation of wave guides - Resonant cavities - Rectangular resonant cavity - Q factor of a rectangular cavity resonator for  $TE_{101}$  mode.

**Total (L= 45, T = 0) = 45 Periods****Text Books :**

- 1 John D. Ryder, "Networks, Lines and Fields", Prentice Hall of India, Second edition, 2015.
- 2 E.C.Jordan, K.G. Balmain: "EM Waves and Radiating Systems", Prentice Hall of India, Second edition, 2011.

**Reference Books :**

- 1 G S N Raju, "Electromagnetic Field Theory and Transmission Lines", Pearson Education, First edition, 2013.
- 2 S.F.Mahmoud, "Electromagnetic Waveguides Theory and Applications," Peter Peregrinus Ltd, First edition 1991.
- 3 B.Somanathan Nair, "Transmission Lines and wave guides", Pearson Education, First edition, 2011.
- 4 P.Baskaran, "Transmission Lines and wave guides", Scitech Publications, First edition, 2013.
- 5 NPTEL Course Link: <http://nptel.ac.in/courses/115101005/>

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**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC415

Course Name : Transmission Lines And Wave Guides

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Develop a transmission line from filter concepts.</i>	3	3	3	-	-	-	-	-	-	-	-	2	2	3
CO2	<i>Discuss the propagation of signals through transmission lines.</i>	3	3	3	-	-	-	-	-	-	-	-	2	2	3
CO3	<i>Analyze signal propagation at radio frequencies.</i>	3	3	3	-	-	-	-	-	-	-	-	2	2	3
CO4	<i>Explain radio propagation in parallel planes and waveguides.</i>	3	3	3	-	-	-	-	-	-	-	-	2	2	3
CO5	<i>Design and analyze cavity resonators.</i>	3	3	3	-	-	-	-	-	-	-	-	2	2	3
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>3</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

SEMESTER - IV

20EC421

ELECTRONIC CIRCUITS AND SIMULATION LABORATORY

L	T	P	C
0	0	3	1

**Prerequisite: Electronic Devices Laboratory****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

- |  |         |
|--|---------|
| CO1: Construct a Class B Push Pull amplifier with and without distortion.                          | Apply   |
| CO2: Construct a negative feedback amplifier and plot its frequency response                       | Analyze |
| CO3: Build an oscillator circuit and observe its output waveform                                   | Analyze |
| CO4: Develop a narrow band amplifier and different wave shaping circuits for various applications. | Apply   |
| CO5: Simulate the given electronic circuits using SPICE tool                                       | Apply   |

**List of Experiments:****Design and Analysis of the following circuits:**

1. Class B complementary symmetry power amplifier.
2. Series feedback amplifier (voltage and current).
3. RC phase shift and Hartley oscillators.
4. Tuned class C amplifier.
5. Integrator, Differentiator, Clipper & Clampers.
6. Astable and Monostable Multivibrators.

**Simulation using SPICE Tool:**

7. Shunt feedback amplifier (voltage and current).
8. Wein Bridge and Colpitts oscillators.
9. Bistable Multivibrator and Schmitt trigger circuit.
10. Time base circuits.

**Total = 45 Periods**

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**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC421

Course Name : **Electronic Circuits And  
Simulation Laboratory**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Construct a Class B Push Pull amplifier with and without distortion.	3	3	3	3	3	-	-	-	1	-	-	2	3	2
CO2	Construct a negative feedback amplifier and plot its frequency response	3	3	3	3	3	-	-	-	1	=	-	2	3	2
CO3	Build an oscillator circuit and observe its output waveform	3	3	3	3	3	-	-	-	1	-	-	2	3	2
CO4	Develop a narrow band amplifier and different wave shaping circuits for various applications.	3	3	3	3	3	-	-	-	1	-	-	2	3	2
CO5	Simulate the given electronics circuits using SPICE tool	3	3	3-	3	3	-	-	-	1	-	-	2	3	2
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>3</b>	<b>2</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

SEMESTER - IV

20EC422

LINEAR INTEGRATED CIRCUITS LABORATORY

L	T	P	C
0	0	3	1

**Prerequisite:** *Electronic devices***Course Outcomes :** *On successful completion of the course, the student will be able to***Cognitive Level**CO1: *Design op-amp circuits for different applications.**Analyze*CO2: *Experiment with frequency response characteristic of various filters using op-amp.**Understand*CO3: *Develop waveform generators using timer.**Analyze*CO4: *Construct voltage regulator using LM723.**Analyze*CO5: *Simulate various applications of operational amplifiers using PSpice.**Understand***List of Experiments:**

Design and verification of

1. Inverting, non-inverting and differential amplifiers using op-amp
2. Integrator and differentiator using op-amp
3. Instrumentation amplifier using op-amp
4. Active low pass, high pass filters using op-amp
5. Astable & monostable multivibrators and schmitt trigger using op-amp
6. Phase shift and wien bridge oscillators using op-amp
7. Astable and monostable multivibrators using IC 555timer.
8. Frequency multiplier using PLL.
9. Voltage regulator using LM723.
10. Simulation of any above three experiments using PSpice

**Total (L= 45, T = 0 ) = 45 Periods**

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**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC422

Course Name : Linear Integrated Circuits  
 Laboratory

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Design op-amp circuits for different applications.</i>	3	3	3	3	3	-	-	-	-	-	-	-	3	2
CO2	<i>Experiment with frequency response characteristic of various filters using op-amp.</i>	3	3	3	3	3	-	-	-	-	-	-	-	3	2
CO3	<i>Develop waveform generators using timer.</i>	3	3	3	3	3	-	-	-	-	-	-	-	3	2
CO4	<i>Construct voltage regulator using LM723.</i>	3	3	3	3	3	-	-	-	-	-	-	-	3	2
CO5	<i>Simulate various applications of operational amplifiers using PSpice.</i>	3	3	3	3	3	-	-	-	-	-	-	-	3	2
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>2</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

SEMESTER – IV

20EC423

MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

L	T	P	C
0	0	3	1

**Prerequisite: Digital Electronics Laboratory****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1: Write assembly language programming for 8085 microprocessor.

Apply

CO2: Write assembly language programming for 8086 microprocessor.

Apply

CO3: Write assembly language programming for 8051 microprocessors.

Apply

CO4: Interface different I/Os with processor.

Apply

CO5: Write assembly language programming using simulation software.

Apply

**List of Experiments:****1. 8085 Microprocessor**

- (i) Arithmetic Operations
- (ii) Array Processing

**2. 8086 Microprocessor**

- (i) Arithmetic Operations
- (ii) Sorting and Searching
- (iii) String Manipulation

**3. 8051 Microcontroller**

- (i) Arithmetic Operations
- (ii) Logical and Bit Manipulation

**4. Peripheral Interfacing**

- (i) Programmable peripheral interface (8255) using 8085.
- (ii) Programmable interval timer (8253) using 8085.
- (iii) ADC and DAC using 8085.
- (iv) Keyboard and display controller (8279) using 8086.
- (v) Programmable interrupt controller (8259) using 8086.
- (vi) Stepper motor using 8051.

**5. Simple 8051 programming using KEIL and Proteus Software.**

Total (P= 45, T = 0 ) = 45 Periods

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**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC423

Course Name : **Microprocessors and  
Microcontrollers Laboratory**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Write assembly language programming for 8085 microprocessor.</i>	3	3	3	3	1	-	1	-	-	-	-	2	3	2
CO2	<i>Write assembly language programming for 8086 microprocessor.</i>	3	3	3	3	1	-	1	-	-	-	-	2	3	2
CO3	<i>Write assembly language programming for 8051 microprocessor.</i>	3	3	3	3	1	-	1	-	-	-	-	2	3	2
CO4	<i>Interface different I/Os with processor.</i>	3	3	3	3	1	-	1	-	-	-	-	2	3	2
CO5	<i>Write assembly language programming using simulation software.</i>	3	3	3	3	3	-	1	-	-	-	-	2	3	2
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>3</b>	<b>2</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



SEMESTER - IV

20HR442	CAREER DEVELOPMENT SKILLS - II	L	T	P	C
		0	2	0	0

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes: On successful completion of the course, the student will be able to** **Cognitive Level**

CO1: Speak and write appropriately by understanding verbal and logical reasoning	Apply
CO2: Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions	Apply
CO3: Enhance their skills on quantitative aptitude	Understand
CO4: Speak and write appropriately by understanding and applying the basic grammatical rules	Create
CO5: Critically evaluate problems related to quantitative aptitude	Apply

**UNIT - I VERBAL AND LOGICAL REASONING – PART 1 [ 06 ]**

Alphabet Test – Synonyms & Antonyms – Idioms & Phrases – Analogies - Theme Detection – Odd Words – Statement & Conclusions - Family Tree – Blood Relations – Coding & Decoding – Syllogism – Odd Man Out.

**UNIT - II QUANTITATIVE APTITUDE – PART 1 [ 06 ]**

Numbers: Number system - Squaring of Numbers – Square Roots – Cube Roots – Divisibility – HCF, LCM – Decimals.

**UNIT - III QUANTITATIVE APTITUDE – PART 2 [ 06 ]**

Percentages – Averages – Ratio & Proportion – Mixtures and Allegations – logarithms.

**UNIT - IV READING COMPREHENSION&WRITTEN COMMUNICATION –PART 3 [ 06 ]**

READING SKILLS : Importance of Reading – Definition of Reading – Levels of Reading – Requirements of Reading – Types of Reading – Techniques of Reading - Academic Reading Tips.

**UNIT - V QUANTITATIVE APTITUDE – PART 3 [ 06 ]**

Profit and Loss – Simple Interest & Compound Interest – Problem on Ages – Calendar.

**Total (L= 0, T = 30 ) = 30 Periods**

**Text Books :**

- 1 Anne Laws, Writing Skills, Orient Black Swan., Hyderabad, 2011.
- 2 Abhijit Guha, Quantitative Aptitude, TMH, New Delhi, Third edition,2009

**Reference Books :**

- 1 Agarwal. R.S ,A.Modern Approach to Verbal and Non- verbal Reasoning, Revised edition 2008, Reprint 2009, S.Chand & Co Ltd., New Delhi.
- 2 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First edition, 2005.
- 3 M.B. Lal & Goswami, Objective Instant Arithmetic, Upkar Publications, New Delhi, Second edition,2012.
- 4 Norman Lewis. W.R., “Word Power Made Easy”, Goyal Publications

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**DEPARTMENT OF SCIENCE AND HUMANITIES**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20HR442

Course Name : Career Development Skills - II

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Speak and write appropriately by understanding verbal and logical reasoning</i>	-	-	-	-	-	-	-	-	2	3	-	3	2	2
CO2	<i>Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions</i>	-	-	-	-	-	-	-	-	2	3	-	3	2	2
CO3	<i>Enhance their skills on quantitative aptitude</i>	-	-	-	-	-	-	-	-	2	3	-	3	2	2
CO4	<i>Speak and write appropriately by understanding and applying the basic grammatical rules</i>	-	-	-	-	-	-	-	-	2	3	-	3	2	2
CO5	<i>Critically evaluate problems related to quantitative aptitude</i>	-	-	-	-	-	-	-	-	2	3	-	3	2	2
<b>Average</b>		-	-	-	-	-	-	-	-	<b>2</b>	<b>3</b>	-	<b>3</b>	<b>2</b>	<b>2</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

## SEMESTER - V

20EC511	<b>ANALOG COMMUNICATION SYSTEMS</b>	L	T	P	C
		3	0	0	3

**Prerequisites:** Engineering Mathematics, Electronic Devices and Circuits.

**Course Outcomes: On successful completion of the course, students will be able to**

**Cognitive Level**

CO1 : Describe the concepts of Amplitude Modulation and its types.	Remember
CO2 : Describe the concepts of Angle Modulation, Pulse Modulation and its types.	Remember
CO3 : Discuss the AM Transmitters and Receivers.	Understand
CO4 : Discuss the FM Transmitters and Receivers.	Understand
CO5 : Infer the concepts of noise in communication systems.	Understand

**UNIT - I AMPLITUDE MODULATION [09]**

Basic representation of communication system - Baseband and band pass signal - Transmission media - Electromagnetic spectrum - Need for modulation - Amplitude modulation: Single tone and multi tone modulation, Phasor representation, Power relations, Representation of DSBSC and SSBSC- Principles of VSB Signals - Frequency translation - FDM-Non-linear distortion.

**UNIT - II ANGLE MODULATION AND PULSE MODULATION [09]**

Frequency modulation: Single tone and multi tone modulation, Representation, Frequency spectrum, Phasor representation, Narrow band and Wide band FM, Average power, Bandwidth requirements - Phase modulation - Comparison of AM, FM & PM - Pulse modulation: PAM, PWM, PPM.

**UNIT - III AM TRANSMITTERS AND RECEIVERS [09]**

Generation of AM: Low level and high level, Modulated transistor amplifier - Generation of SSB: Suppression of carrier and unwanted sideband - Extensions of SSB - Receiver parameters - Tuned radio frequency receiver – Super heterodyne receiver - RF section and characteristics - Frequency changing and tracking - Intermediate frequencies and IF amplifiers - Detection and automatic gain control -Single and independent side band receivers.

**UNIT - IV FM TRANSMITTERS AND RECEIVERS [09]**

Generation of FM: Direct method, Stabilized reactance modulator - AFC - Indirect method - FM receiver: Comparison with AM receiver, Amplitude limiting, Basic FM demodulators, Ratio Detector, FM demodulator comparison, Stereo FM multiplex reception.

**UNIT - V NOISE THEORY [09]**

External noise - Internal noise - Noise figure: Calculation, Equivalent noise resistance, measurement - Noise temperature - Noise bandwidth- Noise triangle - Pre-emphasis and de-emphasis - Noise in DSBSC, SSB, AM and FM receivers.

**Total = 45 Periods**

**Text Books:**

- 1 George Kennedy, Bernard Davis & SRM Prasanna, Electronic Communication Systems, Tata McGraw-Hill Education, New Delhi, Sixth edition, 2017.
- 2 Simon Haykin & Michael Moher, Communication Systems, Wiley India Pvt. Ltd., New Delhi, Fifth edition, 2011.

**Reference Books:**

- 1 Wayne Tomasi, Electronic Communications Systems – Fundamentals Through Advanced, Pearson Education, New York, Fifth edition, 2008.
- 2 A.Bruce Carlson & Paul B. Crilly, Communication Systems, Tata McGraw-Hill Education, New Delhi, Fifth edition, 2011.
- 3 H Taub, D Schilling & G Saha, Principles of Communication Systems, Tata McGraw-Hill Education, New Delhi, Fourth edition, 2013.
- 4 P.Ramkrishna Rao, Analog Communication, Tata McGraw-Hill, New Delhi, First edition, 2011.
- 5 NPTEL Course Link:<http://nptel.ac.in/courses/117102059/>

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC511

Course Name : Analog Communication Systems

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Describe the concepts of Amplitude Modulation and its types.</i>	2	2	3	2	-	2	-	-	-	-	1	1	2	2
CO2	<i>Describe the concepts of Angle Modulation, Pulse Modulation and its types.</i>	2	2	3	1	-	2	-	-	-	-	1	1	2	2
CO3	<i>Discuss the AM Transmitters and Receivers.</i>	3	2	2	1	-	1	-	-	-	-	2	1	2	2
CO4	<i>Discuss the FM Transmitters and Receivers.</i>	3	2	2	1	-	1	-	-	-	-	2	1	2	2
CO5	<i>Infer the concepts of noise in communication systems.</i>	3	3	3	2	-	1	-	-	-	-	1	1	2	2
<b>Average</b>		<b>3</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>

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

**SEMESTER – V**

<b>20EC512</b>	<b>DIGITAL SIGNAL PROCESSING</b>	L	T	P	C
		3	1	0	4

**Prerequisite:** Differential Equations and Numerical Methods, Signals and Systems

**Course Outcomes: On completion of this course, the student will be able to**

**Cognitive Level**

CO1: Describe the concepts of DFT, FFT and convolution process	Understand
CO2: Design appropriate type of FIR filter and implement digital filters in different FIR filter structures	Analyze
CO3: Design digital IIR filter using appropriate type and implement digital filters in various realization structures	Analyze
CO4: Characterize the effects of finite precision representation on digital filters	Understand
CO5: Describe digital signal processors and the programming concepts	Understand

**UNIT – I DISCRETE FOURIER TRANSFORM AND FAST FOURIER TRANSFORM [ 12 ]**

Introduction to Discrete Fourier Transform pairs and its properties – Relation between z transform and DTFT with DFT – Fast Fourier Transform: Introduction, computations using Decimation in Time and Decimation in Frequency algorithms – Sectional convolution: Overlap add and overlap save methods.

**UNIT – II DESIGN OF FINITE IMPULSE RESPONSE DIGITAL FILTERS [ 12 ]**

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations.

**UNIT – III DESIGN OF INFINITE IMPULSE RESPONSE DIGITAL FILTERS [ 12 ]**

Characteristics of practical frequency selective filters. Characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF) - Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.

**UNIT – IV FINITE WORD LENGTH EFFECTS AND MULTIRATE SIGNAL PROCESSING [ 12 ]**

Quantization noise – Derivation for quantization noise power – Binary fixed point and floating point number representations – Truncation and rounding error – Input quantization error – Coefficient quantization error – Product quantization error – Limit cycle oscillations : Zero limit cycle oscillation, overflow limit cycle oscillation and signal scaling – Introduction to multirate signal processing: Up sampling, down sampling and effects of spectrum.

**UNIT – V DIGITAL SIGNAL PROCESSORS [ 12 ]**

Introduction to DSP architecture: Multiplier and multiplier accumulator, bus architectures and memory access scheme, multiported memory, pipelining, special addressing modes – Architecture of TMS320C6747 – Introduction to C programming for DSP applications with code composer studio and simple programs using C.

**Total (L: 45 T:15) = 60 Periods**

**Text Books:**

- 1 John G Proakis and Dimtris G Manolakis, Digital Signal Processing Principles, Algorithms and Application, Pearson Education, USA, Fourth edition, 2014.
- 2 Venkataramani B and Bhaskar M, Digital Signal Processor Architecture, Programming and Application, Tata McGraw Hill, New Delhi, Second edition, 2013.

**Reference Books:**

- 1 Mitra S K, Digital Signal Processing, A Computer based approach, Tata McGraw Hill, Fourth edition, New Delhi, 2013.
- 2 EsakkirajanS, VeerakumarT, Digital Signal Processing, Tata McGraw Hill, First edition, New Delhi, 2021.
- 3 Sen M Kuo and Bob H Lee, Real-Time Digital Signal Processing: Implementations, Application and Experiments with the TMS320C55X, John Wiley & Sons Ltd, England, 2003.
- 4 Texas Instruments, TMS320C6747 DSP data sheet and User's Manual.
- 5 Online reference: <http://nptel.ac.in/courses/117102060/>

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC512

Course Name : Digital Signal Processing

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Describe the concepts of DFT, FFT and convolution process</i>	3	3	2	2	3	1	-	-	-	-	2	1	3	1
CO2	<i>Design appropriate type of FIR filter and implement digital filters in different FIR filter structures</i>	3	3	3	3	3	1	-	-	-	-	1	1	3	2
CO3	<i>Design digital IIR filter using appropriate type and implement digital filters in various realization structures</i>	3	3	3	3	3	1	-	-	-	-	1	1	3	2
CO4	<i>Characterize the effects of finite precision representation on digital filters</i>	3	3	2	2	2	1	-	-	-	-	1	1	3	1
CO5	<i>Describe digital signal processors and the programming concepts</i>	3	3	3	3	2	1	1	-	-	1	2	2	3	1
<b>Average</b>		<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>2</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**SEMESTER - V**

20EC513

**COMPUTER NETWORKS**

L	T	P	C
3	0	0	3

**Prerequisite:** No prerequisites needed for enrolling into the course.

**Course Outcomes :** On successful completion of the course, the student will be able to

**Cognitive Level**

CO1: Understand the concepts of data communication, Network models and transmission media in networks.	Understand
CO2: Describe the concepts of data link layer services and protocols, multiple access protocols, Ethernet protocol and various connecting devices.	Understand
CO3: Apply various routing protocols and algorithms for a given network along with IP addresses.	Apply
CO4: Demonstrate the flow of information from one process to another process in the network.	Understand
CO5: Enumerate the application layer protocols and the need for network security.	Understand

**UNIT - I PHYSICAL LAYER [ 09 ]**

Data communications - Networks: Network criteria, connection types, network topology, network types - Network models: OSI model - TCP/IP model - Addressing - Guided and unguided transmission media - Switching: Circuit switched networks, Datagram networks, Virtual circuit networks.

**UNIT - II DATA LINK LAYER [ 09 ]**

Data link control: Framing, flow control and error control - Protocols: Simple protocol, stop and wait, sliding window, Go Back N, selective repeat - HDLC - Multiple access: Random access, controlled access - IEEE 802.3: Standard Ethernet, changes in the standard, fast Ethernet, gigabit Ethernet - IEEE 802.11 - Connecting devices: Hub, repeater, switch, bridge, router, gateway.

**UNIT - III NETWORK LAYER [ 09 ]**

Logical addressing: IPv4, IPv6 addresses - Internet Protocol: Internetworking, IPv4, IPv6, transition from IPv4 to IPv6 - Address mapping - Delivery - Forwarding - Routing protocols: Intra and inter domain routing, distance vector routing, link state routing, path vector routing.

**UNIT - IV TRANSPORT LAYER [ 09 ]**

Transport layer services - Multiplexing and demultiplexing - User datagram protocol - Transmission control protocol - Congestion control - Quality of Service - Techniques to improve QoS.

**UNIT - V APPLICATION LAYER AND NETWORK SECURITY [ 09 ]**

Domain Name System (DNS) - E-mail - FTP - WWW - HTTP - Network security: Cryptography, symmetric key and public key algorithms, digital signature, communication security, authentication protocols.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :**

- Behrouz A. Forouzan, "Data Communication and Networking", Tata McGraw-Hill, Fifth edition, 2013.
- Andrew S. Tannenbaum and David J. Wetherall, "Computer Networks", Prentice Hall, Fifth edition, 2011.

**Reference Books :**

- Wayne Tomasi, "Introduction to Data Communication and Networking", Pearson Education, First edition, 2007.
- William Stallings, "Data and Computer Communications", Pearson Education, Eight edition, 2014.
- James F. Kurose & Keith W. Ross, "Computer Networking: A Top down Approach", Pearson Education, Fifth edition, 2012.
- Greg Tomsho, "Guide to Networking Essentials", Cengage Learning, Seventh edition, 2016.

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC513

Course Name : Computer Networks

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Understand the concepts of data communication, Network models and transmission media in networks.</i>	1	1	-	2	-	-	-	-	-	-	-	-	-	-
CO2	<i>Describe the concepts of data link layer services and protocols, multiple access protocols, Ethernet protocol and various connecting devices.</i>	1	1	-	2	-	-	-	-	-	-	-	-	-	-
CO3	<i>Apply various routing protocols and algorithms for a given network along with IP addresses.</i>	2	2	-	2	-	-	-	-	-	-	-	2	2	-
CO4	<i>Demonstrate the flow of information from one process to another process in the network.</i>	1	1	-	2	-	-	-	-	-	-	-	2	-	-
CO5	<i>Enumerate the application layer protocols and the need for network security.</i>	1	1	-	2	-	-	-	-	-	-	-	2	2	-
<b>Average</b>		<b>1</b>	<b>1</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



<b>20EC514</b>	<b>EMBEDDED SYSTEMS</b>	L	T	P	C
		3	0	0	3

**Prerequisite:** *Microprocessors and Microcontrollers*

**Course Outcomes :** *On the successful completion of the course, students will be able to*

**Cognitive Level**

CO1	Interpret the basic concepts of embedded system and its application.	Understand
CO2	Outline the concepts of various I/O interface devices and buses.	Understand
CO3	Apply the programming concepts in Embedded system design	Apply
CO4	Explain the architecture of AVR Microcontroller	Understand
CO5	Develop the Programming with Arduino and AVR Microcontrollers	Apply

**UNIT - I INTRODUCTION TO EMBEDDED SYSTEMS [09]**

Embedded system: Definition - Classification - Categories - Recent trends - Design considerations and requirements - Overview of architecture - Purpose - Major application area - Design life cycle.

**UNIT - II EMBEDDED DEVICES AND BUSES [09]**

IO types and examples - Serial communication devices - Parallel device ports - Sophisticated interfacing features in device ports - Wireless devices - Timer and counting devices - Watchdog timer - Real time clock - Networked embedded systems - Serial bus communication protocols - Parallel bus device protocols - Internet enabled systems - Wireless and mobile system protocols - ISR concept - Interrupt sources - Interrupt service handling mechanism.

**UNIT - III EMBEDDED PROGRAMMING [09]**

Software programming in assembly and high level language - Program elements: Macros and functions, data types, data structures, modifiers, statements, loops and pointers - Object oriented programming - Embedded programming in C++ - Embedded programming in JAVA - Program models - DFG models - State machine programming models for event controlled program flow - Modeling of multiprocessor systems - UML modeling.

**UNIT - IV AVR MICROCONTROLLER [09]**

Internal Architecture – internal Memory - Peripheral Functions - Analog Comparator - Analog-to-Digital Converter - Serial I/O - Interrupts - Watchdog Timer - Electrical Characteristics – Arduino - Specific AVR Microcontrollers - **ATmega168/328 - ATmega1280 / ATmega 2560** : Memory, Features, Packages, Ports, Pin Functions, Analog Inputs, Serial Interfaces, Timer/Clock I/O, External Interrupts, Arduino Pin Assignments, Basic Electrical Characteristics.

**UNIT - V Programming the Arduino and AVR Microcontrollers [09]**

Cross Compilers - Boot loaders - The Arduino IDE Environment : Installing the Arduino IDE, Configuring the Arduino IDE- Cross-Compiling with the Arduino: IDE The Arduino Executable Image, The Arduino Software Build Process, Sketch Tabs, Arduino Software Architecture, Runtime Support: The main() Function, Global variables - Libraries

**Total (L: 45) = 45 Periods**

**Text Books :**

- 1 Raj Kamal Embedded Systems Architecture, Programming and Design, McGraw-Hill Education, New Delhi, Second edition, 2011.
- 2 J.M.Hughes, "Arduino: A Technical Reference A Handbook for Technicians, Engineers, and Makers", USA, O' Reilly Media, First edition 2016.

**Reference Books :**

- 1 David E. Simon, An Embedded Software Primer, Addison-Wesley Professional, United States, First edition, 2007.
- 2 Daniel .W Lewis, Fundamentals of Embedded Software, Prentice Hall India Learning, New Delhi, 2003.
- 3 Simon Monk, "Programming Aurdino, getting started with sketches" McGraw Hill, New York, First edition 2012.
- 4 <http://nptel.ac.in/courses/108102045>.

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC514

Course Name : Embedded Systems

CO	Course Outcomes	Programme Outcomes														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	<i>Interpret the basic concepts of embedded system and its application.</i>	2	2	3	-	-	-	-	-	-	-	-	-	1	3	2
CO2	<i>Outline the concepts of various I/O interface devices and buses.</i>	2	2	3	-	-	-	-	-	-	-	-	-	1	3	2
CO3	<i>Apply the programming concepts in Embedded system design</i>	2	2	3	-	-	-	-	-	-	-	-	-	1	3	2
CO4	<i>Explain the architecture of AVR Microcontroller</i>	2	2	3	-	-	-	-	-	-	-	-	-	1	3	2
CO5	<i>Develop the Programming with Arduino and AVR Microcontrollers</i>	2	2	3	-	-	-	-	-	-	-	-	-	1	3	2
<b>Average</b>		<b>2</b>	<b>2</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>3</b>	<b>2</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

SEMESTER – V

20EC521	DIGITAL SIGNAL PROCESSING LABORATORY	L	T	P	C
		0	0	3	1

**Prerequisite:** Programming for Problem Solving & Signals and Systems

**Course Outcomes: On Completion of this course, the student will be able to**

**Cognitive level**

CO1	Carryout basic signal processing operations using MATLAB.	Understand
CO2	Solve time and frequency domain representation of signals.	Apply
CO3	Design and simulate IIR filters and their responses.	Create
CO4	Design and simulate FIR filters and their responses.	Create
CO5	Implement the basic Digital signal Processing algorithms using Processors.	Understand

**List of Experiments:**

**Using MATLAB / Equivalent open source**

1. Basic signal generation and processing
2. a) Generation of Continuous and Discrete Elementary signals using Mathematical expression.  
b) Operations on signals and sequences such as addition, multiplication, scaling, shifting, folding.  
c) Locating the zeros and poles and plotting the pole zero maps in s-plane and z-plane for the given transfer function.
3. Discrete Fourier Transform using FFT and IFT.
4. Convolution and correlation of discrete signals.
5. Sampling and effect of aliasing.
6. Design of FIR filters and IIR filters.

**Using TMS 320C50 Processor**

7. Study of various addressing modes of Digital signal processors using simple programming examples.
8. Calculation of DFT using FFT.
9. Implementation of FIR filter and IIR filter.

**Using TMS 320C6747 Processor**

10. Sampling of input signal and display.
11. Convolution and correlation of discrete signals.

**Total : 45 Periods**

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**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC521

Course Name : Digital Signal Processing Laboratory

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Carryout basic signal processing operations using MATLAB.</i>	3	3	3	2	3	-	-	-	1	-	2	1	3	3
CO2	<i>Solve time and frequency domain representation of signals.</i>	3	3	3	2	3	-	-	-	1	-	1	1	3	3
CO3	<i>Design and simulate IIR filters and their responses.</i>	3	3	3	2	3	-	-	-	1	-	1	1	3	3
CO4	<i>Design and simulate FIR filters and their responses.</i>	3	3	3	2	3	-	-	-	1	-	1	1	3	3
CO5	<i>Implement the basic Digital signal Processing algorithms using Processors.</i>	3	3	3	2	3	-	-	-	1	-	2	1	3	3
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>3</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

SEMESTER - V

20EC522

COMPUTER NETWORKS LABORATORY

L	T	P	C
0	0	3	1

**Prerequisite: Nil****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1	Design and analyze the performance of parallel and serial communication.	Apply
CO2	Compare and contrast the performance of token bus and token ring protocols.	Apply
CO3	Implement and understand the concept of data link layer protocols, routing algorithms and cable crimping	Analyze
CO4	Infer about network security and file transfer concepts.	Apply
CO5	Simulate and evaluate the performance of LAN using NS2.	Analyze

**List of Experiments:**

1. PC to PC communication:  
Parallel communication using 8 bit parallel cable.  
Serial communication using RS 232 cable.
2. Ethernet LAN protocol:  
Create scenario and verify the performance of Ethernet LAN protocol.
3. Token bus and token ring protocols:  
Create scenario and verify the performance of token bus and token ring protocols.
4. Implementation of stop and wait protocol.
5. Implementation of Go Back N and selective repeat protocols.
6. Implementation of distance vector routing algorithm.
7. Implementation of link state routing algorithm.
8. Implementation of data encryption and decryption.
9. Transfer of files from PC to PC using windows socket processing.
10. Simulation and performance analysis of LAN using NS-2.
11. Crimping of Ethernet cable.

**Total = 45 Periods**

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC522

Course Name : Computer Networks Laboratory

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Design and analyze the performance of serial and parallel communication.</i>	1	1	-	2	1	-	-	-	-	-	-	1	2	2
CO2	<i>Compare and contrast the performance of token bus and token ring protocols.</i>	1	1	-	2	1	-	-	-	-	-	-	1	-	-
CO3	<i>Implement and understand the concept of data link layer protocols, routing algorithms and cable crimping</i>	2	2	-	2	1	-	-	-	-	-	-	2	2	2
CO4	<i>Infer about network security and file transfer concepts.</i>	1	1	-	2	1	-	-	-	-	-	-	2	2	2
CO5	<i>Simulate and evaluate the performance of LAN using NS2.</i>	1	1	-	2	1	-	-	-	-	-	-	1	-	-
<b>Average</b>		<b>1</b>	<b>1</b>	<b>-</b>	<b>2</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>2</b>	<b>2</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

## SEMESTER – V

20EC523

EMBEDDED SYSTEM DESIGN LABORATORY

L	T	P	C
0	0	3	1

**Prerequisites:** Programming for problem solving**Course Outcomes :** On the successful completion of the course, students will be able to

C01 Develop embedded C coding for Buzzer Beep and I/O interfacing

C02 Analyze the Analog-to-Digital conversion and LCD interfacing.

C03 Develop embedded C programming for DC motor control and PWM generation for velocity, motion and position control

C04 Develop embedded C programming for white line follower and sensor switching using Firebird V Robot.

C05 Develop embedded C programming for serial communication using Zig Bee

**Cognitive Level**

Apply

Apply

Apply

Apply

Apply

**List of Experiments:****ATMEGA processor programming using Fire Bird V Robot**

- a. Buzzer Beep
- b. I/O Interfacing
- c. Analog-to-Digital conversion
- d. Interfacing LCD for debugging
- e. DC motor control and PWM generation for velocity control
- f. Motion Control
- g. Position Control
- h. Sensor Switching
- i. White line follower
- j. Serial communication using Zig Bee

**Total : 45 Periods**

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC523

Course Name : Embedded System Design Laboratory

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Develop embedded C coding for Buzzer Beep and I/O interfacing</i>	2	2	3	3	3	-	-	-	-	-	-	1	3	2
CO2	<i>Analyze the Analog-to-Digital conversion and LCD interfacing.</i>	2	2	3	3	3	-	-	-	-	-	-	1	3	2
CO3	<i>Develop embedded C programming for DC motor control and PWM generation for velocity, motion and position control</i>	2	2	3	3	3	-	-	-	-	-	-	1	3	2
CO4	<i>Develop embedded C programming for white line follower and sensor switching using Firebird V Robot.</i>	2	2	3	3	3	-	-	-	-	-	-	1	3	2
CO5	<i>Develop embedded C programming for serial communication using Zig Bee</i>	2	2	3	3	3	-	-	-	-	-	-	1	3	2
<b>Average</b>		<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>3</b>	<b>2</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



**SEMESTER - V**

<b>20HR543</b>	<b>CAREER DEVELOPMENT SKILLS - III</b>	L	T	P	C
		0	2	0	0

**Prerequisite:** No prerequisites are needed for enrolling into the course

<b>Course Outcomes : On successful completion of the course, the student will be able to</b>	<b>Cognitive Level</b>
CO1: Understand the nearness of leading various texts.	Apply
CO2: Perform well in verbal and logical reasoning.	Apply
CO3: Understand and develop the etiquette necessary to present oneself in a professional setting.	Understand
CO4: Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.	Create
CO5: Enhance the comprehension Skills in core subjects.	Apply

**UNIT - I WRITTEN AND ORAL COMMUNICATION – PART 1 [ 06 ]**

Reading Comprehension Level 3 - Self Introduction - News Paper Review - Self Marketing - Debate- Structured and Unstructured GDs Psychometric Assessment – Types & Strategies to answer the questions Practices: Sentence Completion - Sentence Correction - Jumbled Sentences - Synonyms & Antonyms - Using the Same Word as Different Parts of Speech - Interpretation of Pictorial Representations – Editing.

**UNIT - II VERBAL & LOGICAL REASONING – PART 2 [ 06 ]**

Syllogism - Assertion and Reasons - Statements and Assumptions - Identifying Valid Inferences - identifying Strong Arguments and Weak Arguments - Statements and Conclusions- Cause and Effect - Deriving Conclusions from Passages - Seating Arrangements Practices: Analogies - Blood Relations - Statement & Conclusions.

**UNIT - III QUANTITATIVE APTITUDE – PART 3 [ 06 ]**

Probability - Calendar- Clocks - Logarithms - Permutations and Combinations.

**UNIT - IV QUANTITATIVE APTITUDE – PART 4 [ 06 ]**

Algebra - Linear Equations - Quadratic Equations – Polynomials – Problem on Numbers – Ages – Train – Time and Work – Sudoku – Puzzles.

**UNIT - V DEPARTMENT TECHNICAL TOPICS [ 06 ]**

**Networks** – Solution Methods, Network Theorems, Time and frequency domain analysis of circuits.

**Electronic Devices**–Diode, BJT, JFET, MOS capacitor, MOSFET, LED, p-i-n and avalanche photo diode, Basics of LASERS & IC fabrication.

**Analog Circuits** - Simple diode circuits, clippers, Clampers, Biasing of transistors, Small Signal Equivalent circuits of diodes, BJTs, MOSFETs, amplifiers, filters, differential amplifiers, oscillators, simple opamp & 555 circuits and Power supplies.

**Total (L = 0, T = 30 ) = 30 Periods**

**Text Books :**

- 1 Anne Laws, Writing Skills, Orient Black Swan, Hyderabad, 2011.
- 2 Abhijit Guha, Quantitative Aptitude, TMH, New Delhi, Third edition, 2009

**Reference Books :**

- 1 Agarwal. R.S ,A.Modern Approach to Verbal and Non- verbal Reasoning, Revised Edition 2008, Reprint 2009, S.Chand & Co Ltd., New Delhi.
- 2 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First edition, 2005.
- 3 M.B. Lal & Goswami, Objective Instant Arithmetic, Upkar Publications, New Delhi, Second edition, 2012.
- 4 Norman Lewis. W.R., “Word Power Made Easy”, Goyal Publications

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF SCIENCE AND HUMANITIES**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20HR543

Course Name : Career Development Skills - III

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Understand the nearness of leading various texts.</i>	-	-	-	-	-	-	-	1	3	3	-	-	1	1
CO2	<i>Perform well in verbal and logical reasoning.</i>	-	-	-	-	-	-	-	1	3	3	-	2	1	1
CO3	<i>Understand and develop the etiquette necessary to present oneself in a professional setting.</i>	-	-	-	-	-	-	-	1	3	3	-	1	1	1
CO4	<i>Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.</i>	-	-	-	-	-	-	-	1	3	3	-	2	1	1
CO5	<i>Enhance the comprehension Skills in core subjects.</i>	-	-	-	-	-	-	-	1	3	3	-	-	1	1
<b>Average</b>		-	-	-	-	-	-	-	<b>1</b>	<b>3</b>	<b>3</b>	-	<b>2</b>	<b>1</b>	<b>1</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

SEMESTER - VI

20HS051	UNIVERSAL HUMAN VALUE AND UNDERSTANDING HARMONY	L	T	P	C
		3	0	0	3

**Prerequisite:**

Course Outcomes : On successful completion of the course, the student will be able to	Cognitive Level
CO1: Explain .the Basic Concepts of Value Education	Understand
CO2: Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co- existence of Self and Body.	Understand
CO3: Explain the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships	Understand
CO4: Describe the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.	Understand
CO5: Explain ethical and unethical practices in work environment	Understand

**UNIT - I INTRODUCTION TO VALUE EDUCATION [ 09 ]**

Need and Basic Guidelines of Value Education – Content and Process of Value Education – Self Exploration – purpose of self Exploration – Content and Process of Self exploration – Natural Acceptance – Realization and Understanding – Basic Human Aspirations – Continuous Happiness and Prosperity – Exploring Happiness and Prosperity – Basic Requirement for Fulfilment of Human Aspirations – Relationships – Physical Facilities – Right Understanding.

**UNIT - II HARMONY IN THE HUMAN BEING [ 09 ]**

Human Begin and Body – Understanding Myself as Co-existence of Self ('I') and Body, Needs of the Self and Body, Activities in the Self and Body, Self ('I') as the Conscious Entity, the Body as the Material Entity – Exercise – Body as an Instrument– Harmony in the Self ('I') – Understanding Myself – Harmony with Body.

**UNIT - III HARMONY IN THE FAMILY AND SOCIETY [ 09 ]**

Harmony in the Family – Justice – Feelings (Values) in Human Relationships – Relationship from Family to Society – Identification of Human Goal – Five dimensions of Human Endeavour.

**UNIT - IV HARMONY IN NATURE AND EXISTENCE [ 09 ]**

Order of Nature – Interconnectedness – Understanding the Four order – Innateness – Natural Characteristic – Basic Activity – Conformance – Introduction to Space – Co-existence of units of Space – Limited and unlimited – Active and No-activity – Existence is Co-existence.

**UNIT - V PROFESSIONAL ETHICS [ 09 ]**

Values in different dimensions of Human Living – Definitiveness of Ethical Human Conduct –Implications of Value based Living – Identification of Comprehensive Human Goal – Humanistic Education – Universal Human Order – Competence and Issues in Professional Ethics.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :**

- 1 Gaur R.R., Sangal R., Bagaria G.P., "A Foundation Course in Human Values and Professional Ethics", 1st Edition, Excell Books Pvt. Ltd., New Delhi, 2016.
- 2 A.N.Tripathy, Human Values, New Age International Publishers, 2003

**Reference Books :**

- 1 Ivan Illich, "Energy & Equity", The Trinity Press, USA, 1974.
- 2 Schumacher E.F., "Small is Beautiful: a study of economics as if people mattered", Britain, 1973.
- 3 E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
- 4 B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.

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**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**CO PO MAPPING**

Regulation: **R 2020**

Course Code: **20HS051**

Course Name: **Universal Human value and  
Understanding Harmony**

CO	Course Outcomes	Programme Outcomes				
		PO1	PO2	PO3	PO4	PO5
CO1	<i>Understand the need, basic guidelines, content and process of value education.</i>	3	-	-	2	-
CO2	<i>Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co- existence of Self and Body.</i>	-	-	3	-	-
CO3	<i>Explain the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships</i>	-	-	2	3	-
CO4	<i>Describe the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.</i>	-	-	2	-	3
CO5	<i>Explain ethical and unethical practices in work environment</i>	-	-	-	3	-
<b>Average</b>		<b>3</b>	<b>-</b>	<b>2</b>	<b>3</b>	<b>3</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

## SEMESTER - VI

20EC611

## DIGITAL COMMUNICATION SYSTEMS

L	T	P	C
3	0	0	3

**Prerequisite:** Nil**Course Outcomes :** On successful completion of the course, the student will be able to**Cognitive Level**CO1: *Illustrate the basics of digital communication systems and signal representation*

Understand

CO2: *Describe the baseband formatting techniques.*

Understand

CO3: *Apply various baseband coding methods.*

Apply

CO4: *Describe the baseband reception techniques.*

Understand

CO5: *Infer band pass signal processing systems.*

Understand

UNIT - I **FUNDAMENTALS OF DIGITAL COMMUNICATION**

[ 09 ]

Elements of digital communication systems: Model of digital communication systems – Channel classification – Performance measure – Geometric representation of signals; Gram Schmidt orthogonalisation procedure – Bandwidth – Mathematical models of communication channel.

UNIT - II **BASEBAND FORMATTING TECHNIQUES**

[ 09 ]

Sampling: Impulse sampling, natural sampling, sampler implementation – Quantization: Uniform and non-uniform – Encoding techniques for analog sources: PCM, DPCM, Delta modulation, Adaptive delta modulation, spectral waveform encoding, model-based encoding.

UNIT - III **BASEBAND CODING TECHNIQUES**

[ 09 ]

Block codes, convolutional codes – Concept of error free communication – Classification of line codes, desirable characteristics and power spectra of line codes.

UNIT - IV **BASEBAND RECEPTION TECHNIQUES**

[ 09 ]

Noise in communication systems – Receiving filter – Correlator type – Matched filter type – Equalizing filter – Signal and system design for ISI elimination, Implementation – Eye pattern analysis – Synchronization – Detector, Maximum likelihood detector, error probability, figure of merit for digital detection.

UNIT - V **BANDPASS SIGNAL TRANSMISSION AND RECEPTION**

[ 09 ]

Memory less modulation methods – Transmitter, receiver signal space diagram and BER; ASK, FSK, PSK, QAM, QPSK – Band pass receiving filter, error performance.

**Total = 45 Periods****Text Books :**

- 1 Amitabha Bhattacharya, Digital Communications, McGraw Hill, New Delhi, First Edition, 2017.
- 2 Simon Haykin, Digital Communications, John Wiley, United States, Fourth Edition (Indian Adaptation Edition), 2021.
- 3 Bernard Sklar, Digital Communication, Pearson Education, New York, Second Edition, 2014.

**Reference Books :**

- 1 John.G. Proakis, Fundamentals of Communication Systems, Pearson Education, New York, Second Edition, 2014.
- 2 Michael. B. Pursley, Introduction to Digital Communication, Pearson Education, New York, First Edition, 2006.
- 3 Herbert Taub & Donald L Schilling, Principles of Communication Systems, TMH, New Delhi, Third Edition, 2008.
- 4 Leon W. Couch, Digital and Analog Communication Systems, Pearson Education, New York, Seventh Edition, 2008.

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC611

Course Name : Digital Communication Systems

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Illustrate the basics of digital communication systems and signal representation</i>	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO2	<i>Describe the baseband formatting techniques.</i>	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO3	<i>Apply various baseband coding methods.</i>	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO4	<i>Describe the baseband reception techniques.</i>	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO5	<i>Infer band pass signal processing systems.</i>	3	3	3	-	-	-	-	-	-	-	-	-	3	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	-	-	-	-	-	-	-	-	-	<b>3</b>	-

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

## SEMESTER - VI

20EC612

## DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

**Prerequisite:** *Digital Signal Processing***Course Outcomes :** On successful completion of the course, the student will be able to**Cognitive Level**

CO1:	<i>Describe the fundamentals in digital imaging.</i>	<i>Understand</i>
CO2:	<i>Apply various image transformation techniques.</i>	<i>Apply</i>
CO3:	<i>Apply different techniques for image enhancement and image restoration.</i>	<i>Apply</i>
CO4:	<i>Infer image segmentation and representation techniques.</i>	<i>Understand</i>
CO5:	<i>Compare various compression techniques.</i>	<i>Apply</i>

**UNIT - I DIGITAL IMAGE FUNDAMENTALS****[09]**

Elements of digital image processing systems - Elements of visual perception - Basic relationship between pixels: Connectivity, Distance measure - Brightness - Contrast - Hue - Saturation - Mach band effect - Color image fundamentals: RGB - HSI models - Conversion from RGB to HSI - Image sampling - Quantization - Dither

**UNIT - II IMAGE TRANSFORMS****[09]**

2D transforms - Discrete fourier transform - Discrete cosine transform - Discrete Sine Transform - Walsh - Hadamard - Slant - Haar transform - DWT: Haar wavelet, Daubechies wavelet .

**UNIT - III IMAGE ENHANCEMENT AND RESTORATION****[09]**

Spatial domain enhancement: Gray level transformations - Histogram Equalization - Smoothing spatial filters, Median filter, Sharpening spatial filters - Homomorphic filtering - Image restoration: Degradation model – Order Statistics filtering - Inverse filtering - Wiener filtering.

**UNIT - IV IMAGE SEGMENTATION AND REPRESENTATION****[09]**

Line and point detection, Edge detection, Edge linking via Hough transform - Morphological operations - Thresholding - Region based segmentation: Region growing - Region splitting and merging - Representation: Chain codes, Signatures, Boundary segments, Skeletons.

**UNIT-V IMAGE COMPRESSION & IMAGE PROCESSING APPLICATIONS****[09]**

Need for data compression - Lossless compression: Huffman coding, Run length coding, Bit plane coding, LZW coding. Lossy compression:, Block truncation coding - Applications: Satellite image processing and face recognition.

**Total (L: 45) = 45 Periods****Text Books :**

- 1 Jayaraman .S, Esakkirajan.S, Veerakumar T, Digital Image Processing, Tata McGraw Hill, New Delhi, Second Edition, 2020
- 2 Rafael C Gonzalez, Richard E Woods, Digital Image Processing, Pearson Education, New Delhi, Fourth Edition, 2019.

**Reference Books :**

- 1 Anil K- Jain, Fundamentals of Digital Image Processing, Pearson Education, New Delhi, First Edition, 2015.
- 2 Kenneth R.Castleman, Digital Image Processing, Pearson, New Delhi, Second reprint, , 2008.
- 3 David Salomon, Data Compression: The Complete Reference, Springer - Verlag, Third Edition, New York, 2011.
- 4 <http://nptel.ac.in/courses/117105079/>

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC612

Course Name : Digital Image Processing

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	Describe the fundamentals in digital imaging.	3	3	2	-	-	-	3	-	-	-	-	2	3	-
C02	Apply various image transformation techniques.	3	3	2	-	-	-	1	-	-	-	-	2	3	-
C03	Apply different techniques for image enhancement and image restoration.	3	3	3	-	-	-	2	-	-	-	-	3	3	-
C04	Infer image segmentation and representation techniques.	3	3	3	-	-	-	2	-	-	-	-	3	3	-
C05	Compare various compression techniques.	3	3	3	-	-	-	2	-	-	-	-	3	3	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>3</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



SEMESTER - VI

VLSI DESIGN

20EC613

L	T	P	C
3	0	0	3

**Prerequisite: Digital Electronics**

**Course Outcomes : On successful completion of the course, the student will be able to**

**Cognitive Level**

CO1: Design the digital circuits and CMOS structures using Verilog HDL.

Apply

CO2: Describe the VLSI fabrication process and design rules.

Understand

CO3: Develop the CMOS structure and layout.

Apply

CO4: Discuss the types of storage elements and dynamic logic circuits.

Understand

CO5: Discuss the types of Test and testability for VLSI circuits.

Understand

UNIT - I **VERILOG HDL**

[ 09 ]

Basic concepts - Modules and ports - Operators - Structural modeling - Data flow modeling - Behavioral modeling – Switch level modeling - Test benches - Verilog code for: adders, subtractors, multiplexer, demultiplexer, encoder, decoder, priority encoder, comparator, D-Latch, D flip flop, shift register and counter.

UNIT - II **VLSI FABRICATION TECHNIQUES**

[ 09 ]

Chip design hierarchy - IC layers - Photolithography and pattern transfers - CMOS fabrication processes: nWell - pWell - Submicron CMOS process - Masks and layout - CMOS design rules: SCMOS design rule set - Lambda based layout.

UNIT - III **CMOS LOGIC GATE DESIGN AND LAYOUT**

[ 09 ]

CMOS inverter voltage transfer curve - NAND and NOR gates - Complex logic gates - Stick diagram - CMOS Layout - Tri state circuits - Large FETs – Transmission gate and pass transistor logic - Standard cell design: Cell hierarchies - Cell libraries.

UNIT - IV **STORAGE ELEMENTS AND DYNAMIC LOGIC CIRCUITS**

[ 09 ]

SR latch - Bit level register - D flip flop - Dynamic D flip flop - Static RAM cell - Clocked CMOS - Dynamic logic – Domino logic - SR logic - Dynamic memories.

UNIT - V **TEST AND TESTABILITY**

[ 09 ]

Need for Testing, Testers, Test fixtures and test programs - Silicon debug principles - Manufacturing test principles Modeling, Design for Testability, Boundary Scan.

**Total = 45 Periods**

**Text Books :**

- 1 John P. Uyemura, Chip Design for Submicron VLSI: CMOS layout and simulation, Cengage Learning India Private Ltd, 11th Indian Reprint 2016.
- 2 Samir Palnitkar, Verilog HDL A Guide to Digital Design and Synthesis, Pearson Education, Second Edition, 2014.

**Reference Books :**

- 1 Kamran Eshraghian, Douglas A. Pucknell and Sholeh Eshraghian, Essentials of VLSI Circuits and Systems, Prentice Hall of India Pvt Ltd, 2013.
- 2 J.Bhasker, Verilog HDL Primer, BS publication, Third Edition, Reprint 2012.
- 3 <http://nptel.ac.in/courses/108101089/>
- 4 <http://nptel.ac.in/syllabus/syllabus.php?subjectId=117108041>

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC613

Course Name : VLSI Design

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	Design the digital circuits and CMOS structures using Verilog HDL.	3	3	3		3							2	3	
C02	Describe the VLSI fabrication process and design rules.	3	3	3		3							2	3	
C03	Develop the CMOS structure and layout.	3	3	3		3							2	3	
C04	Discuss the types of storage elements and dynamic logic circuits.	3	3	3		3							2	3	
C05	Discuss the types of Test and testability for VLSI circuits.	3	3	3		3							2	3	
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>		<b>3</b>							<b>2</b>	<b>3</b>	

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20EC614	ANTENNA AND WAVE PROPAGATION (Elective)	L	T	P	C
		3	0	0	3

**Prerequisite: Engineering Electromagnetics**

<b>Course Outcomes: On Completion of this course , the student will be able to</b>		<b>Cognitive level</b>
CO1	Describe antenna radiation principles and its fundamental parameters.	Understand
CO2	Design different types of antenna arrays and their radiation patterns.	Apply
CO3	Design various types of low and high frequency antennas.	Apply
CO4	Discuss different types of special antennas and techniques used in antenna measurements.	Understand
CO5	Describe different types of wave propagation methods and its characteristics	Understand

**UNIT – I ELECTROMAGNETIC RADIATION AND ANTENNA FUNDAMENTALS [ 9 ]**

Review of electromagnetic theory: Vector potential - Retarded case - Hertzian dipole - Half wave dipole - Quarter wave monopole - Antenna characteristics: Radiation pattern, beam solid angle, directivity, gain, input impedance, polarization, bandwidth, reciprocity, effective aperture, effective length, antenna temperature.

**UNIT – II ANTENNA ARRAYS [ 9 ]**

Expression for electric field from two and N element arrays - Linear arrays: Broad side array and end fire array - Method of pattern multiplication - Binomial array - Phased arrays - Frequency scanning arrays - Adaptive arrays.

**UNIT – III LOW AND HIGH FREQUENCY ANTENNAS [ 9 ]**

Loop antennas: Radiation from small loop and its radiation resistance - Helical antenna: Normal mode and axial mode operation - Yagi Uda antenna - Log periodic antenna - Rhombic antenna - Horn antenna - Reflector antennas and their feed systems - Micro strip antenna.

**UNIT – IV SPECIAL ANTENNAS AND ANTENNA MEASUREMENTS [ 9 ]**

Special applications: Antenna for terrestrial mobile communication systems - GPR - Embedded antennas - UWB - Plasma antenna - Smart antennas. Antenna measurements: Radiation pattern - Gain - Directivity - Polarization - Impedance -Efficiency.

**UNIT – V WAVE PROPAGATION [ 9 ]**

Ground wave propagation: Attenuation characteristics - Space wave propagation: Reflection from ground for vertically and horizontally polarized waves - Reflection characteristics of earth - Resultant of direct and reflected ray at the receiver - Duct propagation - Sky wave propagation: Structure of the ionosphere - Effective dielectric constant of ionized region - Mechanism of refraction - Refractive index - Critical frequency - Skip distance.

**Total = 45 Periods**

**Text Books :**

- 1 Prasad K. D, Antennas and Wave Propagation, Satya Prakashan Publications, New Delhi, 2020.
- 2 John D. Kraus, Ronald J. Marhefka, and Ahmad S. Khan, Antennas and Wave Propagation, Tata McGraw-Hill, New Delhi, Fifth Edition, 2017.

**Reference Books :**

- 1 Constantine A. Balanis, Antenna Theory: Analysis and Design, John Wiley & Sons, USA, Fourth Edition, 2016.
- 2 Edward C. Jordan and Keith G. Balmain, Electromagnetic Waves and Radiating Systems, Pearson Education, Second Edition, 2015.
- 3 Robert E. Collin, Antennas and Radio wave Propagation, McGraw-Hill Education, US, Fourth Edition, 2014
- 4 <https://nptel.ac.in/courses/117/107/117107035/>

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code:20EC614

Course Name: ANTENNA AND WAVE PROPAGATION

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Describe antenna radiation principles and its fundamental parameters.</i>	3	3	3											3
CO2	<i>Design different types of antenna arrays and their radiation patterns.</i>	3	3	3											3
CO3	<i>Design various types of low and high frequency antennas.</i>	3	3	3											3
CO4	<i>Discuss different types of special antennas and techniques used in antenna measurements..</i>	3	3	2											3
CO5	<i>Describe different types of wave propagation methods and its characteristics.</i>	3	3	2											3
<b>Average</b>		3	3	2											3

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

## SEMESTER - VI

20EC621

## COMMUNICATION SYSTEMS LABORATORY

L	T	P	C
0	0	3	1

**Prerequisite: -****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1:	<i>Demonstrate the concept of analog modulation techniques</i>	Apply
CO2:	<i>Demonstrate the concept of pulse modulation techniques</i>	Apply
CO3:	<i>Discuss about the coding techniques for A/D conversion</i>	Understand
CO4:	<i>Demonstrate various digital modulation techniques</i>	Apply
CO5:	<i>Measure the antenna radiation pattern and summarize the frequency response of RF filters</i>	Understand

**List of Experiments:****To Design and observe the waveforms for**

1. To Design AM modulator and demodulator circuit and determine the modulation index of various modulation types using spectrum analyzer and math mode of CRO.
2. To Design FM modulator and demodulator circuit and determine the modulation index.
3. Pulse Modulation - PAM, PWM, PPM.
4. Pulse code modulation encoder and decoder.
5. Delta modulation and demodulation.
6. Digital Modulation Techniques - ASK, FSK, PSK. Compare its bit error performance using MATLAB.
7. Sampling & TDM.
8. Radiation pattern of Yagi-Uda, Horn, Loop antennas and determine its bandwidth, gain and directivity.
9. To simulate broadside array and end fire array using MATLAB.
10. Determine the S-parameters using network analyzer. (DUT Specific)
11. Frequency response of RF filters using spectrum analyzer.

