DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM & SYLLABI

Regulations 2020

(Applicable to candidates admitted in the Academic Year 2020-2021)

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

(Approved by AICTE, Accredited by NAAC with A++ Grade & Affiliated to Anna University)

K.S.R. Kalvi Nagar, Tiruchengode – 637 215

Namakkal (Dt), Tamilnadu, India

Email: info@ksrce.ac.in Website: www.ksrce.ac.in

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

(Autonomous)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

B.E. - Electrical and Electronics Engineering

(REGULATIONS 2020)

Vision of the Institution

IV	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.

Mission of the Institution

IM 1	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.
IM 2	To foster and maintain mutually beneficial partnership with global industries and Institutions through knowledge sharing, collaborative research and innovation.

Vision of the Department

DV	We envision a Department that leads in the field of Electrical and Electronics Engineering through education, training and research committed to influence the direction of the field and make a constructive contribution to society wherein the Department can thrive and grow.

Mission of the Department

DM 1	To create professionally competent and resourceful Electrical and Electronics Engineers.
DM 2	To promote excellence in teaching, pioneering research and innovation for a sustainable growth of the nation and enrichment of humanity.

Programme Educational Objectives (PEOs) : B.E. - Electrical and Electronics Engineering

The graduates of the programme will be able to	
PEO 1	**Employability and Higher studies:** Excel in professional career and/or higher education by acquiring knowledge in basic engineering, science and mathematics in Electrical and Electronics Engineering.
PEO 2	**Sustainable Engineering Solutions:** Develop and apply engineering solutions for solving contemporary social and human issues with realistic constraints through modern tools.
PEO 3	**Interpersonal and Ethical Proficiency:** Exhibit professional and ethical standards, effective communication skills, teamwork spirit and multidisciplinary approach for successful careers in Indian and Multinational companies and to engage in lifelong learning.

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

Program Outcomes (POs)	
PO1	**Engineering Graduates will be able to:** **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
Program Specific Outcomes (PSOs)	
PSO1	**Proficiency in Core:** Realize the generation, transmission, distribution and utilization of electrical power.
PSO2	**Professional Skill:** Formulate the testing procedures needed to make the measurements of electrical and electromagnetic quantities and to provide solutions to the real time problems.

KSR College of Engineering	K.S.R. COLLEGE OF ENGINEERING (Autonomous) (Approved by AICTE & Affiliated to Anna University) K.S.R. Kalvi Nagar, Tiruchengode - 637 215	CURRICULUM UG R - 2020
Department	Electrical and Electronics Engineering	
Programme	B.E - Electrical and Electronics Engineering	

SEMESTER - I

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EN151	Technical English – I (Common to all Branches)	HSMC	3	0	0	3	30	70	100
2.	20MA151	Engineering Mathematics – I (Common to all Branches)	BSC	3	1	0	4	30	70	100
3.	20PH051	Engineering Physics (Common to all Branches)	BSC	3	0	0	3	30	70	100
4.	20CS141	Programming for Problem Solving	ESC	3	0	0	3	30	70	100
MANDATORY COURSES										
5.	20MC151	Induction Programme* (Common to all Branches)	MC	-	-	-	-	-	-	-
6.	20MC052	Environmental Science and Engineering (Common to all Branches)	MC	3	0	0	0	-	-	-
PRACTICAL										
7.	20PH028	Physics Laboratory (Common to all Branches)	BSC	0	0	2	1	50	50	100
8.	20AU127	Engineering Graphics Laboratory (Common to CE, CS, EC, EE & IT)	ESC	0	0	3	1	50	50	100
9.	20CS127	Programming for Problem Solving Laboratory	ESC	0	0	3	1	50	50	100
			Total	**14**	**1**	**9**	**16**	**700**		

*Induction program 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	Total
THEORY										
1.	20EN251	Technical English – II (Common to all Branches)	HSMC	3	0	0	3	30	70	100
2.	20MA242	Applied Mathematics (Common to EC & EE)	BSC	3	1	0	4	30	70	100
3.	20CH051	Engineering Chemistry (Common to all Branches)	BSC	3	0	0	3	30	70	100
4.	20CS241	Python Programming (Common to AU, CE, EE, EC, ME & SF)	ESC	3	0	0	3	30	70	100
5.	20EE211	Electric Circuit Analysis	PCC	3	1	0	4	30	70	100
PRACTICAL										
6.	20CH028	Chemistry Laboratory (Common to all Branches)	BSC	0	0	2	1	50	50	100
7.	20CS227	Python Programming Laboratory (Common to AU, CE, EE, EC, ME & SF)	ESC	0	0	3	1	50	50	100
8.	20GE028	Manufacturing Practices Laboratory (Common to all Branches)	ESC	0	0	3	1	50	50	100
9.	20EE221	Electric Circuit Analysis Laboratory	PCC	0	0	3	1	50	50	100
			Total	**14**	**2**	**12**	**21**	**900**		

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Department	Electrical and Electronics Engineering	
Programme	B.E - Electrical and Electronics Engineering	

SEMESTER - III

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20MA342	Differential Equations and Numerical Methods (Common to EC & EE)	BSC	3	1	0	4	30	70	100
2.	20EE311	Electro Magnetic Theory	PCC	3	1	0	4	30	70	100
3.	20EE312	Electrical Machines - I	PCC	3	0	0	3	30	70	100
4.	20EE313	Analog Electronics	PCC	3	0	0	3	30	70	100
5.	20EE314	Measurements and Instrumentation	PCC	3	0	0	3	30	70	100
6.	20CS331	Object Oriented Programming with C++	ESC	3	0	0	3	30	70	100
PRACTICAL										
7.	20EE321	Electrical Machines Laboratory - I	PCC	0	0	3	1	50	50	100
8.	20EE322	Analog Electronics Laboratory	PCC	0	0	3	1	50	50	100
9.	20CS325	Object Oriented Programming with C++ Laboratory	ESC	0	0	3	1	50	50	100
10.	20HR351	Career Development Skills – I (Common to all Branches)	EEC	0	2	0	0	50	50	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
THEORY										
1.	20EE411	Power Systems - I	PCC	3	0	0	3	30	70	100
2.	20EE412	Electrical Machines - II	PCC	3	0	0	3	30	70	100
3.	20EE413	Control Systems	PCC	3	1	0	4	30	70	100
4.	20EE414	Digital Electronics	PCC	3	0	0	3	30	70	100
5.	20CS432	Data structure and Algorithms	ESC	3	0	0	3	30	70	100
6.	20HS051	Universal Human values & Understanding Harmony (Common to all Branches)	HSMC	3	0	0	3	30	70	100
PRACTICAL										
7.	20EE421	Electrical Machines Laboratory - II	PCC	0	0	3	1	50	50	100
8.	20EE422	Digital Electronics Laboratory	PCC	0	0	3	1	50	50	100
9.	20EE423	Control and Instrumentation Laboratory	PCC	0	0	3	1	50	50	100
10.	20HR452	Career Development Skills – II	EEC	0	2	0	0	50	50	100
			Total	**18**	**3**	**9**	**22**	**1000**		

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Department	Electrical and Electronics Engineering	
Programme	B.E - Electrical and Electronics Engineering	

SEMESTER - V

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EE511	Power Systems – II	PCC	3	0	0	3	30	70	100
2.	20EE512	Signals and Systems	PCC	3	1	0	4	30	70	100
3.	20EE513	Power Electronics	PCC	3	0	0	3	30	70	100
4.	20EE514	Power System Protection and Switchgear	PCC	3	0	0	3	30	70	100
5.	20IE591	Augmented Intelligence led Managed Services (AIMS) – I (Common To CS, EC, EE & IT)	IE	3	0	0	3	30	70	100
6.	-	Professional Elective - I	PEC	3	0	0	3	30	70	100
PRACTICAL										
7.	20EE521	Power Systems Laboratory	PCC	0	0	3	1	50	50	100
8.	20EE522	Power Electronics Laboratory	PCC	0	0	3	1	50	50	100
9.	20HR553	Career Development Skills – III	EEC	0	2	0	0	50	50	100
			Total	**18**	**3**	**6**	**21**	**900**		

SEMESTER - VI

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EE611	Electrical Machine Design	PCC	3	1	0	4	30	70	100
2.	20EE612	Microprocessors and Microcontrollers	PCC	3	0	0	3	30	70	100
3.	20IE691	Augmented Intelligence led Managed Services (AIMS) – II (Common to CS, EC, EE and IT)	IE	3	0	0	3	30	70	100
4.	-	Professional Elective - II	PEC	3	0	0	3	30	70	100
5.	-	Open Elective – I	OEC	3	0	0	3	30	70	100
6.	20HS001	Principles of Management (Common to ALL Branch)	HSMC	3	0	0	3	30	70	100
PRACTICAL										
7.	20EE621	Microprocessors and Microcontrollers Laboratory	PCC	0	0	3	1	50	50	100
8.	20EE622	Electrical Estimation and Electronic Design Laboratory	PCC	0	0	3	1	50	50	100
9.	20HR654	Career Development Skills – IV	EEC	0	2	0	0	50	50	100
			Total	**18**	**3**	**6**	**21**	**900**		

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Department	Electrical and Electronics Engineering	
Programme	B.E - Electrical and Electronics Engineering	

SEMESTER - VII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EE711	Embedded Systems	PCC	3	0	0	3	30	70	100
2.	20EE712	Industrial Automation and Control	PCC	3	0	0	3	30	70	100
3.	20EE713	Soft Computing Techniques	PCC	3	0	0	3	30	70	100
4.	-	Professional Elective – III	PEC	3	0	0	3	30	70	100
5.	-	Professional Elective – IV	PEC	3	0	0	3	30	70	100
6.	-	Open Elective – II	OEC	3	0	0	3	30	70	100
PRACTICAL										
7.	20EE721	Embedded Systems Laboratory	PCC	0	0	3	1	50	50	100
8.	20EE722	Mini Project	PROJ	0	0	6	2	50	50	100
			Total	**18**	**0**	**9**	**21**	**800**		

SEMESTER - VIII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EE811	Energy Auditing and Management	PCC	3	0	0	3	30	70	100
2.	-	Professional Elective - V	PEC	3	0	0	3	30	70	100
3.	-	Professional Elective - VI	PEC	3	0	0	3	30	70	100
PRACTICAL										
4.	20EE821	Project Work & Dissertation	PROJ	0	0	12	6	50	50	100
			Total	**9**	**0**	**12**	**15**	**400**		

K.S.R. COLLEGE OF ENGINEERING: TIRUCHENGODE - 637 215
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
REGULATIONS 2020
LIST OF PROFESSIONAL ELECTIVE COURSES

PROFESSIONAL ELECTIVE - I (SEMESTER - V)

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE561	Power Plant Engineering	S2	PEC	3	0	0	3	30	70	100
2.	20EE562	Special Electrical Machines	S3	PEC	3	0	0	3	30	70	100
3.	20EE563	Advanced Control System	S3	PEC	3	0	0	3	30	70	100
4.	20EE564	Basic VLSI Design	S4	PEC	3	0	0	3	30	70	100
5.	20EE565	Virtual Instrumentation	S5	PEC	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVE - II (SEMESTER - VI)

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE661	Industrial Electronics	S1	PEC	3	0	0	3	30	70	100
2.	20EE662	Solid State Drives	S1	PEC	3	0	0	3	30	70	100
3.	20EE663	Power System Operation and Control	S2	PEC	3	0	0	3	30	70	100
4.	20EE664	High Voltage Engineering	S3	PEC	3	0	0	3	30	70	100
5.	20EE665	Digital Signal Processing	S4	PEC	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVE – III (SEMESTER - VII)

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE761	Power Electronics for Renewable Energy Sources	S1	PEC	3	0	0	3	30	70	100
2.	20EE762	Design and Installation of Solar and Wind Power Generation Systems	S2	PEC	3	0	0	3	30	70	100
3.	20EE763	High Voltage Direct Current Transmission	S2	PEC	3	0	0	3	30	70	100
4.	20EE764	Smart Grid Technology	S2	PEC	3	0	0	3	30	70	100
5.	20EE765	Fundamentals of Nano Technology	S4	PEC	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVE – IV (SEMESTER – VII)

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE766	Electric and Hybrid Vehicles	S1	PEC	3	0	0	3	30	70	100
2.	20EE767	Design of Power Converters	S1	PEC	3	0	0	3	30	70	100
3.	20EE768	Flexible AC Transmission Systems	S2	PEC	3	0	0	3	30	70	100
4.	20EE769	Biomass Energy Conversion Systems	S4	PEC	3	0	0	3	30	70	100
5.	20EE771	Microcontroller Based System Design	S5	PEC	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVE – V (SEMESTER - VIII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE861	Simulation of Power Electronic Systems	S1	PEC	3	0	0	3	30	70	100
2.	20EE862	Modulation Control for Power Converters	S1	PEC	3	0	0	3	30	70	100
3.	20EE863	Power Quality	S2	PEC	3	0	0	3	30	70	100
4.	20EE864	Robotics Engineering	S4	PEC	3	0	0	3	30	70	100
5.	20EE865	Digital Image Processing	S4	PEC	3	0	0	3	30	70	100
6.	20EE872	Electric Vehicle Architecture	S1	PEC	3	0	0	3	30	70	100
7.	20EE873	Testing of Electric Vehicles	S1	PEC	3	0	0	3	30	70	100
8.	20EE874	Grid Integration of Electric Vehicles	S1	PEC	3	0	0	3	30	70	100
9.	20EE875	Intelligent control of Electric Vehicles	S1	PEC	3	0	0	3	30	70	100
10.	20EE876	Embedded Control for Electric Drives	S5	PEC	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVE – VI (SEMESTER - VIII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE866	Batteries and Charging Management Systems	S1	PEC	3	0	0	3	30	70	100
2.	20EE867	Substation Engineering and Automation	S2	PEC	3	0	0	3	30	70	100
3.	20EE868	Electric Power Utilization and Conservation	S2	PEC	3	0	0	3	30	70	100
4.	20EE869	Digital Signal Processor and its Applications	S4	PEC	3	0	0	3	30	70	100
5.	20EE871	Computer Aided Design of Electrical Apparatus	S5	PEC	3	0	0	3	30	70	100
6.	20EE877	Smart System Automation	S5	PEC	3	0	0	3	30	70	100
7.	20EE878	Embedded System for Automotive Applications	S5	PEC	3	0	0	3	30	70	100
8.	20EE879	Industrial IoT	S5	PEC	3	0	0	3	30	70	100
9.	20EE881	Sensor Concepts and Techniques	S4	PEC	3	0	0	3	30	70	100

S1 – Power Electronics S2 – Power Systems S3 – Electrical Engineering

S4 – Electronics Engineering S5 – Embedded Systems

K.S.R. COLLEGE OF ENGINEERING: TIRUCHENGODE - 637 215
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
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	Total
Automobile Engineering											
1.	20AU901	Basics of Automobile Engineering	AE	OEC	3	0	0	3	30	70	100
2.	20AU902	Automotive Engine Technology	AE	OEC	3	0	0	3	30	70	100
3.	20AU903	Automotive Vehicle Technology	AE	OEC	3	0	0	3	30	70	100
4.	20AU904	Automotive Safety	AE	OEC	3	0	0	3	30	70	100
5.	20AU905	Hybrid Vehicles	AE	OEC	3	0	0	3	30	70	100
6.	20AU906	Off Highway Vehicles	AE	OEC	3	0	0	3	30	70	100
7.	20AU907	Modern and Intelligent Vehicle System	AE	OEC	3	0	0	3	30	70	100
8.	20AU908	Vehicle Maintenance	AE	OEC	3	0	0	3	30	70	100
Civil Engineering											
9.	20CE901	Architectural Heritage of India	CE	OEC	3	0	0	3	30	70	100
10.	20CE902	Building Planning and Construction	CE	OEC	3	0	0	3	30	70	100
11.	20CE903	Elementary Civil Engineering	CE	OEC	3	0	0	3	30	70	100
12.	20CE904	Energy and Environment	CE	OEC	3	0	0	3	30	70	100
13.	20CE905	Environmental Laws and Policies	CE	OEC	3	0	0	3	30	70	100
14.	20CE906	Global Warming and Climate Change	CE	OEC	3	0	0	3	30	70	100
15.	20CE907	Introduction to Disaster Management and Mitigation	CE	OEC	3	0	0	3	30	70	100
16.	20CE908	Introduction to Earthquake Engineering	CE	OEC	3	0	0	3	30	70	100
17.	20CE909	Solid Waste Management	CE	OEC	3	0	0	3	30	70	100
18.	20CE910	Water and Air Pollution Management	CE	OEC	3	0	0	3	30	70	100
Computer Science and Engineering											
19.	20CS901	Programming in Java	CSE	OEC	3	0	0	3	30	70	100
20.	20CS902	Basic concepts of Data Structure	CSE	OEC	3	0	0	3	30	70	100
21.	20CS903	Fundamentals of Database Concepts	CSE	OEC	3	0	0	3	30	70	100
22.	20CS904	Internet Programming	CSE	OEC	3	0	0	3	30	70	100
23.	20CS905	Fundamentals of Mobile Application Development	CSE	OEC	3	0	0	3	30	70	100
24.	20CS906	Principles of Ethical Hacking	CSE	OEC	3	0	0	3	30	70	100
25.	20CS907	Green Technology	CSE	OEC	3	0	0	3	30	70	100
26.	20CS908	Artificial Intelligence and Robotics	CSE	OEC	3	0	0	3	30	70	100

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
27.	20CS909	Big Data and Analytics	CSE	OEC	3	0	0	3	30	70	100
28.	20CS910	Hardware and Trouble Shooting	CSE	OEC	3	0	0	3	30	70	100
Electronics and Communication Engineering											
29.	20EC901	Basics of Medical Electronics	EC	OEC	3	0	0	3	30	70	100
30.	20EC902	NANO Technology	EC	OEC	3	0	0	3	30	70	100
31.	20EC903	Electronics and Microprocessor	EC	OEC	3	0	0	3	30	70	100
32.	20EC904	Analog and Digital Communication	EC	OEC	3	0	0	3	30	70	100
33.	20EC905	Principles of Communication	EC	OEC	3	0	0	3	30	70	100
34.	20EC906	Fundamentals of Robotics	EC	OEC	3	0	0	3	30	70	100
35.	20EC907	Internet of Things Sensing and Actuator Devices	EC	OEC	3	0	0	3	30	70	100
36.	20EC908	Consumer Electronics	EC	OEC	3	0	0	3	30	70	100
Information Technology											
37.	20IT901	Data Science using R	IT	OEC	3	0	0	3	30	70	100
38.	20IT902	Principles of Cyber Security	IT	OEC	3	0	0	3	30	70	100
39.	20IT903	Fundamentals of Business Intelligence	IT	OEC	3	0	0	3	30	70	100
40.	20IT904	Blockchain Technologies	IT	OEC	3	0	0	3	30	70	100
41.	20IT905	Internet of Things and Applications	IT	OEC	3	0	0	3	30	70	100
42.	20IT906	Principles of Software Testing	IT	OEC	3	0	0	3	30	70	100
43.	20IT907	Foundation Skills in Logic Building	IT	OEC	3	0	0	3	30	70	100
44.	20IT908	Principles of Cloud Computing	IT	OEC	3	0	0	3	30	70	100
45.	20IT909	Open Source Technologies	IT	OEC	3	0	0	3	30	70	100
46.	20IT910	Principles of Software Engineering	IT	OEC	3	0	0	3	30	70	100
Mechanical Engineering											
47.	20ME901	Basic Mechanical Engineering	ME	OEC	3	0	0	3	30	70	100
48.	20ME902	Solar Energy Utilization	ME	OEC	3	0	0	3	30	70	100
49.	20ME903	Production Technology of Agricultural Machinery	ME	OEC	3	0	0	3	30	70	100
50.	20ME904	Selection of Materials	ME	OEC	3	0	0	3	30	70	100
51.	20ME905	Marine Vehicles	ME	OEC	3	0	0	3	30	70	100
52.	20ME906	Sensors and Transducers	ME	OEC	3	0	0	3	30	70	100
53.	20ME907	Energy Auditing	ME	OEC	3	0	0	3	30	70	100
54.	20ME908	Fiber Reinforced Plastics	ME	OEC	3	0	0	3	30	70	100
55.	20ME909	Lean Manufacturing	ME	OEC	3	0	0	3	30	70	100
56.	20ME910	Surface Engineering	ME	OEC	3	0	0	3	30	70	100
Safety and Fire Engineering											
57.	20SF901	Occupational Health and Hygiene	SF	OEC	3	0	0	3	30	70	100
58.	20SF902	Construction Safety	SF	OEC	3	0	0	3	30	70	100

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
59.	20SF903	Building Fire Safety	SF	OEC	3	0	0	3	30	70	100
60.	20SF904	Safety in Electrical Engineering	SF	OEC	3	0	0	3	30	70	100
61.	20SF905	Legal Aspects of Safety	SF	OEC	3	0	0	3	30	70	100
62.	20SF906	Safety in Industries	SF	OEC	3	0	0	3	30	70	100
63.	20SF907	Food Safety	SF	OEC	3	0	0	3	30	70	100
64.	20SF908	Safety Management and its Principles	SF	OEC	3	0	0	3	30	70	100
65.	20SF909	Safety in Automobile Engineering	SF	OEC	3	0	0	3	30	70	100
66.	20SF910	Safety in Transportation	SF	OEC	3	0	0	3	30	70	100
Science and Humanities											
67.	20SH901	Applications of Statistics	FYA	OEC	3	0	0	3	30	70	100
68.	20SH902	Combinatorics and Graph Theory	FYA	OEC	3	0	0	3	30	70	100
69.	20SH903	Optimization Techniques	FYA	OEC	3	0	0	3	30	70	100
70.	20SH904	Basic Military Education and Training	FYA	OEC	3	0	0	3	30	70	100
71.	20SH905	Professional Communication	FYA	OEC	3	0	0	3	30	70	100
72.	20SH906	Fundamentals of Nanoscience and Technology	FYA	OEC	3	0	0	3	30	70	100

Open Elective courses offered by Electrical and Electronics Engineering to other branches

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE901	Electrical Drives and Control	EE	OEC	3	0	0	3	30	70	100
2.	20EE902	Power Semiconductor Devices	EE	OEC	3	0	0	3	30	70	100
3.	20EE903	Electrical Power Generation Systems	EE	OEC	3	0	0	3	30	70	100
4.	20EE904	Control Engineering	EE	OEC	3	0	0	3	30	70	100
5.	20EE905	Industrial Automation	EE	OEC	3	0	0	3	30	70	100
6.	20EE906	Electrical Instruments and Measurements	EE	OEC	3	0	0	3	30	70	100
7.	20EE907	Energy Conservation and Management	EE	OEC	3	0	0	3	30	70	100
8.	20EE908	Electrical Wiring, Estimation and Costing	EE	OEC	3	0	0	3	30	70	100
9.	20EE909	Fundamentals of Electrical Machinery	EE	OEC	3	0	0	3	30	70	100
10.	20EE910	Principles of Soft Computing Techniques	EE	OEC	3	0	0	3	30	70	100
11.	20EE911	Embedded System Technology	EE	OEC	3	0	0	3	30	70	100

List of Value Added Courses

Sl. No.	Course Code	Course Name	Number of Hours	Offered by Internal / External
1	20EEV01	Control of Motors using Drives	15	External
2	20EEV02	Control Panel Wiring	15	External
3	20EEV03	Electrical CADD	15	External
4	20EEV04	MATLAB for Electrical Engineers	15	EEE / KSRCE
5	20EEV05	PCB Design & Fabrication	15	External
6	20EEV06	Electrical Safety Standards and Practices	15	EEE / KSRCE
7	20EEV07	Solar PV Systems: Design and Simulation	15	EEE / KSRCE
8	20EEV08	Installation of Security Systems	15	External
9	20EEV09	PLC Programming	15	EEE / KSRCE
10	20EEV10	Economics and Management for Engineers	15	External
11	20EEV11	Intellectual Property Rights (IPR)	15	External
12	20EEV12	Drone Technologies	15	External
13	20EEV13	Programming with Arduino Boards	15	EEE / KSRCE
14	20EEV14	Installation Maintenance & Repair of Electrical Equipment's	15	External

Course Component Summary

S. No.	Subject Area	Credits Per Semester								Credits Total	Percentage Credits
		I	II	III	IV	V	VI	VII	VIII		
1.	HSMC	3	3	-	3	-	3	-	-	12	7.5
2.	BSC	8	8	4	-	-	-	-	-	20	12.5
3.	ESC	5	5	4	3	-	-	-	-	17	10.6
4.	PCC	-	5	15	16	18	9	16	3	82	51.3
5.	PEC	-	-	-	-	-	3	3	6	12	7.5
6.	OEC	-	-	-	-	-	3	-	-	03	1.8
7.	IE	-	-	-	-	3	3	-	-	06	3.7
8.	PROJ	-	-	-	-	-	-	2	6	8	5.0
TOTAL		**16**	**21**	**23**	**22**	**21**	**21**	**21**	**15**	**160**	**100**

Total No. of Credits = 160

HSMC - Humanities and Social Sciences including Management courses
BSC - Basic Science Courses
ESC - Engineering Science Courses
PCC - Professional core courses
PEC- Professional Elective courses
OEC - Open Elective courses
IE - Industrial Electives
PROJ – Project

DEPARTMENT OF
ELECTRICAL AND ELECTRONICS ENGINEERING

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM & SYLLABI

Regulations 2020

(Applicable to candidates admitted in the Academic Year 2021-2022)

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

(Approved by AICTE, Accredited by NAAC with A++ Grade & Affiliated to Anna University)

K.S.R. Kalvi Nagar, Tiruchengode – 637 215

Namakkal (Dt), Tamilnadu, India

Email: info@ksrce.ac.in Website: www.ksrce.ac.in

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

(Autonomous)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

B.E. - Electrical and Electronics Engineering

(REGULATIONS 2020)

Vision of the Institution

IV	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.

Mission of the Institution

IM 1	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.
IM 2	To foster and maintain mutually beneficial partnership with global industries and Institutions through knowledge sharing, collaborative research and innovation.

Vision of the Department

DV	We envision a Department that leads in the field of Electrical and Electronics Engineering through education, training and research committed to influence the direction of the field and make a constructive contribution to society wherein the Department can thrive and grow.

Mission of the Department

DM 1	To create professionally competent and resourceful Electrical and Electronics Engineers.
DM 2	To promote excellence in teaching, pioneering research and innovation for a sustainable growth of the nation and enrichment of humanity.

Programme Educational Objectives (PEOs) : B.E. - Electrical and Electronics Engineering

The graduates of the programme will be able to	
PEO 1	**Employability and Higher studies:** Excel in professional career and/or higher education by acquiring knowledge in basic engineering, science and mathematics in Electrical and Electronics Engineering.
PEO 2	**Sustainable Engineering Solutions:** Develop and apply engineering solutions for solving contemporary social and human issues with realistic constraints through modern tools.
PEO 3	**Interpersonal and Ethical Proficiency:** Exhibit professional and ethical standards, effective communication skills, teamwork spirit and multidisciplinary approach for successful careers in Indian and Multinational companies and to engage in lifelong learning.

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

Program Outcomes (POs)	
PO1	**Engineering Graduates will be able to:** **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
Program Specific Outcomes (PSOs)	
PSO1	**Proficiency in Core:** Realize the generation, transmission, distribution and utilization of electrical power.
PSO2	**Professional Skill:** Formulate the testing procedures needed to make the measurements of electrical and electromagnetic quantities and to provide solutions to the real time problems.

	K.S.R. COLLEGE OF ENGINEERING (Autonomous) (Approved by AICTE & Affiliated to Anna University) K.S.R. Kalvi Nagar, Tiruchengode - 637 215	CURRICULUM UG R - 2020
Department	Electrical and Electronics Engineering	
Programme	B.E - Electrical and Electronics Engineering	

SEMESTER - I

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EN151	Technical English – I (Common to all Branches)	HSMC	3	0	0	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 all Branches)	BSC	3	0	0	3	40	60	100
4.	20CS141	Programming for Problem Solving	ESC	3	0	0	3	40	60	100
MANDATORY COURSES										
5.	20MC151	Induction Programme* (Common to all Branches)	MC	-	-	-	-	-	-	-
6.	20MC052	Environmental Science and Engineering (Common to all Branches)	MC	3	0	0	0	-	-	-
PRACTICAL										
7.	20PH028	Physics Laboratory (Common to all Branches)	BSC	0	0	2	1	60	40	100
8.	20AU127	Engineering Graphics Laboratory (Common to CE, CS, EC, EE & IT)	ESC	0	0	3	1	60	40	100
9.	20CS127	Programming for Problem Solving Laboratory	ESC	0	0	3	1	60	40	100
			Total	**14**	**1**	**9**	**16**	**700**		

*Induction program 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	Total
THEORY										
1.	20EN251	Technical English – II (Common to all Branches)	HSMC	3	0	0	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, EE, EC, ME & SF)	ESC	3	0	0	3	40	60	100
5.	20EE211	Electric Circuit Analysis	PCC	3	1	0	4	40	60	100
PRACTICAL										
6.	20CH028	Chemistry Laboratory (Common to all Branches)	BSC	0	0	2	1	60	40	100
7.	20CS227	Python Programming Laboratory (Common to AU, CE, EE, EC, ME & 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.	20EE221	Electric Circuit Analysis Laboratory	PCC	0	0	3	1	60	40	100
			Total	**14**	**2**	**12**	**21**	**900**		

	K.S.R. COLLEGE OF ENGINEERING (Autonomous) (Approved by AICTE & Affiliated to Anna University) K.S.R. Kalvi Nagar, Tiruchengode - 637 215	CURRICULUM UG R - 2020
Department	Electrical and Electronics Engineering	
Programme	B.E - Electrical and Electronics Engineering	

SEMESTER - III

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20MA342	Differential Equations and Numerical Methods (Common to EC & EE)	BSC	3	1	0	4	40	60	100
2.	20EE311	Electro Magnetic Theory	PCC	3	1	0	4	40	60	100
3.	20EE312	Electrical Machines - I	PCC	3	0	0	3	40	60	100
4.	20EE313	Analog Electronics	PCC	3	0	0	3	40	60	100
5.	20EE314	Measurements and Instrumentation	PCC	3	0	0	3	40	60	100
6.	20CS331	Object Oriented Programming with C++	ESC	3	0	0	3	40	60	100
PRACTICAL										
7.	20EE321	Electrical Machines Laboratory - I	PCC	0	0	3	1	60	40	100
8.	20EE322	Analog Electronics Laboratory	PCC	0	0	3	1	60	40	100
9.	20CS325	Object Oriented Programming with C++ Laboratory	ESC	0	0	3	1	60	40	100
10.	20HR351	Career Development Skills – 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
THEORY										
1.	20EE411	Power Systems - I	PCC	3	0	0	3	40	60	100
2.	20EE412	Electrical Machines - II	PCC	3	0	0	3	40	60	100
3.	20EE413	Control Systems	PCC	3	1	0	4	40	60	100
4.	20EE414	Digital Electronics	PCC	3	0	0	3	40	60	100
5.	20CS432	Data structure and Algorithms	ESC	3	0	0	3	40	60	100
6.	20HS051	Universal Human values & Understanding Harmony (Common to all Branches)	HSMC	3	0	0	3	40	60	100
PRACTICAL										
7.	20EE421	Electrical Machines Laboratory - II	PCC	0	0	3	1	60	40	100
8.	20EE422	Digital Electronics Laboratory	PCC	0	0	3	1	60	40	100
9.	20EE423	Control and Instrumentation Laboratory	PCC	0	0	3	1	60	40	100
10.	20HR452	Career Development Skills – II	EEC	0	2	0	0	60	40	100
			Total	**18**	**3**	**9**	**22**	**1000**		

KSR College of Engineering	K.S.R. COLLEGE OF ENGINEERING (Autonomous) (Approved by AICTE & Affiliated to Anna University) K.S.R. Kalvi Nagar, Tiruchengode - 637 215	CURRICULUM UG R - 2020
Department	Electrical and Electronics Engineering	
Programme	B.E - Electrical and Electronics Engineering	

SEMESTER - V

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EE511	Power Systems – II	PCC	3	0	0	3	40	60	100
2.	20EE512	Signals and Systems	PCC	3	1	0	4	40	60	100
3.	20EE513	Power Electronics	PCC	3	0	0	3	40	60	100
4.	20EE514	Power System Protection and Switchgear	PCC	3	0	0	3	40	60	100
5.	20CS501	Artificial Intelligence (Common To EC & EE)	ESC	3	0	0	3	40	60	100
6.	-	Professional Elective - I	PEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20EE521	Power Systems Laboratory	PCC	0	0	3	1	60	40	100
8.	20EE522	Power Electronics Laboratory	PCC	0	0	3	1	60	40	100
9.	20HR553	Career Development Skills – III	EEC	0	2	0	0	60	40	100
			Total	**18**	**3**	**6**	**21**	**900**		

SEMESTER - VI

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EE611	Electrical Machine Design	PCC	3	1	0	4	40	60	100
2.	20EE612	Microprocessors and Microcontrollers	PCC	3	0	0	3	40	60	100
3.	20CS602	Machine Learning (Common To EC & EE)	ESC	3	0	0	3	40	60	100
4.	-	Professional Elective - II	PEC	3	0	0	3	40	60	100
5.	-	Open Elective – I	OEC	3	0	0	3	40	60	100
6.	20HS001	Principles of Management (Common to ALL Branch)	HSMC	3	0	0	3	40	60	100
PRACTICAL										
7.	20EE621	Microprocessors and Microcontrollers Laboratory	PCC	0	0	3	1	60	40	100
8.	20EE622	Electrical Estimation and Electronic Design Laboratory	PCC	0	0	3	1	60	40	100
9.	20HR654	Career Development Skills – IV	EEC	0	2	0	0	60	40	100
			Total	**18**	**3**	**6**	**21**	**900**		

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Department	Electrical and Electronics Engineering	
Programme	B.E - Electrical and Electronics Engineering	

SEMESTER - VII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EE711	Embedded Systems	PCC	3	0	0	3	40	60	100
2.	20EE712	Industrial Automation and Control	PCC	3	0	0	3	40	60	100
3.	20EE713	Soft Computing Techniques	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
PRACTICAL										
7.	20EE721	Embedded Systems Laboratory	PCC	0	0	3	1	60	40	100
8.	20EE722	Mini Project	PROJ	0	0	6	2	60	40	100
			Total	**18**	**0**	**9**	**21**	**800**		

SEMESTER - VIII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EE811	Energy Auditing and Management	PCC	3	0	0	3	40	60	100
2.	-	Professional Elective - V	PEC	3	0	0	3	40	60	100
3.	-	Professional Elective - VI	PEC	3	0	0	3	40	60	100
PRACTICAL										
4.	20EE821	Project Work & Dissertation	PROJ	0	0	12	6	60	40	100
			Total	**9**	**0**	**12**	**15**	**400**		

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

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

REGULATIONS 2020

LIST OF PROFESSIONAL ELECTIVE COURSES

PROFESSIONAL ELECTIVE - I (SEMESTER - V)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE561	Power Plant Engineering	S2	PEC	3	0	0	3	40	60	100
2.	20EE562	Special Electrical Machines	S3	PEC	3	0	0	3	40	60	100
3.	20EE563	Advanced Control System	S3	PEC	3	0	0	3	40	60	100
4.	20EE564	Basic VLSI Design	S4	PEC	3	0	0	3	40	60	100
5.	20EE565	Virtual Instrumentation	S5	PEC	3	0	0	3	40	60	100
6.	20IE591	Augmented Intelligence led Managed Services (AIMS) – I (Common To CS, EC, EE & IT)	S5	IE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE - II (SEMESTER - VI)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE661	Industrial Electronics	S1	PEC	3	0	0	3	40	60	100
2.	20EE662	Solid State Drives	S1	PEC	3	0	0	3	40	60	100
3.	20EE663	Power System Operation and Control	S2	PEC	3	0	0	3	40	60	100
4.	20EE664	High Voltage Engineering	S3	PEC	3	0	0	3	40	60	100
5.	20EE665	Digital Signal Processing	S4	PEC	3	0	0	3	40	60	100
6.	20IE691	Augmented Intelligence led Managed Services (AIMS) – II (Common to CS, EC, EE and IT)	S5	IE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – III (SEMESTER - VII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE761	Power Electronics for Renewable Energy Sources	S1	PEC	3	0	0	3	40	60	100
2.	20EE762	Design and Installation of Solar and Wind Power Generation Systems	S2	PEC	3	0	0	3	40	60	100
3.	20EE763	High Voltage Direct Current Transmission	S2	PEC	3	0	0	3	40	60	100
4.	20EE764	Smart Grid Technology	S2	PEC	3	0	0	3	40	60	100
5.	20EE765	Fundamentals of Nano Technology	S4	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – IV (SEMESTER – VII)											
Sl.No.	Course Code	Course Name	Speciali zation	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE766	Electric and Hybrid Vehicles	S1	PEC	3	0	0	3	40	60	100
2.	20EE767	Design of Power Converters	S1	PEC	3	0	0	3	40	60	100
3.	20EE768	Flexible AC Transmission Systems	S2	PEC	3	0	0	3	40	60	100
4.	20EE769	Biomass Energy Conversion Systems	S4	PEC	3	0	0	3	40	60	100
5.	20EE771	Microcontroller Based System Design	S5	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – V (SEMESTER - VIII)											
Sl.No.	Course Code	Course Name	Speciali zation	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	E S	Total
1.	20EE861	Simulation of Power Electronic Systems	S1	PEC	3	0	0	3	40	60	100
2.	20EE862	Modulation Control for Power Converters	S1	PEC	3	0	0	3	40	60	100
3.	20EE863	Power Quality	S2	PEC	3	0	0	3	40	60	100
4.	20EE864	Robotics Engineering	S4	PEC	3	0	0	3	40	60	100
5.	20EE865	Digital Image Processing	S4	PEC	3	0	0	3	40	60	100
6.	20EE872	Electric Vehicle Architecture	S1	PEC	3	0	0	3	40	60	100
7.	20EE873	Testing of Electric Vehicles	S1	PEC	3	0	0	3	40	60	100
8.	20EE874	Grid Integration of Electric Vehicles	S1	PEC	3	0	0	3	40	60	100
9.	20EE875	Intelligent control of Electric Vehicles	S1	PEC	3	0	0	3	40	60	100
10.	20EE876	Embedded Control for Electric Drives	S5	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – VI (SEMESTER - VIII)											
Sl.No.	Course Code	Course Name	Speciali zation	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE866	Batteries and Charging Management Systems	S1	PEC	3	0	0	3	40	60	100
2.	20EE867	Substation Engineering and Automation	S2	PEC	3	0	0	3	40	60	100
3.	20EE868	Electric Power Utilization and Conservation	S2	PEC	3	0	0	3	40	60	100
4.	20EE869	Digital Signal Processor and its Applications	S4	PEC	3	0	0	3	40	60	100
5.	20EE871	Computer Aided Design of Electrical Apparatus	S5	PEC	3	0	0	3	40	60	100
6.	20EE877	Smart System Automation	S5	PEC	3	0	0	3	40	60	100
7.	20EE878	Embedded System for Automotive Applications	S5	PEC	3	0	0	3	40	60	100
8.	20EE879	Industrial IoT	S5	PEC	3	0	0	3	40	60	100
9.	20EE881	Sensor Concepts and Techniques	S4	PEC	3	0	0	3	40	60	100