**Total (P: 45) = 45 Periods**

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC621

Course Name : Communication Systems Laboratory

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Demonstrate the concept of analog modulation techniques</i>	3	3	3	-	-	-	-	-	3	-	-	-	3	-
CO2	<i>Demonstrate the concept of pulse modulation techniques</i>	3	3	3	-	-	-	-	-	3	-	-	-	3	-
CO3	<i>Discuss about the coding techniques for A/D conversion</i>	3	3	3	-	-	-	-	-	3	-	-	-	3	-
CO4	<i>Demonstrate various digital modulation techniques</i>	3	3	3	-	3	-	-	-	3	-	-	-	3	3
CO5	<i>Measurement of antenna radiation pattern and summarize the frequency response of RF filters</i>	3	3	3	-	3	-	-	-	3	-	-	-	3	3
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>3</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

SEMESTER - VI

20EC622

VLSI LABORATORY

L	T	P	C
3	0	0	1

**Prerequisite: Digital Electronics**

**Course Outcomes : On successful completion of the course, the student will be able to**

**Cognitive Level**

CO1: Design and develop the combinational circuits using Verilog HDL.	Apply
CO2: Develop the sequential circuits using Verilog HDL.	Apply
CO3: Design CMOS logic gates using EDA tool.	Apply
CO4: Verify the functionality of digital circuits using FPGA.	Apply
CO5: Develop place and route of the digital circuits using FPGA.	Apply

**List of Experiments:**

- Design and simulation of combinational logic circuit using Verilog. (CO1)
  1. Adder, subtractor, and multiplier
  2. Multiplexer and demultiplexer
  3. Encoder and decoder
- Design and simulation of sequential logic circuit using Verilog.(CO2)
  4. Flip flops
  5. Counters
  6. Shift registers
- CMOS circuit design using EDA Tool. (CO3)
  7. CMOS inverter
  8. CMOS NAND and NOR gates
  9. CMOS based complex logic gates.
- FPGA implementation with functional verification. (CO4)
  10. Combinational and sequential circuits
- FPGA implementation with place and route. (CO5)
  11. Combinational and sequential circuits
  12. ALU, Counter

**Total (L= 45, T = 0 ) = 45 Periods**

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC622

Course Name : VLSI LABORATORY

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Design and develop the combinational circuits using Verilog HDL.</i>	3	3	3	-	3	-	-	-	-	-	-	2	3	
CO2	<i>Develop the sequential circuits using Verilog HDL.</i>	3	3	3	-	3	-	-	-	-	-	-	2	3	
CO3	<i>Design CMOS logic gates using EDA tool.</i>	3	3	3	-	3	-	-	-	-	-	-	2	3	
CO4	<i>Verify the functionality of digital circuits using FPGA.</i>	3	3	3	-	3	-	-	-	-	-	-	2	3	
CO5	<i>Develop place and route of the digital circuits using FPGA.</i>	3	3	3	-	3	-	-	-	-	-	-	2	3	
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>		<b>3</b>	-	-	-	-	-	-	<b>2</b>	<b>3</b>	

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



SEMESTER - VI

20HR654

CAREER DEVELOPMENT SKILLS – IV

L	T	P	C
0	2	0	0

**Prerequisite(s): NIL****Course Outcomes: On successful completion of the course, the student will be able to****Cognitive Level**

CO1: Employ critical thinking in personal interviews type situations.

Apply

CO2: Understand the Quantitative Aptitude problems in geometry.

Understand

CO3: Understand the data interpretation and analysis by using various graphs.

Understand

CO4: Enhance the skills in resume writing and presentation.

Create

CO5: Develop the comprehension Skills in core subjects.

Apply

**UNIT - I WRITTEN AND ORAL COMMUNICATION****[ 06 ]**

Self-Introduction – GD – Personal Interview Skills Practices on Reading Comprehension Level 2 – Paragraph Writing – Newspaper and Book Review Writing – Skimming and Scanning – Interpretation of Pictorial Representations – Sentence Completion – Sentence Correction – Jumbled Sentences – Synonyms & Antonyms – Using the Same Word as Different Parts of Speech – Editing.

**UNIT - II QUANTITATIVE APTITUDE****[ 06 ]**

Geometry – Straight Line – Triangles – Quadrilaterals – Circles – Co-ordinate Geometry – Cube – Cone – Sphere.

**UNIT - III DATA INTERPRETATION AND ANALYSIS****[ 06 ]**

Data Interpretation based on Text – Data Interpretation based on Graphs and Tables. Graphs Column Graphs, Bar Graphs, Line Charts, Pie Chart, Graphs representing Area, Venn Diagram & Flow Charts.

**UNIT - IV RESUME WRITING & PRESENTATION SKILLS****[ 06 ]**

An Introduction to the Resume – Types of Resumes – Common Resume Errors – Anatomy of a Resume – What is a Cover Letter? – Types of Cover Letters – Enhancing the Language and Style of Your Resume and Cover Letter – Assessment.

**Presentation Skills:** Oral presentation and public speaking skills; business presentations. – Understand the Situation – Know Your Tools – Know Yourself – Organize it, Write the Script – Practice – Delivering a Presentation.

**UNIT - V DOMAIN PROFICIENCY****[ 06 ]**

**Digital circuits** - Boolean algebra, logic gates, Combinatorial circuits, Sequential circuits, Sample and hold circuits, ADCs, DACs, Microprocessor (8085).

**Analog Communication** - Random signals and noise, Analog communication systems, AM, FM modulation and Demodulation, Spectral Analysis, super heterodyne receivers, signal-to-noise ratio.

**Digital Communication** - Sample and Hold Circuits, PCM & DPCM, Digital modulation techniques ASK, FSK, PSK, bandwidth consideration and probability of error calculations, Basics of TDMA, FDMA and CDMA and GSM.

**Total (L= 45, T = 0 ) = 45 Periods****Text Books :**

- 1 Dr.R.S.Aggarwal, Quantitative Aptitude, S. Chand & Company Limited, New Delhi, Sixteenth Edition, 2018.
- 2 Dr.R.S.Aggarwal, A Modern Approach to Verbal & Non -Verbal Reasoning, S. Chand & Company Limited, New Delhi, Fourth Edition, 2015.

**Reference Books :**

- 1 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2005.
- 2 Abhijit Guha, Quantitative Aptitude, TMH, New Delhi, Third Edition, 2016.
- 3 M.B. Lal, Goswami Objective Instant Arithmetic, Upkar Publications, Delhi, Second Edition, 2012.
- 4 ECE for Gate by Kishore Kashyap, McGraw-Hill Education – Europe, 2020.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**  
**CO-PO MAPPING**

**Semester VI**

**Regulation: R 2020**

**Course Code: 20HR654**

**Course Name: CAREER DEVELOPMENT  
SKILLS – IV**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	<i>Develop the basic grammatical rules for written and oral communication.</i>	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO2:	<i>Enhance their skills on quantitative aptitude.</i>	1	-	-	-	-	-	-	-	2	3	-	3	-	-
CO3:	<i>Understand the data interpretation and analysis by using various graphs.</i>	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO4:	<i>Enhance the skills in resume writing and presentation.</i>	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO5:	<i>Develop the comprehension Skills in core subjects.</i>	-	-	-	-	-	-	-	-	2	3	-	3	2	-
<b>Average</b>		<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>2</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous)				R 2020					
SEMESTER - VII									
20EC711		WIRELESS AND CELLULAR COMMUNICATION				L	T	P	C
						3	0	0	3
<b>Prerequisite:</b> <i>Digital Communication Systems</i>									
<b>Course Outcomes : On successful completion of the course, the student will be able to</b>						<b>Cognitive Level</b>			
CO1:		Summarize the evolution of wireless systems.				Understand			
CO2:		Describe the fundamentals of cellular concepts.				Understand			
CO3:		Explain the types of accessing techniques.				Understand			
CO4:		Identify the various diversity schemes and spread spectrum.				Understand			
CO5:		Discuss the architecture and services of Wireless LAN.				Understand			
<b>UNIT - I</b>		<b>WIRELESS COMMUNICATION SYSTEMS</b>						<b>[ 09 ]</b>	
Generation of wireless communication systems: 2G, 3G, 4G and 5G - Examples of wireless systems: Cordless, Paging system and Cellular telephone system - Comparison of wireless system - Personal communication system.									
<b>UNIT - II</b>		<b>CELLULAR FUNDAMENTALS</b>						<b>[ 09 ]</b>	
Frequency reuse - Handoff - Channel assignment - Interference - Improving coverage and capacity in cellular systems - Radio propagation mechanisms: Free space propagation and two ray ground reflection model.									
<b>UNIT - III</b>		<b>WIRELESS ACCESS SYSTEMS</b>						<b>[ 09 ]</b>	
Access methods: TDMA, FDMA, CDMA and CSMA - Capacity of CDMA and SDMA - OFDM - MIMO - Future wireless systems: Introduction to Front Haul and Back Haul.									
<b>UNIT - IV</b>		<b>ANTENNA DIVERSITY AND SPREAD SPECTRUM</b>						<b>[ 09 ]</b>	
Diversity: Space, Time, Polarization and Frequency - Selection diversity improvement - Combining techniques: Selective diversity combining, maximal ratio, equal gain combining, feed forward and feedback combining - Spread spectrum: Basic principles, direct sequence spread spectrum, frequency hopping spread spectrum.									
<b>UNIT - V</b>		<b>WIRELESS LAN</b>						<b>[ 09 ]</b>	
Fundamentals of WLAN - IEEE 802.11n WLAN standard, architecture and services, physical layer - MAC sub layer - MAC management sub layer - IEEE standards - HIPER LAN - Bluetooth - Overview of WIFI - WIMAX - LTE.									
<b>Total (L:45) = 45 Periods</b>									
<b>Text Books :</b>									
1		Rappaport.T.S, Wireless communications, Pearson Education, Bangalore, Second edition, 2014.							
2		David TSE and Pramod Viswanath, Fundamentals of Wireless Communication, Cambridge University Press, First edition 2005.							
<b>Reference Books :</b>									
1		Jochen Schiller, Mobile Communications, Pearson Education, Bengaluru, Second edition, 2017.							
2		KavethPahlavan and Prashant Krishnamurthy, Principles of Wireless Networks, John Wiley & Sons Ltd, Atrium southern gate chichester, Second edition, 2013.							
3		Simon Haykin and Michael Moher, Modern Wireless Communication, Pearson Education, Bengaluru, First edition, 2011.							
4		Kazi Mohammed Saidul Hug and Jonathan Rodriguez, Back hauling/Front hauling for future wireless systems, John Wiley & Sons Ltd, Atrium southern gate chichester, First edition, 2017.							

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code:20EC711

Course Name: **WIRELESS AND CELLULAR  
COMMUNICATION**

**CO PO MAPPING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	<i>Summarize the evolution of wireless systems.</i>	3	3	3	-	-	3	2	-	-	-	-	-	-	3
2	<i>Describe the fundamentals of cellular concepts.</i>	3	3	3	-	-	3	2	-	-	-	-	-	-	3
3	<i>Explain the types of accessing techniques.</i>	3	3	3	-	-	3	2	-	-	-	-	-	-	3
4	<i>Identify the various diversity schemes and spread spectrum.</i>	3	3	3	-	-	3	2	-	-	-	-	-	-	3
5	<i>Discuss the architecture and services of Wireless LAN.</i>	3	3	3	-	-	3	2	-	-	-	-	-	-	3
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

## SEMESTER - VII

20EC712	RF AND MICROWAVE ENGINEERING	L	T	P	C
		3	0	0	3

**Prerequisite:** *Electronic Devices and Circuits*

**Course Outcomes :** *On completion of this course, the student will be able to*

**Cognitive Level**

CO1: *Describe the Z, Y, h, ABCD and S parameters for two port network.*

*Understand*

CO2: *Elaborate the process of microwave signal generation using Reflex klystron, TWTA and Magnetron.*

*Understand*

CO3: *Describe the characteristics of passive and active microwave devices.*

*Understand*

CO4: *Compute the stability for microwave amplifier and design of matching networks.*

*Apply*

CO5: *Measure the power, impedance, VSWR and S-parameters using microwave measuring instruments.*

*Understand*

#### UNIT - I TWO PORT NETWORK PARAMETERS

[ 09 ]

Review of low frequency parameters: Impedance, Admittance, Hybrid and ABCD parameters - Different types of interconnections in two port network - High frequency parameters: Formulation of S parameter for two port network and multiport network - Properties of S parameters - Reciprocal and lossless networks - Transmission matrix - RF behavior of resistors, capacitors and inductors.

#### UNIT - II MICROWAVE TUBES

[ 09 ]

Two cavity klystron: Transit time effect, velocity modulation, current modulation and bunching - Reflex klystron - Slow wave structures - Helix traveling wave tube, its analysis and gain considerations - Magnetron: Operation of Cylindrical magnetron, Hull cutoff magnetic and Hull cutoff voltage Equation.

#### UNIT - III MICROWAVE COMPONENTS AND DEVICES

[ 09 ]

Terminations, Attenuators, Phase shifters, Power dividers, Circulator, Isolators - S matrix of power dividers and directional coupler- Rat race coupler - Impedance matching devices: Crystal diode, Schottky diode, PIN diode, Gunn diode, READ diode and IMPATT diode.

#### UNIT - IV RF AMPLIFIER AND MATCHING NETWORKS

[ 09 ]

Characteristics of amplifiers - Amplifier power relations - Stability considerations - Stabilization methods - Constant VSWR circles - Constant Noise figure circles - Broadband, high power and multistage amplifiers - Matching Networks: Impedance matching using discrete components - Two component matching networks - Frequency response and quality factor - T and Pi matching networks - Micro strip line matching networks - Single stub and Double stub matching networks.

#### UNIT - V MICROWAVE MEASUREMENTS

[ 09 ]

Measuring instruments: VSWR meter, Power meter, Spectrum analyzer, Network analyzer - Measurement of impedance, frequency, Power, VSWR, Q-factor, dielectric constant, scattering coefficients, attenuation, S-parameters.

**Total (L:45) = 45 Periods**

#### Text Books:

- 1 Samuel Y.Liao, *Microwave Devices and Circuits*, Pearson Education Inc., New Delhi, Third edition, 2012.
- 2 Reinhold Ludwig and Gene Bogdanov, *RF Circuit Design: Theory and Applications*, Pearson Education Inc., New Delhi, Second edition, 2012.

#### Reference Books:

- 1 David M.Pozar, *Microwave Engineering*, Wiley India (P) Ltd, New Delhi, Fourth edition, 2011.
- 2 S.Vasuki, D.Margaret Helena and R.Rajeswari, *Microwave Engineering*, McGraw Hill Education, New York, First edition, 2015.
- 3 Annapurna Das and Sisir K Das, *Microwave Engineering*, Tata McGraw Hill, New Delhi, Second edition, 2012.
- 4 Thomas H Lee, *Planar Microwave Engineering: A Practical Guide to Theory, Measurements and Circuits*, Cambridge University Press, United Kingdom, First edition, 2010.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code:20EC712

Course Name: RF AND MICROWAVE ENGINEERING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	<i>Describe the Z, Y, h, ABCD and S parameters for two port network.</i>	3	3	2	2	-	-	-	-	-	-	-	2	3	3
2	<i>Elaborate the process of microwave signal generation using Reflex klystron, TWTA and Magnetron.</i>	3	3	2	2	-	-	-	-	-	-	-	2	3	3
3	<i>Describe the characteristics of passive and active microwave devices.</i>	3	3	2	2	-	-	-	-	-	-	-	2	3	3
4	<i>Compute the stability for microwave amplifier and design of matching networks.</i>	3	3	3	2	-	-	-	-	-	-	-	2	3	3
5	<i>Measure the power, impedance, VSWR and S-parameters using microwave measuring instruments.</i>	3	3	2	2	-	-	-	-	-	-	-	2	3	3
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>3</b>

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

## SEMESTER - VII

20EC713

## FIBER OPTIC COMMUNICATION

L	T	P	C
3	0	0	3

**Prerequisite:** Nil**Course Outcomes:** On successful completion of the course, the student will be able to**Cognitive Level**

CO1: Elaborate the concepts of optical fiber waveguide modes, configurations, structures and the measurement of attenuation, numerical aperture and fiber diameter.	Understand
CO2: Compute the losses due to scattering, absorption, fiber bend and nonlinear effects in optical fibers.	Apply
CO3: Interpret the characteristics of LEDs and Laser sources and explain about power launching and lensing.	Understand
CO4: Interpret the characteristics of optical detectors and describe the receiver operation.	Understand
CO5: Describe the principles of coherent and phase modulated optical fiber systems.	Understand

**UNIT - I OPTICAL FIBER WAVEGUIDES [ 09 ]**

Ray theory transmission: Total internal reflection, acceptance angle, numerical aperture, skew rays - Electromagnetic mode theory of optical propagation: EM wave, modes in planar guide, phase and group velocity - Cylindrical fibers - SM fibers - Fiber attenuation measurements - Fiber numerical aperture measurements - Fiber diameter measurements.

**UNIT - II SIGNAL DEGRADATION IN OPTICAL FIBERS [ 09 ]**

Attenuation - Material absorption losses in silica glass fibers - Linear and nonlinear scattering losses - Fiber bend loss - Mid-band and far-band infrared transmission - Intra and intermodal dispersion - Overall fiber dispersion - Polarization - Nonlinear effects - Optical fiber connections: Fiber alignment and joint losses, fiber splices, fiber connectors, fiber couplers.

**UNIT - III OPTICAL SOURCES [ 09 ]**

LEDs - LASER diodes: Semiconductor laser diode, fabry - perot laser, distributed feedback lasers, modulation of laser diodes, temperature effects - Power launching and coupling: Source to fiber power launching, lensing scheme for coupling improvement, LED coupling to single mode fibers.

**UNIT - IV OPTICAL RECEIVER [ 09 ]**

Optical detectors: PIN photo detector, avalanche photodiodes, construction, characteristics and properties - Photo detector noise: Noise sources, signal to noise ratio, detector response time, comparison of photo detector - Fundamental receiver operation: Digital signal transmission, error sources - Front end amplifier - Probability of error - Quantum limit.

**UNIT - V COHERENT AND PHASE MODULATED OPTICAL FIBER SYSTEMS [ 09 ]**

Basic Coherent Systems – coherent principles – Practical constraints of coherent transmission – Modulation Formats – Demodulation schemes – DPSK – Receiver sensitivities – Multicarrier systems.

**Total (L: 45) = 45 Periods****Text Books:**

- 1 Gerd Keiser, Optical Fiber Communication, McGraw Hill, New York, Fifth edition, 2017.
- 2 John M. Senior, Optical Fiber Communication, Pearson Education, Noida, Third edition, 2009.

**Reference Books:**

- 1 Govind P.Agrawal, Fiber-optic communication systems, Wiley & sons, New Jersey, Fourth edition, 2010.
- 2 Harry J.R Dutton, Understanding Optical Communications, IBM Corporation, International Technical Support Organization, New York, First edition, 1998.
- 3 J.Gower, Optical Communication System, Prentice Hall of India, New Delhi, Second edition, 2003.
- 4 R.P. Khare, Fiber Optics and Optoelectronics, Oxford University Press, London, First edition, 2004.

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20EC713

Course Name: FIBER OPTIC COMMUNICATION

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	<i>Elaborate the concepts of optical fiber waveguide modes, configurations, structures and the measurement of attenuation, numerical aperture and fiber diameter.</i>	3	3	1	-	-	-	-	-	-	-	-	-	3	-
2	<i>Compute the losses due to scattering, absorption, fiber bend and nonlinear effects in optical fibers.</i>	3	3	3	-	-	-	-	-	-	-	-	-	3	-
3	<i>Interpret the characteristics of LEDs and Laser sources and explain about power launching and lensing.</i>	3	3	1	-	-	-	-	-	-	-	-	-	3	-
4	<i>Interpret the characteristics of optical detectors and describe the receiver operation.</i>	3	3	1	-	-	-	-	-	-	-	-	-	3	-
5	<i>Describe the principles of coherent and phase modulated optical fiber systems.</i>	3	3	1	-	-	-	-	-	-	-	-	-	3	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



## SEMESTER - VII

20EC721	RF, MICROWAVE AND OPTIC LABORATORY	L	T	P	C
		0	0	3	1

**Prerequisite:** Nil

**Course Outcomes : On successful completion of the course, the student will be able to** **Cognitive Level**

CO1:	Measure the characteristics of RF Amplifiers, mixers and band pass filters using spectrum analyzer and network analyzer.	Apply
CO2:	Measure the mode characteristics, VSWR, Wavelength and frequency of Reflex Klystron and Gunn diode.	Apply
CO3:	Compute the coupling coefficient of directional coupler and measure the radiation pattern of Horn antenna.	Apply
CO4:	Perform the data transmission in analog and digital form through optical fiber also measure the numerical aperture and bending losses.	Apply
CO5:	Obtain the characteristics of optical sources like LASER, LED and measure the BER and eye pattern for fiber cable.	Apply

**List of Experiments:**

**RF Experiments:**

1. Characteristics of RF circuits using spectrum analyzer
2. Study of frequency response of band pass filter
3. Design of Micro Strip Patch Antenna using HFSS - Study Experiments

**Microwave Experiments:**

1. Characteristics of Reflex klystron and Gunn diode oscillator
2. VSWR Measurements and determination of terminated impedance
3. Guide wavelength and frequency
4. Directivity and Coupling coefficient of Directional coupler
5. Radiation pattern and Gain measurement of Horn antenna

**Optical Experiments:**

1. Analog and digital link using Fiber optical cable
2. Numerical aperture of fiber cables
3. Bending losses
4. DC characteristics of LED and VI characteristics of LASER diode
5. BER and Eye pattern

**Total (P:45) = 45 Periods**

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20EC721

Course Name: RF, MICROWAVE AND OPTIC LABORATORY

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	Measure the characteristics of RF Amplifiers, mixers and band pass filters using spectrum analyzer and network analyzer.	3	3	2	-	-	-	-	-	3	-	-	1	3	1
2	Measure the mode characteristics, VSWR, Wavelength and frequency of Reflex Klystron and Gunn diode.	3	3	2	-	-	-	-	-	3	-	-	1	3	1
3	Compute the coupling coefficient of directional coupler and measure the radiation pattern of Horn antenna.	3	3	2	-	-	-	-	-	3	-	-	1	3	1
4	Perform the data transmission in analog and digital form through optical fiber also measure the numerical aperture and bending losses.	3	3	2	-	-	-	-	-	3	-	-	1	3	1
5	Obtain the characteristics of optical sources like LASER, LED and measure the BER and eye pattern for fiber cable.	3	3	2	-	-	-	-	-	3	-	-	1	3	1
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>3</b>	<b>1</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

## SEMESTER - VII

20EC722	PROJECT WORK PHASE I	L	T	P	C
		0	0	6	3

**Prerequisite:** Nil

**Course Outcomes : On successful completion of the course, the student will be able to** **Cognitive Level**

CO1:	Identify, analyze, interpret and formulate the problem and conceptualize the methodology of the project in research areas of the department interests or of Industrial importance.	Apply
CO2:	Solve a specific problem right from its identification and literature review till the successful solution of the same.	Apply
CO3:	Apply the theoretical concepts to solve real time problems with teamwork and multi-disciplinary approach.	Apply
CO4:	Design /develop/conduct experiment and document the results by using modern tools/methods.	Apply
CO5:	Prepare a good project report and be able to present the ideas with clarity.	Apply

**The students should adhere the following Guidelines:**

1. To start with literature review about the proposed idea of the project and executing the same in consultation with the project guide/project coordinator/Industry experts.
2. A detailed analysis/modeling/simulation/design/problem solving/experiment is must to complete and an effort leading to paper publication or patenting is desired.
3. The progress of the project work phase I is evaluated based on a minimum of three reviews and the review committee may be constituted by the Head of the Department.
4. A project work phase I report is required to be submitted at the end of the semester in the prescribed format.

The project work phase I is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**Total (P:45) = 45 Periods**

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20EC722

Course Name: PROJECT WORK PHASE I

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	Identify, analyze, interpret and formulate the problem and conceptualize the methodology of the project in research areas of the department interests or of Industrial importance.	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	<i>Solve a specific problem right from its identification and literature review till the successful solution of the same.</i>	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	<i>Apply the theoretical concepts to solve real time problems with teamwork and multi-disciplinary approach.</i>	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4	<i>Design /develop/conduct experiment and document the results by using modern tools/methods.</i>	3	3	3	3	3	3	3	3	3	3	3	3	3	3
5	<i>Prepare a good project report and be able to present the ideas with clarity.</i>	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**K.S.R. COLLEGE OF ENGINEERING: TIRUCHENGODE - 637 215**

**(Autonomous)**

**(REGULATIONS 2020)**

## **PROFESSIONAL ELECTIVE COURSES**

**SEMESTER – V**

	L	T	P	C
<b>20IE591</b>				
<b>AUGMENTED INTELLIGENCE LED MANAGED SERVICES (AIMS) – I</b>				
<b>(Common To CS, EC, EE &amp; IT)</b>				
<b>(PROFESSIONAL ELECTIVE - I)</b>	3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes :** On successful completion of the course, the student will be able to

CO1: Identify the operation policies and procedures based on how the organization

CO2: Analysing the procedures to achieve a safe working environment in line with health and safety regulation.

CO3: Apprehend the Key Concepts of Service Management of IT-enabled services

CO4: Recognize an IT Infrastructure and Information Security

CO5: Implement the policies in Microsoft 365.

**Cognitive Level**

Understand

Analyze

Create

Analyze

Understand

**UNIT – I IT OPERATIONS [ 9 ]**

Evolution of Technologies – IT Operations Introduction – Policies – Roles –Support – Procedures for Managing Problems and Incidents

**UNIT– II SECURE WORKING ENVIRONMENT AND ETIQUETTE [ 9 ]**

Introduction – Safety Enforcement – National Standards – Safety Compliance – Health and Safety Awareness – Components of Etiquette – Professionalism and Ethics – Etiquette Standards – Email Communication – Business Meetings, Grooming and Personal Attire – Dining Etiquette

**UNIT– III ITIL [ 9 ]**

Introduction – Understanding ITIL Guiding Principles in an Organization – Optimize and Automate – Four Dimensions of Service Management – Key Activities of the Service Value Chain

**UNIT – IV IT INFRASTRUCTURE AND INFORMATION SECURITY [ 9 ]**

IT Infrastructure – Hardware, Software, Network – IT Infrastructure Types – Designing, Maintenance – Risks faced by Computer Systems and Networks – Analyzing Security Problems – Standard Security Mechanism

**UNIT – V AMS AND TOOLS [ 9 ]**

Introduction – Support Models – Activities Type – Audits – Microsoft 365 – Domain Management – Licensing – Managing Teams – Meeting Policies – Messaging Policies

**Total = 45 Periods**

**Text Books :**

- 1 Eric N. Smith, Workplace Security Essentials. A Guide for Helping Organizations Create Safe Work Environments, Butterworth Heinemann, Elsevier, United States of America, 2014
2. AXELOS, ITIL Foundation ITIL 4 Edition, AXELO Limited, London, Second Edition, 2019

**Reference Books :**

- 1 John R. Vacca, Cyber Security and IT Infrastructure Protection, Syngress, ELSEVIER, United States of America ,First Edition, 2014
- 2 <https://docs.microsoft.com/en-us/learn/m365/>

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20IE591

Course Name: **AUGMENTED INTELLIGENCE LED  
MANAGED SERVICES (AIMS) – I**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Identify the operation policies and procedures based on how the organization</i>	3	3	3	1	1	2	2	1	3	3	3	3	3	3
CO2	<i>Analysing the procedures to achieve a safe working environment in line with health and safety regulation.</i>	3	3	1	2	-	2	2	3	2	3	2	2	2	2
CO3	<i>Apprehend the Key Concepts of Service Management of IT-enabled services</i>	3	-	3	3	3	1	1	1	2	3	1	2	3	3
CO4	<i>Recognize an IT Infrastructure and Information Security</i>	3	3	3	3	-	3	2	3	2	3	1	1	2	3
CO5	<i>Implement the policies in Microsoft 365.</i>	3	2	1	1	1	-	1	-	1	1	2	3	3	3
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**SEMESTER – V**

20HS001	<b>PRINCIPLES OF MANAGEMENT (Common to All Branches)</b>	L 3	T 0	P 0	C 3
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<b>Course Outcomes: On Completion of this course, the student will be able to</b>	<b>Cognitive Level</b>
CO1 Explain the fundamentals of Management thoughts and the conceptual frame work of Management	Understand
CO2 Discuss the various concepts of planning, MBO and Strategy to help solving managerial problems	Understand
CO3 Explain the concepts of organizing, Delegation and Decision-making.	Understand
CO4 Describe the management concepts and styles in Leading.	Understand
CO5 Illustrate the various controlling and emerging concepts in management thought and philosophy	Understand

**UNIT - I OVERVIEW OF MANAGEMENT [09]**

Definition of Management – Importance of management – Management functions – Levels of management – Role of managers – Management a science or an art – Evolution of Management thought: Scientific management and Administrative Principles of management – Ethical issues in Management.

**UNIT - II PLANNING [09]**

Planning: Meaning, purpose, Steps and Types of Plans - Management by objectives (MBO) – Decision Making: Types of Decisions, Steps in Rational Decision making, Common difficulties in Management Decision Making.

**UNIT – III ORGANISING [09]**

Nature and purpose of organizing : Organization structure, Process and Principles of organizing – Line & Staff authority – Departmentation – Span of Control – Centralization and Decentralization – Delegation of authority – Staffing : Sources of Recruitment, Selection process – Training methods – Performance appraisal methods.

**UNIT - IV DIRECTING [09]**

Creativity and Innovation – Motivation and Satisfaction: Motivation Theories – Leadership: Leadership theories and Styles – Communication: Barriers to communication, Principles of effective Communication

**UNIT - V CONTROLLING [09]**

Steps in a control Process: Need for control system, Budgetary and Non-Budgetary control techniques, Problems of the control system, Essentials of effective control system, and Benefits of control.

**Total (L: 45 T: 0) = 45 Periods**

**Text Books :**

1. L.M.Prasad, Principles and Practices of Management, Sultan Chand & Sons, New Delhi, Eleventh edition, 2015.
2. P.C.Tripathi and Reddy Principles of Management, McGraw Hill, New Delhi, Eighth edition, 2015.

**Reference Books :**

1. Hellriegel, Slocum & Jackson, Management A Competency Based Approach, Thomson South Western, London, Fifteenth edition, 2017.
2. Harold Koontz, Heinz Wehrich and mark V Cannice, Management – A Global Entrepreneurial Perspective, Tata McGraw Hill, New Delhi, Twelveth edition, 2014.
3. Andrew J. Dubrin, Essentials of Management, Thomson Southwestern, London, Tenth edition, 2014.
4. Robbins S.P., Fundamentals of Management, Pearson, New Delhi, Second edition, 2003



**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF MANAGEMENT STUDIES**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20HS001

Course Name : Principles of Management

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Explain the fundamentals of Management thoughts and the conceptual frame work of Management</i>	-	-	-	-	-	1	1	3	1	2	3	2	-	-
CO2	<i>Discuss the various concepts of planning, MBO and Strategy to help solving managerial problems</i>	-	-	-	-	-	1	1	3	1	2	3	2	-	-
CO3	<i>Explain the concepts of organizing, Delegation and Decision-making.</i>	-	-	-	-	-	1	1	3	1	2	3	2	-	-
CO4	<i>Describe the management concepts and styles in Leading.</i>	-	-	-	-	-	1	1	3	1	2	3	2	-	-
CO5	<i>Illustrate the various controlling and emerging concepts in management thought and philosophy</i>	-	-	-	-	-	1	1	3	1	2	3	2	-	-
<b>Round off Average</b>		-	-	-	-	-	1	1	3	1	2	3	2	-	-

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

**K.S.R. COLLEGE OF ENGINEERING (Autonomous)  
SEMESTER – V**

**R 2020**

**20EC561**

**ADVANCED DIGITAL SYSTEMS DESIGN  
(PROFESSIONAL ELECTIVE – I)**

L	T	P	C
3	0	0	3

**Prerequisite:** *Digital Electronics*

**Course Outcomes: On Completion of this course , the student will be able to**

**Cognitive level**

CO1	Analyze and design synchronous sequential circuits.	Analyze
CO2	Analyze and design asynchronous sequential circuits	Analyze
CO3	Describe the architecture of programmable logic devices and design digital circuits using programmable devices.	Apply
CO4	Demonstrate and use programming tools for implementing digital circuits of industry standards.	Apply
CO5	Illustrate about different fault models and fault diagnosis.	Apply

**UNIT – I SEQUENTIAL CIRCUIT DESIGN [ 9 ]**

*Analysis and modeling of Clocked Synchronous Sequential Network (CSSN): State diagram, state table, state table assignment and reduction - Design of synchronous sequential circuit - Design of iterative circuit - ASM chart and realization using ASM.*

**UNIT – II ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN [ 9 ]**

*Analysis of Asynchronous Sequential Circuit (ASC) - Flow table reduction - Races in ASC - State assignment and transition table - Design of ASC - Static, dynamic and essential hazards - Data synchronizers - Mixed operating mode asynchronous circuits - Design of vending machine controller.*

**UNIT – III SYNCHRONOUS DESIGN USING PROGRAMMABLE DEVICES [ 9 ]**

*Programmable logic device families - Designing a synchronous sequential circuit using PLA/PAL - Realization of finite state machine using PLD - FPGA - Xilinx FPGA - Xilinx 4000.*

**UNIT – IV SYSTEM DESIGN USING VERILOG HDL [ 9 ]**

*Hardware modeling with Verilog HDL - Data types and operators for modeling in Verilog HDL - Behavioural descriptions in Verilog HDL - HDL based synthesis - Synthesis of finite state machines - Structural modeling - Compilation and simulation of Verilog code - Test bench - Realization of combinational and sequential circuit using Verilog.*

**UNIT – V FAULT DIAGNOSIS AND TESTABILITY ALGORITHMS [ 9 ]**

*Fault table method - Path sensitization method - Boolean difference method - Kohavi algorithm - Tolerance techniques - The Compact Algorithm - Fault in PLA - Test generation - Masking cycle - DFT schemes - Built in self-test.*

**Total = 45 Periods**

**Text Books :**

- 1 Charles H. Roth Jr., Larry L Kinney, Fundamentals of Logic design, Cengage Learning, Enhanced Edition, 2020.
- 2 Nripendra N Biswas, Logic Design Theory, Prentice Hall of India, 2010.

**Reference Books :**

- 1 Donald G. Givone, Digital principles and Design, Tata McGraw Hill, 21st Reprint, 2012
- 2 Stephen Brown and Zvonk Vranesic, Fundamentals of Digital Logic with VHDL Design, TMH, 2004.
- 3 S. Palnitkar, Verilog HDL – A Guide to Digital Design and Synthesis, Pearson, 2003.
- 4 Parag K Lala, Digital System design using PLD, BS Publications, 2003.
- 5 John M Yarbrough, Digital Logic applications and Design, Thomson Learning, 9th Reprint, 2012.
- 6 <https://www.ee.usyd.edu/>
- 7 <https://www.cse.iitb.ac.in/>

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC561

Course Name : ADVANCED DIGITAL SYSTEMS DESIGN

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Analyze and design synchronous sequential circuits.	3	3	2	2	2							2	3	2
CO2	Analyze and design asynchronous sequential circuits	3	3	2	2	2							2	3	2
CO3	Describe the architecture of programmable logic devices and design digital circuits using programmable devices.	3	3	2	2	2							2	3	2
CO4	Demonstrate and use programming tools for implementing digital circuits of industry standards.	3	3	2	2	2							2	3	2
CO5	Illustrate about different fault models and fault diagnosis.	3	3	2	2	2							2	3	2
<b>Average</b>		3	3		2	2							2	3	2

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

## SEMESTER V

20EC562	ELECTRONIC INSTRUMENTATION (Elective )	L	T	P	C
		2	0	1	3

*Prerequisite: NIL*

<b>Course Outcomes: On Completion of this course , the student will be able to</b>		<b>Cognitive level</b>
CO1	Explain different types of electronic meters and their applications.	Understand
CO2	Describe various Digital instruments and its applications.	Understand
CO3	Explain the working of various types of cathode ray oscilloscopes and signal analyzers.	Understand
CO4	Discuss the functional operation of different types of waveform generators.	Understand
CO5	Outline the principle of telemetry, modulation techniques and multiplexing.	Understand

**UNIT – I ELECTRONIC INSTRUMENTS [ 9 ]**

Introduction – Functional elements of a measurement system – Electronic Voltmeter and their advantages – Types: Differential amplifier, rectifier, multirange – True RMS voltmeter – Ohmmeter – Electronic multimeter – Current measurement – Power measurement – Microprocessor based DMM with auto ranging and self-diagnostic features.

**UNIT – II DIGITAL INSTRUMENTS [ 9 ]**

Digital Voltmeter, Types: Ramp, Integrating and Dual slope – Digital Multimeter – Digital Frequency meter – Digital Time Measurement – Digital Tachometer and pH meter – Automation in digital instruments – Microprocessor based instruments.

**UNIT – III CATHODE RAY OSCILLOSCOPE & SIGNAL ANALYZERS [ 9 ]**

General purpose cathode ray oscilloscope – Dual trace, dual beam and sampling oscilloscopes– Analog and digital storage oscilloscope - frequency selective and heterodyne wave analyzer – Harmonic distortion analyzer – Spectrum analyzer.

**UNIT – IV WAVEFORM GENERATORS [ 9 ]**

Wien's bridge and phase shift oscillators – Hartley and crystal oscillators – Square wave and pulse generators – Triangular wave-shape generator – Signal and function generators – Q meter – Electronic Counters.

**UNIT – V TELEMETRY [ 9 ]**

General telemetry system – voltage, current and position telemetry systems – Radio frequency telemetry – Frequency modulation, pulse-amplitude modulation and pulse-code modulation telemetry – Frequency and time multiplexing.

**Total = 45 Periods**

**Text Books :**

- 1 Kalsi, H.S., Electronic Instrumentation, Tata McGraw-Hill, New Delhi, Third Edition, 2017.
- 2 Helfrick, A.D. and Cooper, W.D., Modern Electronic Instrumentation and Measurement Techniques, Pearson India Education , New Delhi, First Edition, 2016.

**Reference Books :**

- 1 David A Bell, Electronic Instrumentation and Measurements, Oxford University Press, London, Third Edition, 2013.
- 2 Prithwiraj Prukait, Budhaditya Biswas, Santanu Das and Chiranjib Koley, Electrical and Electronics Measurement and Instrumentation, Tata McGraw Hill, New Delhi, First Edition, 2013.
- 3 J.J. Carr, Elements of Electronic Instrumentation and Measurement, Pearson Education India, New Delhi, Third Edition, 2011.
- 4 Sawhney, A.K., Electrical, Electronic measurement & Instrumentation, Dhanpat Rai & sons, New Delhi, Eighteenth edition, 2012.

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC562

Course Name : **Electronic Instrumentation**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Explain different types of electronic meters and their applications.</i>	3	3	2	2									3	2
CO2	<i>Describe various Digital instruments and its applications.</i>	3	3	2	2									3	2
CO3	<i>Explain the working of various types of cathode ray oscilloscopes and signal analyzers.</i>	3	3	2	2									3	2
CO4	<i>Discuss the functional operation of different types of waveform generators.</i>	3	3	2	2									3	2
CO5	<i>Outline the principle of telemetry, modulation techniques and multiplexing.</i>	3	3	2	2									3	2
<b>Average</b>		3	3	2	2									3	2

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

	<b>K.S.R. COLLEGE OF ENGINEERING (Autonomous)</b>	<b>R 2020</b>			
<b>20EC661</b>	<b>ELECTRONIC SYSTEM DESIGN (ELECTIVE)</b>	L	T	P	C
		3	0	0	3

**Prerequisite:** NIL

<b>Course Outcomes: On Completion of this course , the student will be able to</b>	<b>Cognitive level</b>
CO1 Design of simple power supplies and amplifiers.	Apply
CO2 Illustrate data acquisition systems.	Understand
CO3 Describe the concept of PCB design methods.	Understand
CO4 Apply RF design methodologies to construct PCB boards.	Apply
CO5 Describe the PCB technology trends	Understand

**UNIT – I DESIGN OF POWER SUPPLIES AND AMPLIFIERS [ 9 ]**

Voltage regulations: Introduction - O/P resistance and load regulation - Types of regulators - Voltage converters. Power amplifiers: Basic consideration - Class A, class B and class AB Power amplifier –SMPS - Power MOSFET.

**UNIT – II DATA ACQUISITION SYSTEMS [ 9 ]**

Digital to analog converters: Introduction, R-2R resistor ladder networks, CMOS current switches, 16-bit monolithic DAC, DAC speed and settling time, Analog to digital converters: ADC transfer characteristic and quantization error, parallel comparator ADC, successive approximation ADC

**UNIT – III PRINTED CIRCUIT BOARD [ 9 ]**

Layout planning: General considerations - PCB sizes - Layout approaches - Layout, General rules and parameters: Resistance, capacitance, inductance, conductor spacing, cooling requirements and package density, layout check.

**UNIT – IV DESIGN RULES FOR DIGITAL & ANALOG CIRCUIT PCB's [ 9 ]**

Digital circuit PCB: Introduction – Reflection - Cross talk - Around and supply line noise - Electromagnetic interference from pulse type EM fields. Analog circuit PCB: Component placing - Signal conductor - Supply and ground conductors.

**UNIT – V PCB TECHNOLOGY TRENDS [ 9 ]**

Introduction - Fine line conductors with ultra-thin copper foil - Multilayer board - Multi wire board - Subtractive additive process - Semi additive process - Additive process - Flexible PCB - Metal core circuit boards - Mechanical milling of PCB

**Total (L: 45) = 45 Periods**

**Text Books :**

- 1 Reinhold Luduig and Pavel Bretchko, "RF Circuit Design – Theory and Applications", Pearson Education, USA Second Edition, 2012.
- 2 Walter C.Bosshart, "Printed circuit Boards – Design and Technology", Tata McGraw-Hill, New Delhi, Second Edition, 2012.

**Reference Books :**

- 1 Keith H.Billings, "Handbook of Switched Mode Power Supplies" McGraw-Hill Publishing Co., New Delhi, Third Edition 2011.
- 2 Michael Jacob, "Applications and Design with Analog Integrated Circuits", PHI, New Delhi, Second Edition, 1999.
- 3 F.H.Mitchell, "Introduction to Electronic Design", Prentice Hall of India, New Delhi, Second Edition, 1992.
- 4 Sydney Soclof, "Applications of Analog Integrated Circuits", Prentice Hall of India, New Delhi, Second Edition 1997.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC661

Course Name : ELECTRONIC SYSTEM DESIGN

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Design of simple power supplies and amplifiers.</i>	3	3	3										3	
CO2	<i>Illustrate data acquisition systems.</i>	3	3	3										3	
CO3	<i>Describe the concept of PCB design methods.</i>	3	3	3										3	
CO4	<i>Apply RF design methodologies to construct PCB boards.</i>	3	3	3										3	
CO5	<i>Describe the PCB technology trends</i>	3	3	3										3	
<b>Average</b>		3	3	3										3	

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

20EC662

## MEDICAL ELECTRONICS

(Elective)

L	T	P	C
3	0	0	3

**Prerequisite:** Measurement and Instrumentation**Course Outcomes: On Completion of this course , the student will be able to****Cognitive level**

CO1	Explain the electrophysiological activity of nerves and cardiopulmonary system of the human body.	Understand
CO2	Illustrate different types of electrodes and transducers used for the bio signal measurement.	Understand
CO3	Outline the procedure used for the measurement of electrical and non-electrical parameters of the human body.	Understand
CO4	Explain the working principle and applications of medical imaging systems.	Understand
CO5	Demonstrate the usage of therapeutic and assisting equipment's in medical applications.	Understand

**UNIT – I ELECTROPHYSIOLOGY****[ 9 ]**

Cell & its structure – Electrical and chemical activities – Action and resting potential – Neurons – Axons – Synapse -CNS – PNS - Propagation of electrical impulses along the nerve – Sodium pump – Cardiopulmonary system – Physiology of heart and lung.

**UNIT – II BIO POTENTIAL ELECTRODES AND TRANSDUCERS****[ 9 ]**

Components of biomedical instrument system – Electrodes: Micro electrodes, Needle electrodes, Surface electrodes – Transducers: Piezoelectric, Ultrasonic – Passive transducers: Resistive, Capacitive, Inductive – Isolation amplifier– Pre-amplifier – Current amplifier – Chopper amplifier.

**UNIT – III INSTRUMENTS USED FOR DIAGNOSIS****[ 9 ]**

ECG – Einthoven triangle – Leads – Electrodes – Measurement of cardiac output, heart rate and heart beat – EEG – EMG EOG– Blood flow measurements – Holter monitor– Respiratory rate measurement – Oximeter–Blood gas analyzer: pH– pCo<sub>2</sub> – pO<sub>2</sub> of blood – Glucometer.

**UNIT – IV MEDICAL IMAGING****[ 9 ]**

Radiographic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography – Different types of bio telemetry systems – Patient monitoring – Sources of electric hazards and safety techniques.

**UNIT – V ASSISTING AND THERAPEUTIC EQUIPMENTS****[ 9 ]**

Pacemaker – Defibrillators – Automated External Defibrillator – Ventilators – Nerve and muscle stimulators – Diathermy – Heart lung machine – Audio meters – Dialysers – Lithotripsy.

**Total = 45 Periods****Text Books :**

- 1 R.S.Khandpur, Handbook of Biomedical Instrumentation, Tata McGraw Hill, Noida, Third Edition, 2014.
- 2 Mandeep Singh, Introduction to Biomedical Instrumentation, PHI Learning Private Ltd, New Delhi, Second Edition, 2014.

**Reference Books :**

- 1 R. Anandanatarajan, Biomedical Instrumentation and Measurements, PHI Learning Private Ltd, New Delhi, Second Edition, 2013
- 2 M.Arumugam, Biomedical Instrumentation, Anuradha Agencies, Tamilnadu, Second Edition, 2002.
- 3 Joseph J. Carr and John M. Brown, Introduction to Biomedical Equipment Technology, Pearson Education, New Delhi, Fourth Edition, 2013.
- 4 Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, Biomedical Instrumentation and Measurements, PHI Learning Private Ltd, New Delhi, Second Edition, 2014.



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**DEPARTMENT OF ELCTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC662

Course Name : **Medical Electronics**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Explain the electrophysiological activity of nerves and cardiopulmonary system of the human body.</i>	3	-										1		2
CO2	<i>Illustrate different types of electrodes and transducers used for the bio signal measurement.</i>	3	-			2							1		2
CO3	<i>Outline the procedure used for the measurement of electrical and non-electrical parameters of the human body.</i>	3	3			3	3	2	3				2		2
CO4	<i>Explain the working principle and applications of medical imaging systems.</i>	3	3			3	3	2	3				2		2
CO5	<i>Demonstrate the usage of therapeutic and assisting equipment's in medical applications.</i>	3	3			3	1	3	3				2		2
<b>Average</b>		3	3			2	2	2	3				2		2

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

## SEMESTER - VI

20EC663	ADVANCED MICROPROCESSORS AND MICROCONTROLLERS (ELECTIVE)	L	T	P	C
		3	0	0	3

**Prerequisite: Microprocessors and Microcontrollers**

**Course Outcomes : On successful completion of the course, the student will be able to** **Cognitive Level**

CO1: *Illustrate the concepts of CISC architecture.* Understand

CO2: *Illustrate the concepts of RISC architecture.* Understand

CO3: *Describe the architectural features and the family of MSP430.* Understand

CO4: *Identify the functions of various peripherals which are interfaced with MSP430.* Understand

CO5: *Develop programs using various instructions of MSP430 for different applications.* Apply

UNIT - I **HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM** [ 09 ]

CPU Architecture- Bus operations – Pipelining – Branch predication – Floating point unit- Operating modes –Paging – Multitasking – Exception and Interrupts – Instruction set – Addressing modes – Programming the Pentium processor.

UNIT - II **HIGH PERFORMANCE RISC ARCHITECTURE – ARM** [ 09 ]

Arcon RISC machine – Architectural inheritance – Core & Architectures - Registers – Pipeline - Interrupts – ARM organization - ARM processor family – Co-processors - ARM instruction set- Thumb instruction set - Instruction cycle timings - The ARM Programmer’s model –ARM Development tools –ARM Assembly language programming - C programming – Optimizing ARM Assembly Code – Optimized primitives.

UNIT - III **MSP430 ARCHITECTURE** [ 09 ]

Introduction – Application areas, The outside view, The inside view - Functional block diagram, Memory, Central Processing Unit, Memory mapped input and output, Clock generator, Exceptions: Interrupts and Resets, MSP430 family.

UNIT - IV **ON CHIP PERIPHERALS, INTERFACING AND APPLICATIONS OF MSP430** [ 09 ]

Watchdog Timer, Timers, Real Time Clock, DAC: Digital-to-Analog Conversion, Direct Memory Access (DMA), LCD Controller, Case studies of applications of MSP 430 data acquisition system

UNIT - V **PROGRAMMING THE MSP430** [ 09 ]

Addressing modes, Instruction set of MSP430, Double operand core instructions, Single operand core instructions (Format II), Program flow control, Emulated instructions, Movement instructions, Implementation of decimal arithmetic, Shift and rotate instructions.

**Total = 45 Periods**

**Text Books :**

- 1 Andrew N.Sloss, Dominic Symes and Chris Wright, “ ARM System Developer’s Guide : Designing and Optimizing System Software”, Morgan Kaufmann Publishers, First edition, 2004.
- 2 K.Uma Rao, Andhe Pallavi, “The 8051 and MSP430 Microcontrollers: Architecture Programming and Applications”, Wiley Publications, 2019

**Reference Books :**

- 1 Daniel Tabak, “Advanced Microprocessors”, McGraw Hill. Inc., Second edition, 2007
- 2 B.B.Brey, “The Intel Microprocessor 8086/8088 /80186/80188, 80286, 80386, 80486 PENTIUM, PENTIUM Pro, PII, PIII IV Architecture, Programming Interfacing”, Pearson Education, Seventh edition, 2010.
- 3 John H Davies, MSP430 Microcontroller Basics, Newnes Publications, Elsevier, 2008.
- 4 Chris Nagy, Embedded Systems Design using TI MSP430 Series, Newnes Publications, Elsevier, 2003.
- 5 User Guide from Texas Instruments

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**DEPARTMENT OF ELCTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20EC663

Course Name : **ADVANCED MICROPROCESSORS AND MICROCONTROLLERS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Illustrate the concepts of CISC architecture.</i>	3	3	3	-	2	-	-	-	-	-	-	1	3	2
CO2	<i>Illustrate the concepts of RISC architecture.</i>	3	3	3	-	2	-	-	-	-	-	-	1	3	2
CO3	<i>Describe the architectural features and the family of MSP430.</i>	3	3	3	-	2	-	-	-	-	-	-	1	3	2
CO4	<i>Identify the functions of various peripherals which are interfaced with MSP430.</i>	3	3	3	-	2	-	-	-	-	-	-	1	3	2
CO5	<i>Develop programs using various instructions of MSP430 for different applications.</i>	3	3	3	-	2	-	-	-	-	-	-	1	3	2
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>3</b>	<b>2</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

## SEMESTER - VI

20EC664	<b>INFORMATION THEORY AND CODING (ELECTIVE)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Prerequisite:** Nil

**Course Outcomes :** On successful completion of the course, the student will be able to

**Cognitive Level**

CO1:	<i>Illustrate the concepts of information theory.</i>	Apply
CO2:	<i>Discuss the source coding methods used in image and video broadcasting.</i>	Apply
CO3:	<i>Infer the methodology of channel coding.</i>	Apply
CO4:	<i>Describe the various block codes for error correcting and detecting process.</i>	Analyze
CO5:	<i>Describe the various convolutional codes for error correcting and detecting process.</i>	Apply

**UNIT - I INFORMATION THEORY [ 9 ]**

Information – Information rate - Entropy – Classification of codes – Kraft McMillan inequality –source coding theorem- Shannon Fano coding - Huffman coding - Extended Huffman coding –joint and conditional entropies- Mutual Information- Discrete memory less channels: BSC, BEC and channel capacity - Shannon limit.

**UNIT - II SOURCE CODING [ 9 ]**

Text: Adaptive Huffman coding, arithmetic coding and latex format - Audio: Perceptual coding, masking techniques, psychoacoustic model, MPEG audio layers - I,II & III - Dolby AC3 – Image and video formats: GIF, TIFF, BMP, PNG, GIF, CIF & QCIF – Image compression: JPEG – Video compression: Principles-I,B,P frames and motion estimation.

**UNIT - III CHANNEL CODING [ 9 ]**

Characteristics of speech signals - Quantization techniques – Channel vocoder - Linear predictive coding –Information capacity theorem – Implication of the information capacity theorem- Information capacity of colored noise channel – Rate distortion theory - Data compression.

**UNIT - IV BLOCK CODES [ 9 ]**

Hamming codes: Hamming weight, hamming distance, minimum distance decoding – Single parity Codes- Repetition codes: Linear block codes, cyclic codes – Syndrome calculation, encoder and decoder - CRC.

**UNIT - V CONVOLUTIONAL CODES [ 9 ]**

Convolutional codes – Code tree, trellis, state diagram - Encoding - Decoding: Sequential search and Viterbi algorithm - Principle of turbo coding – Other codes: RS code, Golay code and Burst error correcting code.

**Total (L: 45 ) = 45Periods**

**Text Books :**

- 1 R. Bose, Information Theory, Coding and Cryptography, Tata McGraw Hill, New Delhi, Third Edition, 2016
- 2 Fred Halsall, Multimedia Communications: Applications, Networks, Protocols and Standards, Pearson Education Asia, Fourth Edition, 2009.

**Reference Books :**

- 1 K.Sayood, Introduction to Data Compression, Elsevier, Netherlands, Fifth Edition, 2017.
- 2 S.Gravano, Introduction to Error Control Codes, Oxford University Press, England, First Edition, 2007.
- 3 Amitabha Bhattacharya, Digital Communications, Tata McGraw Hill, New Delhi, First Edition, 2013.
- 4 Theodore Rappaport, Wireless Communications - Principles and Practice, Pearson Education, Bengaluru, Second Edition, 2012.
- 5 <https://nptel.ac.in/courses/117/101/117101053/>.

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**DEPARTMENT OF ELCETRONICS AND COMMUNICATION ENGINEERING**  
**CO - PO MAPPING**

Regulation : R 2020

Course Code: 20EC664

Course Name : Information Theory and Coding

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Illustrate the concepts of information theory</i>	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO2	<i>Discuss the source coding methods used in image and video broadcasting</i>	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO3	<i>Infer the methodology of channel coding</i>	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO4	<i>Describe the various block codes for error correcting and detecting process</i>	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO5	<i>Describe the various convolutional codes for error correcting and detecting process.</i>	3	3	3	-	-	-	-	-	-	-	-	-	3	-
Average		3	3	3	-	-	-	-	-	-	-	-	-	3	-

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**SEMESTER – V**

<b>20CS601</b>	<b>C# AND .NET FRAMEWORK</b> (Common To CS & EC)	L	T	P	C
		3	0	0	3

**Prerequisite:** Basic Knowledge of object oriented programming

<b>Course Outcomes : On successful completion of the course, the student will be able to</b>	<b>Cognitive Level</b>
CO1: Solve the basic problems using object and classes in C#.	Understand
CO2: Explain the concepts of OOPs.	Understand
CO3: Design application programs using .Net Components.	Apply
CO4: Design website using ASP .Net.	Apply
CO5: Build a server and client with an interface.	Apply

**UNIT - I .NET FRAMEWORK [ 9 ]**

.NET Overview – The Common Language Runtime – .NET Programming – Working with .NET Components – Data and XML – Web Services – Web Forms.

**UNIT – II BASICS OF C# [ 9 ]**

Overview of C# – Literals, Variables and Data types – Operators and Expressions – Decision Making and Branching – Decision Making and Looping – Methods in C# – Handling Arrays – Manipulating Strings – Structures and Enumerations

**UNIT - III OOPs in C# [ 9 ]**

Classes and Objects – Inheritance and Polymorphism – Interface: Multiple Inheritance – Operator Overloading – Delegates and Events – Managing Console I/O Operations – Managing Errors and Exceptions

**UNIT - IV WEB BASED APPLICATION DEVELOPMENT ON .NET [ 9 ]**

Introducing ASP.NET and the .NET Platform – ASP.NET Basics – Constructing ASP.NET Web Pages – Building Web Applications – Using the Validation Controls

**UNIT - V .NET WITH DATABASE CONNECTIVITY [ 9 ]**

Database Design and Development – Speaking SQL – ADO.NET – Displaying Content Using Data Lists – Managing Content Using Grid view and Details View – Advanced Data Access – Security and User Authentication.

**Total = 45 Periods**

**Text Books :**

- 1 Thuan L. Thai and Hoang Lam, .NET Framework Essentials, O'Reilly Media, USA, Third Edition, 2003
- 2 E. Balagurusamy, Programming in C#, Tata McGraw Hill, New Delhi, Third Edition, 2010.

**Reference Books :**

- 1 Cristian Darie, Wyatt Barnett and Tim Posey, Build your own ASP.Net 4 website, Site Point Pvt Ltd, Australia, Fourth Edition, 2011.
- 2 Andrew Troelsen, Pro C# 5.0 and the .net 4.5 frameworks, A press, India, Sixth Edition, 2010.
- 3 Herbert Schildt, The complete reference C# 4.0, Tata McGraw Hill, New Delhi, First Edition, 2010.
- 4 Art Gittleman, Computing with C# & .Net Framework, Jones & Bartlett Publishers, US, Second Edition, 2011.
- 5 nptel.ac.in/courses/105108081/module9/lecture39/lecture.pdf

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**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20CS601

Course Name: C# AND .NET FRAMEWORK

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Solve the basic problems using object and classes in C#.</i>	3	3	3	2	2	-	-	-	2	-	1	1	-	-
CO2	<i>Explain the concepts of OOPs.</i>	3	3	2	1	2	-	-	-	1	-	1	1	-	-
CO3	<i>Design application programs using .Net Components.</i>	3	3	2	2	1	-	-	-	2	-	1	1	-	-
CO4	<i>Design website using ASP .Net.</i>	3	3	3	1	2	-	-	-	2	-	1	1	-	-
CO5	<i>Build a server and client with an interface.</i>	3	3	3	2	1	-	-	-	2	-	1	1	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>1</b>	<b>1</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**SEMESTER - VI**

<b>20IE691</b>	<b>AUGMENTED INTELLIGENCE LED MANAGED SERVICES (AIMS) – II</b> (Common to CS, EC, EE and IT)	L 3	T 0	P 0	C 3
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**Prerequisite:** Basic Knowledge of Augmented Intelligence Led Managed Services (AIMS) – I.

**Course Outcomes : On Completion of this course, the student will be able to**

**Cognitive Level**

CO1: Recognize the essentials of Cloud Computing	Understand
CO2: Identify with the Big Data Platform and create a Hadoop Environment and Generate a Map-Reduce Programming	Apply
CO3: Infer the ML and other AI technologies to implement the application.	Understand
CO4: Apply RPA technologies to automate the identification and resolution of common IT issues.	Apply
CO5: Inspect the life cycle of help desk tickets and fulfilment requests in Service Now.	Apply

**UNIT – I CLOUD COMPUTING [ 9 ]**

Introduction – Characteristics of Cloud computing – Architecture – Types – Service Models – SaaS, IaaS, PaaS – Regions – Cloud Security.

**UNIT– II BIG DATA AND DATA SCIENCE [ 9 ]**

Introduction – Data Science and Challenges – HDFS and Hadoop – Structured and Unstructured data – Processing Big Data – Supervised and Unsupervised Learning – Text Analysis – Data visualization.

**UNIT– III AI/ML AND AIOPS [ 9 ]**

Introduction – Structure of Intelligent Agents – Knowledge and Reasoning – Machine Learning – Deep Learning – Applications of AI – AIOps Technologies – AIOps Benefits – Implementation.

**UNIT – IV ROBOT PROCESS AUTOMATION [ 9 ]**

Introduction – Variables – Control flow – Data Tables and Excel Automation – UI Automation – Selectors – Email Automation.

**UNIT – V SITE RELIABILITY ENGINEERING AND SERVICENOW [ 9 ]**

Introduction – Adopting a DevOps and SRE Model – SRE Vs DevOps – Architecture and Lifecycle – Practices – Error Budgets – Toil Management – DevOps Tools – Introduction to Service Now – Reporting and Managing Issue – Benefits.

**Total = 45 Periods**

**TEXT BOOKS :**

- 1 Daniel Kirsch, Judith Hurwitz, Cloud Computing for Dummies, John Wiley & Sons, Second Edition, 2020
- 2 EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley, First Edition, 2015.

**REFERENCE BOOKS :**

- 1 Ui Path, RPA Design and Development, UiPath Academic Alliance Resource
- 2 Shamayel Mohammed Farooqui, Vishnu Vardhan Chikoti, Hands-on Site Reliability Engineering, PBP, First Edition, 2021
- 3 Tim Woodruff, Learning Service Now, Packt Publishing Limited, Second Edition, 2018., Learning Service Now, Packt Publishing Limited, Second Edition, 2018.



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**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20IE691

Course Name: **AUGMENTED INTELLIGENCE LED MANAGED SERVICES (AIMS) – II**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Recognize the essentials of Cloud Computing	3	3	2	-	2	-	-	-	2	-	-	2	-	-
CO2	Identify with the Big Data Platform and create a Hadoop Environment and Generate a Map-Reduce Programming	3	3	3	-	3	-	-	-	1	-	-	3	-	-
CO3	Infer the ML and other AI technologies to implement the application	2	2	3	-	2	-	-	-	1	-	-	2	-	-
CO4	Apply RPA technologies to automate the identification and resolution of common IT issues.	2	2	2	-	3	-	-	-	1	-	-	3	-	-
CO5	Inspect the life cycle of help desk tickets and fulfilment requests in Service Now.	3	2	3	-	3	-	-	-	3	-	-	2	-	-
<b>Average</b>		<b>3</b>	<b>2</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

## SEMESTER - VII

20EC761	<b>COMMUNICATION AND SWITCHING NETWORKS (PROFESSIONAL ELECTIVE – III)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Prerequisite:** Analog communication systems

**Course Outcomes:** On successful completion of the course, the student will be able to

**Cognitive Level**

CO1: Summarize the different types of switching systems.	Understand
CO2: Differentiate the types digital switching.	Understand
CO3: Describe the network synchronization control and management.	Understand
CO4: Classify the types of telephone operations.	Understand
CO5: Identify the traffic characterization and analysis.	Apply

**UNIT - I OVERVIEW OF TELECOMMUNICATION [ 09 ]**

Introduction: Evolution of telecommunication, basics of switching system, manual switching system – Telecommunication networks - Strowger switching systems: Signaling tones, strowger switching components, step-by-step switching, design parameters - Cross bar switching: Touch tone dial telephone, principles of cross bar switching and cross bar switch configurations, Centralized and distributed stored program control, software architecture, application software, enhanced services offered by stored program control.

**UNIT - II DIGITAL SWITCHING [ 09 ]**

Introduction to switching functions: Space division switching - Time division switching - Two dimensional switching: STS switching, TST switching, No-4 ESS Toll switch - Digital cross-connect systems - Digital switching in an analog environment.

**UNIT - III NETWORK SYNCHRONIZATION CONTROL AND MANAGEMENT [ 09 ]**

Timing: Timing recovery, phase locked loop, clock instability, jitter measurements, systematic jitter - Timing inaccuracies: Slips, asynchronous multiplexing - Network synchronization - Network control - Network management.

**UNIT - IV TELEPHONE OPERATIONS [ 09 ]**

Introduction: Subscriber loop system, switching hierarchy and routing, transmission plan, transmission systems, numbering plan, charging plan, signaling techniques - Digital subscriber access: Digital loop carrier systems, universal digital loop carrier systems, integrated digital loop carrier systems, next-generation digital loop carrier systems - Local microwave distribution service - Digital satellite services.

**UNIT - V TRAFFIC ANALYSIS [ 09 ]**

Traffic characterization: Arrival distributions, holding time distributions - Loss systems - Network blocking probabilities: End to End blocking probabilities overflow traffic - Delay systems: Exponential service times, constant service times, finite queues.

**Total (L: 45) = 45 Periods**

**Text Books:**

- 1 John C Bellamy, Digital Telephony, John Wily & Sons, USA, Third Edition, 2009.
- 2 Thiagarajan Visvanathan, Telecommunication Switching Systems and Networks, PHI, New Delhi, Second Edition, 2015.

**Reference Books:**

- 1 J.E.Flood, Telecommunication Switching, Traffic and Networks, Pearson Education Ltd, USA, First Edition, 2016.
- 2 Syed R Ali, Digital Switching Systems, McGraw-Hill, First Edition, Europe, 2017.
- 3 William Stallings, Data and Computer Communications, Prentice Hall, New Delhi, Ninth Edition, 2011.
- 4 John G Van Bose and Fabrizio devetak, Signaling in telecommunication networks, Wiley Inter Science, USA, Second edition, 2007.

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**CO-PO MAPPING**

Regulation: R 2020

Course Code:20EC761

Course Name: COMMUNICATION AND SWITCHING NETWORKS

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	Summarize the different types of switching systems.	3	3	2	-	-	-	-	-	-	-	-	-	2	3
2	Differentiate the types digital switching	3	3	2	-	-	-	-	-	-	-	-	-	2	3
3	Describe the network synchronization control and management.	3	3	2	-	-	-	-	-	-	-	-	-	2	3
4	Classify the types of telephone operations.	3	3	2	-	-	-	-	-	-	-	-	-	2	3
5	Identify the traffic characterization and analysis.	3	3	2	-	-	-	-	-	-	-	-	-	2	3
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>3</b>

1: Slight (Low)    2: Moderate (Medium)    3: Substantial (High)

## SEMESTER - VII

20EC762	DIGITAL COMMUNICATION SYSTEMS II (PROFESSIONAL ELECTIVE – III)	L	T	P	C
		3	0	0	3

**Prerequisite:** Nil

**Course Outcomes:** On successful completion of the course, the student will be able to **Cognitive Level**

CO1: Compute bandwidth and power requirement for BFSK, M-ary PSK and GMSK modulation schemes.	Apply
CO2: Describe OFDM concepts and applications.	Understand
CO3: Elaborate equalization technique algorithms to control ISI in communication systems.	Understand
CO4: Describe the concepts for spread spectrum signals for digital communication.	Understand
CO5: Elaborate the performances of Multi path Fading channels.	Understand

**UNIT - I DIGITAL MODULATION TECHNIQUES [ 09 ]**

Advantages of constant envelope modulation – Binary frequency shift keying - Coherent and non-coherent detection of BFSK - Minimum shift keying - Gaussian minimum shift keying - M-ary phase shift keying - M-ary quadrature amplitude modulation - M-ary frequency shift keying.

**UNIT - II OFDM [ 09 ]**

Generation of subcarriers uses the IFFT - Guard time and cyclic extension - Windowing - OFDM signal processing - Peak power problem - PAP reduction schemes: Clipping - Filtering - Coding and scrambling.

**UNIT - III EQUALIZATION TECHNIQUES [ 09 ]**

Band limited channels - ISI - Nyquist criterion - Controlled ISI - Partial response signals - Equalization algorithms - Viterbi algorithm - Linear equalizer - Decision feedback equalization - Adaptive equalization algorithms.

**UNIT - IV SPREAD SPECTRUM SIGNALS FOR DIGITAL COMMUNICATION [ 09 ]**

Model of spread spectrum digital communication system, Direct sequence spread spectrum signals, Frequency hopped spread spectrum signals, CDMA, Time hopping SS, Synchronization of SS systems.

**UNIT - V DIGITAL COMMUNICATION THROUGH FADING MULTIPATH CHANNELS [ 09 ]**

Characterization of fading multipath channels, The effect of signal characteristics on the choice of a channel model, Frequency nonselective, Slowly fading channel, Diversity techniques for fading multipath channels, Digital signals over a frequency selective, Slowly fading channel.

**Total (L: 45) = 45 Periods**

**Text Books:**

- 1 M.K.Simon, S.M. Hinedi and W.C.Lindsey, Digital Communication Techniques: Signaling and detection, Prentice Hall India, New Delhi, Reprint edition 2003.
- 2 Richard Van Nee & Ramjee Prasad, OFDM for Multimedia Communications, Artech House Publication, London Reprint edition, 2001.

**Reference Books:**

- 1 Simon Haykin, Digital Communications, John Wiley and sons, New Jersey, Fifth edition, 2014,
- 2 John G. Proakis, Digital Communication, McGraw Hill Publication, New Delhi, Second edition, 2001.
- 3 Theodore S.Rappaport, Wireless Communications, Pearson Education, New Delhi, Second edition, 2002.
- 4 Stephen G.Wilson, Digital Modulation and Coding, Pearson Education, New Delhi, First Indian Reprint, 2003.

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**CO-PO MAPPING**

Regulation: R 2020

Course Code:20EC762

Course Name: **DIGITAL COMMUNICATION SYSTEMS II**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	Compute bandwidth and power requirement for BFSK, M-ary PSK and GMSK modulation schemes.	3	3	3	-	-	-	-	-	-	-	-	-	2	3
2	Describe OFDM concepts and applications.	3	3	1	-	-	-	-	-	-	-	-	-	2	3
3	Elaborate equalization technique algorithms to control ISI in communication systems.	3	3	3	-	-	-	-	-	-	-	-	-	2	3
4	Describe the concepts for spread spectrum signals for digital communication.	3	3	3	-	-	-	-	-	-	-	-	-	2	3
5	Elaborate the performances of Multi path Fading channels.	3	3	1	-	-	-	-	-	-	-	-	-	2	3
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>		-	-	-	-	-	-	-	-	<b>2</b>	<b>3</b>

1: Slight (Low)    2: Moderate (Medium)    3: Substantial (High)

## SEMESTER - VII

20EC763	PC HARDWARE, INSTALLATION, TROUBLESHOOTING AND SERVICING (PROFESSIONAL ELECTIVE – III)	L	T	P	C
		3	0	0	3

**Prerequisite:** Nil

**Course Outcomes:** On successful completion of the course, the student will be able to **Cognitive Level**

CO1:	Elaborate the concepts of computer hardware and motherboards.	Understand
CO2:	Interpret the concepts of processors and memory.	Understand
CO3:	Describe the features, working and installation concepts of various storage devices.	Understand
CO4:	Illustrate the type, features, specification, working of various input and output devices.	Understand
CO5:	Identify the steps to assemble and configure computers hardware.	Apply

**UNIT - I                      HARDWARE AND MOTHERBOARDS                      [ 9 ]**

Computer through generations – Basic computer hardware structure - Hardware and software - Different type of computers - Features of computer systems: Features of desktop system, Features of server computer, Features of laptops, Features of tablets - Motherboards: Features, components, form factor, processor support, controller, memory support, graphics support, BIOS - Connectors: Power Supply, IDE and SATA – External devices interfaces – Selection of motherboards – Trouble shooting and maintenance of motherboards.

**UNIT - II                      PROCESSING UNIT AND MEMORY                      [ 9 ]**

Processor features - Developmental stages of CPU - Towards multiple core processors - Processor architectural details - Processor specifications – Installing and uninstalling CPU – CPU overheating issues – Common problems and solutions - Memory: Features, types, working, memory map, installing and uninstalling memory modules, troubleshooting and maintenance of memory.

**UNIT - III                      STORAGE DEVICES                      [ 9 ]**

Storage Devices, Hard Disks: Details, working, feature, installation, selection, specifications, partitioning and formatting, maintenance and troubleshooting – Solid State Drives: Installation, optical storage devices features, working of optical storage drives, installing optical drives, specification for multi drives, disc burning software, troubleshooting and maintenance.

**UNIT - IV                      INPUT AND OUTPUT DEVICES                      [ 9 ]**

Features of monitor – CRT monitors: Working, specification, troubleshooting and maintenance – LCD monitors: Installing, specification, specification for TFT monitors, maintenance and troubleshooting of LCD monitors – LED monitors and touch screens – Keyboard: Types and features, interfaces, installing, usage guidelines, maintenance and troubleshooting – Mouse: types, working, features, interfaces, maintenance and troubleshooting – Printers: Types – Dot matrix printers: Specifications, installing, maintenance and troubleshooting – Laser printer: Features, working, specifications, installing printer on networks, managing laser printers, maintenance and troubleshooting.

**UNIT - V                      ASSEMBLING AND CONFIGURING COMPUTERS                      [ 9 ]**

Assembling and configuring: Caution and safety, Setting up the cabinet - Installing power supply unit - Installing CPU - Installing heat sink and cooling fan – Installing memory module - Mounting motherboard – Installing hard disk – Installing optical drive – Connecting motherboard - Power supply cables – Connecting to front panel – Connecting mouse, keyboard and monitor – Switching on the computer – Configuring – BIOS Installing operating system – Installing device drivers – Installing add-on cards – common problems and solutions.

**Total (L: 45) = 45 Periods**

**Text Books:**

- 1 K. L. James, Computer Hardware: Installation, Interfacing, Troubleshooting and Maintenance, PHI Learning, Delhi, First edition, 2013.
- 2 B. Govindarajalu, IBM PC and Clones – Hardware, Troubleshooting and Maintenance, Tata McGraw-Hill, New Delhi, First edition, 2002.

**Reference Books:**

- 1 Jean Andrews, Guide to Hardware Managing, Maintaining and Troubleshooting, Cengage Learning (Course Technology), Noida, Ninth Edition, 2016.
- 2 Craig Zacker and John Rourke, PC Hardware: The Complete Reference, McGraw-Hill, New Delhi, First edition 2017.
- 3 Michael W. Graves, A+ Guide to PC Hardware Maintenance and Repair, Cengage Learning, Noida, First edition, 2004.
- 4 Scott M. Mueller, Upgrading and Repairing PCs, Que Publishing, Ahmedabad, Twenty second Edition, 2015.

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**CO-PO MAPPING**

**Regulation: R 2020**

**Course Code:20EC763**

**Course Name: PC HARDWARE, INSTALLATION,  
TROUBLESHOOTING AND SERVICING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	<i>Elaborate the concepts of computer hardware and motherboards .</i>	3	3	2	-	2	-	-	-	-	-	-	-	3	-
2	<i>Interpret the concepts of processors and memory.</i>	3	3	2	-	2	-	-	-	-	-	-	-	3	-
3	<i>Describe the features, working and installation concepts of various storage devices.</i>	3	3	2	-	2	-	-	-	-	-	-	-	3	-
4	<i>Illustrate the type, features, specification, working of various input and output devices.</i>	3	3	2	-	2	-	-	-	-	-	-	-	3	-
5	<i>Identify the steps to assemble and configure computers hardware.</i>	3	3	2	-	2	-	-	-	-	-	-	-	3	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>2</b>		<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

## SEMESTER - VII

20EC764	EMBEDDED SYSTEM DESIGN (PROFESSIONAL ELECTIVE – III)	L	T	P	C
		3	0	0	3

**Prerequisite: Microprocessors and Microcontrollers**

Course Outcomes: <i>On successful completion of the course, the student will be able to</i>	Cognitive Level
CO1: <i>Illustrate the concepts of embedded system design and its accessories.</i>	Understand
CO2: <i>Interpret the components of embedded programming, optimization, validation and testing of programming.</i>	Understand
CO3: <i>Explain various processes and interpret the performance of operating system.</i>	Understand
CO4: <i>Familiarize various architectures and basics of embedded networks.</i>	Understand
CO5: <i>Identify various system design techniques with examples.</i>	Apply

**UNIT - I INTRODUCTION TO EMBEDDED ARCHITECTURE [ 09 ]**

Complex systems and microprocessors - Embedded system design process - Formalisms for system design - Design example: Model train controller - Instruction sets: preliminaries - ARM processor - CPU: Programming input and output - Supervisor mode, exception and traps - Coprocessors - Memory system mechanism - CPU performance - CPU power consumption.

**UNIT - II COMPUTING PLATFORM AND DESIGN ANALYSIS [ 09 ]**

CPU buses - Memory devices - I/O devices - Component interfacing - Design with microprocessors - Development and debugging - Components for embedded programs - Model of programs - Assembly, linking and loading - Basic compilation techniques - Program optimization - Program validation and testing.

**UNIT - III PROCESSES AND OPERATING SYSTEMS [ 09 ]**

Multiple tasks and multi processes - Preemptive real time operating systems - Priority based scheduling - Inter process communication mechanisms - Evaluating operating system performance - Power management and optimization for processes.

**UNIT - IV HARDWARE ACCELERATORS & NETWORKS [ 09 ]**

CPUs and accelerators - Multiprocessor performance analysis - Consumer electronics architecture - Distributed embedded architecture - Networks for embedded systems - Network based design - Internet enabled systems - Vehicles as networks - Sensor networks.

**UNIT - V SYSTEM DESIGN TECHNIQUES [ 09 ]**

Design methodologies - Requirement analysis - Specifications - System analysis and architecture design - Quality assurance - Software tools for embedded system development - Design example: Alarm clock, software modem, elevator controller.

**Total (L: 45) = 45 Periods**

**Text Books:**

- Wayne Wolf, Computers as Components - Principles of Embedded Computing System Design, Morgan Kaufmann Publisher, USA, Fifth edition, 2022.
- David E Simon, An Embedded Software Primer, Pearson Education, New Delhi, Twelfth Indian reprint, 2007.

**Reference Books:**

- K.V.K.K.Prasad, Embedded Real-Time Systems: Concepts, Design & Programming, Dreamtech Press, India, First edition, 2009
- Sriram V Iyer, Pankaj Gupta, Embedded Real Time Systems Programming, Tata McGraw Hill, New Delhi, First edition, 2017.
- Tammy Noergaard, Embedded Systems Architecture, Elsevier, Chennai, Second edition, 2013.
- Raj Kamal, Embedded Systems Architecture, Programming and Design, Tata McGraw Hill, New Delhi, Third edition, 2017.



**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code:20EC764

Course Name: EMBEDDED SYSTEM DESIGN

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	<i>Illustrate the concepts of embedded system design and its accessories.</i>	3	3	3	-	2	3	-	-	-	-	-	3	3	-
2	<i>Interpret the components of embedded programming, optimization, validation and testing of programming.</i>	3	3	3	-	2	3	-	-	-	-	-	3	3	-
3	<i>Explain various processes and interpret the performance of operating system.</i>	3	3	3	-	2	3	-	-	-	-	-	3	3	-
4	<i>Familiarize various architectures and basics of embedded networks.</i>	3	3	3	-	2	3	-	-	-	-	-	3	3	-
5	<i>Identify various system design techniques with examples.</i>	3	3	3	-	2	3	-	-	-	-	-	3	3	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>2</b>	<b>3</b>	<b>-</b>		<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>3</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

## SEMESTER - VII

20EC765	WIRELESS NETWORKS (PROFESSIONAL ELECTIVE – III)	L	T	P	C
		3	0	0	3

**Prerequisite:** *Computer Networks*

**Course Outcomes :** *On successful completion of the course, the student will be able to* **Cognitive Level**

CO1: *Describe the wireless network protocols.* **Understand**

CO2: *Interpret mobile network layer and routing* **Understand**

CO3: *Explain the overview and architecture of 3G networks* **Understand**

CO4: *Compare various schemes used for internetworking between WLANS and WMANS.* **Understand**

CO5: *Illustrate the 4G Networks and its architecture* **Understand**

**UNIT - I WIRELESS LAN [ 09 ]**

Introduction - WLAN technologies: IEEE802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee, 6LoWPAN, Wireless HART.

**UNIT - II MOBILE NETWORK LAYER [ 09 ]**

Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6 - Network layer in the internet - Mobile IP session initiation protocol - mobile ad - hoc network: Routing: Destination Sequence distance vector, IoT: CoAP

**UNIT - III INTERNETWORKING BETWEEN WLANS AND WWANS [ 09 ]**

Internetworking objectives and requirements, Schemes to connect WLANS and 3G Networks, Session Mobility, Internetworking Architecture for WLAN and GPRS, System Description, Local Multipoint Distribution Service, Multichannel Multipoint Distribution System.

**UNIT - IV 3G OVERVIEW [ 09 ]**

Overview of UTMS Terrestrial Radio access network - UMTS Core network Architecture: 3GPP Architecture, User equipment, CDMA2000 overview - Radio and Network components, Network structure, Radio Network, TD - CDMA, TD – SCDMA.

**UNIT - V 4G & 5G NETWORKS [ 09 ]**

Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, IMS Architecture, LTE, Advanced Broadband Wireless Access and Services, MVNO.

**Total (L: 45) = 45 Periods**

**Text Books :**

- 1 Jochen Schiller, *Mobile Communications*, Pearson Education, Bengaluru, Second Edition, 2012.
- 2 Vijay Garg, *Wireless Communications and networking*, Elsevier, First Edition, 2007.

**Reference Books :**

- 1 Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, *3G Evolution HSPA and LTE for Mobile Broadband*, Academic Press, Second Edition, 2008.
- 2 Anurag Kumar, D.Manjunath, Joy kuri, *Wireless Networking*, Elsevier, Brazil, First Edition, 2011.
- 3 Simon Haykin , Michael Moher, David Koilpillai, *Modern Wireless Communications*, Pearson Education, Bengaluru, First edition, 2013.
- 4 Dharma PrakashAgarwal and Qing An Zeng, *Introduction to Wireless and Mobile Systems*, Thomson Learning, United states, Second edition, 2007.

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**CO-PO MAPPING**

Regulation: R 2020

Course Code:20EC765

Course Name: WIRELESS NETWORKS

**CO PO MAPPING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	<i>Describe the wireless network protocols.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	3
2	<i>Interpret mobile network layer and routing</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	3
3	<i>Explain the overview and architecture of 3G networks</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	3
4	<i>Compare various schemes used for internetworking between WLANS and WMANS.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	3
5	<i>Illustrate the 4G Networks and its architecture</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	3
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	-	-	-	-	-	-	-	-	-	-	<b>3</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

## SEMESTER – VII

20EC770	<b>PATTERN RECOGNITION</b> (PROFESSIONAL ELECTIVE – III)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**Prerequisite:****Course Outcomes: On successful completion of the course, the student will be able to****Cognitive Level**

CO1: Relate basics of pattern recognition problems and mathematical foundation for pattern recognition.	Understand
CO2: Illustrate the statistical pattern recognition techniques and functions.	Understand
CO3: Solve problems related to parametric estimation methods in pattern recognition.	Apply
CO4: Describe unsupervised learning in pattern recognition.	Understand
CO5: Elaborate the clustering problems in pattern recognition.	Understand

**UNIT – I INTRODUCTION [ 09 ]**

Introduction: Basics of pattern recognition – Design principles of pattern recognition system - Learning and adaptation – Pattern recognition approaches. Mathematical foundations: Linear algebra – Probability theory – Expectation – Mean and Covariance – Normal distribution - Multivariate normal densities – Chi square test of hypothesis.

**UNIT – II STATISTICAL PATTERN RECOGNITION [ 09 ]**

Statistical Patten Recognition: Bayesian Decision Theory – Classifiers – Normal density and discriminant functions.

**UNIT – III MODELS [ 09 ]**

Parameter estimation methods: Maximum-Likelihood estimation – Bayesian Parameter estimation – Dimension reduction methods – Principal Component Analysis (PCA) – Fisher Linear discriminant analysis – Expectation – maximization (EM) – Hidden Markov Models (HMM) – Gaussian mixture models.

**UNIT – IV NON PARAMETRIC TECHNIQUES [ 09 ]**

Nonparametric Techniques: Density Estimation – Parzen Windows – K-Nearest Neighbor Estimation – Nearest Neighbor Rule – Fuzzy classification.

**UNIT – V CLUSTERING TECHNIQUES [ 09 ]**

Unsupervised Learning and Clustering: Criterion functions for clustering – Clustering Techniques: Iterative square – Error partitional clustering – K-Means – agglomerative hierarchical clustering – Cluster validation.

**Total (L: 45) = 45 Periods****Text Books:**

- 1 Richard O. Duda, Peter E. Hart and David G. Stork, Pattern Classification, Second edition, John Wiley, 2006.
- 2 Bishop, Christopher M., Pattern Recognition and Machine Learning, First edition, Springer, 2009.

**Reference Books:**

- 1 S. Theodoridis, K. Koutroumbas, Pattern Recognition, Fourth edition, Academic Press, 2009.
- 2 Keinosuke Fukunaga, Introduction to Statistical Pattern Recognition, Second edition, Academic Press, 2003.
- 3 Sergios Theodoridis, Konstantinos Koutroumbas, Pattern Recognition, Fourth edition, Academic Press, 2009.
- 4 C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2009.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING  
CO-PO MAPPING

Regulation: R2020

Course Code:20EC770

Course Name: PATTERN RECOGNITION

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	<i>Relate basics of pattern recognition problems and mathematical foundation for pattern recognition.</i>	3	3	3	-	-	-	-	-	-	-	-	-	3	-
2	<i>Illustrate the statistical pattern recognition techniques and functions.</i>	3	3	3	-	-	-	-	-	-	-	-	-	3	-
3	<i>Solve problems related to parametric estimation methods in pattern recognition.</i>	3	3	3	-	-	-	-	-	-	-	-	-	3	-
4	<i>Describe unsupervised learning in pattern recognition.</i>	3	3	3	-	-	-	-	-	-	-	-	-	3	-
5	<i>Elaborate the clustering problems in pattern recognition.</i>	3	3	3	-	-	-	-	-	-	-	-	-	3	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	-	-	-	-	-	-	-	-	-	<b>3</b>	-

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

## SEMESTER – VII

20EC766	CMOS ANALOG CIRCUITS (PROFESSIONAL ELECTIVE – IV)	L	T	P	C
		3	0	0	3

**Prerequisite:** VLSI Design

**Course Outcomes:** On successful completion of the course, the student will be able to **Cognitive Level**

CO1:	Elaborate the concepts of analog Integrated Circuits with consideration of CMOS technology.	Understand
CO2:	Examine the performance of various CMOS device modeling.	Analyze
CO3:	Design a two stage CMOS operational amplifiers with its power supply rejection ratio.	Apply
CO4:	Elaborate the concepts of comparators and switched capacitor circuits in VLSI domain.	Understand
CO5:	Elaborate the concepts of Digital to Analog Converters and Analog to Digital Converters in VLSI domain.	Understand

**UNIT – I                      FUNDAMENTALS OF ANALOG ICs                      [ 09 ]**

Analog integrated circuit design - Notation, symbology and terminology - Analog signal processing - Example of analog VLSI mixed signal circuit design - PN junction - MOS transistor - Passive components - Other considerations of CMOS technology - Integrated circuit layout.

**UNIT – II                      CMOS DEVICE MODELING                      [ 09 ]**

Simple MOS large signal model - Parameters - Small signal model - Computer simulation models - Sub threshold MOS model - SPICE simulation - MOS switch - Diode/Active resistor - Current sinks and sources - Current mirrors - Current and voltage references.

**UNIT – III                      CMOS AMPLIFIERS                      [ 09 ]**

Inverters - Differential amplifiers - Design of CMOS OPAMPs - Compensation of OPAMPs - Design of two stage OPAMPs - Power supply rejection ratio of two stage OPAMPs.

**UNIT – IV                      COMPARATORS AND SWITCHED CAPACITOR CIRCUITS                      [ 09 ]**

Characterization of a comparator - Two stage open-loop comparators - Other open-loop comparators - Switched capacitor circuits - Amplifiers – Integrators

**UNIT – V                      DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS                      [ 09 ]**

Characterization of digital to analog converters - Parallel digital to analog converters - Extending the resolution - Serial digital to analog converters - Characterization of analog to digital converters: Serial, medium and high speed.

**Total (L: 45) = 45 Periods**

**Text Books:**

- 1 Phillip E.Allen, Douglas R.Holberg, CMOS Analog Circuit Design, Oxford University Press, Third edition, 2011.
- 2 Behzad Razavi, Design of Analog CMOS Integrated Circuits, McGraw Hill Higher Education, International edition, 2009.

**Reference Books:**

- 1 Liu Kramer, Indiveri, Delbruck, Douglas, Analog VLSI: Circuits and Principles, Pearson Education, 2004.
- 2 Weste and Harris, CMOS VLSI Design, Pearson Education, Third edition, 2005.
- 3 D.A.Pucknell and K.Eshraghian, Basic VLSI Design, PHI, Third edition, 2003.
- 4 Kamran Eshraghian, Douglas A. Pucknell and Sholeh Eshraghian, Essentials of VLSI Circuits and Systems, PHI, 2013

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20EC766

Course Name: CMOS ANALOG CIRCUITS

CO	Course Outcomes	Programme Outcomes														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
1	<i>Elaborate the concepts of analog Integrated Circuits with consideration of CMOS technology.</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
2	<i>Examine the performance of various CMOS device modeling.</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
3	<i>Design a two stage CMOS operational amplifiers with its power supply rejection ratio.</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
4	<i>Elaborate the concepts of comparators and switched capacitor circuits in VLSI domain.</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
5	<i>Elaborate the concepts of Digital to Analog Converters and Analog to Digital Converters in VLSI domain.</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

## SEMESTER - VII

20EC767	FUNDAMENTALS OF NANO ELECTRONICS (PROFESSIONAL ELECTIVE – III)	L	T	P	C
		3	0	0	3

**Prerequisite:** Engineering physics

**Course Outcomes:** On successful completion of the course, the student will be able to

**Cognitive Level**

CO1:	Understand the basics of Nano electronics including quantum wires, dots and wells	<i>Understand</i>
CO2:	Infer the mechanism behind quantum electronic devices	<i>Understand</i>
CO3:	Illustrate the properties of Nano capacitors, nanowire FETs, SETs.	<i>Understand</i>
CO4:	Analyze the key performance aspects of tunneling and superconducting Nano electronic devices	<i>Understand</i>
CO5:	Apply the knowledge in the development of nanotubes and nanostructure devices.	<i>Understand</i>

**UNIT - I INTRODUCTION TO NANO ELECTRONICS [ 09 ]**

Scaling to nano - Light as a wave and particle - Electrons as waves and particles - origin of quantum mechanics - General postulates of quantum mechanics - Time independent Schrodinger wave equation - Electron confinement - Quantum dots, wires and well-Spin and angular momentum

**UNIT - II QUANTUM ELECTRONICS [ 09 ]**

Quantum electronic devices - Short channel MOS transistor - Split gate transistor - Electron wave transistor - Electron wave transistor - Electron spin transistor - Quantum cellular automata - Quantum dot array, Quantum memory.

**UNIT - III NANO ELECTRONIC TRANSISTORS [ 09 ]**

Coulomb blockade - Coulomb blockade in Nano capacitors - Coulomb blockade in tunnel junctions - Single electron transistors, Semiconductor nanowire FETs and SETs, Molecular SETs and molecular electronics - Memory cell.

**UNIT - IV NANO ELECTRONIC TUNNELING AND SUPER CONDUCTING DEVICES [ 09 ]**

Tunnel effect - Tunneling element - Tunneling diode - Resonant tunneling diode - Three terminal resonant tunneling devices - Superconducting switching devices - Cryotron - Josephson tunneling device.

**UNIT - V NANOTUBES AND NANOSTRUCTURE DEVICES [ 09 ]**

Carbon Nanotube - Fullerenes - Types of nanotubes - Formation of nanotubes - Assemblies - Purification of carbon nanotubes - Electronic properties - Synthesis of carbon nanotubes - Carbon nanotube interconnects - Carbon nanotube FETs and SETs - Nanotube for memory applications Nano structures and Nano structured devices.

**Total (L: 45) = 45 Periods**

**Text Books:**

- 1 W. R. Fahrner, Nanotechnology and Nanoelectronics : materials Springer - Verlag Berlin Heidelberg, scholars porta, First edition, 2019.
- 2 Hanson, Fundamentals of Nanoelectronics, Pearson education, New Delhi, First edition, 2009.

**Reference Books:**

- 1 Jan Dienstuhl, Karl Goser, and Peter Glösekötter, Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices, Springer-Verlag, Berlin Heideberg, First edition, 2004.
- 2 Mircea Dragoman and Daniela Dragoman, Nanoelectronics : Principles and Devices, Artech House, USA, Second edition, 2009.
- 3 Robert Puers, Livio Baldi, Marcel Van de Voorde and Sebastiaan E. Van Nooten, Nanoelectronics: Materials, Devices, Applications, Wiley, First edition, USA, 2017.
- 4 Brajesh Kumar Kaushik, Nanoelectronics : Devices, Circuits and Systems, Elsevier science, First edition, 2018.



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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code:20EC767

Course Name: FUNDAMENTALS OF NANO ELECTRONICS

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	Understand the basics of Nano electronics including quantum wires, dots and wells	3	3	2	2	3	2	-	-	-	-	-	2	3	2
2	Infer the mechanism behind quantum electronic devices	3	3	3	2	3	2	-	-	-	-	-	2	3	2
3	Illustrate the properties of Nano capacitors, nanowire FETs, SETs.	3	3	2	2	3	2	--	-	-	-	-	2	3	2
4	Analyze the key performance aspects of tunneling and superconducting Nano electronic devices	3	3	3	2	3	2	-	-	-	-	-	2	3	2
5	Apply the knowledge in the development of nanotubes and nanostructure devices.	3	3	2	2	3	3	-	-	-	-	-	2	3	2
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>3</b>	<b>2</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

## SEMESTER - VII

20EC768	HIGH PERFORMANCE NETWORKS (PROFESSIONAL ELECTIVE – IV)	L	T	P	C
		3	0	0	3

**Prerequisite:** Computer networks

**Course Outcomes :** On successful completion of the course, the student will be able to **Cognitive Level**

CO1: Describe the concepts of networks. *Understand*

CO2: Interpret the functionalities of high speed networks. *Understand*

CO3: Illustrate the various protocols for real time operations. *Understand*

CO4: Explain the various queuing disciplines and differentiated services. *Understand*

CO5: Compare the connection-oriented services with reference to MPLS & VPN. *Understand*

**UNIT - I NETWORK CONCEPTS [ 09 ]**

Introduction - Principles - Applications - Services: Network elements- Network mechanisms - Layered architecture: layered network - Limitations.

**UNIT - II HIGH SPEED NETWORKS [09 ]**

Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL, High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LANs: applications, requirements – Architecture of 802.11.

**UNIT - III PROTOCOLS FOR QOS SUPPORT [ 09 ]**

RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP.

**UNIT - IV INTEGRATED AND DIFFERENTIATED SERVICES [ 09 ]**

Integrated services architecture: Approach, components, services - Queuing discipline: Fair queuing, processor sharing, bit-round fair queuing, generalized processor sharing, weighted fair queuing - Random early detection - Differentiated services.

**UNIT - V ADVANCED NETWORK CONCEPTS [ 09 ]**

VPN: Remote access, site-to-site, tunneling and point to point protocol - Security in VPN - MPLS: Operation, routing, tunneling and use of FEC, traffic engineering and MPLS based VPNs - Overlay networks: Peer to peer connection.

**Total (L:45)= 45 Periods**

**Text Books :**

- 1 Jean Warland, Pravin Varaiya, High Performance Communication Networks, Morgan Kaufmann Publishers, San Francisco ,Second edition, 2011.
- 2 Nader F. Mir, Computer and Communication Networks, Dorling Kindersley, , Noida, Third edition, 2009.

**Reference Books :**

- 1 Lenon Garcia Widjaja, Communication Networks, Tata McGraw-Hill, New Delhi, Second edition, 2007.
- 2 Othmarkyas, ATM Networks, International Thomson Computer Press, second edition, 1993.
- 3 Ranier Handel Manfred N Huber, Stefan Schroder, ATM Networks - Concepts, Protocols Applications, Addison Wesley, New York, Third edition, 2006.
- 4 Irvan Pepelnjk, Jim Guichard& Jeff Apcar, MPLS and VPN Architecture, Volume 1 and 2, Cisco Press, 2007.

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code:20EC768

Course Name: HIGH PERFORMANCE NETWORKS

**CO PO MAPPING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	<i>Describe the concepts of networks.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	3
2	<i>Interpret the functionalities of high speed networks.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	3
3	<i>Illustrate the various protocols for real time operations.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	3
4	<i>Explain the various queuing disciplines and differentiated services.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	3
5	<i>Compare the connection-oriented services with reference to MPLS &amp; VPN.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	3
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

## SEMESTER - VII

## ROBOTICS

20EC769

(PROFESSIONAL ELECTIVE – IV)

L	T	P	C
3	0	0	3

**Prerequisite:** *Digital image processing***Course Outcomes :** On successful completion of the course, the student will be able to**Cognitive Level**

CO1:	<i>Comprehend the fundamentals of robotics.</i>	Understand
CO2:	<i>Describe the technologies applicable for Robotics in computer based vision.</i>	Understand
CO3:	<i>Elucidate the different sensing devices of robot.</i>	Understand
CO4:	<i>Describe the algorithms applicable for robotics.</i>	Understand
CO5:	<i>Develop 4-axis and 6-axis robot.</i>	Apply

**UNIT - I INTRODUCTION TO ROBOTICS [ 09 ]**

Motion - Potential function - Road maps - Cell decomposition sensor and sensor planning - Kinematics - Forward and inverse kinematics - Transformation matrix and DH transformation - Inverse kinematics - Geometric methods and algebraic methods - Non holonomic constraints.

**UNIT - II COMPUTER VISION [ 09 ]**

Projection - Optics, projection on the Image plane and radiometry - Image processing - Connectivity - Images - Gray Scale and binary images - Blob filling – Thresholding - Histogram - Convolution - Digital convolution and filtering and Masking techniques - Edge detection - Mono and stereo vision - Face detection.

**UNIT - III SENSORS AND SENSING DEVICES [ 09 ]**

Introduction to various types of sensor - Resistive sensors - Range sensors – LADAR - Sonar - Radar and Infra-red - Introduction to sensing - Light sensing - Heat sensing - Touch sensing and position sensing.

**UNIT - IV ARTIFICIAL INTELLIGENCE FOR ROBOTICS [ 09 ]**

Uniform Search strategies - Breadth first, Depth first, Iterative and deepening depth first search and bidirectional search - The A\* algorithm - Planning - State-space planning - Graph plan/Sat plan and their comparison - Probabilistic reasoning - Bayesian networks - Decision trees and bayes net inference.

**UNIT - V INTEGRATION TO ROBOT [ 09 ]**

Building of 4 axis or 6 axis robot - Vision system for pattern detection - Sensors for obstacle detection - Decision making.

**Total (L:45) = 45 Periods****Text Books :**

- 1 Robert Schilling and Craig, Fundamentals of Robotics, Analysis and control, PHI, New Delhi, Third Edition, 2015.
- 2 Stuart Russell and Peter Norvig, Artificial Intelligence-A Modern Approach, Pearson Education Series in Artificial Intelligence, London, Third Edition, 2016.

**Reference Books :**

- 1 Duda. Hart. and Stork., Pattern Recognition, Wiley-Inter science,UK, Second Edition, 2000.
- 2 Mallot., Computational Vision Information Processing in Perception and Visual Behavior, MIT Press,Cambridge, Second Edition, 2000.
- 3 Forsyth. and Ponce., Computer Vision, A modern Approach, Pearson Education, London, Second Edition, 2011.
- 4 Fu,K.S. Gonzalez,R.C and Lee,C.S.G., Robotics control, sensing, vision and intelligence, Tata- McGraw Hill Pub. Co., New York, Second Edition, 2008.
- 5 <https://nptel.ac.in/courses/112/108/112108093/>

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code:20EC769

Course Name: ROBOTICS

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	<i>Comprehend the fundamentals of robotics.</i>	3	3	3	-	-	-	-	-	-	-	-	3	3	-
2	<i>Describe the technologies applicable for Robotics in computer based vision.</i>	3	3	3	-	-	-	-	-	-	-	-	3	3	-
3	<i>Elucidate the different sensing devices of robot.</i>	3	3	3	-	-	-	-	-	-	-	-	3	3	3
4	<i>Describe the AI algorithms applicable for robotics.</i>	3	3	3	-	3	-	-	-	-	-	-	3	3	-
5	<i>Develop 4-axis and 6-axis robot.</i>	3	3	3	-	-	-	-	-	-	-	-	3	3	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>3</b>	<b>3</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

## SEMESTER – VII

20EC771	SOFT COMPUTING TECHNIQUES (PROFESSIONAL ELECTIVE – IV)	L	T	P	C
		3	0	0	3

**Prerequisite:****Course Outcomes: On successful completion of the course, the student will be able to****Cognitive Level**

CO1: Infer the concepts of artificial neural network.

Understand

CO2: Outline the various types of neural network.

Understand

CO3: Discuss the basic concepts of fuzzy logic system.

Apply

CO4: Illustrate the fundamentals of different soft computing techniques.

Understand

CO5: Apply the knowledge of neural networks and fuzzy logic controller for classical applications.

Understand

**UNIT – I INTRODUCTION TO SOFT COMPUTING [ 09 ]**

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta-Perceptron Network-Adaline Network-Madaline Network.

**UNIT – II ARTIFICIAL NEURAL NETWORKS [ 09 ]**

Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory -Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models.

**UNIT – III FUZZY SYSTEMS [ 09 ]**

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

**UNIT – IV GENETIC ALGORITHMS [ 09 ]**

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion -Mutation Operator - Bit-wise Operators -Convergence of Genetic Algorithm

**UNIT – V HYBRID SYSTEMS [ 09 ]**

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic - GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP - Inference by Fuzzy BP - Fuzzy ArtMap: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller

**Total (L: 45) = 45 Periods****Text Books:**

- 1 Sivanandam S.N and Deepa S.N, Principles of soft computing techniques, John Wiley and Sons Ltd, United States, Third Edition, 2011.
- 2 N.P.Padhy, S.P.Simon, Soft Computing with MATLAB Programming, Oxford University Press, 2015.
- 3 S.Rajasekaran, G.A.Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications, PHI Learning Pvt.Ltd., 2017

**Reference Books:**

- 1 Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, Neuro-Fuzzy and Soft ComputingII, Prentice-Hall of India, 2002.
- 2 Kwang H.Lee, First course on Fuzzy Theory and ApplicationsII, Springer, 2005.
- 3 George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic-Theory and ApplicationsII, Prentice Hall, 1996.
- 4 James A. Freeman and David M. Skapura, Neural Networks Algorithms, Applications, and Programming Techniques II, Addison Wesley, 2003.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code:20EC771

Course Name: SOFT COMPUTING TECHNIQUES

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	<i>Comprehend the fundamentals of robotics.</i>	3	3	3	-	-	-	-	-	-	-	-	3	3	-
2	<i>Describe the technologies applicable for Robotics in computer-based vision.</i>	3	3	3	-	-	-	-	-	-	-	-	3	3	-
3	<i>Elucidate the different sensing devices of robot.</i>	3	3	3	-	-	-	-	-	-	-	-	3	3	3
4	<i>Describe the AI algorithms applicable for robotics.</i>	3	3	3	-	3	-	-	-	-	-	-	3	3	-
5	<i>Develop 4-axis and 6-axis robot.</i>	3	3	3	-	-	-	-	-	-	-	-	3	3	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>3</b>	<b>3</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**K.S.R. COLLEGE OF ENGINEERING: TIRUCHENGODE - 637 215**

**(Autonomous)**

**(REGULATIONS 2020)**

## **OPEN ELECTIVE COURSES**



	<b>K.S.R. COLLEGE OF ENGINEERING (Autonomous)</b>	<b>R 2020</b>
<b>20AU901</b>	<b>BASICS OF AUTOMOBILE ENGINEERING</b> (Open Elective)	L T P C 3 0 0 3

**Prerequisite: -**

<b>Course Outcomes : On successful completion of the course, the student will be able to</b>	<b>Cognitive Level</b>
CO1: Provide basic platform knowledge of automobile engineering	Understand
CO2: Explain the working principal of petrol and diesel engines	Understand
CO3: Interpret the method of power transmission unit	Understand
CO4: Built knowledge of steering and brake	Understand
CO5: Illustrate the knowledge of automotive electrical systems and functioning	Understand

**UNIT - I INTRODUCTION [ 09 ]**

Automobile - Components of an automobile - Classification of automobiles - Layout of chassis - Types of drives front wheel-rear wheel - four wheel.

**UNIT - II IC ENGINES [ 09 ]**

Classification - ignition system - firing order - Otto/ Diesel cycles - Two stroke and four stroke engines – scavenging - Cooling and Lubrication systems - Fuel Supply system – air fuel ratio - Carburetor – types.

**UNIT - III TRANSMISSION SYSTEM [ 09 ]**

Clutch - Function - single plate - multi plate - friction clutches - Centrifugal and semi centrifugal clutch - Gear Box -slide mesh - constant mesh and synchromesh gear box - Torque convertor – overdrive - Propeller shaft and rear axle- Universal joint – Differential - Rear axle drives - Wheels and Tyres.

**UNIT - IV STEERING AND BRAKE [ 09 ]**

Steering system - function and principle - Ackerman and Davis steering principles - wheel alignment –steering gear boxes. Brakes - Mechanical - hydraulic and vacuum brake - master cylinder - wheel cylinder -Bleeding of brakes.

**UNIT - V ELECTRICAL SYSTEMS [ 09 ]**

Battery – types - Dynamo and Alternator – Cut-out relay - Diagram of Wiring system - Lighting System and Accessories - Headlight - switches - Windscreen Wipers – Horn – Speedometer – Heater and Air conditioning.

**Total = 45 Periods**

**Text Books :**

- 1 Kirpal Singh, Automobile Engineering, Vol. I & II, Standard Publishers, New Delhi, Fourteenth Edition, 2018.
- 2 Gupta, S. K., A Textbook of Automobile Engineering, S.Chand Publishing, New Delhi, Second Edition, 2020.

**Reference Books :**

- 1 Rajput, R K, A Textbook of Automobile Engineering, Laxmi Publications (P) Ltd, New Delhi, Second Edition, 2017.
- 2 Ganesan. V, Internal Combustion Engines, Tata McGraw-Hill Publishing Co., New Delhi, Fourth Edition, 2012.
- 3 Mathur M.L. and Sharma R.P, A Course in Internal Combustion Engines, DhanpatRai and sons, New Delhi, Second Edition, 2016.
- 4 Ramalingam K.K, Automobile Engineering, Scitech Publications (India) Pvt. Ltd, Chennai, Second Edition, 2011.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF AUTOMOBILE ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20AU901

Course Name: Basics of Automobile Engineering

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Provide basic platform knowledge of automobile engineering</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	<i>Explain the working principal of petrol and diesel engines</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	<i>Interpret the method of power transmission unit</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	<i>Built knowledge of steering and brake</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	<i>Illustrate the knowledge of automotive electrical systems and functioning</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>	-	-	-	-	-	-	-	-	-	-	-

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

20AU902

## AUTOMOTIVE ENGINE TECHNOLOGY

(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite: -****Course Outcomes : On successful completion of the course, the student will be able to** **Cognitive Level**

CO1: Illustrate the fundamental concepts and functions of an automotive engine and working cycles	Understand
CO2: Explain the combustion phenomena in SI engines	Understand
CO3: Identify the CI engines injection, ignition and combustion phenomena	Understand
CO4: Outline the emission control techniques.	Understand
CO5: Demonstrate the measurement techniques and emission standards.	Understand

**UNIT – I CONSTRUCTION AND OPERATION [ 09 ]**

Constructional details of spark ignition (SI) and compression ignition (CI) engines. Working principles. Two stroke SI and CI engines. Comparison of SI and CI engines and four stroke and two stroke engines. Engine classification, firing order. Otto, diesel and dual cycles. Introduction to Lean burn engine technologies.

**UNIT – II SI ENGINES [ 09 ]**

Air fuel ratio requirements - Carburetion - Throttle body injection, Multi point injection. Function of Components, Spark plug, Ignition System - battery coil, magneto coil, Electronic. Combustion in SI Engines - Combustion Chambers, Stages of Combustion - factors affecting flame propagation, Knock in SI engines, variables affecting knocking. Pollution from SI engines.

**UNIT – III CI ENGINES [ 09 ]**

Diesel fuel injection system, Function of Components, Jerk type pump, Distributor pump, Mechanical and pneumatic Governor, Fuel Injector, Types of nozzles, importance of Swirl, Squish, Turbulence air motion, Combustion in CI Engines - Combustion Chambers, Stages of Combustion, Factors affecting Ignition Delay, Knock in CI engines. Pollution from CI engines.

**UNIT - IV EMISSION CONTROL TECHNIQUES [ 09 ]**

Design of engine, optimum selection of operating variables for control of emissions, EGR, charge stratification, SCR, DPF, Lean NOX catalyst technology. Thermal reactors, secondary air injection, catalytic converters, catalysts, fuel modifications, fuel cells, Two stroke engine pollution and control.

**UNIT - V MEASUREMENT TECHNIQUES, EMISSION STANDARDS AND TEST PROCEDURES [ 09 ]**

NDIR, FID, Chemiluminescent analyzers, Gas Chromatograph, smoke meters, emission standards, driving cycles - USA, Japan, Euro and India. Test procedures - ECE, FTP Tests. SHED Test - Chassis dynamometers, dilution tunnels.

**Total = 45 Periods****Text Books :**

- 1 Ganesan. V, Internal Combustion Engines, Tata McGraw-Hill Publishing Co., New Delhi, Fourth Edition, 2012.
- 2 Mathur M.L. and Sharma R.P, A Course in Internal Combustion Engines, Dhanpat Rai and sons, New Delhi, Second Edition, 2016.

**Reference Books :**

- 1 Ramalingam K.K, Automobile Engineering, Scitech Publications (India) Pvt. Ltd, Chennai, Second Edition, 2011.
- 2 John B. Heywood, Internal Combustion Engine Fundamentals, Tata McGraw Hill Education, New Delhi, Second Edition, 2018.
- 3 Gupta H.N, Fundamentals of Internal Combustion Engines, PHI Learning Private Ltd., New Delhi, Second Edition, 2013.
- 4 Obert, E.F., Internal Combustion Engineering and Air Pollution, Intext Education Publishers, New York, Third Edition, 1988.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF AUTOMOBILE ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20AU902

Course Name: Automotive Engine Technology

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Illustrate the fundamental concepts and functions of an automotive engine and working cycles</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	<i>Explain the combustion phenomena in SI engines.</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	<i>Identify the CI engines injection, ignition and combustion phenomena</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	<i>Outline the emission control techniques.</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	<i>Demonstrate the measurement techniques and emission standards.</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>	-	-	-	-	-	-	-	-	-	-	-

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

20AU903

## AUTOMOTIVE VEHICLE TECHNOLOGY

(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite: -****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1: Identify the construction and working of various types of automobile engines.	Understand
CO2: Evaluate the significance of clutch and transmission system.	Understand
CO3: Illustrate the types of axle, suspension and classification of steering system.	Understand
CO4: Discuss the various vehicle control systems.	Understand
CO5: Demonstrate the various new generation vehicles.	Understand

**UNIT - I AUTOMOBILE ENGINE [ 09 ]**

Construction layout, types and components of engines, SI – CI – Wankel engine, working of engines, lubrication system, coolant system, power supply, alternate and dynamo, flywheel and damper.

**UNIT - II CLUTCH AND TRANSMISSION [ 09 ]**

Types of clutches, construction and working procedure of single plate clutch, multi-plate clutch, cone clutch, gears – types of gears, terminology of spur gear, gear trains, construction and working of manual and automatic gear box.

**UNIT - III AXLE, SUSPENSION AND STEERING [ 09 ]**

Types of axles, necessity of axle for an automobile, suspension system, types and construction of suspension system, significance of suspension system, steering system and vehicle handling, classification of steering system, merits and demerits of power steering.

**UNIT - IV VEHICLE CONTROL SYSTEM [ 09 ]**

Cruise control, antilock braking system, tyre slip controller, electronic steering control, global positioning system, autonomous navigation system.

**UNIT - V NEW GENERATION VEHICLES [ 09 ]**

Electric vehicles, hybrid vehicles, flexible fuel vehicles, solar powered vehicles, high energy and power density batteries, regenerative braking, safety air bags.

**Total = 45 Periods****Text Books :**

- 1 David A. Crolla, Automotive Engineering – Powertrain, Chassis system and Vehicle body, Butterworth-Heinemann, New Delhi, First Edition, 2009.
- 2 Ganesan. V, Internal Combustion Engines, Tata McGraw-Hill Publishing Co., New Delhi, Fourth Edition, 2012.

**Reference Books :**

- 1 Heinz Heisler, Advance Vehicle Technology, Butterworth-Heinemann, London, Second Edition, 2002.
- 2 Mathur M.L. and Sharma R.P, A Course in Internal Combustion Engines, Dhanpat Rai and sons, New Delhi, Second Edition, 2016.
- 3 James Larminie and John Lowry, Electric Vehicle Technology Explained, John Wiley & Sons, New York, Second Edition, 2012.
- 4 William B Ribbens, Understanding Automotive Electronics, Butterworth-Heinemann, Woburn, Eighth edition, 2017.