Vertical Courses

VERTICAL – I: ELECTRIC VEHICLE TECHNOLOGY											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE766	Electric and Hybrid Vehicles	S1	PEC	3	0	0	3	40	60	100
2.	20EE767	Design of Power Converters	S1	PEC	3	0	0	3	40	60	100
3.	20EE862	Modulation Control for Power Converters	S1	PEC	3	0	0	3	40	60	100
4.	20EE866	Batteries and Charging Management Systems	S1	PEC	3	0	0	3	40	60	100
5.	20EE872	Electric Vehicle Architecture	S1	PEC	3	0	0	3	40	60	100
6.	20EE873	Testing of Electric Vehicles	S1	PEC	3	0	0	3	40	60	100
7.	20EE874	Grid Integration of Electric Vehicles	S1	PEC	3	0	0	3	40	60	100
8.	20EE875	Intelligent control of Electric Vehicles	S1	PEC	3	0	0	3	40	60	100

VERTICAL – II: EMBEDDED SYSTEMS AND IOT											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE564	Basic VLSI Design	S4	PEC	3	0	0	3	40	60	100
2.	20EE771	Microcontroller Based System Design	S5	PEC	3	0	0	3	40	60	100
3.	20EE864	Robotics Engineering	S4	PEC	3	0	0	3	40	60	100
4.	20EE876	Embedded Control for Electric Drives	S5	PEC	3	0	0	3	40	60	100
5.	20EE877	Smart System Automation	S5	PEC	3	0	0	3	40	60	100
6.	20EE878	Embedded System for Automotive Applications	S5	PEC	3	0	0	3	40	60	100
7.	20EE879	Industrial IoT	S5	PEC	3	0	0	3	40	60	100
8.	20EE881	Sensor Concepts and Techniques	S4	PEC	3	0	0	3	40	60	100

S1 – Power Electronics S2 – Power Systems S3 – Electrical Engineering

S4 – Electronics Engineering S5 – Embedded Systems

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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	Total
Automobile Engineering											
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
Civil Engineering											
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
Computer Science and Engineering											
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	3	40	60	100

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week L	T	P	Credit C	Maximum Marks CA	ES	Total
28.	20CS910	Hardware and Trouble Shooting	CSE	OEC	3	0	0	3	40	60	100
		Electronics and Communication Engineering									
29.	20EC901	Basics of Medical Electronics	EC	OEC	3	0	0	3	40	60	100
30.	20EC902	NANO Technology	EC	OEC	3	0	0	3	40	60	100
31.	20EC903	Electronics and Microprocessor	EC	OEC	3	0	0	3	40	60	100
32.	20EC904	Analog and Digital Communication	EC	OEC	3	0	0	3	40	60	100
33.	20EC905	Principles of Communication	EC	OEC	3	0	0	3	40	60	100
34.	20EC906	Fundamentals of Robotics	EC	OEC	3	0	0	3	40	60	100
35.	20EC907	Internet of Things Sensing and Actuator Devices	EC	OEC	3	0	0	3	40	60	100
36.	20EC908	Consumer Electronics	EC	OEC	3	0	0	3	40	60	100
		Information Technology									
37.	20IT901	Data Science using R	IT	OEC	3	0	0	3	40	60	100
38.	20IT902	Principles of Cyber Security	IT	OEC	3	0	0	3	40	60	100
39.	20IT903	Fundamentals of Business Intelligence	IT	OEC	3	0	0	3	40	60	100
40.	20IT904	Blockchain Technologies	IT	OEC	3	0	0	3	40	60	100
41.	20IT905	Internet of Things and Applications	IT	OEC	3	0	0	3	40	60	100
42.	20IT906	Principles of Software Testing	IT	OEC	3	0	0	3	40	60	100
43.	20IT907	Foundation Skills in Logic Building	IT	OEC	3	0	0	3	40	60	100
44.	20IT908	Principles of Cloud Computing	IT	OEC	3	0	0	3	40	60	100
45.	20IT909	Open Source Technologies	IT	OEC	3	0	0	3	40	60	100
46.	20IT910	Principles of Software Engineering	IT	OEC	3	0	0	3	40	60	100
		Mechanical Engineering									
47.	20ME901	Basic Mechanical Engineering	ME	OEC	3	0	0	3	40	60	100
48.	20ME902	Solar Energy Utilization	ME	OEC	3	0	0	3	40	60	100
49.	20ME903	Production Technology of Agricultural Machinery	ME	OEC	3	0	0	3	40	60	100
50.	20ME904	Selection of Materials	ME	OEC	3	0	0	3	40	60	100
51.	20ME905	Marine Vehicles	ME	OEC	3	0	0	3	40	60	100
52.	20ME906	Sensors and Transducers	ME	OEC	3	0	0	3	40	60	100
53.	20ME907	Energy Auditing	ME	OEC	3	0	0	3	40	60	100
54.	20ME908	Fiber Reinforced Plastics	ME	OEC	3	0	0	3	40	60	100
55.	20ME909	Lean Manufacturing	ME	OEC	3	0	0	3	40	60	100
56.	20ME910	Surface Engineering	ME	OEC	3	0	0	3	40	60	100
		Safety and Fire Engineering									
57.	20SF901	Occupational Health and Hygiene	SF	OEC	3	0	0	3	40	60	100
58.	20SF902	Construction Safety	SF	OEC	3	0	0	3	40	60	100
59.	20SF903	Building Fire Safety	SF	OEC	3	0	0	3	40	60	100
60.	20SF904	Safety in Electrical Engineering	SF	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	Total
61.	20SF905	Legal Aspects of Safety	SF	OEC	3	0	0	3	40	60	100
62.	20SF906	Safety in Industries	SF	OEC	3	0	0	3	40	60	100
63.	20SF907	Food Safety	SF	OEC	3	0	0	3	40	60	100
64.	20SF908	Safety Management and its Principles	SF	OEC	3	0	0	3	40	60	100
65.	20SF909	Safety in Automobile Engineering	SF	OEC	3	0	0	3	40	60	100
66.	20SF910	Safety in Transportation	SF	OEC	3	0	0	3	40	60	100
Science and Humanities											
67.	20SH901	Applications of Statistics	FYA	OEC	3	0	0	3	40	60	100
68.	20SH902	Combinatorics and Graph Theory	FYA	OEC	3	0	0	3	40	60	100
69.	20SH903	Optimization Techniques	FYA	OEC	3	0	0	3	40	60	100
70.	20SH904	Basic Military Education and Training	FYA	OEC	3	0	0	3	40	60	100
71.	20SH905	Professional Communication	FYA	OEC	3	0	0	3	40	60	100
72.	20SH906	Fundamentals of Nanoscience and Technology	FYA	OEC	3	0	0	3	40	60	100

Open Elective courses offered by Electrical and Electronics Engineering to other branches

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE901	Electrical Drives and Control	EE	OEC	3	0	0	3	40	60	100
2.	20EE902	Power Semiconductor Devices	EE	OEC	3	0	0	3	40	60	100
3.	20EE903	Electrical Power Generation Systems	EE	OEC	3	0	0	3	40	60	100
4.	20EE904	Control Engineering	EE	OEC	3	0	0	3	40	60	100
5.	20EE905	Industrial Automation	EE	OEC	3	0	0	3	40	60	100
6.	20EE906	Electrical Instruments and Measurements	EE	OEC	3	0	0	3	40	60	100
7.	20EE907	Energy Conservation and Management	EE	OEC	3	0	0	3	40	60	100
8.	20EE908	Electrical Wiring, Estimation and Costing	EE	OEC	3	0	0	3	40	60	100
9.	20EE909	Fundamentals of Electrical Machinery	EE	OEC	3	0	0	3	40	60	100
10.	20EE910	Principles of Soft Computing Techniques	EE	OEC	3	0	0	3	40	60	100
11.	20EE911	Embedded System Technology	EE	OEC	3	0	0	3	40	60	100

List of Value Added Courses

Sl. No.	Course Code	Course Name	Number of Hours	Offered by Internal / External
1	20EEV01	Control of Motors using Drives	15	External
2	20EEV02	Control Panel Wiring	15	External
3	20EEV03	Electrical CADD	15	External
4	20EEV04	MATLAB for Electrical Engineers	15	EEE / KSRCE
5	20EEV05	PCB Design & Fabrication	15	External
6	20EEV06	Electrical Safety Standards and Practices	15	EEE / KSRCE
7	20EEV07	Solar PV Systems: Design and Simulation	15	EEE / KSRCE
8	20EEV08	Installation of Security Systems	15	External
9	20EEV09	PLC Programming	15	EEE / KSRCE
10	20EEV10	Economics and Management for Engineers	15	External
11	20EEV11	Intellectual Property Rights (IPR)	15	External
12	20EEV12	Drone Technologies	15	External
13	20EEV13	Programming with Arduino Boards	15	EEE / KSRCE
14	20EEV14	Installation Maintenance & Repair of Electrical Equipment's	15	External

Course Component Summary

S. No.	Subject Area	Credits Per Semester								Credits Total	Percentage Credits
		I	II	III	IV	V	VI	VII	VIII		
1.	HSMC	3	3	-	3	-	3	-	-	12	7.5
2.	BSC	8	8	4	-	-	-	-	-	20	12.5
3.	ESC	5	5	4	3	3	3	-	-	23	14.4
4.	PCC	-	5	15	16	15	9	10	3	73	45.6
5.	PEC	-	-	-	-	3	3	6	6	18	11.3
6.	OEC	-	-	-	-	-	3	3	-	06	3.7
7.	PROJ	-	-	-	-	-	-	2	6	8	5.0
TOTAL		**16**	**21**	**23**	**22**	**21**	**21**	**21**	**15**	**160**	**100**

Total No. of Credits = 160

HSMC - Humanities and Social Sciences including Management courses
BSC - Basic Science Courses
ESC - Engineering Science Courses
PCC - Professional core courses
PEC- Professional Elective courses
OEC - Open Elective courses
IE - Industrial Electives
PROJ – Project

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B.E./B.TECH. HONOURS (SPECIALIZATION IN THE SAME DISCIPLINE): VERTICALS

Emerging Areas: Electrical and Electronics Engineering

(i) B.E. Honours (Specialization in the same discipline)

a. The student should have earned additionally a minimum of 18 credits from a specified group of Professional Electives of the same programme.
b. Should have passed all the courses in the first attempt.
c. Should have earned a minimum of 7.50 CGPA.

(ii) B.E Honours

a. The students should have taken additional courses from more than one vertical of the same programme and earned a minimum of 18 credits.
b. Should have passed all the courses in the first attempt.
c. Should have earned a minimum of 7.50 CGPA.

(iii) B.E. minor in other specialization.

The student should have earned additionally a minimum of 18 credits in any one of the verticals of other B.E programmes.

- Out of these 18 credits, students can earn a maximum of 6 credits in online mode (SWAYAM platform), as approved by Centre for Academic Courses.
- B.E./ B. Tech. (Hons) Specialization in the same discipline, B.E / B.Tech. Honors and B.E./B.Tech. Minor in other specialization degree will be optional for students.
- For the categories (i) to (ii), the students shall be permitted to register for the courses from the V Semester onwards provided the students has earned a minimum CGPA 7.50 of until III Semester and has cleared all the courses in the first attempt.
- For the category (iii), the students will be permitted, to register the courses from Semester V onwards provided the marks earned by the students until Semester III is CGPA 7.50 and above.
- If a student decides not to opt for Honours, after completing certain number of additional courses, the additional courses studied shall be considered instead of the Professional Elective courses, which are part of the curriculum. If the student has studied more number of such courses than the number of Professional Elective courses required as per the curriculum, the courses with higher grades shall be considered for the calculation of CGPA. Remaining courses shall be printed in the mark sheet, however, they will not be considered for calculation of CGPA.

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V to VIII. These courses are listed in groups called verticals that represent a particular area of specialization / diversified group. The student should have earned additionally a minimum of 18 credits in any one of the verticals for obtaining B.E./B.Tech. Honours with specialization in the same disciplines.

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL – I: ELECTRIC VEHICLE TECHNOLOGY			VERTICAL – II: EMBEDDED SYSTEMS AND IOT		
S.No.	Course Code	Course Name	S.No.	Course Code	Course Name
1.	20EE766	Electric and Hybrid Vehicles	1.	20EE564	Basic VLSI Design
2.	20EE767	Design of Power Converters	2.	20EE771	Microcontroller Based System Design
3.	20EE862	Modulation Control for Power Converters	3.	20EE864	Robotics Engineering
4.	20EE866	Batteries and Charging Management Systems	4.	20EE876	Embedded Control for Electric Drives
5.	20EE872	Electric Vehicle Architecture	5.	20EE877	Smart System Automation
6.	20EE873	Testing of Electric Vehicles	6.	20EE878	Embedded System for Automotive Applications
7.	20EE874	Grid Integration of Electric Vehicles	7.	20EE879	Industrial IoT
8.	20EE875	Intelligent control of Electric Vehicles	8.	20EE881	Sensor Concepts and Techniques

DEPARTMENT OF
ELECTRICAL AND ELECTRONICS ENGINEERING

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM & SYLLABI

Regulations 2020

(Applicable to candidates admitted in the Academic Year 2022-2023)

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

(Approved by AICTE, Accredited by NAAC with A++ Grade & Affiliated to Anna University)

K.S.R. Kalvi Nagar, Tiruchengode – 637 215

Namakkal (Dt), Tamilnadu, India

Email: info@ksrce.ac.in Website: www.ksrce.ac.in

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

(Autonomous)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

B.E. - Electrical and Electronics Engineering

(REGULATIONS 2020)

Vision of the Institution

IV	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.

Mission of the Institution

IM 1	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.
IM 2	To foster and maintain mutually beneficial partnership with global industries and Institutions through knowledge sharing, collaborative research and innovation.

Vision of the Department

DV	We envision a Department that leads in the field of Electrical and Electronics Engineering through education, training and research committed to influence the direction of the field and make a constructive contribution to society wherein the Department can thrive and grow.

Mission of the Department

DM 1	To create professionally competent and resourceful Electrical and Electronics Engineers.
DM 2	To promote excellence in teaching, pioneering research and innovation for a sustainable growth of the nation and enrichment of humanity.

Programme Educational Objectives (PEOs) : B.E. - Electrical and Electronics Engineering

The graduates of the programme will be able to

PEO 1	**Employability and Higher studies:** Excel in professional career and/or higher education by acquiring knowledge in basic engineering, science and mathematics in Electrical and Electronics Engineering.
PEO 2	**Sustainable Engineering Solutions:** Develop and apply engineering solutions for solving contemporary social and human issues with realistic constraints through modern tools.
PEO 3	**Interpersonal and Ethical Proficiency:** Exhibit professional and ethical standards, effective communication skills, teamwork spirit and multidisciplinary approach for successful careers in Indian and Multinational companies and to engage in lifelong learning.

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

Program Outcomes (POs)	
PO1	**Engineering Graduates will be able to:** **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
Program Specific Outcomes (PSOs)	
PSO1	**Proficiency in Core:** Realize the generation, transmission, distribution and utilization of electrical power.
PSO2	**Professional Skill:** Formulate the testing procedures needed to make the measurements of electrical and electromagnetic quantities and to provide solutions to the real time problems.

KSR College of Engineering	K.S.R. COLLEGE OF ENGINEERING (Autonomous) (Approved by AICTE & Affiliated to Anna University) K.S.R. Kalvi Nagar, Tiruchengode - 637 215	CURRICULUM UG R - 2020
Department	Electrical and Electronics Engineering	
Programme	B.E - Electrical and Electronics Engineering	

SEMESTER - I

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EN151	Technical English – I (Common to all Branches)	HSMC	3	0	0	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 all Branches)	BSC	3	0	0	3	40	60	100
4.	20CS141	Programming for Problem Solving	ESC	3	0	0	3	40	60	100
MANDATORY COURSES										
5.	20MC151	Induction Programme* (Common to all Branches)	MC	-	-	-	-	-	-	-
6.	20MC052	Environmental Science and Engineering (Common to all Branches)	MC	3	0	0	0	-	-	-
PRACTICAL										
7.	20PH028	Physics Laboratory (Common to all Branches)	BSC	0	0	2	1	60	40	100
8.	20AU127	Engineering Graphics Laboratory (Common to CE, CS, EC, EE & IT)	ESC	0	0	3	1	60	40	100
9.	20CS127	Programming for Problem Solving Laboratory	ESC	0	0	3	1	60	40	100
			Total	**14**	**1**	**9**	**16**	**700**		

*Induction program 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	Total
THEORY										
1.	20GE051	Heritage of Tamils (Common to All branches)	HSMC	1	0	0	1	40	60	100
2.	20EN251	Technical English – II (Common to all Branches)	HSMC	3	0	0	3	40	60	100
3.	20MA242	Applied Mathematics (Common to EC & EE)	BSC	3	1	0	4	40	60	100
4.	20CH051	Engineering Chemistry (Common to all Branches)	BSC	3	0	0	3	40	60	100
5.	20CS241	Python Programming (Common to AU, CE, EE, EC, ME & SF)	ESC	3	0	0	3	40	60	100
6.	20EE211	Electric Circuit Analysis	PCC	3	1	0	4	40	60	100
PRACTICAL										
6.	20CH028	Chemistry Laboratory (Common to all Branches)	BSC	0	0	2	1	60	40	100
7.	20CS227	Python Programming Laboratory (Common to AU, CE, EE, EC, ME & 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.	20EE221	Electric Circuit Analysis Laboratory	PCC	0	0	3	1	60	40	100
			Total	**15**	**2**	**12**	**22**	**900**		

KSR College of Engineering	**K.S.R. COLLEGE OF ENGINEERING (Autonomous)** **(Approved by AICTE & Affiliated to Anna University)** **K.S.R. Kalvi Nagar, Tiruchengode - 637 215**	**CURRICULUM** **UG** **R - 2020**
Department	Electrical and Electronics Engineering	
Programme	B.E - Electrical and Electronics Engineering	

SEMESTER - III

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20GE052	Tamils and Technology (Common to All Branches)	HSMC	1	0	0	1	40	60	100
2.	20MA342	Differential Equations and Numerical Methods (Common to EC & EE)	BSC	3	1	0	4	40	60	100
3.	20EE311	Electro Magnetic Theory	PCC	3	1	0	4	40	60	100
4.	20EE312	Electrical Machines - I	PCC	3	0	0	3	40	60	100
5.	20EE313	Analog Electronics	PCC	3	0	0	3	40	60	100
6.	20EE314	Measurements and Instrumentation	PCC	3	0	0	3	40	60	100
7.	20CS331	Object Oriented Programming with C++	ESC	3	0	0	3	40	60	100
PRACTICAL										
8.	20EE321	Electrical Machines Laboratory - I	PCC	0	0	3	1	60	40	100
9.	20EE322	Analog Electronics Laboratory	PCC	0	0	3	1	60	40	100
10.	20CS325	Object Oriented Programming with C++ Laboratory	ESC	0	0	3	1	60	40	100
11.	20HR351	Career Development Skills – I (Common to all Branches)	EEC	0	2	0	0	60	40	100
			Total	**19**	**4**	**9**	**24**	**1100**		

SEMESTER - IV

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EE411	Power Systems - I	PCC	3	0	0	3	40	60	100
2.	20EE412	Electrical Machines - II	PCC	3	0	0	3	40	60	100
3.	20EE413	Control Systems	PCC	3	1	0	4	40	60	100
4.	20EE414	Digital Electronics	PCC	3	0	0	3	40	60	100
5.	20CS432	Data structure and Algorithms	ESC	3	0	0	3	40	60	100
6.	20HS051	Universal Human values & Understanding Harmony (Common to all Branches)	HSMC	3	0	0	3	40	60	100
PRACTICAL										
7.	20EE421	Electrical Machines Laboratory - II	PCC	0	0	3	1	60	40	100
8.	20EE422	Digital Electronics Laboratory	PCC	0	0	3	1	60	40	100
9.	20EE423	Control and Instrumentation Laboratory	PCC	0	0	3	1	60	40	100
10.	20HR452	Career Development Skills – II	EEC	0	2	0	0	60	40	100
			Total	**18**	**3**	**9**	**22**	**1000**		

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Department	Electrical and Electronics Engineering	
Programme	B.E - Electrical and Electronics Engineering	

SEMESTER - V

Sl.No.	Course Code	Course Name	Category	Hours/ Week L	T	P	Credit C	Maximum Marks CA	ES	Total
THEORY										
1.	20EE511	Power Systems – II	PCC	3	0	0	3	40	60	100
2.	20EE512	Signals and Systems	PCC	3	1	0	4	40	60	100
3.	20EE513	Power Electronics	PCC	3	0	0	3	40	60	100
4.	20EE514	Power System Protection and Switchgear	PCC	3	0	0	3	40	60	100
5.	20CS501	Artificial Intelligence (Common To EC & EE)	ESC	3	0	0	3	40	60	100
6.	-	Professional Elective - I	PEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20EE521	Power Systems Laboratory	PCC	0	0	3	1	60	40	100
8.	20EE522	Power Electronics Laboratory	PCC	0	0	3	1	60	40	100
9.	20HR553	Career Development Skills – III	EEC	0	2	0	0	60	40	100
			Total	**18**	**3**	**6**	**21**	**900**		

SEMESTER - VI

Sl.No.	Course Code	Course Name	Category	Hours/ Week L	T	P	Credit C	Maximum Marks CA	ES	Total
THEORY										
1.	20EE611	Electrical Machine Design	PCC	3	1	0	4	40	60	100
2.	20EE612	Microprocessors and Microcontrollers	PCC	3	0	0	3	40	60	100
3.	20CS602	Machine Learning (Common To EC & EE)	ESC	3	0	0	3	40	60	100
4.	-	Professional Elective - II	PEC	3	0	0	3	40	60	100
5.	-	Open Elective – I	OEC	3	0	0	3	40	60	100
6.	20HS001	Principles of Management (Common to ALL Branch)	HSMC	3	0	0	3	40	60	100
PRACTICAL										
7.	20EE621	Microprocessors and Microcontrollers Laboratory	PCC	0	0	3	1	60	40	100
8.	20EE622	Electrical Estimation and Electronic Design Laboratory	PCC	0	0	3	1	60	40	100
9.	20HR654	Career Development Skills – IV	EEC	0	2	0	0	60	40	100
			Total	**18**	**3**	**6**	**21**	**900**		

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Department	Electrical and Electronics Engineering	
Programme	B.E - Electrical and Electronics Engineering	

SEMESTER - VII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EE711	Embedded Systems	PCC	3	0	0	3	40	60	100
2.	20EE712	Industrial Automation and Control	PCC	3	0	0	3	40	60	100
3.	20EE713	Soft Computing Techniques	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
PRACTICAL										
7.	20EE721	Embedded Systems Laboratory	PCC	0	0	3	1	60	40	100
8.	20EE722	Mini Project	PROJ	0	0	6	2	60	40	100
			Total	**18**	**0**	**9**	**21**	**800**		

SEMESTER - VIII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EE811	Energy Auditing and Management	PCC	3	0	0	3	40	60	100
2.	-	Professional Elective - V	PEC	3	0	0	3	40	60	100
3.	-	Professional Elective - VI	PEC	3	0	0	3	40	60	100
PRACTICAL										
4.	20EE821	Project Work & Dissertation	PROJ	0	0	12	6	60	40	200
			Total	**9**	**0**	**12**	**15**	**500**		

K.S.R. COLLEGE OF ENGINEERING: TIRUCHENGODE - 637 215
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
REGULATIONS 2020
LIST OF PROFESSIONAL ELECTIVE COURSES

PROFESSIONAL ELECTIVE - I (SEMESTER - V)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE561	Power Plant Engineering	S2	PEC	3	0	0	3	40	60	100
2.	20EE562	Special Electrical Machines	S3	PEC	3	0	0	3	40	60	100
3.	20EE563	Advanced Control System	S3	PEC	3	0	0	3	40	60	100
4.	20EE564	Basic VLSI Design	S4	PEC	3	0	0	3	40	60	100
5.	20EE565	Virtual Instrumentation	S5	PEC	3	0	0	3	40	60	100
6.	20IE591	Augmented Intelligence led Managed Services (AIMS) – I (Common To CS, EC, EE & IT)	S5	IE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE - II (SEMESTER - VI)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE661	Industrial Electronics	S1	PEC	3	0	0	3	40	60	100
2.	20EE662	Solid State Drives	S1	PEC	3	0	0	3	40	60	100
3.	20EE663	Power System Operation and Control	S2	PEC	3	0	0	3	40	60	100
4.	20EE664	High Voltage Engineering	S3	PEC	3	0	0	3	40	60	100
5.	20EE665	Digital Signal Processing	S4	PEC	3	0	0	3	40	60	100
6.	20IE691	Augmented Intelligence led Managed Services (AIMS) – II (Common to CS, EC, EE and IT)	S5	IE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – III (SEMESTER - VII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE761	Power Electronics for Renewable Energy Sources	S1	PEC	3	0	0	3	40	60	100
2.	20EE762	Design and Installation of Solar and Wind Power Generation Systems	S2	PEC	3	0	0	3	40	60	100
3.	20EE763	High Voltage Direct Current Transmission	S2	PEC	3	0	0	3	40	60	100
4.	20EE764	Smart Grid Technology	S2	PEC	3	0	0	3	40	60	100
5.	20EE765	Fundamentals of Nano Technology	S4	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – IV (SEMESTER – VII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE766	Electric and Hybrid Vehicles	S1	PEC	3	0	0	3	40	60	100
2.	20EE767	Design of Power Converters	S1	PEC	3	0	0	3	40	60	100
3.	20EE768	Flexible AC Transmission Systems	S2	PEC	3	0	0	3	40	60	100
4.	20EE769	Biomass Energy Conversion Systems	S4	PEC	3	0	0	3	40	60	100
5.	20EE771	Microcontroller Based System Design	S5	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – V (SEMESTER - VIII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE861	Simulation of Power Electronic Systems	S1	PEC	3	0	0	3	40	60	100
2.	20EE862	Modulation Control for Power Converters	S1	PEC	3	0	0	3	40	60	100
3.	20EE863	Power Quality	S2	PEC	3	0	0	3	40	60	100
4.	20EE864	Robotics Engineering	S4	PEC	3	0	0	3	40	60	100
5.	20EE865	Digital Image Processing	S4	PEC	3	0	0	3	40	60	100
6.	20EE872	Electric Vehicle Architecture	S1	PEC	3	0	0	3	40	60	100
7.	20EE873	Testing of Electric Vehicles	S1	PEC	3	0	0	3	40	60	100
8.	20EE874	Grid Integration of Electric Vehicles	S1	PEC	3	0	0	3	40	60	100
9.	20EE875	Intelligent control of Electric Vehicles	S1	PEC	3	0	0	3	40	60	100
10.	20EE876	Embedded Control for Electric Drives	S5	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – VI (SEMESTER - VIII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE866	Batteries and Charging Management Systems	S1	PEC	3	0	0	3	40	60	100
2.	20EE867	Substation Engineering and Automation	S2	PEC	3	0	0	3	40	60	100
3.	20EE868	Electric Power Utilization and Conservation	S2	PEC	3	0	0	3	40	60	100
4.	20EE869	Digital Signal Processor and its Applications	S4	PEC	3	0	0	3	40	60	100
5.	20EE871	Computer Aided Design of Electrical Apparatus	S5	PEC	3	0	0	3	40	60	100
6.	20EE877	Smart System Automation	S5	PEC	3	0	0	3	40	60	100
7.	20EE878	Embedded System for Automotive Applications	S5	PEC	3	0	0	3	40	60	100
8.	20EE879	Industrial IoT	S5	PEC	3	0	0	3	40	60	100
9.	20EE881	Sensor Concepts and Techniques	S4	PEC	3	0	0	3	40	60	100

Vertical Courses

VERTICAL – I: ELECTRIC VEHICLE TECHNOLOGY											
Sl.No.	**Course Code**	**Course Name**	**Specialization**	**Category**	**Hours/ Week**			**Credit**	**Maximum Marks**		
					L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	20EE766	Electric and Hybrid Vehicles	S1	PEC	3	0	0	3	40	60	100
2.	20EE767	Design of Power Converters	S1	PEC	3	0	0	3	40	60	100
3.	20EE862	Modulation Control for Power Converters	S1	PEC	3	0	0	3	40	60	100
4.	20EE866	Batteries and Charging Management Systems	S1	PEC	3	0	0	3	40	60	100
5.	20EE872	Electric Vehicle Architecture	S1	PEC	3	0	0	3	40	60	100
6.	20EE873	Testing of Electric Vehicles	S1	PEC	3	0	0	3	40	60	100
7.	20EE874	Grid Integration of Electric Vehicles	S1	PEC	3	0	0	3	40	60	100
8.	20EE875	Intelligent control of Electric Vehicles	S1	PEC	3	0	0	3	40	60	100

VERTICAL – II: EMBEDDED SYSTEMS AND IOT											
Sl.No.	**Course Code**	**Course Name**	**Specialization**	**Category**	**Hours/ Week**			**Credit**	**Maximum Marks**		
					L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	20EE564	Basic VLSI Design	S4	PEC	3	0	0	3	40	60	100
2.	20EE771	Microcontroller Based System Design	S5	PEC	3	0	0	3	40	60	100
3.	20EE864	Robotics Engineering	S4	PEC	3	0	0	3	40	60	100
4.	20EE876	Embedded Control for Electric Drives	S5	PEC	3	0	0	3	40	60	100
5.	20EE877	Smart System Automation	S5	PEC	3	0	0	3	40	60	100
6.	20EE878	Embedded System for Automotive Applications	S5	PEC	3	0	0	3	40	60	100
7.	20EE879	Industrial IoT	S5	PEC	3	0	0	3	40	60	100
8.	20EE881	Sensor Concepts and Techniques	S4	PEC	3	0	0	3	40	60	100

K.S.R. COLLEGE OF ENGINEERING: TIRUCHENGODE - 637 215
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
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	Total
Automobile Engineering											
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
Civil Engineering											
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
Computer Science and Engineering											
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

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
27.	20CS909	Big Data and Analytics	CSE	OEC	3	0	0	3	40	60	100
28.	20CS910	Hardware and Trouble Shooting	CSE	OEC	3	0	0	3	40	60	100
Electronics and Communication Engineering											
29.	20EC901	Basics of Medical Electronics	EC	OEC	3	0	0	3	40	60	100
30.	20EC902	NANO Technology	EC	OEC	3	0	0	3	40	60	100
31.	20EC903	Electronics and Microprocessor	EC	OEC	3	0	0	3	40	60	100
32.	20EC904	Analog and Digital Communication	EC	OEC	3	0	0	3	40	60	100
33.	20EC905	Principles of Communication	EC	OEC	3	0	0	3	40	60	100
34.	20EC906	Fundamentals of Robotics	EC	OEC	3	0	0	3	40	60	100
35.	20EC907	Internet of Things Sensing and Actuator Devices	EC	OEC	3	0	0	3	40	60	100
36.	20EC908	Consumer Electronics	EC	OEC	3	0	0	3	40	60	100
Information Technology											
37.	20IT901	Data Science using R	IT	OEC	3	0	0	3	40	60	100
38.	20IT902	Principles of Cyber Security	IT	OEC	3	0	0	3	40	60	100
39.	20IT903	Fundamentals of Business Intelligence	IT	OEC	3	0	0	3	40	60	100
40.	20IT904	Blockchain Technologies	IT	OEC	3	0	0	3	40	60	100
41.	20IT905	Internet of Things and Applications	IT	OEC	3	0	0	3	40	60	100
42.	20IT906	Principles of Software Testing	IT	OEC	3	0	0	3	40	60	100
43.	20IT907	Foundation Skills in Logic Building	IT	OEC	3	0	0	3	40	60	100
44.	20IT908	Principles of Cloud Computing	IT	OEC	3	0	0	3	40	60	100
45.	20IT909	Open Source Technologies	IT	OEC	3	0	0	3	40	60	100
46.	20IT910	Principles of Software Engineering	IT	OEC	3	0	0	3	40	60	100
Mechanical Engineering											
47.	20ME901	Basic Mechanical Engineering	ME	OEC	3	0	0	3	40	60	100
48.	20ME902	Solar Energy Utilization	ME	OEC	3	0	0	3	40	60	100
49.	20ME903	Production Technology of Agricultural Machinery	ME	OEC	3	0	0	3	40	60	100
50.	20ME904	Selection of Materials	ME	OEC	3	0	0	3	40	60	100
51.	20ME905	Marine Vehicles	ME	OEC	3	0	0	3	40	60	100
52.	20ME906	Sensors and Transducers	ME	OEC	3	0	0	3	40	60	100
53.	20ME907	Energy Auditing	ME	OEC	3	0	0	3	40	60	100
54.	20ME908	Fiber Reinforced Plastics	ME	OEC	3	0	0	3	40	60	100
55.	20ME909	Lean Manufacturing	ME	OEC	3	0	0	3	40	60	100
56.	20ME910	Surface Engineering	ME	OEC	3	0	0	3	40	60	100
Safety and Fire Engineering											
57.	20SF901	Occupational Health and Hygiene	SF	OEC	3	0	0	3	40	60	100
58.	20SF902	Construction Safety	SF	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	Total
59.	20SF903	Building Fire Safety	SF	OEC	3	0	0	3	40	60	100
60.	20SF904	Safety in Electrical Engineering	SF	OEC	3	0	0	3	40	60	100
61.	20SF905	Legal Aspects of Safety	SF	OEC	3	0	0	3	40	60	100
62.	20SF906	Safety in Industries	SF	OEC	3	0	0	3	40	60	100
63.	20SF907	Food Safety	SF	OEC	3	0	0	3	40	60	100
64.	20SF908	Safety Management and its Principles	SF	OEC	3	0	0	3	40	60	100
65.	20SF909	Safety in Automobile Engineering	SF	OEC	3	0	0	3	40	60	100
66.	20SF910	Safety in Transportation	SF	OEC	3	0	0	3	40	60	100
Science and Humanities											
67.	20SH901	Applications of Statistics	FYA	OEC	3	0	0	3	40	60	100
68.	20SH902	Combinatorics and Graph Theory	FYA	OEC	3	0	0	3	40	60	100
69.	20SH903	Optimization Techniques	FYA	OEC	3	0	0	3	40	60	100
70.	20SH904	Basic Military Education and Training	FYA	OEC	3	0	0	3	40	60	100
71.	20SH905	Professional Communication	FYA	OEC	3	0	0	3	40	60	100
72.	20SH906	Fundamentals of Nanoscience and Technology	FYA	OEC	3	0	0	3	40	60	100

Open Elective courses offered by Electrical and Electronics Engineering to other branches

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE901	Electrical Drives and Control	EE	OEC	3	0	0	3	40	60	100
2.	20EE902	Power Semiconductor Devices	EE	OEC	3	0	0	3	40	60	100
3.	20EE903	Electrical Power Generation Systems	EE	OEC	3	0	0	3	40	60	100
4.	20EE904	Control Engineering	EE	OEC	3	0	0	3	40	60	100
5.	20EE905	Industrial Automation	EE	OEC	3	0	0	3	40	60	100
6.	20EE906	Electrical Instruments and Measurements	EE	OEC	3	0	0	3	40	60	100
7.	20EE907	Energy Conservation and Management	EE	OEC	3	0	0	3	40	60	100
8.	20EE908	Electrical Wiring, Estimation and Costing	EE	OEC	3	0	0	3	40	60	100
9.	20EE909	Fundamentals of Electrical Machinery	EE	OEC	3	0	0	3	40	60	100
10.	20EE910	Principles of Soft Computing Techniques	EE	OEC	3	0	0	3	40	60	100
11.	20EE911	Embedded System Technology	EE	OEC	3	0	0	3	40	60	100

List of Value Added Courses

Sl. No.	Course Code	Course Name	Number of Hours	Offered by Internal / External
1	20EEV01	Control of Motors using Drives	15	External
2	20EEV02	Control Panel Wiring	15	External
3	20EEV03	Electrical CADD	15	External
4	20EEV04	MATLAB for Electrical Engineers	15	EEE / KSRCE
5	20EEV05	PCB Design & Fabrication	15	External
6	20EEV06	Electrical Safety Standards and Practices	15	EEE / KSRCE
7	20EEV07	Solar PV Systems: Design and Simulation	15	EEE / KSRCE
8	20EEV08	Installation of Security Systems	15	External
9	20EEV09	PLC Programming	15	EEE / KSRCE
10	20EEV10	Economics and Management for Engineers	15	External
11	20EEV11	Intellectual Property Rights (IPR)	15	External
12	20EEV12	Drone Technologies	15	External
13	20EEV13	Programming with Arduino Boards	15	EEE / KSRCE
14	20EEV14	Installation Maintenance & Repair of Electrical Equipment's	15	External

Course Component Summary

S. No.	Subject Area	Credits Per Semester								Credits Total	Percentage Credits
		I	II	III	IV	V	VI	VII	VIII		
1.	HSMC	3	4	1	3	-	3	-	-	14	8.6
2.	BSC	8	8	4	-	-	-	-	-	20	12.3
3.	ESC	5	5	4	3	3	3	-	-	23	14.2
4.	PCC	-	5	15	16	15	9	10	3	73	45.1
5.	PEC	-	-	-	-	3	3	6	6	18	11.1
6.	OEC	-	-	-	-	-	3	3	-	06	3.7
7.	PROJ	-	-	-	-	-	-	2	6	8	4.9
TOTAL		**16**	**22**	**24**	**22**	**21**	**21**	**21**	**15**	**162**	**100**

Total No. of Credits = 162

HSMC - Humanities and Social Sciences including Management courses
BSC - Basic Science Courses
ESC - Engineering Science Courses
PCC - Professional core courses
PEC- Professional Elective courses
OEC - Open Elective courses
IE - Industrial Electives
PROJ – Project

K.S.R. COLLEGE OF ENGINEERING: TIRUCHENGODE - 637 215
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B.E./B.TECH. HONOURS (SPECIALIZATION IN THE SAME DISCIPLINE): VERTICALS

Emerging Areas: Electrical and Electronics Engineering

(i) B.E. Honours (Specialization in the same discipline)

a. The student should have earned additionally a minimum of 18 credits from a specified group of Professional Electives of the same programme.
b. Should have passed all the courses in the first attempt.
c. Should have earned a minimum of 7.50 CGPA.

(ii) B.E Honours

a. The students should have taken additional courses from more than one vertical of the same programme and earned a minimum of 18 credits.
b. Should have passed all the courses in the first attempt.
c. Should have earned a minimum of 7.50 CGPA.

(iii) B.E. minor in other specialization.

The student should have earned additionally a minimum of 18 credits in any one of the verticals of other B.E programmes.