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**DEPARTMENT OF AUTOMOBILE ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20AU903

Course Name: Automotive Vehicle Technology

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Identify the construction and working of various types of automobile engines.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	<i>Evaluate the significance of clutch and transmission system.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	<i>Illustrate the types of axle, suspension and classification of steering system.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	<i>Discuss the various vehicle control systems.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	<i>Demonstrate the various new generation vehicles.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	-	-	-	-	-	-	-	-	-	-	-

1: Slight (Low)    2: Moderate (Medium)    3: Substantial (High)

20AU904

**AUTOMOTIVE SAFETY**

(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite: -****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1: Explain the automotive safety and its importance.	Understand
CO2: Analyze the safety concepts.	Understand
CO3: Illustrate the various safety equipment functions and importance	Understand
CO4: Identify the various crash test and impact test mechanics.	Understand
CO5: Examine the function of warning and avoidance systems.	Understand

**UNIT - I INTRODUCTION [ 09 ]**

Evolution of automotive safety - Active safety: driving safety, conditional safety, perceptibility safety, operating safety-  
passive safety: exterior safety, interior safety, safety sandwich construction – NCAP.

**UNIT - II SAFETY CONCEPTS [ 09 ]**

Design of the body for safety -Energy equation - engine location - deceleration of vehicle inside passenger compartment  
- deceleration on impact with stationary and movable obstacle.

**UNIT - III SAFETY EQUIPMENTS [ 09 ]**

Seat belt - regulations, automatic seat belt tightener system - collapsible steering column - tiltable steering wheel - air  
bags - electronic system for activating air bags - bumper design for safety - Collision warning system - Central Locking  
system - Child safety.

**UNIT - IV CRASH AND IMPACT MECHANICS [ 09 ]**

Design of crash crumple zones - Behavior of specific body structures in crash testing - Roll over crash tests - Regulatory  
requirements for crash testing & testing procedure - vehicle impacts- Side and Frontal Pole Impact.

**UNIT - V COMFORT AND CONVENIENCE SYSTEM [ 09 ]**

Steering and mirror adjustment - central locking system - Garage door opening system - tyre pressure control system -  
rain sensor system - environment information system.

**Total = 45 Periods****Text Books :**

- 1 LjuboVlacic, Michel Parent and Fumio Harashima, Intelligent Vehicle Technologies, Butterworth-Heinemann publications, Oxford, First Edition, 2001.
- 2 Robert Bosch GmbH, Safety, Comfort and Convenience Systems, John Wiley& Sons, New Delhi, Third edition, 2007

**Reference Books :**

- 1 Bosch, Automotive HandBook, SAE International, New York, Eighth Edition, 2011.
- 2 Vivek D. Bhise, Ergonomics in the automotive design process. CRC Press, New York, 2012.
- 3 Ronald K Jurgen, Automotive Electronics Handbook, Tata McGraw-Hill Inc., New York, Second Edition, 1999.
- 4 William B Ribbens, Understanding Automotive Electronics, Butterworth-Heinemann, Woburn, Eighth edition, 2017.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF AUTOMOBILE ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20AU904

Course Name: Automotive Safety

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Explain the automotive safety and its importance.</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO2	<i>Analyze the safety concepts.</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3	<i>Illustrate the various safety equipment functions and importance</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4	<i>Identify the various crash test and impact test mechanics.</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5	<i>Examine the function of warning and avoidance systems.</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	-	-	-	-	-	-	-	-	<b>3</b>	-	-

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



20AU905

## HYBRID VEHICLES

(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite: -****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1: Summarize the electric and hybrid vehicle operation and architectures.	Understand
CO2: Explain the different subsystems of hybrid and electric vehicle	Understand
CO3: Demonstrate the energy requirement for vehicles	Understand
CO4: Model and simulate the vehicle characteristics, operating modes, and performance parameters of the vehicle	Understand
CO5: Design and develop the systems of hybrid and electric vehicles	Understand

**UNIT - I NEED FOR ALTERNATIVE SYSTEM [ 09 ]**

Need for hybrid and electric vehicles – main components and working principles of a hybrid and electric vehicles, Different configurations of hybrid and electric vehicles. Comparative study of diesel, petrol, hybrid and electric Vehicles. Advantages and Limitations of hybrid and electric Vehicles.

**UNIT - II SUBSYSTEMS OF HYBRID AND ELECTRIC VEHICLES [ 09 ]**

Basics – Types, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Battery pack Design, Properties of Batteries.

**UNIT - III ENERGY SOURCES [ 09 ]**

Battery Parameters- - Different types of batteries – Lead Acid- Nickel Metal Hydride – Lithium ion- Sodium based- Metal Air. Battery Modeling- Equivalent circuits, Battery charging- Quick Charging devices. Fuel Cell- Fuel cell Characteristics- Fuel cell types-Half reactions of fuel cell. Ultra capacitors. Battery Management System.

**UNIT - IV MOTORS AND CONTROLLERS [ 09 ]**

Types of Motors, Characteristic of DC motors, AC single phase and 3-phase motor, PM motors, Switched reluctance motors, Motor Drives and speed controllers, Torque Vectoring, Regenerative Braking. Rectifiers, Inverters, DC/DC converters.

**UNIT - V DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES [ 09 ]**

Design requirement for electric vehicles- Range, maximum velocity, acceleration, power requirement, mass of the vehicle. Various Resistance- Transmission efficiency- Electric vehicle chassis and Body Design, Electric Vehicle Recharging and Refueling Systems, performance of electrical vehicles.

**Total = 45 Periods****Text Books :**

- 1 Iqbal Husain, Electric and Hybrid Vehicles-Design Fundamentals, CRC Press, New York, Second Edition, 2010.
- 2 Mehrdad Ehsani, Modern Electric, Hybrid Electric and Fuel Cell Vehicles, CRC Press, New York, Second Edition, 2009.

**Reference Books :**

- 1 James Larminie and John Lowry, Electric Vehicle Technology Explained, John Wiley & Sons, New York, Second Edition, 2012.
- 2 Lino Guzzella, Vehicle Propulsion Systems, Springer-Verlag Berlin, Heidelberg, Third Edition, 2013
- 3 Ron Hodkinson, Light Weight Electric/ Hybrid Vehicle Design, Butterworth Heinemann Publication, London, 2001
- 4 Ronald K Jurgen, Electric and Hybrid – Electric Vehicles, SAE International, New York, First Edition, 2011.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF AUTOMOBILE ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20AU905

Course Name: Hybrid Vehicles

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Summarize the electric and hybrid vehicle operation and architectures.</i>	3	3	2	-	-	-	3	-	-	-	-	-	-	-
CO2	<i>Explain the different subsystems of hybrid and electric vehicle</i>	3	3	2	-	-	-	3	-	-	-	-	-	-	-
CO3	<i>Demonstrate the energy requirement for vehicles</i>	3	3	3	-	-	-	3	-	-	-	-	-	-	-
CO4	<i>Model and simulate the vehicle characteristics, operating modes, and performance parameters of the vehicles.</i>	3	3	2	-	-	-	3	-	-	-	-	-	-	-
CO5	<i>Design and develop the systems of hybrid and electric vehicles.</i>	3	2	2	-	-	-	3	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>	-	-	-	<b>3</b>	-	-	-	-	-	-	-

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

20AU906

**OFF HIGHWAY VEHICLES**  
 (Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite: -****Course Outcomes : On successful completion of the course, the student will be able to** **Cognitive Level**CO1: Describe the construction and requirement of off road vehicles. *Understand*CO2: Explain the different types of earth moving machines and explain the different sub systems. *Understand*CO3: Describe the specifications, functions, merits and demerits of different types and subsystems of scrapers, graders and ditchers. *Understand*CO4: Discuss the construction and working principle of farm equipment, military and combat vehicles. *Understand*CO5: Explain the vehicle systems and features. *Understand***UNIT - I CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES [ 09 ]**

Construction layout, capacity and applications. Power Plants, Chassis and Transmission, Multi-axle vehicles.

**UNIT - II EARTH MOVING MACHINES [ 09 ]**

Earthmovers like dumpers, loaders - single bucket, Multi bucket and rotary types - bulldozers, excavators, backhoe loaders, scrapers, drag and self powered types, Bush cutters, stumpers, tree dozer, rippers etc. – Power and capacity of earth moving machines.

**UNIT - III SCRAPERS ,GRADERS, SHOVELS AND DITCHERS [ 09 ]**

Scrapers, elevating graders, motor graders, self powered scrapers and graders, Power shovel, revolving and stripper shovels – drag lines – ditchers – capacity of shovels.

**UNIT - IV FARM EQUIPMENT, MILITARY AND COMBAT VEHICLES [ 09 ]**

Power take off, special implements. Special features and constructional details of tankers, gun carriers and transport vehicles.

**UNIT - V VEHICLE SYSTEMS AND FEATURES [ 09 ]**

Brake system and actuation – OCDB and dry disc caliper brakes. Body hoist and bucket operational hydraulics. Hydro-pneumatic suspension cylinders. Power steering system. Kinematics for loader and bulldozer operational linkages. Safety features, safe warning system for dumper.

**Total = 45 Periods****Text Books :**

- 1 Robert L. Peurifoy, Clifford J. Schexnayder, Construction, planning, equipment and methods, Tata McGraw Hill Publishing company Ltd, New Delhi, Ninth Edition, 2018.
- 2 Nakra C.P., Farm machines and equipment, Dhanparai Publishing company, New Delhi, First Edition, 2003.

**Reference Books :**

- 1 Wong.J.Y., Theory of Ground Vehicles, John Wiley & Sons, New York, Fifth Edition, 2022.
- 2 Ageikin S., Off the road wheeled and combined traction devices – Ashgate Publishing Co. Ltd., New Delhi, First Edition, 1988
- 3 Heinz Heisler, Vehicle and Engine Technology, , SAE International, New York, Second Edition, 1999
- 4 Sean Bennet and Ian Andrew Norman, Heavy Duty Truck systems, Delmar Cengage learning, New York, Fifth Edition, 2011.

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**DEPARTMENT OF AUTOMOBILE ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20AU906

Course Name: Off Highway Vehicles

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Describe the construction and requirement of off road vehicles.</i>	3	3	2	-	-	-	3	3	-	-	-	-	-	-
CO2	<i>Explain the different types of earth moving machines and explain the different sub systems.</i>	3	3	2	-	-	-	3	-	-	-	-	-	-	-
CO3	<i>Describe the specifications, functions, merits and demerits of different types and subsystems of scrappers, graders and ditchers.</i>	3	3	3	-	-	-	3	3	-	-	-	-	-	-
CO4	<i>Discuss the construction and working principle of farm equipment, military and combat vehicles.</i>	3	3	2	-	-	-	3	3	-	-	-	-	-	-
CO5	<i>Explain the vehicle systems and features.</i>	3	2	2	-	-	-	3	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

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

20AU907

## MODERN AND INTELLIGENT VEHICLE SYSTEM

(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite: -****Course Outcomes : On successful completion of the course, the student will be able to** **Cognitive Level**

CO1: Identify the various systems involved in driver support systems and their working principle.	Understand
CO2: Familiarize with global positioning systems, geographical information systems and navigation systems.	Understand
CO3: Comprehend the constructional and working features of safety systems and security systems.	Understand
CO4: Recognize about the various comfort systems.	Understand
CO5: Explain the various adaptive control systems.	Understand

**UNIT - I DRIVER ASSISTANCE SYSTEMS [ 09 ]**

Introduction, driver support systems – driver information, driver perception, driver convenience, driver monitoring. Vehicle support systems – general vehicle control, vehicle status monitoring and automated highway systems.

**UNIT - II TELEMATICS [ 09 ]**

Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition and application of Internet of Things (IoT) in automotive industry.

**UNIT - III SAFETY SYSTEMS AND SECURITY SYSTEMS [ 09 ]**

Airbags, seat belt tightening system, collision avoidance and warning systems, child lock, antilock braking systems, Anti-theft technologies, smart card system and number plate coding.

**UNIT - IV COMFORT SYSTEMS [ 09 ]**

Active suspension systems, requirement and characteristics, different types, power steering, collapsible and tiltable steering column and power windows.

**UNIT - V ADAPTIVE CONTROL SYSTEMS [ 09 ]**

Adaptive cruise control, adaptive noise control, anti spin regulation, traction control systems and cylinder cut off technology and autonomous driving.

**Total = 45 Periods****Text Books :**

- 1 LjuboVlacic, Michel Parent and Fumio Harashima, Intelligent Vehicle Technologies, Butterworth-Heinemann publications, Oxford, First Edition, 2001.
- 2 Ronald K Jurgen, Navigation and Intelligent Transportation Systems – Progress in Technology, Automotive Electronics Series, SAE, New York, First Edition, 1998.

**Reference Books :**

- 1 Richard Bishop, Intelligent Vehicle Technology and Trends, Artech House, London, First Edition, 2005.
- 2 William B Ribbens, Understanding Automotive Electronics, Butterworth-Heinemann, Woburn, Eighth edition, 2017.
- 3 Robert Bosch, Automotive Handbook, Bentley Publishers, Cambridge, Tenth Edition, 2018.
- 4 Robert Bosch, Bosch Automotive Electrics and Automotive Electronics, Springer Vieweg Wiesbaden, Switzerland, Fifth Edition, 2013.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF AUTOMOBILE ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20AU907

Course Name: Modern and Intelligent Vehicle System

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Identify the various systems involved in driver support systems and their working principle.</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO2	<i>Familiarize with global positioning systems, geographical information systems and navigation systems.</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3	<i>Comprehend the constructional and working features of safety systems and security systems</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4	<i>Recognize about the various comfort systems.</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5	<i>Explain the various adaptive control systems.</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>

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

20AU908

## VEHICLE MAINTENANCE

(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite: -****Course Outcomes : On successful completion of the course, the student will be able to** **Cognitive Level**

CO1: Describe the importance, types and requirements of vehicle maintenance and related records and schedules.	Understand
CO2: Practice the engine overhauling, reconditioning; methods, procedures, tools of power plants, ignition system, cooling system and other engine components.	Understand
CO3: Demonstrate the maintenance procedures of clutch, gear box, propeller shaft and steering systems.	Understand
CO4: Demonstrate the construction, testing, fault diagnosis and maintenance of body panel and body tinkering.	Understand
CO5: Describe the maintenance procedures of electrical systems. .	Understand

**UNIT - I MAINTENANCE TOOL, SHOP, SCHEDULE, RECORDS [ 09 ]**

Standard tool set, torque wrenches, compression and vacuum gauges, engine analyzer and scanner, computerized wheel alignment and balancing, gauges for engine tune up and pollution measurement, spark plug cleaner, cylinder re-boring machine, fuel injection calibration machine. Importance of maintenance. Schedule and unscheduled maintenance. Scope of maintenance. Equipment downtime. Vehicle inspection. Reports. Log books. Trip sheet. Lay out and requirements of maintenance shop.

**UNIT - II ENGINE REPAIR AND OVERHAULING [ 09 ]**

Dismantling of engine and its components. Cleaning methods. Inspection and checking. Repair and reconditioning methods for all engine components. Maintenance of ignition system, fuel injection system, cooling system – lubrication system. Engine trouble shooting chart.

**UNIT - III MAINTENANCE, REPAIR AND OVERHAULING OF THE CHASSIS [ 09 ]**

Maintenance, servicing and repair of clutch, fluid coupling, gearbox, torque converter, propeller shaft. Maintenance of front axle, rear axle, brakes, steering systems.

**UNIT - IV MAINTENANCE AND REPAIR OF VEHICLE BODY [ 09 ]**

Body panel tools for repairing. Tinkering and painting. Use of soldering, metalloid paste. Tyre maintenance, metallic ,plastics

**UNIT - V MAINTENANCE AND REPAIR OF ELECTRICAL SYSTEMS [ 09 ]**

Care, maintenance, testing and troubleshooting of battery, starter motor, dynamo, alternator and regulator. Transistorized regulator problems.

**Total = 45 Periods****Text Books :**

- 1 John E. Dolce, Analytical Fleet Maintenance Management, SAE International, New York, Third Edition, 2009.
- 2 James D. Halderman, Advanced Engine Performance Diagnosis, Pearson Education, New Delhi, Seventh Edition, 2019.

**Reference Books :**

- 1 Bosch Automotive Handbook, SAE International, New York, Tenth Edition,2018
- 2 Willam H. Crouse and Donald L. Anglin, Automotive Mechanics, Tata McGraw Hill Publishing Company, New Delhi, Tenth Edition, 2007.
- 3 Service Manuals from different vehicle manufacturers.
- 4 Judge. A.N, Motor vehicle engine servicing, Pitman Paper pack, London, Third Edition, 1969.

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**DEPARTMENT OF AUTOMOBILE ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20AU908

Course Name: Vehicle Maintenance

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Describe the importance, types and requirements of vehicle maintenance and related records and schedules.</i>	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO2	<i>Practice the engine overhauling, reconditioning; methods, procedures, tools of power plants, ignition system, cooling system and other engine components.</i>	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO3	<i>Demonstrate the maintenance procedures of clutch, gear box, propeller shaft and steering systems.</i>	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO4	<i>Demonstrate the construction, testing, fault diagnosis and maintenance of body panel and body tinkering.</i>	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO5	<i>Describe the maintenance procedures of electrical systems.</i>	3	3	2	-	-	-	-	-	-	-	-	3	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>

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



20CE901

## ARCHITECTURAL HERITAGE OF INDIA

(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course**Course Outcomes :** On successful completion of the course, the student will be able to**Cognitive Level**

CO1:	Illustrate various materials used and construction style of Indus Valley Civilization	Understand
CO2:	Demonstrate the materials used and construction style of Chera, Chola and Pandya architecture	Understand
CO3:	Describe the materials used and construction style of Mughal architecture	Understand
CO4:	Explain the various materials and construction style of British architecture	Understand
CO5:	Describe various materials and construction style of Portuguese, Dutch, French and Danish	Understand

**UNIT - I INDUS VALLEY CIVILIZATION [ 09 ]**

Indus valley civilization – Chronological introduction – Construction style – Materials used – The cities Harappa, lothal and Mohenjo-Daro, The great bath – The granary at Harappa – The assembly hall – Ajanta-Ellora Cave temples – Mahabodhi temple complex

**UNIT - II SOUTH INDIAN ARCHITECTURE [ 09 ]**

Chera-Chola-Pandya architecture – Chronological introduction – Construction style – Materials used – Brihadeeswarar Temple – Meenakshi Temple – Kalinga – Chalukya – Pallava architecture – Mahabalipuram stone temples – Khajuraho – MuskinBhanvi – Konark Sun Temple – Hoysala – Vijayanagara architecture – twin temples Mosale – Virupaksha temple Raya Gopura at Hampi

**UNIT - III MUGHAL ARCHITECTURE [ 09 ]**

Mughal architecture – Chronological introduction – Construction style – Materials used – QutubMinar – TajMahal – Humayun's Tomb – Redfort – Fatehpur Sikri – Agra fort – Jama Masjid – Rajput civil architecture – Chronological introduction – Construction style – Materials used – All hill forts of Rajasthan

**UNIT - IV BRITISH ARCHITECTURE [ 09 ]**

British colonial architecture – Chronological introduction – Construction style – Materials used – Buildings in Chennai, Mumbai, Shimla – Churches – Mountain railways of India-bridges.

**UNIT - V COLONIAL ARCHITECTURE [ 09 ]**

Other colonial architecture – Portuguese-Dutch-French-Danish – Chronological introduction – Construction style – Materials used – Churches – Churches and Convents of Goa and Cochi – French town of Puducherry – Tranquebar fort – Bungalow on the beach

**Total (L= 45, T = 0) = 45 Periods****Text Books :**

- 1 Bindia Thapar, Surat Kumar Manto, and Suparna Bhalla., Introduction to Indian Architecture: Arts of Asia, Periplus Editions (HK) Ltd, Hong Kong, First Edition, 2005
- 2 Sandhya Ketkar., The History of Indian Art, Jyotsna Prakashan Publisher, Maharashtra, E – Edition, 2020

**Reference Books :**

- 1 Christopher Tadgell., The History of Architecture in India, Phaidon Press Ltd, New York, First Edition, 1990
- 2 Mark M. Jarzombek, Vikramaditya Prakash, Francis D. K. Ching., A Global History of Architecture, John Wiley & Sons, Hoboken, Second Edition, 2010
- 3 <https://nptel.ac.in/courses/124106009>
- 4 <https://ncert.nic.in/textbook/pdf/kefa106.pdf>

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF CIVIL ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20CE901

Course Name: Architectural Heritage of India

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Illustrate various materials used and construction style of Indus Valley Civilization</i>	3	3	-	2	-	2	2	-	-	-	-	3	-	-
CO2	<i>Demonstrate the materials used and construction style of Chera, Chola and Pandya architecture</i>	3	3	-	2	-	2	2	-	-	-	-	3	-	-
CO3	<i>Describe the materials used and construction style of Mughal architecture</i>	3	3	-	1	-	2	2	-	-	-	-	3	-	-
CO4	<i>Explain the various materials and construction style of British architecture</i>	3	3	-	2	-	2	2	-	-	-	-	3	-	-
CO5	<i>Describe various materials and construction style of Portuguese, Dutch, French and Danish</i>	3	3	-	1	-	2	2	-	-	-	-	3	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

	<b>K.S.R. COLLEGE OF ENGINEERING (Autonomous)</b>	<b>R 2020</b>
<b>20CE902</b>	<b>BUILDING PLANNING AND CONSTRUCTION</b>	L T P C
	(Open Elective)	3 0 0 3

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes :** On successful completion of the course, the student will be able to

**Cognitive  
Level**

CO1: Outline the factors to be considered in planning and construction of buildings	Understand
CO2: Infer the different components and Foundations of building in their construction practices.	Understand
CO3: Interpret masonry and alternative materials of wood, aluminum and glass.	Understand
CO4: Discuss different types of floors, roofs and the materials which are commonly used for construction.	Understand
CO5: Explain about dampness and fire resistance in buildings	Understand

**UNIT - I FUNCTIONAL PLANNING OF BUILDINGS [ 09 ]**

Types of Buildings, Aspects and Principles of Building Planning, Building By - laws and Regulations, Site Selection criteria, Orientation of Building and its relation to surrounding environment, Sustainability and Green Buildings - Building Bye - laws and Building code of India 2016.

**UNIT - II BUILDING COMPONENTS AND FOUNDATIONS [ 09 ]**

Lintels, arches, different types of floors-concrete, mosaic, terrazzo floors, pitched, flat and curved roofs, lean-to roof, coupled roofs, trussed roofs, king and queen post trusses; RCC roofs, madras terrace/shell roofs. Foundations: Shallow foundations, spread, combined, strap and mat footings.

**UNIT - III ALTERNATIVE MATERIALS AND MASONRY [ 09 ]**

Structure, properties, seasoning of timber; Classification of various types of woods used in buildings, defects in timber; Alternative materials for wood, galvanized iron, fibre-reinforced plastics, steel, aluminium and glass; Types of masonry, English and Flemish bonds, rubble and ashlar masonry, cavity and partition walls - Light weight concrete blocks – merits and demerits.

**UNIT - IV FLOORS, ROOFS AND STAIRCASES [ 09 ]**

Components of a floor, materials used for floor construction, Different types of flooring, Ground floor and upper floors, Types of roofs, Basic roofing elements and Roof coverings. Functional requirements of a good stair, type of stairs, planning a stair case.

**UNIT - V DAMP PROOFING AND FIRE PROTECTION [ 09 ]**

Damp proofing and Fire protection: Causes and effect of dampness on buildings, Materials and methods used for damp proofing, Fire hazards, Grading of buildings according to fire resistance, Fire resisting properties of common building materials, Fire resistant construction.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :**

- 1 Varghese P. C., Building construction, PHI Learning Pvt. Ltd, New Delhi ,Second Edition, 2016.
- 2 B. C. Punmia , Ashok Kumar Jain, Arun Kumar Jain, Building Construction, Laxmi Publications, New Delhi ,Eleventh Edition,2019.

**Reference Books :**

- 1 S. K. Duggal, Building Materials II, New Age International (P) Limited, New Delhi ,Fourth Edition, 2016,
- 2 Bulding Bye-laws 2019
- 3 National Building Code of India, 2016.
- 4 [www.nptel.ac.in/courses/105101088/2\\_home.htm](http://www.nptel.ac.in/courses/105101088/2_home.htm)

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF CIVIL ENGINEERING**  
**CO-PO MAPPING**

Course Code: 20CE902 Regulation: R 2020  
 Course Name: Building Planning and Construction

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Outline the factors to be considered in planning and construction of buildings</i>	3	2	1	1	-	3	2	-	-	-	-	2	-	-
CO2	<i>Infer the different components and Foundations of building in their construction practices.</i>	3	2	-	2	-	2	3	-	-	-	-	2	-	-
CO3	<i>Interpret masonry and alternative materials of wood, aluminum and glass.</i>	2	-	-	2	-	3	2	-	-	-	-	2	-	-
CO4	<i>Discuss different types of floors, roofs and the materials which are commonly used for construction.</i>	3	2	-	2	-	3	2	-	-	-	-	2	-	-
CO5	<i>Explain about dampness and fire resistance in buildings</i>	3	2	-	2	-	3	3	-	-	-	-	2	-	-
<b>Average</b>		<b>3</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**K.S.R. COLLEGE OF ENGINEERING (Autonomous)****R 2020****20CE903****ELEMENTARY CIVIL ENGINEERING**

(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course**Course Outcomes :** On successful completion of the course, the student will be able to**Cognitive Level**

CO1: Provide an overview of civil engineering

Understand

CO2: Explain the basics of surveying, modern tools of surveying and mapping

Understand

CO3: Summarize the fundamentals of building materials in civil engineering

Understand

CO4: Explain the components of building structures.

Understand

CO5: Interpret various infrastructures of civil engineering in construction

Understand

**UNIT - I OVERVIEW OF CIVIL ENGINEERING****[ 09 ]**

History of Civil Engineering - Role and Functions of Civil Engineer - Fields of Civil Engineering - Importance of Civil Engineering

**UNIT - II BASICS OF SURVEYING****[ 09 ]**

Introduction - Basic Definitions (Surveying, leveling, Plans, Maps, Scales) - Introduction to divisions of surveying - Classification of surveying - Fundamental principles of surveying - Measurement in Surveying - Phases of Surveying

**MODERN TOOLS OF SURVEYING AND MAPPING:**

Introduction to Global Positioning System - Remote Sensing and Geographic Information System

**UNIT - III FUNDAMENTALS OF BUILDING MATERIALS****[ 09 ]**

Bricks – stones – sand – M-sand - cement – fly ash - silica fume - mortar- concrete – steel – glass - wood –plastics – ceramics

**UNIT - IV COMPONENTS OF BUILDING****[ 09 ]**

Foundations – stone masonry – brick masonry – beams – columns – lintels – roofing – flooring – plastering- damp proofing weathering course

**UNIT - V STRUCTURES****[ 09 ]**

Introduction to dams, weirs, barrages and check dams - Role of transportation in national development - Modes of transportation - Introduction to road traffic and traffic control - Introduction to mass transportation system

**Total (L= 45, T = 0) = 45 Periods****Text Books :**

- 1 Anurag Kandya, Elements of Civil Engineering, Charotar Publishing House Pvt. Ltd, Gujarat, Third Edition, 2017.
- 2 Palanichamy M.S., Basic Civil Engineering, Tata McGraw-Hill, New Delhi, Fourth Edition, 2011.

**Reference Books :**

- 1 Poonam Sharma & Swati Rajput, Sustainable Smart Cities in India – Challenges and Future Perspectives, Springer, First Edition, 2017.
- 2 Dr.B.C.Punamia, Surveying, Laxmi Publication, New Delhi, Seventh Edition, 2016.
- 3 <https://nptel.ac.in/courses/105102088>
- 4 <https://byjusexamprep.com/civil-engineering-exams/building-materials>

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF CIVIL ENGINEERING**  
**CO-PO MAPPING**

Course Code: 20CE903

Regulation: R 2020

Course Name: Elementary Civil Engineering

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Provide an overview of civil engineering</i>	1	-	-	-	-	1	-	-	-	-	-	1	-	-
CO2	<i>Explain the basics of surveying and modern tools of surveying and mapping</i>	2	1	-	-	-	2	-	-	-	-	-	1	-	-
CO3	<i>Summarize the fundamentals of building materials in civil engineering</i>	2	1	-	-	-	2	2	-	-	-	-	1	-	-
CO4	<i>Explain the components of building structures.</i>	2	1	-	-	-	2	-	-	-	-	-	1	-	-
CO5	<i>Interpret various infrastructures of civil engineering in construction</i>	3	2	1	-	-	3	2	-	-	-	-	1	-	-
<b>Average</b>		<b>3</b>	<b>2</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**K.S.R. COLLEGE OF ENGINEERING (Autonomous)**

**R 2020**

**20CE904**

**ENERGY AND ENVIRONMENT**  
(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes :** On successful completion of the course, the student will be able to

**Cognitive Level**

CO1: Outline the earth's energy, environment and the processes leading to climate change.	Understand
CO2: Infer the atmospheric issues related to the chemistry, greenhouse gases	Understand
CO3: Summarize the role of the terrestrial energy-environment-climate system	Understand
CO4: Interpret the Possible effects of Global Warming and climate change.	Understand
CO5: Outline the Natural and Anthropogenic and Green House Gas theory	Understand

**UNIT - I INTRODUCTION [ 09 ]**

Overview on the Earth's energy requirements-Climate Change-Origins of the terrestrial atmosphere-Earth's early atmosphere- Introduction to Climate-Layers of the atmosphere.

**UNIT - II GLOBAL ATMOSPHERIC ISSUES [ 09 ]**

Composition of the present day atmosphere-Introduction to Atmospheric chemistry-Green House Gases, and the O3 - depletion problem-Post Industrial Revolution Scenario

**UNIT - III ENERGY BALANCE [ 09 ]**

Earth Atmosphere System- Solar and Terrestrial Radiation- Absorption of Radiation by gases.-Energy balance- Solar variability and the Earth's Energy Balance.

**UNIT - IV ATMOSPHERIC CHEMISTRY AND CLIMATE [ 09 ]**

The Global Temperature Record.-Possible effects of Global Warming. – Indian Context. Atmospheric Chemistry and Climate Change- Atmospheric Aerosol and Cloud Effects on Climate.

**UNIT - V ENVIRONMENTAL VARIABILITY [ 09 ]**

Natural (volcanoes, forest fires) and Anthropogenic (Antarctic Ozone Hole, Global Warming).-Green House Gas theory.- Effects of urbanization- Landscape changes-Influence of Irrigation-Desertification and Deforestation

**Total (L= 40, T = 5) = 45 Periods**

**Text Books :**

- 1 Peter E Hodgson, Energy the Environment and Climate Change, Imperial College Press, London, First Edition, 2010
- 2 Ahluwalia V K, Energy and Environment, The Energy and Resources Institute, New Delhi, First Edition, 2019

**Reference Books :**

- 1 Richard Wolfson, Energy, Environment, and Climate, Publisher: W. W. Norton & Company, New York, Second Edition,2011
- 2 Saeed Moaveni ,Energy, Environment, and Sustainability with Mind Tap, Cengage India Private Limited ,New Delhi, First Edition,2017
- 3 Wilbanks, T., Bilello D, Schmalzer D, Scott, Climate Change and Energy Supply and Use: Technical Report for the U.S. Department of Energy in Support of the National Climate Assessment., Island Press,Washington,2013
- 4 Frank T. Princiotta, Global Climate Change - The Technology Challenge, Springer Publisher, New York, First Edition, 2011

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF CIVIL ENGINEERING**  
**CO-PO MAPPING**

**Course Code: 20CE904**

**Regulation: R 2020**  
**Course Name: Energy and Environment**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Outline The Earth's Energy, Environment and the processes leading to climate change.</i>	3	3	-	-	-	2	2	-	-	-	-	2	-	-
CO2	<i>Infer the Atmospheric issues related to the chemistry, Green House Gases</i>	3	3	-	-	-	2	2	-	-	-	-	2	-	-
CO3	<i>Summarize the role of the Terrestrial Energy-Environment-Climate System</i>	3	3	-	-	-	2	2	-	-	-	-	2	-	-
CO4	<i>Interpret the Possible effects of Global Warming and climate change.</i>	3	3	-	-	-	2	2	-	-	-	-	2	-	-
CO5	<i>Outline the Natural and Anthropogenic and Green House Gas theory</i>	3	3	-	-	-	2	2	-	-	-	-	2	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



**K.S.R. COLLEGE OF ENGINEERING (Autonomous)****R 2020****20CE905****ENVIRONMENTAL LAWS AND POLICIES**

(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course**Course Outcomes :** On successful completion of the course, the student will be able to**Cognitive Level**

CO1:	Summarize the basic concepts in environmental laws and its judicial activism	Understand
CO2:	Interpret different water acts and marine laws in India	Understand
CO3:	Summarize various Environment protection laws and acts in the framework of Mega projects	Understand
CO4:	Explain the management and handling of various hazardous waste management	Understand
CO5:	Summarize the International Environmental laws framed at various conferences.	Understand

**UNIT - I BASIC CONCEPTS IN ENVIRONMENTAL LAW [ 09 ]**

An introduction to the legal system – Constitution – Acts – Rules – Regulations - Indian Judiciary - Doctrine of precedents - judicial review - Writ petitions - PIL– liberalization of the rule of locus standi - Judicial activism - Introduction to environmental laws in India - Constitutional provisions - Stockholm conference - Bhopal gas tragedy - Rio conference - General principles in Environmental law - Precautionary principle - Polluter pays principle - Sustainable development- Public trust doctrine - Overview of legislations and basic concepts.

**UNIT - II AIR- WATER - MARINE LAWS [ 09 ]**

National Water Policy and some state policies - Laws relating to prevention of pollution, access and management of water and institutional mechanism - Water Act, 1974 - Water Cess Act, 1977 - EPA, 1986 - Pollution Control Boards Ground water and law Judicial remedies and procedures Marine laws of India - Coastal zone regulations - Legal framework on Air pollution - Air Act,1981 - EPA, 1986

**UNIT - III ENVIRONMENT PROTECTION LAWS - LARGE PROJECTS [ 09 ]**

Legal framework on environment protection - Environment Protection Act as the framework legislation - strength and weaknesses of EIA - National Green tribunal the courts infrastructure projects

**UNIT - IV HAZARDOUS SUBSTANCES AND ACTIVITIES [ 09 ]**

Legal framework - EPA and rules made there under PLI Act, 199 - Principles of strict and absolute liability - Hazardous Wastes (Management, Handling and Transboundary) Rules, 2008 - Biomedical Waste (Management and Handling) Rules, 1998 - Municipal Solid Wastes (Management and Handling) Rules, 2000 - E - Waste (Management and Handling) Rules, 2011 - Batteries (Management & Handling) Rules, 2001

**UNIT - V INTERNATIONAL ENVIRONMENTAL LAW [ 09 ]**

Development of international environmental law, nature and scope of key international environmental law principles and rights (substantive and procedural), Establishment of Environmental Institutions like UNEP, Ozone Protection – Montreal Protocol for the Protection of Ozone Layer, 1987 as amended; U.N. Convention on Climate Change 1992, Kyoto Protocol, 1997; Public Participation in Decision-making and Access to Justice in Environmental Matters, 1998 (Aarhus Convention); Johannesburg Conference, 2002.

**Total (L= 45, T = 0 ) = 45 Periods****Text Books :**

- 1 Divan,S and Rosencranz, A., Environmental Law and Policy in India, Oxford India Paperbacks, New Delhi, Second edition, 2005.
- 2 Kanchan Chopra., Development and Environmental Policy in India: The Last Few Decades, Springer Publication, New Delhi, First edition, 2017.

**Reference Books :**

- 1 Birnie, P Boyle, and Red well's., International Law and the Environment ,Oxford University Press, United Kingdom, Fourth edition,2021.
- 2 Upadhyay S. and Upadhyay V., Hand Book on Environmental Law- Forest Laws, Wildlife Laws and the Environment; Vols. I, II and III, Lexis Nexis Butterworths , New Delhi ,India, First Edition , 2001.
- 3 Leelakrishnan,P., Environmental Law Case Book, Lexis Nexis, India, Sixth Edition, 2021.
- 4 Sands, P., Principles of International Environmental Law, Cambridge University press, United Kingdom, Second Edition, 2002.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF CIVIL ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20CE905

Course Name: Environmental Laws and Policies

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Summarize the basic concepts in Environmental laws and its judicial activism</i>	3	2	2	-	-	2	-	-	-	-	2	3	-	-
CO2	<i>Interpret different water acts and marine laws in India</i>	3	2	2	-	-	-	-	-	-	-	-	3	-	-
CO3	<i>Summarize Various Environment protection laws and acts in the framework of Mega projects</i>	3	2	3	-	-	2	-	-	-	-	2	3	-	-
CO4	<i>Explain the management and Handling of various hazardous waste management</i>	3	2	3	1	-	3	1	-	-	-	2	3	-	-
CO5	<i>Summarize the International Environmental laws framed at various conferences.</i>	3	2	3	2	-	3	-	-	-	-	2	3	-	-
<b>Average</b>		<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>3</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20CE906

## GLOBAL WARMING AND CLIMATE CHANGE

(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes :** On successful completion of the course, the student will be able to

**Cognitive Level**

CO1:	Outline the concept of the causes and effects of global warming	Understand
CO2:	Summarize about physical and chemical characteristics of atmosphere	Understand
CO3:	Identify the causes and effects of climate change	Remember
CO4:	Infer the agreements took place among the countries regarding climate change	Understand
CO5:	Summarize skills about the concept of mitigation measures against climate change	Understand

**UNIT - I EARTH'S CLIMATE SYSTEM [ 09 ]**

Role of ozone in environment – Ozone layer – Ozone depleting gases – Greenhouse gases and its sources - Green House Effect, Radiative Effects of Greenhouse Gases -The Hydrological Cycle – Green House Gases and Global Warming – Effects and causes of Global Warming, Carbon Cycle.

**UNIT - II ATMOSPHERE AND ITS COMPONENTS [ 09 ]**

Importance of Atmosphere – Physical Chemical Characteristics of Atmosphere - Vertical structure of the atmosphere - Composition of the atmosphere - Atmospheric stability -Temperature profile of the atmosphere - Lapse rates-Temperature inversion - effects of inversion on pollution dispersion.

**UNIT - III IMPACTS OF CLIMATE CHANGE [ 09 ]**

Causes of Climate change – Change of Temperature in the environment - Melting of ice Pole-sea level rise - Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

**UNIT - IV OBSERVED CHANGES AND ITS CAUSES [ 09 ]**

Climate change and Carbon credits – CDM- Initiatives in India - Kyoto Protocol - Intergovernmental Panel on Climate change - Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India .

**UNIT - V CLIMATE CHANGE AND MITIGATION MEASURES [ 09 ]**

Clean Development Mechanism – Carbon Trading – Examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding - Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS) - Waste(MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

**Total (L= 40, T = 5) = 45 Periods**

**Text Books :**

- 1 Kandarp Tarkeshprasad Vaishnav., Climate Change Solutions, Global Warming Solutions & Innovative Ideas For Construction of World Development, Notion Press, Chennai, First Edition, 2018
- 2 Vivian Moritz., Climate Change and Global Warming, Syrawood Publishing House, New York, First Edition, 2017

**Reference Books :**

- 1 Marie Antonette and Chloe Marechal., Climate Change Past, Present & Future, Wiley-Blackwell, New Jersey, First Edition, 2015.
- 2 Empereur Raymond., Global Warming and Climate Change, Litfire Publishing, Atlanta, First Edition, 2017.
- 3 Agarwal S.K., Global Warming and Climate Change Past, Present & Future, Ashish Publishing House, New Delhi, First Edition, 2004.
- 4 [https://onlinecourses.swayam2.ac.in/arp19\\_ap55/preview](https://onlinecourses.swayam2.ac.in/arp19_ap55/preview)

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF CIVIL ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20CE906

Course Name: Global Warming and Climate Change

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Outline the concept of the causes and effects of global warming</i>	3	2	2	-		3	2	-	-	-	-	2	-	-
CO2	<i>Summarize about physical and chemical characteristics of atmosphere</i>	3	2	-	-	-	3	3	-	-	-	2	2	-	-
CO3	<i>Identify the causes and effects of climate change</i>	3	-	-	2	-	3	2	-	-	-	2	3	-	-
CO4	<i>Infer the agreements took place among the countries regarding climate change</i>	3	2	-	2	-	3	2	-	2	-	-	2	-	-
CO5	<i>Summarize skills about the concept of mitigation measures against climate change</i>	3	2	-	-	-	3	3	-	3	-	2	3	-	-
<b>Average</b>		<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>2</b>	<b>3</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20CE907	INTRODUCTION TO DISASTER MANAGEMENT AND MITIGATION (Open Elective)	L	T	P	C
		3	0	0	3

**Prerequisite: Nil**

Course Outcomes : On successful completion of the course, the student will be able to	Cognitive Level
CO1: Explain the concepts of disaster and its effect in Indian scenario.	Understand
CO2: Elaborate the difference between natural and manmade disasters.	Understand
CO3: Outline the disaster management cycle and its operation.	Understand
CO4: Outline the disaster management in India and its profile.	Understand
CO5: Propose the application of geo-informatics for disaster management and mitigation.	Apply

**UNIT - I INTRODUCTION TO DISASTER [09]**

Definition of Disaster, hazard, global and Indian scenario, general perspective, importance of study in human life, Direct and indirect effects of disasters, long term effects of disasters. Introduction to global warming and climate change.

**UNIT - II NATURAL DISASTER AND MANMADE DISASTERS [09]**

Natural Disaster: Meaning and nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion.

Manmade Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.

**UNIT - III DISASTER MANAGEMENT CYCLE AND FRAMEWORK [09]**

Disaster Management Cycle, Paradigm Shift in Disaster Management Pre-Disaster Risk Assessment and Analysis, Risk Mapping, zonation and Micro zonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development, Awareness During Disaster Evacuation, Disaster Communication, Search and Rescue, Emergency Operation Centre, Incident Command System, Relief and Rehabilitation, Damage and Needs Assessment, Restoration of Critical Infrastructure, Early Recovery, Reconstruction and Redevelopment, IDNDR, Yokohama Strategy, Hyogo Framework of Action.

**UNIT - IV DISASTER MANAGEMENT IN INDIA DISASTER PROFILE OF INDIA [09]**

Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005, Institutional and Financial Mechanism, National Policy on Disaster Management, National Guidelines and Plans on Disaster Management, Role of Government, Non-Government and Inter-Governmental Agencies.

**UNIT - V APPLICATIONS OF SCIENCE AND TECHNOLOGY FOR DISASTER MANAGEMENT & MITIGATION [09]**

Geo-informatics in Disaster Management, Disaster Communication System, Land Use Planning and Development Regulations, Structural and Non Structural Mitigation of Disasters, S&T Institutions for Disaster Management in India.

**Total (L= 45, T = 0) = 45 Periods**

**Text Books :**

- 1 R B Singh., Disaster Management and Mitigation, World focus Publisher, New Delhi, First Edition, 2016.
- 2 Satish Modh, Introduction to disaster management, Macmillan publishers India Ltd, New Delhi, Second Edition, 2019.

**Reference Books :**

- 1 R B Singh., Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi, Reprint Edition, 2006.
- 2 Pardeep Sahni, Disaster Risk Reduction in South Asia, PHI Learning, New Delhi, Fourth Edition, 2018.
- 3 M. Saravanakumar, Disaster Management, Himalaya Publishing House, Bangalore, First Edition, 2017
- 4 Singh, Disaster Management: Future Challenges, IK International, New Delhi, First Edition, 2017.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF CIVIL ENGINEERING**  
**CO-PO MAPPING**

Course Code: 20CE907

Regulation: R 2020

Course Name: Introduction to Disaster Management and Mitigation

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	<i>Explain the concepts of disaster and its effect in Indian scenario.</i>	3	3	1	-	-	2	-	-	-	-	-	3	-	-
CO2:	<i>Elaborate the difference between natural and manmade disasters.</i>	3	3	1	-	-	3	-	-	-	-	-	3	-	-
CO3:	<i>Outline the disaster management cycle and its operation</i>	3	3		-	-	2	-	-	-	-	-	3	-	-
CO4:	<i>Outline the disaster management in India and its profile</i>	3	3	1	-	-	3	-	-	-	-	-	3	-	-
CO5:	<i>Propose the application of geo-informatics for disaster management and mitigation.</i>	3	3	3	-	2	3	-	-	-	-	-	3	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>2</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>

20CE908

**INTRODUCTION TO EARTHQUAKE ENGINEERING**  
 (Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes :** On successful completion of the course, the student will be able to

**Cognitive Level**

CO1: Illustrate the causes and effects of earthquake.	Understand
CO2: Explain the basic concepts in seismology and correlate to earthquake engineering.	Understand
CO3: Summarize the theory of vibrations.	Understand
CO4: Outline the design process for earthquake resisting structures	Understand
CO5: Predict the performance of building and structures under the earthquake.	Understand

**UNIT - I CAUSES AND EFFECTS OF EARTHQUAKE [ 09 ]**

Causes of earthquake by natural sources and manmade sources - Earthquake effects on building structure - Liquefaction of soils, effects of liquefaction, methods to reduce liquefaction - Land and rock slides - tsunamis.

**UNIT - II ELEMENTS OF ENGINEERING SEISMOLOGY [ 09 ]**

Plate tectonics, Elastic rebound, seismic zoning map of India , Focus, epicenter, seismic waves, magnitude, intensity, intensity scale and its correlation with ground acceleration, characteristics of strong ground motions.

**UNIT - III THEORY OF VIBRATIONS [ 09 ]**

Basic concepts of vibration - Difference between static loading and dynamic loading - Types of vibration - Vibration measuring instruments - Degrees of freedom -Types of Damping.

**UNIT - IV DESIGN METHODOLOGY [ 09 ]**

Design methodology - Architectural consideration - Geotechnical consideration - Structural design consideration, earthquake design philosophy, importance of ductility - Capacity design - Techniques of aseismic design - Design spectrum.

**UNIT - V PERFORMANCE OF BUILDING AND STRUCTURES [ 09 ]**

Lessons learnt from the past earthquakes - Shear wall, types of shear wall ,function of shear wall - Concepts of seismic base isolation technique - Base isolation devices - Seismic dampers - Seismic active control.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :**

- 1 Duggal, S .K., Earthquake Resistant Design of Structures, Oxford University Press, London, Second Edition, 2013.
- 2 Damodarasamy, S.R. and Kavitha, S., Basics of structural dynamics and Aseismic design, PHI Learning Pvt. Ltd, New Delhi, Fifth Edition, 2006.

**Reference Books :**

- 1 Pankaj Agarwal. and Manish Shrikhande., Earthquake Resistant Design of Structures, Prentice Hall of India, New Delhi, Third Edition, 2009.
- 2 Chopra, Anil. K., Dynamics of Structures -Theory and Applications to Earthquake Engineering, Prentice Hall of India (P), New Delhi, Fifth Edition, 2020.
- 3 Murty C.V.R .Earthquake tips, IITK, Building material and technology promotion council, New Delhi, First Edition, 2005.
- 4 <http://nptel.ac.in/syllabus/105101004/>

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF CIVIL ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20CE908

Course Name: Introduction to Earthquake Engineering

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Illustrate the causes and effects of earthquake.</i>	3	2	2	-	-	-	2	-	-	-	-	3	-	-
CO2	<i>Explain the basic concepts in seismology and correlate to earthquake engineering.</i>	3	2	2	-	-	-	2	-	-	-	-	3	-	-
CO3	<i>Summarize the theory of vibrations.</i>	3	2	3	-	-	-	2	-	-	-	-	3	-	-
CO4	<i>Outline the design process for earthquake resisting structures</i>	3	2	3	2	-	-	2	-	-	-	-	3	-	-
CO5	<i>Predict the performance of building and structures under the earthquake.</i>	3	2	3	2	-	-	2	-	-	-	-	3	-	-
<b>Average</b>		<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



20CE909

**SOLID WASTE MANAGEMENT**  
(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course**Course Outcomes :** On successful completion of the course, the student will be able to**Cognitive Level**

CO1: Overview the concept of Solid waste and management.

Understand

CO2: Summarize about on-site storage and processing of solid waste.

Understand

CO3: Summarize about collection and transportation of waste.

Understand

CO4: Summarize about off-Site Processing of solid waste.

Understand

CO5: Interpret about safe disposal of solid waste.

Understand

**UNIT - I Solid Waste and its Perspectives****[ 09 ]**

Sources – Types – Composition – Properties – Characteristics – Quantities – Generation rates – Types of Sampling – Functional elements – Legislative measures – 3R concept – Participatory waste management.

**UNIT - II On-Site Storage and Processing****[ 09 ]**

On-site storage methods - materials used for containers –on site segregation of solid wastes -public health &amp; economic aspects of storage - options under Indian conditions - Critical Evaluation of Options.

**UNIT - III Collection and Transfer****[ 09 ]**

Collection services – Classification of container systems – Analysis of collection system – Collection routes – Guidelines – Transfer station –Site selection – Types – Manpower requirement.

**UNIT - IV Off-Site Processing****[ 09 ]**

Processing techniques and Equipment; Resource recovery from solid wastes – composting – Factors affecting composting – Indore and Bangalore processes – Vermicomposting, Incineration, Pyrolysis - options under Indian conditions.

**UNIT - V Disposal****[ 09 ]**

Sanitary landfills – site selection – merits and demerits - methods and operation of sanitary landfills - Leachate collection and control methods – Incinerators - types – hazardous wastes and its effects on environment – case studies.

**Total (L= 40, T = 5 ) = 45 Periods****Text Books :**

- 1 Tchobanoglous, G., Frank Kreith, Hand Book of Solid Waste Management, McGraw-Hill, Inc., California, Second Edition, 2002.
- 2 Ramachandra, T. V., Management of Municipal Solid Waste, TERI Press, New Delhi, First Edition, 2009

**Reference Books :**

- 1 William A. Worrell, P. Aarne Vesilind, Solid Waste Engineering, Cengage Learning Asia Pte Limited, Second Edition, 2012.
- 2 Rao, M.N., Sultana, Razia Kota, Sri Harsha, Solid and Hazardous Waste Management: Science and Engineering, Butterworth-Heinemann, Burlington, First Edition, 2016
- 3 John Pichtel, Waste Management Practices: Municipal, Hazardous, and Industrial, CRC Press, US, Second Edition, 2014.
- 4 Freeman, H. M., –Standard Handbook of Hazardous Waste Treatment and Disposal, McGraw-Hill, Inc., Second Edition, Noida, 1997.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF CIVIL ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20CE909

Course Name: Solid Waste Management

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Overview the concept of Solid waste and management.</i>	3	3	3	-	-	-	-	-	2	-	-	-	-	-
CO2	<i>Summarize about on-site storage and processing of solid waste.</i>	3	3	3	-	-	-	-	-	2	-	-	-	-	-
CO3	<i>Summarize about Collection and transportation of waste.</i>	3	3	3	-	-	-	-	-	2	-	-	-	-	-
CO4	<i>Summarize about off-Site Processing of solid waste.</i>	3	3	3	-	-	-	-	-	2	-	-	-	-	-
CO5	<i>Interpret about safe disposal of solid waste.</i>	3	3	3	-	-	-	-	-	2	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	-	-	-	-	-	<b>2</b>	-	-	-	-	-

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

	<b>K.S.R. COLLEGE OF ENGINEERING (Autonomous)</b>	<b>R 2020</b>			
<b>20CE910</b>	<b>WATER AND AIR POLLUTION MANAGEMENT</b>	L	T	P	C
	<b>(Open Elective)</b>	3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes :** On successful completion of the course, the student will be able to

**Cognitive Level**

CO1: Explain water and air quality standards	Understand
CO2: Discuss water treatment and fundamentals of air pollution	Understand
CO3: Demonstrate the particulate of air pollution.	Understand
CO4: Classify air pollution control technologies.	Understand
CO5: Describe air pollution control equipment.	Understand

**UNIT - I INTRODUCTION [ 09 ]**

Water effluent standards -water quality indices - physical- chemical and biological parameters of water- water quality requirement - potable water standards -Air pollutants – Sources – Classification of air pollutants – Particulates and gaseous pollutants – Effects of air pollutants on human health, vegetation and property – Global issues and air pollution – Global warming – Ozone layer depletion – Ambient air quality and emission standards – Air pollution indices – Air act.

**UNIT - II WATER TREATMENT AND FUNDAMENDALS OF ATMOSPHERIC POLLUTANTS [ 09 ]**

Water purification systems in natural systems- physical processes-chemical processes and biological processes primary, secondary and tertiary treatment-Unit operations-unit processes. Mixing, clarification - sedimentation; Types; aeration and gas transfer – coagulation and flocculation, coagulation processes - stability of colloids –Disinfection - Fundamentals of meteorology – Wind roses – Atmospheric stability – Atmospheric diffusion of pollutants – Transport, transformation and deposition of air contaminants – Plume behaviour – Atmospheric diffusion theories – Plume rise.

**UNIT - III PARTICULATE AIR POLLUTION [ 09 ]**

Control principles – Principles and equipment description of control technologies – Particulates control by Gravitation, centrifugal, filtration, scrubbing, electrostatic precipitation – Absorption, adsorption, condensation, incineration and biofiltration for control of gaseous air pollutants.

**UNIT - IV AIR POLLUTION CONTROL TECHNOLOGIES [ 09 ]**

Biological air pollution control technologies – Bioscrubbers, biofilters. Air pollutants in indoor environments – Levels of pollutants in indoor and outdoor air – Indoor air pollution from outdoor sources – Measurement methods – Control Technologies.

**UNIT - V AIR POLLUTION CONTROL EQUIPMENT [ 09 ]**

Introduction – Installation of Settling chambers, Inertial separators, Dust trap, Involute cyclone, Multiple cyclone, Filters, Electrostatic precipitators, Scrubbers, Separating devices – Efficiency of equipment.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :**

- 1 Rao, C. S., Environmental Pollution Control Engineering, New Age International, New Delhi, First Edition, 2006.
- 2 Davis M. L. and Cornwell D. A., Introduction to Environmental Engineering, Tata McGraw Hill Education Pvt. Ltd., New Delhi, First Edition, 2010.

**Reference Books :**

- 1 Rao, C. S., Environmental Pollution Control Engineering, New Age International, New Delhi, First Edition, 2006.
- 2 Anjaneyulu, D., Air Pollution and Control Technologies, Allied Publishers, Mumbai, First Edition 2002.
- 3 S.K. Garg, "Water Supply Engineering", Khanna Publishers, New Delhi, Thirty three Edition, 2010.
- 4 <https://nptel.ac.in/courses/122106030>

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF CIVIL ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20CE910

Course Name: Water and Air Pollution Management

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Explain water and air quality standards</i>	3	3	-	-	-	-	2	-	-	-	-	3	-	-
CO2	<i>Discuss water treatment and fundamentals of air pollution</i>	3	3	-	-	-	-	-	-	-	-	-	2	-	-
CO3	<i>Demonstrate the particulate of air pollution.</i>	3	2	-	-	-	-	2	-	-	-	-	3	-	-
CO4	<i>Classify air pollution control technologies</i>	3	3	-	-	-	-	2	-	-	-	-	3	-	-
CO5	<i>Describe air pollution control equipment.</i>	3	3	-	-	-	-	2	-	-	-	-	3	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20CS901	PROGRAMMING IN JAVA			
	L	T	P	C
(Open Elective)	3	0	0	3

**Prerequisite:**

Course Outcomes : On successful completion of the course, the student will be able to	Cognitive Level
CO1: Discover java programming fundamentals to solve real world problem.	Understand
CO2: Implement the concept of class and constructor.	Apply
CO3: Examine important features of java like inheritance and interfaces.	Understand
CO4: Illustrate the features of package and exception handling.	Understand
CO5: Apply the concepts of string manipulations.	Apply

**UNIT – I JAVA FUNDAMENTALS [ 09 ]**

The Java Buzzwords – Data Types – Variables– Local Variable – Instant Variable – Static variable – Array-Single Dimensional Array-Multi Dimensional Array – Operators – Control Statements – if – if else – nested if– else if– for – for each – while – do while – Switch – Break– Continue.

**UNIT – II CLASS FUNDAMENTALS AND CONSTRUCTORS [ 09 ]**

Class Fundamentals –Declaring Objects – Methods – Instant Method– Static Method– Method Overloading– Recursion – this keyword – Garbage Collection – Constructors – Argument constructor– No-Argument Constructor – Constructor Overloading – Access Control.

**UNIT – III INHERITANCE AND INTERFACES [ 09 ]**

Inheritance – Single – Multilevel – Hierarchical – Super keyword – Method Overriding – Abstract class – Final variable– Final class – Interfaces – Default Interface Methods – Static Methods in Interface.

**UNIT – IV PACKAGES AND EXCEPTION HANDLING [ 09 ]**

Packages –User define Package – Predefine Package – Access Protection – Importing Packages – Array List– Wrapper Classes – Exception Handling Fundamentals – Exceptions Types –Try and Catch – Multiple Catch – Nested Try – Throw – Throws – Finally.

**UNIT – V STRING AND STRING BUFFER [ 09 ]**

The String Constructors – String Length – Character Extraction – String Comparison – Searching Strings – Modifying a String – Data Conversion using valueOf method – Methods in String Buffer – append – delete – replace – insert – reverse – capacity.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :**

- 1 Herbert Schildt, Java - The Complete Reference, Oracle Press, McGraw-Hill Education, New Delhi, Eleventh Edition, 2018.
- 2 Cay S. Horstmann, Core Java Volume 1 - Fundamentals, Prentice Hall, India, Tenth Edition, 2015.

**Reference Books :**

- 1 Herbert Schildt, Java - A Beginner Guide, Oracle Press, McGraw-Hill Education, New Delhi, Sixth Edition, 2014.
- 2 Joshua Bloch, Effective Java: A Programming Language Guide, Addison-Wesley Professional, USA, Third Edition, 2018.
- 3 Allen B. Downey and Chris Mayfield, Think Java: How to Think Like a Computer Scientist, O'Reilly, California, First Edition, 2016.
- 4 [https://onlinecourses.nptel.ac.in/noc19\\_cs07/preview](https://onlinecourses.nptel.ac.in/noc19_cs07/preview)

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20CS901

Course Name: PROGRAMMING IN JAVA

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Discover java programming fundamentals to solve real world problem.</i>	3	3	2	3	3	-	-	-	-	-	-	3	-	-
CO2	<i>Implement the concept of class and constructor.</i>	3	3	2	3	2	-	-	-	-	-	-	3	-	-
CO3	<i>Examine important features of java like inheritance and interfaces.</i>	3	3	1	3	2	-	-	-	-	-	-	2	-	-
CO4	<i>Illustrate the features of package and exception handling.</i>	3	3	2	2	3	-	-	-	-	-	-	3	-	-
CO5	<i>Apply the concepts of string manipulations.</i>	3	3	2	3	2	-	-	-	-	-	-	3	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>

1: Slight (Low)    2: Moderate (Medium)    3: Substantial (High)



**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**CO-PO MAPPING**

Course Code: 20CS902

Regulation: R 2020  
 Course Name: BASIC CONCEPTS OF DATA  
 STRUCTURE

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Elaborate the different linear data structure to solve simple problems.</i>	3	2	3	-	2	-	-	-	-	-	-	2	-	-
CO2	<i>Build the various tree structures with its operations.</i>	3	2	3	-	2	-	-	-	-	-	-	2	-	-
CO3	<i>Describe the concept of AVL tree, splay tree, B tree and B+ tree.</i>	3	3	2	-	2	-	-	-	-	-	-	2	-	-
CO4	<i>Apply graph data structure to solve real time problems.</i>	3	2	2	-	2	-	-	-	-	-	-	2	-	-
CO5	<i>Discover various sorting, hashing and searching techniques.</i>	3	2	2	-	2	-	-	-	-	-	-	2	-	-
<b>Average</b>		<b>3</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



20CS903	FUNDAMENTALS OF DATABASE CONCEPTS	L	T	P	C
	(Open Elective)	3	0	0	3

**Prerequisite:**

Course Outcomes : On successful completion of the course, the student will be able to	Cognitive Level
CO1: Outline database architecture and the E-R Model for Database design.	Understand
CO2: Apply Structured query language to create and manipulate a relational database.	Apply
CO3: Build functions, triggers and recursive queries.	Apply
CO4: Demonstrate the purpose of normalization.	Understand
CO5: Discover about transaction and query processing concepts.	Understand

**UNIT – I BASIC CONCEPTS AND E-R MODEL [ 9 ]**

Database System Applications – Purpose of Database Systems – Views of Data – Database Languages –Database and Application Architecture. Overview of the Design Process – The Entity-Relationship model – Complex Attributes – Mapping Cardinalities and Keys.

**UNIT – II RELATIONAL MODEL AND SQL FUNDAMENTALS [ 9 ]**

Introduction to Relational Model: Structure of Relational Databases – Database Schema –Keys – Schema Diagrams. Overview of the SQL Query Language – SQL Data Definition – Basic Structure of SQL Queries – Additional Basic Operations – Set operations – Null values – Aggregate functions – Modification of the Database.

**UNIT - III INTERMEDIATE SQL AND ADVANCED SQL [ 09 ]**

Join Expressions – Views – Transactions – Integrity Constraints – Authorization –Accessing SQL from Programming Language – Functions and Procedures – Triggers – Recursive Queries.

**UNIT - IV NORMALIZATION [ 09 ]**

Functional Dependencies – Non-loss Decomposition – First, Second and Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

**UNIT - V TRANSACTIONS AND QUERY PROCESSING [ 09 ]**

Transaction Concept – A Simple Transaction Model – Storage Structure – Transaction Atomicity and Durability – Transaction Isolation – Serializability – Concurrency Control – Lock-Based protocols – Query Processing overview

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :**

- 1 Abraham Silberschatz, Henry F. Korth and S. Sudharshan, Database System Concepts, Tata McGraw Hill, New Delhi, Seventh Edition, 2019.
- 2 RamezElmasri and Shamkant B. Navathe, Fundamentals of Database Systems, Pearson Education, New Delhi, Seventh Edition, 2016.

**Reference Books :**

- 1 Abraham Silberschatz, Henry F. Korth and S. Sudharshan, Database System Concepts, Tata McGraw Hill, New Delhi, Sixth Edition, 2015.
- 2 S.K.Singh, Database Systems Concepts, Design and Applications, Pearson Education, New Delhi, Second Edition, 2011.
- 3 C.J.Date, A.Kannan and S.Swamynathan, An Introduction to Database Systems, Pearson Education, New DelhiEighth Edition, 2006.
- 4 <http://freevideolectures.com/course/2668/database-management-system#>

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**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**CO-PO MAPPING**

Course Code: 20CS903

Regulation: R 2020  
 Course Name: FUNDAMENTALS OF DATABASE CONCEPTS

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Outline database architecture and the E-R Model for Database design.</i>	3	3	3	-	2	2	-	-	-	-	-	2	-	-
CO2	<i>Apply Structured query language to create and manipulate a relational database.</i>	3	3	3	-	2	2	-	-	-	-	-	2	-	-
CO3	<i>Build functions, triggers and recursive queries.</i>	3	3	3	-	2	2	-	-	-	-	-	2	-	-
CO4	<i>Demonstrate the purpose of normalization.</i>	3	3	3	-	2	2	-	-	-	-	-	2	-	-
CO5	<i>Discover about transaction and query processing concepts.</i>	3	3	3	-	2	2	-	-	-	-	-	2	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20CS904	<b>INTERNET PROGRAMMING</b>	L	T	P	C
	(Open Elective)	3	0	0	3

**Prerequisite:**

<b>Course Outcomes : On successful completion of the course, the student will be able to</b>	<b>Cognitive Level</b>
CO1: Summarize the technologies around the internet.	Understand
CO2: Construct the idea of web designing at user interface.	Apply
CO3: Discuss the concept of data processing on client and server side.	Understand
CO4: Construct the web oriented response at server side in PHP and XML format	Apply
CO5: Illustrate the web service architecture and to enable rich client presentation using AJAX.	Understand

**UNIT – I INTRODUCTION TO WEB [ 09 ]**

Web Essentials: Clients, Servers, and Communications. The Internet – History – Basic Internet Protocols: TCP and IP – DNS – URL. The World Wide Web – HTTP: Request Message – Response Message – Web Clients – Web Servers – Case Study.

**UNIT – II BASICS OF HTML AND CSS [ 09 ]**

HTML. An Introduction to HTML History and Version - Structure of HTML Page – HTML tags for data formatting - Tables – Links – Images - List – Frames – Forms - HTML 5 Tags and Validation. Style Sheets: CSS Syntax and Structure – CSS Rules for Backgrounds, Colours, and Properties – Manipulating Texts, Fonts, borders and Boxes - Margin – Padding Lists – CSS Positioning.

**UNIT– III CLIENT SIDE SCRIPTING [ 09 ]**

JavaScript: Syntax and Execution – Internal, embedded and External JavaScript. JavaScript: Variables – Arrays – Functions – Conditions – Loops – Type Conversion – Objects and DOM – Inbuilt Functions – Validation and Regular Expressions – Event Handling.

**UNIT – IV SERVER SIDE SCRIPTING [ 09 ]**

PHP: Introduction – Using PHP – variables – Program Control. Built-in Functions: Connecting to Database – Using cookies – Regular Expression. XML: Basics – DTD – XML Scheme – DOM and Presenting XML – XML parsers and validation.

**UNIT– V AJAX and WEB SERVICE [ 09 ]**

AJAX: Introduction – Ajax Client Server Architecture, XML http Request Object – Call Back Methods. Introduction to Web Services – Java web services: Basics – SOAP – WSDL: Creating, Publishing and Describing a web service – Consuming a web service – Database Driven Web Service from an application.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :**

- 1 Randy Connolly and Ricardo Hoar, Fundamentals of Web Development, Pearson Education New Delhi, First Edition, 2016.
- 2 Paul Deitel, Harvey Deitel and Abbey Deitel , Internet and World Wide Web – How to Program, Pearson Education, New Delhi, Fifth Edition, 2012.

**Reference Books :**

- 1 Chris Bates, Web Programming – Building Internet Applications, John Wiley & Sons Ltd, USA, Third Edition, 2007.
- 2 John Dean, Web Programming With HTML5, CSS and JavaScript, Jones and Bartlett Publishers, Inc, United States, Third Edition, 2008.
- 3 Jon Duckett, Beginning Web Programming With HTML, XHTML and CSS, Wiley Publishing Inc, India, Second Edition, 2008.
- 4 [www.tutorialspoint.com](http://www.tutorialspoint.com)

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CO-PO MAPPING

Course Code: 20CS904

Regulation: R 2020

Course Name: INTERNET PROGRAMMING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Summarize the technologies around the internet.</i>	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO2	<i>Construct the idea of web designing at user interface.</i>	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO3	<i>Discuss the concept of data processing on client and server side.</i>	3	3	3	-	3	1	-	-	-	-	-	2	-	-
CO4	<i>Construct the web oriented response at server side in PHP and XML format</i>	3	3	3	-	3	1	-	-	-	-	-	2	-	-
CO5	<i>Illustrate the web service architecture and to enable rich client presentation using AJAX.</i>	3	2	3	-	3	2	-	-	-	-	-	3	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20CS905	FUNDAMENTALS OF MOBILE APPLICATION DEVELOPMENT (Open Elective)	L	T	P	C
		3	0	0	3

**Prerequisite:**

Course Outcomes : On successful completion of the course, the student will be able to	Cognitive Level
CO1: Identify various concepts of mobile programming that make it unique from programming for other platforms.	Understand
CO2: Critique mobile applications on their design pros and cons.	Understand
CO3: Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.	Apply
CO4: Program mobile applications for the Android operating system that use basic and advanced phone features.	Understand
CO5: Deploy applications to the Android marketplace for distribution.	Apply

**UNIT – I OVERVIEW OF THE ANDROID PLATFORM [ 09 ]**

Introducing Android – Setting Up Your Android Development Environment – Writing Your First Android Application – Mastering the Android Development Tools

**UNIT – II ANDROID APPLICATION BASICS [ 09 ]**

Understanding the Anatomy of an Android Application – Defining Your Application Using the Android Manifest File – Managing Application Resources

**UNIT – III ANDROID USER INTERFACE DESIGN ESSENTIALS [ 09 ]**

Exploring User Interface Screen Elements – Designing User Interfaces with Layouts – Working with Fragments – Working with Dialogs

**UNIT – IV ANDROID APPLICATION DESIGN ESSENTIALS [ 09 ]**

Android application design: Using Android Preferences – Working with Files and Directories – Using Content Providers – Designing Compatible Applications

**UNIT – V PUBLISHING AND DISTRIBUTING ANDROID APPLICATIONS [ 09 ]**

The Android Software Development Process – Designing and Developing Bulletproof Android Applications – Testing Android Applications – Publishing Your Android Application

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :**

- 1 Lauren Darcey, Shane Conder, Android Wireless Application Development, Pearson Education, India, Second Edition, 2011.
- 2 Ed Burnette, Hello Android: Introducing Google's Mobile Development Platform, The Pragmatic Publishers, North Carolina USA, Third Edition, 2010.

**Reference Books :**

- 1 Google Developer Training, Android Developer Fundamentals Course – Concept Reference, Google Developer Training Team, 2016.
- 2 Zigurd Mednieks, Laird Dornin, Blake Meike G, Masumi Nakamura, Programming Android: Java Programming for the New Generation of Mobile Devices, O'Reilly Media, USA, Second Edition, 2011.
- 3 2016Reto Meier, Professional Android 4 Application Development, Wrox Publications, John Wiley, New York, First Edition, 2012.
- 4 <https://developer.android.com/training/basics/firstapp>

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**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**CO-PO MAPPING**

**Course Code: 20CS905**

**Regulation: R 2020**  
**Course Name: FUNDAMENTALS OF MOBILE APPLICATION DEVELOPMENT**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Identify various concepts of mobile programming that make it unique from programming for other platforms.</i>	3	2	2	-	1	-	-	-	-	-	-	1	-	-
CO2	<i>Critique mobile applications on their design pros and cons.</i>	3	2	3	-	2	-	-	-	-	-	-	2	-	-
CO3	<i>Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.</i>	3	2	3	-	2	-	-	-	-	-	-	2	-	-
CO4	<i>Program mobile applications for the Android operating system that use basic and advanced phone features.</i>	3	2	2	-	2	-	-	-	-	-	-	1	-	-
CO5	<i>Deploy applications to the Android marketplace for distribution.</i>	3	2	3	-	2	-	-	-	-	-	-	2	-	-
<b>Average</b>		<b>3</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20CS906	PRINCIPLES OF ETHICAL HACKING (Open Elective)	L	T	P	C
		3	0	0	3

**Prerequisite:**

Course Outcomes : On successful completion of the course, the student will be able to	Cognitive Level
CO1: Discuss the basics of hacking with its ethics	Understand
CO2: Extend the possibilities and types of Attacks	Understand
CO3: Summarize the testing process with programming Language.	Understand
CO4: Infer about the impact of hacking wireless network	Understand
CO5: Outline about the protection scheme.	Understand

**UNIT - I ETHICAL HACKING OVERVIEW [ 9 ]**

Introduction to Ethical Hacking – What You Can Do Legally – What You Cannot Do Legally – TCP/IP Concepts Review – IP Addressing – Overview of Numbering Systems

**UNIT - II NETWORK ATTACKS AND ITS IMPACT [ 9 ]**

Malicious Software – Protecting Against Malware Attacks – Intruder Attacks on Networks and Computers - Addressing Physical Security – Using Web Tools for Foot printing – Conducting Competitive Intelligence – Introduction to Social Engineering – Using Port-Scanning Tools – Conducting Ping Sweeps – Understanding Scripting.

**UNIT - III SECURITY TESTING [ 9 ]**

Enumerating Operating Systems – Introduction to Computer Programming – Understanding C,HTML, Pearl and Object Oriented Programming Basics – Windows OS Vulnerabilities – Tools for Identifying Vulnerabilities in Windows – Windows and Other Embedded Operating Systems – Vulnerabilities of Embedded OSs.

**UNIT - IV WEB APPLICATION AND WIRELESS NETWORK [ 9 ]**

Understanding Web Applications – Understanding Web Application Vulnerabilities – Tools for Web Attackers and Security Testers – Hacking Wireless Networks

**UNIT - V PROTECTION SYSTEM [ 9 ]**

Understanding Cryptography Basics – Understanding Symmetric and Asymmetric Algorithms – Understanding Public Key Infrastructure – Understanding Cryptography Attacks – Understanding Routers and Firewalls – Understanding Intrusion Detection and Prevention Systems – Understanding Honey pots

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :**

- 1 Michael T. Simpson and Nicholas Antill, Ethical Hacking and Network defense, Cengage Learning, New Delhi, Third Edition, 2017.
- 2 Ankit Fadia, Ethical Hacking, Macmillan India Ltd, India, Second Edition, 2006.

**Reference Books :**

- 1 Steven Defino, Barry Kaufman and Nick Valenteen, Official Certified Ethical Hacker review guide, Cenage learning New Delhi, Second Edition, 2012.
- 2 Ankit Fadia, The Ethical Hacking Guide to Corporate Security, Macmillan Publishers, India, Second Edition, 2010.
- 3 James S. Tiller, The Ethical Hack: A Framework for Business value Penetration Testing, CRC Press, Florida, First Edition, 2005.
- 4 [https://onlinecourses.nptel.ac.in/noc22\\_cs13](https://onlinecourses.nptel.ac.in/noc22_cs13)

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**CO-PO MAPPING**

Regulation: **R 2020**  
 Course Code: **20CS906**      Course Name: **PRINCIPLES OF ETHICAL HACKING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Discuss the basics of hacking with its ethics</i>	3	3	3	-	3	3	-	3	-	-	-	2	-	-
CO2	<i>Extend the possibilities and types of Attacks</i>	3	3	2	-	1	2	-	1	-	-	-	1	-	-
CO3	<i>Summarize the testing process with programming Language.</i>	3	3	2	-	3	3	-	2	-	-	-	3	-	-
CO4	<i>Infer about the impact of hacking wireless network</i>	3	3	2	-	3	2	-	1	-	-	-	2	-	-
CO5	<i>Outline about the protection scheme.</i>	3	3	2	-	3	2	-	1	-	-	-	3	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



20CS907	GREEN TECHNOLOGY		L	T	P	C
	(Open Elective)		3	0	0	3

**Prerequisite:**

Course Outcomes : On successful completion of the course, the student will be able to	Cognitive Level
CO1: Identify Green IT with its different dimensions and Strategies.	Understand
CO2: Describe Green data centres and storage along with its green software methodologies.	Understand
CO3: Outline the concepts o to manage the green IT with necessary components.	Understand
CO4: Recognize various green enterprise activities, functions and their role with IT.	Understand
CO5: Categorize various laws, standards and protocols for regulating green IT.	Understand

**UNIT – I GREEN IT [ 09 ]**

Environmental Concerns and Sustainable Development – Environmental Impacts of IT – Green IT – Holistic Approach to Greening IT – Greening IT – Applying IT for enhancing Environmental sustainability – Green IT Standards and Eco- Labelling of IT – Enterprise Green IT strategy – Life Cycle of a device or hardware – Reuse, Recycle and Dispose.

**UNIT – II SUSTAINABLE SOFTWARE DEVELOPMENT AND GREEN DATA CENTRES [ 09 ]**

Current Practices – Sustainable Software – Attributes – Metrics – Methodology – Defining Actions – Data Centres: Associated Energy Challenges – IT Infrastructure – Management – Green Data Centre Metrics – Green Data Storage – Storage Media Power Characteristics – Energy Management Techniques for Hard Disks.

**UNIT – III ENTERPRISE GREEN IT STRATEGY [ 09 ]**

Approaching Green IT Strategies – Business Drivers – Business Dimensions for Green IT Transformation – Organizational Considerations – Steps to Develop Green IT Strategy – Metrics and Measurements – Multilevel Sustainable Information – Sustainability Hierarchy Models.

**UNIT – IV GREEN ENTERPRISE READINESS AND THE ROLE OF IT [ 09 ]**

Readiness and Capability – Development and Measuring of an Organization's G-Readiness Framework – Organizational and Enterprise Greening – Information systems in Greening Enterprises – IT Usage and Hardware – Inter-Organizational Enterprise activities and Green Issues – Enablers and making the case for IT and Green Enterprise.

**UNIT – V LAWS, STANDARDS AND PROTOCOLS [ 09 ]**

The regulatory environment and IT manufacturers – Non regulatory government initiatives – Industry associations and standards bodies – Green building standards – Green data centres – Social movements and Greenpeace – Cloud Computing – Energy Usage Model.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :ENERGY MANAGEMENT**

- 1 San Murugesan, G.R. Gangadharan, Harnessing Green IT - Principles and Practices, Wiley Publication, India, First Edition, 2012.
- 2 Bhuvan Unhelkar, Green IT Strategies and Applications - Using Environmental Intelligence, CRC Press, Florida, First Edition, 2016.

**Reference Books :**

- 1 Woody Leonhard, Katherrine Murray, Green Home computing for dummies, Wiley Publication, India, First Edition, 2009.
- 2 Bud E. Smith, Green Computing: Tools and Techniques for Saving Energy, Money and Resources, CRC Press, Florida, Second Edition, 2014.
- 3 Jason Harris, Green Computing and Green IT - Best Practices on regulations and industry, Lulu.com, First edition, 2008.
- 4 <https://nptel.ac.in/courses/106/105/106105167/>

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**CO-PO MAPPING**

**Course Code: 20CS907**

**Regulation: R 2020**  
**Course Name: GREEN TECHNOLOGY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Identify Green IT with its different dimensions and Strategies.	3	3	3	-	3	-	-	-	-	-	-	2	-	-
CO2	Describe Green data centres and storage along with its green software methodologies.	3	2	2	-	3	-	-	-	-	-	-	1	-	-
CO3	Outline the concepts o to manage the green IT with necessary components.	3	3	2	-	3	-	-	-	-	-	-	2	-	-
CO4	Recognize various green enterprise activities, functions and their role with IT.	3	3	3	-	3	-	-	-	-	-	-	1	-	-
CO5	Categorize various laws, standards and protocols for regulating green IT.	3	3	3	-	3	-	-	-	-	-	-	2	-	-
<b>Average</b>		3	3	3	-	3	-	-	-	-	-	-	2	-	-

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20CS908

## ARTIFICIAL INTELLIGENCE AND ROBOTICS

(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite:**

Course Outcomes : On successful completion of the course, the student will be able to	Cognitive Level
CO1: Describe agents structure and predict uninformed search algorithms for any AI problem	Understand
CO2: Illustrate appropriate AI methods to solve a given problem.	Apply
CO3: Explain a problem using first order and predicate logic.	Understand
CO4: Identify planning algorithms and illustrate about learning	Apply
CO5: Infer about robotics concept.	Understand

**UNIT – I FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE [ 9 ]**

Intelligent Agents – Agents and environments – Good behavior– The Nature of Environments – The Structure of Agents – Solving Problems by Searching: Problem-Solving Agents – Example problems – Searching for solutions – Uninformed search strategies.

**UNIT – II INFORMED SEARCHING TECHNIQUES [ 9 ]**

Informed (Heuristic) Search Strategies – Heuristic functions – Local Search and Optimization Problems – Adversarial Search – Games – Optimal decisions in games – Alpha-Beta Pruning – Constraint Satisfaction Problems – Defining Constraint Satisfaction Problems.

**UNIT – III LOGICAL REASONING [ 9 ]**

First order logic – Representation revisited – Syntax and semantics for first order logic – Using first order logic – Knowledge engineering in first order logic – Inference in First order logic – Propositional versus first order logic – Unification and lifting – Forward chaining – Backward chaining.

**UNIT – IV PLANNING AND LEARNING [ 9 ]**

Classical Planning: Definition of Classical Planning – Algorithm for Planning as State – Space Search – Planning graphs – Analysis of Planning Approaches – Learning from Examples: Forms of Learning – Supervised learning – Learning Decision trees – Ensemble Learning – Explanation-Based Learning.

**UNIT – V ROBOTICS [ 9 ]**

Introduction – Robot Hardware – Robot Perception – Planning to Move – Planning Uncertain Movements – Moving – Robotic Software Architectures – Application Domains.

**Total (L= 45, T = 0 ) = 45 Periods****Text Books :**

- 1 Stuart Russell and Peter Norvig, Artificial Intelligence – A Modern Approach, Pearson Education, New Delhi, Third Edition, 2016
- 2 Kevin Night and Elaine Rich, Nair B., Artificial Intelligence (SIE) , McGraw Hill, New Delhi, Third Edition, 2008

**Reference Books :**

- 1 Dan W. Patterson, Introduction to AI and ES, Pearson Education, New Delhi, Third Edition, 2007.
- 2 Peter Jackson, Introduction to Expert Systems, Pearson Education, New Delhi, Third Edition, 2007.
- 3 Deepak Khemani, Artificial Intelligence, Tata McGraw Hill, New Delhi, Third Edition, 2013.
- 4 David L. Poole and Alan K. Mackworth, –Artificial Intelligence: Foundations of Computational AgentsI, Cambridge University Press, England, First Edition, 2010.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**CO-PO MAPPING**

**Course Code: 20CS908**                      **Regulation: R 2020**  
**Course Name: ARTIFICIAL INTELLIGENCE AND ROBOTICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Describe agents structure and predict uninformed search algorithms for any AI problem</i>	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO2	<i>Illustrate appropriate AI methods to solve a given problem.</i>	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO3	<i>Explain a problem using first order and predicate logic.</i>	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO4	<i>Identify planning algorithms and illustrate about learning</i>	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO5	<i>Infer about robotics concept.</i>	3	3	3	-	3	2	-	-	-	-	-	3	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20CS909	BIG DATA AND ANALYTICS			
	L	T	P	C
	3	0	0	3

(Open Elective)

**Prerequisite:****Course Outcomes : On successful completion of the course, the student will be able to** **Cognitive Level**

CO1: Discover the insights of big data analytics	Understand
CO2: Identify the file systems and to know the map reduce technique	Understand
CO3: Summarize data by utilizing various statistical and data mining approaches	Understand
CO4: Deploy and Perform analytics on real-time streaming data	Understand
CO5: Comprehend the various NoSql alternative database models	Understand

**UNIT – I INTRODUCTION TO BIG DATA [ 9 ]**

Big Data – Definition, Characteristic Features – Big Data Applications – Big Data vs Traditional Data – Risks of Big Data – Structure of Big Data – Web Data – Evolution of Analytic Scalability – Evolution of Analytic Processes, Tools and methods – Analysis Vs Reporting – Modern Data Analytic Tools.

**UNIT – II HADOOP FRAMEWORK [ 9 ]**

Distributed File Systems – Large-Scale File System Organization – HDFS concepts – Map Reduce Execution, Algorithms using Map Reduce, Matrix-Vector Multiplication – Hadoop YARN.

**UNIT - III DATA ANALYSIS [ 9 ]**

Statistical Methods : Regression modelling – Multivariate Analysis – Classification: SVM & Kernel Methods – Rule Mining – Cluster Analysis – Types of Data in Cluster Analysis – Predictive Analytics – Data analysis using R.

**UNIT – IV MINING DATA STREAMS [ 9 ]**

Streams: Concepts – Stream Data Model and Architecture – Sampling data in a stream – Mining Data Streams and Mining Time-series data – Real Time Analytics Platform Applications – Real Time Sentiment Analysis – Stock Market Predictions.

**UNIT – V BIG DATA FRAMEWORKS [ 9 ]**

Introduction to NoSQL – Aggregate Data Models – Hbase: Data Model and Implementations – Hbase Clients – Examples – Cassandra: Data Model – Examples – Cassandra Clients – Hadoop Integration. Pig – Grunt – Pig Data Model – Pig Latin – developing and testing Pig Latin scripts.

**Total (L= 45, T = 0 ) = 45 Periods****Text Books :**

- 1 Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, John Wiley & Sons, Incorporated, United States, First Edition, 2012.
- 2 David Loshin, Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph, Elsevier Science, Netherlands, First Edition, 2013.

**Reference Books :**

- 1 Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, Germany, Second Edition, 2014.
- 2 Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley, United States, First Edition, 2013.
- 3 P. J. Sadalage and M. Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison-Wesley Professional, United States, Third Edition, 2013.
- 4 Richard Cotton, Learning R – A Step-by-step Function Guide to Data Analysis, O\_Reilly Media, California, Third Edition, 2018.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**CO-PO MAPPING**

**Course Code: 20CS909**

**Regulation: R 2020**

**Course Name: BIG DATA AND ANALYTICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Discover the insights of big data analytics</i>	3	3	2	-	3	2	-	-	-	-	-	1	-	-
CO2	<i>Identify the file systems and to know the map reduce technique</i>	3	2	1	-	3	3	-	-	-	-	-	1	-	-
CO3	<i>Summarize data by utilizing various statistical and data mining approaches</i>	3	3	2	-	3	2	-	-	-	-	-	1	-	-
CO4	<i>Deploy and Perform analytics on real-time streaming data</i>	3	3	2	-	3	2	-	-	-	-	-	1	-	-
CO5	<i>Comprehend the various NoSql alternative database models</i>	3	3	1	-	3	2	-	-	-	-	-	1	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20CS910	HARDWARE AND TROUBLE SHOOTING (Open Elective)	L	T	P	C
		3	0	0	3

**Prerequisite:**

Course Outcomes : On successful completion of the course, the student will be able to	Cognitive Level
CO1: Identify with the Basic functional units of a computer system.	Understand
CO2: Discover the working Concepts of I/O devices in computer.	Understand
CO3: Examine the interfaces and controllers connected to PC.	Understand
CO4: Outline the system configuration, Installation and maintenance of PC.	Understand
CO5: Summarize about faults, diagnostics and troubleshooting in PC.	Understand

**UNIT – I INTRODUCTION [ 9 ]**

Introduction - Computer Organization – Number Systems and Codes – Memory – ALU – CU – Instruction prefetch – Interrupts – I/O Techniques – Device Controllers – Error Detection Techniques – Microprocessor – Personal Computer Concepts – Advanced System Concepts – Microcomputer Concepts – OS – Multitasking and Multiprogramming – Virtual Memory – Cache Memory – Modern PC and User.

**UNIT – II PERIPHERAL DEVICES [ 9 ]**

Introduction – Keyboard – CRT Display Monitor – Printer – Magnetic Storage Devices –FDD – HDD – Special Types of Disk Drives – Mouse and Trackball – Modem – Fax Modem – CD ROM Drive – Scanner – Digital Camera – DVD – Special Peripherals.

**UNIT – III PC HARDWARE OVERVIEW [ 9 ]**

Introduction – Hardware BIOS DOS Interaction – The PC family – PC hardware – Inside the System Box – Motherboard Logic – Memory Space – Peripheral Interfaces and Controllers – Keyboard Interface – CRT Display interface – FDC – HDC – Microprocessors in PC.

**UNIT – IV INSTALLATION AND PREVENTIVE MAINTENANCE [ 9 ]**

Introduction – system configuration – pre installation planning – Installation practice – routine checks – PC Assembling and integration – BIOS setup – Engineering versions and compatibility – preventive maintenance – DOS – Virus – Data Recovery.

**UNIT – V TROUBLESHOOTING [ 9 ]**

Introduction – computer faults – Nature of faults – Types of faults – Diagnostic programs and tools – Microprocessor and Firmware – Programmable LSI's – Bus Faults – Faults Elimination process – Systematic Troubleshooting – Symptoms observation and analysis – fault diagnosis – fault rectification – Troubleshooting levels – FDD, HDD, CD ROM Problems.

**Total (L= 45, T = 0) = 45 Periods**

**Text Books :**

- 1 B. Govindarajalu, IBM PC Clones Hardware, Troubleshooting and Maintenance, McGraw-Hill, New Delhi, Second Edition, 2003.
- 2 K.L. James, Computer Hardware Installation, Interfacing, Troubleshooting and maintenance, PHI Learning Private Limited, India, First Edition, 2013.

**Reference Books :**

- 1 Craig Zacker and John Rourke, PC Hardware: The Complete Reference, McGraw-Hill, New Delhi, Fifth Edition, 2001.
- 2 Jean Andrews, Guide to Hardware Managing, Maintaining and Troubleshooting, Cengage Learning (Course Technology), Boston, Fifth Edition, 2010
- 3 Cheryl A. Schmidt, Complete A+ guide to IT Hardware and Software, Pearson Education, India, Eighth Edition, 2020.
- 4 Scott M. Mueller, Upgrading and Repairing PCs, Pearson Education, India, Twenty Second Edition, 2012.

CO-PO MAPPING

Regulation: R 2020  
 Course Code: 20CS910 Course Name: HARDWARE AND TROUBLE SHOOTING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Identify with the Basic functional units of a computer system.	3	2	-	-	2	-	-	-	-	-	-	2	-	-
CO2	Discover the working Concepts of I/O devices in computer.	3	2	-	-	2	-	-	-	-	-	-	2	-	-
CO3	Examine the interfaces and controllers connected to PC.	3	2	-	-	2	-	-	-	-	-	-	2	-	-
CO4	Outline the system configuration, Installation and maintenance of PC.	3	2	-	-	2	-	-	-	-	-	-	2	-	-
CO5	Summarize about faults, diagnostics and troubleshooting in PC.	3	2	-	-	2	-	-	-	-	-	-	2	-	-
<b>Average</b>		<b>3</b>	<b>2</b>	-	-	<b>2</b>	-	-	-	-	-	-	<b>2</b>	-	-

1: Slight (Low)    2: Moderate (Medium)    3: Substantial (High)



20EE901

**ELECTRICAL DRIVES AND CONTROL**

(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite:****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1:	Categorize and explain the operation of electrical drives	Understand
CO2:	Explain the characteristics of various electrical drives	Understand
CO3:	Interpret the operation of starting and braking methods of AC and DC machines	Understand
CO4:	Choose the appropriate speed control techniques for DC motor drives	Understand
CO5:	Choose the appropriate speed control techniques for AC motor drives	Understand

**UNIT - I INTRODUCTION [ 09 ]**

Electrical drives – Need – Advantage of electrical drives – Basic elements of electrical drives – Factors influencing the choice of electrical drives – Four quadrant operation of a motor driving a hoist load – Load torques – Selection of motors with regard to thermal overloading – Classes of motor duty.

**UNIT - II CHARACTERISTICS OF ELECTRIC DRIVES [ 09 ]**

DC Motors: DC shunt, DC series, DC compound and Permanent Magnet DC motors – AC Motors: Single phase and three phase Induction motors – Speed–Torque characteristics of various types of loads and drive motors.

**UNIT - III MOTOR STARTING AND BRAKING METHODS [ 09 ]**

Types of Starters: Two Point Starter, Three Point Starter, Four Point Starter, DOL Starter, Y-Δ Starter. Braking of Electrical Motors: Shunt Motor, Series Motor, Single Phase Induction Motor.

**UNIT - IV DC DRIVES [ 09 ]**

Speed control of DC series and shunt motors — Armature and field control – Ward-Leonard control system – Controlled Rectifiers Fed DC motor Drive – Chopper fed DC motor Drive: Buck, Boost and Buck-Boost – Applications.

**UNIT - V AC DRIVES [ 09 ]**

Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Inverter and AC Voltage Controller Based Induction Drives – Applications.

**Total (L= 45, T = 0) = 45 Periods****Text Books :**

- 1 Dubey G.K, Fundamentals of Electrical Drives, Narosa Publishing House, New Delhi, Second Edition, 2019.
- 2 Vedam Subramaniam, Electric Drives: Concepts and Applications, Tata McGraw Hill Publishing Company, New Delhi, Second Edition, 2010.

**Reference Books :**

- 1 Krishnan. R, Electric Motor Drives: Modeling, Analysis and Control, Prentice Hall Pvt. Ltd, New Delhi, Second Edition, 2003.
- 2 Pillai.S.K, A First Course on Electric Drives, Wiley Eastern Limited, New Delhi, Fourth Edition, 2012.
- 3 Nagrath I.J and Kothari D. P, Electrical machines, Tata McGraw Hill Publishing Company Ltd, New Delhi, Fifth Edition, 2017.
- 4 M.D. Singh and K.B. Khanchandani, Power Electronics, Tata McGraw Hill Publishing Co Ltd., New Delhi, Second Edition, 2013.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20EE901

Course Name: Electrical Drives and Control

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Categorize and explain the operation of electrical drives</i>	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO2	<i>Explain the characteristics of various electrical drives</i>	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO3	<i>Interpret the operation of starting and braking methods of AC and DC machines</i>	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO4	<i>Choose the appropriate speed control techniques for DC motor drives</i>	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO5	<i>Choose the appropriate speed control techniques for AC motor drives</i>	3	-	1	-	-	2	2	1	-	-	-	2	-	-
<b>Average</b>		<b>3</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>

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

20EE902	POWER SEMICONDUCTOR DEVICES (Open Elective)	L	T	P	C
		3	0	0	3

**Prerequisite:**

Course Outcomes : On successful completion of the course, the student will be able to	Cognitive Level
CO1: Explain the power diode characteristics and applications for adjustable speed motor control	Understand
CO2: Infer the static and dynamic characteristics of current controlled power semiconductor devices	Understand
CO3: Realize the static and dynamic characteristics of voltage controlled power semiconductor devices	Understand
CO4: Examine the gate drive requirements for power devices and isolation techniques between the gate and power circuits	Understand
CO5: Discuss the electrical analogy of thermal models and the methods for cooling power devices	Understand

**UNIT - I POWER SEMICONDUCTOR DIODES AND CIRCUITS [ 09 ]**

Power diode: Structure, V-I and reverse recovery characteristics–types of power diodes – Series and parallel connected diodes – Diode rectifiers: Single phase half wave and full wave rectifiers with R,RL load.

**UNIT - CURRENT CONTROLLED DEVICES [ 09 ]**

BJT's: Construction, operation, static and switching characteristics, Negative temperature coefficient and secondary breakdown, on-state losses, safe operating area. Thyristors: Construction, working, Two transistor analogy, V–I and switching characteristics, series and parallel operation; comparison of BJT and Thyristor – Basics of TRIAC, RCT,GTO, MCT.

**UNIT - III VOLTAGE CONTROLLED DEVICES [ 09 ]**

Power MOSFETs and IGBTs – Principle of voltage controlled devices, construction, types, static and switching characteristics, Comparison of Power MOSFET and IGBTs – Applications.

**UNIT - IV FIRING AND PROTECTING CIRCUITS [ 09 ]**

Gate drives circuit: SCR, MOSFET, IGBTs and base driving for power BJT – Necessity of isolation, Isolation of gate and base drives: pulse transformer and optocoupler – Overvoltage and overcurrent protections for power devices – Design of snubber circuits.

**UNIT - V THERMAL PROTECTION [ 09 ]**

Heat transfer – conduction, convection and radiation; Cooling – liquid cooling, vapour and phase cooling; Guidance for heat sink selection – Thermal resistance and impedance – Electrical analogy of thermal components, heat sink types and design – Mounting types- switching loss calculation for power device.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :**

- 1 Rashid.M.H, Power Electronics Circuits Devices and Applications, PHI learning private limited, New Delhi, Fourth Edition, 2017.
- 2 Bimbhra.P.S, Power Electronics, Khanna Publishing, New Delhi, Fifth Edition, 2013.

**Reference Books :**

- 1 M.D. Singh and K.B. Khanchandani, Power Electronics, Tata McGraw Hill Publishing Co Ltd., New Delhi, 2013.
- 2 Ned Mohan Tore. M. Undeland, William. P. Robbins, Power Electronics: Converters, Applications and Design, John Wiley and sons Ltd, United States, Second Edition, 2013.
- 3 Sen.P.C, Power Electronics, Tata McGraw Hill Publishing Co Ltd., New Delhi, Thirtieth reprint, 2008.
- 4 Joseph Vithayathil, Power Electronics: Principles and Applications, Delhi, Tata McGraw-Hill, 2010.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**  
**CO-PO MAPPING**

Course Code: 20EE902

Regulation: R 2020  
 Course Name: Power Semiconductor Devices

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Explain the power diode characteristics and applications for adjustable speed motor control</i>	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO2	<i>Infer the static and dynamic characteristics of current controlled power semiconductor devices</i>	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO3	<i>Realize the static and dynamic characteristics of voltage controlled power semiconductor devices</i>	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO4	<i>Examine the gate drive requirements for power devices and isolation techniques between the gate and power circuits</i>	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO5	<i>Discuss the electrical analog of thermal models and the methods for cooling power devices</i>	3	2	-	-	-	-	-	-	-	-	-	2	-	-
<b>Average</b>		<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20EE903	ELECTRICAL POWER GENERATION SYSTEMS (Open Elective)	L	T	P	C
		3	0	0	3

**Prerequisite:**

Course Outcomes : On successful completion of the course, the student will be able to	Cognitive Level
CO1: Describe the layout and function of various parts inside the thermal power plant.	Remember
CO2: Outline the layout, construction, working of the components inside the hydro power plant.	Understand
CO3: Explain the principle of operation, layout and types of nuclear reactor in a nuclear power plant.	Understand
CO4: Discuss about the types, performance and layout of gas and diesel power plants.	Understand
CO5: Infer the basic concepts of different non-conventional energy sources.	Understand

**UNIT - I Thermal power plant [ 09 ]**

Basic thermodynamic laws - various components of steam power plant – layout - pulverized coal burners - Fluidized bed combustion - coal handling and ash handling systems - Forced draft and induced draft fans – Boilers - feed pumps – superheater - regenerator – condenser – deaerators - cooling tower.

**UNIT - II Hydro power plant [ 09 ]**

Hydel power plant classifications- essential elements, selection of water turbines - selection of site for a hydel power plant - layout – dams – pumped storage power plants - micro hydel developments.

**UNIT - III Nuclear power plant [ 09 ]**

Principles of nuclear energy - nuclear fission - nuclear reactor, types – pressurized water reactor, boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor-nuclear power plants

**UNIT - IV Gas and diesel power plant [ 09 ]**

Fuels - gas turbine material, open and closed cycle gas turbine, work output & thermal efficiency, methods to improve performance - advantages and disadvantages- types of diesel engine power plant- components and layout.

**UNIT - V Renewable energy [ 09 ]**

Solar energy collectors – OTEC - wind power plants, tidal power plants and geothermal resources, fuel cell, MHD power generation principle.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :**

- 1 Domkundwa, Arora Domkundwar, A Course in Power Plant Engineering, Dhanpat Rai and Co. Pvt. Ltd., New Delhi, Eighth edition, 2016.
- 2 P.K. Nag, Power Plant Engineering, Tata McGraw Hill Publishing Co Ltd., New Delhi, Third Edition, 2010.

**Reference Books :**

- 1 Philip Kiameh, Power Generation Handbook, Tata McGraw Hill Publishing Co Ltd., New Delhi, Third Edition, 2013.
- 2 P.C. Sharma, Power Plant Engineering, S.K. Kataria and Sons, New Delhi, First Edition, 2013.
- 3 Raja, A.K., Amit Prakash Manish Dwivedi, Power Plant Engineering, New Age International, New Delhi, First Edition, 2012.
- 4 Gupta, Manoj Kumar, Power Plant Engineering, PHI learning private limited, New Delhi, First Edition, 2012.

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**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**  
**CO-PO MAPPING**

Course Code: 20EE903

Regulation: R 2020  
 Course Name: Electrical Power Generation Systems

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Describe the layout and function of various parts inside the thermal power plant.</i>	3	1	-	-	-	2	3	2	-	-	-	1	-	-
CO2	<i>Outline the layout, construction, working of the components inside the hydro power plant.</i>	3	2	-	-	-	2	3	1	-	-	-	1	-	-
CO3	<i>Explain the principle of operation, layout and types of nuclear reactor in a nuclear power plant.</i>	3	2	-	-	-	3	3	2	-	-	-	1	-	-
CO4	<i>Discuss about the types, performance and layout of gas and diesel power plants.</i>	3	2	-	-	-	2	3	1	-	-	-	1	-	-
CO5	<i>Infer the basic concepts of different non-conventional energy sources.</i>	3	1	-	-	-	3	3	2	-	-	-	1	-	-
<b>Average</b>		<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20EE904	<b>CONTROL ENGINEERING</b>	L	T	P	C
	(Open Elective)	3	0	0	3

**Prerequisite: Applied Mathematics**

**Course Outcomes : On successful completion of the course, the student will be able to** **Cognitive Level**

CO1: Obtain the transfer function of electrical and mechanical systems.	Apply
CO2: Determine the time-domain response of first and second order systems.	Apply
CO3: Examine the stability of open loop system using bode / polar plot.	Apply
CO4: Analyze the stability of the system by Root locus and Routh Hurwitz criterion.	Apply
CO5: Design lag, lead, lag-lead compensator using bode plot.	Apply

**UNIT - I                    SYSTEM AND THEIR REPRESENTATION                    [ 09 ]**

Basic elements in control system – Classification of control systems: Open and closed loop systems– Electrical, Mechanical translational and rotational system – Block diagram reduction techniques – Signal flow graphs.

**UNIT - II                    TIME RESPONSE ANALYSIS                    [ 09 ]**

Types and order of systems – Types of test signal – First and second order time response –Time domain specification of second order under damped systems – Generalized error series–Steady state error and error constants.

**UNIT - III                    FREQUENCY RESPONSE ANALYSIS                    [ 09 ]**

Frequency response of the system – Bode plot – Polar plot – Constant M and N circles – Determination of closed loop response from open loop response.

**UNIT - IV                    STABILITY OF CONTROL SYSTEM                    [ 09 ]**

Characteristics equation – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition.

**UNIT - V                    COMPENSATOR AND CONTROLLER                    [ 09 ]**

Lag, lead and lag-lead networks – Lag, lead and lag-lead compensator using bode plots – P, PI, PID controllers.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :**

- 1 Nagrath, J., and Gopal,V., Control Systems Engineering, New Age International (p) Limited, Publishers, New Delhi, Fourth Edition, 2007.
- 2 Benjamin C. Kuo, Automatic Control systems, PHI Learning, New Delhi, Seventh Edition, 2009.

**Reference Books :**

- 1 Ogata,K., Modern Control Engineering, PHI, New Delhi, Fifth Edition, 2009.
- 2 Norman S. Nise, Control Systems Engineering, John Wiley, New Delhi, Seventh Edition, 2014.
- 3 Smarajit Ghosh, Control systems, Pearson Education, New Delhi, Second Edition, 2009.
- 4 Roychoudhury,D., Modern control engineering, Prentice Hall of India, Second Edition, 2005.

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**CO-PO MAPPING**

Course Code: 20EE904

Regulation: R 2020  
 Course Name: Control Engineering

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Obtain the transfer function of electrical and mechanical systems.	3	3	2	2	-	-	-	-	-	-	-	2	-	-
CO2	Determine the time-domain response of first and second order systems.	3	3	2	2	-	-	-	-	-	-	-	2	-	-
CO3	Examine the stability of open loop system using bode / polar plot.	3	3	3	2	-	-	2	-	-	-	-	2	-	-
CO4	Analyze the stability of the system by Root locus and Routh Hurwitz criterion.	3	3	3	2	-	-	2	-	-	-	-	2	-	-
CO5	Design lag, lead, lag-lead compensator using bode plot.	3	3	3	2	-	-	2	-	-	-	-	2	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



20EE905	INDUSTRIAL AUTOMATION		L	T	P	C
		(Open Elective)		3	0	0

**Prerequisite:**

Course Outcomes : On successful completion of the course, the student will be able to	Cognitive Level
CO1: Explain the major components of Programmable Logic Controller and its applications.	Understand
CO2: Summarize the logical functions, timers and counters of PLC	Understand
CO3: Discuss the various instructions and modes of operation related to PLC.	Understand
CO4: Realize the architecture and various interfacing techniques of Distributed Control Systems	Understand
CO5: Examine the different applications of PLC and Distributed Control Systems (DCS).	Understand

**UNIT - I INTRODUCTION TO PROGRAMMABLE LOGIC CONTROLLER (PLC) [ 09 ]**

Introduction - PLC Evolution – PLC Vs Computers – Block Diagram of PLC – Parts of a PLC- Principles of Operation- Modifying the Operation- PLC Hardware Components: I/O modules, Power Supply, CPU – PLC size and Applications.

**UNIT - II LOGIC FUNDAMENTALS, TIMER AND COUNTER [ 09 ]**

Logic functions – Boolean instructions and functions – Hardwired logic Vs Programmed Logic - Developing circuits from Boolean instructions – PLC timer: classification and instructions – PLC counter: classification, instructions and applications

**UNIT - III PLC PROGRAMMING [ 09 ]**

PLC-memory map - Program scan – Relay type instructions – Instruction addressing - Branch instructions - Internal relay instructions - EXAMINE IF CLOSED and EXAMINE IF OPEN instructions - Modes of operation – Basic relay ladder logic and its control flow chart

**UNIT - IV DISTRIBUTED CONTROL SYSTEM [ 09 ]**

Distributed control system : Evolution – Architectures – Comparison – Local control unit – Process interfacing issues – Communication facilities – HMI Interface – Low and high level operator interfaces – Operator displays – Low and high level engineering interfaces – Introduction to SCADA.

**UNIT - V APPLICATIONS OF PLC AND DCS [ 09 ]**

PLC applications: Automatic Control of WareHouse Door – Automatic Lubricating Oil Supplier – Conveyor Belt motor Control – Automatic Car Washing Machine – DCS applications: Pulp and paper environment, Petroleum and refining environment.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :**

- 1 Frank D. and Petruzella, Programmable Logic controllers, Tata McGraw Hill Publishing Company Limited, New Delhi, Fifth Edition, 2017
- 2 Lucas ,M.P., Distributed Control System, Van Nostrand and Reinhold Co., New york, First Edition, 1986.

**Reference Books :**

- 1 Gary Dunning, Introduction to Programmable Logic Controllers, Delmar Thomson Learning, New york, Third Edition, 2010
- 2 John W.Webb and Ronald A.Reis, Programmable Logic Controllers: Principles and Applications, PHI Private Ltd., New Delhi, Fifth Edition, 2003
- 3 Krishna Kant, "Computer - Based Industrial Control", Prentice Hall, New Delhi, Second Edition(Revised), 2011
- 4 Madhuchhanda Mitra and Smarajit Sen Gupta, Programmable Logic Controllers and Industrial Automation, Penram International Publishing (India) Pvt. Ltd, Mumbai, Second Edition, 2009

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**CO-PO MAPPING**

Course Code: 20EE905

Regulation: R 2020  
 Course Name: Industrial Automation

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Explain the major components of Programmable Logic Controller and its applications.</i>	3	2	3		2	-	-	-	-	-	-	1	-	-
CO2	<i>Summarize the logical functions, timers and counters of PLC</i>	3	2	3		2	-	-	-	-	-	-	1	-	-
CO3	<i>Discuss the various instructions and modes of operation related to PLC.</i>	3	2	3		2	-	-	-	-	-	-	1	-	-
CO4	<i>Realize the architecture and various interfacing techniques of Distributed Control Systems</i>	3	2	3		1	-	-	-	-	-	-	1	-	-
CO5	<i>Examine the different applications of PLC and Distributed Control Systems (DCS)</i>	3	2	3		2	-	-	-	-	-	-	1	-	-
<b>Average</b>		<b>3</b>	<b>2</b>	<b>3</b>		<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

	<b>K.S.R. COLLEGE OF ENGINEERING (Autonomous)</b>	<b>R 2020</b>			
<b>20EE906</b>	<b>ELECTRICAL INSTRUMENTS AND MEASUREMENTS</b>	L	T	P	C
	(Open Elective)	3	0	0	3

**Prerequisite:**

<b>Course Outcomes : On successful completion of the course, the student will be able to</b>	<b>Cognitive Level</b>
CO1: Explain the construction and calibration of moving coil and Moving iron meters	Understand
CO2: Discuss the operation and error correction method of wattmeter and Energy meter.	Understand
CO3: Describe the various types of potentiometer and their limitations	Understand
CO4: Determine the values of resistor, inductor, capacitor and frequency using bridges.	Understand
CO5: Explain the concepts of storage and display devices.	Understand

**UNIT - I MEASUREMENT OF VOLTAGE AND CURRENT [ 9 ]**

Galvanometers – Ballistic, D'Arsonval galvanometer – Principle, construction, operation and comparison of moving coil, moving iron meter – Extension of range and calibration of voltmeter and ammeter – Errors and compensation.

**UNIT - II MEASUREMENT OF POWER AND ENERGY [ 9 ]**

Wattmeters: Induction, Electro-dynamometer - Theory & its errors - Methods of correction – Calibration of wattmeter – Energy meter: Single Phase Energy Meter - Construction, Theory, Errors - Adjustment of Errors – Construction and principle of working of single phase dynamometer type power factor meter.

**UNIT - III POTENTIOMETERS & INSTRUMENT TRANSFORMERS [ 9 ]**

DC potentiometer – Basic circuit, standardization – Laboratory type (Crompton's) – AC potentiometer – Drysdale (polar type) type – Gall-Tinsley (coordinate) type – Limitations & applications – C.T and P.T construction, theory, operation, phasor diagram – Applications.

**UNIT - IV BRIDGE MEASUREMENT [ 9 ]**

Measurement of resistance : Wheatstone bridge, Kelvin double bridge, Megger – Measurement of Inductance : Maxwell Bridge, Anderson bridge – Measurement of Capacitance: Schering bridge, Desauty's Bridge – Determination of frequency using Wein Bridge.

**UNIT - V STORAGE AND DISPLAY DEVICES [ 9 ]**

Recorders: Strip Chart, X-Y Recorders – Digital Plotters – Digital Storage Oscilloscope – Digital multimeters – LED – DLP – Dot Matrix Display – Data Loggers

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :**

- 1 Golding, E.W and Widdis F.C, Electrical Measurements & Measuring Instruments, A.H.Wheeler & Co, Allahabad, India, Sixth Edition,2019.
- 2 Sawhney, A.K., A course in Electrical & Electronic Measurements and Instrumentation, Dhanpat Rai & Co (P) Ltd, Delhi, Nineteenth Edition, 2021.

**Reference Books :**

- 1 Gupta, J.B, Electrical Measurements and Measuring Instruments, S.K. Kataria & Sons, Delhi, Third edition, 2012.
- 2 Singh, S.K, Industrial Instrumentation and control, Tata McGraw Hill, New york, Second Edition, 2003.
- 3 Kalsi H.S, Electronic Instrumentation, Tata McGraw Hill, New york, Second Edition, 2004.
- 4 Martia U. Reissland, Electrical Measurement, New Age International (P) Ltd., New Delhi, Second Edition, 2001.

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**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**  
**CO-PO MAPPING**

**Regulation:** R 2020  
**Course Code:** 20EE906      **Course Name:** Electrical Instruments and Measurements

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Explain the construction and calibration of moving coil and Moving iron meters</i>	3	3	2	-	-	1	1	-	-	-	-	3	2	3
CO2	<i>Discuss the operation and error correction method of wattmeter and Energy meter.</i>	3	3	2	-	-	1	1	-	-	-	-	3	2	3
CO3	<i>Describe the various types of potentiometer and their limitations</i>	3	3	2	-	-	1	1	-	-	-	-	3	2	3
CO4	<i>Determine the values of resistor, inductor, capacitor and frequency using bridges.</i>	3	3	2	-	-	1	1	-	-	-	-	3	2	3
CO5	<i>Explain the concepts of storage and display devices.</i>	3	3	2	-	-	1	1	-	-	-	-	3	2	3
<b>Average</b>		<b>3</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>2</b>	<b>3</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**K.S.R. COLLEGE OF ENGINEERING (Autonomous)**

**R 2020**

<b>20EE907</b>	<b>ENERGY CONSERVATION AND MANAGEMENT</b>	L	T	P	C
	(Open Elective)	3	0	0	3

**Prerequisite:**

<b>Course Outcomes : On successful completion of the course, the student will be able to</b>	<b>Cognitive Level</b>
CO1: Give the introduction about energy conservation principle and practices	Remember
CO2: Describe the concept of energy efficiency in the building.	Understand
CO3: Explain the concept of energy efficiency in the industry	Understand
CO4: Illustrate the concept of energy efficiency in the power plant	Understand
CO5: Describe the importance energy management and Demand Control Techniques	Understand

**UNIT - I ENERGY CONSERVATION PRINCIPLES AND PRACTICES [ 09 ]**

Energy scenario – Principles and imperatives of energy conservation – Energy consumption pattern – Resource availability – Need for energy saving – Overview of energy consumption and its effects –Energy Monitoring, targetng and reporting - Role of Bureau of Energy Efficiency - Standards and labeling.

**UNIT - II ENERGY EFFICIENCY IN BUILDINGS [ 09 ]**

Introduction, definition and concepts – Energy and water as a resource – Electrical energy conservation: Opportunities and techniques for energy conservation in buildings – Green buildings, Intelligent buildings, Rating of buildings, Efficient use of buildings – Solar passive architecture – Eco-housing concepts.

**UNIT - III ENERGY EFFICIENCY IN INDUSTRIES [ 09 ]**

Potential areas for electrical energy conservation in various industries – Conservation methods – Energy management opportunities in electrical heating, cable selection – Energy efficient motors – Adjustable AC drives – Application and its use – Energy efficiency in lighting.

**UNIT - IV ENERGY EFFICIENCY IN POWER PLANTS [ 09 ]**

Captive power generation systems – Sequence operation of power plants – Gas Insulated Substation – Bus ducts – Types and working principle - Energy management opportunities in transformer – Power transformer – Types of switchgear (HT and LT switchgear) GCB and generator.

**UNIT - V ENERGY MANAGEMENT AND AUDIT [ 09 ]**

Energy Management : Definition, Objective, Importance of energy management, Load management: Demand control techniques - Utility monitoring control system. Energy Audit: definition, types of energy audit, Methodology, Need for energy Audit, Steps involved in energy auditing.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :ENERGY MANAGEMENT**

- 1 Mehmet Kanoglu and Yunus A. Cengel Dr, Energy Efficiency and Management for Engineers, Tata Mcgrow Hill, New Delhi, First Edition, 2019
- 2 Craig B. Smith, Energy Management Principles, Pergamon Press, United Kingdom, Second Edition, 2015.