- Out of these 18 credits, students can earn a maximum of 6 credits in online mode (SWAYAM platform), as approved by Centre for Academic Courses.
- B.E./ B. Tech. (Hons) Specialization in the same discipline, B.E / B.Tech. Honors and B.E./B.Tech. Minor in other specialization degree will be optional for students.
- For the categories (i) to (ii), the students shall be permitted to register for the courses from the V Semester onwards provided the students has earned a minimum CGPA 7.50 of until III Semester and has cleared all the courses in the first attempt.
- For the category (iii), the students will be permitted, to register the courses from Semester V onwards provided the marks earned by the students until Semester III is CGPA 7.50 and above.
- If a student decides not to opt for Honours, after completing certain number of additional courses, the additional courses studied shall be considered instead of the Professional Elective courses, which are part of the curriculum. If the student has studied more number of such courses than the number of Professional Elective courses required as per the curriculum, the courses with higher grades shall be considered for the calculation of CGPA. Remaining courses shall be printed in the mark sheet, however, they will not be considered for calculation of CGPA.

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V to VIII. These courses are listed in groups called verticals that represent a particular area of specialization / diversified group. The student should have earned additionally a minimum of 18 credits in any one of the verticals for obtaining B.E./B.Tech. Honours with specialization in the same disciplines.

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL – I: ELECTRIC VEHICLE TECHNOLOGY			VERTICAL – II: EMBEDDED SYSTEMS AND IOT		
S.No.	**Course Code**	**Course Name**	**S.No.**	**Course Code**	**Course Name**
1.	20EE766	Electric and Hybrid Vehicles	1.	20EE564	Basic VLSI Design
2.	20EE767	Design of Power Converters	2.	20EE771	Microcontroller Based System Design
3.	20EE862	Modulation Control for Power Converters	3.	20EE864	Robotics Engineering
4.	20EE866	Batteries and Charging Management Systems	4.	20EE876	Embedded Control for Electric Drives
5.	20EE872	Electric Vehicle Architecture	5.	20EE877	Smart System Automation
6.	20EE873	Testing of Electric Vehicles	6.	20EE878	Embedded System for Automotive Applications
7.	20EE874	Grid Integration of Electric Vehicles	7.	20EE879	Industrial IoT
8.	20EE875	Intelligent control of Electric Vehicles	8.	20EE881	Sensor Concepts and Techniques

DEPARTMENT OF
ELECTRICAL AND ELECTRONICS ENGINEERING

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM & SYLLABI

Regulations 2020

(Applicable to candidates admitted in the Academic Year 2023-2024)

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

(Approved by AICTE, Accredited by NAAC with A++ Grade & Affiliated to Anna University)

K.S.R. Kalvi Nagar, Tiruchengode – 637 215

Namakkal (Dt), Tamilnadu, India

Email: info@ksrce.ac.in Website: www.ksrce.ac.in

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

(Autonomous)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

B.E. - Electrical and Electronics Engineering

(REGULATIONS 2020)

Vision of the Institution

IV	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.

Mission of the Institution

IM 1	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.
IM 2	To foster and maintain mutually beneficial partnership with global industries and Institutions through knowledge sharing, collaborative research and innovation.

Vision of the Department

DV	We envision a Department that leads in the field of Electrical and Electronics Engineering through education, training and research committed to influence the direction of the field and make a constructive contribution to society wherein the Department can thrive and grow.

Mission of the Department

DM 1	To create professionally competent and resourceful Electrical and Electronics Engineers.
DM 2	To promote excellence in teaching, pioneering research and innovation for a sustainable growth of the nation and enrichment of humanity.

Programme Educational Objectives (PEOs): B.E. - Electrical and Electronics Engineering

The graduates of the programme will be able to	
PEO 1	**Employability and Higher studies:** Excel in professional career and/or higher education by acquiring knowledge in basic engineering, science and mathematics in Electrical and Electronics Engineering.
PEO 2	**Sustainable Engineering Solutions:** Develop and apply engineering solutions for solving contemporary social and human issues with realistic constraints through modern tools.
PEO 3	**Interpersonal and Ethical Proficiency:** Exhibit professional and ethical standards, effective communication skills, teamwork spirit and multidisciplinary approach for successful careers in Indian and Multinational companies and to engage in lifelong learning.

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

Program Outcomes (POs)	
PO1	**Engineering Graduates will be able to:** **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
Program Specific Outcomes (PSOs)	
PSO1	**Proficiency in Core:** Realize the generation, transmission, distribution and utilization of electrical power.
PSO2	**Professional Skill:** Formulate the testing procedures needed to make the measurements of electrical and electromagnetic quantities and to provide solutions to the real time problems.

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Department	Electrical and Electronics Engineering	
Programme	B.E - Electrical and Electronics Engineering	

SEMESTER - I

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20GE051	Heritage of Tamils (Common to All branches)	HSMC	1	0	0	1	40	60	100
2.	20EN151	Technical English – I (Common to all Branches)	HSMC	3	0	0	3	40	60	100
3.	20MA151	Engineering Mathematics – I (Common to all Branches)	BSC	3	1	0	4	40	60	100
4.	20PH051	Engineering Physics (Common to all Branches)	BSC	3	0	0	3	40	60	100
5.	20CS141	Programming for Problem Solving	ESC	3	0	0	3	40	60	100
MANDATORY COURSES										
6.	20MC151	Induction Programme* (Common to all Branches)	MC	-	-	-	-	-	-	-
7.	20MC052	Environmental Science and Engineering (Common to all Branches)	MC	3	0	0	0	-	-	-
PRACTICAL										
8.	20PH028	Physics Laboratory (Common to all Branches)	BSC	0	0	2	1	60	40	100
9.	20AU127	Engineering Graphics Laboratory (Common to CE, CS, EC, EE & IT)	ESC	0	0	3	1	60	40	100
10.	20CS127	Programming for Problem Solving Laboratory	ESC	0	0	3	1	60	40	100
			Total	**15**	**1**	**9**	**17**	**800**		

*Induction program 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	Total
THEORY										
1.	20GE052	Tamils and Technology (Common to All Branches)	HSMC	1	0	0	1	40	60	100
2.	20EN251	Technical English – II (Common to all Branches)	HSMC	3	0	0	3	40	60	100
3.	20MA242	Applied Mathematics (Common to EC & EE)	BSC	3	1	0	4	40	60	100
4.	20CH051	Engineering Chemistry (Common to all Branches)	BSC	3	0	0	3	40	60	100
5.	20CS241	Python Programming (Common to AU, CE, EE, EC, ME & SF)	ESC	3	0	0	3	40	60	100
6.	20EE211	Electric Circuit Analysis	PCC	3	1	0	4	40	60	100
PRACTICAL										
7.	20CH028	Chemistry Laboratory (Common to all Branches)	BSC	0	0	2	1	60	40	100
8.	20CS227	Python Programming Laboratory (Common to AU, CE, EE, EC, ME & SF)	ESC	0	0	3	1	60	40	100
9.	20GE028	Manufacturing Practices Laboratory (Common to all Branches)	ESC	0	0	3	1	60	40	100
10.	20EE221	Electric Circuit Analysis Laboratory	PCC	0	0	3	1	60	40	100
			Total	**15**	**2**	**12**	**22**	**1000**		

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Department	Electrical and Electronics Engineering	
Programme	B.E - Electrical and Electronics Engineering	

SEMESTER - III

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20MA342	Differential Equations and Numerical Methods (Common to EC & EE)	BSC	3	1	0	4	40	60	100
2.	20EE311	Electro Magnetic Theory	PCC	3	1	0	4	40	60	100
3.	20EE312	Electrical Machines - I	PCC	3	0	0	3	40	60	100
4.	20EE313	Analog Electronics	PCC	3	0	0	3	40	60	100
5.	20EE314	Measurements and Instrumentation	PCC	3	0	0	3	40	60	100
6.	20CS331	Object Oriented Programming with C++	ESC	3	0	0	3	40	60	100
PRACTICAL										
7.	20EE321	Electrical Machines Laboratory - I	PCC	0	0	3	1	60	40	100
8.	20EE322	Analog Electronics Laboratory	PCC	0	0	3	1	60	40	100
9.	20CS325	Object Oriented Programming with C++ Laboratory	ESC	0	0	3	1	60	40	100
10.	20HR351	Career Development Skills – 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
THEORY										
1.	20EE411	Power Systems - I	PCC	3	0	0	3	40	60	100
2.	20EE412	Electrical Machines - II	PCC	3	0	0	3	40	60	100
3.	20EE413	Control Systems	PCC	3	1	0	4	40	60	100
4.	20EE414	Digital Electronics	PCC	3	0	0	3	40	60	100
5.	20CS432	Data structure and Algorithms	ESC	3	0	0	3	40	60	100
6.	20HS051	Universal Human values & Understanding Harmony (Common to all Branches)	HSMC	3	0	0	3	40	60	100
PRACTICAL										
7.	20EE421	Electrical Machines Laboratory - II	PCC	0	0	3	1	60	40	100
8.	20EE422	Digital Electronics Laboratory	PCC	0	0	3	1	60	40	100
9.	20EE423	Control and Instrumentation Laboratory	PCC	0	0	3	1	60	40	100
10.	20HR452	Career Development Skills – II	EEC	0	2	0	0	60	40	100
Total				**18**	**3**	**9**	**22**	**1000**		

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SEMESTER - V

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EE511	Power Systems – II	PCC	3	0	0	3	40	60	100
2.	20EE512	Signals and Systems	PCC	3	1	0	4	40	60	100
3.	20EE513	Power Electronics	PCC	3	0	0	3	40	60	100
4.	20EE514	Power System Protection and Switchgear	PCC	3	0	0	3	40	60	100
5.	20CS501	Artificial Intelligence (Common to EC & EE)	ESC	3	0	0	3	40	60	100
6.	-	Professional Elective - I	PEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20EE521	Power Systems Laboratory	PCC	0	0	3	1	60	40	100
8.	20EE522	Power Electronics Laboratory	PCC	0	0	3	1	60	40	100
9.	20HR553	Career Development Skills – III	EEC	0	2	0	0	60	40	100
			Total	**18**	**3**	**6**	**21**	**900**		

SEMESTER - VI

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EE611	Electrical Machine Design	PCC	3	1	0	4	40	60	100
2.	20EE612	Microprocessors and Microcontrollers	PCC	3	0	0	3	40	60	100
3.	20CS602	Machine Learning (Common to EC & EE)	ESC	3	0	0	3	40	60	100
4.	-	Professional Elective - II	PEC	3	0	0	3	40	60	100
5.	-	Open Elective – I	OEC	3	0	0	3	40	60	100
6.	20HS001	Principles of Management (Common to ALL Branch)	HSMC	3	0	0	3	40	60	100
PRACTICAL										
7.	20EE621	Microprocessors and Microcontrollers Laboratory	PCC	0	0	3	1	60	40	100
8.	20EE622	Electrical Estimation and Electronics Design Laboratory	PCC	0	0	3	1	60	40	100
9.	20HR654	Career Development Skills – IV	EEC	0	2	0	0	60	40	100
Total				**18**	**3**	**6**	**21**	**900**		

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Programme	B.E - Electrical and Electronics Engineering

SEMESTER - VII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EE711	Embedded Systems	PCC	3	0	0	3	40	60	100
2.	20EE712	Industrial Automation and Control	PCC	3	0	0	3	40	60	100
3.	20EE713	Soft Computing Techniques	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
PRACTICAL										
7.	20EE721	Embedded Systems Laboratory	PCC	0	0	3	1	60	40	100
8.	20EE722	Mini Project	PROJ	0	0	6	2	60	40	100
			Total	**18**	**0**	**9**	**21**	**800**		

SEMESTER - VIII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EE811	Energy Auditing and Management	PCC	3	0	0	3	40	60	100
2.	-	Professional Elective - V	PEC	3	0	0	3	40	60	100
3.	-	Professional Elective - VI	PEC	3	0	0	3	40	60	100
PRACTICAL										
4.	20EE821	Project Work & Dissertation	PROJ	0	0	12	6	60	40	100
			Total	**9**	**0**	**12**	**15**	**400**		

K.S.R. COLLEGE OF ENGINEERING: TIRUCHENGODE - 637 215
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
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LIST OF PROFESSIONAL ELECTIVE COURSES

PROFESSIONAL ELECTIVE - I (SEMESTER - V)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE561	Power Plant Engineering	S2	PEC	3	0	0	3	40	60	100
2.	20EE562	Special Electrical Machines	S3	PEC	3	0	0	3	40	60	100
3.	20EE563	Advanced Control System	S3	PEC	3	0	0	3	40	60	100
4.	20EE564	Basic VLSI Design	S4	PEC	3	0	0	3	40	60	100
5.	20EE565	Virtual Instrumentation	S5	PEC	3	0	0	3	40	60	100
6.	20IE591	Augmented Intelligence led Managed Services (AIMS) – I (Common to CS, EC, EE & IT)	S5	IE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE - II (SEMESTER - VI)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE661	Industrial Electronics	S1	PEC	3	0	0	3	40	60	100
2.	20EE662	Solid State Drives	S1	PEC	3	0	0	3	40	60	100
3.	20EE663	Power System Operation and Control	S2	PEC	3	0	0	3	40	60	100
4.	20EE664	High Voltage Engineering	S3	PEC	3	0	0	3	40	60	100
5.	20EE665	Digital Signal Processing	S4	PEC	3	0	0	3	40	60	100
6.	20IE691	Augmented Intelligence led Managed Services (AIMS) – II (Common to CS, EC, EE and IT)	S5	IE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – III (SEMESTER - VII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE761	Power Electronics for Renewable Energy Sources	S1	PEC	3	0	0	3	40	60	100
2.	20EE762	Design and Installation of Solar and Wind Power Generation Systems	S2	PEC	3	0	0	3	40	60	100
3.	20EE763	High Voltage Direct Current Transmission	S2	PEC	3	0	0	3	40	60	100
4.	20EE764	Smart Grid Technology	S2	PEC	3	0	0	3	40	60	100
5.	20EE765	Fundamentals of Nano Technology	S4	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – IV (SEMESTER – VII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE766	Electric and Hybrid Vehicles	S1	PEC	3	0	0	3	40	60	100
2.	20EE767	Design of Power Converters	S1	PEC	3	0	0	3	40	60	100
3.	20EE768	Flexible AC Transmission Systems	S2	PEC	3	0	0	3	40	60	100
4.	20EE769	Biomass Energy Conversion Systems	S4	PEC	3	0	0	3	40	60	100
5.	20EE771	Microcontroller Based System Design	S5	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – V (SEMESTER - VIII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE861	Simulation of Power Electronic Systems	S1	PEC	3	0	0	3	40	60	100
2.	20EE862	Modulation Control for Power Converters	S1	PEC	3	0	0	3	40	60	100
3.	20EE863	Power Quality	S2	PEC	3	0	0	3	40	60	100
4.	20EE864	Robotics Engineering	S4	PEC	3	0	0	3	40	60	100
5.	20EE865	Digital Image Processing	S4	PEC	3	0	0	3	40	60	100
6.	20EE872	Electric Vehicle Architecture	S1	PEC	3	0	0	3	40	60	100
7.	20EE873	Testing of Electric Vehicles	S1	PEC	3	0	0	3	40	60	100
8.	20EE874	Grid Integration of Electric Vehicles	S1	PEC	3	0	0	3	40	60	100
9.	20EE875	Intelligent control of Electric Vehicles	S1	PEC	3	0	0	3	40	60	100
10.	20EE876	Embedded Control for Electric Drives	S5	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – VI (SEMESTER - VIII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE866	Batteries and Charging Management Systems	S1	PEC	3	0	0	3	40	60	100
2.	20EE867	Substation Engineering and Automation	S2	PEC	3	0	0	3	40	60	100
3.	20EE868	Electric Power Utilization and Conservation	S2	PEC	3	0	0	3	40	60	100
4.	20EE869	Digital Signal Processor and its Applications	S4	PEC	3	0	0	3	40	60	100
5.	20EE871	Computer Aided Design of Electrical Apparatus	S5	PEC	3	0	0	3	40	60	100
6.	20EE877	Smart System Automation	S5	PEC	3	0	0	3	40	60	100
7.	20EE878	Embedded System for Automotive Applications	S5	PEC	3	0	0	3	40	60	100
8.	20EE879	Industrial IoT	S5	PEC	3	0	0	3	40	60	100
9.	20EE881	Sensor Concepts and Techniques	S4	PEC	3	0	0	3	40	60	100

Vertical Courses

VERTICAL – I: ELECTRIC VEHICLE TECHNOLOGY											
Sl.No.	**Course Code**	**Course Name**	**Speciali zation**	**Category**	**Hours/ Week**			**Credit**	**Maximum Marks**		
					L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	20EE766	Electric and Hybrid Vehicles	S1	PEC	3	0	0	3	40	60	100
2.	20EE767	Design of Power Converters	S1	PEC	3	0	0	3	40	60	100
3.	20EE862	Modulation Control for Power Converters	S1	PEC	3	0	0	3	40	60	100
4.	20EE866	Batteries and Charging Management Systems	S1	PEC	3	0	0	3	40	60	100
5.	20EE872	Electric Vehicle Architecture	S1	PEC	3	0	0	3	40	60	100
6.	20EE873	Testing of Electric Vehicles	S1	PEC	3	0	0	3	40	60	100
7.	20EE874	Grid Integration of Electric Vehicles	S1	PEC	3	0	0	3	40	60	100
8.	20EE875	Intelligent control of Electric Vehicles	S1	PEC	3	0	0	3	40	60	100

VERTICAL – II: EMBEDDED SYSTEMS AND IOT											
Sl.No.	**Course Code**	**Course Name**	**Speciali zation**	**Category**	**Hours/ Week**			**Credit**	**Maximum Marks**		
					L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	20EE564	Basic VLSI Design	S4	PEC	3	0	0	3	40	60	100
2.	20EE771	Microcontroller Based System Design	S5	PEC	3	0	0	3	40	60	100
3.	20EE864	Robotics Engineering	S4	PEC	3	0	0	3	40	60	100
4.	20EE876	Embedded Control for Electric Drives	S5	PEC	3	0	0	3	40	60	100
5.	20EE877	Smart System Automation	S5	PEC	3	0	0	3	40	60	100
6.	20EE878	Embedded System for Automotive Applications	S5	PEC	3	0	0	3	40	60	100
7.	20EE879	Industrial IoT	S5	PEC	3	0	0	3	40	60	100
8.	20EE881	Sensor Concepts and Techniques	S4	PEC	3	0	0	3	40	60	100

S1 – Power Electronics S2 – Power Systems S3 – Electrical Engineering

S4 – Electronics Engineering S5 – Embedded Systems

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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	Total
Automobile Engineering											
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
Civil Engineering											
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
Computer Science and Engineering											
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

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
27.	20CS909	Big Data and Analytics	CSE	OEC	3	0	0	3	40	60	100
28.	20CS910	Hardware and Trouble Shooting	CSE	OEC	3	0	0	3	40	60	100
Electronics and Communication Engineering											
29.	20EC901	Basics of Medical Electronics	EC	OEC	3	0	0	3	40	60	100
30.	20EC902	NANO Technology	EC	OEC	3	0	0	3	40	60	100
31.	20EC903	Electronics and Microprocessor	EC	OEC	3	0	0	3	40	60	100
32.	20EC904	Analog and Digital Communication	EC	OEC	3	0	0	3	40	60	100
33.	20EC905	Principles of Communication	EC	OEC	3	0	0	3	40	60	100
34.	20EC906	Fundamentals of Robotics	EC	OEC	3	0	0	3	40	60	100
35.	20EC907	Internet of Things Sensing and Actuator Devices	EC	OEC	3	0	0	3	40	60	100
36.	20EC908	Consumer Electronics	EC	OEC	3	0	0	3	40	60	100
Information Technology											
37.	20IT901	Data Science using R	IT	OEC	3	0	0	3	40	60	100
38.	20IT902	Principles of Cyber Security	IT	OEC	3	0	0	3	40	60	100
39.	20IT903	Fundamentals of Business Intelligence	IT	OEC	3	0	0	3	40	60	100
40.	20IT904	Blockchain Technologies	IT	OEC	3	0	0	3	40	60	100
41.	20IT905	Internet of Things and Applications	IT	OEC	3	0	0	3	40	60	100
42.	20IT906	Principles of Software Testing	IT	OEC	3	0	0	3	40	60	100
43.	20IT907	Foundation Skills in Logic Building	IT	OEC	3	0	0	3	40	60	100
44.	20IT908	Principles of Cloud Computing	IT	OEC	3	0	0	3	40	60	100
45.	20IT909	Open Source Technologies	IT	OEC	3	0	0	3	40	60	100
46.	20IT910	Principles of Software Engineering	IT	OEC	3	0	0	3	40	60	100
Mechanical Engineering											
47.	20ME901	Basic Mechanical Engineering	ME	OEC	3	0	0	3	40	60	100
48.	20ME902	Solar Energy Utilization	ME	OEC	3	0	0	3	40	60	100
49.	20ME903	Production Technology of Agricultural Machinery	ME	OEC	3	0	0	3	40	60	100
50.	20ME904	Selection of Materials	ME	OEC	3	0	0	3	40	60	100
51.	20ME905	Marine Vehicles	ME	OEC	3	0	0	3	40	60	100
52.	20ME906	Sensors and Transducers	ME	OEC	3	0	0	3	40	60	100
53.	20ME907	Energy Auditing	ME	OEC	3	0	0	3	40	60	100
54.	20ME908	Fiber Reinforced Plastics	ME	OEC	3	0	0	3	40	60	100
55.	20ME909	Lean Manufacturing	ME	OEC	3	0	0	3	40	60	100
56.	20ME910	Surface Engineering	ME	OEC	3	0	0	3	40	60	100
Safety and Fire Engineering											
57.	20SF901	Occupational Health and Hygiene	SF	OEC	3	0	0	3	40	60	100
58.	20SF902	Construction Safety	SF	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	Total
59.	20SF903	Building Fire Safety	SF	OEC	3	0	0	3	40	60	100
60.	20SF904	Safety in Electrical Engineering	SF	OEC	3	0	0	3	40	60	100
61.	20SF905	Legal Aspects of Safety	SF	OEC	3	0	0	3	40	60	100
62.	20SF906	Safety in Industries	SF	OEC	3	0	0	3	40	60	100
63.	20SF907	Food Safety	SF	OEC	3	0	0	3	40	60	100
64.	20SF908	Safety Management and its Principles	SF	OEC	3	0	0	3	40	60	100
65.	20SF909	Safety in Automobile Engineering	SF	OEC	3	0	0	3	40	60	100
66.	20SF910	Safety in Transportation	SF	OEC	3	0	0	3	40	60	100
Science and Humanities											
67.	20SH901	Applications of Statistics	FYA	OEC	3	0	0	3	40	60	100
68.	20SH902	Combinatorics and Graph Theory	FYA	OEC	3	0	0	3	40	60	100
69.	20SH903	Optimization Techniques	FYA	OEC	3	0	0	3	40	60	100
70.	20SH904	Basic Military Education and Training	FYA	OEC	3	0	0	3	40	60	100
71.	20SH905	Professional Communication	FYA	OEC	3	0	0	3	40	60	100
72.	20SH906	Fundamentals of Nanoscience and Technology	FYA	OEC	3	0	0	3	40	60	100

Open Elective courses offered by Electrical and Electronics Engineering to other branches

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20EE901	Electrical Drives and Control	EE	OEC	3	0	0	3	40	60	100
2.	20EE902	Power Semiconductor Devices	EE	OEC	3	0	0	3	40	60	100
3.	20EE903	Electrical Power Generation Systems	EE	OEC	3	0	0	3	40	60	100
4.	20EE904	Control Engineering	EE	OEC	3	0	0	3	40	60	100
5.	20EE905	Industrial Automation	EE	OEC	3	0	0	3	40	60	100
6.	20EE906	Electrical Instruments and Measurements	EE	OEC	3	0	0	3	40	60	100
7.	20EE907	Energy Conservation and Management	EE	OEC	3	0	0	3	40	60	100
8.	20EE908	Electrical Wiring, Estimation and Costing	EE	OEC	3	0	0	3	40	60	100
9.	20EE909	Fundamentals of Electrical Machinery	EE	OEC	3	0	0	3	40	60	100
10.	20EE910	Principles of Soft Computing Techniques	EE	OEC	3	0	0	3	40	60	100
11.	20EE911	Embedded System Technology	EE	OEC	3	0	0	3	40	60	100

List of Value Added Courses

Sl. No.	Course Code	Course Name	Number of Hours	Offered by Internal / External
1	20EEV01	Control of Motors using Drives	15	External
2	20EEV02	Control Panel Wiring	15	External
3	20EEV03	Electrical CADD	15	External
4	20EEV04	MATLAB for Electrical Engineers	15	EEE / KSRCE
5	20EEV05	PCB Design & Fabrication	15	External
6	20EEV06	Electrical Safety Standards and Practices	15	EEE / KSRCE
7	20EEV07	Solar PV Systems: Design and Simulation	15	EEE / KSRCE
8	20EEV08	Installation of Security Systems	15	External
9	20EEV09	PLC Programming	15	EEE / KSRCE
10	20EEV10	Economics and Management for Engineers	15	External
11	20EEV11	Intellectual Property Rights (IPR)	15	External
12	20EEV12	Drone Technologies	15	External
13	20EEV13	Programming with Arduino Boards	15	EEE / KSRCE
14	20EEV14	Installation Maintenance & Repair of Electrical Equipment's	15	External

Course Component Summary

S. No.	Subject Area	Credits Per Semester								Credits Total	Percentage Credits
		I	II	III	IV	V	VI	VII	VIII		
1.	HSMC	4	4	-	3	-	3	-	-	14	8.6
2.	BSC	8	8	4	-	-	-	-	-	20	12.3
3.	ESC	5	5	4	3	3	3	-	-	23	14.2
4.	PCC	-	5	15	16	15	9	10	3	73	45.1
5.	PEC	-	-	-	-	3	3	6	6	18	11.1
6.	OEC	-	-	-	-	-	3	3	-	06	3.7
7.	PROJ	-	-	-	-	-	-	2	6	8	4.9
TOTAL		**17**	**22**	**23**	**22**	**21**	**21**	**21**	**15**	**162**	**100**

Total No. of Credits = 162

HSMC - Humanities and Social Sciences including Management courses
BSC - Basic Science Courses
ESC - Engineering Science Courses
PCC - Professional core courses
PEC- Professional Elective courses
OEC - Open Elective courses
IE - Industrial Electives
PROJ – Project

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B.E./B.TECH. HONOURS (SPECIALIZATION IN THE SAME DISCIPLINE): VERTICALS

Emerging Areas: Electrical and Electronics Engineering

(i) B.E. Honours (Specialization in the same discipline)

a. The student should have earned additionally a minimum of 18 credits from a specified group of Professional Electives of the same programme.
b. Should have passed all the courses in the first attempt.
c. Should have earned a minimum of 7.50 CGPA.

(ii) B.E Honours

a. The students should have taken additional courses from more than one vertical of the same programme and earned a minimum of 18 credits.
b. Should have passed all the courses in the first attempt.
c. Should have earned a minimum of 7.50 CGPA.

(iii) B.E. minor in other specialization.

The student should have earned additionally a minimum of 18 credits in any one of the verticals of other B.E programmes.

- Out of these 18 credits, students can earn a maximum of 6 credits in online mode (SWAYAM platform), as approved by Centre for Academic Courses.
- B.E./ B. Tech. (Hons) Specialization in the same discipline, B.E / B.Tech. Honors and B.E./B.Tech. Minor in other specialization degree will be optional for students.
- For the categories (i) to (ii), the students shall be permitted to register for the courses from the V Semester onwards provided the students has earned a minimum CGPA 7.50 of until III Semester and has cleared all the courses in the first attempt.
- For the category (iii), the students will be permitted, to register the courses from Semester V onwards provided the marks earned by the students until Semester III is CGPA 7.50 and above.
- If a student decides not to opt for Honours, after completing certain number of additional courses, the additional courses studied shall be considered instead of the Professional Elective courses, which are part of the curriculum. If the student has studied more number of such courses than the number of Professional Elective courses required as per the curriculum, the courses with higher grades shall be considered for the calculation of CGPA. Remaining courses shall be printed in the mark sheet, however, they will not be considered for calculation of CGPA.

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V to VIII. These courses are listed in groups called verticals that represent a particular area of specialization / diversified group. The student should have earned additionally a minimum of 18 credits in any one of the verticals for obtaining B.E./B.Tech. Honours with specialization in the same disciplines.

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL – I: ELECTRIC VEHICLE TECHNOLOGY			VERTICAL – II: EMBEDDED SYSTEMS AND IOT		
S.No.	**Course Code**	**Course Name**	**S.No.**	**Course Code**	**Course Name**
1.	20EE766	Electric and Hybrid Vehicles	1.	20EE564	Basic VLSI Design
2.	20EE767	Design of Power Converters	2.	20EE771	Microcontroller Based System Design
3.	20EE862	Modulation Control for Power Converters	3.	20EE864	Robotics Engineering
4.	20EE866	Batteries and Charging Management Systems	4.	20EE876	Embedded Control for Electric Drives
5.	20EE872	Electric Vehicle Architecture	5.	20EE877	Smart System Automation
6.	20EE873	Testing of Electric Vehicles	6.	20EE878	Embedded System for Automotive Applications
7.	20EE874	Grid Integration of Electric Vehicles	7.	20EE879	Industrial IoT
8.	20EE875	Intelligent control of Electric Vehicles	8.	20EE881	Sensor Concepts and Techniques

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SEMESTER - I

20GE051	HERITAGE OF TAMILS (Common to All branches)	L	T	P	C
		1	0	0	1

Prerequisite(s): *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:	*Recognize the extensive literature of Tamil and its classical nature.*	*Understand*
CO2:	*Apprehend the heritage of sculpture, painting and musical instruments of ancient people.*	*Understand*
CO3:	*Review on folk and martial arts of Tamil people.*	*Understand*
CO4:	*Insight thinai concepts, trade and victory of Chozha dynasty.*	*Understand*
CO5:	*Realize the contribution of Tamil in Indian freedom struggle, self-esteem movement and siddha medicine.*	*Understand*

UNIT – I LANGUAGE AND LITERATURE [03]

Language Families in India – Dravidian Languages – Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature – Management Principles in Thirukural – Tamil Epics and Impact of Buddhism & Jainism in Tamil Land – Bakthi Literature Azhwars and Nayanmars – Forms of minor Poetry – Development of Modern literature in Tamil – Contribution of Bharathiyar and Bharathidhasan.

UNIT – II HERITAGE-ROCK ART PAINTINGS TO MODERN ART-SCULPTURE [03]

Hero stone to modern sculpture – Bronze icons – Tribes and their handicrafts – Art of temple car making – Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments – Mridhangam, Parai, Veenai, Yazh and Nadhaswaram – Role of Temples in Social and Economic Life of Tamils.

UNIT – III FOLK AND MARTIAL ARTS [03]

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance – Sports and Games of Tamils.

UNIT – IV THINAI CONCEPT OF TAMILS [03]

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature – Aram Concept of Tamils – Education and Literacy during Sangam Age – Ancient Cities and Ports of Sangam Age – Export and Import during Sangam Age – Overseas Conquest of Cholas.

UNIT – V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE [03]

Contribution of Tamils to Indian Freedom Struggle – The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement – Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

Total (L= 15, T = 0) = 15 Periods

Text Books :

1 Dr.K.K.Pillay, Social Life of Tamils, a joint Publication of TNTB & ESC and RMRL.
2 Dr.S.V.Subatamanian, Dr.K.D.Thirunavukarasu, Historical Heritage of the Tamils, International Institute of Tamil Studies.

Reference Books :

1 Dr.S.Sigaravelu, Social Life of the Tamils – The Classical Period, International Institute of Tamil Studies.
2 Dr.M.Valarmathi, The Contribution of the Tamil to Indian Culture, International Institute of Tamil Studies.
3 Keeladi, Sangam City Civilization on the banks of river Vaigai, Department of Archaeology & Tamilnadu Text Book and Educational Services Corporation, Tamilnadu.
4 Dr.K.K.Pillay, Studies in the History of India with Special Reference to Tamilnadu.

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CO-PO MAPPING

Semester:	**I**	**Regulations:**	**R 2020**
Course Code:	**20GE051**	**Course Name:**	**Heritage of Tamils**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Recognize the extensive literature of Tamil and its classical nature.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO2:	*Apprehend the heritage of sculpture, painting and musical instruments of ancient people.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO3:	*Review on folk and martial arts of Tamil people.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO4:	*Insight thinai concepts, trade and victory of Chozha dynasty.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO5:	*Realize the contribution of Tamil in Indian freedom struggle, self-esteem movement and siddha medicine.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
	Average	-	-	-	-	-	-	**3**	**3**	**-**	**2**	**-**	**3**	-	**-**

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

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SEMESTER - I

20GE051	தமிழர்மரபு (அனைத்து துறைகளுக்கும் பொதுவானது)	L	T	P	C
		1	0	0	1

முன்கூட்டிய துறைசார் அறிவு : தேவை இல்லை

பாடம் கற்றத்தின் விளைவுகள்: பாடத்தை வெற்றிகரகமாக கற்று முடித்த பின்பு, மாணவர்களால் முடியும் விளைவுகள்		***அறிவாற்றல் நிலை***
CO1:	*தமிழ்மொழியின் செந்ததன்மை மற்றும் இலக்கியம் குறித்த தெரிதல்.*	*புரிதல்*
CO2:	*தமிழர்களின் சிற்பக்கலை , ஓவியக்கலை மற்றும் இசைக் கருவிகள் குறித்த தெளிவு.*	*புரிதல்*
CO3:	*தமிழர்களின் நாட்டுப் புரைக் கலைகள் மற்றும் வீரவிளையாட்டுகள் குறித்த தெளிவு.*	*புரிதல்*
CO4:	*தமிழர்களின் திணைக் கோட்பாடுகள், சங்ககாலவணிகம் மற்றும் சோழர்களின் வெற்றிகள் குறித்த தகவல்கள்.*	*புரிதல்*
CO5:	*இந்திய தேசிய இயக்கம், சுயமரியாதை இயக்கம் மற்றும் சித்த மருத்தவம் பற்றிய புரிதல்.*	*புரிதல்*

அலகு – I **மொழி மற்றும் இலக்கியம்** **[03]**

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலயக்கிகியங்கள் – சங்க இலக்கியத்தின் சமயச்சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ் காப்பியங்கள், தமிழகத்தில் சமணபௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலகியங்கள் தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கியவளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு – II **மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை** **[03]**

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனியில் திருவள்ளுவர் சிலை – இசை கருவிகள் – மிருதங்கம், பறை. வீணை. யாழ். நாதஸ்வரம் – தமிழர்களின் சமூகபொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு – III **நாட்டுப் புறக் கலைகள் மற்றும் வீர விளையாட்டுக்கள்** **[03]**

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவை**க்** கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு – IV **தமிழர்களின் திணைக் கோட்பாடுகள்** **[03]**

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

அலகு – V **இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு** **[03]**

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறபகுதிகளில் தமிழ் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித்தமருத்துவத்தின் பங்கு கல்வெட்டுகள் கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்கள்களின் அச்சு வரலாறு.

Total (L= 15, T = 0) = 15 Periods

Text Books:

1 கே.கே.பிள்ளை, தமிழகவரலாறு-மக்களும்பண்பாடும் (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியில் பணிகள் கழகம்) , உலகத் தமிழாராய்ச்சி நிறுவனம், சென்னை, 2002.

2 கணினித்தமிழ்முனைவர் இல. சுந்தரம், விகடன் பிரசுரம், 2016.

Reference Books:

1 கீழடி-வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம் (தொல்லியல் துறை வெளியீடு).

2 பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).

3 Dr.K.K.Pillay, Social Life of Tamils, a joint Publication of TNTB & ESC and RMRL – (in print).

4 Dr.S.Sigaravelu, Social Life of the Tamils, The Classical Period (Published by: International Institute of Tamil Studies).

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CO-PO MAPPING

Semester: I **Regulations:** R 2020

Course Code: 20GE051 **Course Name:** Heritage of Tamils

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*தமிழ் மொழியின் செந்ததன்மை மற்றும் இலக்கியம் குறித்ததெரிதல்.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO2:	*தமிழர்களின் சிற்பக்கலை, ஓவியக்கலை மற்றும் இசைக் கருவிகள் குறித்த தெளிவு.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO3:	*தமிழர்களின் நாட்டுப்புரைக் கலைகள் மற்றும் வீரவிளையாட்டுகள் குறித்த தெளிவு.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO4:	*தமிழர்களின் திணைக் கோட்பாடுகள், சங்ககால வணிகம் மற்றும் சோழர்களின் வெற்றிகள் குறித்த தகவல்கள்.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO5:	*இந்திய தேசிய இயக்கம், சுயமரியாதை இயக்கம் மற்றும் சித்த மருத்தவம் பற்றிய புரிதல்.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
Average		**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**-**	**3**	**-**	**-**

1. சிறிது (குறைந்த) 2. மிதமான (நடுத்தர) 3. கணிசமான (உயர்)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - I

		L	T	P	C
20EN151	**TECHNICAL ENGLISH – I** (Common To All Branches)	3	0	0	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 Newspaper – 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 Sumant, S, 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 Ashra Rizvi,M, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition,2005.
4 Kiranmani Dutt, P, A course in Communication Skills, Cambridge University Press, New Delhi, First Edition, 2014.

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CO-PO MAPPING

Semester	**I**	**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:	*Comprehend and apply Grammar in context for professional communication.*	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO2:	*Infer the gist and specific information.*	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO3:	*Discuss, express and interact in the society and place of study.*	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO4:	*Critically interpret and comprehend a given text.*	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO5:	*Prioritize the listening skills for academic and professional purposes.*	-	-	-	-	-	-	-	-	2	3	-	1	-	-
	Average	**-**	**-**	**-**	**-**	**-**		**-**	**-**	**2**	**3**	**-**	**1**	-	**-**

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

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SEMESTER – I

		L	T	P	C
20MA151	**ENGINEERING MATHEMATICS – I** (Common To All Branches)	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:	*Interpret the concepts of Matrix applications in the field of engineering.*	*Understand*
CO2:	*Acquire knowledge in solving ordinary differential equations.*	*Evaluate*
CO3:	*Extend and apply the concepts of differential calculus problems.*	*Apply*
CO4:	*Develop the skills in solving the functions of several variables.*	*Remember*
CO5:	*Apply the concepts and solving the Vector Calculus problems.*	*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 – Involutes and Evolutes.

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 parallelopiped only.

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

Text Books :

1 Ravish R. Singh and Mukul Bhatt, Engineering Mathematics – I, McGraw Hill Publications, New Delhi, Fourth Edition, 2016.

2 Grewal, B.S, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company, New Delhi, Forty Third Edition, 2015.

Reference Books :

1 Bali, N.P and Manish Goyal, Textbook on Engineering Mathematics, Laxmi Publications (p) Ltd., New Delhi, Seventh Edition, 2016.