**Reference Books :**

- 1 Wayne C Turner, Energy Management Handbook, The Fairmount Press, Newyork, Eighth Edition, 2006.
- 2 Bureau of Energy Efficiency Study material for Energy Managers and Auditors Examination: Paper I to IV
- 3 G. G. Rajan, Optimizing Energy Efficiencies in Industry”, Tata McGraw Hill, New Delhi , Fourth Edition, , 2004
- 4 Frank Kreith and Yogi Goswami D, Energy Management and Conservation Handbook, Taylor & Francis, New Delhi Second Edition, 2016.

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**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**  
**CO-PO MAPPING**

Course Code: 20EE907

Regulation: R 2020

Course Name: Energy Conservation and Management

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Give the introduction about energy conservation principle and practices</i>	2	1	2	-	-	-	1	3	1	-	-	3	-	-
CO2	<i>Describe the concept of energy efficiency in the building.</i>	2	2	2	-	-	-	1	3	1	-	-	3	-	-
CO3	<i>Explain the concept of energy efficiency in the industry</i>	2	2	2	-	-	-	1	3	1	-	-	3	-	-
CO4	<i>Illustrate the concept of energy efficiency in the power plant</i>	2	2	2	-	-	-	1	3	1	-	-	3	-	-
CO5	<i>Describe the importance energy management and Demand Control Techniques</i>	2	2	2	-	-	-	1	3	-	-	-	3	-	-
<b>Average</b>		<b>2</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

	<b>K.S.R. COLLEGE OF ENGINEERING (Autonomous)</b>	<b>R 2020</b>			
<b>20EE908</b>	<b>ELECTRICAL WIRING, ESTIMATION AND COSTING</b>	L	T	P	C
	(Open Elective)	3	0	0	3

**Prerequisite:**

<b>Course Outcomes : On successful completion of the course, the student will be able to</b>	<b>Cognitive Level</b>
CO1: Describe the various wiring materials and protective devices.	Understand
CO2: Discuss the internal wiring system and illumination.	Understand
CO3: Outline the external wiring system and installations.	Understand
CO4: Apply the knowledge to prepare electrical estimation for domestic installation.	Apply
CO5: Apply the knowledge to prepare the electrical estimation details for industrial installation.	Apply

**UNIT - I INTRODUCTION TO WIRING AND PROTECTIVE DEVICES [ 09 ]**

Wiring accessories – main switch – isolator and load break duty – classification of main switches – functional switches – one way, two way, intermediate switches – knife switches – specification of switches – function and specification of socket outlets, ceiling roses, fan regulators – Fuses, need, classification, Neutral link – Miniature circuit breaker, classification, function and specification – ELCB – RCCB.

**UNIT - II INTERNAL WIRING SYSTEM [ 09 ]**

Design and Drawing of Internal wiring system for various types of Residential, Commercial and Industrial buildings – Electrical layout – Clearance of line – Different types of circuits, Light circuit, Power circuit, Sub-main wiring, Main wiring, Single Line diagram – Different types of Lamps used in Residential, Commercial and Industrial buildings.

**UNIT - III EXTERNAL WIRING SYSTEM AND EARTHING [ 09 ]**

Different types of Under Ground (UG) Cables – Cable Laying – Electrical Control Panels – External Electrical Distribution System – Single Line Diagram – Load Calculations – General Specifications of Generating Set, Transformer – Street Lighting – Earthing, Different types of earthing system – Plate earthing, Pipe Earthing.

**UNIT - IV ESTIMATION OF DOMESTIC INSTALLATION [ 09 ]**

Selection of cables for internal wiring – Cable size calculation – Selection criteria for control switches – main switch – size of earth continuity conductor and earthing conductor – Preparation of schematic diagrams and wiring diagrams – Estimation problems regarding Electrification of domestic buildings – Relevant rules regarding electrification of high rise buildings.

**UNIT - V ESTIMATION OF INDUSTRIAL INSTALLATIONS [ 09 ]**

Installation of motor pump set – Estimation problem regarding domestic and irrigation pump sets – Estimation problems in small workshops below 50kW connected load – Service connection, definition, classification – use of weather proof cables – estimation problems for single phase and three phase overhead service connections.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :**

- 1 Raina, K.B. and Bhattacharya, S.K., Electrical Design Estimating and Costing, New Age International, Bengaluru, Second Edition, 2017.
- 2 Gupta, J.B., A Course in Electrical Installation Estimating and Costing, S K Kataria & Sons, New Delhi, First Edition Reprint, 2013.

**Reference Books :**

- 1 Surjith Singh, Electrical estimating and costing, Dhanpat Rai Publishing Company, New Delhi, First Edition, 2016.
- 2 Uppal, S.L., Electrical Wiring, Estimating and Costing, Khanna Publisher, New Delhi, Sixth Edition, 1987.
- 3 Soni, P.M. and Upadhyay, P.A., Wiring, Estimating, Costing & Contracting, ATUL PRAKASHAN, Gujarat, First Edition, 2017.
- 4 Bureau of Indian Standards, I.E. rules for wiring, Electricity Supply Act-1948.

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**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**  
**CO-PO MAPPING**

**Course Code:** 20EE908                      **Regulation:** R 2020  
**Course Name:** Electrical Wiring, Estimation and Costing

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Describe the various wiring materials and protective devices.	3	-	1	-	-	-	-	-	-	-	-	-		
CO2	Discuss the internal wiring system and illumination.	3	-	1	-	-	-	-	-	-	-	-	-		
CO3	Outline the external wiring system and installations.	3	-	1	-	-	-	-	-	-	-	-	-		
CO4	Explain the electrical estimation for domestic installation.	3	2	1	-	1	-	-	-	-	-	-	-		
CO5	Describe the electrical estimation details for industrial installation.	3	2	1	-	1	-	-	-	-	-	-	-		
<b>Average</b>		<b>3</b>	<b>2</b>	<b>1</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>		

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



20EE909	<b>FUNDAMENTALS OF ELECTRICAL MACHINERY</b>	L	T	P	C
	(Open Elective)	3	0	0	3

**Prerequisite:**

<b>Course Outcomes : On successful completion of the course, the student will be able to</b>	<b>Cognitive Level</b>
CO1: Discuss fundamentals in various electrical circuits.	Understand
CO2: Explain the operation and characteristics of DC machines.	Understand
CO3: Determine the efficiency and regulation of the transformer.	Understand
CO4: Explain the operation and starting methods of Induction Motors.	Understand
CO5: Describe the applications of Synchronous Machines.	Understand

**UNIT - I INTRODUCTION [ 09 ]**

Electromagnetic Induction– Faraday's Laws – Series and Parallel circuits – Self and Mutual Inductance-Numerical problems – Purpose of Earthing – Methods of Earthing – Merits of Earthing – Different types of Electrical Machines.

**UNIT - II DC MACHINES [ 09 ]**

Principle of operation of DC generator – Types of DC machines – EMF equation – Open Circuit Characteristics – Principle of operation of DC Motor – Torque Equation – Speed control methods of DC motor – Losses in DC machines – Performance Characteristics.

**UNIT - III TRANSFORMERS [ 09 ]**

Principle of operation and construction Details – Classification of Transformers – EMF equation – Losses in a Transformer – Calculation of efficiency and regulation – Autotransformer.

**UNIT - IV INDUCTION MOTORS [ 09 ]**

Principle of operation – Constructional Details – Classification – Revolving Magnetic Fields – Starting Methods – Principle of operation of Single Phase Induction Motor – Starting Methods – Applications.

**UNIT - V SYNCHRONOUS MACHINES [ 09 ]**

Principle of operation and construction of alternators – EMF Equation – Regulation of alternator by Synchronous Impedance Method – Principle of operation of synchronous motor – Synchronous Condenser – Applications.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :**

- 1 Rajendra Prasad, Fundamentals of Electrical Engineering, PHI Publications, New Delhi, Second Edition, 2005
- 2 B L Theraja and AK Theraja, A Textbook of Electrical Technology: Volume 2 AC and DC Machines, S. Chand & Co Ltd, New Delhi, Twenty Third Edition, 2006

**Reference Books :**

- 1 D. P. Kothari and I. J. Nagrath, Electric Machines, Tata McGraw Hill Publishing Company Ltd, Noida, Fourth Edition, 2017
- 2 Stephen J.Chapman, Electric Machinery Fundamentals, Tata McGraw Hill, New Delhi, Fourth Edition, 2018.
- 3 P. S. Bimbhra, Electrical Machinery, Khanna Publishers, New Delhi, Seventh Edition, 2018
- 4 J.B. Gupta, Theory & Performance of Electrical Machines, S.K. Kataria & Sons, New Delhi, First Edition Reprint, 2013.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**  
**CO-PO MAPPING**

Course Code: 20EE909

Regulation: R 2020

Course Name: Fundamentals of Electrical Machinery

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Discuss fundamentals in various electrical circuits.</i>	3	1	-	-	-		-	-	-	-	-	-	-	-
CO2	<i>Explain the operation and characteristics of DC machines.</i>	3	1	-	-	-		2	-	-	-	-	-	-	-
CO3	<i>Determine the efficiency and regulation of the transformer.</i>	3	1	-	-	-		2	-	-	-	-	-	-	-
CO4	<i>Explain the operation and starting methods of Induction Motors.</i>	3	1	-	-	-		2	-	-	-	-	-	-	-
CO5	<i>Describe the applications of Synchronous Machines.</i>	3	1	-	-	-		2	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>		<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

	<b>K.S.R. COLLEGE OF ENGINEERING (Autonomous)</b>	<b>R 2020</b>			
<b>20EE910</b>	<b>PRINCIPLES OF SOFT COMPUTING TECHNIQUES</b>	L	T	P	C
	(Open Elective)	3	0	0	3

**Prerequisite:**

<b>Course Outcomes : On successful completion of the course, the student will be able to</b>	<b>Cognitive Level</b>
CO1: Describe the concepts of artificial neural network	Understand
CO2: Summarize the various types of neural network	Understand
CO3: Discuss the basic concepts of fuzzy logic system	Understand
CO4: Illustrate various methods used in fuzzy systems	Understand
CO5: Outline the genetic algorithm and hybrid genetic algorithm concepts	Understand

**UNIT - I Introduction artificial neural network [ 09 ]**

Artificial neural networks - biological neurons, Basic models of artificial neural networks – Connections, Learning, Activation Functions, McCulloch and Pitts Neuron, Hebb network.

**UNIT - II Neural network architecture and algorithms [ 09 ]**

Perceptron networks – Learning rule – Training and testing algorithm, Adaptive Linear Neuron, Back propagation Network – Architecture, Training algorithm.

**UNIT - III Introduction to fuzzy logic [ 09 ]**

Fuzzy logic - fuzzy sets - properties - operations on fuzzy sets, fuzzy relations - operations on fuzzy relations.

**UNIT - IV Fuzzy logic system [ 09 ]**

Fuzzy membership functions, fuzzification, Methods of membership value assignments – intuition – inference – rank ordering, Lambda –cuts for fuzzy sets, Defuzzification methods.

**UNIT - V Genetic and hybrid algorithms [ 09 ]**

Introduction to genetic algorithm, operators in genetic algorithm - coding - selection - crossover – mutation, Stopping condition for genetic algorithm , Genetic neuro hybrid systems, Genetic-Fuzzy rule based system

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books :**

- 1 S.N.Sivanandam and S.N.Deepa, Principles of soft computing, Wiley India, New Delhi, Third edition, 2011.
- 2 Timothy J. Ross, Fuzzy Logic with engineering applications, Wiley India, New Delhi, Third edition, 2010.

**Reference Books :**

- 1 N. K. Sinha and M. M. Gupta, Soft Computing & Intelligent Systems: Theory & Applications, Academic Press /Elsevier, Massachusetts, First edition, 2009.
- 2 Simon Haykin, Neural Network, A Comprehensive Foundation, Prentice Hall International, New Jersey, Third edition, 2009.
- 3 Bart Kosko, Neural Network and Fuzzy Systems, Prentice Hall, New Jersey, First edition, 1992.
- 4 Goldberg D.E., Genetic Algorithms in Search, Optimization, and Machine Learning, Addison Wesley, Boston ,First edition, 1989

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**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**  
**CO-PO MAPPING**

**Course Code: 20EE910**

**Regulation: R 2020**

**Course Name: Principles of Soft Computing Techniques**

CO	Course Outcomes	Programme Outcomes														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	<i>Describe the concepts of artificial neural network</i>	3	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	<i>Summarize the various types of neural network.</i>	3	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO3	<i>Discuss the basic concepts of fuzzy logic system.</i>	3	2	-	-	3	-	-	-	-	-	-	-	1	-	-
CO4	<i>Illustrate various methods used in fuzzy systems</i>	3	2	-	-	3	-	-	-	-	-	-	-	1	-	-
CO5	<i>Outline the genetic algorithm and hybrid genetic algorithm concepts</i>	3	2	-	-	3	-	-	-	-	-	-	-	1	-	-
<b>Average</b>		<b>3</b>	<b>2</b>	-	-	<b>3</b>	-	-	-	-	-	-	-	<b>1</b>	-	-

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20EE911	EMBEDDED SYSTEM TECHNOLOGY (Open Elective)	L	T	P	C
		3	0	0	3

**Prerequisite:**

<b>Course Outcomes : On successful completion of the course, the student will be able to</b>	<b>Cognitive Level</b>
CO1: Illustrate the fundamentals of embedded systems.	Understand
CO2: Outline the various types of embedded communication protocols	Understand
CO3: Explain the concept of software development process and tools	Understand
CO4: Describe the functions of real time operating systems	Understand
CO5: Discuss the applications of real time embedded systems	Understand

**UNIT – I INTRODUCTION TO EMBEDDED SYSTEMS [ 09 ]**

Embedded System Vs General Computing System – Classification of embedded systems – Functional building blocks of embedded systems – Structural units in embedded processor – Selection of processor & memory devices – Processor interfacing with memory and I/O units – Embedded hardware unit.

**UNIT - II EMBEDDED NETWORKS [ 09 ]**

Introduction to I/O device ports & buses – Serial communication using I<sup>2</sup>C, CAN, SPI and USB bus – Parallel communication using PCI, PCI-X buses, ARM bus.

**UNIT – III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT [ 09 ]**

Introduction to embedded software development process and tools – Host and target machines – linking and locating software – Embedded Product Development Life Cycle – objectives, different phases of EDLC, Modeling of EDLC.

**UNIT – IV REAL TIME OPERATING SYSTEMS [ 09 ]**

Introduction to basic concepts of RTOS – Task, process & threads – Context switching – Multiprocessing and Multitasking – Preemptive and nonpreemptive scheduling – Round Robin scheduling – Task communication – shared memory, message passing – Interprocess communication – semaphores, Message queue, Mailbox, pipes.

**UNIT – V RTOS BASED EMBEDDED SYSTEM DESIGN [ 09 ]**

Basic Functions and Types of RTOS – Interrupt routines in RTOS – Case Study of Washing Machine – Automotive Application – Smart card system – ATM machine – Digital camera.

**Total (L= 45, T = 0) = 45 Periods**

**Text Books :**

- 1 Rajkamal.P, Embedded System – Architecture, Programming, Design, Tata McGraw Hill Education Private Limited, New Delhi, Third Edition, 2016.
- 2 John B.Peatman, Design With PIC microcontroller, Pearson Education, India, First Edition, 2009.

**Reference Books :**

- 1 Frank Vahid and Tony Givargi, Embedded System Design - A Unified Hardware & Software Introduction, John Wiley, New Jersey, Third Edition, 2011.
- 2 David E.Simon, An Embedded software primer, Pearson Education, India, First Edition, 2007.
- 3 Steve Heath, Embedded System Design, Elsevier, India, Second Edition, 2003.
- 4 Wayne wolf, Computers as components: Principles of embedded computing system design, Morgan Kaufmann publishers, USA, Third Edition, 2012.

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**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**  
**CO-PO MAPPING**

Course Code: 20EE911

Regulation: R 2020

Course Name: Embedded System Technology

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Illustrate the fundamentals of embedded systems</i>	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO2	<i>Outline the various types of embedded communication protocols</i>	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO3	<i>Explain the concept of software development process and tools.</i>	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO4	<i>Describe the functions of real time operating systems.</i>	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO5	<i>Discuss the applications of real time embedded systems</i>	3	2	3	-	3	3	-	-	-	-	-	3	-	-
<b>Average</b>		<b>3</b>	<b>2</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**K.S.R. COLLEGE OF ENGINEERING (Autonomous)**

**R 2020**

<b>20EC901</b>	<b>BASICS OF MEDICAL ELECTRONICS</b>	L	T	P	C
	(Open Elective)	3	0	0	3

**Prerequisite:**

<b>Course Outcomes : On the successful completion of the course, students will be able to</b>	<b>Cognitive Level</b>
CO1 Describe the recording methods of various bio-potentials.	Understand
CO2 Illustrate the working of various equipment that deal with bio-chemical and non-electrical parameter measurement.	Understand
CO3 Discuss the different types of therapeutic equipment.	Understand
CO4 Interpret the principles of various medical imaging modalities.	Understand
CO5 Outline the recent trends in medical instrumentation.	Understand

**UNIT – I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING [09]**

The origin of bio-potentials - Bio-potential electrodes - Carrier, chopper and isolation amplifiers -Transducers for biomedical applications: Strain gauge, piezoelectric transducer, thermocouple, thermistor, biosensors - ECG, EEG, EMG, PCG, ERG and EOG: Lead systems, recording methods.

**UNIT - II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT [09]**

Blood gas analyzers - Electrophoresis - Colorimeter & Photometer - Auto analyzer - Blood flow meter - Cardiac output - Respiratory measurement - Blood pressure measurement - Temperature measurement - Pulse measurement -Blood cell counters: Coulter counters.

**UNIT - III THERAPEUTIC EQUIPMENTS [09]**

Cardiac pacemakers - DC defibrillator - Dialyzers - Surgical diathermy - Physiotherapy and electrotherapy equipment - Oxygenators - Heart lung machine.

**UNIT - IV MEDICAL IMAGING [09]**

X-Ray - Computer Axial Tomography - Positron Emission Tomography - MRI and NMR - Ultrasonic Imaging systems.

**UNIT - V RECENT TRENDS IN MEDICAL INSTRUMENTATION - [09]**

Thermograph - Endoscopy unit - LASER in medicine - Biomedical telemetry - Radio-pill - Cardiac catheterization laboratory - Electrical safety of medical equipment.

**Total (L: 45) = 45 Periods**

**Text Books :**

- 1 R.S.Khandpur, Handbook of Biomedical Instrumentation, Tata McGraw Hill, New Delhi, Third Edition, 2014
- 2 Leslie Cromwel, Fred J.Weibel, Erich A. Pfeiffer, Biomedical Instrumentation and Measurements, Pearson/Prentice Hall India, New Delhi, Second Edition, 2011.

**Reference Books :**

- 1 John G.Webster, Medical Instrumentation Application and Design, John Wiley & Sons Inc, New Jersey, Fourth Edition, 2009.
- 2 Joseph J.Carr and John M.Brown, Introduction to Biomedical Equipment Technology, John Wiley & Sons, New Jersey, Fourth Edition, 2008.
- 3 M. Arumugam, Biomedical Instrumentation, Anuradha Publications, Chennai, Second Edition, Reprint 2009.
- 4 R.L. Reka & C. Ravikumar, Biomedical Instrumentation/ Medical Electronics, Lakshmi Publications, Chennai, Second Edition, Reprint 2010.

**K.S.R. COLLEGE OF ENGINEERING (Autonomous)**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO PO MAPPING**

Regulation: R 2020

Course Code : 20EC901

Course Name: Basics of Medical Electronics

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Describe the recording methods of various bio-potentials.</i>	2	1	2	-	-	1	-	-	-	-	-	1	-	-
CO2	<i>Illustrate the working of various equipment that deal with bio-chemical and non-electrical parameter measurement.</i>	2	1	2	-	-	1	-	-	-	-	-	1	-	-
CO3	<i>Discuss the different types of therapeutic equipment.</i>	2	1	2	-	-	1	-	-	-	-	-	1	-	-
CO4	<i>Interpret the principles of various medical imaging modalities.</i>	2	1	2	-	-	1	-	-	-	-	-	1	-	-
CO5	<i>Outline the recent trends in medical instrumentation.</i>	2	1	2	-	-	1	-	-	-	-	-	1	-	-
<b>Average</b>		<b>2</b>	<b>1</b>	<b>2</b>			<b>1</b>						<b>1</b>		

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



20EC902

## NANO TECHNOLOGY

(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite:****Course Outcomes: On completion of this course, the student will be able to****Cognitive Level**

CO1 Describe the evolution and associated techniques of Nano science.

Understand

CO2 Interpret the diversities in Nano systems.

Understand

CO3 Classify different Nano particles, shells and their Characterization.

Understand

CO4 Illustrate the importance of nanotechnology in biotechnology.

Understand

CO5 Outline the applications of nanotechnology in industry and society.

Understand

**UNIT – I INTRODUCTION****[09]**

Nano science - Evolution - Electron microscopes - Scanning probe microscopes - Optical microscopes for nanotechnology - X ray diffraction - Associated techniques.

**UNIT – II DIVERSITY IN NANO SYSTEMS****[09]**

Fullerenes - Synthesis and purification - Mass spectrometry and ion/molecule reactions - Chemistry of fullerenes - Endo-hedral chemistry - Conductivity and super conductivity in doped fullerenes - Carbon nanotubes - Synthesis and purification - Electronic structure - Transport - Mechanical - Physical properties applications - Semiconductor quantumdots - Synthesis and applications.

**UNIT – III METAL NANO PARTICLES AND NANO SHELLS****[09]**

Method of preparation - Characterization - Functions and applications - Core shell nanoparticles: Types of system - Characterization - Functions and applications - Nano shells: Types, characterization, properties and applications.

**UNIT – IV EVOLVING INTERFACES IN NANO****[09]**

Nano biology - Interaction between bio molecules and nano particle surfaces - Applications of nano in biology - Microprobes for medical diagnosis and biotechnology - Current status - Nano sensors - Order from chaos - Applications - Smart dust sensors - Nano medicines various kinds - Future directions.

**UNIT – V IMPACT OF NANO TECHNOLOGY ON SOCIETY****[09]**

Introduction - Industrial revolution to Nano revolution - Implications of Nano sciences and Nano technology on society - Issues - Nano policies and institutions - Nanotech and war - Nano arms race - Harnessing nano technology for economic and social development.

**Total = 45 Periods****Text Books :**

- 1 PradeepT, Nano: The Essentials, Understanding Nano Science and Nano technology, TMH, New Delhi, FirstEdition, 2007.
- 2 Mick Wilson, Kamali Kannargare., Geoff Smith, Nano technology: Basic Science and Emerging technologies, Overseas Press, New Delhi, FirstEdition, 2005.

**Reference Books :**

- 1 Nalwa H S, Encyclopedia of Nanoscience and Nanotechnology, Vol 1-10, American Scientific Publishers, California, FirstEdition 2004.
- 2 Rao C N R and Govindaraj A, Nanotubes and Nanowires, Royal Society of Chemistry, London, Third Edition, 2005.
- 3 Richard A L Jones, Soft Machines: Nanotechnology and Life, Oxford University Press, Oxford, FirstEdition, 2007
- 4 Charles P. Poole, Frank J. Owens, Introduction to Nanotechnology, Wiley Inter science, New Jersey, First Edition, 2003.
- 5 Mark A. Ratner, Daniel Ratner, Nanotechnology: A gentle introduction to the next Big Idea, Pearson Education, London, 2003.

**K.S.R. COLLEGE OF ENGINEERING (Autonomous)**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO PO MAPPING**

Course Code: 20EC902

Regulation: R 2020

Course Name: NANO Technology

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Describe the evolution and associated techniques of Nano science.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	<i>Interpret the diversities in Nano systems.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	<i>Classify different Nano particles, shells and their Characterization.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	<i>Illustrate the importance of nanotechnology in biotechnology.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	<i>Outline the applications of nanotechnology in industry and society.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	-	-	-	-	-	-	-	-	-	-	-

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20EC903

## ELECTRONICS AND MICROPROCESSOR

(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite:****Course Outcomes: On the successful completion of the course, students will be able to****Cognitive Level**

CO1 Interpret the fundamental concepts of semiconductor device.

Understand

CO2 Explain the various characteristics of amplifiers.

Understand

CO3 Outline the fundamental concepts of Digital Electronics

Understand

CO4 Describe about 8085 microprocessors

Understand

CO5 Explain the applications using microprocessor

Understand

**UNIT – I SEMICONDUCTORS AND RECTIFIERS****[09]**

Classification of solids based on energy band theory - Intrinsic semiconductors - Extrinsic semiconductors - PN junction diode: Characteristics - Half wave and full wave rectifiers - Zener diode: Characteristics - Voltage regulator.

**UNIT – II TRANSISTORS AND AMPLIFIERS****[09]**

Bipolar junction transistor: Construction and characteristics - CE configuration and characteristics - Transistor biasing: Fixed and voltage divider biasing - Construction and characteristics: FET, SCR and UJT - Concept of feedback: Negative feedback – Application in temperature and motor speed control - Common Emitter Amplifier (Qualitative treatment only).

**UNIT – III DIGITAL ELECTRONICS****[09]**

Number system: Binary, Octal, Hexadecimal - Boolean algebra - Logic gates - Half adder and full adder - Flip flops - Shift Registers: SISO, SIPO, PISO, PIPO - Counters: 3-bit Synchronous up & down, 3-bit Asynchronous up & down - A/D conversion: Single slope, Successive approximation - D/A conversion: Binary weighted resistor type.

**UNIT – IV 8085 MICROPROCESSOR****[09]**

Block diagram of Microcomputer – 8085: Architecture, Pin configuration, Addressing modes, Instruction set and Simple programs using arithmetic and logical operations.

**UNIT – V INTERFACING AND APPLICATIONS OF MICROPROCESSOR****[09]**

Basic interfacing concepts - Interfacing of Input and Output devices - Applications of microprocessor: Temperature control, Stepper motor control, Traffic light control - Case study: Mining problem, Turbine monitor using 8085.

**Total (L: 45) = 45 Periods****Text Books :**

- 1 Jacob Millman and Christos C. Halkias, Integrated Electronics, Tata McGraw-Hill publishers, US, Second Edition, 2011.
- 2 Ramesh Gaonkar, Microprocessor Architecture II, Programming and Applications with 8085, Penram International Publishing, USA, Sixth Edition, 2013.

**Reference Books :**

- 1 Malvino Leach and Saha, Digital Principles and Applications, Tata McGraw-Hill Education, New Delhi, Eighth Edition, 2014.
- 2 Mehta V.K, Principles of Electronics, S. Chand and Company Ltd., New Delhi, Seventh Edition, 2014.
- 3 Salivahanan S, Suresh Kumar N, Vallavaraj A, Electronic Devices and Circuits, Tata McGraw-Hill Education, New Delhi, Third Edition, 2012.
- 4 Krishna Kant, Microprocessors and Microcontrollers, PHI Learning Private Ltd., New Delhi, Second Edition, 2013.

**K.S.R. COLLEGE OF ENGINEERING (Autonomous)**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO PO MAPPING**

Course Code: 20EC903

Regulation: R 2020

Course Name: Electronics and Microprocessor

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Interpret the fundamental concepts of semiconductor device.</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	<i>Explain the various characteristics of amplifiers.</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	<i>Outline the fundamental concepts of Digital Electronics</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	<i>Describe about 8085 microprocessors</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	<i>Explain the applications using microprocessor</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
<b>Average</b>		3	3	2	-	-	-	-	-	-	-	-	-	-	-

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

	<b>K.S.R. COLLEGE OF ENGINEERING (Autonomous)</b>	<b>R 2020</b>			
<b>20EC904</b>	<b>ANALOG AND DIGITAL COMMUNICATION</b>	L	T	P	C
	(Open Elective)	3	0	0	3

**Prerequisite:**

<b>Course Outcomes: On the successful completion of the course, students will be able to</b>	<b>Cognitive Level</b>
CO1 Describe analog communication techniques	Understand
CO2 Describe Digital communication techniques	Understand
CO3 Use data and pulse communication techniques	Understand
CO4 Explain Source and Error control coding	Understand
CO5 Utilize multi-user radio communication	Understand

**UNIT – I ANALOG COMMUNICATION [09]**

Noise: Source of Noise – External Noise- Internal Noise- Noise Calculation. Introduction to Communication Systems: Modulation – Types – Need for Modulation. Theory of Amplitude Modulation – Evolution and Description of SSB Techniques – Theory of Frequency and Phase Modulation – Comparison of various Analog Communication System (AM – FM – PM).

**UNIT – II DIGITAL COMMUNICATION [09]**

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) Minimum Shift Keying (MSK) –Phase Shift Keying (PSK) – BPSK – QPSK – 8 PSK – 16 PSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).

**UNIT – III DATA AND PULSE COMMUNICATION [09]**

Data Communication: History of Data Communication – Standards Organizations for Data Communication- Data Communication Circuits – Data Communication Codes – Error Detection and Correction Techniques – Data communication Hardware – serial and parallel interfaces. Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) – Comparison of various Pulse Communication System (PAM – PTM – PCM).

**UNIT – IV SOURCE AND ERROR CONTROL CODING [09]**

Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, mutual information, channel capacity, channel coding theorem, Error Control Coding, linear block codes, cyclic codes, convolution codes, viterbi decoding algorithm.

**UNIT – V MULTI-USER RADIO COMMUNICATION [09]**

Advanced Mobile Phone System (AMPS) – Global System for Mobile Communications (GSM) – Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse – Channel Assignment and Hand – Overview of Multiple Access Schemes – Satellite Communication – Bluetooth.

**Total (L: 45) = 45 Periods**

**Text Books :**

- 1 Wayne Tomasi, Advanced Electronic Communication Systems, Pearson Education, London, Sixth Edition 2009.
- 2 Simon Haykin, Communication Systems, John Wiley & Sons, New Jersey, Fourth Edition, 2004.

**Reference Books :**

- 1 H.Taub, D L Schilling and G Saha, Principles of Communication, McGraw Hill Education, New York, Fourth Edition, 2017.
- 2 B. P.Lathi, Modern Analog and Digital Communication Systems, Oxford University Press, Oxford, Third Edition, 2007.
- 3 Rappaport T.S, Wireless Communications: Principles and Practice, Pearson Education, London, Third Edition 2007.
- 4 Blake, Electronic Communication Systems, Thomson Delmar Publications, USA, Second Edition, 2001.

**K.S.R. COLLEGE OF ENGINEERING (Autonomous)**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO PO MAPPING**

Regulation: R 2020  
 Course Code: 20EC904 Course Name: Analog and Digital Communication

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Describe analog communication techniques</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	<i>Describe Digital communication techniques</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	<i>Use data and pulse communication techniques</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	<i>Explain Source and Error control coding</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	<i>Utilize multi-user radio communication</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	-	-	-	-	-	-	-	-	-	-	-

1: Slight (Low)    2: Moderate (Medium)    3: Substantial (High)

20EC905	PRINCIPLES OF COMMUNICATION (Open Elective)	L	T	P	C
		3	0	0	3

**Prerequisite:**

Course Outcomes: On the successful completion of the course, students will be able to	Cognitive Level
CO1 Determine the performance of analog modulation schemes in time and frequency domains.	Understand
CO2 Determine the performance of systems for generation and detection of modulated analog signals.	Understand
CO3 Characterize analog signals in time domain as random processes and in frequency domain using Fourier transforms	Understand
CO4 Determine the performance of analog communication systems in the presence of Noise	Understand
CO5 Interpret the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems.	Understand

**UNIT – I AMPLITUDE MODULATION [09]**

Introduction, Amplitude Modulation: Time & Frequency – Domain description, switching modulator, Envelop detector. Time and Frequency – Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing. SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television.

**UNIT – II ANGLE MODULATION [09]**

Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase-Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Super heterodyne Receiver

**UNIT - III RANDOM VARIABLES & PROCESS [09]**

Introduction, Probability, Conditional Probability, Random variables, Several Random Variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross-correlation functions

**UNIT – IV NOISE IN ANALOG MODULATION [09]**

Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth (refer Chapter 5 of Text), Noise Figure. Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM.

**UNIT – V DIGITAL REPRESENTATION OF ANALOG SIGNALS [09]**

Introduction, Why Digitize Analog Sources?, The Sampling process, Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, The Quantization Process, Quantization Noise, Pulse-Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing.

**Total (L: 45) = 45 Periods**

**Text Books :**

- Wayne Tomasi, Advanced Electronic Communication Systems, Pearson Education, London, Sixth Edition, 2009.
- Simon Haykin, Communication Systems, John Wiley & Sons, New Jersey, Fourth Edition 2004.

**Reference Books :**

- H.Taub & D.L.Schilling, Principles of Communication Systems, TMH, New Delhi, First Edition, 2011.
- H.Taub, D L Schilling and G Saha, Principles of Communication, Pearson Education, London, Fourth Edition, 2017.
- B. P.Lathi, Modern Analog and Digital Communication Systems, Oxford University Press, Oxford, Third Edition 2007.
- Blake, Electronic Communication Systems, Thomson Delmar Publications, USA, First Edition, 2002.

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO PO MAPPING**

**Course Code: 20EC905**

**Regulation: R 2020**  
**Course Name: Principles of Communication**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Determine the performance of analog modulation schemes in time and frequency domains.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	Determine the performance of systems for generation and detection of modulated analog signals.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	Characterize analog signals in time domain as random processes and in frequency domain using Fourier transforms	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	Determine the performance of analog communication systems in the presence of Noise	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	Interpret the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



20EC906	FUNDAMENTALS OF ROBOTICS (Open Elective)	L	T	P	C
		3	0	0	3

**Prerequisite:****Course Outcomes: On completion of this course, the students will be able to****Cognitive Level**

CO1	Describe the basis of Robotics	Understand
CO2	Describe the technologies applicable for Robotics in computer based vision	Understand
CO3	Interpret the different sensing elements of robot	Understand
CO4	Develop the algorithms applicable for robotics	Apply
CO5	Develop 4-axis and 6-axis robot	Apply

**UNIT – I INTRODUCTION TO ROBOTICS [09]**

Motion - Potential function - Road maps - Cell decomposition sensor and sensor planning - Kinematics - Forward and inverse kinematics - Transformation matrix and DH transformation - Geometric methods and algebraic methods.

**UNIT – II COMPUTER VISION [09]**

Projection - Optics, projection on the Image plane and radiometry - Image processing - Connectivity - Images - Gray Scale and binary images - Blob filling - Histogram - Convolution - Digital convolution and filtering and Masking techniques - Edge detection - Face detection.

**UNIT - III SENSORS AND SENSING DEVICES [09]**

Introduction to various types of sensor - Resistive sensors - Range sensors – Radar and Infra-red - Introduction to sensing - Light sensing - Heat sensing - Touch sensing and position sensing.

**UNIT – IV ARTIFICIAL INTELLIGENCE [09]**

Uniform Search strategies - Breadth first, Depth first, Depth limited - Iterative and deepening depth first search and bidirectional search - The A\* algorithm - Planning - State-space planning - Plan - space planning - Graph plan/Sat plan and their comparison - Multi-agent planning 1 and Multi-agent planning 2 - Probabilistic reasoning

**UNIT – V INTEGARATION TO ROBOT [09]**

Building of 4 axis or 6 axis robot - Vision system for pattern detection - Sensors for obstacle detection - AI algorithms for path finding - Decision making.

**Total (L: 45) = 45 Periods****Text Books :**

- 1 Duda, Hart and Stork, Pattern Recognition, Wiley-Inter science, New Jersey, First Edition, 2000.
- 2 Mallot, Computational Vision: Information Processing in Perception and Visual Behavior, MIT Press, USA, First Edition, 2000.

**Reference Books :**

- 1 Stuart Russell and Peter Norvig, Artificial Intelligence-A Modern Approach, Pearson Education Series in Artificial Intelligence, USA, First Edition, 2004.
- 2 Robert Schilling and Craig., Fundamentals of Robotics, Analysis and control, PHI, New Delhi, First Edition 2003.
- 3 Forsyth and Ponce, Computer Vision, A modern Approach, Pearson Education, USA, First Edition 2003.
- 4 <https://nptel.ac.in/courses/112/108/112108093/>

**K.S.R. COLLEGE OF ENGINEERING (Autonomous)**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO PO MAPPING**

Course Code: 20EC906

Regulation: R 2020

Course Name: Fundamentals of Robotics

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Describe the basis of Robotics</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	<i>Describe the technologies applicable for Robotics in computer based vision</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	<i>Interpret the different sensing elements of robot</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	<i>Develop the algorithms applicable for robotics</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	<i>Develop 4-axis and 6-axis robot</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	-	-	-	-	-	-	-	-	-	-	-

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20EC907	INTERNET OF THINGS SENSING AND ACTUATOR DEVICES (Open Elective)	L	T	P	C
		3	0	0	3

**Prerequisite:****Course Outcomes: On completion of this course, the student will be able to****Cognitive Level**

CO1	Describe what IoT is and how it works today.	Understand
CO2	Design and program IoT devices.	Understand
CO3	Describe the functions and characteristics of IoT sensors.	Understand
CO4	Illustrate the wireless, energy, power, RF and sensing modules.	Understand
CO5	Describe the applications and technological challenges faced by IoT devices.	Understand

**UNIT – I BASICS OF IOT [ 09 ]**

Definitions and Functional Requirements – Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information Security

**UNIT – II IOT PROTOCOLS [ 09 ]**

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BAC Net Protocol – Modbus – KNX – Zigbee Architecture – Network layer – APS layer – Security

**UNIT – III IOT SENSORS [ 09 ]**

Industrial sensors – Description & Characteristics–First Generation – Description & Characteristics– Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics–Polytronics Systems – Description & Characteristics–Sensors' Swarm – Description & Characteristics–Printed Electronics –Description & Characteristics–IoT Generation Roadmap.

**UNIT– IV TECHNOLOGICAL ANALYSIS [ 09 ]**

Wireless Sensor Structure–Energy Storage Module–Power Management Module – RF Module– Sensing Module

**UNIT – V APPLICATIONS [ 09 ]**

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronization and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging

**Total = 45 Periods****Text Books:**

- 1 David Easley and Jon Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, London, First Edition, 2010.
- 2 Guillaume Girardin, Antoine Bonnabel, Dr. Eric Mounier, Technologies & Sensors for the Internet of Things Businesses & Market Trends, First Edition, 2014.

**Reference Books:**

- 1 Honbo Zhou, Dieter Uckelmann; Mark Harrison, The Internet of Things in the Cloud: A Middleware Perspective - CRC Press, USA, First Edition, 2012.
- 2 Florian Michahelles, Architecting the Internet of Things — Springer, Berlin, First Edition, 2011.
- 3 Ida N, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.
- 4 Olivier Hersent, Omar Elloumi and David Boswarthick, The Internet of Things: Applications to the Smart Grid and Building Automation, Wiley, New Jersey, First Edition, 2012.

**K.S.R. COLLEGE OF ENGINEERING (Autonomous)**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO PO MAPPING**

Regulation: R 2020

Course Code: 20EC907

Course Name: Internet of Things Sensing and Actuator Devices

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Describe what IoT is and how it works today.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	<i>Design and program IoT devices.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	<i>Describe the functions and characteristics of IoT sensors.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	<i>Illustrate the wireless, energy, power, RF and sensing modules.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	<i>Describe the applications and technological challenges faced by IoT devices.</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20EC908	CONSUMER ELECTRONICS (Open Elective)	L	T	P	C
		3	0	0	3

**Prerequisite:****Course Outcomes: On completion of this course, the student will be able to****Cognitive Level**

CO1	Describe the evolution and fundamentals of consumer electronics	Understand
CO2	Discuss various entertainment electronics appliances	Understand
CO3	Demonstrate various smart home systems	Understand
CO4	Outline various home appliances	Understand
CO5	Illustrate various communication equipment's used In day to day life	Understand

**UNIT – I CONSUMER ELECTRONICS FUNDAMENTALS [ 09 ]**

History of Electronic Devices- Vacuum Tubes, Transistors, Integrated Circuits- Moore's Law, Semiconductor Devices, Diodes, Rectifiers, Transistors, Logic Gates, Combinational Circuits, ADC, DAC and Microprocessors, Microprocessor Vs Microcontrollers, Microcontrollers in consumer electronics, Energy management, Intelligent Building Perspective.

**UNIT – II ENTERTAINMENT ELECTRONICS [ 09 ]**

Audio systems: Construction and working principle of: Microphone, Loud speaker, AM and FM receiver, stereo, 2.1 home theatres, 5.1 home theatres, Display systems: CRT, LCD, LED and Graphics display Video Players: DVD and Blue RAY. Recording Systems: Digital Cameras and Camcorders.

**UNIT – III SMART HOME [ 09 ]**

Technology involved in Smart home, Home Virtual Assistants- Alexa and Google Home. Home Security Systems - Intruder Detection, Automated blinds, Motion Sensors, Thermal Sensors and Image Sensors, PIR, IR and Water Level Sensors.

**UNIT– IV HOME APPLIANCES [ 09 ]**

Home Enablement Systems: RFID Home, Lighting control, Automatic Cleaning Robots, Washing Machines, Kitchen Electronics- Microwave, Dishwasher, Induction Stoves, Smart Refrigerators, Smart alarms, Smart toilet, Smart floor, Smart locks.

**UNIT – V COMMUNICATION SYSTEMS [ 09 ]**

Cordless Telephones, Fax Machines, PDAs - Tablets, Smart Phones and Smart Watches, Introduction to Smart OS - Android and iOS. Video Conferencing Systems - Web/IP Camera, Video security, Internet Enabled Systems, Wi-Fi, IoT, Li-Fi, GPS and Tracking Systems.

**Total = 45 Periods****Text Books:**

- 1 Dennis C Brewer, Home Automation, Que Publishing, London, First Edition, 2013.
- 2 Jordan Frith, Smartphones as Locative Media, Wiley, New Jersey, First Edition, 2014.

**Reference Books:**

- 1 Lyla B Das, Embedded Systems-An Integrated Approach, Pearson, London, First Edition, 2013
- 2 Marilyn Wolf, Computers as Components - Principles of Embedded Computing System Design, Third Edition Morgan Kaufmann Publisher (An imprint from Elsevier), 2012
- 3 Peckol, Embedded system Design, John Wiley & Sons, USA, First Edition, 2010
- 4 Thomas M. Coughlin, Digital Storage in Consumer Electronics, Elsevier and Newness, Amsterdam, Netherlands, First Edition, 2012.
- 5 Philip Hoff, Consumer Electronics for Engineers, Cambridge University Press. London, First Edition, 1998.

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**CO PO MAPPING**

Course Code: 20EC908

Regulation: R 2020  
 Course Name: Consumer Electronics

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Describe the evolution and fundamentals of consumer electronics</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	<i>Discuss various entertainment electronics appliances</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	<i>Demonstrate various smart home systems</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	<i>Outline various home appliances</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	<i>Illustrate various communication equipment's used In day to day life</i>	3	3	3	-	-	-	-	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20IT901	<b>DATA SCIENCE USING R</b> (Open Elective)	L	T	P	C
		3	0	0	3

**Prerequisite: -**

<b>Course Outcomes : On successful completion of the course, the student will be able to</b>	<b>Cognitive Level</b>
CO1: Explain the life cycle of data science.	Understand
CO2: Interpret the data manipulation statements and functional programming in R.	Understand
CO3: Outline the packages to implement machine learning techniques.	Understand
CO4: Explore the concepts of object-oriented programming in R.	Understand
CO5: Discuss the data visualization packages in R.	Understand

**UNIT – I DATA SCIENCE [9]**

Data Science : Data Science Lifecycle – Dealing with Missing Values – Using R Packages – Expression – Data Types – Control Structures – Functions – Recursive Functions – Simple Programs.

**UNIT – II DATA MANIPULATION AND FUNCTIONAL PROGRAMMING [ 9]**

Data Manipulation – Data Import and Export – Manipulation Data – Vectoring Functions – Infix Operator – Replacement Functions – Function with arguments and return statement.

**UNIT – III MACHINE LEARNING [ 9]**

Dealing with large Dataset – Sampling – Supervised Learning Methods: Linear Regression – Logistic Regression – Evaluating and Validating Models – Decision Trees – Neural Network – Support Vector Machine – Unsupervised Learning – Clustering – Association Rule Mining.

**UNIT – IV CLASS AND OBJECTS [ 9]**

Immutable objects and Polymorphic functions – Data structures – Classes – Programming with New Classes – Inheritance and Inter-Class Relations – Virtual Classes – Creating and Validating Objects.

**UNIT – V DATA VISUALIZATION AND PACKAGES [ 9]**

Data Visualization: XY Plot – Graphics Package – ggplot2 – Package concept and tools – Creating R package – Namespace – R Oxygen – Adding data to Package – Documentation for Packages.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Book:**

- 1 Thomas Mailund, Beginning Data Science in R – Data Analysis, Visualization and Modeling for the Data Scientist, Apress Publication, New York, First Edition, 2017.
- 2 Hadley Wickham and Garrett Grolemund ,R for Data Science, Import, Tidy, Transform, Visualize, and Model Data, O'Reilly, India, First Edition ,2017.

**Reference Books :**

- 1 Nicholas J. Horton, Ken Kleinman, Using R and RStudio for Data Management, Statistical Analysis, and Graphics, CRC Press, United States , Second Edition, 2015.
- 2 Sara Baase and Allen Van Gelder, Computer Algorithms - Introduction to Design and Analysis, Pearson Education, India , Third Edition, 2010.
- 3 K.G.Srinivasa, G M Siddesh, Chetan Shetty, Statistical Programming in R, Oxford University Press, New Delhi, First Edition , 2017.
- 4 John Maindonald, W. John Braun, Data Analysis and Graphics Using R: An Example-Based Approach, University Press, Cambridge, Third Edition, 2010.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF INFORMATION TECHNOLOGY**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20IT901

Course Name: DATA SCIENCE USING R

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain the life cycle of data science.	3	2	3	-	2	-	-	-	-	-	-	3	-	-
CO2	Interpret the data manipulation statements and functional programming in R	3	2	3	-	2	-	-	-	-	-	-	3	-	-
CO3	Outline the packages to implement machine learning techniques	3	2	3	-	2	-	-	-	-	-	-	3	-	-
CO4	Explore the concepts of object-oriented programming in R	3	2	3	-	2	-	-	-	-	-	-	3	-	-
CO5	Discuss the data visualization packages in R	3	2	3	-	2	-	-	-	-	-	-	3	-	-
<b>Average</b>		3	2	3	-	2	-	-	-	-	-	-	3	-	-

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



20IT902

## PRINCIPLES OF CYBER SECURITY

(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite: -****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1: Describe the basic concepts in cyber security and cybercrime.	Remember
CO2: Explore about classification of cyber forensics.	Understand
CO3: Summarize the latest trends in ethical hacking.	Understand
CO4: Discuss the fundamentals of computer forensics and evidence collection.	Understand
CO5: Describe the vulnerabilities in cyber security.	Remember

**UNIT – I CYBER CRIME [9]**

Cyber Crime – Types of Cyber Crime – Classification of Cyber Criminals – Tools used in Cyber Crime – Challenges – Strategies – Crypto Currency – Bitcoin and Block chain – Ransomware.

**UNIT – II CYBER FORENSICS [ 9]**

Cyber Forensics: Definition – Disk Forensics – Network Forensics – Wireless Forensics – Database Forensics – Malware Forensics – Mobile Forensics – Email Forensics.

**UNIT – III ETHICAL HACKING [ 9]**

Ethical Hacking– Hacking Windows – Network Hacking – Web Hacking – Password Hacking – Malware – Scanning – Cracking.

**UNIT – IV DIGITAL EVIDENCE IN CRIMINAL INVESTIGATIONS [ 9]**

Digital Evidence in Criminal Investigations: The Analog and Digital World – Training and Education – Evidence Collection and Data Seizure: Collection Options Obstacles – Types of Evidence –Rules of Evidence –Volatile Evidence.

**UNIT – V CYBER SECURITY VULNERABILITIES [ 9]**

Vulnerabilities in software – System administration – Complex Network Architectures – Open Access to Organizational Data — Unprotected Broadband communications – Poor Cyber Security Awareness – Encryption Tool: KeePass.

**Total (L= 45, T = 0 ) = 45 Periods****Text Books:**

- 1 Deje, Dr.Murugan, Cyber Forensics, Oxford University Press, India, First Edition, 2018.
- 2 William Stallings and Lawrie Brown, Computer Security: Principles and Practice, Prentice Hall, United States, Third Edition, 2017.

**Reference Books :**

- 1 John W. Ritting house, William M. Hancock, Cyber Security Operations Handbook, Elsevier Publications , India ,First Edition,2008
- 2 Deborah G Johnson, Computer Ethics, Pearson Education Publication, India ,Fourth Edition , 2014
- 3 [https://onlinecourses.swayam2.ac.in/cec20\\_cs15/preview](https://onlinecourses.swayam2.ac.in/cec20_cs15/preview)
- 4 <https://www.simplilearn.com/tutorials/cyber-security-tutorial/cyber-security-for-beginners>

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF INFORMATION TECHNOLOGY**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20IT902

Course Name: PRINCIPLES OF CYBER SECURITY

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Describe the basic concepts in cyber security and cybercrime.</i>	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO2	<i>Explore about classification of cyber forensics.</i>	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO3	<i>Summarize the latest trends in ethical hacking.</i>	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO4	<i>Discuss the fundamentals of computer forensics and evidence collection.</i>	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO5	<i>Describe the vulnerabilities in cyber security.</i>	3	3	3	-	2	-	-	-	-	-	-	3	-	-
<b>Average</b>		3	3	3	-	2	-	-	-	-	-	-	3	-	-

1: Slight (Low)    2: Moderate (Medium)    3: Substantial (High)

20IT903	FUNDAMENTALS OF BUSINESS INTELLIGENCE (Open Elective)	L	T	P	C
		3	0	0	3

**Prerequisite: -**

Course Outcomes : On successful completion of the course, the student will be able to	Cognitive Level
CO1: Summarize the nuances of extracting information from the various sources of digital data	Understand
CO2: Infer the techniques involved in Online Transaction Processing and Online Analytical processing systems.	Understand
CO3: Discuss the concept of data integration.	Remember
CO4: Summarize the various methods of data integration.	Understand
CO5: Describe the various process involved in the Enterprise Reporting.	Understand

**UNIT – I DIGITAL DATA [ 09 ]**

Digital Data: Sources and Characteristics –Structured– Unstructured– Semi-Structured – Business Intelligence(BI) : Definition – BI Component Framework – BI Users – BI Applications – BI Tools.

**UNIT – II OLTP AND OLAP [ 09 ]**

OLTP: Advantages – Challenges – OLAP: Types of Data – OLAP Architectures: MOLAP – ROLAP – HOLAP – OLAP and OLTP – Data models for OLTP – Data models for OLAP.

**UNIT – III DATA INTEGRATION [ 09 ]**

Data Integration : Approaches and Advantages – Technologies – Data Quality – Data Profiling – Data Warehouse : Goals and Sources – Data Mart –Operational Data Store – Ralph Kimball's Approach– Data Mapping –Staging.

**UNIT – IV MULTIDIMENSIONAL DATA MODELING [ 09 ]**

Data Modeling: Entity and Attribute – Cardinality of Relationship – Types of Data Model – Data Modeling Techniques – Fact Table – Dimension table – Dimensional Models –Dimensional Modeling Life Cycle.

**UNIT – V ENTERPRISE REPORTING [ 09 ]**

Enterprise Reporting: Reporting Perspectives– Report Standardization and Presentation Practices – Enterprise Reporting Characteristics in OLAP –Balanced Scorecards – Create Dashboards – Scorecards Vs Dashboards.

**Total (L= 45, T = 0) = 45 Periods**

**Text Books:**

- 1 R. N. Prasad, Seema Acharya, Fundamentals of Business Analytics, Wiley Publication Hoboken, New Jersey, Second Edition, 2016.
- 2 Regi Mathew, Business Analytics for Decision Making, Pearson Education, India , First Edition,2020.

**Reference Books :**

- 1 David Stephenson, Big Data Demystified, FT Publishing International, United States, First Edition, 2018.
- 2 Wayne Winston, Microsoft Excel 2019 Data Analytics and Business Modeling, Microsoft Press, United States, Sixth Edition, 2019.
- 3 Soheil Bakhshi, Expert Data Modelling with Power BI, Packt Publishing , Mumbai, First Edition, 2021.
- 4 <https://nptel.ac.in/courses/110107092>

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF INFORMATION TECHNOLOGY**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20IT903

Course Name: **FUNDAMENTALS OF BUSINESS INTELLIGENCE**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Summarize the nuances of extracting information from the various sources of digital data</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO2	<i>Infer the techniques involved in Online Transaction Processing and Online Analytical processing systems.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3	<i>Discuss the concept of data integration.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO4	<i>Summarize the various methods of data integration.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO5	<i>Describe the various process involved in the Enterprise Reporting.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
<b>Average</b>		3	2	3	-	-	-	-	-	-	-	-	3	-	-

1: Slight (Low)    2: Moderate (Medium)    3: Substantial (High)

20IT904	<b>BLOCKCHAIN TECHNOLOGIES</b> (Open Elective)	L T P C 3 0 0 3
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**Prerequisite: -**

**Course Outcomes : On successful completion of the course, the student will be able to** **Cognitive Level**

CO1: Infer the theoretical aspects of blockchain and apply in real case scenarios.	Understand
CO2: Discuss the core components and working of blockchain.	Remember
CO3: Explain the technical concepts of bit coin.	Understand
CO4: Interpret the Ethereum blockchain for different use cases.	Understand
CO5: Outline the end-to-end development of a decentralized application.	Understand

**UNIT – I BLOCKCHAIN ARCHITECTURE [9]**

History –Blockchain –Centralized vs. Decentralized Systems–Layers of Blockchain–Versions of Blockchain:3.0 and 4.0  
–Blockchain Uses and Use Cases –Laying the Blockchain Foundation – Cryptography.

**UNIT – II WORKING OF BLOCKCHAIN [9]**

Game Theory –Prisoner’s Dilemma –Byzantine Generals’ Problem – The Blockchain – Merkle Trees – Properties of Blockchain Solutions – Blockchain Transactions – Distributed consensus mechanisms – Blockchain applications.

**UNIT – III BITCOIN [9]**

History of Money – Working with Bitcoins –Bitcoin Blockchain – The Bitcoin Network – Bitcoin Scripts – Full Node svs SPVs – Bitcoin Wallets.

**UNIT – IV ETHEREUM AND HYPERLEDGER [9]**

Bitcoin to Ethereum – Ethereum Blockchain – Ethereum Smart Contracts – Ethereum Virtual Machine and Code Execution–Ethereum Ecosystem – Swarm – Whisper – DApp – Development components – Hyper ledger : Iroha – Blockchain Explorer – Fabric Chain tool.

**UNIT – V APPLICATIONS OF BLOCKCHAIN [9]**

Decentralized Applications – Blockchain Application Development – Interacting with Bitcoin Blockchain – Sending Transactions–Creating a Smart Contract – Executing Smart Contract Functions – Public vs. Private Blockchains.

**Total (L= 45, T = 0) = 45 Periods**

**Text Books:**

- 1 Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Beginning Blockchain: A Beginner’s Guide to Building Blockchain Solutions, APress, New York, First Edition, 2018.
- 2 Brenn Hill, Samanyu Chopra, Paul Valen court, Blockchain Quick Reference: A guide to exploring decentralized blockchain application development, Packt Publishing, Mumbai, First Edition, 2018.

**Reference Books :**

- 1 Imran Bashir, Mastering Blockchain Distributed Ledgers, Decentralization and Smart Contracts Explained, Packt Publishing, Mumabi , First Edition, 2017.
- 2 Pethuru Raj, Chellammal Suria Narayanan, Kavita Saini, Blockchain Technology and Applications, CRC Press, United States, First Edition ,2021.
- 3 E. Golden Julie, J. Jesu VedhaNayahi, Noor Zaman Jhanjhi, Blockchain Technology Fundamentals, Applications, and Case Studies, CRC Press , United States, First Edition, 2021.
- 4 [https://onlinecourses.nptel.ac.in/noc20\\_cs01/preview](https://onlinecourses.nptel.ac.in/noc20_cs01/preview)

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF INFORMATION TECHNOLOGY**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20IT904

Course Name: BLOCKCHAIN TECHNOLOGIES

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Infer the theoretical aspects of block chain and apply in real case scenarios.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO2	<i>Discuss the core components and working of block chain.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3	<i>Explain the technical concepts of bit coin.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO4	<i>Interpret the Ethereum block chain for different use cases.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO5	<i>Outline the end-to-end development of a decentralized application.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
<b>Average</b>		3	2	3	-	-	-	-	-	-	-	-	3	-	-

1: Slight (Low)    2: Moderate (Medium)    3: Substantial (High)

20IT905

**INTERNET OF THINGS AND APPLICATIONS**  
 (Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite: -****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1: Explain the physical and logical design of IoT.	Understand
CO2: Summarize the various design methodologies of IoT.	Understand
CO3: Outline the various packages in Python for IoT real world application.	Understand
CO4: Discuss IoT applications using Raspberry Pi and Python.	Remember
CO5: Infer the knowledge on design of smart IoT applications.	Understand

**UNIT-I FUNCTIONAL BLOCKS OF IoT [ 09 ]**

Definition and Characteristics of IoT – Physical Design: Layers and Protocols – Logical Design: IoT Functional Blocks – IoT Communication models and APIs – IoT Enabling Technologies –IoT Levels and Deployment Templates.

**UNIT-II IoT DESIGN METHODOLOGY [ 09 ]**

M2M – M2M Vs IoT – Software Defined Networks – Network function Virtualization – IoT Platform Design Methodologies – Domain Specific IoT.

**UNIT – III PYTHON PACKAGES FOR IOT AND RASPBERRY PI [ 09 ]**

JSON – XML – HTTPLib and URLLib – SMTPLib. Raspberry Pi : Pin Configurations – Interfaces : Serial, SPI, 12C Programming – Python program with Raspberry Pi –Controlling Output – Reading input from pins.

**UNIT –IV IoT APPLICATIONS USING RASPBERRY PI [ 09 ]**

LED Controlling – Traffic Light controller – Integrating Sensors – Developing web application to control IoT device – Uploading the sensor values onto the cloud for analysis – Sending SMS – Sending images and video via mail.

**UNIT-V IoT USE CASES [ 09 ]**

Smart and Connected Cities – An IoT Strategy for Smarter Cities – Architecture – Use Cases: Street Lighting – Smart Parking – Smart Traffic – Smart Home Automation – Smart Agriculture– Weather Monitoring.

**Total (L= 45, T = 0 ) = 45 Periods****Text Books:**

- 1 Arshdeep Bahga and Vijay Madiseti, Internet of Things –A Hands-on Approach, Orient Blackswan Private Limited, New Delhi, First Edition, 2015.
- 2 David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Pearson Education, First Edition, 2017.

**Reference Books :**

- 1 Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Apress Publications, New York, First Edition, 2013.
- 2 Rajkamal, Internet of Things: Architecture, Design Principles And Applications, McGraw Hill Education, New York, First Edition, 2017.
- 3 Olivier Hersent, DavidBoswarthick, Omar Elloumi, The Internet of Things – Key Applications and Protocols, Wiley, New York, 2015.
- 4 [https://onlinecourses.nptel.ac.in/noc22\\_cs53/preview](https://onlinecourses.nptel.ac.in/noc22_cs53/preview)

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF INFORMATION TECHNOLOGY**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20IT905

Course Name: INTERNET OF THINGS AND APPLICATIONS

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	<i>Explain the physical and logical design of IoT.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
C02	<i>Summarize the various design methodologies of IoT.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
C03	<i>Outline the various packages in Python for IoT real world application.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
C04	<i>Discuss IoT applications using Raspberry PI and Python.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
C05	<i>Infer the knowledge on design of smart IoT applications.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
<b>Average</b>		3	2	3	-	-	-	-	-	-	-	-	3	-	-

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



20IT906	<b>PRINCIPLES OF SOFTWARE TESTING</b> (Open Elective)	L T P C 3 0 0 3
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**Prerequisite: -**

<b>Course Outcomes : On successful completion of the course, the student will be able to</b>	<b>Cognitive Level</b>
CO1: Outline the strategies for software testing.	Understand
CO2: Infer the need and conduct of testing levels.	Understand
CO3: Discuss the various techniques used in testing.	Understand
CO4: Interpret the various types of testing used in real world application.	Understand
CO5: Explain the test case templates and reviews process.	Understand

**UNIT - I SOFTWARE TESTING [ 9]**

Software Testing – Definition of Software Testing – Objective and limits of testing – Testing Strategy – Roles and Responsibilities of a Software Tester – Independent Verification and Validation.

**UNIT - II SOFTWARE TESTING REQUIREMENTS [ 9]**

Software Testing Requirements – Analyzing the requirements –Functional and Non-Functional Requirements. Software Testing Review Process – Types of Reviews: Peer Review – Walkthrough – Inspection – Checklists of Review Process.

**UNIT - III WHITE AND BLACK BOX TESTING [ 9]**

White Box Testing Techniques: Decision/Branch Coverage – Basic Path Testing – Control Flow Graph Coverage – Conditional Coverage. Black Box Test Techniques: Boundary Value Analysis – Equivalent Class Partition – Cause-Effect Analysis – State Transition Table.

**UNIT - IV TESTING TECHNIQUES [ 9]**

Functional Testing: Smoke Testing – Integration and System Testing User Acceptance Testing – Non-Functional Testing: – Performance Testing – Recovery Testing – Security Testing – Compatibility Testing – Usability Testing – Ad Hoc Testing.

**UNIT - V TEST CASE DESIGN [ 9]**

Test Case :Standards, Characteristics , Guidelines and Naming Conventions – Test Case Templates – Creation of Test Case – Requirement Coverage –Traceability Matrix – Test Case Review Process – Test Execution – Test Log – Reporting of Test Execution

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books:**

- 1 S.Subashni, N.Satheesh Kumar, Dr.B.G.Geetha, Dr.G.Singaravel, Software Testing, Umayam Publications, First Edition, 2013.
- 2 Srinivasan Desikan, Gopaldaswamy Ramesh, Software Testing: Principles and Practice, Pearson Education, India, Second Edition , 2017.

**Reference Books :**

- 1 MarnieL.Hutchson, Software Testing Fundamentals Methods and Metrics, Wiley, India, Second Edition,2003.
- 2 GlenfordJ.Myess, The Art of Testing, Wiley, India, Third Edition, 2003.
- 3 [https://onlinecourses.nptel.ac.in/noc22\\_cs12/preview](https://onlinecourses.nptel.ac.in/noc22_cs12/preview)
- 4 <https://www.digimat.in/nptel/courses/video/106105150/L01.html>

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF INFORMATION TECHNOLOGY**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20IT906

Course Name: PRINCIPLES OF SOFTWARE TESTING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	<i>Outline the strategies for software testing.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
C02	<i>Infer the need and conduct of testing levels.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
C03	<i>Discuss the various techniques used in testing.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
C04	<i>Interpret the various types of testing used in real world application.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
C05	<i>Explain the test case templates and reviews process.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
<b>Average</b>		3	2	3	-	-	-	-	-	-	-	-	3	-	-

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

20IT907	<b>FOUNDATION SKILLS IN LOGIC BUILDING</b> (Open Elective)	L T P C 3 0 0 3
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**Prerequisite: -**

**Course Outcomes : On successful completion of the course, the student will be able to** **Cognitive Level**

CO1: Summarize the various approaches in problem solving.	Understand
CO2: Discuss the different algorithm design techniques.	Remember
CO3: Demonstrate the various array based problem.	Understand
CO4: Summarize the concept of sorting and searching.	Understand
CO5: Outline the various methods to solve number based problem.	Understand

**UNIT – I PROBLEM SOLVING PROCESS [ 9 ]**

Problem Solving Process –Approaches in Problem Solving: System Centric– Problem Centric– Solution Centric and Solver Centric Approach – Algorithm– Pseudocode – Flowchart– Important Problem Types.

**UNIT – II ALGORITHMIC PROBLEM SOLVING [ 9 ]**

Notion of the Algorithm – Algorithm Design and Analysis Process – Time and Space Complexity – Algorithm Design Techniques: Divide and Conquer – Dynamic Programming – Greedy Technique – Backtracking.

**UNIT – III ARRAY BASED PROBLEMS [ 9 ]**

Array Order Reversal – Array Counting – Removal duplicates – Finding the kth smallest element – Swapping of elements – Subarray with given Sum – Find the longest consecutive subsequence.

**UNIT – IV SORTING AND SEARCHING [ 9 ]**

Searching: Linear Search – Binary Search. Sorting: Bubble Sort– Selection Sort– Insertion Sort– Merge Sort– Quicksort – Heap Sort.

**UNIT – V NUMBER BASED PROBLEMS [ 9 ]**

Swapping the values –Summation of Set of Number – Fibonacci Sequence and Factorial Computation –Integer Reversal – Euclid's algorithm – Prime Numbers Generation.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books:**

- 1 R.G.Dromey, How to Solve it by Computer, Pearson Education, India, Fifth Edition, 2008.
- 2 ISRD GROUP, Programming and Problem Solving Using C Language, McGraw Hill Education, India , First Edition 2017.

**Reference Books :**

- 1 ITL Educational Solutions Limited, Introduction to Information Technology, Pearson Education, India, Second Edition, India, 2012.
- 2 G. Polya, How to Solve It : A New Aspect of Mathematical Method, Princeton University Press, New Jersey, Second Edition, 2008
- 3 Ellis Horowitz, Fundamentals of Programming languages, Galgotia Publications, New Delhi, Second Edition, 2012.
- 4 [www.nptel.ac.in/courses/106104074](http://www.nptel.ac.in/courses/106104074)

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF INFORMATION TECHNOLOGY**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20IT907

Course Name: FOUNDATION SKILLS IN LOGIC  
BUILDING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Summarize the various approaches in problem solving.</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO2	<i>Discuss the different algorithm design techniques.</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3	<i>Demonstrate the various array based problem.</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4	<i>Summarize the concept of sorting and searching.</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5	<i>Outline the various methods to solve number based problem.</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
<b>Average</b>		3	3	3	-	-	-	-	-	-	-	-	3	-	-

1: Slight (Low)    2: Moderate (Medium)    3: Substantial (High)

20IT908	<b>PRINCIPLES OF CLOUD COMPUTING</b> (Open Elective)	L T P C 3 0 0 3
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**Prerequisite: -**

<b>Course Outcomes : On successful completion of the course, the student will be able to</b>	<b>Cognitive Level</b>
CO1: Explain the characteristics of cloud computing.	Understand
CO2: Interpret the performance of cloud computing in various computing environment.	Understand
CO3: Discuss the concept of cloud architecture.	Understand
CO4: Infer the knowledge on cloud simulators.	Understand
CO5: Outline the usage of simulators like VMWare simulator.	Understand

**UNIT – I CLOUD COMPUTING [ 9 ]**

Origins of Cloud Computing – Cloud Components – Essential Characteristics — Broad Network Access – Location Independent Resource Pooling – Rapid Elasticity – Measured Service – Roots of Cloud Computing.

**UNIT – II CLOUD INSIGHTS [ 9 ]**

Architectural Influences – High-Performance Computing – Utility and Enterprise Grid Computing – Cloud Scenarios – Benefits– Application Development – Security level of Third Party – Security Benefits – Regularity Issues.

**UNIT – III CLOUD ARCHITECTURE [ 9 ]**

Layers in Cloud Architecture – Software as a Service– Features of SaaS and benefits– Platform as a Services – Features of PaaS and benefits– Infrastructure as a Service– Features of IaaS and benefits– Cloud Service Providers – Challenges and risks in cloud adoption –Types of Cloud.

**UNIT – IV CLOUD SIMULATORS [ 9 ]**

CloudSim Simulator –Architecture– User code–CloudSim– GridSim– SimJava –Working platform for CloudSim–GreenCloud.

**UNIT-V VMWARE SIMULATOR [ 9 ]**

VMWare– Advantages of VMWare virtualization–VMWare workstation–Virtual Machines – Create a new virtual machine on local host – Cloning virtual machine – Recent Trends.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Book:**

- 1 Anthony T.Velte , Toby J. Velte Robert Elsenpeter, Cloud computing : A Practical Approach, Tata McGraw- Hill , New Delhi ,Second Edition, 2017.
- 2 Dan C Marinescu,Cloud Computing: Theory and Practice, MK Elsevier, Second Edition,United States,2017.

**Reference Books :**

- 1 Judith Hurwitz,Robin Bloor, Marcia Kaufman, Fern Halper,Cloud computing for Dummies, Wiley, India,Second Edition,2020.
- 2 Rajkumar Buyya, James Broberg,Andrzej Goscinski,Cloud Computing:Principles and Paradigms, Wiley, India,First Edition,2011.
- 3 [https://onlinecourses.nptel.ac.in/noc22\\_cs20/preview](https://onlinecourses.nptel.ac.in/noc22_cs20/preview)
- 4 <https://archive.nptel.ac.in/courses/106/105/106105167/>

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF INFORMATION TECHNOLOGY**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20IT908

Course Name: PRINCIPLES OF CLOUD  
COMPUTING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Explain the characteristics of cloud computing.</i>	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO2	<i>Interpret the performance of cloud computing in various computing environment.</i>	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO3	<i>Discuss the concept of cloud architecture.</i>	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO4	<i>Infer the knowledge on cloud simulators.</i>	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO5	<i>Outline the usage of simulators like VMWare simulator.</i>	3	3	3	-	2	-	-	-	-	-	-	3	-	-
<b>Average</b>		3	3	3	-	2	-	-	-	-	-	-	3	-	-

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

20IT909	<b>OPEN SOURCE TECHNOLOGIES</b>	L	T	P	C
	(Open Elective)	3	0	0	3

**Prerequisite: -**

<b>Course Outcomes : On successful completion of the course, the student will be able to</b>	<b>Cognitive Level</b>
CO1: Outline the need and importance of Linux Open Source Software.	Understand
CO2: Discuss the manipulations on Array and String using PHP.	Remember
CO3: Summarize various functions in String and Date object	Understand
CO4: Describe simple code segment using list and tuple in Python.	Understand
CO5: Outline the usage of decision and looping statements in PERL.	Remember

**UNIT – I LINUX [ 09 ]**

Open Sources: Need, Advantages and Applications – Open Source Operating Systems : LINUX – Kernel Mode and – Process – Scheduling – Personalities – Cloning and Signals.

**UNIT – II PHP [ 09 ]**

PHP :Syntax of PHP –Common PHP Script Elements –Variables and Constants – Data types – Operators and Statements –Arrays and Functions –String Manipulations– Regular Expression.

**UNIT – III MySQL [ 09 ]**

Setting up an account – Starting, Terminating and writing your own MySQL Programs – Record Selection Technology – Strings – Date and Time – Sorting Query Results module – DDL – DDL –DCL –TDL.

**UNIT – IV PYTHON [ 09 ]**

Syntax and Style – Python Objects – Numbers – Sequences – Strings – Lists and Tuples – Dictionaries – Decision and Loops – Files – Input and Output Statements – Errors and Exceptions – Functions.

**UNIT – V PERL [ 09 ]**

Perl : Perl Parsing Rules – Variables and Data – Statements and Control Structures – Subroutines – Packages and Modules – Files and Data Manipulation.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Book:**

- 1 Martin C.Brown, Python: The Complete Reference, McGraw Hill Education, India, Fourth Edition, 2018.
- 2 Richard Petersen, The Complete Reference Linux, Tata McGraw Hill, New Delhi, Sixth Edition, 2017.

**Reference Books :**

- 1 Frank M. Kromann, Beginning PHP and MySQL, Apress , New York , Fifth Edition ,2018.
- 2 Martin C. Brown, Perl: The Complete Reference, Tata McGraw-Hill, New Delhi, Fifth, 2017.
- 3 Steven Holzner, PHP: The Complete Reference, Tata McGraw-Hill, New Delhi, Sixth Edition, 2017.
- 4 <https://nptel.ac.in/courses/106106145>

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**DEPARTMENT OF INFORMATION TECHNOLOGY**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20IT909

Course Name: OPEN SOURCE TECHNOLOGIES

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Outline the need and importance of Linux Open Source Software.</i>	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO2	<i>Discuss the manipulations on Array and String using PHP.</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3	<i>Summarize various functions in String and Date object</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4	<i>Describe simple code segment using list and tuple in Python.</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5	<i>Outline the usage of decision and looping statements in PERL.</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
<b>Average</b>		3	3	3	-	-	-	-	-	-	-	-	3	-	-

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



20IT910	<b>PRINCIPLES OF SOFTWARE ENGINEERING</b> (Open Elective)	L T P C 3 0 0 3
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**Prerequisite: -**

<b>Course Outcomes : On successful completion of the course, the student will be able to</b>	<b>Cognitive Level</b>
CO1: Explain the software engineering process and its various models	Understand
CO2: Summarize how requirements may be organized in software requirements document	Understand
CO3: Illustrate the architectural design decisions and apply real time systems.	Understand
CO4: Outline the methods rely on documented specifications and Design.	Understand
CO5: Discuss the process involved in verification and validation.	Understand

**UNIT - I SYSTEMS ENGINEERING [ 9 ]**

Professional and Ethical Responsibility - Systems Engineering – Legacy Systems – Critical System – Software Process Models – Process Iteration – The Rational Unified Process – Project Planning – Project Scheduling.

**UNIT - II REQUIREMENTS ANALYSIS [ 9 ]**

Software Requirements: Functional and Non-Functional Requirements - User Requirements - System Requirements – Requirements Validation – Requirements Management – System Models: Context Models, Behavioral Models, Data Models ,Object Models, Structured Methods– Risk-Driven Specification, Safety Specification.

**UNIT - III ARCHITECTURAL DESIGN [ 9 ]**

Architectural Design Decisions – System Organization – Multiprocessor Architectures – Client – Server Architectures – Data Processing Systems – Objects and Object Classes – Real–Time Operating Systems – Monitoring and Control Systems – User Interface Design : Issue, Process, Analysis.

**UNIT - IV CRITICAL SYSTEMS [ 9 ]**

Agile Methods – Rapid Application Development – Software Prototyping – Components and Component Models – Fault Tolerance – Fault-Tolerance Architectures – Software Maintenance – Evolution Processes – Legacy System Evolution .

**UNIT - V VERIFICATION AND VALIDATION [ 9 ]**

Planning Verification and Validation – Software Inspections – Verification and Formal Methods – Systems Testing – Component Testing – Test Case Design – Test Automation – Safety Assurance – Security Assessment.

**Total (L= 45, T = 0 ) = 45 Periods**

**Text Books:**

- 1 Lan Sommerville, Software Engineering, Pearson Education, India , Tenth Edition, 2017.
- 2 Roger Pressman, Software Engineering: A Practitioner's Approach, McGraw Publications , India , Seventh Edition ,2017

**Reference Books :**

- 1 Jalote P,An Integrated Approach to Software Engineering, Narosa Publishers, New Delhi, Third Edition, 2015.
- 2 Mark Richards and Neal Ford, Fundamentals of Software Architecture: An Engineering Approach, O'Relly, First Edition, 2020.
- 3 Rajib Mall, Fundamentals of Software Engineering, PHI Learning, India ,Fifth Edition,2018.
- 4 <https://nptel.ac.in/courses/106105087>

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF INFORMATION TECHNOLOGY**  
**CO-PO MAPPING**

Regulation: R 2020

Course Code: 20IT910

Course Name: PRINCIPLES OF SOFTWARE  
ENGINEERING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Explain the software engineering process and its various models</i>	3	2	3	-		-	-	-		-	-	3	-	-
CO2	<i>Summarize how requirements may be organized in software requirements document</i>	3	2	3	-		-	-	-		-	-	3	-	-
CO3	<i>Illustrate the architectural design decisions and apply real time systems.</i>	3	2	3	-		-	-	-		-	-	3	-	-
CO4	<i>Outline the methods rely on documented specifications and Design.</i>	3	2	3	-		-	-	-		-	-	3	-	-
CO5	<i>Discuss the process involved in verification and validation.</i>	3	2	3	-		-	-	-		-	-	3	-	-
<b>Average</b>		3	2	3	-		-	-	-		-	-	3	-	-

1: Slight (Low)    2: Moderate (Medium)    3: Substantial (High)

OPEN ELECTIVE

20ME901

BASIC MECHANICAL ENGINEERING

L	T	P	C
3	0	0	3

**Prerequisite:****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1: Explore the fundamental knowledge on basics of mechanical engineering

Understand

CO2: Demonstrate the concepts of manufacturing technology.

Understand

CO3: Describe the knowledge of power plants and pumps.

Understand

CO4: Interpret the basic concepts of IC Engines.

Understand

CO5: Analyze the Refrigeration and air conditioning systems

Analyze

**UNIT - I FUNDAMENTALS****[ 09 ]**

Introduction to mechanical engineering, concepts of thermal engineering, mechanical machine design, industrial engineering, and manufacturing technology.

**UNIT - II MANUFACTURING TECHNOLOGY****[ 09 ]**

Manufacturing, classification, lathe, drilling machines, milling machines, metal joining, metal forming, casting, forging, and introduction to powder metallurgy.

**UNIT - III POWER PLANT ENGINEERING****[ 09 ]**

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

**UNIT - IV I C ENGINES****[ 09 ]**

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines.

**UNIT - V REFRIGERATION AND AIR CONDITIONING SYSTEM****[ 09 ]**

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system–Layout of typical domestic refrigerator–Window and Split type room Air condition.

**Total (L= 45, T = 0 ) = 45 Periods****Text Books :**

- 1 Shantha Kumar S R J., Basic Mechanical Engineering, Hi-tech Publications, Mayiladuthurai, Second Edition, 2000.
- 2 Venugopal K and Prahu Raja V, Basic Mechanical Engineering, Anuradha Publishers, Kumbakonam , Fourth Edition 2000.

**Reference Books :**

- 1 Lecture notes prepared by Department of Mechanical Engineering, NITT, 2020.
- 2 R. K. Rajput, Manufacturing Processes, University Science Press, New Delhi, Fourth Edition, 2020.
- 3 Hajra Choudry, S. K., Elements of Work Shop Technology – Vol. I, Media Promoters, New Delhi, Fourth Edition, 2010.
- 4 Ramesh Babu, Basic civil and Mechanical Engineering, VRB Publishers, Chennai, Fourth Edition, 2017.

**K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**CO PO MAPPING**

Regulation : R2020

Course Code : 20ME901

Course Name : BASIC MECHANICAL ENGINEERING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explore the fundamental knowledge on basics of mechanical engineering	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO2	Demonstrate the concepts of manufacturing technology	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO3	Describe the knowledge of power plants and pumps.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO4	Interpret the basic concepts of IC Engines.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO5	Analyze the Refrigeration and air conditioning systems	3	3	3	-	-	2	-	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	-	-	<b>2</b>	-	-	-	-	-	-	-	-

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

OPEN ELECTIVE

20ME902

SOLAR ENERGY UTILIZATION

L	T	P	C
3	0	0	3

**Prerequisite:****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1:	Explore the measurement of solar radiation and their application to various systems.	Understand
CO2:	Illustrate the principles of non-concentrating collectors and apply the principles in various real time applications.	Apply
CO3:	Describe the concept of concentrating collectors and their application to a wide range of systems.	Apply
CO4:	Analyze the various material characteristics of solar cell and determine maximum efficiency of solar cells.	Analyze
CO5:	Demonstrate the solar storage equipment and evaluate the economic analysis of various solar equipment.	Understand

**UNIT - I INTRODUCTION TO SOLAR ENERGY [ 09 ]**

Introduction - Sun-Earth relationships- solar constant- solar radiation at the earth surface- depletion of solar radiation- measurement of solar radiation- solar radiation data- solar time- solar radiation geometry- solar radiation on tilted surfaces- Sun as the source of energy sun angles - overview of applications.

**UNIT - II NON CONCENTRATING COLLECTORS [ 09 ]**

Types and classification of solar collectors - terminology related to flat plate collectors - evacuated collectors-Heat transfer processes and efficiency of a solar collector -solar drying- solar desalination- solar mechanical cooling- solar desiccant cooling- detailed study on heat pump – it needed.

**UNIT - III CONCENTRATING COLLECTORS [ 09 ]**

Tracking systems - compound parabolic concentrators - parabolic trough concentrators - concentrators with point focus - Heliostats- comparison of various designs - central receiver systems - parabolic trough systems - solar performance analysis - solar power plant - solar furnace.

**UNIT - IV SOLAR PHOTOVOLTAIC [ 09 ]**

Fundamentals of solar cells- - types of solar cell- P-N junction photodiode- description and principle of working of a solar cell- cell structure- solar module and panel- I-V characteristics of a PV module- maximum power point- cell efficiency- fill factor- Manufacturing of solar cell.

**UNIT - V SOLAR ENERGY STORAGE AND ECONOMIC ANALYSIS [ 09 ]**

Storage of solar energy - thermal storage-sensible and latent heat storage-Economic Analysis: Initial and annual costs-definition of economic terms for a solar system- present worth calculation-repayment of loan in equal annual installments- annual savings- cumulative savings and life cycle savings- payback period- clean development mechanism -solar vehicle -BIPV(Building Integrated photo voltaic ) - house hold appliances.

**Total (L= 45, T = 0 ) = 45 Periods****Text Books :**

- 1 Garg H P and Prakash J, Solar Energy: Fundamentals & Applications, McGraw Hill, New Delhi, First Revised Edition 2014 .
- 2 Duffie.J.A and Beckman W.A, Solar Engineering of Thermal processes, John Wiley And Sons, New York, Fourth Edition,2013 .

**Reference Books :**

- 1 Sukhatme. K and Sukhatme S.P., Solar Energy principles of thermal collection and storage, Tata McGraw Hill education, New Delhi, Third Edition,2008.
- 2 Rai G.D., Solar energy Utilization, Khanna Publishers, New Delhi, Fifth Edition, 2020.
- 3 Bhattachariya.T , Terrestrial Solar Photovoltaic, Narosa Publishers, New Delhi, Fourth Edition,2008.
- 4 Sukhatme S.P., Solar Energy, Tata McGraw Hills P Co., Third Edition, 2008.

**K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**CO PO MAPPING**

Regulation : R2020

Course Code : 20ME902

Course Name : SOLAR ENERGY UTILIZATION

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Evaluate the measurement of solar radiation and their application to various systems.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO2	Illustrate the principles of non-concentrating collectors and apply the principles in various real time applications.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO3	Describe the concept of concentrating collectors and their application to a wide range of systems.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO4	Analyze the various material characteristics of solar cell and determine maximum efficiency of solar cells.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO5	Demonstrate the solar storage equipment and evaluate the economic analysis of various solar equipment.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

OPEN ELECTIVE

20ME903

PRODUCTION TECHNOLOGY OF AGRICULTURAL MACHINERY

L	T	P	C
3	0	0	3

**Prerequisite:****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1: Acquire various engineering materials, classifications, compositions and properties	Understand
CO2: Explore the concept and basic mechanics of metal cutting, working of standard machine tools and allied machines.	Understand
CO3: Apply the manufacturing process in welding for component production.	Apply
CO4: Demonstrate various advanced manufacturing process in engineering field.	Understand
CO5: Describe the basic concepts of Computer Numerical Control (CNC) machine tool and CNC programming.	Understand

**UNIT – I ENGINEERING MATERIALS [ 09 ]**

Engineering materials - their classification - Mechanical properties of materials, strength, elasticity, plasticity, stiffness, malleability, ductility, brittleness, toughness, hardness, resilience, machinability, formability, weldability. Steels and cast irons: Carbon steels, their classification based on percentage of carbon as low, mild, medium & high carbon steel, their properties & applications. Wrought iron, cast iron. Alloy steels: Stainless steel, tool steel.

**UNIT - II MACHINING [ 09 ]**

Basic principles of lathe - machine and operations performed on it. Basic description of machines and operations of Shaper-Planner, Drilling, Milling & Grinding.

**UNIT - III WELDING [ 09 ]**

Introduction, classification of welding processes. Gas welding, types of flames and their applications. Electric Arc welding. Resistance welding, Soldering & Brazing processes and their uses.

**UNIT - IV ADVANCED MANUFACTURING PROCESS [ 09 ]**

Abrasive flow machining - abrasive jet machining - water jet machining - Electro Discharge Machining (EDM) - Wire cut EDM - Electro Chemical Machining (ECM) - Ultrasonic Machining / Drilling (USM / USD) - Electron Beam Machining (EBM) - Laser Beam Machining (LBM).

**UNIT - V CNC MACHINE [ 09 ]**

Numerical control (NC) machine tools - CNC: types, constitutional details, special features – design considerations of CNC machines for improving machining accuracy - structural members – slide ways - linear bearings - ball screws - spindle drives and feed drives. Part programming fundamentals - manual programming.

**Total (L= 45, T = 0) = 45 Periods****Text Books :**

- 1 Kalpakjian and Schmid ,Manufacturing Engineering and Technology, Pearson, New Delhi, Eighth Edition, 2016.
- 2 Hajra Choudry, Elements of workshop technology - Vol II, Media promoters, New Delhi ,Fourth Edition,2018

**Reference Books :**

- 1 Gupta. K.N., and Kaushik, J.P., Workshop Technology Vol I and II, New Heights, Daryaganj, New Delhi, Second Edition, 1998,.
- 2 Arthur. D., et. al., General Engineering Workshop Practice, Asia Publishing House, Bombay, Third Edition,2001.
- 3 Chapman W.A.J., Workshop Technology, Part I, II, III, E.L.B.S. and Edward Arnold Publishers Ltd, London, First Edition,1992.
- 4 Dr. P. Kamaraj, Dr. V. R. Ramachandran, Production Technology of Agricultural Machinery, Kerela, First Edition,2020.

**K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**CO PO MAPPING**

Regulation : R2020

Course Code : 20ME903

Course Name : PRODUCTION TECHNOLOGY OF AGRICULTURAL MACHINERY

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Acquire various engineering materials, classifications, compositions and properties	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO2	Explore the concept and basic mechanics of metal cutting, working of standard machine tools and allied machines.	3	3	3	-	-	2	-	-	-	-	-	-	-	
CO3	Apply the manufacturing process in welding for component production.	3	3	3	-	-	2	-	-	-	-	-	-	-	
CO4	Demonstrate various advanced manufacturing process in engineering field.	3	3	3	-	-	2	-	-	-	-	-	-	-	
CO5	Describe the basic concepts of Computer Numerical Control (CNC) machine tool and CNC programming.	3	3	3	-	-	2	-	-	-	-	-	-	-	
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



OPEN ELECTIVE

20ME904

## SELECTION OF MATERIALS

L	T	P	C
3	0	0	3

**Prerequisite:****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1: Explore the classification and properties of engineering materials	Understand
CO2: Acquire the knowledge on mechanical properties of various metal alloys.	Understand
CO3: Identify different types of availability materials.	Analyze
CO4: Examine required materials for engineering applications.	Analyze
CO5: Select suitable material for various applications	Evaluate

**UNIT - I ENGINEERING MATERIALS [ 09 ]**

Introduction – classification of engineering materials – selection of materials for engineering purposes –selection of materials and shape –classification metal and alloys, polymers, ceramics and glasses, composites, natural materials,- nonmetallic materials- smart materials - physical, metrical properties of metals.

**UNIT - II MATERIAL PROPERTIES [ 09 ]**

Mechanical properties – fatigue strength – fracture Toughness - Thermal Properties - Magnetic Properties - Fabrication Properties –electrical , optical properties - Environmental Properties , Corrosion properties –shape and size - Material Cost and Availability– failure analysis.

**UNIT - III MANUFACTURING PROCESSING AND ECONOMIC ANALYSIS [ 09 ]**

Interaction of Materials Selection, Design, and Manufacturing Processes - Production Processes and Equipment for Metals - Metal Forming, Shaping, and Casting - Plastic Parts Processing - Composites Fabrication Processes - Advanced Ceramics Processing – surface treatment - Resource -The Price and Availability of Materials.

**UNIT - IV MATERIALS SELECTION CHARTS AND TESTING [ 09 ]**

Ashby material selection charts-Testing of Metallic Materials - Plastics Testing - Characterization and Identification of Plastics - Professional and Testing Organizations - Ceramics Testing - Nondestructive Inspection.

**UNIT - V APPLICATIONS AND USES [ 09 ]**

Selection of Materials for Biomedical Applications - Medical Products - Materials in Electronic Packaging - Advanced Materials in Sports Equipment - Materials Selection for Wear Resistance - Advanced Materials in Telecommunications - Using Composites - Manufacture and Assembly with Plastics, fiber and Diamond Films.

**Total (L= 45, T = 0) = 45 Periods****Text Books :**

- 1 Ashby, M. F. , Materials selection in mechanical design, Elsevier, New Delhi, Third Edition, 2005.
- 2 Ashby, M. F. and Johnson, K. Materials and design – the art and science of material selection in product design. Elsevier, New Delhi, First Edition, 2002.

**Reference Books :**

- 1 Charles, J. A., Crane, F. A. A. and Furness, J. A. G. ,Selection and use of engineering materials, Butterworth-Heinemann, New Delhi, Third Edition, 1997.
- 2 Handbook of Materials Selection. Edited by Myer Kutz John Wiley & Sons, Inc., New York, Second Edition, 2002.
- 3 Fisher P.E., Selection of Engineering Materials and Adhesives ,CRC Press, US, First Edition,2020
- 4 Joseph Datsko ,Materials Selection for Design and Manufacturing theory and practice, CRC Press, US, First edition,2020.

**K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**CO PO MAPPING**

Regulation : R2020

Course Code : 20ME904

Course Name : SELECTION OF MATERIALS

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explore the classification and properties of engineering materials	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO2	Acquire knowledge on mechanical properties of various metal alloys.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO3	Identify different types of availability materials.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO4	Examine required materials for engineering applications.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO5	Select suitable material for various applications	3	3	3	-	-	1	-	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	-	-	1	-	-	-	-	-	-	-	-

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

OPEN ELECTIVE

20ME905

MARINE VEHICLES

L	T	P	C
3	0	0	3

**Prerequisite:****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1: Explore the various types of marine vehicles and its applications	Understand
CO2: Acquire marine vehicle Safety, Operations and controls of bunkering.	Understand
CO3: Demonstrate remotely operable vehicle design, construction and its components.	Apply
CO4: Analyze submersible and autonomous under water vehicles.	Analyze
CO5: Design and operational consideration of manned and un manned submersible.	Create

**UNIT - I MARINE VEHICLES [ 09 ]**

Types – general – by function – commercial marine vehicles- passenger ship, cargo ships, oil and chemical tankers , cattle carriers, harbor crafts, off shore platform, container ships.

**UNIT - II REEFERS AND GAS CARRIERS [ 09 ]**

.Introduction – Types , design considerations, safety – operation and controls, precaution during bunkering.

**UNIT - III REMOTELY OPERABLE VEHICLE (ROV), UMS SHIPS [ 09 ]**

Remotely Operable Vehicles (ROV) – The ROV business – Design theory and standards – control and simulation – design and stability – components of ROV – applications, UMS operation, and controls.

**UNIT - IV SUBMERSIBLES AND AUTONOMOUS UNDERWATER VEHICLE (AUV) [ 09 ]**

submersibles types – applications, AUV – Design and construction considerations – components – sensors – Navigation - control strategies – applications.

**UNIT - V MANNED AND UN MANNED SUBMERSIBLE [ 09 ]**

Introduction – Design and operational consideration – pressure hull exo-structure – ballasting and trim – maneuvering and control – Life support and habitability – emergency devices and equipment's – certification and classification, towed vehicles – gliders – crawler – Design and construction.

**Total (L= 45, T = 0 ) = 45 Periods****Text Books :**

- Jonathan M. Ross, human factors for naval marine vehicle design and operation, CRC Press, US, Second Edition, 2001.
- Sabiha A. Wadoo, Pushkin Kachroo, Autonomous underwater vehicles, modeling, control design and Simulation, CRC press,US, Second Edition, 2011.

**Reference Books :**

- Ferial L hawry, The ocean engineering handbook, CRC press, US, First Edition, 2000.
- Richard A Geyer, Submersibles and their use in oceanography and ocean engineering, Elsevier, New Delhi, First Edition, 1997.
- Robert D. Christ,Robert L. Wernli, Sr., The ROV Manual A User Guide for Remotely Operated Vehicles, Elsevier, New Delhi, second edition, 2014.
- Frank Busby. R, Manned Submersibles, Office of the oceanographer of the Navy, United states, First Edition, 1976.

**K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**CO PO MAPPING**

Regulation : R2020

Course Code : 20ME905

Course Name : MARINE VEHICLES

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explore the various types of marine vehicles and its applications	3	3	3	-	-	2	-	-	1	-	-	-	-	-
CO2	Acquire Safety, Operations and controls of bunkering.	3	3	3	-	-	2	-	-	1	-	-	-	-	-
CO3	Demonstrate remotely operable vehicle design, construction and its components.	3	3	3	-	-	2	-	-	1	-	-	-	-	-
CO4	Analyze submersible and autonomous under water vehicles.	3	3	3	-	-	2	-	-	1	-	-	-	-	-
CO5	Design and operational consideration of manned and un manned submersible.	3	3	3	-	-	2	-	-	1	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

OPEN ELECTIVE

20ME906

SENSORS AND TRANSDUCER

L	T	P	C
3	0	0	3

**Prerequisite:****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1: Explore the basic concepts of various sensors and transducers.	Understand
CO2: Develop knowledge in mechanical and electromechanical sensor.	Apply
CO3: Differentiate the types of thermal sensor which are used in various applications.	Apply
CO4: Identify various types of magnetic sensors and working principles	Analyze
CO5: Acquire suitable sensors and its applications.	Understand

**UNIT - I INTRODUCTION [ 09 ]**

Definition, classification, static and dynamic parameters, Characterization - Electrical, mechanical, thermal and chemical. Classification of errors - Error analysis, Static and dynamic characteristics of transducers.

**UNIT - II MECHANICAL AND ELECTROMECHANICAL SENSORS [ 09 ]**

Resistive Potentiometer - strain gauge - Inductive sensors and transducer - capacitive sensors – ultrasonic sensors.

**UNIT - III THERMAL SENSOR [ 09 ]**

Gas thermometric sensors - acoustic temperature sensors - magnetic thermometer, resistance change -type thermometric sensors.

**UNIT - IV MAGNETIC SENSOR [ 09 ]**

Force and displacement measurement - Magneto resistive sensors - Hall Effect sensor, Inductance and eddy current sensors - Angular/rotary movement transducer - Electromagnetic flow meter, squid sensor.

**UNIT - V SENSORS AND THEIR APPLICATIONS [ 09 ]**

Automobile sensor - Home appliance sensor - Aerospace sensors - sensors for manufacturing medical diagnostic sensors - environmental monitoring.

**Total (L= 45, T = 0 ) = 45 Periods****Text Books :**

- 1 Ernest O Doebelin, Measurement Systems – Applications and Design, Tata McGraw-Hill, New Delhi, Fourth edition, 2016.
- 2 Sawney A K and PuneetSawney, A Course in Mechanical Measurements and Instrumentation and Control, DhanpatRai and Co, New Delhi, Fourteenth edition, 2016.

**Reference Books :**

- 1 Patranabis D, Sensors and Transducers, PHI, New Delhi, Sixth Edition, 2015.
- 2 Richard Zurawski, Industrial Communication Technology Handbook, CRC Press, US, Second edition, 2015.

**E-Resources :**

- 1 <https://nptel.ac.in/courses/108/108/108108147/>
- 2 <https://www.youtube.com/watch?v=1uPTyjxZzyo>

**K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**CO PO MAPPING**

Regulation : R2020

Course Code : 20ME906

Course Name : SENSORS AND TRANSDUCER

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explore the basic concepts of various sensors and transducers.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO2	Develop knowledge in mechanical and electromechanical sensor.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO3	Differentiate the types of thermal sensor which are used in various applications.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO4	Identify various types of magnetic sensors and working principles	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO5	Acquire suitable sensors and its applications.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	-	-	1	-	-	-	-	-	-	-	-

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

OPEN ELECTIVE

20ME907

ENERGY AUDITING

L	T	P	C
3	0	0	3

**Prerequisite:****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1: Describe the energy crisis & environmental concerns associated with the energy management and the importance of energy auditing.	Understand
CO2: Identify the tools, techniques, management practices for the audit and management of electrical energy.	Understand
CO3: Recognize the techniques of energy analysis and the associated energy efficient technologies for the routinely used thermal energy systems.	Apply
CO4: State about the typical electrical energy powered utilities, services of industrial facilities & organizations and be able to identify the opportunities and options for the conservation & management of electrical energy.	Understand
CO5: Interpret the basic economic concepts of underlay energy production and end use.	Evaluate

**UNIT - I INTRODUCTION****[ 09 ]**

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.

**UNIT - II ELECTRICAL SYSTEMS****[ 09 ]**

Components of EB billing – HT and LT supply, Transformers, Cable sizing, Concept of capacitors, Power factor improvement, Harmonics, Electric motors – Motors efficiency computation, Energy efficient motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED lighting and scope of economics in illumination – Auditing in electrical systems.

**UNIT - III THERMAL SYSTEMS****[ 09 ]**

Stoichiometry, Boilers, Furnaces and Thermal fluid heaters – Efficiency computation and economic measures. Steam: Distribution & usage, Steam traps, Condensate recovery, Flash steam utilization, Insulators & Refractories – Auditing in thermal systems.

**UNIT - IV ENERGY CONSERVATION IN MAJOR UTILITIES****[ 09 ]**

Pumps, Fans, Blowers, Compressed air systems, Refrigeration and Air Conditioning systems – Cooling towers – D.G. sets - Auditing and energy conservation.

**UNIT - V ECONOMICS****[ 09 ]**

Energy economics – Discount rate, Payback period, Internal rate of return, Net present value, Life cycle costing – ESCO concept – Auditing and Economics.

**Total (L= 45, T = 0) = 45 Periods****Text Books :**

- 1 Energy manager training manual (4 Volumes) available at [www.energymanagertraining.com](http://www.energymanagertraining.com), a website administered by Bureau of energy efficiency (BEE), a statutory body under ministry of power, Government Of India, 2004.
- 2 Abbi, Y.B., Energy Audit, Open University, The Energy and Resources Institute, Government Of India, 2012.

**Reference Books :**

- 1 Witte. L.C., P. S. Schmidt, D.R. Brown, Industrial Energy Management and Utilization, Hemisphere Pub, Washington, First Edition, 1988.
- 2 Sonal Desai, Handbook of Energy Audit, Tata McGraw Hill, New Delhi, Second Edition, 2015.
- 3 Dryden. I.G.C., The Efficient Use Of Energy, Butterworth's, London, Fourth Edition, 2013.
- 4 Turner W.C., Energy Management Handbook, Wiley, New York, Eighth Edition, 2014.

**K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**CO PO MAPPING**

Regulation : R2020

Course Code : 20ME907

Course Name : ENERGY AUDITING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Describe the energy crisis & environmental concerns associated with the energy management and the importance of energy auditing.	3	3	3	-	2	2	-	-	1	-	-	-	-	-
CO2	Identify the tools and techniques, and the management practices for the audit and management of electrical energy.	3	3	3	-	2	2	-	-	1	-	-	-	-	-
CO3	Recognize the techniques of energy analysis and the associated energy efficient technologies for the routinely used thermal energy systems.	3	3	3	-	2	2	-	-	1	-	-	-	-	-
CO4	State about the typical electrical energy powered utilities, services of industrial facilities & organizations and be able to identify the opportunities and options for the conservation & management of electrical energy.	3	3	3	-	2	2	-	-	1	-	-	-	-	-
CO5	Interpret the basic economic concepts of underlay energy production and end use.	3	3	3	-	2	2	-	-	1	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



OPEN ELECTIVE

20ME908

FIBRE REINFORCED PLASTICS

L	T	P	C
3	0	0	3

**Prerequisite:****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1: Select various materials for designing composite structures.	Understand
CO2: Apply knowledge of fracture mechanics of composites during designing of composite structures.	Apply
CO3: Analyze critically damping capacity of composite materials.	Analyze
CO4: Correlate various manufacturing/fabricating techniques for composite structures based on design.	Analyze
CO5: Explore various composite applications.	Understand

**UNIT - I INTRODUCTION [ 09 ]**

Definition, Reason for composites, Classifications of composites, Thermosets - Epoxy; Unsaturated polyester resin; vinyl ester, polyimides etc.,-preparation, properties, and uses.

**UNIT - II REINFORCEMENTS [ 09 ]**

Types, Properties, chemistry and applications of fillers such as silica, titanium oxide, talc, mica etc., Manufacturing process, Properties, structure and uses of Glass fiber -.Carbon, Aramid, Boron, jute, sisal, cotton.

**UNIT - III FABRICATIONS OF THERMOSET COMPOSITES [ 09 ]**

Hand layup method, compression and transfer moulding, pressure and vacuum bag process, filament winding, protrusion, reinforced RIM, Injection moulding, of thermosets, SMC and DMC, Advantages and disadvantages of each method.

**UNIT - IV TESTING OF COMPOSITES [ 09 ]**

Destructive and non-destructive tests; Destructive-tensile, compression, flexural, impact strength, Hardness–Fatigue-toughness HDT ,basic concepts of fracture mechanisms.

**UNIT - V APPLICATIONS OF COMPOSITES [ 09 ]**

Aerospace, land transport, marine, structural, chemical plants and corrosion resistant products and energy applications sports, electrical, electronic and communication applications.

**Total (L= 45, T = 0 ) = 45 Periods****Text Books :**

- 1 Chawla, K.K, Composite Material s, Springer Science in progress, USA, Sixth Edition, 2019.
- 2 Balasubramaniam, Composite Materials, John Wiley & Sons, Indian Ed., New York, Fourth Edition, 2016.

**Reference Books :**

- 1 Sharma S.C., Composite materials, Narosa Publications, NewDelhi, Third Edition, 2015.
- 2 Isaac M. Daniel and Ori Ishai, Engineering Mechanics of Composite Materials, Oxford University Press, UK, Second Edition, 2017.

**E-RESOURCES**

- 1 <https://nptel.ac.in/courses/112/105/112105232/>
- 2 <https://nptel.ac.in/courses/112/107/112107142/>

**K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**CO PO MAPPING**

Regulation : R2020

Course Code : 20ME908

Course Name : FIBRE REINFORCED PLASTICS

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Select various materials for designing composite structures.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO2	Apply knowledge of fracture mechanics of composites during designing of composite structures.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO3	Analyze critically damping capacity of composite materials.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO4	Correlate various manufacturing / fabricating techniques for composite structures based on design.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO5	Explore various composite applications.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	-	-	1	-	-	-	-	-	-	-	-

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

OPEN ELECTIVE

20ME909

LEAN MANUFACTURING

L	T	P	C
3	0	0	3

**Prerequisite:****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1: Demonstrate the lean manufacturing principles to find and eliminate wastes.

Understand

CO2: Identify the lean manufacturing tools and their potential applications.

Understand

CO3: Summarize the usage of visual management, TPM and lean practices.

Apply

CO4: Acquire the technology drivers of lean manufacturing.

Understand

CO5: Describe technology drivers of lean manufacturing.

Analyze

**UNIT - I LEAN MANUFACTURING PRINCIPLES [ 09 ]**

Lean manufacturing paradigms - lean manufacturing - origin - Toyota Production System - types of wastes -tools and techniques to eliminate wastes - value stream mapping (VSM) - primary icons - secondary icons - developing the VSM.

**UNIT - II LEAN MANUFACTURING TOOLS [ 09 ]**

5S concepts - stages of 5S and waste elimination - Kaizen - steps of Kaizen - lean manufacturing through Kaizen – Single Minute Exchange of Die - theory of SMED - design for SMED - strategic SMED and waste elimination - pull production through Kanban - one piece flow production.

**UNIT - III VISUAL MANAGEMENT, TPM AND LEAN IMPLEMENTATION [ 09 ]**

Visual management - tools for eliminating wastes - overproduction, inventory, delay, transportation, processing, unnecessary motion, defective parts, underutilization of people - implementation - total productive maintenance - implementation of lean practices.

**UNIT - IV MANAGEMENT AND TECHNOLOGY DRIVERS OF LEAN MANUFACTURING [ 09 ]**

Lean manufacturing - twenty criteria model - management driver - organizational structure - devolution of authority - employee status and involvement - nature of management - business and technical processes - time management - agility through technology driver.

**UNIT - V MANUFACTURING STRATEGY AND COMPETITIVE DRIVERS OF LEAN MANUFACTURING [ 09 ]**

Quick manufacturing setups - quick response - product life cycle management - product service elimination - automation - competitive driver - status of quality and productivity - compatible cost accounting system.

**Total (L= 45, T = 0 ) = 45 Periods****Text Books :**

- 1 Devadasan.S.R, Mohan Sivakumar.V, Muruges.R and Shalij.P.R, Lean Manufacturing: Theoretical, Practical and Research Futurities, PHI Learning Private Limited, New Delhi, Second Edition, 2012.
- 2 Pascal Dennis, Lean Production Simplified, Productivity Press, New York, Third Edition, 2007.

**Reference Books :**

- 1 Bill Carreira, Lean Manufacturing That Works, PHI Learning Private Limited, New Delhi, Third Edition, 2016.
- 2 Dennis P. Hobbs, LEAN Manufacturing Implementation, Cengage Learning, New Delhi, Fifth Edition, 2015.

**E-RESOURCES**

- 1 <https://nptel.ac.in/courses/112/104/112104188/> - (Lean Manufacturing System Technology)
- 2 <https://freevideolectures.com/course/4162/nptel> - (Toyota Production system)

**K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**CO PO MAPPING**

Regulation : R2020

Course Code : 20ME909

Course Name : LEAN MANUFACTURING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Demonstrate the lean manufacturing principles to find and eliminate wastes .	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO2	Identify the lean manufacturing tools and their potential applications.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO3	Summarize the usage of visual management, TPM and lean practices.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO4	Acquire the technology drivers of lean manufacturing.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO5	Describe technology drivers of lean manufacturing.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	-	-	2	-	-	-	-	-	-	-	-

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

OPEN ELECTIVE

20ME910

SURFACE ENGINEERING

L	T	P	C
3	0	0	3

**Prerequisite:****Course Outcomes : On successful completion of the course, the student will be able to****Cognitive Level**

CO1: Demonstrate the various factors influencing wear in materials

Understand

CO2: Identify wear resistance techniques in engineering materials

Apply

CO3: Acquire various surface treatment methods for alloy metals

Understand

CO4: Describe various surface treatment techniques and its applications

Analyze

CO5: Explore the corrosion behaviour of engineering materials

Understand

**UNIT - I WEAR [ 09 ]**

Introduction tribology, surface degradation, wear and corrosion, types of wear, roles of friction and lubrication- overview of different forms of corrosion, introduction to surface engineering, importance of substrate

**UNIT - II COATING [ 09 ]**

Chemical and electrochemical polishing, significance, specific examples, chemical conversion coatings, phosphating, chromating, chemical colouring, anodizing of aluminium alloys, thermochemical processes -industrial practices

**UNIT - III SURFACE TREATMENT [ 09 ]**

Surface pre-treatment, deposition of copper, zinc, nickel and chromium - principles and practices, alloy plating, electrocomposite plating, electroless plating of copper, nickel-phosphorous, nickel-boron; electroless composite plating; application areas, properties, test standards (ASTM) for assessment of quality deposits

**UNIT - IV SURFACE TREATMENT TECHNIQUES [ 09 ]**

Definitions and concepts, physical vapour deposition (PVD), evaporation, sputtering, ion plating, plasma nitriding, process capabilities, chemical vapour deposition (CVD), metal organic CVD, plasma assisted CVD, specific industrial applications

**UNIT - V SPRAYING [ 09 ]**

Thermal spraying, techniques, advanced spraying techniques - plasma surfacing, D-Gun and high velocity oxy-fuel processes, laser surface alloying and cladding, specific industrial applications, tests for assessment of wear and corrosion behaviour

**Total (L= 45, T = 0 ) = 45 Periods****Text Books :**

- 1 Stachowiak, G.W & Batchelor A.W, Engineering Tribology, Butterworth-Heinemann, UK, First Edition, 2005.
- 2 Rabinowicz.E, Friction and Wear of materials, John Wiley &Sona ,New York, Second Edition,1995.

**Reference Books :**

- 1 Sudarshan T S, Surface modification technologies - An Engineer's guide, Marcel Dekker, Newyork, First Edition,1989.
- 2 Varghese C.D, Electroplating and Other Surface Treatments - A Practical Guide, TMH, New Delhi, First Edition,1993.
- 3 Williama. J.A, Engineering Tribology, Oxford univ. Press, UK, Second Edition,1994.
- 4 Basu S.K,. Sengupta S.N &Ahuja B.P, Fundamentals of Tribology, Prentice-Hall of India Pvt. Ltd, New Delhi, Second Edition,2005.

**K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**CO PO MAPPING**

Regulation : R2020

Course Code : 20ME910

Course Name : SURFACE ENGINEERING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Demonstrate the lean manufacturing principles to find and eliminate wastes.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	Identify the lean manufacturing tools and their potential applications.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	Acquire various surface treatment methods for alloy metals	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	Describe various surface treatment techniques and its applications	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	Explore the corrosion behavior of engineering materials	3	3	3	-	-	-	-	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	-	-	-	-	-	-	-	-	-	-

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20SF901

**OCCUPATIONAL HEALTH AND HYGIENE  
(Open Elective)**

L	T	P	C
3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes: On successful completion of the course, the student will be able to**

**Cognitive Level**

CO1	Compare the concept and spectrum of health functional units and activities of occupational health service.	Understand
CO2	Identify physical chemical and biological hazards in the work environment and its control measures.	Apply
CO3	Explain the principles of ventilation and its requirements.	Understand
CO4	Demonstrate about the lighting and its requirements.	Understand
CO5	Reduce the gas poisoning and its effects.	Apply

**UNIT - I OCCUPATIONAL HEALTH [09]**

Concept and spectrum of health - functional units and activities of occupational health services - occupational and work-related disease - Levels of prevention of diseases - notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, siderosis, anthracosis, aluminosis and anthrax.

**UNIT - II VIBRATION [09]**

Recognition, evaluation and control of physical hazards. Vibration - Description and measurement of vibration. Vibration control methods. Effects of whole-body vibration on human body and control measures - Noise - noise measurement, evaluation, noise control methods - hearing loss - causes - Biological effects of noise exposure.

**UNIT - III VENTILATION [09]**

Ventilation systems - Purpose of ventilation - General principles ventilation requirements. Physiological and comfort level. Natural ventilation - Dilution ventilation - Mechanical ventilation - Local exhaust ventilation - Ventilation measuring instruments. Fundamentals of hood and duct designs. Standards on ventilation.

**UNIT - IV LIGHTING [09]**

Purpose of lighting - Advantages of good illumination - Lighting and the work - Sources and kinds of artificial lighting principles of good illumination. Design of Lighting installation - Maintenance - Lighting and Color Standards on lighting and illuminations.

**UNIT - V GAS POISONING [09]**

Lead - Nickel, Chromium and Manganese toxicity - Gas poisoning (such as CO, ammonia, coal and dust) their effects and prevention - Local and systemic and chronic effects - Carcinogens, Mutagens, Teratogens. Personal monitoring devices - Medical support.

**Total = 45 Periods****Text Books:**

1. Jeanne Mager Stellman(ed) Encyclopedia of Occupational Health and Safety, International Labour Office, Geneva, Fourth Edition, 1998.
2. The Industrial Environment -Its Evaluation and Control, DHHS (NIOSH),1973.

**Reference Books:**

1. Barbara Cohrsen, Patty's Industrial Hygiene and Toxicology, Wiley, Inder science, NewYork. Seventh Edition, 2021.
2. Yudenich, V.V., Accident First Aid, Mir Publishers, Moscow, 1986.
3. Cantlie, James., First aid to the injured. St John Ambulance Association, 1932.
4. S.K. Halder, Industrial and Occupational Health, Kindle Edition, 2017.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF SAFETY AND FIRE ENGINEERING**  
**CO PO MAPPING**

Regulation: R2020

Course Code: 20SF901

Course Name: Occupational Health and Hygiene

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Compare the concept and spectrum of health functional units and activities of occupational health service.</i>	3	2	2	-	-	3	2	2	-	-	-	2	-	-
CO2	<i>Identify physical chemical and biological hazards in the work environment and its control measures.</i>	3	2	2	-	-	3	2	2	-	-	-	2	-	-
CO3	<i>Explain the principles of ventilation and its requirements.</i>	3	2	2	-	-	3	2	2	-	-	-	2	-	-
CO4	<i>Demonstrate about the lighting and its requirements.</i>	3	2	2	-	-	3	2	2	-	-	-	2	-	-
CO5	<i>Reduce the gas poisoning and its effects.</i>	3	2	2	-	-	3	2	2	-	-	-	2	-	-
<b>Average</b>		<b>3</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



**K.S.R. COLLEGE OF ENGINEERING (Autonomous)**

**R 2020**

**20SF902**

**CONSTRUCTION SAFETY  
(Open Elective)**

L	T	P	C
3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes: On successful completion of the course, the student will be able to**

**Cognitive Level**

- |     |   |            |
|-----|---|------------|
| CO1 | List out Hazards from various Construction equipment and activities.  | Remember   |
| CO2 | Mention various Control measures adopted in each Construction activity to avoid Incidents.                                  | Apply      |
| CO3 | Demonstrate the safe use of various types of ladders, Hand held power tools, Hydraulic tools used in Construction industry. | Understand |
| CO4 | Compare various components of cranes, safety features and its function.   | Understand |
| CO5 | Choose the minimum requirements of BOCW act to the Construction site when they work.  | Apply      |

**UNIT - I INTRODUCTION [09]**

Safety aspects of construction planning- Human factors in construction safety management. Roles of various groups in ensuring safety in construction industry.