2 Dass, H.K, Advance Engineering Mathematics, S. Chand and company, Eleventh Edition, 2015.

3 Jain, R.K, and Iyengar, S.R.K., Advanced Engineering Mathematics, Narosa Publications, Eighth Edition, 2012.

4 Narayanan, S and Manicavachagom Pillai. T.K. Calculas, Vol. I and Vol. II, S.Chand& Co., Sixth Edition, 2014.

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CO-PO MAPPING

Semester:	**I**	**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:	*Interpret the concepts of Matrix applications in the field of engineering.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2:	*Acquire knowledge in solving ordinary differential equations.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3:	*Extend and apply the concepts of differential calculus problems.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4:	*Develop the skills in solving the functions of several variables.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5:	*Apply the concepts and solving the Vector Calculus problems.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

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SEMESTER – I

		L	T	P	C
20PH051	**ENGINEERING PHYSICS** (Common To All Branches)	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 [09]

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 [09]

Introduction – Principle of Spontaneous emission and stimulated emission – Population inversion, pumping – Einstein's A and B coefficients (derivation). Types of lasers – Nd-YAG, CO_2 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 [09]

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 [09]

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 [09]

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 Avadhanulu, M.N, and Kshirsagar, P.G., A text book of Engineering Physics, S. Chand and Company, New Delhi, Seventh Edition, 2014.

2 Gaur, R.K., and Gupta,S.L, Engineering Physics, Dhanpat Rai Publication, New Delhi, Seventh Edition, 2014.

Reference Books :

1 Halliday, D., Resnick, R., and Walker, J, Fundamentals of Physics, John Wiley & Sons, USA, Ninth Edition, 2011.

2 Rajendran,V., Engineering Physics, Tata McGraw Hill, New Delhi, First Edition, 2011.

3 Serway, R.A. and Jewett,J. W., 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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CO-PO MAPPING

Semester:	**I**	**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:	*Describe the impact of engineering solutions in the constructional and designing environment.*	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO2:	*Categorize the types of laser and utilize it for specific application based on their desirable requisite.*	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO3:	*Utilize the conceived concepts and techniques for synthesizing novel crystals with enhanced multifunctional properties.*	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO4:	*Enumerate the preambles of quantum physics and implement its concepts to tackle the cumbersome engineering problems.*	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO5:	*Comprehend the fundamental ideas of optoelectronic materials and to fabricate it for the potential applications*	3	3	-	-	2	-	-	1	-	2	-	2	-	-
	Average	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**1**	**-**	**2**	**-**	**2**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – I

		L	T	P	C
20CS141	**PROGRAMMING FOR PROBLEM SOLVING**	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:	*Identify basics of computer and problem solving.*	*Understand*
CO2:	*Summarize the basics of C programming.*	*Understand*
CO3:	*Design and Implement C programs for arrays and strings.*	*Create*
CO4:	*Demonstrate efficient programs using functions and pointers.*	*Evaluate*
CO5:	*Implement simple C applications using structures, unions and file.*	*Apply*

UNIT - I BASICS OF COMPUTER AND PROBLEM SOLVING [09]

Generation and Classification of Computer – Organization of Digital Computer – Categories of Software – Software Development Life Cycle – Number System and Conversions – Representation of an Algorithm: Pseudo code, Flowchart with examples – Steps in Problem Solving – Problem Solving Strategies.

UNIT - II C PROGRAMMING BASICS [09]

Fundamentals – Structure of a C program – Compilation and Linking processes – Constants, Variables – Data Types – Operators – Expressions – Managing Input and Output operations – Decision Making and Branching – Looping statements – Simple Programs.

UNIT - III ARRAYS AND STRINGS [09]

Arrays: Introduction, One Dimensional Array, Declaration – Initialization of One Dimensional Array, Two-Dimensional Arrays, Initializing Two Dimensional Arrays – Simple Programs. String: Declaring and Initializing String Variables – String handling Functions and Operations.

UNIT - IV FUNCTIONS AND POINTERS [09]

Function: Declaration – Definition – Categories – Pass by Value – Pass by Reference – Recursion – Pointers: Definition – Initialization – Pointers arithmetic – Pointers to Pointers – Pointers and Arrays – Simple Programs.

UNIT - V STRUCTURES, UNIONS AND FILE [09]

Structures: Declaration – Definition – Structure within a structure – Union – Storage Classes – Preprocessor Directives – Files: Defining and Opening a file – Closing a file – Input/output operations on files – Command line arguments.

Total = 45 Periods

Text Books :

1 Herbert Schildt, C - The Complete Reference, Tata McGraw-Hill, New Delhi, Fourth Edition, 2013.

2 Dromey, R.G., How to Solve it by Computer, Pearson Education, India, First Edition, 2008.

References :

1 Ashok N.Kamathane, Computer Programming, Pearson Education, New Delhi, Second Edition, 2014.

2 Pradip Dey and Manas Ghosh, Fundamentals of Computing and Programming in C, First Edition, Oxford University Press, Bengaluru, 2013.

3 Balagurusamy,E., Programming in ANSI C, Tata McGraw-Hill, New Delhi, Sixth Edition, 2012.

4 Nptel.ac.in/courses/106104128/

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

Semester:	**I**	**Regulation:**	**R 2020**
Course Code:	**20CS141**	**Course Name:**	**Programming for Problem Solving**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Identify basics of computer and problem solving.*	3	3	1	3	1	-	-	-	1	-	-	1	-	-
CO2:	*Summarize the basics of C programming.*	3	3	1	3	2	-	-	-	1	-	-	1	-	-
CO3:	*Design and Implement C programs for arrays and strings.*	3	3	2	2	1	-	-	-	1	-	-	1	-	-
CO4:	*Demonstrate efficient programs using functions and pointers.*	3	2	2	2	2	-	-	-	1	-	-	1	-	-
CO5:	*Implement simple C applications using structures, unions and file.*	2	2	2	2	2	-	-	-	1	-	-	1	-	-
	Average	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R2020**

SEMESTER- I

		L	T	P	C
20MC151	**INDUCTION PROGRAMME** **(**Common To All Branches**)**	0	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 choose 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.

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

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – I

20MC052	**ENVIRONMENTAL SCIENCE AND ENGINEERING** (Common To All Branches)	L	T	P	C
		3	0	0	0

Prerequisite: NIL

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive level***
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** **[09]**

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** **[09]**

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** **[09]**

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** **[09]**

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** **[09]**

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 Arun Luiz, T., Environmental Science and Engineering, S. Chand & Company Private Limited, New Delhi, First Edition, 2016.

2 Anubha Kaushik, Kaushik, C.P., Environmental Science and Engineering, New Age International Publishers, Chennai, Fifth Edition, 2016.

Reference Books :

1 Tyler Miller, G., Scott E. Spoolman, Environmental Science, Cengage Learning India Private Limited, New Delhi, Fourteenth Edition, 2014.

2 Ravikrishnan, A., 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 Dara, S.S., A Text book of Environmental Chemistry and pollution control, S. Chand & Company Limited, New Delhi, Tenth Edition, 2005.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: I **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	*Interpret the importance in conservation of resources for future generation.*	3	2	2	-	-	3	3	2	-	-	-	1	-	-
CO2	*Relate the importance of ecosystem and biodiversity.*	3	2	2	-	-	3	3	2	-	-	-	1	-	-
CO3	*Analyze the impact of pollution and hazardous waste in a global and societal context.*	3	2	2	-	-	3	3	2	-	-	-	1	-	-
CO4	*Identify the contemporary issues that result in environmental degradation that would attempt to provide solutions to overcome the problems.*	3	2	2	-	-	3	3	2	-	-	-	1	-	-
CO5	*Predict the concept of Sustainability and Green Chemistry.*	3	2	2	-	-	3	3	2	-	-	-	1	-	-
Average		**3**	**2**	**2**	**-**	**-**	**3**	**3**	**2**	**-**	**-**	**-**	**1**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – I

		L	T	P	C
20PH028	**PHYSICS LABORATORY** (Common to All Branches)	0	0	2	1

Prerequisite: *NIL*

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive level***
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, Chennai, Tweleth Edition, 2017.

References :

1. Dr. G. Senthilkumar, Physics Lab manual, VRB Publications Pvt. Ltd., Chennai, Tenth Edition, 2006.
2. R Suresh and 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 ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester:	**I**	**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:	*Comprehend the different physical parameters of optics.*	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO2:	*Perceive the production of ultrasonic waves through inverse piezoelectric effect and to determine the velocity of sound waves in the given liquid*	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO3:	*Explore the principle of thermal conductivity thereby to calculate the thermal conductivity of various bad conductors like cardboard, mica, etc.*	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO4:	*Confer the experimental counterparts of materials properties such as modulus, solar cell, and energy gap.*	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO5:	*Imbibe the concept of capillary action in fluid dynamics and to compare the coefficient of viscosity of the given liquid.*	3	3	-	-	2	-	-	1	-	2	-	2	-	-
	Average	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**1**	**-**	**2**	**-**	**2**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - I

		L	T	P	C
20AU127	**ENGINEERING GRAPHICS LABORATORY** (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

CO PO MAPPING

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	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – I

		L	T	P	C
20CS127	**PROGRAMMING FOR PROBLEM SOLVING LABORATORY**	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:	*Be familiar with creating a table, flow chart, mail merge and apply text manipulation in a word document*	*Understand*
CO2:	*Design a spreadsheet for creating the charts and apply formulas and functions.*	*Evaluate*
CO3:	*Create power point presentation with animations and generate a report in MS access.*	*Create*
CO4:	*Apply good programming design methods for program development.*	*Apply*
CO5:	*Design and implement C programs for simple applications.*	*Evaluate*

List of Experiments:

1. Study and Identification of PC Motherboard and its interfacing components
2. Prepare a Bio-data using MS Word with appropriate page, text and table formatting options and send the same too many recipients using mail merge.
3. Prepare a mark sheet with five subjects for five students in MS Excel File using Formulas, Functions and charts.
4. 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.

Implement the following program using C

5. Generate Fibonacci series and compute factorial for a given number using looping statements. (While and do…while).
6. Consider the five subjects Physics, Chemistry, Biology, Mathematics and Computer. Calculate the average and grade according to following:

   Percentage >= 90%: Grade A

   Percentage >= 80%: Grade B

   Percentage >= 70%: Grade C

   Percentage >= 60%: Grade D

   Percentage >= 40%: Grade E

   Percentage < 40%: Grade F Using if … else & switch
7. Declare an array with N elements then delete given element from the array and display.
8. Maintain a record of ‘n’ employee details using an array of structures with four fields (Employee ID, Name, salary and designation). Assume appropriate data type for each field. Print the employee details.
9. Generate prime factors of an integer using functions.
10. Implement the following using pointer:

    i) Arithmetic operations ii) Swapping of two variables.

Total : 45 Periods

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: I **Regulation:** R 2020
Course Code: 20CS127 **Course Name:** Programming for Problem Solving Laboratory

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Be familiar with creating a table, flow chart, mail merge and apply text manipulation in a word document*	3	3	3	2	1	-	-	-	1	-	-	1	-	-
CO2:	*Design a spreadsheet for creating the charts and apply formulas and functions.*	3	3	2	2	2	-	-	-	1	-	-	1	-	-
CO3:	*Create power point presentation with animations and generate a report in MS access.*	3	3	2	1	2	-	-	-	1	-	-	1	-	-
CO4:	*Apply good programming design methods for program development.*	3	3	3	2	3	-	-	-	1	-	-	1	-	-
CO5:	*Design and implement C programs for simple applications.*	3	2	3	1	3	-	-	-	1	-	-	1	-	-
Average		**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – II

		L	T	P	C
20GE052	**TAMILS AND TECHNOLOGY** (Common to All Branches)	1	0	0	1

Prerequisite(s): *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:	*Understand the weaving and ceramic technology of ancient tamil people nature.*	*Understand*
CO2:	*Comprehend the construction technology, building materials in sangam period and case studies.*	*Understand*
CO3:	*Infer the metal process, coin and beads manufacturing with relevant archeological evidence.*	*Understand*
CO4:	*Realize the agriculture methods, irrigation technology and pearl diving.*	*Understand*
CO5:	*Apply the knowledge of scientific Tamil and Tamil computing.*	*Apply*

UNIT - I **WEAVING AND CERAMIC TECHNOLOGY** **[03]**

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT - II **DESIGN AND CONSTRUCTION TECHNOLOGY** **[03]**

Designing and Structural construction House and Designs in household materials during Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram – Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places – Temples of Nayaka Period – Type study (Madurai Meenakshi Temple) – Thirumalai Nayakar Mahal – Chetti Nadu Houses, Indo – Saracenic architecture at Madras during British Period.

UNIT - III **MANUFACTURING TECHNOLOGY** **[03]**

Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel – Copper and gold – Coins as source of history – Minting of Coins – Beads making – industries Stone beads – Glass beads –Terracotta beads –Shell beads/ bone beats – Archeological evidences – Gem stone types described in Silappathikaram.

UNIT - IV **AGRICULTURE AND IRRIGATION TECHNOLOGY** **[03]**

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry – Wells designed for cattle use – Agriculture and Agro Processing – Knowledge of Sea – Fisheries – Pearl – Conche diving – Ancient Knowledge of Ocean – Knowledge Specific Society.

UNIT - V **SCIENTIFIC TAMIL AND TAMIL COMPUTING** **[03]**

Development of Scientific Tamil – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

Total (L= 15, T = 0) = 15 Periods

Text Books :

1 Dr.K.K.Pillay, Social Life of Tamils, a joint Publication of TNTB & ESC and RMRL – (in print).
2 Dr.S.Sigaravelu, Social Life of the Tamils – The Classical Period (Published by: International Institute of Tamil Studies).

Reference Books :

1 Dr.S.V.Subatamanian, Dr.K.D. Thirunavukarasu, Historical Heritage of the Tamils, International Institute of Tamil Studies.
2 Dr.M.Valarmathi, The Contribution of the Tamils to Indian Culture, Published by International Institute of Tamil Studies.
3 Keeladi – Sangam City Civilization on the banks of river Vaigai; Jointly Published by: Department of Archaeology & Tamilnadu Text Book and Educational Services Corporation, Tamilnadu.
4 Dr.K.K.Pillay Studies in the History of India with Special Reference to Tamilnadu.

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Semester: **II** **Regulations:** **R 2020**
Course Code: **20GE052** **Course Name:** **Tamils and Technology**

CO-PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Understand the weaving and ceramic technology of ancient Tamil People nature.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO2:	*Comprehend the construction technology, building materials in sangam Period and case studies.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO3:	*Infer the metal process, coin and beads manufacturing with relevant archeological evidence*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO4:	*Realize the agriculture methods, irrigation technology and pearl diving.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO5:	*Apply the knowledge of scientific Tamil and Tamil computing.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
	Average	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**-**	**3**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - II

		L	T	P	C
20GE052	**தமிழரும் தொழில் நுட்பமும்** (அனைத்து துறைகளுக்கும் பொதுவானது)	1	0	0	1

முன் கூட்டிய துறைசார் அறிவு : *தேவை இல்லை*

பாடம் கற்றத்தின் விளைவுகள் : பாடத்தை வெற்றிகரகமாக கற்று முடித்த பின்பு, மாணவர்களால் முடியும் விளைவுகள்		***அறிவாற்றல் நிலை***
CO1:	*சங்ககாலத் தமிழிர்களின் நெசவு மற்றும் பானைவனைதல் தொழில் நுட்பம் குறித்து கற்றுணர்தல்.*	*புரிதல்*
CO2:	*சங்ககாலத் தமிழிர்களின் கட்டிட தொழில் நுட்பம் கட்டுமான பொருட்கள் மற்றும் அவற்றை விளகும் தளங்கள் குறித்து அறிவு.*	*புரிதல்*
CO3:	*சங்ககாலத் தமிழிர்களின் உலோகத் தொழில், நாணயங்கள் மற்றும் மணிகள் சார்ந்த தொல்லியல் சான்றுகள் பற்றிய அறிவு.*	*புரிதல்*
CO4:	*சங்ககாலத் தமிழிர்களின் வேளாண்மை, நீர்ப்பாசன முறைகள் மற்றும் முத்து குளித்தல் குறித்த தெளிவு.*	*புரிதல்*
CO5:	*நவீன அறிவியல் தமிழ் மற்றும் கன்னி தமிழ் குறித்த புரிந்துகொள்ளலும் மற்றும் பயன்படுத்தலும்.*	*பகுப்பாய்வு*

அலகு – I நெசவு மற்றும் பானைத் தொழில்நுட்பம் [03]

சங்ககாலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் கருப்பு சிவப்பு பாண்டங்கள் – பாண்டகளில் கீறல் குறியீடுகள்.

அலகு – II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் [03]

சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு – சங்க காலத்தில் கட்டுமானப் பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள்-மாமல்லபுரச் சிற்பங்களும், கோவில்களும்-சோழர்காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள்-நாயக்கர் காலக்கோயில்கள்-மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன்ஆலயம் மற்றும் திருமலைநாயக்கர்மஹால் – செட்டிநாட்டுவீடுகள்-பிரிட்டிஷ்காலத்தில் சென்னை இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

அலகு – III உற்பத்தித் தொழில்நுட்பம் [03]

கப்பல் கட்டும் கலை-உலோகவியல்-இரும்புத்தொழிற்சாலை-இரும்பை உருக்குதல், எஃகு-வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்கநாணயங்கள்-நாணயங்கள் அச்சடித்தல்-மணி உருவாக்கும் தொழிற்சாலைகள்-கல் மணிகள்-கண்ணாடி மணிகள்-சுடு மண்மணிகள்-சங்குமணிகள்-எலும்புத்துண்டுகள்-தொல்லியல் சான்றுகள்-சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு – IV வேளாண்மை மற்றும் நீர்ப் பாசனத் தொழில்நுட்பம் [03]

அணை,ஏரி,குளங்கள்,மதகு-சோழர்காலகுமிழித்தூம்பின் முக்கியத்துவம்-கால்நடை பராமரிப்பு-கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள்-வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள்-கடல்சார் அறிவு – மீன் வளம்-முத்து மற்றும் முத்துக் குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

அலகு – V அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் **[03]**

அறிவியல் தமிழின் வளர்ச்சி – கணினித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென் பொருட்கள் உருவாக்கம் – தமிழ் இணையக்கல்விக் கழகம் – தமிழ் மின்நூலகம் – இணையத்தில் தமிழ் அகராதிகள் சொற்குவைத் திட்டம்.

Total (L= 15, T = 0) = 15 Periods

Text Books :

1 தமிழகவரலாறு – மக்களும் பண்பாடும்- கேகேபிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியில் பணிகள் கழகம்).
2 கணினித்தமிழ் – முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்).

Reference Books :

1 கீழடி- வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம்.(தொல்லியல் துறை வெளியீடு).
2 பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).
3 Dr.K.K.Pillay, Studies in the History of India with Special Reference to Tamilnadu, (Published by : The Author).
4 Porunai Civilization (Jointly Published by: Department of Archaeology &Tamilnadu Textbook and Educational Services Corporation, Tamilnadu).

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Semester:	**II**	**Regulations:**	**R 2020**
Course Code:	**20GE052**	**Course Name:**	**Tamils and Technology**

CO-PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*சங்ககாலத் தமிழிர்களின் நெசவு மற்றும் பானைவனைதல் தொழில்நுட்பம் குறித்து கற்றுணர்தல்*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO2:	*சங்ககாலத் தமிழிர்களின் கட்டிட தொழில்நுட்பம் கட்டுமான பொருட்கள் மற்றும் அவற்றை விளகும் தளங்கள் குறித்து அறிவு*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO3:	*சங்ககாலத் தமிழிர்களின் உலோகத் தொழில், நாணயங்கள் மற்றும் மணிகள் சார்ந்த தொல்லியல் சான்றுகள் பற்றிய அறிவு*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO4:	*சங்ககாலத் தமிழிர்களின் வேளாண்மை, நீர்ப்பாசன முறைகள் மற்றும் முத்து குளித்தல் குறித்த தெளிவு*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO5:	*நவீன அறிவியல் தமிழ் மற்றும் கன்னி தமிழ் குறித்த புரிந்து கொள்ளலும் மற்றும் பயன்படுத்தலும்*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
	Average	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**-**	**3**	**-**	**-**

1. சிறிது (குறைந்த) 2. மிதமான (நடுத்தர) 3. கணிசமான (உயர்)

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SEMESTER - II

		L	T	P	C
20EN251	**TECHNICAL ENGLISH – II** (Common To All Branches)	3	0	0	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 – Checklist – 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 Ashra Rizvi, M, 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.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester:	**II**	**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:	*Infer and apply the enriched vocabulary, by knowing the basic grammatical structure, in academic and professional contexts.*	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO2:	*Identify and use Standard English in diverse situations.*	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO3:	*Interpret by reading a text and comprehend a given text.*	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO4:	*Organize and compose business letters.*	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO5:	*Prioritize the listening skill for academic and personal development purposes.*	-	-	-	-	-	-	-	-	2	3	-	1	-	-
	Average	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**	**1**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – II

		L	T	P	C
20MA242	**APPLIED MATHEMATICS** (Common To EC and EE)	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:	*Solving the Laplace and inverse Laplace transform problems.*	*Solve*
CO2:	*Apply the ideas of analytic functions, conformal mapping and bilinear transformations.*	*Apply*
CO3:	*Develop their skills in double and triple integrals.*	*Remember*
CO4:	*Solving the Fourier series problems.*	*Solve*
CO5:	*Interpret the concepts of Fourier Transforms.*	*Understand*

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 Kreyszig, E, 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 ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester:	**II**	**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:	*Solving the Laplace and inverse Laplace transform problems*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2:	*Apply the ideas of analytic functions, conformal mapping and bilinear transformations.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3:	*Develop their skills in double and triple integrals*	3	3	2	3	-	-	-	-	-	-	-	-	-	-
CO4:	*Solving the Fourier series problems.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5:	*Interpret the concepts of Fourier Transforms.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – II

		L	T	P	C
20CH051	**ENGINEERING CHEMISTRY** (Common to All Branches)	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 [09]

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_2; Nano materials – CNT– synthesis [CVD, laser evaporation, pyrolysis] – applications – medicine, electronics, biomaterials and environment.

UNIT–II ELECTROCHEMISTRY AND CORROSION [09]

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 [09]

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 [09]

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 ($[Fe(CN)_6]^{3-}$, $[Ni(CN)_4]^{2-}$ and $[CoCl_4]^{2-}$ only); Role of transition metal ions in biological system; Band theory of solids.

UNIT – V PHOTOCHEMISTRY AND SPECTROSCOPIC TECHNIQUES [09]

Laws of photochemistry – Grotthuss Draper law – Stark-Einstein law – Beer-Lambert law – phosphorescence – fluorescence and it's 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, Sri Krishna 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. Daraand 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.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: II **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	*Make use of the manufacture, properties and uses of advanced engineering materials.*	3	3	2	-	-	-	2	-	-	-	-	1	-	-
CO2	*Explain the concept of corrosion and its control.*	3	3	2	-	-	-	3	-	-	-	-	2	-	-
CO3	*Use the concept of thermodynamics in engineering applications.*	3	3	2	-	-	-	2	-	-	-	-	2	-	-
CO4	*Recall the periodic properties such as ionization energy, electron affinity and electro negativity.*	3	3	2	-	-	-	2	-	-	-	-	1	-	-
CO5	*Analyze the usage of various spectroscopic techniques.*	3	3	2	-	-	-	3	-	-	-	-	1	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – II

		L	T	P	C
20CS241	**PYTHON PROGRAMMING** (Common to AU, CE, EE, EC, ME & SF)	3	0	0	3

Prerequisite: *Basic knowledge of C programming.*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
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 [09]

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 [09]

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

UNIT – III OBJECT ORIENTED PROGRAMMING [09]

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 [09]

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 [09]

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 and www.diveintopython3.net
5 To practice: www.codeacademy.com and https://codingbat.com/python

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CO-PO MAPPING

Semester: **II** **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:	*Illustrate basic concepts of python programming.*	3	3	2	2	1	-	-	-	1	-	-	1	-	-
CO2:	*Apply the necessary data structures includes list, tuple and dictionary in the required fields.*	3	3	3	2	2	-	-	-	1	-	-	1	-	-
CO3:	*Analyze, design and implement the problems using OOPs technology*	3	3	3	2	2	-	-	-	1	-	-	1	-	-
CO4:	*Demonstrate the simple file operations*	3	3	3	3	2	-	-	-	1	-	-	1	-	-
CO5:	*Design web site using GUI.*	3	3	3	3	2	-	-	-	1	-	-	1	-	-
	Average	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - II

		L	T	P	C
20EE211	**ELECTRIC CIRCUIT ANALYSIS**	3	1	0	4

Prerequisite: *Engineering Mathematics, Engineering Physics*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Solve the direct current electric circuits using basic concepts and fundamental laws.*	*Apply*
CO2:	*Apply various network reduction techniques, including network theorems for simplifying the electric circuits.*	*Apply*
CO3:	*Determine the parameters of single phase AC circuits.*	*Apply*
CO4:	*Compute the parameters of three phase and series resonance circuits.*	*Apply*
CO5:	*Interpret the behavior of two port networks.*	*Understand*

UNIT - I DC & AC CIRCUITS [12]

Basic Definitions – Circuit Terminologies – Ohm's Law & its Limitations – Kirchhoff's Laws – Resistors in Series and Parallel circuits – Voltage and Current division Techniques – Mesh Current and Node Voltage Methods (DC Circuits only). Characteristics of Sinusoids – Average and RMS Value – Form Factor – Peak Factor – Phase Difference – Phasor Representation – Concept of Impedance and Admittance.

UNIT - II REDUCTION TECHNIQUES AND NETWORK THEOREMS [12]

Source Transformation – Star Delta Conversion – Thevenin's Theorem – Norton Theorem – Superposition Theorem – Maximum Power Transfer Theorem – Reciprocity Theorem (DC Circuits only).

UNIT - III SINUSOIDAL STEADY STATE ANALYSIS [12]

Analysis of Purely Resistive Circuit – Purely Inductive Circuit – Purely Capacitive Circuit – Series RL, RC and RLC Circuit: Phasor diagram – Voltage Triangle, Impedance Triangle, Power Factor, Power Triangle.

UNIT - IV THREE PHASE CIRCUITS AND RESONANCE [12]

Three Phase Circuits: Advantages of Three Phase System – Star and Delta Connected Balanced and Unbalanced Loads – Two Wattmeter Method of Power Measurements. Series Resonance Circuit: Phasor Diagram – Properties – Variation of X_L, X_C, R and Z with Frequency – Q Factor – Half-Power Frequencies – Selectivity – Bandwidth.

UNIT - V TWO PORT NETWORKS [12]

Two Port Networks, Terminal pairs, Relationship of Two Port Variables, Impedance Parameters, Admittance Parameters, Transmission Parameters, Interconnections of Two Port Networks.

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

Text Books :

1 Sudhakar, A., and Shyam Mohan S.P., Circuits and Network Analysis and Synthesis, Tata McGraw Hill Publishing Company Limited, New Delhi, Fourth Edition, 2010.
2 Mahadevan K., and Chitra C., Electrical Circuit Analysis, PHI Learning Pvt. Ltd, First Edition, 2015.

Reference Books :

1 Charles K.Alexander, Matthew N.O.Sadiku, Fundamentals of Electric Circuits, McGraw Hill, Fifth Edition, 2013.
2 William, H.,HaytJr, Jack E., Kemmerly and Steven M., Durbin, Engineering Circuit Analysis, Tata McGraw Hill publishers, New Delhi, Seventh Edition, 2010.
3 Chakrabarti, A, Circuit Theory (Analysis and Synthesis), Dhanpat Rai & Co, New Delhi, Sixth Edition, 2004.
4 NagrathI, J., and Kothari, D. P., Electric Machines, Tata McGraw Hill Publishing Company Ltd, Fourth Edition, 2012.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: II **Regulation:** R 2020
Course Code: 20EE211 **Course Name:** Electric Circuit Analysis

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Solve the direct current electric circuits using basic concepts and fundamental laws.*	3	3	1	-	-	2		-	-	-	-	2	3	2
CO2:	*Apply various network reduction techniques, including network theorems for simplifying the electric circuits.*	3	3	1	-	-	1		-	-	-	-	2	3	**2**
CO3:	*Determine the parameters of single phase AC circuits.*	3	3	1	-	-	2		-	-	-	-	2	3	**2**
CO4:	*Compute the parameters of three phase and series resonance circuits.*	3	3	1	-	-	2		-	-	-	-	2	3	**2**
CO5:	*Interpret the behavior of two port networks.*	3	3	1	-	-	-		-	-	-	-	2	2	-
Average		**3**	**3**	**1**	**-**	**-**	**2**		**-**	**-**	**-**	**-**	**2**	**3**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – II

20CH028 **CHEMISTRY LABORATORY**

(Common To All Branches)

L	T	P	C
0	0	2	1

Prerequisite: *NIL*

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

CO1:	*Apply the principle of conductometric titration.*	*Understand*
CO2:	*Relate the role of pH in quantitative analysis of a solution.*	*Understand*
CO3:	*Perceive the knowledge of the concentration of Iron by electrochemical methods.*	*Understand*
CO4:	*Analyze the application of water in various fields.*	*Understand*
CO5:	*Recall the nature of corrosion process.*	*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, $BaCl_2$Vs. Na_2SO_4.
4. Estimation of Ferrous ion by Potentiometry – Fe^{2+}Vs $K_2Cr_2O_7$.
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 Vogel, I., Vogel's Textbook of Quantitative Chemical Analysis, John Wiley &Sons, Newyork, Eighth Edition, 2014.

Reference Books :

1 Bhasin, S.K., and Sudha Rani, Laboratory Manual of Engineering Chemistry, Dhanpat Rai Publishing Company Private Limited, New Delhi, Third Edition, 2012.

2 Vogel, I., and Mendham, J., Vogel's Textbook of Quantitative Chemical Analysis, Harlow, Prentice Hall, Sixth Edition, 2000.

3 Jeffery, G.H., Bassett, J., Mendham J., and Denny, R.C., Vogel's Text book of Quantitative Analysis Chemical Analysis, Longman, Singapore publishers, Singapore, ELBS Fifth Edition, 1996.

4 Furniss, B.S., Hannaford, A.J, Smith, P.W.G., and A.R. Tatchel, Vogels, Textbook of Practical Organic Chemistry, John Wiley &Sons, Newyork, Fifth Edition, 1989.

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

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – II

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

Prerequisite: *Basic knowledge of C programming.*

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

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

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - II

		L	T	P	C
20GE028	**MANUFACTURING PRACTICES LABORATORY** (Common to All Branches)	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.*	*Creating*
CO2:	*Perform welding practice to join simple structures.*	*Applying*
CO3:	*Practice simple operations in lathe and drilling machine.*	*Understanding*

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.

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	-	-
CO2:	*Perform welding practice to join simple structures.*	2	-	-	3	-	-	-	3	1	-	-	3	-	-
CO3:	*Practice simple operations in lathe and drilling machine.*	2	-	-	3	-	-	-	3	1	-	-	3	-	-
	Average	**2**	**-**	**-**	**3**	**-**	**-**	**-**	**3**	**1**	**-**	**-**	**3**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – II

		L	T	P	C
20GE028	**GROUP B (ELECTRICAL & ELECTRONICS)** (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

CO PO MAPPING

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	-	-
	Average	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**-**	**3**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - II

		L	T	P	C
20EE221	**ELECTRIC CIRCUIT ANALYSIS LABORATORY**	0	0	3	1

Prerequisite: *Engineering physics*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Simulate and build electrical circuits to verify the basic laws, mesh and nodal analysis.*	*Apply*
CO2:	*Apply network reduction techniques and concepts in engineering applications.*	*Apply*
CO3:	*Compute the transient and frequency responses of simple RL and RC circuits.*	*Apply*
CO4:	*Analyze the series and parallel resonance circuits.*	*Analyze*
CO5:	*Determine the power of three phase circuits with balanced loads using Two-Wattmeter Method.*	*Apply*

LIST OF EXPERIMENTS:

1. Simulation and Verification of Ohm's Law and Kirchhoff's Laws.
2. Simulation and Verification of Mesh and Nodal analysis.
3. Simulation and Verification of Thevenin's and Norton's Theorems.
4. Simulation and Verification of Superposition Theorem.
5. Simulation and Verification of Maximum Power Transfer Theorem.
6. Simulation and Verification of Reciprocity Theorem.
7. Simulation and determination of frequency response of RL and RC circuit.
8. Simulation of Series RL and RC Transients.
9. Design and Simulation of Series and Parallel Resonance Circuits.
10. Experimental determination of power in three phase circuits by Two-Wattmeter method.

Total = 45 Periods

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: II **Regulation:** R 2020
Course Code: 20EE221 **Course Name:** Electric Circuit Analysis Laboratory

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Simulate and build electrical circuits to verify the basic laws, mesh and nodal analysis.*	3	3	3	1	3	-	-	1	3	-	-	3	3	3
CO2:	*Apply network reduction techniques and concepts in engineering applications.*	3	3	2	1	3	-	-	1	3	-	-	2	3	3
CO3:	*Compute the transient and frequency responses of simple RL and RC circuits.*	3	3	2	1	3	-	-	1	3	-	-	2	3	3
CO4:	*Analyze the series and parallel resonance circuits.*	3	3	2	1	3	-	-	1	3	-	-	2	3	3
CO5:	*Determine the power of three phase circuits with balanced loads using Two-Wattmeter Method.*	3	3	2	1	-	-	-	1	3	-	-	2	3	3
Average		**3**	**3**	**2**	**1**	**3**	**-**	**-**	**1**	**3**	**-**	**-**	**2**	**3**	**3**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

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:	*Enable to solve polynomial, transcendental equations, simultaneous linear equations numerically*	*Understand*
CO3:	*Able to apply the Interpolation techniques.*	*Understand*
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 $1/3^{rd}$ and $3/8^{th}$ 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 Grewal, B.S., 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 Venkataraman, M.K., 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 Kandasamy, P., Thilagavathy and Gunavathy, K., Numerical Methods, S.Chand & company Ltd, Third Edition, New Delhi, 2003.
4 Gerald, C.F., Wheatley, P.O., Applied Numerical Analysis, Pearson Education (Asia), Seventh Edition, 2007.

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

Semester: **III** **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:	*Apply the concepts of partial differential equations.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2:	*Enable to solve polynomial, transcendental equations, simultaneous linear equations numerically.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3:	*Able to apply the Interpolation techniques.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4:	*Developing their skills in numerical differentiation and integration.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5:	*Determine the numerical solutions to boundary value problems.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
Average		**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

		L	T	P	C
20EE311	**ELECTRO MAGNETIC THEORY**	3	1	0	4

Prerequisite: *Engineering mathematics*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Infer the spatial variations of physical quantities using various vector calculus and coordinate systems.*	*Understand*
CO2:	*Interpret the basic laws of electrostatics to determine force and electric field intensity.*	*Understand*
CO3:	*Determine the magnetic vector quantities, inductance and energy densities.*	*Understand*
CO4:	*Examine the electrodynamic fields using Maxwell's equations.*	*Apply*
CO5:	*Identify the electromagnetic wave propagation in different medias using poynting vector and theorem.*	*Apply*

UNIT - I VECTOR CALCULUS AND CO-ORDINATE SYSTEMS [12]

Sources and effects of electromagnetic fields – Scalar and Vector fields – Different Co-ordinate Systems: Rectangular, Cylindrical and Spherical – Relationship between Coordinate systems – Vector Calculus – Gradient, Divergence and Curl – Divergence theorem – Stoke's theorem.

UNIT - II ELECTROSTATICS [12]

Coulomb's Law – Electric field intensity (E) – Field due to point and continuous charges – Electric field due to finite line charge, circular disc and infinite sheet of charge, two concentric shells and coaxial cylinders – Electric flux density (D) – Gauss's law and its applications – Electrical potential – Electric field in dielectric and equipotential plots – Electric Dipole, Electric field in multiple dielectrics – Boundary conditions between dielectric media, Poisson's and Laplace's equations – Capacitance – energy density.

UNIT - III MAGNETOSTATICS [12]

Lorentz Law of force, magnetic field intensity (H) – Biot-Savart's Law – Ampere's Law – Magnetic field intensity due to straight conductors, infinite sheet of current, at the centre of the toroid, along the axis of the circular loop and solenoid – Magnetic flux density (B) – Magnetic materials – Magnetization – Magnetic field in multiple media – Boundary conditions – Magnetic Scalar and vector potential – Magnetic force – Torque – Inductance – Energy density. Applications: Magnetic Levitation.

UNIT - IV ELECTRODYNAMIC FIELDS [12]

Faraday's laws, Induced EMF – Transformer and Motional EMF, Maxwell's Equations (differential and integral forms) – Conduction and Displacement Current – Continuity Equation of Current – Ohm's law in point form – Relation between field theory and circuit theory .Applications: Time-varying Electric and Magnetic Fields.

UNIT - V ELECTROMAGNETIC WAVES [12]

Generation – Electro Magnetic Wave equations – Wave parameters; velocity, intrinsic impedance, propagation constant – uniform plane wave and its properties – Waves in free space, lossy and lossless dielectrics, conductors – skin depth, Poynting vector and Poynting Theorem.

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

Text Books :

1 Mathew N. O. Sadiku, Elements of Electromagnetics, Oxford University Press, Seventh Edition, 2018.
2 William H.Hayt, Engineering Electromagnetics, Tata McGraw Hill, Seventh Edition, 2019.

Reference Books :

1 Gangadhar, K.A, Field Theory, Khanna Publishers, New Delhi, Sixteenth Edition, 2020.
2 Ghosh, S.P and Lipika Datta, Electromagnetic Field Theory, Tata McGraw Hill Educational Private Limited, New Delhi, First Edition, 2012.
3 Joseph. A. Edminister, Theory and problems of Electromagnetics, Schaum Series, Tata McGraw Hill, Second Edition, 2016.
4 David J.Griffiths, Introduction to Electrodynamics, Pearson Education, Fourth Edition, 2020.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: III **Regulation:** R 2020
Course Code: 20EE311 **Course Name:** Electro Magnetic Theory

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Infer the spatial variations of physical quantities using various vector calculus and coordinate systems.*	3	2	1	-	-	-	1	-	-	-	-	1	2	2
CO2:	*Interpret the basic laws of electrostatics to determine force and electric field intensity.*	3	2	1	-	-	-	1	-	-	-	-	1	2	2
CO3:	*Determine the magnetic vector quantities, inductance and energy densities.*	3	2	1	-	-	-	1	-	-	-	-	2	2	2
CO4:	*Examine the electrodynamic fields using Maxwell's equations.*	3	2	1	-	-	-	1	-	-	-	-	2	2	2
CO5:	*Identify the electromagnetic wave propagation in different medias using poynting vector and theorem.*	3	2	1	1	-	-	1	-	-	-	-	2	2	2
	Average	**3**	**2**	**1**	**1**	-	**-**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

		L	T	P	C
20EE312	**ELECTRICAL MACHINES - I**	3	0	0	3

Prerequisite: *Electric Circuit and Analysis*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Discuss the basic concepts of magnetic circuits and torque in round rotor machine.*	*Understand*
CO2:	*Describe the constructional details and principle of operation of DC generator.*	*Understand*
CO3:	*Explain the working of DC motor with starting and speed control methods.*	*Understand*
CO4:	*Explicate the construction, working principle and performance of transformers.*	*Understand*
CO5:	*Explore the several testing methods of DC machines and transformers.*	*Understand*

UNIT - I MAGNETIC CIRCUITS [09]

Review of magnetic circuit: MMF, flux, Reluctance and Inductance – Statically and Dynamically Induced EMF – Properties of magnetic materials Hysteresis and Eddy Current losses – BH curve – AC Operation of Magnetic Circuits – Classification of Electrical Machines – Torque in Round Rotor Machine.

UNIT - II DC GENERATORS [09]

Constructional Details –Materials used for construction – Lap and wave winding – Principle of Operation – EMF Equation – Methods of Excitation – Types of DC generator – Losses and Efficiency – Simple Problems – Armature Reaction – Commutation – Methods for Improving Commutation– Characteristics of DC Generators – Critical speed –Applications of DC Generator.

UNIT - III DC MOTORS [09]

Principle of Operation – Back EMF – Simple Problems – comparison of generator and motor action –Types of DC Motor – Torque Equation – Losses and Efficiency – Characteristic of DC Motors – Speed control of DC Shunt and Series Motor – Necessity of Starters – Types of Starters – Applications of DC Motor.

UNIT - IV TRANSFORMERS [09]

Constructional Details: Shell type and Core Type – Principle of Operation – EMF Equation –transformer on load, Ideal transformer – Transformation Ratio – Equivalent Circuit – Losses, Efficiency and Regulation – Rating of Transformer– Tap changing transformers– Autotransformer – Three Phase Transformer Connections.

UNIT - V TESTING OF DC MACHINES AND TRANSFORMERS [09]

Testing of DC Machines: Brake test – Swinburne's Test – Retardation Test – Hopkinson's test and Field's test for series motor – Testing of transformers: Load test, Open and Short Circuit Tests –Sumpner's test – All day efficiency.

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

Text Books :

1 Nagrath I.J and Kothari D. P, Electrical machines, Tata McCraw Hill Publishing Company Ltd, Fifth Edition, 2017.

2 Theraja B. L and Theraja, A.K, A Text book of Electrical Technology, S. Chand Publishing, First Multicolor Edition 2005, Reprint 2015.

Reference Books :

1 Fitzgerald, A.E. Charles KingslyJr, Stephen D. Umans, Electric Machinery, McCraw 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.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: III **Regulation:** R 2020
Course Code: 20EE312 **Course Name:** Electrical Machines - I

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Discuss the basic concepts of magnetic circuits and torque in round rotor machine.*	3	2	-	-	-	1	2	-	-	-	-	1	3	1
CO2:	*Describe the constructional details and principle of operation of DC generator.*	3	2	-	-	-	1	2	-	-	-	-	1	**3**	**2**
CO3:	*Explain the working of DC motor with starting and speed control methods.*	3	2	-	-	-	1	2	-	-	-	-	1	**3**	**2**
CO4:	*Explicate the construction, working principle and performance of transformers.*	3	2	-	-	-	1	2	-	-	-	-	1	**3**	**2**
CO5:	*Explore the several testing methods of DC machines and transformers.*	3	2	-	-	-	1	2	-	-	-	-	1	3	3
	Average	**3**	**2**	**-**	**-**	**-**	**1**	**2**	**-**	**-**	**-**	**-**	**1**	**3**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

		L	T	P	C
20EE313	**ANALOG ELECTRONICS**	3	0	0	3

Prerequisite: *Engineering physics and Electric Circuit Analysis*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Illustrate the operation of various semiconductor devices*	*Understand*
CO2:	*Explain the various configurations of transistors and power amplifiers*	*Understand*
CO3:	*Discuss the various oscillatory and feedback amplifier circuits*	*Understand*
CO4:	*Describe the op-amp and its characteristics*	*Understand*
CO5:	*Explain the applications of op-amp and 555 timers*	*Understand*

UNIT - I SEMICONDUCTOR DEVICES [09]

PN junction diode: VI characteristics, Dynamic Resistance, Temperature coefficients, Drift and diffusion currents, Study of data sheet – Zener diode: VI characteristics, Voltage Regulators – Special Diodes: PIN diode, Varactor diode.

UNIT - II TRANSISTOR AND ITS APPLICATIONS [09]

Bipolar Junction Transistor: structure, operation, configurations, Applications as switch and amplifier. h-Parameter: CE, CC and CB configurations – Power amplifier: class A and class B – Junction Field Effect Transistor: structure, operation and characteristics.

UNIT - III FEEDBACK AMPLIFIERS AND OSCILLATORS [09]

Introduction to feedback amplifiers – Effect of positive and negative feedbacks – voltage series, current series, voltage shunt, current shunt feedback amplifiers. Oscillator: condition for oscillation, RC phase shift, Wein bridge, Crystal oscillator, UJT Relaxation Oscillator.

UNIT - IV IC FABRICATION & OPERATIONAL AMPLIFIERS [09]

Basic planar process for IC fabrication – Op Amp: Ideal characteristics – inverting and non-inverting operational amplifiers – DC and AC characteristics: frequency response of op-amp, slew rate – differential amplifiers – CMRR.

UNIT - V APPLICATIONS OF OPAMP & 555 TIMER [09]

Differentiator, Integrator, V to I and I to V converters – DAC: R-2R ladder, Weighted resistor types – ADC: Flash type, Successive approximation type – 555 timer: Mode of operations and its applications, study of data sheet.

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

Text Books :

1 Albert Malvino & David Bates, Electronic Principles, Tata McGraw Hill, Eighth Edition, 2016.

2 Roy Choudhary D & Shell B. Jani, Linear Integrated Circuits, New Age International, Fourth Edition, 2017.

Reference Books :

1 Sedha, R.S, A textbook of Applied Electronics, S.Chand & Company Pvt. Ltd., Re-edition 2014.

2 David A Belll, Fundamentals of Electronic Devices and Circuits, Oxford University Press India, Fifth Edition, PHI. 2009.

3 David A. Bell, Op-amp & Linear ICs, Oxford University Press India, Third Edition, 2011.

4 Gray and Mayer, Analysis and design of Analog Integrated Circuits, Wiley International, Fifth Edition, 2009.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: **III** **Regulation:** **R 2020**
Course Code: **20EE313** **Course Name:** **Analog Electronics**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Illustrate the operation of various semiconductor devices*	3	2	1	-	-	2	1	-	-	-	-	2	1	1
CO2:	*Explain the various configurations of transistors and power amplifiers*	3	2	1	-	-	2	1	-	-	-	-	2	**1**	**1**
CO3:	*Discuss the various oscillatory and feedback amplifier circuits*	3	2	1	-	-	2	1	-	-	-	-	2	**1**	**1**
CO4:	*Describe the op-amp and its characteristics*	3	2	1	-	-	2	1	-	-	-	-	2	**1**	**1**
CO5:	*Explain the applications of op-amp and 555 timers*	3	2	1	-	-	2	1	-	-	-	-	2	1	1
Average		**3**	**2**	**1**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**1**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

		L	T	P	C
20EE314	**MEASUREMENTS AND INSTRUMENTATION**	3	0	0	3

Prerequisite: *Engineering physics and Electric Circuit Analysis*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the functional elements of instruments, errors, characteristics, calibration and various* measurement *standards.*	*Understand*
CO2:	*Describe the various electrical and electronics instruments.*	*Understand*
CO3:	*Determine the values of resistor, inductor, capacitor and frequency using bridges.*	*Understand*
CO4:	*Discuss the various types of sensors and transducers.*	*Understand*
CO5:	*Explain the concepts of storage, display devices and data acquisition system.*	*Understand*

UNIT - I INTRODUCTION [09]

Introduction to Measurement and Instruments – Functional Elements of an Instrument – Static Characteristics – Dynamic Characteristics – Errors and Classification – Statistical Evaluation of Measurement Data – Measurement Standards – Calibration Methods – Problems on Errors.

UNIT - II ELECTRICAL AND ELECTRONICS INSTRUMENTS [09]

Principle and operation of analog and digital Meters: Voltmeter, Ammeter – Energy Meters: Single Phase Energy Meter, Three Phase Energy Meter – Wattmeters: Induction, Electro-dynamometer – Power Factor Meter – Frequency Meter – Instrument Transformers – Megger and Digital multimeters.

UNIT - III BRIDGE MEASUREMENTS [09]

Measurement of Resistance: Kelvin Bridge, Kelvin Double Bridge, Wheatstone Bridge – Measurement of Inductance: Maxwell's Bridge, Anderson Bridge – Measurement of Capacitance: Schering Bridge, Desauty's Bridge – Determination of frequency using Wein Bridge.

UNIT - IV SENSORS AND TRANSDUCERS [09]

Sensors: Proximity Sensor, Accelerometer, IR Sensor – Transducers: Resistive Transducers, Inductive Transducers, Capacitive Transducers, Piezoelectric Transducer, Optical and Digital Transducers.

UNIT - V STORAGE, DISPLAY DEVICES AND DATA ACQUISITION SYSTEMS [09]

Recorders: Strip Chart, X-Y Recorders – Digital Plotters – Digital Storage Oscilloscope – OLED – DLP – Dot Matrix Display – Data Loggers – Elements of Data Acquisition System.

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

Text Books :

1 Sawhney, A.K, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai and Co, Nineteenth Revised Edition, 2017.

2 Ernest O. Doebelin, Measurement Systems Application and Design, Tata McGraw Hill, Fifth Edition, 2015.

Reference Books :

1 Gupta, J.B, A Course in Electronic and Electrical Measurements, S.K. Katariaand Sons, Delhi, Fourteenth Edition, 2014.

2 Kalsi, H.S, Electronic Instrumentation, Tata McGraw Hill, Third Edition, 2012.

3 Banerjee, G. K, Electrical and Electronic Measurements, PHI Learning Pvt. Ltd., Second Edition, 2016.

4 Moorthy, D.V.S, Transducers and Instrumentation, Prentice Hall of India Pvt. Ltd, Second Edition, 2015.

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

Semester:	**III**	**Regulation:**	**R 2020**
Course Code:	**20EE314**	**Course Name:**	**Measurements and Instrumentation**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the functional elements of instruments, errors, characteristics, calibration and various* measurement *standards.*	3	2	1	-	-	-	-	-	-	-	-	2	2	3
CO2:	*Describe the various electrical and electronics instruments.*	3	2	1	-	-	-	-	-	-	-	-	2	2	3
CO3:	*Determine the values of resistor, inductor, capacitor and frequency using bridges.*	3	2	1	-	-	-	-	-	-	-	-	2	2	3
CO4:	*Discuss the various types of sensors and transducers.*	3	2	1	-	-	-	-	-	-	-	-	3	3	3
CO5:	*Explain the concepts of storage, display devices and data acquisition system.*	3	2	1	-	-	-	-	-	-	-	-	3	3	3
	Average	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**3**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

		L	T	P	C
20CS331	**OBJECT ORIENTED PROGRAMMING WITH C++**	3	0	0	3

Prerequisite: *Basic knowledge of C Programming*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Recognize the principles of object-oriented problem solving and programming.*	*Understand*
CO2:	*Implement the concepts of constructor and inheritance.*	*Apply*
CO3:	*Analyze the concept of reusability and polymorphism.*	*Analyze*
CO4:	*Demonstrate the concepts of I/O operations and file handling.*	*Understand*
CO5:	*Identify the uses of templates, STL and exception handling.*	*Analyze*

UNIT - I BASICS OF OOPS [09]

Object Oriented Programming Concepts – Object Oriented Vs Procedure Oriented – Benefits – Applications – Introduction to C++ – Data types – tokens – Identifiers – Variables – Operators – Control structures and Loops – Classes – Objects – Default Arguments – Static Member Functions –Static Data Members – Const Member Functions – Pointers to Member Functions – Friend Function – Local Classes.

UNIT - II ACCESS SPECIFIERS,CONSTRUCTORS AND INHERITANCE [09]

Array of Objects – Object as Function Arguments – Access Specifiers and their Scope – Constructors – Default Constructor – Parameterized Constructors – Constructor with Dynamic Allocation – Copy Constructor – Destructors – Inheritance – Derived Class –Types of Inheritance – Single inheritance – Multilevel Inheritance – Multiple Inheritance – Hierarchical and Hybrid Inheritance – Virtual Base Classes – Abstract Class.

UNIT - III POLYMORPHISM AND TYPE CONVERSIONS [09]

Polymorphism – Compile Time Polymorphism: Function Overloading – Operator Overloading – Unary Operator Overloading – Binary Operator Overloading – Rules for Operator Overloading – Run Time Polymorphism: Virtual Functions – Pure Virtual Function – Type Conversions.

UNIT - IV CONSOLE I/O OPERATIONS AND FILE HANDLING [09]

C++ Streams – Stream Classes – Unformatted I/O Operations – Formatted Console Operations – Managing Output With Manipulators – Files: Opening and Closing a File – Detecting End-Of-File – File Pointers and Manipulations – Sequential I/O Operations – Updating a File – Error Handling in File Operations.

UNIT - V TEMPLATES, EXCEPTION HANDLING AND STL [09]

Class Templates – Function Templates – Exception Handling – Throwing Mechanism – Catching Mechanism – Rethrowing Exception – Specifying Exceptions – Introduction to STL – Components of STL – Containers – Algorithms – Iterators.

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

Text Books :

1 Robert Lafore, Object Oriented Programming in-C++, Galgotia Publication, Fourth Edition, 2014.
2 Balagurusamy,E., Object Oriented Programming with C++, The Mc Hill, Sixth Edition, 2013.

Reference Books :

1 Herbert Schildt, The Complete Reference C++, Fourth Edition, McGraw-Hill Education, 2017.
2 Ashok N. Kamthane, Programming in C++, Pearson, Second Edition, 2016.
3 Venugopal K.R., Rajkumar Buyya, Mastering C++, Second Edition, McGraw-Hill Education, 2013.
4 Deitel & Deitel, C++ How to Program, Prentice Hall, Ninth Edition, 2014.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: III **Regulation:** R 2020
Course Code: 20CS331 **Course Name:** Object Oriented Programming with C++

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Recognize the principles of object-oriented problem solving and programming.*	3	3	2	2	2	-	-	-	1	-	-	1	-	-
CO2:	*Implement the concepts of constructor and inheritance.*	3	3	2	3	2	-	-	-	1	-	-	1	-	-
CO3:	*Analyze the concept of reusability and polymorphism.*	3	3	1	3	2	-	-	-	1	-	-	1	-	-
CO4:	*Demonstrate the concepts of I/O operations and file handling.*	2	3	2	2	1	-	-	-	1	-	-	1	-	-
CO5:	*Identify the uses of templates, STL and exception handling.*	2	3	2	3	1	-	-	-	1	-	-	1	-	-
	Average	**3**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

		L	T	P	C
20EE321	**ELECTRICAL MACHINES LABORATORY - I**	0	0	3	1

Prerequisite: *Electric Circuit and Analysis*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Determine the performance of separately excited and self-excited DC generators.*	*Analyze*
CO2:	*Assess the performance of DC series, shunt and compound motors.*	*Analyze*
CO3:	*Demonstrate the speed control of the DC shunt motor.*	*Understand*
CO4:	*Analyze the performance of the transformer by direct and indirect test.*	*Analyze*
CO5:	*Demonstrate the different three phase transformer connections.*	*Understand*

LIST OF EXPERIMENTS

1. Open circuit and load characteristics of separately excited DC generators.
2. Open circuit and load characteristics of self-excited DC shunt generators.
3. Load characteristics of DC compound generator with differential and cumulative connection.
4. Load characteristics of DC shunt motor.
5. Load characteristics of DC compound motor.
6. Load characteristics of DC series motor.
7. Swinburne's tests on DC shunt motor.
8 Speed control of DC shunt motor.
9. Load test on single phase transformer.
10. Open circuit and short circuit tests on single phase transformer.
11. Three phase transformer connection.

Total = 45 Periods

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Determine the performance of separately excited and self-excited DC generators.*	3	3	2	-	-	-	-	1	2	-	-	3	3	2
CO2:	*Assess the performance of DC series, shunt and compound motors.*	3	3	2	-	-	-	-	1	2	-	-	3	3	2
CO3:	*Demonstrate the speed control of the DC shunt motor.*	3	3	2	-	-	-	-	1	2	-	-	3	3	2
CO4:	*Analyze the performance of the transformer by direct and indirect test.*	3	3	2	-	-	-	-	1	2	-	-	3	3	2
CO5:	Demonstrate the different three phase transformer connections.	3	3	2	-	-	-	-	1	2	-	-	3	3	2
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**-**	**-**	**3**	**3**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

		L	T	P	C
20EE322	**ANALOG ELECTRONICS LABORATORY**	0	0	3	1

Prerequisite: *Engineering Physics and Electric Circuit Analysis*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Verify the characteristics of various semiconductor devices.*	*Understand*
CO2:	*Realize the operation of oscillator circuits using BJT.*	*Understand*
CO3:	*Develop the op-amp circuit for different applications.*	*Apply*
CO4:	*Construct an A/D and D/A converter using op-amp.*	*Apply*
CO5:	*Design an Astable and Monostable Multivibrator using NE / SE 555 timer.*	*Apply*

LIST OF EXPERIMENTS

1. Simulation and real time verification of V-I Characteristics of semiconductor diodes.
2. Simulation and real time verification of V-I Characteristics of Zener diodes.
3. Simulation and real time verification of V-I Characteristics of FET.
4. Characteristics of transistor under common emitter configuration.
5. Design a RC phase shift Oscillator using BJT.
6. Design an inverting & non-inverting op-amp.
7. Design an integrator & differentiator using op-amp.
8. Design a digital to analog converter using op-amp.
9. Design an analog to digital converter using op-amp.
10. Design an Astable & Monostable multivibrator using NE / SE 555 timer.

Total = 45 Periods

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1:	*Verify the characteristics of various semiconductor devices.*	3	2	2	-	3	-	-	1	3	-	-	2	1	1
CO2:	*Realize the operation of oscillator circuits using BJT.*	3	2	2	-	3	-	-	1	3	-	-	2	1	1
CO3:	*Develop the op-amp circuit for different applications.*	3	2	2	-	-	-	-	1	3	-	-	2	1	1
CO4:	*Construct an A/D and D/A converter using op-amp.*	3	2	2	-	-	-	-	1	3	-	-	2	1	1
CO5:	*Design an Astable and Monostable Multivibrator using NE / SE 555 timer.*	3	2	2	-	-	-	-	1	3	-	-	2	1	1
	Average	**3**	**2**	**2**	**-**	**3**	**-**	**-**	**1**	**3**	**-**	**-**	**2**	**1**	**1**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

20CS325	OBJECT ORIENTED PROGRAMMING WITH C++ LABORATORY	L	T	P	C
		0	0	3	1

Prerequisite: *Basic knowledge of C Programming*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Develop simple programs using class and objects concepts.*	*Create*
CO2:	*Illustrate the concepts of constructors, destructors and inheritance.*	*Understand*
CO3:	*Demonstrate the concepts of operator overloading and function overloading.*	*Analyze*
CO4:	*Develop programs the concepts of polymorphism.*	*Create*
CO5:	*Develop code segments using templates and exception handling.*	*Create*

LIST OF EXPERIMENTS

1. Implementation of class and object.
2. Implementation of static member functions.
3. Implementation of default arguments.
4. Implementation of function overloading.
5. Implementation of operator overloading.
6. Implementation of copy constructor.
7. Implementation of dynamic constructor.
8. Implementation of multiple and multilevel inheritance.
9. Implementation of virtual function (run-time polymorphism).
10. Implementation of exception handling.
11. Implementation of function template.
12. Implementation of class template.

Total = 45 Periods

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CO-PO MAPPING

Semester III **Regulation:** R 2020
Course Code: 20CS325 **Course Name:** Object Oriented Programming with C++ Laboratory

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Develop simple programs using class and objects concepts.*	3	3	2	2	1	-	-	-	1	-	-	1	-	-
CO2:	*Illustrate the concepts of constructors, destructors and inheritance.*	3	3	2	2	2	-	-	-	1	-	-	1	-	-
CO3:	*Demonstrate the concepts of operator overloading and function overloading.*	3	3	2	2	1	-	-	-	1	-	-	1	-	-
CO4:	*Develop programs the concepts of polymorphism.*	3	3	3	3	2	-	-	-	1	-	-	1	-	-
CO5:	*Develop code segments using templates and exception handling.*	3	3	3	3	2	-	-	-	1	-	-	1	-	-
	Average	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

		L	T	P	C
20HR351	**CAREER DEVELOPMENT SKILLS – I** (Common To All Branches)	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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CO-PO MAPPING

Semester: III **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:	*Have competent knowledge on grammar with an understanding of its basic rules.*	-	-	-	-	1	-	-	-	3	3	-	3	-	-
CO2:	*Communicate effectively and enhance interpersonal skills with renewed self – confidence*	-	-	-	-	1	-	-	-	3	3	-	3	-	-
CO3:	*Construct sentence in English and make correction*	-	-	-	-	1	-	-	-	3	3	-	3	-	-
CO4:	*Perform oral communication in any formal situation*	-	-	-	-	1	-	-	-	3	3	-	3	-	-
CO5:	*Develop their LSRW skills.*	-	-	-	-	1	-	-	-	3	3	-	3	-	-
Average		**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**3**	**3**	**-**	**3**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20EE411	**POWER SYSTEMS - I**	3	0	0	3

Prerequisite: Electromagnetic Theory

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the power system components and various power generation methods.*	*Understand*
CO2:	*Explain the transmission line parameters for different conductor arrangements*	*Understand*
CO3:	*Estimate the performance of various transmission lines based on distance.*	*Understand*
CO4:	*Illustrate the construction of different types of line insulators and cables.*	*Understand*
CO5:	*Explain the concepts of AC and DC distributors and substation layout.*	*Understand*

UNIT - I INTRODUCTION TO POWER SYSTEMS [09]

Evolution of Power Systems and Present day Scenario – Structure of a power system – Generation: Conventional Thermal, Hydro & Nuclear power plants; Renewable & Distributed Energy Resources. Comparison of AC and DC transmission- HVDC and EHV AC systems.

UNIT - II TRANSMISSION LINE PARAMETERS [09]

Parameters of Single and Three phase transmission lines with Single circuits: Resistance, Inductance and Capacitance of solid, stranded and bundled conductors: Symmetrical and Unsymmetrical spacing and Transposition –Application of Self and Mutual GMD – Skin and Proximity effects.

UNIT - III MODELLING AND PERFORMANCE OF TRANSMISSION LINES [09]

Classification of lines: Short line, Medium line and Long line; Equivalent circuits, Attenuation constant, Phase constant, Surge impedance – Transmission efficiency and Voltage regulation - Real and Reactive power flow in lines – Ferranti effect and Corona loss.

UNIT - IV INSULATORS AND CABLES [09]

Insulators: Types, Voltage distribution in insulator string and grading, improvement of string efficiency. Underground cables: Introduction – Types of cables, Capacitance of Single-core cable, Grading of cables, Capacitance of 3-core belted cable, Constructional features of LT and HT cables

UNIT - V DISTRIBUTION SYSTEMS [09]

Types of AC and DC distributors: 2-wire and 3-wire, Radial and Ring main distribution; Distributed and Concentrated loads Substation Layout and Grounding.

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

Text Books :

1 Wadhwa,C.L., Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 Singh,S.N., Electric Power Generation Transmission and Distribution, Prentice Hall of India Pvt. Ltd., Delhi, Second Edition, 2011.

Reference Books :

1 Rajput,R.K., Power system engineering, Laxmi publisher, New Delhi, Third Edition, 2016.

2 Das,D., Electrical Power systems, New Age International Pvt. Ltd, New Delhi, 2012.

3 Hadi Saadat, Power System Analysis, Tata McGraw Hill Publishing Company, New Delhi, Third Edition, 2010.

4 Padiyar, K.R., HVDC Power Transmission Systems, New Age International Pvt. Ltd, New Delhi, First Edition, 2007.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CO-PO MAPPING

Semester: IV **Regulation: 2020**

Course Code: 20EE411 **Course Name: Power Systems – I**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Describe the power system components and various power generation methods.*	3	2	2	-	-	1	2	-	-	-	-	1	3	2
CO2:	*Explain the transmission line parameters for different conductor arrangements*	3	3	2	-	-	1	2	-	-	-	-	1	**3**	**2**
CO3:	*Estimate the performance of various transmission lines based on distance.*	3	3	2	-	-	2	2	-	-	-	-	1	**3**	**2**
CO4:	*Illustrate the construction of different types of line insulators and cables.*	3	3	2	-	-	2	2	-	-	-	-	1	**3**	**2**
CO5:	*Explain the concepts of AC and DC distributors and substation layout.*	3	2	2	-	-	2	2	-	-	-	-	1	3	2
Round off Average		**3**	**3**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**3**	**2**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20EE412	**ELECTRICAL MACHINES - II**	3	0	0	3

Prerequisite: Electrical Machines - I

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the constructional details and the voltage regulation methods of synchronous generators.*	*Understand*
CO2:	*Illustrate the working principle, starting methods and the performance of synchronous motor.*	*Understand*
CO3:	*Elucidate the constructional details, characteristics and starting methods of three phase induction motor.*	*Understand*
CO4:	*Exhibit the performance analysis and speed control methods of three phase induction motor.*	*Understand*
CO5:	*Explain the construction and starting methods of single phase induction motor and special electrical machines.*	*Understand*

UNIT - I SYNCHRONOUS GENERATOR [09]

Basic requirements – Constructional details – Types of rotors – EMF equation – Synchronous reactance – Effect of chording and distribution of Winding – Armature reaction – Voltage regulation: EMF, MMF and ZPF methods – Synchronizing and parallel operation – Synchronizing power – Change of excitation and mechanical input – Determination of direct axis and quadrature axis reactances of salient-pole machines – Alternator on infinite Bus bar.

UNIT - II SYNCHRONOUS MOTOR [09]

Principle of operation – Starting methods – Torque equation – Operation on infinite bus bars – V and inverted V curves – Power input and power developed equations – constant excitation and constant power developed – Damper winding – Hunting – Synchronous condenser – Applications.

UNIT - III THREE PHASE INDUCTION MACHINES [09]

Constructional details – Types of rotors – Principle of operation – Rotating Magnetic field – Slip – Torque equations – Slip-torque characteristics – Equivalent circuit – Types of starters: DOL, Rotor resistance, autotransformer and star-delta starters – Crawling and cogging – Double cage rotors – Induction generator.

UNIT - IV PERFORMANCE ANALYSIS AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR [09]

Power flow and performance calculations – Load test – No load and blocked rotor tests – Circle diagram – Separation of no load losses – Speed control: Change of voltage, frequency, number of poles and slip – Slip power recovery scheme.

UNIT - V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES [09]

Constructional details of Single Phase Induction Motor – Double revolving field theory and operation – Equivalent Circuit – Types of starting methods: Split Phase, Capacitor Start, Capacitor Start and Run and Shaded Pole – Working Principles: stepper motor, Hysteresis motor, Reluctance motor and Universal Motor– Applications.

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

Text Books :

1 Nagrath I.J and Kothari D. P., Electric Machines, Tata McGraw Hill Publishing Company Ltd, New Delhi, Fourth Edition, 2012.

2 Samarajit Ghosh, Electrical Machines, Pearson Education, New Delhi, Second Edition, 2012.

Reference Books :

1 Fitzgerald, A.E. , Charles Kingsely Jr, Stephen D. Umans, Electric Machinery, McGraw Hill Education, New Delhi, Seventh Edition, 2017.

2 Murugesh Kumar, K., Induction and synchronous Machines, Vikas publishing house Pvt Ltd, Chennai, First Edition, 2009.

3 Charless A. Gross, Electric Machines, CRC Press, United States, First Edition, 2010.

4 Bimbhra, P.S., Electrical Machinery, Khanna Publishers, Delhi, Seventh Edition, 2011.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CO PO MAPPING

Semester : IV | **Regulation : 2020**

Course Code : 20EE412 | **Course Name : Electrical Machines – II**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explain the constructional details and the voltage regulation methods of synchronous generators.*	3	2	-	-	-	1	2	-	-	-	-	1	3	2
CO2	*Illustrate the working principle, starting methods and the performance of synchronous motor.*	3	2	-	-	-	1	2	-	-	-	-	1	3	2
CO3	*Elucidate the constructional details, characteristics and starting methods of three phase induction motor.*	3	2	-	-	-	1	2	-	-	-	-	1	3	2
CO4	*Exhibit the performance analysis and speed control methods of three phase induction motor.*	3	2	-	-	-	1	2	-	-	-	-	1	3	2
CO5	*Explain the construction and starting methods of single phase induction motor and special electrical machines.*	3	2	-	-	-	1	2	-	-	-	-	1	3	2
	Average	**3**	**2**	**-**	**-**		**1**	**2**	**-**		**-**	**-**	**1**	**3**	**2**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20EE413	**CONTROL SYSTEMS**	3	1	0	4

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, Nyquist stability and Routh Hurwitz criterion.*	*Analyze*
CO5:	*Design lag, lead, lag-lead compensator using bode plot.*	*Analyze*

UNIT - I SYSTEM AND THEIR REPRESENTATION [12]

Basic elements in control system – Types of system–Open and closed loop systems– Electrical analogous of mechanical translational and rotational system –Thermal system– Transfer function–AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

UNIT - II TIME RESPONSE ANALYSIS [12]

.Types of test signal – First and second order time response –Time domain specification of second order under damped systems – Types and Order of systems– Generalized error series–Steady state error and error constants.

UNIT - III FREQUENCY RESPONSE ANALYSIS [12]

Frequency response of the system – Bode plot – Polar plot – Constant M and N circles – Determination of closed loop response from open loop response – Correlation between frequency and time response.

UNIT - IV STABILITY OF CONTROL SYSTEM [12]

Characteristics equation – Routh Hurwitz criterion – Root locus construction –Nyquist stability criterion – Effect of pole, zero addition.

UNIT - V COMPENSATOR AND CONTROLLER DESIGN [12]

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots – P, PI, PID controllers.

Total (L= 45, T = 15) =60 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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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CO PO MAPPING

Semester : IV **Regulation : 2020**

Course Code : 20EE413 **Course Name : Control Systems**

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	3	2
CO2	*Determine the time-domain response of first and second order systems.*	3	3	2	2	-	-	-	-	-	-	-	2	3	2
CO3	*Examine the stability of open loop system using bode / polar plot.*	3	3	3	2	-	-	2	-	-	-	-	2	3	2
CO4	*Analyze the stability of the system by Root locus, Nyquist stability and Routh Hurwitz criterion.*	3	3	3	2	-	-	2	-	-	-	-	2	3	2
CO5	*Design lag, lead, lag-lead compensator using bode plot.*	3	3	3	2	-	-	2	-	-	-	-	2	3	2
	Average	**3**	**3**	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**3**	**2**

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SEMESTER - IV

		L	T	P	C
20EE414	**DIGITAL ELECTRONICS**	3	0	0	3

Prerequisite: Analog Electronics

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Simplify the logical expression using various reduction techniques.*	*Understand*
CO2:	*Design of various combinational circuits using logic gates.*	*Apply*
CO3:	*Design of synchronous* sequential circuits *and counters.*	*Apply*
CO4:	*Analyze the asynchronous Sequential circuits.*	*Apply*
CO5:	*Describe the operation of various semiconductor memories and programmable logic devices.*	*Understand*

UNIT - I FUNDAMENTALS OF BOOLEAN ALGEBRA AND GATE LEVEL MINIMIZATION [09]

Number Systems – Conversions – Binary Arithmetic – One's and Two's complements Arithmetic – Boolean postulates and laws – De-Morgan's Theorem – Principle of Duality – Boolean expression – Gate level Minimization: Standard representation for logic functions– Karnaugh map Minimization – Don't care conditions – Quine-McCluskey method.

UNIT - II COMBINATIONAL DIGITAL CIRCUITS [09]

Digital Logic Gates: AND, OR, NOT, NAND, NOR and Exclusive-OR operations – NAND – NOR Implementation – Adders – Subtractors – Multiplexer and Demultiplexer – Magnitude Comparator – Encoder and Decoders – Parity checker/ generator – Code Converters – Binary to gray, BCD to Excess-3, Gray to Binary.

UNIT - III SEQUENTIAL CIRCUITS AND COUNTERS [09]

Introduction – Storage Elements: Latches, Flip-Flop: SR, D, JK & T – operation and excitation tables – Realization of one flip flop using other flip flops – Analysis of Clocked Sequential Circuits – State Equation, State Table, State Diagram, State reduction and Assignment – shift registers and types – Counters– ripple (Asynchronous) counters, synchronous counters – Design of Synchronous counters using flip flop.

UNIT - IV ASYNCHRONOUS SEQUENTIAL CIRCUITS [09]

Introduction – Analysis and Design Procedure – State table and State diagrams, State Reduction Techniques. Design of asynchronous sequential circuits. Races and Cycles – Hazards, Design of Hazard free Switching circuits. Algorithmic State Machine.

UNIT - V SEMICONDUCTOR MEMORIES AND PROGRAMMABLE LOGIC DEVICES [09]

Semiconductor memories – Random Access Memory (RAM) – Read and Write operation, Read Only Memory (ROM), Programmable logic devices: ROM as a PLD, Programmable logic array – Programmable array logic – complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

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

Text Books :

1 Morris Mano,M., Digital Design, Pearson Education, New Delhi, Fifth Edition, 2015.

2 Morris Mano, M.,& Michael D.Ciletti, Digital Design with an Introduction to the Verilog HDL, Prentice Hall of IndiaPvt.Ltd, New Delhi, Fifth Edition, 2015.

Reference Books :

1 Salivahanan, S, and Arivazhagan, S, Digital Circuits and Design, Oxford University Press, New Delhi, Fifth Edition, 2018.

2 Tocci, Digital Systems: Principles and applications, Pearson Education, New Delhi, Tenth Edition, 2011.

3 Charles H.Roth, Fundamentals of Logic Design, Cengage Learning Publishing, Uttar Pradesh, Seventh Edition, 2013.

4 Anand Kumar, A., Fundamentals Of Digital Circuits, PHI Publication, New Delhi, Fourth Edition, 2016.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CO PO MAPPING

Semester	**: IV**	**Regulation**	**: 2020**
Course Code	**: 20EE414**	**Course Name**	**: Digital Electronics**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Simplify the logical expression using various reduction techniques.*	3	2	3	-	-	-	-	-	-	-	-	2	-	1
CO2:	*Design of various combinational circuits using logic gates.*	3	3	3	2	-	-	-	-	-	-	-	2	-	1
CO3:	*Design of synchronous* sequential circuits *and counters.*	3	3	3	2	-	-		-	-	-	-	2	-	2
CO4:	*Analyze the asynchronous Sequential circuits.*	3	3	3	2	-	-	-	-	-	-	-	2	-	2
CO5:	*Describe the operation of various semiconductor memories and programmable logic devices.*	3	2	3	-	-	-	-	-	-	-	-	2	-	2
	Average	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**2**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20CS432	**DATA STRUCTURE AND ALGORITHMS**	3	0	0	3

Prerequisite: *Basic knowledge of C Programming*

Course Outcomes: On Completion of this course , the student will be able to		***Cognitive level***
CO1	*Construct the different linear data structure to solve simple problems.*	*Understand*
CO2	*Build the various tree structures with its operations.*	*Create*
CO3	*Examine the concept of AVL tree, splay tree, B tree and B+ tree.*	*Analyze*
CO4	*Apply graph data structure to solve real time problems.*	*Apply*
CO5	*Analyze the efficiency of algorithms and evaluate various techniques.*	*Analyze*

UNIT - I LINEAR STRUCTURES [09]

Abstract Data Types (ADT) – List ADT – Array based implementation – Linked list implementation – Singly and Doubly linked lists – Stack ADT – Queue ADT – Implementation of Stack and Queue using Array and Linked list – Applications of stack: Evaluating arithmetic expressions – Conversion of Infix to postfix expression – Applications of Queue.

UNIT - II TREE STRUCTURES [09]

Tree ADT – Binary Tree ADT – Binary Tree traversals – Expression trees – Applications of trees – Binary search tree ADT – Insertion, Deletion, Find Min and Max.

UNIT - III BALANCED TREES AND HASHING [09]

AVL Trees – B-Tree – B+ Tree – Binary heaps – Hashing – Separate Chaining – Open Addressing – Linear Probing.

UNIT - IV GRAPHS [09]

Introduction to Graphs and its Types – Topological sort – Breadth First traversal – Depth-first traversal – Shortest path algorithms: Dijkstra's Algorithm – Minimum Spanning tree: Prim's and Kruskal's algorithms – Bi connectivity – Applications of graph

UNIT - V ALGORITHM DESIGN AND ANALYSIS [09]

Algorithm analysis framework – Asymptotic notation – Recurrences – Greedy algorithms: Prim's Algorithm – Kruskal's Algorithm – Divide and Conquer: Merge Sort – Dynamic programming: Knapsack Problem – Back tracking: Depth first search – Hamiltonian Circuit.

Total = 45 Periods

Text Books :

1 Weiss,M.A., Data Structures and Algorithm Analysis in C, Pearson Education, New Delhi, Second Edition, 2015.
2 Anany Levitin, Introduction to the Design and Analysis of Algorithms, Addition-Wesley Professional, USA, Third Edition, 2014.

References :

1 Gilberg,R.F., Forouzan,B.A. Data Structures, Thomson India, India, Second Edition, 2005.
2 Sharma, A.K., Data Structures using C, Pearson Education, New Delhi, First Edition,2011.
3 Aho, V., Hopcroft,J.E., and Ullman, J. D., Data Structures and Algorithms, Pearson Education, New Delhi, First Edition, 2003.
4 http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html

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

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CO PO MAPPING

Semester	**: IV**	**Regulation**	**: 2020**
Course Code	**: 20CS432**	**Course Name**	**: Data Structure and Algorithms**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Construct the different linear data structure to solve simple problems.*	3	2	3	2	2	-	-	-	1	-	2	1	-	-
CO2	*Build the various tree structures with its operations.*	3	2	3	2	2	-	-	-	1	-	3	1	-	-
CO3	*Examine the concept of AVL tree, splay tree, B tree and B+ tree.*	3	3	2	2	2	-	-	-	1	-	2	1	-	-
CO4	*Apply graph data structure to solve real time problems.*	3	2	2	2	2	-	-	-	1	-	3	1	-	-
CO5	*Analyze the efficiency of algorithms and evaluate various techniques.*	3	2	2	2	2	-	-	-	1	-	2	1	-	-
Average		**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**1**	**-**	**2**	**1**	**-**	**-**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20HS051	**UNIVERSAL HUMAN VALUES AND UNDERSTANDING HARMONY** (Common To All Branches)	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.*	*Understanding*
CO2:	*Distinguish between the self and the body, implement the meaning of harmony in the Co–existence of Self and the Body.*	*Understanding*
CO3:	*Explain the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships.*	*Understanding*
CO4:	*Describe the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.*	*Understanding*
CO5:	*Explain the ethical and unethical practices in work environment.*	*Understanding*

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 Fulfillment 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, Excell Books Pvt. Ltd., New Delhi, First Edition, 2016.