**UNIT - II SAFETY IN VARIOUS CONSTRUCTION OPERATIONS [09]**

Excavation- underwater works- Ladders & Scaffolds - Tunneling- Blasting- Demolition- Pneumatic caissons- Confined Space- Temporary Structures. Indian Standards on construction safety- National Building Code Provisions on construction safety.

**UNIT - III SAFETY IN MATERIAL HANDLING EQUIPMENTS [09]**

Storage & stacking of construction materials, Safety in the use of construction equipment's - Vehicles, Cranes, Tower Cranes, Lifting gears, Hoists & Lifts, Wire Ropes, Pulley blocks, Temporary power supply, Mixers, Conveyors, Pneumatic and hydraulic tools in construction.

**UNIT - IV CONTRACT CONDITIONS ON SAFETY [09]**

Health, Welfare, Social Security and Insurance. Application of ergonomics for construction safety.

**UNIT - V CONTRACT LABOUR ACT AND CENTRAL RULES [09]**

Buildings and other Construction Workers (RE & CS) Act and Central Rules. Provisions regarding Licensing, safety, health, welfare and social security aspects only.

**Total = 45 Periods**

**Text Books:**

- National Building Code of India, Bureau of Indian Standards, New Delhi, 2005.
- Building & Other Construction Workers (RE &CS) Act and Central Rules, 1966.

**Reference Books:**

- V.J. Davies & K. Tomasin, Construction Safety Handbook, Thomas Telford Publishing, London. 1990.
- K.N. Vaid (Ed.), Construction Safety Management, National Institute of Construction Management and Research, Bombay, 1988.
- James B. Full man, Construction Safety, Security & Loss Prevention, John Wiley & Sons. 1984.
- R.T. Ratay, Handbook of Temporary Structures in Construction, Mc Graw-Hill, 1984.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF SAFETY AND FIRE ENGINEERING**  
**CO PO MAPPING**

Regulation: R2020

Course Code: 20SF902

Course Name: Construction Safety

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	List out Hazards from various Construction equipment and activities.	3	2	3	-	2	-	3	-	1	-	-	2	-	-
CO2	Mention various Control measures adopted in each Construction activity to avoid Incidents.	3	2	3	-	2	-	3	-	1	-	-	2	-	-
CO3	Demonstrate the safe use of various types of ladders, Hand held power tools, Hydraulic tools used in Construction industry.	3	2	3	-	2	-	3	-	1	-	-	2	-	-
CO4	Compare various components of cranes, safety features and its function.	3	2	3	-	2	-	3	-	1	-	-	2	-	-
CO5	Choose the minimum requirements of BOCW act to the Construction site when they work.	3	2	3	-	2	-	3	-	1	-	-	2	-	-
<b>Average</b>		<b>3</b>	<b>2</b>	<b>3</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**K.S.R. COLLEGE OF ENGINEERING (Autonomous)**

**R 2020**

**20SF903**

**BUILDING FIRE SAFETY  
(Open Elective)**

L	T	P	C
3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes: On successful completion of the course, the student will be able to**

**Cognitive Level**

CO1	Explain the human behaviour under emergency movement and the concept of planning and design of seating arrangements in assembly buildings, evacuation routes and exits.	Understand
CO2	Outline the general life safety requirements applicable to all buildings and to plan, design and locate exits in buildings.	Understand
CO3	Illustrate the fire and life safety requirements for buildings of specific occupancy.	Understand
CO4	Choose and distribute portable and fixed firefighting systems in buildings of different occupancies as per BIS.	Apply
CO5	Develop the method of carrying out fire investigation, arson identification, fire training, fire safety audit and fire risk assessment.	Apply

**UNIT - I BASIC BUILDING PLANNING AND DESIGN [09]**

Process of emergency evacuation - special features of personnel movement. Parameter characteristics of the movement of people; Stages of evacuation; Planning and design of evacuation routes and exits; planning of seating arrangements in large assembly buildings.

**UNIT - II NBC CODES FOR BUILDINGS [09]**

Classification of buildings based on occupancy and type of construction according to fire resistance as per NBC; Fire zone; General fire safety requirements applicable to all individual occupancies. General exit requirements as per NBC; Internal staircases; horizontal exits; fire tower; ramps; fire lifts; external fire escape ladders; Planning of location and calculation of capacity, number and width of exit as per NBC for different occupancy classification.

**UNIT - III FIRE PREVENTION AND BIS STANDARD [09]**

Fire and life safety requirements in different groups of buildings-Hotel, Schools & Colleges, Hospitals, Theatres, shopping malls, etc., Fire protection and prevention in high rise buildings - Fire protection in underground structures and in buildings under construction. Siting of detectors as per relevant Indian standard specifications; Selection and planning of alarm system as per relevant standards (BIS).

**UNIT - IV FIRE PREVENTION AND BIS STANDARD [09]**

Selection and distribution of portable extinguishers (for class A and B fires) and other fire protection equipment and systems for different occupancy classification as per NBC; Planning of fixed firefighting installation for different occupancy classification-sprinkler system; total flooding system; CO2 system; foam system; Fire Investigation; Detection of arson; Fire training and education - fire drill, fire order; Fire safety audits; Fire risk assessment.

**UNIT - V FIRE SAFETY AND CODES [09]**

Causes of fire in buildings. Stages of fire and how it spreads. Fire drill. Heat / fire / smoke detection. Alarm and extinguisher systems. Fire safety standards. General guidelines for egress design for multi-storey buildings. Understanding all the above through product literature/ field visits. Exercise on design of fire safety systems for different building types through choice, calculations, layout and drawings.

**Total = 45 Periods**

**Text Books:**

- Butcher, E.G. And Parnell, A.C., Designing of fire safety. John Wiley and Sons Ltd., New York, U.S.A, 1983.
- Roytman, M. Ya., Principles of Fire Safety Standards for Building Construction, Amerind Publishing Co. Pvt. Ltd., New Delhi, 1975.

**Reference Books:**

- Barendra Mohan Sen, Fire Protection and Prevention the Essential Handbook, UBS Publishers and Dist., New Delhi, 2013.
- Jain, V.K., Fire Safety in Buildings, New Age International (P) Ltd., New Delhi, Second Edition, 2010.
- Huang, Kai, Population and Building Factors That Impact Residential Fire Rates in Large U.S. Cities, Applied Research Project, Texas State University.
- Life Safety Code Handbook, National Fire Protection Association, Lathrop, James K.Ed. NFPA, 1991.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF SAFETY AND FIRE ENGINEERING**  
**CO PO MAPPING**

Regulation: R2020

Course Code: 20SF903

Course Name: Building Fire Safety

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Explain the human behaviour under emergency movement and the concept of planning and design of seating arrangements in assembly buildings, evacuation routes and exits.</i>	3	3	3	-	-	-	2	-	-	1	-	2	-	-
CO2	<i>Outline the general life safety requirements applicable to all buildings and to plan, design and locate exits in buildings.</i>	3	3	3	-	-	-	2	-	-	1	-	2	-	-
CO3	<i>Illustrate the fire and life safety requirements for buildings of specific occupancy.</i>	3	3	3	-	-	-	2	-	-	1	-	2	-	-
CO4	<i>Choose and distribute portable and fixed firefighting systems in buildings of different occupancies as per BIS.</i>	3	3	3	-	-	-	2	-	-	1	-	2	-	-
CO5	<i>Develop the method of carrying out fire investigation, arson identification, fire training, fire safety audit and fire risk assessment.</i>	3	3	3	-	-	-	2	-	-	1	-	2	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20SF904

**SAFETY IN ELECTRICAL ENGINEERING**  
(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes:** On successful completion of the course, the student will be able to

**Cognitive Level**

CO1	Explain the working principles and applications of various kinds of Electrical Machines and/or systems.	Understand
CO2	Choose & brief the hazards associated with electricity at work place.	Apply
CO3	Recall human safety aspects over electric and magnetic fields.	Remember
CO4	Compare various protective equipment and enumerate their working and application.	Understand
CO5	Identify hazardous areas/locations in a given industrial site for selection, installation, operation and maintenance of electrical equipment.	Apply

**UNIT - I INTRODUCTION TO ELECTRICAL EQUIPMENTS [09]**

Transformers, DC Machines, Alternators, Induction Machines- Characteristics, application Protection Relays: Requirements of relay- types of protection, Classification: Distance Relay, Differential Relay, Static Relay- Definitions and types.

**UNIT - II CIRCUIT BREAKERS [09]**

Function switch gear, Arc Phenomenon- Initialization of an Arc, Arc interruption, Recovery voltage, and Restriking voltage classification and working, Working of MCB and ELCB. Faults in Power System: Causes and types, Fuses: Definition, types of fuses, selection of fuses, advantages and disadvantages.

**UNIT - III EFFECT OF ELECTRIC FIELD AND MAGNETIC FIELD [09]**

Human Safety Aspects, Effect of Current and Voltage on Human being- distance from the source, Typical V-I characteristics of skin - Nervous System, Electrical Shocks and their prevention, Insulation: Classes of Insulation, FRLS insulation, Continuity test.

**UNIT - IV SAFETY DURING INSTALLATION OF PLANT AND EQUIPMENT [09]**

Safe sequences in installation -Risk during installation, Safety during testing and commissioning- steps, Test on relays- Protection and interlock system on safety.

**UNIT - V HAZARDOUS ZONES [09]**

Classification of hazardous zones. Intrinsically safe and explosion proof electrical apparatus, Selection of equipment in hazardous area. Electrical Fires: Hazards of static electricity, Safety procedures in electrical maintenance, Statutory requirements from Electrical Inspectorate. Introduction to Indian Electricity Act and Rules.

**Total = 45 Periods**

**Text Books:**

1. S. Rao, Electrical Safety, Fire Safety Engineering and Safety Management, Khanna Publishers, New Delhi, Third Edition, 2019.
2. John Cadick, Electrical Safety Hand book, John Cadick, TMH Publishers, Sixth Edition, 2019.

**Reference Books:**

1. Charles A Gross, Fundamentals of Electrical Engineering, Taylor and Francis Group, 2012.
2. H. Wayne Beaty, Handbook for Electrical Engineers, McGrawHill, Fifteenth Edition, 2007.
3. Donald G Fink, Standard Handbook for Electrical Engineers, Mc GrawHill, Twelfth Edition, 1987.
4. Donald G Fink, Electrical Engineering, Mc Graw Hill, Fifteenth Edition, 1907.

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**DEPARTMENT OF SAFETY AND FIRE ENGINEERING**  
**CO PO MAPPING**

Regulation : R2020

Course Code: 20SF904

Course Name: Safety in Electrical Engineering

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Explain the working principles and applications of various kinds of Electrical Machines and/or systems.</i>	3	1	2	-	-	2	1	-	-	-	-	-	-	-
CO2	<i>Choose &amp; brief the hazards associated with electricity at work place.</i>	3	1	2	-	-	2	1	-	-	-	-	-	-	-
CO3	<i>Recall human safety aspects over electric and magnetic fields.</i>	3	1	2	-	-	2	1	-	-	-	-	-	-	-
CO4	<i>Compare various protective equipment and enumerate their working and application.</i>	3	1	2	-	-	2	1	-	-	-	-	-	-	-
CO5	<i>Identify hazardous areas/locations in a given industrial site for selection, installation, operation and maintenance of electrical equipment.</i>	3	1	2	-	-	2	1	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>1</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20SF905	LEGAL ASPECTS OF SAFETY (Open Elective)	L	T	P	C
		3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course

Course Outcomes: <i>On successful completion of the course, the student will be able to</i>	Cognitive Level
CO1 Describe about the factories act and rules.	Understand
CO2 Illustrate the legal obligations regarding any injury by gaining knowledge of Workmen's Compensation Act. ESI Act & Rules.	Understand
CO3 Outline about the legal aspects granting of license for storage, transportation and usage of explosive substance as applicable as per Petroleum Act and Explosive Act.	Understand
CO4 Explain the Environment (Protection) act and Rules. Choose the concept, powers and functions of Central, State and Joint Boards, provisions regarding prevention and control of Water & Air pollution, Penalties, Central & State Laboratories.	Understand
CO5	Apply

#### UNIT - I FACTORIES ACT [09]

Factories Act- Definitions, Preliminary, inspecting staff, Health, Safety, Provisions relating to hazardous processes, Welfare, Working hours of adults, Employment of young persons, Special provisions - Definitions, Powers of inspectors, Power of Govt. to direct inquiry. Duties of Safety Officers, Reporting of accidents, Emergency Action Plan, Safety Committee.

#### UNIT - II WORKMEN'S COMPENSATION ACT [09]

Workmen's Compensation Act: Definitions, Employer's liability for compensation, Calculation of amount of compensation. ESI Act and Rules: Applicability, Definitions and Benefits. Public Liability Insurance Act and Rules- Definitions, Calculation of amount of relief, Environmental Relief Fund, Advisory Committee, Powers of District Collector, Extent of Liability, Contribution to Relief Fund.

#### UNIT - III EXPLOSIVES ACT [09]

Explosives Act: Definitions, Categories of Explosives, General Safety Provisions, and Use of Explosives, Grant of license, Notice of Accidents, Inquiry into ordinary and more serious accidents. Extension of definition to other explosive substances. Explosives Rules, SMPV Rules and Gas Cylinder Rules (in brief). Petroleum Act with important rules - definitions, safety in the import, transport, storage, license, exemption, notice of accidents.

#### UNIT - IV ENVIRONMENT (PROTECTION) ACT [09]

Water Act and Air Act: Definitions, powers and functions of Boards, prevention and control of pollution, consent administration. Environment (Protection) Act and Rules-Definitions, powers of central government, power of giving directions, authorities. MSIHC Rules- Definitions, Duties of Authorities, Notification of major accidents, Safety Reports, Safety Audit, On- site & Off-site emergency plans.

#### UNIT - V POWER TO MAKE RULES [09]

Powers and Functions of Central, State and Joint Boards, Provisions regarding prevention and control of water pollution, Penalties, Central & State Water Laboratories, Power to make rules, Power of supersession and overriding effect. Rules on Consent for Establishment.

**Total = 45 Periods**

#### Text Books:

1. S.K.T. Narayanan, Safety, Health and Environment Handbook Hardcover, McGraw Hill Education (India) Private limited, First Edition, 2017.
2. Gayle Wood Side and Dianna Koeurek, Environmental Safety and Health Engineering, John Wiley & Sons, 1997.

#### Reference Books:

1. Ganguly & Changeriya, Health Safety and Environment, 2016.
2. Explosives Act and Related Rules & The Gas Cylinder Rules, Professional Book Publishers, 2004.
3. James B. Well, Environmental Management Handbook for Hydrocarbon Processing Industries, Factories Act, 1948.
4. Petroleum Act and Rules & The Petroleum Act, Universal Law Publishing, 1934.

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**DEPARTMENT OF SAFETY AND FIRE ENGINEERING**  
**CO PO MAPPING**

Regulation: R2020

Course Code: 20SF905

Course Name: Legal Aspects of Safety

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Describe about the factories act and rules.</i>	3	-	3	-	-	3	3	2	-	-	-	2	-	-
CO2	<i>Illustrate the legal obligations regarding any injury by gaining knowledge of Workmen's Compensation Act. ESI Act &amp; Rules.</i>	3	-	3	-	-	3	3	2	-	-	-	2	-	-
CO3	<i>Outline about the legal aspects granting of license for storage, transportation and usage of explosive substance as applicable as per Petroleum Act and Explosive Act.</i>	3	-	3	-	-	3	3	2	-	-	-	2	-	-
CO4	<i>Explain the Environment (Protection) act and Rules.</i>	3	-	3	-	-	3	3	2	-	-	-	2	-	-
CO5	<i>Choose the concept, powers and functions of Central, State and Joint Boards, provisions regarding prevention and control of Water &amp; Air pollution, Penalties, Central &amp; State Laboratories.</i>	3	-	3	-	-	3	3	2	-	-	-	2	-	-
<b>Average</b>		<b>3</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



20SF906	SAFETY IN INDUSTRIES (Open Elective)	L	T	P	C
		3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes: On Completion of this course, the student will be able to**

**Cognitive Level**

CO1	Explain the General safety rules, principles, maintenance, Inspections in Foundry Operations.	Understand
CO2	Apply the concepts of safety in design of building fire safety.	Apply
CO3	Develop the safety in industrial operations.	Apply
CO4	Recall about welding, common hazards in welding, personal protective equipment and safety precautions in welding.	Remember
CO5	Illustrate on safety in finishing, inspection and testing of machines.	Understand

**UNIT - I                      FOUNDRY OPERATIONS SAFETY                      [09]**

Foundry Operations - Furnace - health hazard - safe methods of operation. Forging operations heat radiation - maintenance of machines - final checking of tools, guards, lubrication, shop equipment and hand tools - safe work practice. Operations in hot and cold rolling mills. Shearing -bending - rolling - drawing - turning - boring - milling - planning - grinding. Selection and care of tools - health hazards and prevention.

**UNIT - II                      BUILDING FIRE SAFETY                      [09]**

Building Fire Safety Objectives of fire safe building design, Fire load, fire resistant material and fire testing - structural fire protection - structural integrity - concept of exit design -exists width calculations -fire certificates - fire safety requirements for high-rise buildings - snookers.

**UNIT - III                      PERSONNEL RISK IN INDUSTRIAL OPERATIONS                      [09]**

Storages and Transportation General consideration, petroleum product storages, storage tanks and vessel-storages layout segregation, separating distance, secondary containment - venting and relief, atmospheric vent, pressure, vacuum valves, flame arrestors, fire relief - fire prevention and protection - LPG storages -underground storages-loading and unloading facilities-drum and cylinder storage ware house, storage hazard assessment of LPG and LNG Hazards during transportation –pipeline transport.

**UNIT - IV                      WORKSHOP PROCESS SAFETY                      [09]**

Workshop Safety Hand tools and Power tools - Safety while using Grinding stone - Welding and gas cutting safety -Identification of Dangerous points - Lubrication Safety-Safety in Cold Forming and Hot Working of Metals.

**UNIT - V                      SAFETY INSPECTION AND AUDIT                      [09]**

Safety Inspections Safety Audit- Safety Survey - Plant safety inspection - Safety tour – Safety samplings - What is safety budget - Direct cost - indirect cost- Safety Equipment's & their budget preparation.

**Total = 45 Periods**

**Text Books:**

1. Elahi Naseer, Industrial Safety Management, Kalpaz Publication,2006.
2. Dr. Shailednrakumar U Kale,Dr. Umesh Gramopadhye, Industrial Safety Management.

**Reference Books:**

1. Guidelines for Hazard Evaluation Procedures, Centre for Chemical Process Safety, Third Edition, AIChE 2008.
2. Guidelines for Chemical Process Quantitative Risk Analysis, Centre for Chemical Process Safety, Second Edition, AIChE, 2000.
3. Methodologies for Risk and Safety Assessment in Chemical Process Industries, Common Wealth Science Council, UK.
4. Trevor A Klett, Hazop and Hazon, Institute of Chemical Engineering.

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**DEPARTMENT OF SAFETY AND FIRE ENGINEERING**  
**CO PO MAPPING**

Regulation: R2020

Course Code: 20SF906

Course Name: Safety in Industries

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Explain the General safety rules, principles, maintenance, Inspections in Foundry Operations.</i>	2	3	-	-	-	3	3	2	-	-	-	2	-	-
CO2	<i>Apply the concepts of safety in design of building fire safety.</i>	2	3	-	-	-	3	3	2	-	-	-	2	-	-
CO3	<i>Develop the safety in industrial operations.</i>	2	3	-	-	-	3	3	2	-	-	-	2	-	-
CO4	<i>Recall about welding, common hazards in welding, personal protective equipment and safety precautions in welding.</i>	2	3	-	-	-	3	3	2	-	-	-	2	-	-
CO5	<i>Illustrate on safety in finishing, inspection and testing of machines.</i>	2	3	-	-	-	3	3	2	-	-	-	2	-	-
<b>Average</b>		<b>2</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20SF907	FOOD SAFETY (Open Elective)	L	T	P	C
		3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course

Course Outcomes: On Completion of this course, the student will be able to	Cognitive Level
CO1 Apply the knowledge on food quality in food industry.	Apply
CO2 Identify the food additives and food contaminants and their chemical and toxicological properties.	Apply
CO3 Summarize the effects of pests on food and the various methods for controlling them.	Understand
CO4 Explain about the national and international regulations for biosafety.	Understand
CO5 Demonstrate an ability to recognize the environmental, social and ethical implications of biotech applications.	Understand

#### UNIT - I FOOD QUALITY [09]

Objective and importance of quality control, classification of quality attributes and its role in food quality, quality assessment of food materials (fruits, cereals, milk and meat), types of quality characteristics of food, methods used for determination of the quality in food industry, factors influencing the quality of food, sample and sampling methods of quality evaluation.

#### UNIT - II FOOD SANITATION [09]

Factors contributing to physical, chemical and biological contamination in food chain, prevention and control of food borne hazards, definition and regulation of food sanitation, sources of contamination, personal hygiene-food handlers, cleaning compounds, sanitation methods and pest control, sanitation and safety in foodservices.

#### UNIT - III FOOD SAFETY [09]

Principles of food safety and quality, quality assurance, Good Agricultural Practices (GAP), Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP), Good Veterinary Practice (GVP), Applications of HACCP in food safety, Current challenges to food safety.

#### UNIT - IV FOOD LAWS AND REGULATIONS [09]

Basic concepts of food standards, Role of national regulatory agencies: Food safety and Standards Act: salient provision and prospects, FSSAI, PFA, certification- AGMARK, ISI (BIS). Role of international regulatory agencies: USDA, FDA, BRC, WHO, FAO, Codex Alimentarius commission, WTO agreements: SPS and TBT agreements, ISO and its standards for food quality and safety.

#### UNIT - V FOOD SAFETY AUDITING [09]

Food surveillance: International and national practices, procedure and protocols, food alerts, traceability and food product recall. Export and import of food in India: introduction, import and export policies, FDA import policy, export-import policy, export control systems. Import intelligence and alert systems, packaging and labelling, specifications and certifications.

**Total = 45 Periods**

#### Text Books:

1. Fleming & Hunt, Biological Safety, Principles and Practices, ASM Press, Fourth Edition, 2006.
2. Fawatt, H.H. and Wood, W.S., Safety and Accident Prevention in Chemical Operation, Wiley Inter science, 1965.

#### Reference Books:

1. N.G. Marriott, G.W. Schilling and B. Robert, Principles of Food Sanitation, Springer, Fifth Edition 2018.
2. I. Alli, Food Quality Assurance - Principles & Practices, CRC Press, India, 2018.
3. Cynthia A. Robert, The Food Safety Information Hand Book, 2009.
4. Early, Guide to Quality Management Systems for the Food Industry, Springer, First Edition, 2005.

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**DEPARTMENT OF SAFETY AND FIRE ENGINEERING**  
**CO PO MAPPING**

Regulation: R2020

Course Code: 20SF907

Course Name: Food Safety

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Apply the knowledge on food quality in food industry.</i>	3	3	3	-	-	3	3	3	-	-	-	3	-	-
CO2	<i>Identify the food additives and food contaminants and their chemical and toxicological properties.</i>	3	3	3	-	-	3	3	3	-	-	-	3	-	-
CO3	<i>Summarize the effects of pests on food and the various methods for controlling them.</i>	3	3	3	-	-	3	3	3	-	-	-	3	-	-
CO4	<i>Explain about the national and international regulations for biosafety.</i>	3	3	3	-	-	3	3	3	-	-	-	3	-	-
CO5	<i>Demonstrate an ability to recognize the environmental, social and ethical implications of biotech applications.</i>	3	3	3	-	-	3	3	3	-	-	-	3	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**K.S.R. COLLEGE OF ENGINEERING (Autonomous)**

**R 2020**

**20SF908**

**SAFETY MANAGEMENT AND ITS PRINCIPLE  
(Open Elective)**

L	T	P	C
3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes: On Completion of this course, the student will be able to**

**Cognitive Level**

<i>CO1</i>	<i>Demonstrate the knowledge and understanding of basic terms in safety management.</i>	<i>Understand</i>
<i>CO2</i>	<i>Compare safety organizational requirements for effective safety management.</i>	<i>Understand</i>
<i>CO3</i>	<i>Solve the workplace hazards and apply controls measures using hierarchy of control.</i>	<i>Apply</i>
<i>CO4</i>	<i>Develop the safety performance of an organization.</i>	<i>Apply</i>
<i>CO5</i>	<i>Explain accident investigation methodologies and apply systematic procedure to identify and unearth the root cause of the incident and accident.</i>	<i>Understand</i>

**UNIT - I INTRODUCTION OF SAFETY [09]**

Safety – Goals of safety engineering – Need for safety, Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents, History of safety movement – Theories of accident causation.

**UNIT - II SAFETY ORGANIZATION [09]**

Objectives, Types, Functions, Role of management, Supervisors, Workmen, Unions, Government and voluntary agencies in safety – Safety policy – Safety Officer – Responsibilities – Safety committee – Need, Types, Advantages.

**UNIT - III ACCIDENT PREVENTION AND TRAINING [09]**

Accident Prevention Methods – Engineering, Education and Enforcement, Safety Education & Training – Importance, Various training methods, Effectiveness of training, Behavior Oriented Training – Communication – Purpose, Barrier to communication. Housekeeping: Responsibility of management and employees – Advantages of good housekeeping – 5 's of housekeeping – Work permit system – objectives, hot work and cold work permits. Typical industrial models and methodology – Entry into confined spaces.

**UNIT - IV MONITORING SAFETY PERFORMANCE [09]**

Frequency rate, Severity rate, Incidence rate, Activity rate – Cost of accidents – Computation of Costs – Utility of Cost data – Plant safety inspection types, Inspection procedure – Safety sampling techniques – Job safety Analysis (JSA), Safety surveys, Safety audits – Safety Inventory Technique.

**UNIT - V INVESTIGATION ON ACCIDENTS [09]**

Why? When? Where? Who? & How? Basics – Man – Environment & Systems. Process of Investigation – Tools – Data Collection - Handling witnesses - Case study. Accident analysis – Analytical Techniques – System Safety – Change Analysis.

**Total = 45 Periods**

**Text Books:**

1. N.V. Krishnan, Safety Management in Industry, Jaico Publishing House, 1997.
2. Ronald P. Blake, Industrial Safety, Prentice Hall, New Delhi, 1973.

**Reference Books:**

1. Willie Hammer, Occupational Safety Management and Engineering, Prentice Hall, Fifth Edition, 2007.
2. Ted S. Ferry, Modern Accident Investigation and Analysis, John Wiley & Sons, Second Edition, 2007.
3. John V. Grimaldi and Rollin H. Simonds, Safety Management, American Society of Safety Engineers, Fifth Edition, 1993.
4. Accident Prevention Manual for Industrial Operations, National Safety Council, Chicago, 1982.

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**DEPARTMENT OF SAFETY AND FIRE ENGINEERING**  
**CO PO MAPPING**

**Regulation: R2020**

**Course Code: 20SF908**

**Course Name: Safety Management and its Principles**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Demonstrate the knowledge and understanding of basic terms in safety management.</i>	3	2	2	-	-	3	3	2	2	-	-	1	-	-
CO2	<i>Compare safety organizational requirements for effective safety management.</i>	3	2	2	-	-	3	3	2	2	-	-	1	-	-
CO3	<i>Solve the workplace hazards and apply controls measures using hierarchy of control.</i>	3	2	2	-	-	3	3	2	2	-	-	1	-	-
CO4	<i>Develop the safety performance of an organization.</i>	3	3	2	-	-	3	3	2	2	-	-	1	-	-
CO5	<i>Explain accident investigation methodologies and apply systematic procedure to identify and unearth the root cause of the incident and accident.</i>	3	3	2	-	-	3	3	2	2	-	-	1	-	-
<b>Average</b>		<b>3</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20SF909

SAFETY IN AUTOMOBILE ENGINEERING  
(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes:** On Completion of this course, the student will be able to

**Cognitive Level**

CO1	Explain about automobile engines, fuel systems and CMV rules for proto type testing and emission standards.	Understand
CO2	Demonstrate the electrical systems-ignition, lighting, horn, wipers, HVAC and concerned CMV rules	Understand
CO3	Classify the transmission systems - clutch, gearbox, steering, and differential. Chassis - springs, axles and brakes and corresponding CMV rules.	Understand
CO4	Outline the lubricating systems, cooling systems and miscellaneous systems. CMV rules for safety devices.	Understand
CO5	Choose passive and active safety.	Apply

**UNIT - I INTRODUCTION AND EMISSION [09]**

Types of automobiles. Limiting Dimensions as per Central Motor Vehicles Rules. Engines - Classification, Construction, Materials of engine components. Prototype Testing as per Central Motor Vehicles Rules. Fuel System - Fuel tank, Fuel filter, Types of Fuel system. Carburettor – Simple and Modern, Fuel injection System. Emission Standards as per CMV Rules.

**UNIT - II ELECTRICITY STORAGE AND ITS UTILIZATION [09]**

Electrical System - Storage Battery Operations and Maintenance. Ignition System - Coil and Magneto Ignition System. Starting System, Lighting System, Horn System-Wind Shield Wiper Motors, Fans, Heaters, Trafficators. Automobile air conditioning. Central Motor Vehicles Rules regarding Lighting, Windshields, Wipers.

**UNIT - III TRANSMISSION SYSTEM AND BRAKING SYSTEM [09]**

Transmission System - Clutches - operation and fault finding of clutches, Fluid Flywheel, Gear Box types, Steering Systems, Chassis Springs, and Suspension. Differential, Dead and Live axles, Rims, Tyre etc. Brakes - Types, construction and fault finding. CMV Rules-Brakes, Steering & Tyre.

**UNIT - IV LUBRICATION AND COOLING SYSTEM [09]**

Lubrication Systems-Types, Components, Lubricating oil, Cooling system- Details of components, Study of Systems, Types. Miscellaneous - Special gadgets and accessories for fire fighting vehicles. Automobile accidents. CMV Rules regarding Safety devices for drivers, passengers.

**UNIT - V PASSIVE AND ACTIVE SAFETY [09]**

Design of body for safety, deceleration of vehicle, passenger. Concept of crumple zone, Safety Cage. Optimum crash pulse. Barrier test - Crash tests - Antilock braking system, Stability Control. Adaptive cruise control, Lane Keep Assist System, Collision warning, avoidance system, Blind Spot Detection system, Driver alertness detection System. ADAS, DAT.

**Total = 45 Periods**

**Text Books:**

1. Robert Bosch GmbH, Safety, Comfort and Convenience Systems, Wiley, Third Edition, 2007.
2. Ljubo Vlacic, Michel Parent, Fumio Harashima, Intelligent Vehicle Technologies Theory and Applications, Butterworth Heinemann, 2001.

**Reference Books:**

1. GBS Narang, Automobile Engineering, Khanna Publishers, Delhi, 2014.
2. Kirpal Singh, Automobile Engineering, Vol.I & II. Standard publishes, Delhi, Thirteenth Edition, 2012.
3. Joseph Heitner, Automotive Mechanics-Principles & Practices, CBS Publisher-Delhi, Second Edition, 2006.
4. P. L. Kohli, Automotive Electrical Equipment's, McGraw Hill, New Delhi, 1993.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF SAFETY AND FIRE ENGINEERING**  
**CO PO MAPPING**

Regulation: R2020

Course Code: 20SF909

Course Name: Safety in Automobile Engineering

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Explain about automobile engines, fuel systems and CMV rules for proto type testing and emission standards.</i>	3	3	2	-	-	3	3	3	-	-	-	2	-	-
CO2	<i>Demonstrate the electrical systems - ignition, lighting, horn, wipers, HVAC and concerned CMV rules.</i>	3	3	2	-	-	3	3	3	-	-	-	2	-	-
CO3	<i>Classify the transmission systems - clutch, gearbox, steering, and differential. Chassis - springs, axles and brakes and corresponding CMV rules.</i>	3	3	2	-	-	3	3	3	-	-	-	2	-	-
CO4	<i>Outline the lubricating systems, cooling systems and miscellaneous systems. CMV rules for safety devices.</i>	3	3	2	-	-	3	3	3	-	-	-	2	-	-
CO5	<i>Choose passive and active safety.</i>	3	3	2	-	-	3	3	3	-	-	-	2	-	-
		<b>3</b>	<b>3</b>	<b>2</b>	-	-	<b>3</b>	<b>3</b>	<b>3</b>	-	-	-	<b>2</b>	-	-

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)



20SF910

**SAFETY IN TRANSPORTATION**  
(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes: On Completion of this course, the student will be able to**

**Cognitive Level**

CO1	Explain the Working of railways and safety aspects in railway operation	Understand
CO2	Apply the Basic geometric design features of roads	Apply
CO3	Summarize about traffic studies and traffic safety	Understand
CO4	Outline the basic layout and facilities of docks and harbour	Understand
CO5	Choose the Working of airways and safety aspects in airway operation	Remember

**UNIT - I RAILWAY ENGINEERING [09]**

Introduction of Railway Engineering: Permanent way. Curves, super-elevation, negative super elevation, transition curve, grade compensation on curves. Railway operation and control - points and crossings turn-out. Signalling and interlocking. Centralized traffic control. Railway accidents & safety. Rapid transit railways - types, merits & demerits.

**UNIT - II HIGHWAY ENGINEERING [09]**

Introduction of Highway Engineering: Classification of highways and urban road patterns. Typical cross section of roads. Factors controlling the alignment of roads. Basic geometric design - stopping and overtaking sight distances.

**UNIT - III TRAFFIC ENGINEERING [09]**

Introduction of Traffic Engineering: Traffic characteristics. Various traffic studies and their applications. Traffic signals. Carriage-way markings. Traffic islands. Highway intersections. Principles of highway lighting. Road Accidents prevention, investigation and reduction.

**UNIT - IV HARBOUR AND DOCK ENGINEERING [09]**

Introduction of Harbour & Dock Engineering: Water transportation, classification of harbours, accessibility and size, ports, Indian ports. Layout of ports, breakwater, facilities (in brief) for docking, repair, approach, loading and unloading, storing and guiding.

**UNIT - V AIR TRANSPORTATIONENGINEERING [09]**

Classification of air transportation, Types of air craft engines - Propellants-feeding systems – Ignition and combustion - Theory of rocket propulsion - Performance study - Staging - Terminal and characteristic velocity-Applications – spaceflights. Air way accidents & safety.

**Text Books:**

1. B.S. Dhillon, Transportation Systems, Reliability and Safety, CRC Press, 2011.
2. John Khisty C, Kent Lall B, Transportation Engineering - An Introduction, Prentice Hall of India, New Delhi, Third Edition 2002.

**Reference Books:**

1. Srinivasan, R., Harbour, Dock and Tunnel Engineering, Charotar Publishing House Pvt. Ltd, Anand,2013.
2. Chandra, S. & Agarwal, M. M. Railway Engineering, Oxford University Press, New Delhi, 2007.
3. Kadiyali, L. R., Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, 2004.
4. Khanna, S. K. and Justo, C.E.G., Highway Engineering, Nem Chand & Brothers, New Delhi, Nineth Edition,2001.

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**DEPARTMENT OF SAFETY AND FIRE ENGINEERING**  
**CO PO MAPPING**

**Regulation: R2020**

**Course Code: 20SF910**

**Course Name: Safety in Transportation**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	<i>Explain the Working of railways and safety aspects in railway operation</i>	3	3	3	-	-	2	-	2	-	-	-	3	-	-
C02	<i>Apply the Basic geometric design features of roads</i>	3	3	3	-	-	2	-	2	-	-	-	3	-	-
C03	<i>Summarize about traffic studies and traffic safety</i>	3	3	3	-	-	2	-	2	-	-	-	3	-	-
C04	<i>Outline the basic layout and facilities of docks and harbour</i>	3	3	3	-	-	2	-	2	-	-	-	3	-	-
C05	<i>Choose the Working of airways and safety aspects in airway operation</i>	3	3	3	-	-	2	-	2	-	-	-	3	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**K.S.R. COLLEGE OF ENGINEERING (Autonomous)**

**R 2020**

**20SH901**

**APPLI CATIONS OF STATISTICS**  
(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes : On Completion of this course, the student will be able to**

**Cognitive Level**

CO1	Analyze the measures of central tendency and dispersion.	Analyze
CO2	Applying the concepts of Correlation and Regression analysis	Apply
CO3	Testing the samples using method of hypothesis to obtain inferences.	Remember
CO4	Develop their skills in Design of Experiments.	Remember
CO5	Solving Non Parametric data to obtain inferences.	Understand

**UNIT – I DESCRIPTIVE STATISTICS [09]**

Introduction to Statistics, Measures of Central Tendency - Mean, Median, Mode, Weighted Mean, Geometric Mean, Harmonic Mean, Measures of Variability- Range, Inter-Quartile Range, Variance, Standard Deviation, Coefficient of Variation.

**UNIT – II CORRELATION AND REGRESSION ANALYSIS [09]**

Types of Correlation-Karl Pearson's Coefficient of Correlation- Spearman's Rank Correlation-Regression Analysis-Uses-Regression equations-X on Y and Y on X Estimation.

**UNIT – III TESTING OF HYPOTHESIS [09]**

Large sample test based on Normal distribution for single mean and difference of means - Tests based on t - F distributions for testing means and variances-Chi-Square Test.

**UNIT – IV DESIGN OF EXPERIMENTS [09]**

Analysis of variance - One-way and two-way classifications - Completely randomized design - Randomized block design - Latin square design.

**UNIT – V NON PARAMETRIC TESTS [09]**

The Sign Test- Rank Sum Test- Mann-Whitney U Test, One Sample run Test-Spearman's Rank Correlation and Kruskal-Wallis Test (H-test).

**Total (L: 45 T:0) = 45 Periods**

**Text Books :**

- 1 Gupta .S.P.,Statistical Methods , Sultan Chand & Sons Educational Publishers ,New Delhi, Thirty first Edition,2002.
- 2 Ross, S.M., Introduction to Probability and Statistics for Engineers and Scientists, Elsevier ,Third Edition,2004.

**Reference Books :**

- 1 Srivatsava TN and Shailaja Rego, Statistics for Management, Tata McGraw Hill,Fifth Edition, 2008.
- 2 Walpole. R.E., Myers. R.H., and Ye. K., Probability and Statistics for Engineers and Scientists, Pearson Education, Asia , Eighth Edition, 2007.
- 3 Richard I. Levin, David S. Rubin, Statistics for Management, Pearson Education, Seventh Edition, 2011.
- 4 Pillai R.S.N and Bagavathi.V ,Statistics ,S.Chand Publishers ,New Delhi, Seventeenth Reprint Edition 2008.

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**DEPARTMENT OF SCIENCE AND HUMANITIES**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20SH901

Course Name : APPLI CATIONS OF STATISTICS

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Analyze the measures of central tendency and dispersion.	3	3	3	3										
CO2	Applying the concepts of Correlation and Regression analysis	3	3	3	3										
CO3	Testing the samples using method of hypothesis to obtain inferences.	3	3	3	3										
CO4	Develop their skills in Design of Experiments	3	3	3	3										
CO5	Solving Non Parametric data to obtain inferences.	3	3	3	3										
<b>Average</b>		3	3	3	3										

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**K.S.R. COLLEGE OF ENGINEERING (Autonomous)**

**R 2020**

**20SH902**

**COMBINATORICS AND GRAPH THEORY**  
(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite:** No prerequisites are needed for enrolling into the course

**Course Outcomes : On Completion of this course, the student will be able to**

**Cognitive Level**

CO1	<i>Interpret the concept of combinatorics Principles in Computer applications.</i>	<i>Understand</i>
CO2	<i>Acquire knowledge in Recurrences and Generating Functions.</i>	<i>Evaluate</i>
CO3	<i>Applying the concepts of graph theory</i>	<i>Apply</i>
CO4	<i>Constructing algorithm using Trees..</i>	<i>Remember</i>
CO5	<i>Developing Skills in Colouring and Directed Graphs.</i>	<i>Analyze</i>

**UNIT – I COMBINATORICS [09]**

The pigeon-hole principle - Basic counting problems- The binomial coefficients (the binomial theorem, algebraic vs. combinatorial proof, Pascal's identity, Pascal's triangle, Catalan numbers) - the principle of inclusion and exclusion.

**UNIT – II RECURRENCES [09]**

Fibonacci numbers - The substitution method- Linear recurrences (mostly homogenous recurrences, the characteristic polynomial) - Generating functions.

**UNIT – III INTRODUCTION TO GRAPH THEORY [09]**

. Definition - examples – subgraphs – complements and graph isomorphism – Euler trail and circuits – planar graphs – Hamilton paths and cycles.

**UNIT – IV TREES [09]**

Definition – rooted trees – trees and sorting – weighted trees and prefix codes – bi connected components and Articulation points.

**UNIT – V MATRICES, COLOURING AND DIRECTED GRAPH [09]**

Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four color problem – Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness – Euler graphs.

**Total (L: 45 T:0) = 45 Periods**

**Text Books :**

- 1 Grimaldi, R.P. Discrete and Combinatorial Mathematics: An Applied Introduction, Fourth Edition, Pearson Education Asia, Delhi, 2007.
- 2 Narsingh Deo, Graph Theory With Application to Engineering and Computer Science, Prentice Hall of India, Second Edition, 2003.

**Reference Books :**

- 1 Douglas B. West, Introduction to Graph Theory, Prentice-Hall of India, Second Edition, 2012.
- 2 John Clark, Derek Allan Holton, A first look at Graph Theory, World Scientific Publishing Company illustrated edition, Reprint, 1991
- 3 Rosen, K.H., Discrete Mathematics and its Applications, Seventh Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
- 4 Diestel, R, Graph Theory, Springer, Third Edition, 2006

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**DEPARTMENT OF SCIENCE AND HUMANITIES**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20SH902

Course Name: COMBINATORICS AND GRAPH THEORY

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Interpret the concept of combinatorics Principles in Computer applications.</i>	3	3	3	3										
CO2	<i>Acquire knowledge in Recurrences and Generating Functions.</i>	3	3	3	3										
CO3	<i>Applying the concepts of graph theory</i>	3	3	3	3										
CO4	<i>Constructing algorithm using Trees..</i>	3	3	3	3										
CO5	<i>Developing Skills in Colouring and Directed Graphs.</i>	3	3	3	3										
<b>Average</b>		3	3	3	3										

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

20SH903

## OPTIMIZATION TECHNIQUES

(Open Elective)

L	T	P	C
3	0	0	3

**Prerequisite: No prerequisites are needed for enrolling into the course.**

**Course Outcomes : On successful completion of the course , the student will be able to**

**Cognitive Level**

<b>CO1</b>	<i>Enable to develop the decision making during the uncertain situations by linear programming approach.</i>	<i>Apply</i>
<b>CO2</b>	<i>Identify to minimize the Transportation and Assignment cost and maximize the profit in Industries.</i>	<i>Analyze</i>
<b>CO3</b>	<i>Developing the network techniques in project scheduling.</i>	<i>Apply</i>
<b>CO4</b>	<i>Study the importance of stock controlling to maximize the profit.</i>	<i>Remember</i>
<b>CO5</b>	<i>Understand and apply the Replacement and sequencing methods in manufacturing engineering.</i>	<i>Understand</i>

**UNIT - I LINEAR PROGRAMMING PROBLEM [09]**

Introduction - scope and role of OR - phases of OR - limitations of OR - linear programming problem - formulation of linear programming problem - optimum solution by graphical method - simplex method (using slack variables only).

**UNIT - II TRANSPORTATION AND ASSIGNMENT PROBLEM [09]**

Transportation Models (Minimizing and Maximizing Cases) - Balanced and unbalanced cases - Initial Basic feasible solution by North West Corner Rule, Least cost and Vogel's approximation methods. Check for optimality by Modified method.

Assignment Models (Minimizing and Maximizing Cases) - Balanced and Unbalanced Cases - Solution by Hungarian method.

**UNIT - III NETWORK MODELS [09]**

Network - Fulkerson's rule - construction of a network - critical path method (CPM) - optimistic, pessimistic and most likely time estimates - project scheduling by PERT analysis.

**UNIT - IV INVENTORY MODEL [09]**

Types of Inventory - Deterministic inventory models - EOQ and EBQ models with and without shortages - Quantity discount model - Price breaks - probabilistic inventory model.

**UNIT - V REPLACEMENT MODELS AND SEQUENCING [09]**

Replacement of items that deteriorate with time - value of money changing with time - not changing with time – optimum replacement policy - individual and group replacement. Sequencing problem - assumptions - processing of 'n' jobs in 2 machines, 'n' jobs with 'm' machine

**Total (L: 45 T: 0) = 45 Periods**

**Text Books :**

- 1 P.K. Gupta and Man Mohan, Problems in Operations Research, S. Chand and Co, New Delhi ,Fourteenth Edition, 2016.
- 2 Wayne. L. Winston, Operations Research applications and algorithms, Thomson learning, New Delhi, Tenth Edition 2016.

**Reference Books :**

- 1 Hira and Gupta, Problems in Operations Research, S. Chand and Co, New Delhi, Eighth Edition, 2015.
- 2 Taha H.A, Operation Research, Pearson Education, New Delhi, Sixth Edition, 2016.
- 3 J k Sharma , Operation Research, Macmillan India Pvt. Ltd., New Delhi, Seventh Edition,2007
- 4 R.Panneerselvam Operations Research, PHI Learning, Second Edition,2011.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF SCIENCE AND HUMANITIES**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code:20SH903

Course Name : OPTIMIZATION TECHNIQUES

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Enable to develop the decision making during the uncertain situations by linear programming approach.</i>	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2	<i>Identify to minimize the Transportation and Assignment cost and maximize the profit in industries</i>	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	<i>Developing the network techniques in project scheduling.</i>	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	<i>Study the importance of stock controlling to maximize the profit.</i>	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	<i>Understand and apply the Replacement and sequencing methods in manufacturing engineering.</i>	3	3	3	3	-	-	-	-	-	-	-	-	-	-
<b>Average</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

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



**K.S.R. COLLEGE OF ENGINEERING (Autonomous)****R 2020**

<b>BASIC MILITARY EDUCATION AND TRAINING</b>		L	T	P	C
<b>20SH904</b>	(Open Elective )	3	0	0	3

**Prerequisite:** Only NCC Cadets are eligible for opting into the course.

<b>Course Outcomes: On Completion of this course , the student will be able to</b>		<b>Cognitive level</b>
CO1	Develop the character, camaraderie of NCC cadets	Apply
CO2	Inculcate the discipline and secular outlook.	Apply
CO3	Educate weapon handling and training.	Understand
CO4	Learn the quality of selfless service among the cadets by working as a team.	Remember
CO5	Learn the basis of military management.	Understand

**UNIT – I NCC ORGANIZATION & NATIONAL INTEGRATION [ 09 ]**

*NCC Organization – History of NCC- NCC Organization- NCC Training- NCC Uniform – Promotion of NCC cadets – Aim and advantages of NCC Training- NCC badges of Rank- Honours and Awards – Incentives for NCC cadets by central and state govt. National Integration- Unity in diversity- contribution of youth in nation building- national integration council- Images and Slogans on National Integration.*

**UNIT – II BASIC PHYSICAL TRAINING & DRILL [ 09 ]**

Basic physical Training – various exercises for fitness (with Demonstration). Food – Hygiene and Cleanliness.

*Drill- Words of commands- position and commands- sizing and forming- saluting- marching- turning on the march and wheeling- saluting on the march- side pace, pace forward and to the rear- marking time- Drill with arms- ceremonial drill-guard mounting. ( WITH DEMONSTRATION)*

**UNIT – III WEAPON TRAINING [ 09 ]**

*Main Parts of a Rifle- Characteristics of 5.56mm INSAS rifle- Characteristics of .22 rifle- loading and unloading – position and holding- safety precautions – range procedure- MPI and Elevation- Group and Snap shooting- Long/Short range firing( WITH PRACTICE SESSION) - Characteristics of 7.62mm SLR- LMG- carbine machine gun.*

**UNIT – IV SOCIAL AWARENESS AND COMMUNITY DEVELOPMENT [ 09 ]**

*Aims of Social service-Variou Means and ways of social services- family planning – HIV and AIDS- Cancer its causes and preventive measures- NGO and their activities- Drug trafficking- Rural development programmes - MGNREGA-SGSY-JGSY-NSAP-PMGSY-Terrorism and counter terrorism- Corruption – female feticide -dowry –child abuse-RTI Act- RTE Act- Protection of children from sexual offences act- civic sense and responsibility*

**UNIT – V SPECIALIZED SUBJECT (ARMY) [ 09 ]**

*Basic structure of Armed Forces- Military History – War heroes- battles of Indo-Pak war- Param Vir Chakra- Career in the Defense forces- Service tests and interviews-Field craft and Battle craft-Basics of Map reading including practical.*

**Total = 45 Periods**

**Text Books :**

- 1 National Cadet Corps- A Concise handbook of NCC Cadets by Ramesh Publishing House, New Delhi, 2014.

**Reference Books :**

- 1 *Cadets Handbook – Common Subjects SD/SW published by DG NCC, New Delhi.*
- 2 *Cadets Handbook- Specialized Subjects SD/SW published by DG NCC, New Delhi*
- 3 *NCC OTA Precise published by DG NCC, New Delhi.*

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF SCIENCE AND HUMANITIES**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code: 20SH904

Course Name: **BASIC MILITARY EDUCATION AND TRAINING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Display sense of patriotism, secular values and shall be transformed into motivated youth who will contribute towards nation building through national unity and social cohesion.	3	1	1	1	3	3	3	3	3	3	-	-	-	-
CO2	Demonstrate Health Exercises, the sense of discipline, improve bearing, smartness, turnout, develop the quality of immediate and implicit obedience of orders	3	1	1	1	3	3	3	3	3	3	-	-	-	-
CO3	Basic knowledge of weapons and their use and handling.	3	2	1	1	3	3	3	3	3	3	-	-	-	-
CO4	Understanding about social evils and shall inculcate sense of whistle blowing against such evils and ways to eradicate such evils	3	2	1	1	3	3	3	3	3	3	-	-	-	-
CO5	Acquaint, expose & provide knowledge about Army/Navy/ Air force and to acquire information about expansion of Armed Forces, service subjects and important battles.	3	2	1	1	3	3	3	3	3	3	-	-	-	-
<b>Average</b>		<b>3</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

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

20SH905	PROFESSIONAL COMMUNICATION		L	T	P	C
	(Open Elective)		1	0	2	3

**Prerequisite:**

**Course Outcomes : On Successful Completion of the Course, the student will be able to**

**Cognitive Level**

CO1	Organize and compose resume' and SWOT analysis.	Understand
CO2	Prioritize the skills for interviews and job hunt.	Understand
CO3	Interpret by Listening and reading a text and comprehend it.	Understand
CO4	Identify the purpose of writing short messages and presentation.	Understand
CO5	Optimize the speaking skills to do well in Group Discussion.	Understand

**UNIT – I SWOT Analysis and Resume' Writing [09]**

SWOT Analysis – Key SWOT Questions- Assessment of strength and weakness – Mind map and Activity – Job Application and Resume' – Types of Resume' – Common mistakes in Resume' writing – Cover Letter (Email).

**UNIT – II Interview Skills [09]**

Types of Interviews – Telephone Interview (HR and Technical) – Dos and Don'ts in telephone Interview – Video Interviews – Practice for successful interviews – Video Samples.

**UNIT - III Listening and Reading [09]**

**Listening** – Listening and typing – Listening and sequencing of sentences – Filling in the blanks – Listening and answering questions.

**Reading** – Filling in the blanks – Cloze exercise – Vocabulary building – Reading and answering questions.

**UNIT - IV Writing Short Messages and Presentation Skills [09]**

Writing Memos – Email writing - Business Email – Elements of effective presentation – Structure of presentation – Audience analysis – Body Language.

**UNIT - V Group Discussion and Essay Writing [09]**

Introduction to Group Discussion – Structure of GD – Brainstorming the topic – Body Language – Mock GD – Five steps to writing an essay – writing short essays.

**Total = 45 Periods****Text Books :**

- 1 Ravindran, Padma, English for Work, Ebek Language Laboratories Private Limited, Trichy, First Edition, 2011
- 2 Kalpana V, Communication Skills Laboratory Manual, Vijay Nicole Imprints Private Limited, Chennai, First Edition, 2013

**Reference Books :**

- 1 Norman Whitby, Business Benchmark: Pre-Intermediate to Intermediate –BEC Preliminary, Cambridge University Press, New Delhi, First Edition, 2008.
- 2 Meenakshi Raman and Sangeeta Sharma, Technical Communication English for Engineers, Oxford University Press, New Delhi, 2008.
- 3 Rizvi Ashraf M, Effective Technical Communication, Mc Graw Hill, New Delhi, 28<sup>th</sup> Reprint, 2015.
- 4 Department of English, English for Technologies and Engineers, Orient Black Swan, Hyderabad, First Edition, 2016.

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF SCIENCE AND HUMANITIES**  
**CO-PO MAPPING**

Regulation : R 2020  
 Course Code: 20SH905 Course Name : PROFESSIONAL COMMUNICATION

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Organize and compose resume' and SWOT analysis.									3	3		2		
CO2	Prioritize the skills for interviews and job hunt.									3	3		2		
CO3	Interpret by Listening and reading a text and comprehend it.									3	3		2		
CO4	Identify the purpose of writing short messages and presentation.									3	3		2		
CO5	Optimize the speaking skills to do well in Group Discussion.									3	3		2		
<b>Average</b>										<b>3</b>	<b>3</b>		<b>2</b>		

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)

**K.S.R. COLLEGE OF ENGINEERING (Autonomous)**  
**FUNDAMENTALS OF NANOSCIENCE AND TECHNOLOGY**  
 (Open Elective )

**R 2020**

	L	T	P	C
<b>20SH906</b>	3	0	0	3

**Prerequisite:** NIL

<b>Course Outcomes: On Completion of this course , the student will be able to</b>	<b>Cognitive level</b>
CO1 Learn the basics of nanotechnology in physics, chemistry and biology	Remember
CO2 Recognize the methods of preparation of nanomaterials	Analyze
CO3 Relate the characterization techniques for confirming nanomaterials	Apply
CO4 Categorize the nanomaterials and its preparation	Analyze
CO5 Identify the area of application and its field	Understand

**UNIT – I INTRODUCTION [ 09 ]**

Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thin films multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties.

**UNIT – II GENERAL METHODS OF PREPARATION [09 ]**

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapor phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

**UNIT – III NANOMATERIALS [ 09 ]**

Nanoforms of Carbon – Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis (arc-growth, laser ablation, CVD routes, Plasma CVD), structure-properties. Applications- Nanometal oxides-ZnO, TiO<sub>2</sub>, MgO, ZrO<sub>2</sub>, NiO, nano alumina, CaO, AgTiO<sub>2</sub>, Ferrites, Nano clays- functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

**UNIT – IV CHARACTERIZATION TECHNIQUES [ 09 ]**

X-ray diffraction technique, Scanning Electron Microscopy – experimental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, STM, ESCA-Nanoindentation.

**UNIT – V APPLICATIONS [ 09 ]**

Nano InfoTech: Information storage- nano computer, molecular switch, super chip, nanocrystal, Nano biotechnology: nanoprobe in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery, Bioimaging – Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nano sensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sun barrier products – In Photostat, printing, solar cell, battery.

**Total = 45 Periods**

**Text Books :**

- 1 John Dinardo. N, “Nanoscale characterization of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000
- 2 Introduction to Nanoscience and Nanotechnology by Chattopadhyay K.K 1 January 2013

**Reference Books :**

- 1 Timp .G, “Nanotechnology”, AIP press/Springer, 1999.
- 2 AkhleshLakhtakia (Editor),“The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.
- 3 NANO: The Essentials: Understanding Nanoscience and Nanotechnology by T. Pradeep
- 4 An Introduction To Nanomaterials And Nanoscience (Pb 2020) by DAS A

**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215**  
**DEPARTMENT OF SCIENCE AND HUMANITIES**  
**CO-PO MAPPING**

Regulation : R 2020

Course Code:20SH906

Course Name : **FUNDAMENTALS OF  
 NANOSCIENCE AND TECHNOLOGY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Learn the basics of nanotechnology in physics, chemistry and biology	3	3			2			1		2		2		
CO2	Recognize the methods of preparation of nanomaterials	3	3			2			1		2		2		
CO3	Relate the characterization techniques for confirming nanomaterials	3	3			2			1		2		2		
CO4	Categorize the nanomaterials and its preparation	3	3			2			1		2		2		
CO5	Identify the area of application and its field	3	3			2			1		2		2		
<b>Average</b>		3	3			2			1		2		2		

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