2 Tripaty, A.N., 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 Seebauer, E.G., Robert L. Berry, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press, 2000.

4 Banerjee,B.P., Foundations of Ethics and Management, Excel Book, 2005.

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

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CO PO MAPPING

Semester : **IV** **Regulation** : **2020**

Course Code : **20HS051** **Course Name** : **Universal Human Values and Understanding Harmony**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explain the basic concepts of value education.*	-	-	-	-	-	1	1	3	3	-	1	3	-	-
CO2	*Distinguish between the self and the body, implement the meaning of Harmony in the Co– existence of Self and the Body.*	-	-	-	-	-	1	1	3	3	-	1	3	-	-
CO3	*Explain the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human–human relationships.*	-	-	-	-	-	1	1	3	3	-	1	3	-	-
CO4	*Describe the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.*	-	-	-	-	-	1	1	3	3	-	1	3	-	-
CO5	*Explain the ethical and unethical practices in work environment.*	-	-	-	-	-	1	1	3	3	-	1	3	-	-
	Average	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**3**	**3**	**-**	**1**	**3**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20EE421	**ELECTRICAL MACHINES LABORATORY - II**	0	0	3	1

Prerequisite: *Electrical Machines Laboratory - I*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Compute the performance of three phase alternator by* direct and indirect tests.	*Understand*
CO2:	*Obtain the* V and Inverted V curves of three-phase synchronous motor.	*Understand*
CO3:	*Determine the performance of the single phase, three phase squirrel cage and slip ring induction motor.*	*Understand*
CO4:	*Predetermine the performance of the single phase and three phase squirrel cage induction motor.*	*Understand*
CO5:	*Realize the speed control of three phase induction motor.*	*Understand*

LIST OF EXPERIMENTS

1. Regulation of three phase alternator by EMF, MMF and ZPF methods.
2. Load test on three phase alternator.
3. V and Inverted-V curves of three phase synchronous motor.
4. Load test on single phase induction motor.
5. Load test on three phase squirrel cage induction motor.
6. Load test on three phase slip ring induction motor.
7. Determination of equivalent circuit of single-phase induction motor.
8. No-load and blocked rotor test on three-phase induction motor.
9. Loss summation method on three-phase induction motor.
10. Speed control of three phase induction motor by V/f method.

Total = 45 Periods

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Compute the performance of three phase alternator by* direct and indirect tests	3	3	2	-	-	-	-	1	2	-	-	3	3	2
CO2	*Obtain the* V and Inverted V curves of three-phase synchronous motor.	3	3	2	-	-	-	-	1	2	-	-	3	3	2
CO3	*Determine the performance of the single phase, three phase squirrel cage and slip ring induction motor.*	3	3	2	-	-	-	-	1	2	-	-	3	3	2
CO4	*Predetermine the performance of the single phase and three phase squirrel cage induction motor.*	3	3	2	-	-	-	-	1	2	-	-	3	3	2
CO5	*Realize the speed control of three phase induction motor.*	3	3	2	-	-	-	-	1	2	-	-	3	3	2
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**-**	**-**	**3**	**3**	**2**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20EE422	**DIGITAL ELECTRONICS LABORATORY**	0	0	3	1

Prerequisite: *Analog Electronics*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Verify the basic Boolean expression using logic gates.*	*Apply*
CO2:	*Design and implementation of adder and subtractor circuits.*	*Apply*
CO3:	*Design and implement the various combinational circuits using logic gates.*	*Apply*
CO4:	*Verify and implement the application of various flip flops.*	*Apply*
CO5:	*Design and implement the basic digital circuits using FPGA.*	*Apply*

LIST OF EXPERIMENTS

1. Verification of basic Boolean expression using logic gates.
2. Design and implement Full adder and Full subtractor.
3. Design and implement 4-bit Parallel Adder/ subtractor using IC 7483.
4. Design and implement a parity generator and checker.
5. Design and implement the following code converter: BCD to Excess -3, Binary to Gray.
6. Design and implement a MUX and DE-MUX.
7. Design and implement an encoder and a decoder.
8. Implementation and verification of truth table for S-R flip-flop, D flip-flop and T flip-flop.
9. Design and implementation of synchronous counter using S-R flip-flops.
10. Implementation practice of digital circuits using FPGA.

Total = 45 Periods

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Verify the basic Boolean expression using logic gates.*	3	2	-	2	-	-	-	1	2	-	-	1	-	-
CO2	*Design and implementation of adder and subtractor circuits.*	3	2	3	2	-	-	-	1	2	-	-	1	1	2
CO3	*Design and implement the various combinational circuits using logic gates.*	3	2	3	2	-	-	-	1	2	-	-	1	1	2
CO4	*Verify and implement the application of various flip flops.*	3	2	3	2	-	-	-	1	2	-	-	1	1	2
CO5	*Design and implement the basic digital circuits using FPGA.*	3	2	3	2	3	-	-	1	2	-	-	1	1	2
Average		**3**	**2**	**3**	**2**	**3**	**-**	**-**	**1**	**2**	**-**	**-**	**1**	**1**	**2**

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SEMESTER - IV

20EE423	**CONTROL AND INSTRUMENTATION LABORATORY**	L	T	P	C
		0	0	3	1

Prerequisite: *Electrical Machines – I , Measurement and Instrumentation*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Determine the transfer function of DC machines and* AC servo motor.	*Understand*
CO2:	*Examine the characteristics of DC and AC position control systems.*	*Understand*
CO3:	*Examine the lag, lead compensators and stability of linear system* using MATLAB.	*Understand*
CO4:	*Determine the unknown resistance, inductance and capacitance using bridges*	*Understand*
CO5:	*Determine the physical quantities using LVDT and* LabVIEW.	*Understand*

LIST OF EXPERIMENTS

1. Determine the transfer function of DC shunt generator.
2. Determine the transfer function of DC shunt motor.
3. Determine the transfer function of AC servo motor.
4. Position control of DC and AC servo motor
5. Simulation of lag and lead compensator and, stability analysis of linear systems.
6. Measurement of Resistance using Wheatstone and Kelvin's Double bridge.
7. Measurement of Inductance using Maxwell's and Anderson bridge.
8. Measurement of capacitance using Schering's bridge and Desauty's bridge.
9. Measurement of displacement using LVDT.
10. Measurement of temperature and pressure using LabVIEW

Total = 45 Periods

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	*Determine the transfer function of DC machines and* AC servo motor.	3	2	3	1	-	-	-	1	2	-	-	1	3	2
CO2	*Examine the characteristics of DC and AC position control systems.*	3	2	3	1	-	-	-	1	2	-	-	1	3	2
CO3	*Examine the lag, lead compensators and stability of linear system* using MATLAB.	3	2	3	1	3	-	-	1	2	-	-	1	3	2
CO4	*Determine the unknown resistance, inductance and capacitance using bridges*	3	2	3	1	-	-	-	1	2	-	-	1	1	3
CO5	*Determine the physical quantities using LVDT and* LabVIEW.	3	2	3	1	3	-	-	1	2	-	-	1	1	3
	Average	**3**	**2**	**3**	**1**	**3**	**-**	**-**	**1**	**2**	**-**	**-**	**1**	**2**	**2**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20HR452	**CAREER DEVELOPMENT SKILLS - II**	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 Ashra Rizvi,M, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2005.

3 Lal & Goswami, M.B. Objective Instant Arithmetic, Upkar Publications, New Delhi, Second Edition, 2012.

4 Norman Lewis. W.R., Word Power Made Easy, Goyal Publications.

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20EE511	**POWER SYSTEMS – II**	3	0	0	3

Prerequisite: *Electric Circuit Analysis, Power Systems-I*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Infer the knowledge about modeling of power systems*	*Understand*
CO2:	*Determine the power system network parameters*	*Apply*
CO3:	*Analyze the power flow in the power system network*	*Apply*
CO4:	*Assess the power systems abnormal (fault) conditions*	*Apply*
CO5:	*Explain the stability of the power system for various disturbances*	*Understand*

UNIT - I INTRODUCTION TO POWER SYSTEM ANALYSIS [09]

Introduction to modern power system – Need for system analysis in planning and operation of power system – Basic components of a power system – Single line diagram – Per phase analysis: Generator model, Transformer model, Line model, Load representation – Per unit representation.

UNIT - II ADMITTANCE AND IMPEDANCE MATRIX [09]

Introduction to network equation – Primitive matrix – Formation of Y-bus matrix: Inspection method, Singular transformation method (Without Mutual coupling), Node elimination – Formation of Z-bus matrix using step by step method (Without Mutual coupling) – Equivalent circuit of transformer with off-nominal tap ratio.

UNIT - III POWER FLOW ANALYSIS [09]

Bus classification – Statement of load flow problem – Derivation of power flow equation – Power flow solution using Gauss-Seidel method – Power flow solution using Newton-Raphson method and Fast Decoupled power flow analysis (Quantitative Approach) – Comparison of power flow analysis methods.

UNIT - IV FAULT ANALYSIS [09]

Importance of short circuit study – Short circuit capacity – Balanced three phase fault analysis: using bus impedance matrix, Thevenin's method – Unsymmetrical Fault Analysis: Fundamental of symmetrical components, Sequence impedance, Sequence networks, Single line to ground fault, Line to line fault and Double line to ground fault.

UNIT - V STABILITY ANALYSIS [09]

Basic concepts of stability studies – Classification of power system stability: Rotor angle stability and voltage stability – Single Machine Infinite Bus (SMIB) system: Development of swing equation – Equal area criterion – Critical clearing angle and time – Modified Euler method and Runge-Kutta fourth order method.

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

Text Books :

1 John J. Grainger and Jr.W.D. Stevenson, Power System Analysis, Tata McGraw Hill, New Delhi, First Edition, Reprint 2014.

2 S. Ramar and S. Kuruseelan, Power System Analysis, PHI Learning Private Limited, New Delhi, First Edition, 2013.

Reference Books :

1 Nagrath. I.J, Kothari. D.P, Modern Power System Analysis, Tata McGraw Hill, New Delhi, Third Edition, 2003.

2 Hadi Saadat, Power System Analysis, Tata McGraw Hill Publishing Company, New Delhi, Third Edition, 2011.

3 A.Nagoor Kani, Power System Analysis, RBA Publications, Chennai, First Edition, 2013.

4 P. Kundur, Power System Stability and Control, Tata McGraw Hill Publishing Company, New Delhi, First Edition, 2006.

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

Semester:	**V**	**Regulation:**	**R 2020**
Course Code:	**20EE511**	**Course Name:**	**Power Systems – II**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Infer the knowledge about modeling of power systems*	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO2:	*Determine the power system network parameters*	3	3	2	-	2	1	-	-	-	-	-	3	3	2
CO3:	*Analyze the power flow in the power system network*	3	3	2	-	2	2	-	-	-	-	-	3	3	2
CO4:	*Assess the power systems abnormal (fault) conditions*	3	3	2	-	2	3	-	-	-	-	-	3	3	2
CO5:	*Explain the stability of the power system for various disturbances*	3	3	2	-	1	2	-	-	-	-	-	3	3	2
Average		**3**	**3**	**2**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20EE512	**SIGNALS AND SYSTEMS**	3	1	0	4

Prerequisite: *Differential Equations and Numerical Methods*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Examine the properties of continuous and discrete time signals*	*Understand*
CO2:	*Find the performance of LTI CT systems using Laplace Transform*	*Apply*
CO3:	*Analyze the Continuous Time Periodic signals using Fourier Series*	*Apply*
CO4:	*Resolve the signals in frequency domain using Continuous Time Fourier Transform.*	*Apply*
CO5:	*Compute the Discrete Time Fourier Transform for Discrete time Aperiodic signals.*	*Apply*

UNIT - I CONTINUOUS TIME (CT) AND DISCRETE TIME (DT) SIGNALS [12]

Signal representation – Basic operations on signals – CT complex exponential and sinusoidal signals, DT complex exponential and sinusoidal signals, CT unit impulse and unit step function, DT unit impulse and unit step sequence – Classification of signals – Signal Energy and Power – Periodic signals – Even and Odd signals – Random signal.

UNIT - II CONTINUOUS TIME SYSTEMS [12]

Properties of continuous time systems – Convolution integral – Representation of continuous time Linear time invariant (LTI) systems using differential equations – Block diagram representation – Unit step and unit impulse response of LTI system – Analysis of LTI systems using Laplace transform.

UNIT - III FOURIER SERIES ANALYSIS [12]

Fourier series representation of continuous time periodic signals: Trigonometric Fourier series, Exponential Fourier series – Convergence of Fourier series – Gibbs Phenomenon – Properties of continuous time Fourier series.

UNIT - IV CONTINUOUS TIME FOURIER TRANSFORM [12]

Continuous Time Fourier transform – Existence of Fourier transform – Fourier transform of standard signals - Properties of continuous time Fourier transform – Analysis of continuous time LTI systems using Fourier transform.

UNIT - V DISCRETE TIME FOURIER TRANSFORM [12]

Discrete Time Fourier Transform (DTFT) – Properties of DTFT – Time and frequency shifting – Conjugation – Parseval's relation – Frequency Response of first order LTI system – Inverse DTFT.

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

Text Books :

1 Alan V Oppenheim, Alan S. Wilskey and Hamid Nawab.S, Signals and Systems, Pearson Education, New Delhi, Second Edition, 2015.

2 Anand Kumar.A, Signals and Systems, PHI Publications, New Delhi, Third Edition, 2015.

Reference Books :

1 V. Krishnaveni, and A. Rajeswari, Signals & System, Wiley India Pvt. Ltd , New Delhi, First Edition, 2012.

2 Rodger Ziemer. E, William Tranter. H and Ronald Fannin. D, Signals and Systems-Continuous and Discrete, Pearson Education, New Delhi, Fourth Edition, 2015.

3 Gabel, R.A and Richard, R.A, Signals and Linear Systems, John Wiley and sons, New Delhi, Third Edition 1995.

4 Gordan E Carlson, Signals and Linear Systems Analysis, John Wiley and sons, New Delhi, Second Edition, 1998

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: V | **Regulation:** R 2020
Course Code: 20EE512 | **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:	*Examine the properties of continuous and discrete time signals.*	3	3	2	-	-	-	-	-	-	-	-	3	-	2
CO2:	*Find the performance of LTI CT systems using Laplace Transform.*	3	3	3	-	2	-	-	-	-	-	-	3	-	2
CO3:	*Analyze the Continuous Time Periodic signals using Fourier Series.*	3	3	3	-	2	-	-	-	-	-	-	3	-	2
CO4:	*Resolve the signals in frequency domain using Continuous Time Fourier Transform.*	3	3	3	-	2	-	-	-	-	-	-	3	-	2
CO5:	*Compute the Discrete Time Fourier Transform for Discrete time Aperiodic signals.*	3	2	3	-	2	-	-	-	-	-	-	3	-	2
	Average	**3**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

20EE513	**POWER ELECTRONICS**	L	T	P	C
		3	0	0	3

Prerequisite: *Analog Electronics*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the characteristics of power semiconductor devices and firing scheme, protection and commutation techniques for SCR.*	*Understand*
CO2:	*Analyze the electrical parameter of different AC to DC phase controlled converters with various loads and summarize the effect of source inductance of various converters.*	*Apply*
CO3:	*Make use of the DC chopper for various quadrant operations and analyze the performance.*	*Understand*
CO4:	*Analyze the performance of AC to AC Converters.*	*Understand*
CO5:	*Explain the principle of various inverter topologies and employing power electronics devices in utility related applications.*	*Understand*

UNIT - I **POWER SEMICONDUCTOR DEVICES** **[09]**

Introduction – V-I and switching characteristics of power semiconductor devices: Power Diode, Thyristor, Power MOSFET, Power IGBT, TRIAC and GTO – SCR protection circuits – SCR firing circuits – SCR Commutation techniques – Gate drive circuits: Power MOSFET and IGBT.

UNIT - II **AC TO DC CONVERTER** **[09]**

Principle of phase controlled rectifier – Single phase semi and fully controlled converter with R, RL, RLE load – Single phase Dual Converter – Three phase semi and fully controlled converter with R, RL, RLE load – Three phase dual converter – Effect of source inductance.

UNIT - III **DC TO DC CONVERTER** **[09]**

Classification: Buck converter, Boost converter and Buck-Boost converter – CUK Converter – Control Techniques: Time ratio control and current limit control – Types: Class A, Class B, Class C, Class D and Class E chopper.

UNIT - IV **AC TO AC CONVERTER** **[09]**

Introduction – Single phase and three phase AC voltage controllers with R and RL load – Control Techniques: Principle of ON-OFF control and phase angle control – Single phase and three phase step-up and step-down cycloconverters – Operation of single phase matrix converter.

UNIT - V **DC TO AC CONVERTER** **[09]**

Principle of operation: Single phase voltage source inverter, Three phase voltage source inverters (120° and 180° mode) – Single phase and Three phase current source inverter – PWM techniques.

Power Electronic Applications: UPS, SMPS and HVDC transmission systems.

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, First Edition, 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 Dubey.G.K, Doradla.S.R, Joshi.A and Sinha.R.M, Thyristorised Power Controllers, John Wiley and Sons Ltd, United States, First Reprint, 2005.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: V **Regulation:** R 2020
Course Code: 20EE513 **Course Name:** Power Electronics

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Describe the characteristics of power semiconductors devices and firing scheme, protection and commutation techniques for SCR.*	3	2	2	-	3	-	-	-	-	-	-	2	3	2
CO2:	*Analyze the electrical parameter of different AC to DC phase controlled converters with various loads and summarize the effect of source inductance for various converters.*	3	2	2	-	3	-	-	-	-	-	-	2	3	2
CO3:	*Make use of the DC chopper for various quadrant operations and analyze the performance.*	3	2	2	-	3	-	-	-	-	-	-	2	3	2
CO4:	*Analyze the performance of AC to AC Converters.*	3	2	2	-	3	-	-	-	-	-	-	2	3	2
CO5:	*Explain the principle of various inverter topologies and employing power electronics devices in utility related applications.*	3	2	2	-	3	-	-	-	-	-	-	2	3	2
Average		**3**	**2**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20EE514	**POWER SYSTEM PROTECTION AND SWITCHGEAR**	3	0	0	3

Prerequisite: *Power Systems – I*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline various faults and different types of relays used for protection of power system equipment.*	*Understand*
CO2:	*Explain the protection schemes for different power system components.*	*Understand*
CO3:	*Discuss the fundamentals of arcing phenomena.*	*Understand*
CO4:	*Demonstrate the functionality of various protecting devices used in power systems.*	*Understand*
CO5:	*Explain power system earthing and the methods of protection against over voltages.*	*Understand*

UNIT - I OPERATING PRINCIPLES AND RELAY CHARACTERISTICS [09]

Principles and need for protective schemes – Nature and causes of faults – Types of faults – Zones of protection and essential qualities of protection – Protection scheme – Construction and Characteristics of relays – Over current relays – Directional, distance and differential relays – Under frequency relays – Static relays.

UNIT - II APPARATUS AND LINE PROTECTION [09]

Generator protection: Protection against stator faults - Balanced earth fault Protection - Stator inter turn protection - Unbalanced loading of alternator - Overloading protection - Prime mover failure - Overvoltage protection - Restricted earth fault protection of generator - Standby earth fault protection - Miscellaneous Relays - Rotor fault protection - Backup protection - Digital protection- Generators - Motor Protection.

Transformer Protection: Differential Protection of Transformers - Buchholz's Relay. Busbar: Types of busbar, Busbar protection - Frame leakage protection, Line Protection: Distance or impedance Protection - Carrier current protection.

UNIT - III THEORY OF CIRCUIT INTERRUPTION [09]

Physics of arc phenomena and arc interruption – Restriking voltage and Recovery voltage, Rate of rise of recovery voltage, Current chopping, Interruption of capacitive current, Resistance switching – DC and AC circuit breaking.

UNIT - IV FUSES & CIRCUIT BREAKERS [09]

Fuses: Types and its specification – Fault clearing process – Interruption of current – Types of Circuit Breakers – Air blast, Air break, Oil, SF6 and Vacuum circuit breakers – Comparative merits of different circuit breakers – Rating of circuit breakers.

UNIT - V EARTHING AND PROTECTION AGAINST OVER VOLTAGES [09]

Power system earthing – Concepts of Step potential and Touch potential – Effect of electric shock on human beings – Causes of over voltages – Methods of protection against over voltages, Ground wires, Lightning, Switching, Insulation failure, Peterson coil, Surge absorbers, Surge diverters – Relay coordination – Selection of protective system.

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

Text Books :

1 Soni.M.L, Gupta.P.V, Bhatnagar.V.S, Chakrabarti.A, A Text Book on Power System Engineering, Dhanpat Rai & Co., New Delhi, Thirteenth Reprint, Second Edition, 2018.

2 Ravindra P. Singh, Switchgear and Power System Protection, Prentice-Hall of India Pvt. Ltd., New Delhi, Second Reprint, First Edition, 2014.

Reference Books :

1 Ravindranath.B and Chander.N, Power System Protection & Switchgear, New Age Publishers, India, Second Edition, 2018.

2 Badri Ram and Vishwakarma, Power System Protection and Switchgear, Tata McGraw-Hill Publishing Company Ltd., New Delhi, Tenth Reprint, Second Edition, 2015.

3 Prof. Bhaveshkumar R. Bhalja,Power System Protection and Switchgear, Oxford University Press, Second edition, New Delhi, India, 2018.

4 Bhuvanesh A. Oza, Nirmal-Kumar C. Nair, Rashesh P. Mehta and Vijay H. Makwana, Power System Protection and Switchgear, Tata McGraw-Hill Publishing Company Ltd., New Delhi, Fourth Reprint, First Edition, 2012.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: **V** **Regulation:** **R 2020**
Course Code: **20EE514** **Course Name:** **Power System Protection and Switchgear**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Outline various faults and different types of relays used for protection of power system equipment.*	3	2	2	-	-	2	2	-	-	-	-	2	3	3
CO2:	*Explain the protection schemes for different power system components.*	3	2	2	-	-	2	2	-	-	-	-	2	3	3
CO3:	*Discuss the fundamentals of arcing phenomena.*	3	2	2	-	-	2	2	-	-	-	-	2	3	3
CO4:	*Demonstrate the functionality of various protecting devices used in power systems.*	3	2	2	-	-	2	2	-	-	-	-	2	3	3
CO5:	*Explain power system earthing and the methods of protection against over voltages.*	3	2	2	-	-	2	2	-	-	-	-	2	3	3
	Average	**3**	**2**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**3**	**3**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20IE591	**AUGMENTED INTELLIGENCE LED MANAGED SERVICES (AIMS) – I** (Common To CS, EC, EE & IT)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify the operation policies and procedures based on how the organization works.*	*Understand*
CO2:	*Apply the procedures to achieve a safe working environment in line with health and safety regulation.*	*Apply*
CO3:	*Outline the Key Concepts of Service Management of IT-enabled services*	*Understand*
CO4:	*Recognize an IT Infrastructure and Security mechanism*	*Understand*
CO5:	*Implement the policies in Microsoft 365.*	*Apply*

UNIT – I IT OPERATIONS [09]

Evolution of Technologies – IT Operations Introduction – Policies – Roles – Support – Procedures for Managing Problems and Incidents.

UNIT – II SECURE WORKING ENVIRONMENT AND ETIQUETTE [09]

Introduction – Safety Enforcement – National Standards – Safety Compliance – Health and Safety Awareness – Components of Etiquette – Professionalism & Ethics – Etiquette Standards – Email Communication – Business Meetings, Grooming & Personal Attire – Dining Etiquette.

UNIT – III ITIL [09]

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 [09]

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 [09]

Introduction – Support Models – Activities Type – Audits – Microsoft 365 – Domain Management – Licensing – Managing Teams – Meeting Policies – Messaging Policies.

Total (L= 45, T = 0) = 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/

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CO-PO MAPPING

Semester:	**V**	**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:	*Identify the operation policies and procedures based on how the organization works.*	3	2	2	-	2	-	-	2	1	-	-	2	-	-
CO2:	*Apply the procedures to achieve a safe working environment in line with health and safety regulation.*	3	3	3	-	3	-	-	2	1	-	-	2	-	-
CO3:	*Outline the Key Concepts of Service Management of IT-enabled services*	3	2	2	-	3	-	-	2	1	-	-	2	-	-
CO4:	*Recognize an IT Infrastructure and Security mechanism*	3	2	3	-	2	-	-	2	1	-	-	2	-	-
CO5:	*Implement the policies in Microsoft 365.*	3	2	3	-	3	-	-	1	1	-	-	3	-	-
	Average	**3**	**2**	**3**	**-**	**3**	**-**	**-**	**2**	**1**	**-**	**-**	**2**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – V

ARTIFICIAL INTELLIGENCE
(Common To EC & EE)

20CS501	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 appropriate 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.*	*Analyze*
CO4:	*Use planning algorithms and illustrate about learning*	*Apply*
CO5:	*Describe about expert systems.*	*Understand*

UNIT – I BASICS OF ARTIFICIAL INTELLIGENCE [9]

Intelligent Agents – Agents and environments – Good behavior– Nature of environments – Structure of agents – Problem Solving: Problem solving agents – Example problems – Searching for solutions – Un-informed search strategies.

UNIT – II PROBLEM SOLVING [9]

Informed search and exploration – Informed search strategies – Heuristic function – Local search algorithms and optimistic problems – Constraint Satisfaction Problems – Backtracking search – Structure of problems – Adversarial Search – Games – Optimal decisions in games – Alpha-Beta Pruning.

UNIT – III PROBABILISTIC 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 – Prepositional versus first order logic – Unification and lifting – Forward chaining – Backward chaining – Resolution.

UNIT– IV PLANNING AND LEARNING [9]

Planning Problem – Planning with state – space search – Partial-order planning – Planning graphs – Learning from observation – Inductive learning – Decision trees – Explanation based learning.

UNIT – V EXPERT SYSTEMS [9]

Expert Systems – Architecture of Expert Systems – Roles of Expert Systems – Knowledge Acquisition – Typical Expert Systems – MYCIN – Expert Systems Shells.

Total = 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 York, 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 Education, New York, First Edition, 2013.

4 David L. Poole and Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, Second Edition, 2010.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CS501** **Course Name:** **ARTIFICIAL INTELLIGENCE**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Describe agents structure and predict appropriate uninformed search algorithms for any AI problem*	3	3	3	3	3	2	-	-	-	2	-	3	-	-
CO2	*Illustrate appropriate AI methods to solve a given problem.*	3	3	3	3	3	2	-	-	-	2	-	3	-	-
CO3	*Explain a problem using first order and predicate logic.*	3	3	3	3	3	2	-	-	-	2	-	3	-	-
CO4	*Use planning algorithms and illustrate about learning*	3	3	3	3	3	2	-	-	-	2	-	3	-	-
CO5	*Describe about expert systems.*	3	3	3	3	3	2	-	-	-	2	-	3	-	-
Average		**3**	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**3**	**-**	-

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20EE521	**POWER SYSTEMS LABORATORY**	0	0	3	1

Prerequisite: *Power Systems-I*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Obtain the transmission line parameters of the power system.*	*Apply*
CO2:	*Determine the bus admittance and impedance matrix and evaluate the power flow in the power system network.*	*Apply*
CO3:	*Assess the abnormal (fault) conditions of the power system.*	*Apply*
CO4:	*Analyze the small signal stability limit of the single machine infinite bus system and examine the transient Stability of multi-machine power system.*	*Apply*
CO5:	*Determine the economic dispatch of generating units with and without loss.*	*Apply*

List of Experiments

1. Computation of Performance Parameters and Modeling of Transmission Lines.
2. Formation of Bus Admittance Matrices.
3. Formation of Bus Impedance Matrices.
4. Load Flow Analysis – I: using Gauss-Seidel Method.
5. Load Flow Analysis – II: using Newton-Raphson Method.
6. Load Flow Analysis – II: using Fast Decoupled Method.
7. Fault Analysis: Solution of Short Circuit Analysis.
8. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System.
9. Transient Stability Analysis of Multi–Machine Power Systems.
10. Economic Dispatch in Power Systems.

Total = 45 Periods

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: V **Regulation:** R 2020
Course Code: 20EE521 **Course Name:** Power Systems Laboratory

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Obtain the transmission line parameters of the power system.*	3	2	3	-	3	-	-	2	2	-	-	1	3	2
CO2:	*Determine the bus admittance and impedance matrix and evaluate the power flow in the power system network.*	3	2	3	-	3	-	-	2	2	-	-	2	3	2
CO3:	*Assess the abnormal (fault) conditions of the power system.*	3	2	3	-	3	-	-	2	2	-	-	2	3	2
CO4:	*Analyze the small signal stability limit of the single machine infinite bus system and examine the transient Stability of multi-machine power system.*	3	2	3	-	3	-	-	2	2	-	-	2	3	2
CO5:	*Determine the economic dispatch of generating units with and without loss.*	3	2	3	-	3	-	-	2	2	-	-	2	3	2
	Average	**3**	**2**	**3**	**-**	**3**	**-**	**-**	**2**	**2**	**-**	**-**	**2**	**3**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20EE522	**POWER ELECTRONICS LABORATORY**	0	0	3	1

Prerequisite: *Analog Electronics Laboratory*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Contrast and relate the various characteristics of power semiconductors.*	*Apply*
CO2:	*Design and analyze the performance of different AC to DC controlled converters.*	*Apply*
CO3:	*Design the Buck-Boost converter and PWM inverters.*	*Apply*
CO4:	*Analyze the performance of a single phase cyclo converter.*	*Apply*
CO5:	*Design and simulate the different types of converter and inverters using MATLAB.*	*Apply*

List of Experiments

1. V-I characteristics of SCR and TRIAC.
2. V-I and transfer characteristics of MOSFET and IGBT.
3. Single- phase half and fully controlled converter.
4. Three-phase half and fully controlled converter.
5. MOSFET based Buck-Boost converter.
6. IGBT based single phase PWM inverter.
7. Simulation and real time validation of single-phase cyclo converter.
8. Simulations of single-phase half and fully controlled converter.
9. Simulations of three-phase half and fully controlled converter.
10. Simulation of single and three phase inverters.

Total = 45 Periods

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

Semester: V **Regulation:** R 2020

Course Code: 20EE522 **Course Name:** Power Electronics Laboratory

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Contrast and relate the various characteristics of power semiconductors.	3	2	-	-	-	-	-	2	3	1	-	2	2	2
CO2:	*Design and analyze the performance of different AC to DC controlled converters.*	3	2	3	-	2	-	-	2	3	1	-	2	2	2
CO3:	*Design the Buck-Boost converter and PWM inverters.*	3	2	3	-	2	-		2	3	1	-	2	2	2
CO4:	*Analyze the performance of a single phase cyclo converter.*	3	2	3	-	2	-	-	2	3	1	-	2	2	2
CO5:	*Design and simulate the different types of converter and inverters using MATLAB.*	3	2	3	-	3	-	-	2	3	1	-	2	2	2
	Average	**3**	**2**	**3**	**-**	**2**	**-**	**-**	**2**	**3**	**1**	**-**	**2**	**2**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20HR553	**CAREER DEVELOPMENT SKILLS – III**	0	2	0	0

Prerequisite: *NIL*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Develop the basic grammatical rules for written and oral communication.*	*Understand*
CO2:	*Perform well in verbal and logical reasoning.*	*Understand*
CO3:	*Enhance their skills on quantitative aptitude.*	*Understand*
CO4:	*Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.*	*Understand*
CO5:	*Develop the comprehension Skills in core subjects.*	*Understand*

UNIT - I WRITTEN AND ORAL COMMUNICATION [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 [06]

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

UNIT - III QUANTITATIVE APTITUDE [06]

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

UNIT - IV QUANTITATIVE APTITUDE [06]

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

UNIT - V DOMAIN PROFICIENCY [06]

Fundamentals of electric circuits, Construction and operation of Electrical machines, Electrodynamic fields, Introduction to Non-conventional energy sources.

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

Text Books :

1 Anne Laws, Writing Skills, Orient Black Swan, Hyderabad, First Edition, 2011.
2 Abhijt Guha, Quantitative Aptitude, Tata McGraw HILL, New Delhi, Third Edition, 2009.

Reference Books :

1 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2005
2 Sarah Freeman, Written Communication in English, Orient Black Swan, Hyderabad, First Edition, 2015.
3 M.B. Lal & Goswami, Objective Instant Arithmetic, Upkar Publications, New Delhi, First Edition, 2010.
4 V.K. Mehta & Rohit Mehta, Objective Electrical Technology, S Chand publications, New Delhi, First Edition, 2012.

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

Semester: V **Regulation:** R 2020
Course Code: 20HR553 **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:	*Develop the basic grammatical rules for written and oral communication.*	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO2:	*Perform well in verbal and logical reasoning.*	1	-	-	-	-	-	-	-	2	3	-	3	-	-
CO3:	*Enhance their skills on quantitative aptitude.*	1	-	-	-	-	-	-	-	2	3	-	3	-	-
CO4:	*Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.*	2	-	-	-	-	-	-	-	2	3	-	3	-	-
CO5:	*Develop the comprehension Skills in core subjects.*	-	-	-	-	-	-	-	-	2	3	-	3	-	-
Average		**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**	**3**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

20EE611	**ELECTRICAL MACHINE DESIGN**	L	T	P	C
		3	1	0	4

Prerequisite(s): *Electrical Machines - I, Electrical Machines - II*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Apply the concept of specific loadings and MMF to design the electrical machines.*	*Apply*
CO2:	*Identify the optimal design for the transformer.*	*Apply*
CO3:	*Design a DC machine's armature, air-gap, commutator, brushes and investigate the choice of number of poles.*	*Apply*
CO4:	*Apply the procedure to design stator and squirrel cage rotor for three phase induction machine.*	*Apply*
CO5:	*Design stator and rotor windings of salient and non-salient pole machines and identify the factors for the choice of specific loading to design of synchronous machine.*	*Apply*

UNIT – I **BASIC CONSIDERATION IN DESIGN** **[12]**

Considerations and limitations in design – Specific electric and magnetic loadings – Rating of machines – Selection of motor power ratings.

Concept of magnetic circuit – MMF calculation for various types of electrical machines – Real and apparent flux density of rotating machines – Leakage reactance calculation for transformers, induction and synchronous machine.

UNIT – II **TRANSFORMERS** **[12]**

kVA rating of single phase and three phase transformers – Relation between output and volt per turn – Choice of specific loadings – Optimum design of transformers – Design of core, yoke and windings for core and shell type transformers – Design of tank and cooling tubes of transformers.

UNIT – III **DC MACHINES** **[12]**

Output equation – Main dimensions – Choice of specific loadings – Choice of number of poles – Armature design – Design of air gap – Design of commutator and brushes.

UNIT – IV **THREE PHASE INDUCTION MOTORS** **[12]**

Output equation – Main Dimensions – Choice of specific loadings – Design of stator – Length of air gap – Design of squirrel cage rotor – Rotor bars and slots – Design of end rings – Design of wound rotor.

UNIT – V **SYNCHRONOUS MACHINES** **[12]**

Output equation – Main dimensions – Choice of specific loadings – Short circuit ratio – Design of stator and rotor of cylindrical pole and salient pole machines – Design of damper windings – Design of field coil – Cooling of Turbo alternators.

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

Text Books :

1 A.K. Sawhney, A Course in Electrical Machine Design, Dhanpat Rai and Sons, New Delhi, Eighth Edition, 2016.

2 R.K. Agarwal, Principles of Electrical Machine Design, S.K. Kataria and Sons, Delhi, Fifth Edition, Reprint 2020.

Reference Books :

1 S.K. Sen, Principles of Electrical Machine Design with Computer Programmes, Oxford and IBH Publishing Co Pvt. Ltd., New Delhi, Second edition, 2006.

2 V.N. Mittle and A.Mittle, Design of Electrical Machines, Standard Publications Distributors, Delhi, Fifth Edition, 2013.

3 M.V. Deshpande, Design and Testing of Electrical Machines, PHI Learning Private Limited, New Delhi, Third Edition, 2010.

4 A. Shanmugasundaram, G. Gangadharan, R. Palani, Electrical Machine Design Data Book, New Age International Pvt. Ltd., New Delhi, Second Edition, 2015.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: VI **Regulation:** R 2020

Course Code: 20EE611 **Course Name:** Electrical Machine Design

CO	Course Outcomes	Programme Outcomes													
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1:	*Apply the concept of specific loadings and MMF to design the electrical machines.*	3	3	2	1	-	-	-	-	-	-	-	2	3	-
CO2:	*Identify the optimal design for the transformer.*	3	3	3	1	-	2	1	1	-	-	-	2	3	-
CO3:	*Design a DC machine's armature, air-gap, commutator, brushes and investigate the choice of number of poles.*	3	3	3	1	-	2	1	1	-	-	-	2	3	-
CO4:	*Apply the procedure to design stator and squirrel cage rotor for three phase induction machine.*	3	3	3	1	-	2	1	1	-	-	-	2	3	-
CO5:	*Design stator and rotor windings of salient and non-salient pole machines and identify the factors for the choice of specific loading to design of synchronous machine.*	3	3	3	1	-	2	1	1	-	-	-	2	3	-
	Average	**3**	**3**	**3**	**1**	**-**	**2**	**1**	**1**	**-**	**-**	**-**	**2**	**3**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20EE612	**MICROPROCESSORS AND MICROCONTROLLERS**	3	0	0	3

Prerequisite(s): Analog Electronics, Digital Electronics

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the hardware architecture and programming of 8085 microprocessor.*	Understand
CO2:	*Summarize the architecture and addressing modes of 8051 Microcontroller.*	Understand
CO3:	*Develop the various interfacing using 8051 Microcontroller.*	Apply
CO4:	*Illustrate the fundamental and instruction sets in ARM processor.*	Understand
CO5:	*Design and validate the interfacing of different peripherals with Arduino.*	Apply

UNIT – I 8085 MICROPROCESSOR [09]

Introduction to 8085 microprocessor – Hardware architecture of 8085 – Instruction format – Memory interfacing – Interrupt structure – Assembly language programming for arithmetic operations.

UNIT – II 8051 MICROCONTROLLER [09]

Introduction to 8051 Microcontroller – Architecture – Memory Organization – Special Function Registers – Program Counter – PSW register – Instruction set – Addressing modes.

UNIT – III INTERFACING I/O PERIPHERALS WITH 8051 [09]

LCD interfacing – ADC and DAC interfacing – Keyboard and display interface – Stepper motor interfacing -– Closed loop control of servo motor – DC motor speed control.

UNIT – IV ARM PROCESSOR [09]

ARM architecture – Organization and implementation – ARM instruction set – Thumb instruction set – Processor cores: ARM7TDMI, ARM9TDMI – Embedded ARM Applications: The Ericsson-VLSI Bluetooth Baseband Controller.

UNIT – V ARDUINO FUNDAMENTALS [09]

Introduction to Arduino – The Arduino IDE Environment: Installing the Arduino IDE, Configuring the Arduino IDE – Arduino components – Interfacing with Arduino: Tricolor LED and Push button – LCD – Display counter using Arduino — Analog to Digital Conversion.

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

Text Books :

1 Ramesh Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, Penram International Publishing Private Ltd., Mumbai, Sixth Edition, 2013.

2 Muhammad Ali Mazidi and Janice Gilli Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson New International Edition, New Delhi, First Edition, 2014.

Reference Books :

1 Steve Furbe, ARM System-on-chip Architecture, Addison-Wesley Professional, United States, Second Edition, 2015.

2 J.M. Hughes, Arduino: A Technical Reference A Handbook for Technicians, Engineers, and Makers, USA, O'Reilly Media, First Edition 2016.

3 https://nptel.ac.in/courses/108105102.

4 https://spoken-tutorial.org.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester:	**VI**	**Regulation:**	**R 2020**
Course Code:	**20EE612**	**Course Name:**	**Microprocessors and Microcontrollers**

CO	Course Outcomes	Programme Outcomes													
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1:	*Explain the hardware architecture and programming of 8085 microprocessor.*	3	2	2	-	3	-	-	-	-	-	-	2	-	3
CO2:	*Summarize the architecture and addressing modes of 8051 Microcontroller.*	3	2	2	-	3	-	-	-	-	-	-	2	-	3
CO3:	*Develop the various interfacing using 8051 Microcontroller.*	3	2	2	-	3	-	-	-	3	-	-	2	-	3
CO4:	*Illustrate the fundamental and instruction sets in ARM processor.*	3	2	2	-	3	-	-	-	-	-	-	2	-	3
CO5:	*Design and validate the interfacing of different peripherals with Arduino.*	3	2	2	-	3	-	-	-	3	-	-	2	-	3
	Average	**3**	**2**	**2**	**-**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**2**	**-**	**3**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20IE691	**AUGMENTED INTELLIGENCE LED MANAGED SERVICES (AIMS) – II** (Common To CS, EC, EE and IT)	3	0	0	3

Prerequisite: 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 ServiceNow.	*Apply*

UNIT – I CLOUD COMPUTING [09]

Introduction – Characteristics of Cloud computing – Architecture – Types – Service Models – SaaS, IaaS, PaaS – Regions – Cloud Security.

UNIT– II BIG DATA AND DATA SCIENCE [09]

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 [09]

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 [09]

Introduction – Variables – Control flow – Data Tables and Excel Automation – UI Automation – Selectors – Email Automation.

UNIT – V SITE RELIABILITY ENGINEERING AND SERVICENOW [09]

Introduction – Adopting a DevOps and SRE Model – SRE Vs DevOps – Architecture and Lifecycle – Practices – Error Budgets – Toil Management – DevOps Tools – Introduction to ServiceNow – Reporting and Managing Issue – Benefits.

Total (L= 45, T = 0) = 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.

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

Semester : VI **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 ServiceNow.*	3	2	3	-	3	-	-	-	3	-	-	2	-	-
	Average	**3**	**2**	**3**	**-**	**3**	**-**	**-**	**-**	**1**	**-**	**-**	**2**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20CS602	**MACHINE LEARNING (Common To EC & EE)**	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Distinguish between supervised, unsupervised and semi-supervised learning.*	*Understand*
CO2:	*Design a neural network for an application of your choice.*	*Understand*
CO3:	*Apply Dimensionality Reduction and Evolutionary Models for real world problems.*	*Understand*
CO4:	*Outline existing machine learning algorithms to improve classification efficiency.*	*Understand*
CO5:	*Design systems that uses the appropriate graph models of machine learning.*	*Apply*

UNIT – I FUNDAMENTALS OF MACHINE LEARNING AND SUPERVISED LEARNING [09]

Introduction to Machine Learning – Examples of machine learning applications – Types of Machine Learning: Supervised Learning – Machine Learning Process – The Curse of Dimensionality, Overfitting – Training, Testing, and Validation Sets.

UNIT– II NEURAL NETWORKS AND MULTI-LAYER PERCEPTRON [09]

Brain and The Neuron - Neural Networks – Perceptron – Linear Separability – Linear Regression – Multi-layer Perceptron: Going Forwards – Going Backwards – Multi-Layer Perceptron in Practice – Examples of Using the MLP – Deriving Back-Propagation.

UNIT – III DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS [09]

Linear Discriminant Analysis (LDA) – Principal Component Analysis (PCA) – Factor Analysis – Independent Component Analysis – Gaussian Mixture Models: EM Algorithm – Nearest Neighbour Methods – Support Vector Machines.

UNIT– IV INSTANCE BASED LEARNING [09]

Evolutionary Learning – The Genetic Algorithm (GA) – Reinforcement Learning – Decision Trees – Classification and Regression Trees (CART) – Ensemble Learning: Boosting – Bagging – Random Forests – Unsupervised Learning: K-Means Algorithm.

UNIT– V GRAPHICAL MODELS [09]

Graphical model: Bayesian Networks – Markov Random Fields – Hidden Markov Model (HMMS) – Tracking Methods – Deep Belief Networks (DBN).

Total = 45 Periods

Text Books :

1 Stephen Marsland, Machine Learning: An Algorithmic Perspective, Chapman and Hall / CRC Machine Learning and Pattern Recognition Series, United States, Second Edition, 2015.

2 Ethem Alpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press, Cambridge, United States, Third Edition, 2014.

Reference Books :

1 Tom M Mitchell, Machine Learning, McGraw-Hill Education Private Limited, India, First Edition, 2017.

2 Kevin Murphy, Machine Learning: An Probabilistic Perspective, MIT Press, Cambridge, United States, First Edition, 2012.

3 Peter Flach,, Machine Learning: The Art and Science Algorithms That Makes Sense of Data, First Edition, Cambridge University Press, 2012.

4 https://nptel.ac.in/courses/106105152
https://nptel.ac.in/courses/106106139

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

Regulation: **R 2020**

Course Code: **20CS602** **Course Name:** **Machine Learning**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Distinguish between supervised, unsupervised and semi-supervised learning.*	3	2	2	2	1	2	-	-	-	-	-	1	-	-
CO2	*Design a neural network for an application of your choice.*	3	3	2	2	2	2	-	-	-	-	-	1	-	-
CO3	*Apply Dimensionality Reduction and Evolutionary Models for real world problems.*	3	2	2	3	2	2	-	-	-	-	-	1	-	-
CO4	*Outline existing machine learning algorithms to improve classification efficiency.*	3	2	3	2	2	1	-	-	-	-	-	1	-	-
CO5	*Design systems that uses the appropriate graph models of machine learning.*	3	2	2	2	3	2	-	-	-	-	-	1	-	-
Average		**3**	**2**	**2**	**3**	**2**	**2**		**-**	**-**	**-**	**-**	**1**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

20HS001	**PRINCIPLES OF MANAGEMENT** (Common to All Branches)	L	T	P	C
		3	0	0	3

Prerequisite(s): Nil

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

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester:	**VI**	**Regulation:**	**R 2020**
Course Code:	**20HS001**	**Course Name:**	**Principles of Management**

CO	Course Outcomes	Programme Outcomes													
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1:	*Explain the fundamentals of Management thoughts and the conceptual frame work of Management.*	-	-	-	-	-	1	1	3	1	2	3	2	-	-
CO2:	*Discuss the various concepts of planning, MBO and Strategy to help solving managerial problems*	-	-	-	-	-	1	1	3	1	2	3	2	-	-
CO3:	*Explain the concepts of organizing, Delegation and Decision making.*	-	-	-	-	-	1	1	3	1	2	3	2	-	-
CO4:	*Describe the management concepts and styles in Leading.*	-	-	-	-	-	1	1	3	1	2	3	2	-	-
CO5:	*Illustrate the various controlling and emerging concepts in management thought and philosophy.*	-	-	-	-	-	1	1	3	1	2	3	2	-	-
	Average	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**3**	**1**	**2**	**3**	**2**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20EE621	**MICROPROCESSORS AND MICROCONTROLLERS LABORATORY**	0	0	3	1

Prerequisites: *Analog Electronics Laboratory and Digital Electronics Laboratory*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Perform simple arithmetic operations using assembly language program in 8085 and 8051.*	Apply
CO2:	*Develop simple programs to perform the control instructions.*	Apply
CO3:	*Write an assembly language program to convert digital input to analog output.*	Apply
CO4:	*Perform the interfacing of peripheral devices with 8085 and 8051.*	Apply
CO5:	*Perform the basic functions using Arduino.*	Apply

List of Experiments

1. Perform 8-bit (Addition & Subtraction) using 8085 microprocessor.
2. Perform 8-bit (Multiplication & Division) using 8051 microcontroller.
3. Programming with control instructions Maximum of number using 8085 microprocessor.
4. Programming with control instruction of Ascending order in 8051 microcontroller.
5. Interfacing and programming of DAC with 8051 microcontroller.
6. Programming for Traffic light control with 8085 microprocessor.
7. Program for stepper motor control interfacing using 8051 microcontroller.
8. Interface and Program for Keyboard and display with 8051 microcontroller.
9. Program using Arduino to obtain Tricolor LED Push button.
10. Program using Arduino to perform Push button

.

Total = 45 Periods

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester:	**VI**	**Regulation:**	**R 2020**
Course Code:	**20EE621**	**Course Name:**	**Microprocessors and Microcontrollers Laboratory**

CO	Course Outcomes	Programme Outcomes													
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1:	*Perform simple arithmetic operations using assembly language program in 8085 and 8051.*	3	2	-	-	3	-	-	-	3	-	-	3	-	-
CO2:	*Develop simple programs to perform the control instructions.*	3	2	2	-	3	-	-	-	3	-	-	3	2	-
CO3:	*Write an assembly language program to convert digital input to analog output.*	3	2	-	-	3	-	-	-	3	-	-	3	2	-
CO4:	*Perform the interfacing of peripheral devices with 8085 and 8051.*	3	2	2	3	3	-	-	-	3	-	-	3	-	-
CO5:	*Perform the basic functions using Arduino.*	3	2	2	3	3	-	-	-	3	-	-	3	-	-
Average		**3**	**2**	**2**	**3**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**2**	**2**	**-**

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

.

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20EE622	**ELECTRICAL ESTIMATION AND ELECTRONICS DESIGN LABORATORY**	0	0	3	1

Prerequisites: *Manufacturing Practices Laboratory and Analog Electronics Laboratory*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Estimate the electrical quantities and cost of wiring materials for single and three-phase overhead service connection.*	*Apply*
CO2:	*Estimate the electrical quantities and cost of wiring materials for residential / commercial buildings and small-scale industries.*	*Apply*
CO3:	*Design and test the prototype model for constant and variable voltage power supply.*	*Apply*
CO4:	*Design and test the prototype model of domestic UPS.*	*Apply*
CO5:	*Design and test the circuit model for water level controller and infrared motion detector.*	*Apply*

List of Experiments

1. Prepare the wiring material required and estimate the cost for single-phase and three-phase overhead service connection.
2. Prepare the wiring material required and estimate the cost for Residential / Commercial buildings.
3. Prepare the wiring material required and estimate the cost for small scale industries.
4. Design a prototype model of ± 5V, 1A constant voltage power supply.
5. Design a prototype model of ± (0-12 V), 1A variable power supply.
6. Design a prototype model of domestic UPS.
7. Design a prototype model of simple water level controller with indicator.
8. Design a prototype model of infrared motion detector.

Total = 45 Periods

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester:	**VI**	**Regulation:**	**R 2020**
Course Code:	**20EE622**	**Course Name:**	**Electrical Estimation and Electronics Design Laboratory**

CO	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1:	*Estimate the electrical quantities and cost of wiring materials for single and three-phase overhead service connection.*	3	2	-	-	-	2	2	3	2	2	2	3	2	2
CO2:	*Estimate the electrical quantities and cost of wiring materials for residential / commercial buildings and small-scale industries.*	3	2	-	-	-	2	2	3	2	2	2	3	2	2
CO3:	*Design and test the prototype model for constant and variable voltage power supply.*	3	-	2	-	2	2	2	-	2	2	2	3	2	3
CO4:	*Design and test the prototype model of domestic UPS.*	3	-	2	-	2	2	2	-	2	2	2	3	2	3
CO5:	*Design and test the circuit model for water level controller and infrared motion detector.*	3	-	2	-	2	2	2	-	2	2	2	3	2	3
	Average	**3**	**2**	**2**	**-**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**3**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20HR654	**CAREER DEVELOPMENT SKILLS – IV**	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]

Competitive exam training: Basics concept of Transformer — Three phase induction motors — Power system – Microprocessor and Microcontroller.

Total (L= 30, T = 0) = 30 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 B.L Theraja, V.K Pandey, Objective Electrical Technology, S Chand Publications, New Delhi, Fourth Edition, 2014.

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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													
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1:	*Employ critical thinking in personal interviews type situations.*	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO2:	*Understand the Quantitative Aptitude problems in geometry.*	1	-	-	-	-	-	-	-	2	3	-	3	-	-
CO3:	*Understand the data interpretation and analysis by using various graphs.*	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO4:	*Enhance the skills in resume writing and presentation.*	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO5:	*Develop the comprehension Skills in core subjects.*	-	-	-	-	-	-	-	-	2	3	-	3	2	-
Average		**1**	**-**		**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**	**3**	**2**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20EE711	**EMBEDDED SYSTEMS**	3	0	0	3

Prerequisite(s): *Microprocessor and Microcontroller*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
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:	*Apply the knowledge of embedded product development.*	*Apply*

UNIT – I INTRODUCTION TO EMBEDDED SYSTEMS [09]

Embedded system V_s 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 units – PIC16F877A: Architecture – Instruction set.

UNIT – II EMBEDDED NETWORKS [09]

Introduction to I/O device ports & buses – Serial communication using I^2C, CAN, SPI, USB and PROFI buses – Parallel communication using PCI, PCI-X buses, ARM bus – Internet enabled systems – Wireless and mobile system protocols.

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 – Fundamental issues in hardware and software Co-design – Data flow graph – state machine model.

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 – Priority inversion – Priority inheritance.

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

Semester:	**VII**	**Regulation:**	**R 2020**
Course Code:	**20EE711**	**Course Name:**	**Embedded Systems**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Illustrate the fundamentals of embedded systems.*	3	2	3	-	3	3	2	-	-	2	-	3	-	-
CO2:	*Outline the various types of embedded communication protocols.*	3	2	3	-	3	3	2	-	-	2	-	3	-	-
CO3:	*Explain the concept of software development process and tools.*	3	2	3	-	3	3	2	-	-	2	-	3	-	-
CO4:	*Describe the functions of real time operating systems.*	3	2	3	-	3	3	2	-	-	2	-	3	-	-
CO5:	*Apply the knowledge of embedded product development.*	3	2	3	-	3	3	2	-	3	2	-	3	-	-
Average		**3**	**2**	**3**	**-**	**3**	**3**	**2**	**-**	**3**	**2**	**-**	**3**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20EE712	**INDUSTRIAL AUTOMATION AND CONTROL**	3	0	0	3

Prerequisite(s): *Digital Electronics, Control Systems*

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.*	*Apply*

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 – PLC Programming Languages.

UNIT – II LOGIC FUNDAMENTALS, TIMER AND COUNTER [09]

Logic functions – Boolean instructions and functions – Hardwired logic Vs Programmed Logic – Developing circuits from Boolean instructions – Programming Word Level Logic 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 – Entering the Ladder Diagram – Modes of operation.

UNIT – IV DISTRIBUTED CONTROL SYSTEM [09]

Distributed control system: Evolution – Architectures – Comparison – Local control unit – Process interfacing issues – Communication facilities – Low and high level operator interfaces – Operator displays – Low and high level engineering interfaces – General purpose computers in DCS.

UNIT – V APPLICATIONS OF PLC AND DCS [09]

PLC interfaces – 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.Petruzella, Programmable Logic controllers, Tata McGraw Hill Publishing Co Ltd., New Delhi, Fifth Edition, 2019.

2 Lucas, M.P., Distributed Control System, Van Nostrand and Reinhold Co., Newyork, First Edition, 1986.

Reference Books:

1 Gary Dunning, Introduction to Programmable Logic Controllers, Delmar Thomson Learning, Third Edition, 2010.

2 John W.Webb and Ronald A.Reis, Programmable Logic Controllers: Principles and Applications, PHI learning private limited, New Delhi, Fifth Edition, 2002.

3 Krishna Kant, Computer - Based Industrial Control, PHI learning private limited, New Delhi, Second Edition, 2011.

4 Madhuchhanda Mitra and Smarajit Sen Gupta, Programmable Logic Controllers and Industrial Automation, Penram International Publishing (India) Pvt. Ltd., Mumbai, First Edition, 2008.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester:	**VII**	**Regulation:**	**R 2020**
Course Code:	**20EE712**	**Course Name:**	**Industrial Automation and Control**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the major components of programmable logic controller and its applications.*	3	2	-	-	-	2	2	-	-	-	-	2	2	2
CO2:	*Summarize the logical functions, timers and counters of PLC.*	3	2	2	-	2	2	2	-	-	-	-	2	2	2
CO3:	*Discuss the various instructions and modes of operation related to PLC.*	3	2	2	-	2	2	2	-	-	-	-	2	2	2
CO4:	*Realize the architecture and various interfacing techniques of Distributed Control Systems.*	3	2	2	-	-	2	2	-	-	-	-	2	2	2
CO5:	*Examine the different applications of PLC and Distributed Control Systems.*	3	2	-	-	2	2	2	-	-	-	-	2	2	2
	Average	**3**	**2**	**2**	**-**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**2**

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

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SEMESTER - VII

		L	T	P	C
20EE713	**SOFT COMPUTING TECHNIQUES**	3	0	0	3

Prerequisite(s): *NIL*

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.*	*Understand*
CO4:	*Illustrate the fundamentals of different soft computing techniques.*	*Understand*
CO5:	*Apply the knowledge of neural networks and fuzzy logic controller for classical applications.*	Applying

UNIT – I INTRODUCTION [09]

Fundamental concept to Neural Networks – Basic models of Artificial Neural Network: Weights, Bias and thresholds, Common activation functions, Learning rules, Learning methods – McCulloch-Pitts neuron – Linear Separability – Hebb Network – Perceptron Networks.

UNIT – II ARTIFICIAL NEURAL NETWORKS [09]

Adaptive Linear Neuron – Back-Propagation Network – Auto associative Memory Network – Hopfield Networks – Kohonen Self-Organizing Feature Maps – Boltzmann Machine.

UNIT – III FUZZY LOGIC SYSTEM [09]

Introduction to crisp sets and fuzzy sets – Basic fuzzy set operation and approximate reasoning – Fuzzy logic modeling and control: Fuzzification, inferencing and defuzzification, fuzzy knowledge and rule bases.

UNIT – IV OPTIMIZATION ALGORITHMS [09]

Introduction to optimization algorithms – Steps in genetic algorithm – operators – stopping condition – constraints – classification – Advantages and limitations of Genetic Algorithm – Ant colony optimization.

UNIT – V APPLICATIONS OF SOFT COMPUTING [09]

Stability Analysis using Artificial Neural Networks – Fuzzy logic in control systems – Neural network toolbox – Fuzzy logic MATLAB toolbox.

Total (L= 45, T = 0) = 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 Jacek M.Zurada, Introduction to Artificial Neural Systems, Jaico Publishing Home, Mumbai, First Edition, 2002.

Reference Books :

1 Laurance Fausett Englewood cliffs, N.J., Fundamentals of Neural Networks, Pearson Education, New Delhi, First Edition, 1992.

2 Kosko, B. Neural Networks And Fuzzy Systems, Prentice-Hall of India Pvt. Ltd., New Delhi, Third Edition, 1994.

3 David E. Goldberg, Genetic Algorithm in Search Optimization and Machine Learning, Pearson Education, New Delhi, Thirteenth Edition, 2013.

4 Simon Haykin, Neural Networks Comprehensive Foundation, Pearson Education, New Delhi, Second Edition, 2005.

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CO-PO MAPPING

Semester	**VII**	**Regulation:**	**R 2020**
Course Code:	**20EE713**	**Course Name:**	**Soft Computing Techniques**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Infer the concepts of artificial neural network.*	3	-	-	-	-	-	-		-	-	-	1	2	1
CO2:	*Outline the various types of neural network.*	3	2	-	-	_	-	-	1	-	-	-	1	2	1
CO3:	*Discuss the basic concepts of fuzzy logic system.*	3	2	-	-	-	-	-	-	-	-	-	1	2	1
CO4:	*Illustrate the fundamentals of different soft computing techniques.*	3	2	-	2	-	-	-	1	-	-	-	1	2	1
CO5:	*Apply the knowledge of neural networks and fuzzy logic controller for classical applications.*	3	2	-	-	3	-	-	1	-	-	-	1	2	1
	Average	**3**	**2**	**-**	**2**	**3**	**-**	**-**	**1**	**-**	**-**	**-**	**1**	**2**	**1**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

20EE721	**EMBEDDED SYSTEMS LABORATORY**	L	T	P	C
		0	0	3	1

Prerequisites: *Microprocessor and Microcontroller Laboratory*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Develop the programs for simple arithmetic and relay operation.*	*Apply*
CO2:	*Construct the* alarm clock and seven segment display *applications using PIC microcontrollers.*	*Apply*
CO3:	*Construct the model train and* stepper motor *applications using microcontrollers.*	*Apply*
CO4:	*Develop the programs for* I^2C LED output and logical controller *interfacing kits using ARM processor.*	*Apply*
CO5:	*Construct the* keyboard display and graphical LCD *applications using ARM processor.*	*Apply*

LIST OF EXPERIMENTS

1. Write the PIC ALP program for simple arithmetic operations.
2. Write the program for Relay operation and verify with PIC microcontroller using MPLAB software.
3. Design an Alarm clock with PIC microcontroller using MPLAB software.
4. Design a Seven Segment Display With PIC Microcontroller Using MPLAB Software.
5. Design a model train interface with PIC microcontroller using MPLAB software.
6. Design a stepper motor interface with ARM processor using KEIL software.
7. Verify I^2C LED interface with ARM processor using KEIL software.
8. Verify logical controller interface with ARM processor using KEIL software.
9. Design a Keyboard display interface with ARM processor using KEIL software.
10. Design a graphical LCD interface with an ARM processor using KEIL software.

Total = 45 Periods

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: **VII** **Regulation:** **R 2020**
Course Code: **20EE721** **Course Name:** **Embedded Systems Laboratory**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Develop the programs for simple arithmetic and relay operation.*	-	-	3	-	3	3	-	2	2	2	-	2	-	-
CO2:	*Construct the* alarm clock and seven segment display *applications using PIC microcontrollers.*	-	-	3	-	3	3	-	2	2	2	-	3	-	-
CO3:	*Construct the model train and* stepper motor *applications using microcontrollers.*	-	-	3	-	3	3	-	2	2	2	-	3	-	-
CO4:	*Develop the programs for* I²C LED output and logical controller *interfacing kits using ARM processor.*	-	-	3	-	3	3	-	2	2	2	-	3	-	-
CO5:	*Construct the* keyboard display and graphical LCD *applications using ARM processor.*	-	-	3	-	3	3	-	2	2	2	-	3	-	-
	Average	**-**	**-**	**3**	**-**	**3**	**3**	**-**	**2**	**2**	**2**	**-**	**3**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20EE722	**MINI PROJECT**	0	0	6	2

Prerequisites: *Electrical Machine I & II, Measurements and Instrumentation, Digital Electronics, Power Electronics*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Practice acquired knowledge within the chosen area of technology for project development.*	*Understand*
CO2:	*Study and explore software/ hardware skills.*	*Analyze*
CO3:	*Work as an individual or in a team in development of technical projects.*	*Create*
CO4:	*Refine technical aspects for engineering projects.*	*Apply*
CO5:	*Report and present the findings of the study conducted in the preferred domain.*	*Apply*

The students should adhere the following guidelines:

1. They should select a problem which addresses some basic home, office or other real life applications.
2. Group of maximum three students can be permitted to work on a single mini project.
3. The mini project must have hardware parts.
4. A detailed study of the problem and its financial implications and physical and mental hazards can be studied.
5. The methodology to tackle this problem can be studied and analyzed.
6. It is desirable that the systems developed by the students have some novel features.
7. A mini project report should be submitted at the end of the semester as per guidelines.
8. This project work should be evaluated by the examiners.

Total = 45 Periods

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CO-PO MAPPING

Semester:	**VII**	**Regulation:**	**R 2020**
Course Code:	**20EE722**	**Course Name:**	**Mini Project**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Practice acquired knowledge within the chosen area of technology for project development.*	3	3	3	3	3	3	3	3	3	-	-	3	-	3
CO2:	*Study and explore software/ hardware skills.*	3	3	3	3	3	3	3	3	-	-	-	3	-	3
CO3:	*Work as an individual or in a team in development of technical projects.*	-	-	-	-	-	-	-	3	3	-	3	3	-	-
CO4:	*Refine technical aspects for engineering projects.*	3	3	3	3	3	3	3	3	-	3	-	3	-	3
CO5:	*Report and present the findings of the study conducted in the preferred domain.*	-	-	-	-	3	3	3	3	3	3	3	3	-	-
	Average	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**-**	**3**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII

		L	T	P	C
20EE811	**ENERGY AUDITING AND MANAGEMENT**	3	0	0	3

Prerequisite(s): *Electrical Machines – I, Electrical Machines – II, Measurement and Instrumentations*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the concept of energy management and auditing.*	*Understanding*
CO2:	*Explain the energy cost and Load management.*	*Understanding*
CO3:	*Enlighten the role of motors and electrical equipments in energy management.*	*Understanding*
CO4:	*Elucidate the Metering in energy management.*	*Understanding*
CO5:	*Describe the concepts and controls of the lighting system.*	*Understanding*

UNIT – I INTRODUCTION [09]

Energy Scenario: Present energy scenario – Energy pricing in India, Need for energy management – Energy basics – Designing and starting an energy management program – Energy accounting – Energy monitoring, targeting and reporting – Energy audit, Definition, Need for energy audit – Types of energy audit – Energy audit process.

UNIT – II ENERGY COST AND LOAD MANAGEMENT [09]

Important concepts in an economic analysis – Economic models – Time value of money – Utility rate structures – Loss evaluation – Load management: Demand control techniques – Utility monitoring and control system – HVAC and energy management.

UNIT – III ENERGY MANAGEMENT FOR MOTORS, ELECTRICAL EQUIPMENT AND COGENERATION [09]

Electric motors: Types – Factors affecting motor performance – Rewinding and motor replacement issues – Energy saving opportunities with energy efficient motors – Soft starters with energy saver – Variable speed drives – Transformer in energy management – Capacitors and synchronous machines – Energy management by cogeneration.

UNIT – IV METERING FOR ENERGY MANAGEMENT [09]

Energy audit instruments: Types and functions – Utility meters: Timing of meter disc for kilowatt measurement – Demand meters – Paralleling of current transformers – Instrument transformer burdens – Multitasking solid–state meters – Metering location vs. requirements – Metering techniques and practical examples.

UNIT – V LIGHTING SYSTEMS AND BEE [09]

Lighting System: Types of Light sources – Ballast – Occupancy sensors – Energy saving opportunities in lighting systems – Energy efficient lighting controls – Power factor improvement and its benefit – Selection and location of capacitors – Automatic power factor controllers – Role of Bureau of Energy Efficiency (BEE) – Functions of BEE – Objectives of Standards & Labeling.

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

Text Books:

1 Yogi Goswami D and Frank Kreith, Energy Management and Conservation Handbook, CRC Press, New Delhi, Second Edition, 2017.

2 Wayne C.Turner, Energy Management Handbook, Fairmont Press, USA, Eighth Edition, 2012.

Reference Books:

1 Anil Kumar, Om Prakash, Prashant Singh Chauhan and Samsher Gautam, Energy Management Conservation and Audits, CRC Press, New Delhi, First Edition, 2021.

2 Albert Thumann and William J. Younger, Handbook of Energy Audits, CRC Press, New Delhi, Ninth Edition, 2012.

3 Amlan Chakrabarti, Energy Engineering and Management, PHI Publications, New Delhi, Second Edition, 2011.

4 Success stories of Energy Conservation by BEE, New Delhi (https://beeindia.gov.in/).

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO–PO MAPPING

Semester: **VIII** **Regulation:** **R 2020**

Course Code: **20EE811** **Course Name:** **Energy Auditing and Management**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Describe the concept of energy management and auditing.*	3	2	2	-	2	1	1	2	-	-	-	1	3	2
CO2:	*Explain the energy cost and Load management.*	3	2	2	-	2	1	1	2	-	-	-	1	3	2
CO3:	*Enlighten the role of motors and electrical equipments in energy management.*	3	2	2	-	2	1	1	2	-	-	-	1	3	2
CO4:	*Elucidate the Metering in energy management.*	3	2	2	-	2	1	1	2	-	-	-	1	3	2
CO5:	*Describe the concepts and controls of the lighting system.*	3	2	2	-	2	1	1	2	-	-	-	1	3	2
	Average	**3**	**2**	**2**	**-**	**2**	**1**	**1**	**2**	**-**	**-**	**-**	**1**	**3**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII

		L	T	P	C
20EE821	**PROJECT WORK & DISSERTATION**	0	0	12	6

Prerequisites: *All the core and elective courses of the programme.*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify a real world problem and develop the design solutions.*	*Apply*
CO2:	*Select the proper components as per requirements of the design/system.*	*Apply*
CO3:	*Apply the new tools, algorithms, methodologies that contribute to obtain the solution of the project.*	*Analyze*
CO4:	*Analyze the findings and execute the project with developed prototype as a team.*	*Analyze*
CO5:	*Defend the findings and conclude with oral/written reports.*	*Evaluate*

The students should adhere the following guidelines:

1. 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 to be completed and an effort should be made to publish a paper in journals and filing a patent.
3. A working model or prototype is to be submitted at the end semester for evaluation.
4. Project work done at Industry should be supported by duly signed certificate by the Industry. The students should provide a copy of certificate at the end of the project report.
5. The review committee constituted by the Head of the Department will conduct at least three consecutive reviews to access the progress of the project.
6. A project report should be submitted at the end of the semester in the prescribed format.
7. The project work will be evaluated by the oral presentation and the project report by examiners.

Total = 180 Periods

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester:	**VIII**	**Regulation:**	**R 2020**
Course Code:	**20EE821**	**Course Name:**	**Project Work & Dissertation**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Identify a real world problem and develop the design solutions.*	3	3	3	3	3	3	2	3	3	-	2	3	3	2
CO2:	*Select the proper components as per requirements of the design/system.*	3	3	3	3	3	3	2	3	3	-	2	3	3	2
CO3:	*Apply the new tools, algorithms, methodologies that contribute to obtain the solution of the project.*	3	3	2	3	3	2	1	2	3	2	3	3	3	1
CO4:	*Analyze the findings and execute the project with developed prototype as a team.*	3	3	2	3	3	1	1	2	3	2	3	3	3	1
CO5:	*Defend the findings and conclude with oral/written reports.*	1	3	1	3	3	-	-	3	3	3	3	3	3	2
	Average	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**3**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20EE561	**POWER PLANT ENGINEERING** (Professional Elective – I)	3	0	0	3

Prerequisite: *Engineering Physics, Electrical machines*

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.*	*Understand*
CO2:	*Demonstrate 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:	*Explain the basic concepts of different non-conventional energy sources.*	*Understand*

UNIT - I THERMAL POWER PLANTS [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 HYDEL POWER PLANTS [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 development.

UNIT - III NUCLEAR POWER PLANTS [09]

Principles of nuclear energy - nuclear fission - nuclear reactor, types – pressurized water reactor, CANDU reactor, boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor-nuclear power plants.

UNIT - IV GAS AND DIESEL POWER PLANTS [09]

Fuels - gas turbine material, open and closed cycle gas turbine, work output & thermal efficiency, methods to improve performance - advantage and disadvantages- types of diesel engine power plant- components and layout of diesel power plants.

UNIT - V NON-CONVENTIONAL POWER GENERATION [09]

Solar energy collectors – OTEC - wind power plants, tidal power plants and geothermal resources, fuel cell, MHD power generation- principle, thermoelectric generation, thermionic power generation.

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

Semester:	**V**	**Regulation:**	**R 2020**
Course Code:	**20EE561**	**Course Name:**	**Power Plant Engineering**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Describe the layout and function of various parts inside the thermal power plant.*	3	2	-	-	-	2	2	-	-	-	-	3	3	2
CO2:	*Demonstrate the layout, construction, working of the components inside the hydro power plant*	3	2	-	-	-	2	2	-	-	-	-	3	3	2
CO3:	*Explain the principle of operation, layout and types of nuclear reactor in a nuclear power plant.*	3	2	-	-	-	2	2	-	-	-	-	3	3	2
CO4:	*Discuss about the types, performance and layout of gas and diesel power plants*	3	2	-	-	-	2	2	-	-	-	-	3	3	2
CO5:	*Explain the basic concepts of different non-conventional energy sources*	3	2	-	-	-	2	2	-	-	-	-	3	3	2
	Average	**3**	**2**	**-**	**-**		**2**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**2**

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

R 2020

K.S.R. COLLEGE OF ENGINEERING (Autonomous)

SEMESTER - V

20EE562	SPECIAL ELECTRICAL MACHINES (Professional Elective – I)	L	T	P	C
		3	0	0	3

Prerequisite: *Electrical Machines - I, Electrical Machines - II*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain about the principles of various stepper motors and its methods.*	*Understand*
CO2:	*Discuss the operation of permanent magnet synchronous motors.*	*Understand*
CO3:	*Explain the operation, performance characteristics and commutation of permanent magnet brushless dc motors.*	*Understand*
CO4:	*Summarize the constructional features of switched reluctance motors and illustrate the various rotor position sensing techniques*	*Understand*
CO5:	*Illustrate the constructional features of synchronous reluctance motors.*	*Understand*

UNIT - I STEPPER MOTORS [09]

Constructional features – Principle of operation – Variable reluctance motor – Permanent Magnet motor – Hybrid motor – Single and multi-stack configurations – Torque equation – Modes of excitation – Characteristics – Drive system and control circuitry – Processor control of stepping motors – Closed loop control.

UNIT - II PERMANENT MAGNET SYNCHRONOUS MOTORS [09]

Permanent magnet motors – Classifications of PMSM – Principle of operation – EMF and torque equations – Armature reaction MMF – Phasor diagram – Converter volt ampere requirements – Torque speed characteristics – Self Control – Microprocessor based control.

UNIT - III PERMANENT MAGNET BRUSHLESS D.C. MOTORS [09]

Permanent magnetic materials – Construction – Principle of operation – Types – Voltage equation – EMF and torque equations – Commutation in DC motors: Electronic commutation, difference between mechanical and electrical commutators – Controllers – Classification.

UNIT - IV SWITCHED RELUCTANCE MOTORS [09]

Constructional features – Rotary and linear SRMs – Principle of operation – Voltage and Torque equation – Power converters and their controllers – Torque-speed characteristics – Methods of rotor position sensing – Sensorless operation – Closed loop control of SRM – Processor based control of SRM – Applications.

UNIT - V SYNCHRONOUS RELUCTANCE MOTORS [09]

Constructional features – Rotor design types – Operating principle – Design considerations – voltage and torque equations – Phasor diagram – Torque-speed characteristics – Applications.

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

Text Books :

1 Miller.T.J.E, Brushless Permanent Magnet and Reluctance Motor Drives, Clarendon Press, Oxford, First Edition, 1989.

2 Kenjo T, Stepping Motors and Their Microprocessor Controls, Oxford University Press, New Delhi, Third Edition, 2009.

Reference Books :

1 Krishnan.R, Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application, CRC Press, New York, Second Edition, 2009.

2 Paul Acarnley, Stepping Motors – A Guide to Motor Theory and Practice, The Institute of Engineering and Technology, London, Fourth edition, 2007.

3 E.G.Janardanan, Special Electrical Machines, PHI Learning Pvt. ltd., India, Second Edition, 2014.

4 Bose.B.K, Modern Power Electronics & AC drives, Pearson Education, India, Second Edition, 2003.

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CO-PO MAPPING

Semester:	**V**	**Regulation:**	**R 2020**
Course Code:	**20EE562**	**Course Name:**	**Special Electrical Machines**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the construction, operating principles of various stepper motors and develop its torque equation.*	3	2	2	-	-	-	-	-	-	-	-	2	3	2
CO2:	*Demonstrate the principle of operation of permanent magnet synchronous motors and illustrate its phasor diagram along with torque speed characteristics*	3	2	2	-	-	-	-	-	-	-	-	2	3	2
CO3:	*Explain the operation, performance characteristics of permanent magnet brushless dc motors and its various commutation techniques*	3	2	2	-	-	-	-	-	-	-	-	2	3	2
CO4:	*Summarize the constructional features of switched reluctance motors and illustrate the various rotor position sensing techniques*	3	2	2	-	-	-	-	-	-	-	-	2	3	2
CO5:	*Illustrate the constructional features of various synchronous reluctance motors and realize its phasor diagram.*	3	2	2	-	-	-	-	-	-	-	-	2	3	2
	Average	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20EE563	**ADVANCED CONTROL SYSTEM** (Professional Elective – I)	3	0	0	3

Prerequisite: Control systems

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Apply state variables to form state equations and analyze for controllability and observability.*	Apply
CO2:	*Design feedback controllers and observers.*	Apply
CO3:	*Analyze sampled data control system.*	Apply
CO4:	*Discuss the features of phase plane analysis and describe function analysis.*	Apply
CO5:	*Examine BIBO, asymptotic stability, Liapunov's stability and Popov's criterion.*	Apply

UNIT - I STATE SPACE ANALYSIS [09]

Introduction to state space analysis – Physical variable, Phase variable and Canonical variables forms – State transition matrix – controllability and observability.

UNIT - II STATE VARIABLE DESIGN [09]

Design by state feedback – output feedback – Pole assignment technique – Design of state and output feedback controllers – Design of reduced and full order observers – PI feedback – Dynamic state feedback.

UNIT - III SAMPLED DATA CONTROL SYSTEM [09]

Introduction to Sample data control systems – Sampling process, signal reconstruction, difference equation, Z-transform – Inverse Z-transform, Z-transform analysis of sampled data control system.

UNIT - IV NON-LINEAR SYSTEMS [09]

Types of non-linearity – Typical examples – Equivalent linearization – Phase plane analysis – Limit cycles – Describing functions – Analysis using Describing functions.

UNIT - V STABILITY [09]

Stability concepts – Equilibrium points – BIBO and asymptotic stability – Direct method of Liapunov – Application to non-linear problems – Frequency domain stability criteria – Popov's method and its extensions.

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

Text Books :

1 M.Gopal, Digital control and state variable methods, Tata McGraw Hill Publishing Co Ltd., New Delhi, Second Edition, 2007.

2 M.Gopal, Modern control system theory, John Wiley & Sons Ltd, United States, Second Edition, 1993.

Reference Books :

1 I.J. Nagarth and M. Gopal, Control Systems Engineering, New Age International Pvt Ltd, New Delhi, Sixth edition 1993

2 K. Ogata, Discrete - Time Control Systems, PHI learning private limited, New Delhi, Second Edition, 2005.

3 Benjamin C. Kuo Farid Golnaraghi, Automatic Control systems, John Wiley and Sons Ltd, India, Ninth Edition, 2014.

4 Sarkar B.N, Advanced Control Systems, PHI learning private limited, New Delhi, First Edition, 2013

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: V **Regulation:** R 2020
Course Code: 20EE563 **Course Name:** Advanced Control System

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Apply state variables to form state equations and analyze for controllability and observability.*	3	3	2	-	2	-	-	-	-	-	-	2	3	2
CO2:	*Design feedback controllers and observers.*	3	3	2	-	2	-	-	-	-	-	-	2	3	2
CO3:	*Analyze sampled data control system.*	3	3	3	-	2	-	-	-	-	-	-	2	3	2
CO4:	*Discuss the features of phase plane analysis and describe function analysis.*	3	3	3	-	2	-	-	-	-	-	-	2	3	2
CO5:	*Examine BIBO, asymptotic stability, Liapunov's stability and Popov's criterion*	3	3	3	-	2	-	-	-	-	-	-	2	3	2
Average		**3**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20EE564	**BASIC VLSI DESIGN** (Professional Elective – I)	3	0	0	3

Prerequisite: *Analog Electronics, Digital Electronics*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the basic CMOS circuits and the CMOS process technology.*	*Understand*
CO2:	*Design a layout for CMOS logic gates.*	*Apply*
CO3:	*Design the complex logic gates and estimate the power dissipation.*	*Apply*
CO4:	*Describe various memory elements and types of logic design.*	*Apply*
CO5:	*Explain the architecture of FPGA.*	*Understand*

UNIT - I INTRODUCTION TO MOS TRANSISTOR [09]

A brief history - MOS transistors - Ideal I - V characteristics - Non-ideal I - V effects, Inverter DC transfer characteristics Fabrication: nMOS fabrication, CMOS fabrication [P-well process, N-well process, Twin tub process].

UNIT - II VLSI CIRCUIT DESIGN PROCESSES [09]

VLSI design flow- CMOS technologies, NMOS and CMOS inverters - MOS layers- Stick diagrams-Design rules and Layout - Transistors layout diagrams for NMOS and CMOS inverters and logic gates.

UNIT - III CMOS LOGIC GATE DESIGN AND POWER DISSIPATION [09]

NAND and NOR gates - Complex logic gates - Tri state circuits - Large FETs - Transmission gate and pass transistor logic – Static and dynamic power dissipation.

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 FIELD PROGRAMMABLE GATE ARRAYS [09]

Types of ASICs - Standard cell design and cell libraries, FPGA building block architectures - Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 and 7000 - Altera MAX 9000 – Altera FLEX Design.

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

Text Books :

1 N.Weste, D.Harris, CMOS VLSI Design-A circuits and System Approach, Pearson education, New Delhi, Fourth Edition, 2015

2 John P. Uyemura, Chip Design for Submicron VLSI: CMOS layout and simulation, Cengage Learning, India, Eleventh Indian Reprint, 2013.

Reference Books :

1 M.J. Smith, Application Specific Integrated Circuits, Addison-Wesley, New Delhi, First Edition, 2010.

2 Wayne Wolf, Modern VLSI Design System-On-Chip, PHI learning private limited, New Delhi, Third Edition, 2007.

3 http://nptel.ac.in/courses/108101089/

4 https://nptel.ac.in/courses/108/107/108107129/

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: V **Regulation:** R 2020
Course Code: 20EE564 **Course Name:** Basic VLSI Design

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the basic CMOS circuits and the CMOS process technology.*	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2:	*Design a layout for CMOS logic gates.*	3	2	2	3	3	-	-	-	-	-	-	3	-	-
CO3:	*Design the complex logic gates and estimate the power dissipation.*	3	2	2	3	3	-	-	-	-	-	-	3	2	2
CO4:	*Describe various memory elements and types of logic design.*	3	2	1	1	1	-	-	-	-	-	-	2	1	1
CO5:	*Explain the architecture of FPGA.*	3	2	2	1	1	-	-	-	-	-	-	-	-	-
	Average	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20EE565	**VIRTUAL INSTRUMENTATION** (Professional Elective – I)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline of the block diagram and architecture of virtual instrumentation.*	*Understand*
CO2:	*Demonstrate the different programming techniques and VI software.*	*Understand*
CO3:	*Explain the various data acquisition methods used in the VI.*	*Understand*
CO4:	*Recall the distinct interfacing instruments of VI and its applications.*	*Understand*
CO5:	*Summarizing the tools and applications of the VI.*	*Understand*

UNIT - I INTRODUCTION TO VIRTUAL INSTRUMENTATION [09]

History of VI – Block diagram and architecture of VI – Conventional and graphical programming – LabVIEW environment Front panel, controls, block diagram, subVIs – Data types – Data flow program – Introduction to modular programming.

UNIT - II PROGRAMMING TECHNIQUES [09]

Repetition and loops: for and while loops – Arrays – Strings – Clusters – Case and sequence structure – Graph and charts – File I/O – Simple arithmetic programs

UNIT - III INTRODUCTION TO DATA ACQUISITION BASICS [09]

Classification of signals – DAQ hardware configuration – DAQ software architecture – Counters and timers – Interfacing with assistant: DAQ assistant – Analysis assistant – Instrument assistant

UNIT - IV INTERFACING INSTRUMENTS [09]

RS232 Vs GPIB – Handshaking – GPIB interfacing – RS232 / RS 485 interfacing – VISA – IMAQ vision: Vision basics and analysis – Motion control: Motion controller – Move types – Motion components

UNIT - V ANALYSIS TOOLS AND APPLICATION OF VI [09]

Fourier transform – FFT – Power spectrum – Correlation methods – Windows and filtering – Development of control system – Industrial communication – Process control applications – LabVIEW FPGA: Introduction – Application development.

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

Text Books :

1 Gary Jonson, Richard Jennings, LabVIEW Graphical Programming, Tata McGraw Hill, New Delhi, Fourth Edition, 2011.

2 Sanjay Gupta, Joseph John, and Virtual Instrumentation using Lab VIEW: Principles and Practices of Graphical Programming, New Delhi: Tata McGraw-Hill, 4th edition (16 August 2006)

Reference Books :

1 Jovitha Jerome, Virtual Instrumentation using LabVIEW, PHI Learning Private Limited, New Delhi, Fourth Edition, 2010.

2 John Essick, Hands–on Introduction to LabVIEW for Scientists and Engineers, Oxford university press, Fourth Edition, Oxford University Press USA, 2018.

3 Jeffrey Travis, Jim Kring, LabVIEW for Everyone: Graphical Programming Made Easy and Fun, Prentice Hall; 3rd edition, 2006.

4 Rick Bitter, Taqi Mohiuddin, Matt Nawrocki, LabView: Advanced Programming Techniques, CRC Press, Boca Raton. Second Edition, 2007.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: V **Regulation:** R 2020
Course Code: 20EE565 **Course Name:** Virtual Instrumentation

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Outline the block diagram and architecture of virtual instrumentation.*	3	2	2	-	3	-	-	-	-	-	-	2	-	3
CO2:	*Demonstrate the different programming techniques and VI software.*	3	2	2	-	3	-	-	-	-	-	-	2	-	3
CO3:	*Explain the various data acquisition methods used in the VI.*	3	2	2	-	3	-	-	-	-	-	-	2	-	3
CO4:	*Recall the distinct interfacing instruments of VI and its applications.*	3	2	2	-	3	-	-	-	-	-	-	2	-	3
CO5:	*Summarize the tools and applications of the VI.*	3	2	-	-	3	-	-	-	-	-	-	-	-	3
Average		**3**	**2**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	-	**3**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20EE661	**INDUSTRIAL ELECTRONICS** (PROFESSIONAL ELECTIVE - II)	3	0	0	3

Prerequisite: *Power Electronics*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the advanced power semiconductor devices and their application*	*Understand*
CO2:	*Discuss the firing and production circuits of power semiconductor devices.*	*Understand*
CO3:	*Enlighten the different types of sensors*	*Understand*
CO4:	*Discuss the operation of special motor drives*	*Understand*
CO5:	*Explain the concept of stepper motor and heating control in an industrial application*	*Understand*

UNIT – I ADVANCED POWER SEMICONDUCTOR DEVICES [09]

Introduction to Power Semiconductor Devices – Construction and working principle of power semiconductor devices : IGCT, SIT, RCT, SITH, MCT, FCT, GTO and LASCR – Applications.

UNIT – II FIRING AND PROTECTION CIRCUITS [09]

Necessity of Isolation, Pulse Transformer, Optocoupler – Gate Drives Circuit: SCR, MOSFET, IGBT and base Driving for Power BJT – Over Voltage, Over Current and Gate Protections – PWM Firing Circuit.

UNIT – III SENSORS [09]

Introduction – open and closed loop control – Proximity Sensor: Inductive and Capacitive – Limit Switch – Photoelectric Sensor – Laser Sensor – Temperature Sensors – Pressure Sensor – Liquid Level Sensor – Fiber optic Sensor – Vibration Sensor – Seismic Sensor.

UNIT – IV SPECIAL MOTOR DRIVES [09]

Introduction – Operation and control: Permanent Magnet Synchronous Motor drives, Switched Reluctance Motor drives, BLDC Speed control drives, Universal Motor drives, Phase locked loop control of DC Motor drive. Introduction to solar and battery powered drive.

UNIT – V STEPPER MOTOR DRIVES AND INDUSTRIAL HEATING [09]

Variable reluctance, Permanent magnet and hybrid stepper motors drives – Industrial heating: Arc furnace, high frequency heating, High frequency source for induction heating, dielectric heating and microwave heating – Applications.

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

Text Books :

1 Rashid M.H. Power Electronics: Circuits, Devices & Applications, Fourth Edition, Prentice Hall India, New Delhi, 2013.
2 Sen P.C, Power Electronics, Second Edition, Tata McGraw Hill, New Delhi, 2017.

Reference Books :

1 M.D. Singh and K.B Khanchandani, Power Electronics, Tata McGraw Hill, New Delhi, 2001.
2 Sabrie Soloman, Sensor Handbook, Second Edition, Tata McGraw Hill, New Delhi, 2010.
3 Biswanath Paul, Industrial Electronics and Control, Third Edition, Prentice Hall India, New Delhi, 2014.
4 P.P. Aearnley, Stepping Motors – A Guide to Motor Theory and Practice, Peter Perengrinus, London, 1982.

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

Semester: VI **Regulation:** R 2020
Course Code: 20EE661 **Course Name:** Industrial Electronics

CO	Course Outcomes	Programme Outcomes													
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1:	*Describe the advanced power semiconductor devices and their application*	3	1	2	-	2	-	-	-	-	-	-	2	2	2
CO2:	*Discuss the firing and production circuits of power semiconductor devices.*	3	2	2	-	2	-	-	-	-	-	-	2	2	2
CO3:	*Enlighten the different types of sensors*	3	2	2	-	3	-	-	-	-	-	-	2	2	3
CO4:	*Discuss the operation of special motor drives*	3	2	2	-	2	-	-	-	-	-	-	2	2	2
CO5:	*Explain the concept of stepper motor and heating control in an industrial application*	3	2	2	-	2	-	-	-	-	-	-	2	2	2
	Average	**3**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20EE662	**SOLID STATE DRIVES (Professional Elective - II)**	3	0	0	3

Prerequisite: *Electrical Machines – I, Electrical Machines – II, Control Systems, Power Electronics,*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the characteristics of various types of drive motor and loads.*	*Understand*
CO2:	*Outline the controlled rectifier and chopper fed DC Motor.*	*Apply*
CO3:	*Illustrate the various speed control methods of Induction motor drive.*	*Apply*
CO4:	*Summarize the various speed control methods of Synchronous motor drive.*	*Understand*
CO5:	*Describe the concept and application of special machines in modern electric drives.*	*Understand*

UNIT - I INTRODUCTION [09]

Concept of electric drive – Advantages of electric drives – Classification of electrical drives – Basic elements of an electric drive – Choice of Electric Drives – Speed-torque characteristics of various types of loads and drive motors – Classes of duty and selection of motors with regard to thermal overloading – Multi quadrant operation.

UNIT - II CONVERTER/CHOPPER FED DC MOTOR DRIVES [09]

Controlled rectifier-fed DC drives: single, two, and four quadrant operations – Chopper-fed DC motor drives: Single, two, and four quadrant operations – Effect of ripples on the motor performance – Closed loop speed control of DC motor – Starting and Braking of DC Motors – Applications of DC Drives.

UNIT - III INDUCTION MOTOR DRIVES [09]

Three phase induction motor Starting and Braking – Stator control of Induction Motor: voltage control, frequency control, V/f control – Rotor control of Induction Motor: rotor resistance control, Slip power recovery schemes: Static Kramer and Scherbius drives – VSI, CSI and Cyclo converter fed induction motor drives – Application of induction motor drive.

UNIT - IV SYNCHRONOUS MOTOR DRIVES [09]

Introduction – Starting and Braking – Synchronous motor variable speed drives – variable frequency control – modes of variable frequency control – self-controlled synchronous motor drive employing load commutated thyristor inverter – self-controlled synchronous motor drive employing a cycloconverter.

UNIT - V SPECIAL DRIVES AND APPLICATIONS [09]

Brushless DC motor drives – DC and AC Servo motor drives – Comparison between Servo drive and Stepper drive – Switched Reluctance motor drives – Solar and Battery powered drives – Drive considerations for textile mills, paper mills, cranes and hoist drives.

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

Text Books :

1 Dubey. G.K, Fundamentals of Electrical Drives, Narosa Publishing House, New Delhi, Second Edition, 2010.

2 Vedam Subramanyam, Electric Drives: Concepts and Applications, Tata McGraw hill Pvt. Ltd, New Delhi, Second Edition, 2011.

Reference Books :

1 Bose.B.K, Modern Power Electronics and AC Drives, Pearson Education Pvt. Ltd, New Delhi, First Edition, 2015.

2 De. N.K., and P.K. Sen, Electric drives, Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2014.

3 Krishnan. R, Electric Motor Drives: Modeling, Analysis and Control, PHI Pvt. Ltd, New Delhi, First Edition, 2002.

4 Ned Mohan, Electric Machines and Drives, John Wiley and Sons Ltd, India, First Edition, 2012.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester : VI | **Regulation : R 2020**
Course Code : 20EE662 | **Course Name : Solid State Drives**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Describe the characteristics of various types of drive motor and loads.*	3	-	2	-	-	-	-	-	-	2	-	2	1	-
CO2:	*Outline the controlled rectifier and chopper fed DC Motor.*	3	3	3	-	-	-	-	-	-	2	-	2	2	-
CO3:	*Illustrate the various speed control methods of Induction motor drive.*	3	3	3	-	-	-	-	-	-	2	-	3	2	-
CO4:	*Summarize the various speed control methods of Synchronous motor drive.*	3	3	3	-	-	-	-	-	-	2	-	3	2	-
CO5:	*Describe the concept and application of special machines in modern electric drives.*	3	3	3	-	-	-	-	-	-	2	-	3	2	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	-	-	**-**	**2**	**-**	**3**	**2**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20EE663	**POWER SYSTEM OPERATION AND CONTROL (Professional Elective - II)**	3	0	0	3

Prerequisite: *Power Systems I, Power Systems II*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Describe the concepts of power system operation and control and economic dispatch.	*Understand*
CO2:	Infer the concepts of unit commitment problem.	*Understand*
CO3:	Describe real power-frequency controller.	*Apply*
CO4:	Illustrate the reactive power-voltage interaction and maintain the voltage profile against varying system load.	*Understand*
CO5:	Outline the operation and application of SCADA for real time operation of power systems.	*Understand*

UNIT – I BASICS OF OPERATION CONTROL & ECONOMIC DISPATCH [09]

An overview of PS operation and control – Definitions – Load curves and Economics of generation – Statement of economic dispatch problem – Cost of generation – Incremental cost curve co–ordination equations without loss and with loss, solution by direct method and λ–iteration method (Qualitative Only).

UNIT – II UNIT COMMITMENT [09]

Statement of Unit Commitment problem – Constraints: spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints – Solution methods – Priority–list methods – Forward dynamic programming approach – Qualitative treatment only in priority–list method using full–load average production cost.

UNIT – III REAL POWER – FREQUENCY CONTROL [09]

Basics of speed governing mechanism and modeling – Control area concept LFC control of a single area system – Static and dynamic analysis of uncontrolled and controlled cases – Integration of economic dispatch control with LFC – Two-area system – Static analysis of uncontrolled case.

UNIT – IV REACTIVE POWER–VOLTAGE CONTROL [09]

Basics of reactive power control – Excitation systems – Modeling – Generation and absorption of reactive power – Relation between voltage, power and reactive power at a node – Method of voltage control – tap-changing transformer – System level control using generator voltage magnitude setting, tap setting of OLTC transformer.

UNIT – V COMPUTER CONTROL OF POWER SYSTEMS [09]

Importance of load forecasting - Linear State estimation - Concept of energy control centre (or) load dispatch centre and the functions – System monitoring – Data acquisition and control – System hardware configuration – SCADA and EMS functions.

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

Text Books:

1 Allen. J. Wood and Bruce F. Wollen berg, Power Generation, Operation and Control, John Wiley & Sons, Inc., 2016.

2 Abhijit Chakrabarti and Sunita Halder, Power System Analysis Operation and Control, PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.

Reference Books:

1 Olle.I. Elgerd, Electric Energy Systems theory - An introduction, McGraw Hill Education Pvt. Ltd., New Delhi, Thirty Fourth Reprint, 2010.

2 Kothari D.P. and Nagrath I.J., Power System Engineering, Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second Edition, 2008.

3 HadiSaadat, Power System Analysis, Tata McGraw Hill Education Pvt. Ltd., New Delhi, Twenty First Reprint, 2010.

4 Kundur P., Power System Stability and Control, Tata McGraw Hill Education Pvt. Ltd., New Delhi, Tenth Reprint, 2010.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester	**: VI**	**Regulation**	**: R 2020**
Course Code	**: 20EE663**	**Course Name**	**: Power System Operation and Control**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Describe the concepts of power system operation and control and economic dispatch.	3	2	-	-	-	-	-	-	-	2	-	-	3	1
CO2:	Infer the concepts of unit commitment problem.	3	3	-	-	-	-	-	-	-	2	-	-	3	2
CO3:	Describe real power-frequency controller.	3	3	-	-	-	2	-	-	-	2	-	-	3	2
CO4:	Illustrate the reactive power-voltage interaction and maintain the voltage profile against varying system load.	3	2	-	-	-	2	-	-	-	2	-	2	3	3
CO5:	Outline the operation and application of SCADA for real time operation of power systems.	3	2	-	-	2	-	1	-	-	2	-	2	3	3
	Average	**3**	**2**	**-**	**-**	**2**	**2**	**1**	**-**	**-**	**2**	**-**	**2**	**3**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

20EE664	**HIGH VOLTAGE ENGINEERING (Professional Elective - II)**	L	T	P	C
		3	0	0	3

Prerequisite(s): *Engineering physics, Electrical Machines – I, Power system – I*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Realize the basic concepts of various breakdown processes occurring in gases and vacuum insulation.*	*Understand*
CO2:	*Discuss about the concepts of various breakdown processes occurring in liquid and solid insulation material.*	*Understand*
CO3:	*Outline the generation of high AC, DC, Impulse Voltages and generation of high AC, DC Impulse Currents.*	*Understand*
CO4:	*Describe the different techniques used to measure the high AC, DC, Impulse Voltages and Current.*	*Understand*
CO5:	Summarize *the test procedure of various apparatus used in Electrical system.*	*Understand*

UNIT – I **ELECTRIC BREAKDOWN IN GASES AND VACUUM** **[09]**

Ionization and decay processes: Ionization by collision, Photo-ionization and Secondary ionization processes – Electric Breakdown in Gases: Townsend's breakdown mechanism – Breakdown in Electronegative gases – Time lags for breakdown – Streamer mechanism of spark – Paschen's law – Gaseous breakdown in non-uniform fields and corona discharges – Mechanisms for breakdown in vacuum insulation.

UNIT – II **ELECTRIC BREAKDOWN IN LIQUIDS AND SOLIDS** **[09]**

Electric Breakdown in Liquids: Properties of liquid dielectrics, Conduction and Breakdown in Pure Liquids – Conduction and Breakdown in Commercial Liquids: Suspended particle Mechanism, Cavitation and Bubble Mechanism, Stressed oil volume Mechanism – Breakdown in Solids: Electromechanical breakdown – Thermal breakdown – Electrochemical breakdown – Breakdown due to Treeing and Tracking – Breakdown due to Internal Discharges – Breakdown in Composite Insulation.

UNIT – III **GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS** **[09]**

Generation of High DC voltages: Greinacher voltage doubler circuit – Cockroft Walton voltage multiplier circuit – VandeGraaff Generator – Generation of High Alternating Voltages: Cascade Transformers – Resonant Transformers – Generation of Impulse Voltages: Standard Impulse Wave shapes – Marx circuit – Generation of Switching Surges – Generation of Impulse Currents – Tripping and Control of Impulse Generators.

UNIT – IV **MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS** **[09]**

Measurement of High DC Voltages: Series Resistance Microammeter – Resistance Potential Dividers – Generating Voltmeters – Measurement of High AC Voltages: CVT – Electrostatic Voltmeters – Sphere gaps for measurement of high DC, AC and Impulse Voltage Measurements – Measurement of High DC, AC and Impulse Currents: DC current transformer – Hall generator – Rogowski Coils – Magneto Optical Method – CRO for Impulse Measurements.

UNIT – V **HIGH VOLTAGE TESTING** **[09]**

Testing of Insulators – Testing of Bushings – Testing of Isolators and Circuit Breakers – Testing of Cables – Testing of Transformers – Testing of Surge Arresters – Radio Interference Measurements.

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

Text Books:

1 Naidu, M.S. and Kamaraju, V., High Voltage Engineering, Tata McGraw Hill Publishing Co Ltd., New Delhi, Sixth Edition, 2020.

2 Wadhwa, C.L. High Voltage Engineering, New Age International Pvt. Ltd., New Delhi, Third Edition, 2012.

Reference Books:

1 Kuffel, E., Kuffel, J. and Zaengl, W.S., High Voltage Engineering: Fundamentals, Newnes Publisher, New Delhi, Second Edition, Elsevier, 2014.

2 Dieter Kind and Kurt Feser, High Voltage Test Techniques, Newnes Publisher, New Delhi, Second Edition, 2001.

3 Subir Ray, An Introduction to High Voltage Engineering, PHI Learning Private Limited, New Delhi, Second Edition, 2013.

4 Alston, L.L., High Voltage Technology, Oxford University Press, New Delhi, First Edition, 2011.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: VI **Regulation:** R 2020
Course Code: 20EE664 **Course Name:** High Voltage Engineering

CO	Course Outcomes	Programme Outcomes													
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1:	Realize the basic concepts of various breakdown processes occurring in gases and vacuum insulation.	3	3	-	-	-	-	-	-	-	2	-	3	3	-
CO2:	Discuss about the concepts of various breakdown processes occurring in liquid and solid insulation material.	3	3	-	-	-	-	-	-	-	2	-	3	3	-
CO3:	Outline the generation of high AC, DC, Impulse Voltages and generation of high AC, DC, and Impulse Currents.	3	3	2	-	-	2	-	-	-	2	-	3	3	-
CO4:	Describe the different techniques used to measure the high AC, DC, Impulse Voltages and Current.	3	3	2	-	-	2	-	-	-	2	-	3	2	3
CO5:	Summarize the test procedure of various apparatus used in Electrical system.	3	2	2	-	-	2	-	-	-	2	-	3	2	3
	Average	**3**	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**-**	**3**	**2**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20EE665	**DIGITAL SIGNAL PROCESSING (Professional Elective - II)**	3	0	0	3

Prerequisite: *Engineering Mathematics, Signals and Systems.*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Examine the discrete-time system using Z-Transform.*	*Apply*
CO2:	*Compute the Discrete Fourier Transform using the FFT algorithms.*	*Apply*
CO3:	*Design digital IIR filters using analog filter design methods.*	*Apply*
CO4:	*Design the FIR filters using various windowing techniques.*	*Apply*
CO5:	*Explain the digital signal processors hardware architecture and its real-time applications.*	*Understand*

UNIT – I DISCRETE-TIME SYSTEM ANALYSIS [09]

Need and advantages of Digital Signal Processing – Typical DSP System: Sampling, Quantization, Quantization Error, Nyquist rate, Aliasing effect – Z-Transform and ROC – Properties of Z-Transform – Inverse Z-Transform – Solution of Difference Equation using Z-Transform – Stability Analysis – Convolution using Z-Transform.

UNIT – II DISCRETE FOURIER TRANSFORM [09]

DFT: Definition and its properties – Computation of DFT and IDFT – Computation of DFT using DIT-FFT and DIF-FFT Radix 2 algorithms – Computation of IDFT using DIT-FFT and DIF-FFT algorithms.

UNIT – III DESIGN OF IIR FILTERS [09]

Realization of IIR filter: Direct form I and II, Cascade and Parallel forms – Analog low pass filter design: Butterworth and Chebyshev – Digital filter design: Impulse invariant method and Bilinear transformation – Warping and Prewarping.

UNIT – IV DESIGN OF FIR FILTERS [09]

Amplitude and Phase response of FIR filters – Linear phase characteristics – Design of FIR filters using windows: Rectangular, Triangular, Hamming and Hanning.

UNIT – V DSP HARDWARE [09]

Introduction – Selection of DSP processor – Application of DSP processor – Van Neumann architecture – Harvard architecture – TMS320C50 digital signal processor: Architecture, addressing modes and Instruction set.

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

Text Books:

1 Anand Kumar. A, Digital Signal Processing, PHI Learning Private Limited, India, Second Edition, 2015.

2 John G.Prokis, Dimtris G. Manolakis, Digital Signal Processing Principles, Algorithms and Application, Pearson Education, India, Fourth Edition, 2011.

Reference Books:

1 Alan V. Oppenheim, Ronald W. Schafer, John R. Back, Discrete Time Signal Processing, Pearson Education, India, Third Edition, 2014.

2 Johny R.Johnson, Introduction To Digital Signal Processing, Pearson Education, India, First Edition, 2015.

3 Tarun Kumar Rawat, Digital Signal Processing, Oxford University Press, India, First Edition, 2015.

4 Salivanan. S, Vallavaraj. A, Gnanapriya. C, Digital Signal Processing, Tata McGraw Hill Publishing Co Ltd., New Delhi, Second Edition, 2011.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: VI **Regulation:** R 2020
Course Code: 20EE665 **Course Name:** Digital Signal Processing

CO	Course Outcomes	Programme Outcomes													
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1:	Examine the discrete time system using Z-Transform	3	3	2	-	2	-	-	-	-	-	-	3	-	2
CO2:	Compute the Discrete Fourier Transform using the FFT algorithms.	3	3	3	-	2	-	-	-	-	-	-	3	-	2
CO3:	Design digital IIR filters using analog filter design methods.	3	3	3	-	-	-	-	-	-	-	-	3	-	2
CO4:	Design the FIR filters using various windowing techniques	3	3	3	-	-	-	-	-	-	-	-	3	-	2
CO5:	Explain the digital signal processors hardware architecture and its real time applications.	3	2	2	-	3	-	-	-	-	-	-	3	-	1
Average		**3**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20EE761	**POWER ELECTRONICS FOR RENEWABLE ENERGY SOURCES** (Professional Elective – III)	3	0	0	3

Prerequisite(s): *Power System – I, Power Electronics*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the functions of renewable energy generation systems.*	*Understand*
CO2:	*Describe the principles behind the electrical machines for renewable energy conversion.*	*Understand*
CO3:	*Analyze the performance of power converters and its types.*	*Analyze*
CO4:	*Analyze the performance of wind and PV systems with grid systems.*	*Analyze*
CO5:	*Interpret the concept hybrid systems for renewable energy sources.*	*Analyze*

UNIT – I INTRODUCTION TO RENEWABLE ENERGY SOURCES [09]

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (Cost-GHG Emission) – Qualitative study of different renewable energy resources: Ocean, Biomass, Hydrogen energy systems, Solar PV, Fuel cells, wind electrical systems – Control strategy.

UNIT – II ELECTRICAL MACHINES FOR WIND POWER GENERATION SYSTEM [09]

Review of reference theory fundamentals – principle of operation and analysis: Induction Generator (IG), Permanent Magnet Synchronous Generator (PMSG), Squirrel Cage Induction Generator (SCIG) and Doubly Fed Induction Generator (DFIG).

UNIT – III POWER CONVERTERS [09]

Line commutated converters (inversion mode) – Boost, Buck and Buck-boost converters – Three phase AC voltage controllers - AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid interactive Inverters.

UNIT – IV ANALYSIS OF WIND AND PV SYSTEMS [09]

PV System: Solar Cell – Solar PV system costs – General scheme of solar PV system – Grid Connected PV system – Stand-alone PV systems – Maximum Power Point Tracking of PV system – Energy Storage System for PV applications – PV and Battery Sizing – Control of PV system – Operational Issues of PV system.

Wind System: Wind power generation – Technological challenges and driving forces – Wind turbine concepts – Maximum Power Point Tracking of wind – Power electronics converters in wind power applications – Control of wind turbines.

UNIT – V HYBRID RENEWABLE ENERGY SYSTEMS [09]

Introduction – Drawbacks of standalone renewable energy sources – Need for hybrid renewable energy systems – Types of hybrid system: PV-Wind, PV-Hydraulic, Hydraulic-Wind and Solar-Biomass – Components of Hybrid Renewable Energy Systems – Power Converters in Hybrid Renewable Energy Systems.

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

Text Books :

1 Rai. G.D, Non-conventional energy sources, Khanna Publishing, New Delhi, First Edition, 2004.

2 Bimal K.Bose, Power Electronics in Renewable Energy Systems and Smart Grid: Technology and Applications, John Wiley & Sons, United States, First Edition, 2019.

Reference Books :

1 Bhadra, S.N, Kastha, D & Banerjee. S, Wind Electrical Systems, Oxford University Press, London, Seventh Impression Edition, 2005.

2 Rashid, M.H, Power Electronics Hand Book, Butterworth-Heinemann, United Kingdom, Third Edition, 2011.

3 Rai. G.D, Solar Energy Utilization, Khanna Publishing, New Delhi, Fifth Edition, 1995.

4 Chakraborty, S, Simoes, M.G, Kramer, W.E, Power Electronics for Renewable and Distributed Energy Systems, Springer, First Edition, 2013.

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

Semester:	**VII**	**Regulation:**	**R 2020**
Course Code:	**20EE761**	**Course Name:**	**Power Electronics for Renewable Energy Sources**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the functions of renewable energy generation systems.*	3	-	-	2	2	1	1	2	-	-	-	3	3	-
CO2:	*Describe the principles behind the electrical machines for renewable energy conversion.*	3	-	-	2	2	-	1	2	-	-	-	3	3	1
CO3:	*Analyze the performance of power converters and its types.*	3	2	-	2	2	1	1	2	-	-	-	3	3	2
CO4:	*Analyze the performance of wind and PV systems with grid systems.*	3	2	-	2	2	1	1	2	-	-	-	3	3	2
CO5:	*Interpret the concept hybrid systems for renewable energy sources.*	3	2	-	2	2	1	1	2	-	-	-	3	3	2
	Average	**3**	**2**	**-**	**2**	**2**	**1**	**1**	**2**	**-**	**-**	**-**	**3**	**3**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20EE762	**DESIGN AND INSTALLATION OF SOLAR AND WIND POWER GENERATION SYSTEMS** (Professional Elective – III)	3	0	0	3

Prerequisite(s): *Power Systems - I, Power Electronics*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the operation of different types of PV-Thermal energy systems.*	*Understand*
CO2:	*Discuss the design and installation of solar-wind hybrid power generation system.*	*Understand*
CO3:	*Describe the concept, design and Implementation of building integrated PV systems.*	*Understand*
CO4:	*Explain the procedure to be followed for the integration of solar system with the grid.*	*Understand*
CO5:	*Describe the floating PV energy system and Canal top solar PV systems.*	*Understand*

UNIT – I PV-THERMAL ENERGY SYSTEMS [09]

PV-Thermal air heating: PV Integrated with air collector, Double-pass PV-Thermal solar air collector – PV-Thermal water heating: temperature-dependent PV module performance – PV module efficiency and output power as a function of the operating temperature – Overall Thermal and Electrical Efficiency.

UNIT – II SOLAR-WIND POWER GENERATION SYSTEMS [09]

Introduction and need of solar-wind conversion systems – Concept, design and installation of Solar-Wind hybrid systems – Electrical output of the hybrid system – Site and resources assessment for the installation of Solar-Wind energy systems – Interaction of grid with solar-wind power generation systems – limitation of the Solar-Wind generation: cost, technology and environmental issues.

UNIT – III BUILDING INTEGRATED PV (BIPV) SYSTEMS [09]

Concept, design and Implementation of BIPV systems – Classification of BIPV system and their application – Cell and module design for BIPV systems, Rooftop and Facade based systems – Different parameters of building integrated PV systems – Electrical and thermal analysis – International standards and test conditions – Total energy generation – Performance Issues and limitations of BIPV.

UNIT – IV GRID INTEGRATION OF SOLAR SYSTEM [09]

Grid and solar power generation – Integration of solar thermal and photovoltaic systems – Matching of voltage, phase and frequency – smart grid technology and challenges – Grid power control and power management – type of electrical power grids – Impact of smart grid on solar power generation.

UNIT – V ADVANCED PV SYSTEMS [09]

Floating PV energy systems: Concept and commercial designs of Floating Solar System – Economical analysis - Comparison between floating V_s land based PV systems – Environmental impacts – Challenges or Issues of floating PV system – Canal top solar PV systems: concept, design and installation criteria – Effect of water evaporation rate – Environmental issues and limitations.

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

Text Books :

1 Gevorkian, P., Grid-connected photovoltaic power generation, Cambridge University Press, United Kingdom, First Edition, 2017.

2 Prasad, D. and Snow, M., Designing with solar power: a source book for building integrated photovoltaics (BiPV), Routledge, London, First Edition, 2014.

Reference Books :

1 Khartchenko, N.V. and Kharchenko, V. M., Advanced Energy Systems, CRC Press, New York, Second Edition, 2013.

2 Mukund R. Patel, Beik, O., Wind and Solar Power Systems: Design, Analysis and Operation, CRC Press, New York, Third Edition, 2021.

3 Russell, C. T. and Vaisberg, O., The interaction of the solar wind with Venus, Priroda, pp. 873-940, 1983.

4 Kalogirou, S. A. (2001). Use of TRNSYS for modelling and simulation of a hybrid PV–thermal solar system for Cyprus, Renewable Energy, Vol. 23, Issue 2, pp. 247-260, 2001.

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

Semester: VII **Regulation:** R 2020
Course Code: 20EE762 **Course Name:** Design and Installation of Solar and Wind Power Generation Systems

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the operation of different types of PV-Thermal energy systems.*	2	1	3	-	2	2	2	1	-	-	-	3	3	2
CO2:	*Discuss the design and installation of Solar-Wind hybrid power generation system.*	3	3	3	-	2	2	2	1	-	-	-	3	3	2
CO3:	*Describe the concept, design and Implementation of building integrated PV systems.*	3	3	3	-	2	2	2	1	-	-	-	3	3	2
CO4:	*Explain the procedure to be followed for the integration of solar system with the grid.*	3	3	3	-	2	2	2	1	-	-	-	3	3	2
CO5:	*Describe the floating PV energy system and Canal top solar PV systems.*	2	3	3	-	2	2	2	1	-	-	-	3	3	2
	Average	**3**	**3**	**3**	**-**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**3**	**3**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20EE763	**HIGH VOLTAGE DIRECT CURRENT TRANSMISSION** (Professional Elective – III)	3	0	0	3

Prerequisite(s): *Power System – I, Power System – II, High Voltage Engineering*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Realize the concept of AC, DC, and HVDC transmission.*	*Understand*
CO2:	*Analyze the performance of HVDC converters and its characteristics.*	*Understand*
CO3:	*Interpret the concept of compounding and outline the regulation of HVDC transmission.*	*Understand*
CO4:	*Design the filters to eliminate the harmonics.*	*Understand*
CO5:	*Analyze the performance of HVDC cables and modeling of HVDC systems using simulation.*	*Understand*

UNIT – I INTRODUCTION [09]

Introduction of DC power transmission – Comparison of AC and DC transmission – Economics of HVDC power transmission, Technical performance and reliability – Description of HVDC transmission system – Planning for HVDC transmission – Modern trends in HVDC transmission – Application of DC transmission.

UNIT – II ANALYSIS OF HVDC CONVERTERS [09]

Pulse number – Choice of converter configuration – Simplified analysis of Graetz circuit – Converter bridge characteristics – Analysis of a 12 pulse converters – Analysis of VSC topologies and firing schemes.

UNIT – III COMPOUNDING AND REGULATIONS [09]

General – Required regulation – Inverter compounding – Uncompounded inverter – Rectifier compounding – Transmission characteristics with the rectifier and inverter compounding – Communication link – Current regulation from the inverter side – Transformer tap changing.

UNIT – IV HARMONICS AND FILTERS [09]

Introduction – Generation of harmonics – Characteristics and uncharacteristic harmonics – Design of AC filters and DC filters – Active filters – Interference with neighboring communication lines.

UNIT – V HVDC CABLES AND SIMULATION OF HVDC SYSTEMS [09]

Introduction of DC cables – Basic physical phenomenon arising in DC insulation – Practical dielectrics – Dielectric stress consideration – Economics of DC cables compared with AC cables – Introduction to system simulation – Philosophy and tools – HVDC system simulation – Modeling of HVDC systems for digital dynamic simulation.

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

Text Books :

1 Padiyar, K.R, HVDC power transmission system, New Age International (P) Ltd., New Delhi, Second Edition, 2010.
2 Kamakshaiah,S, Kamaraju,V, HVDC Transmission, Tata McGraw Hill Education Private Limited, First Edition, 2011.

Reference Books :

1 Dragan Jovcic, High Voltage Direct Current Transmission: Converters, Systems and DC Grids, John Wiley & Sons Ltd., Second Edition, 2019.
2 Arrillaga, J, High Voltage Direct Current Transmission, Peter Pregrinus, London, Second Edition, 1998.
3 Rakosh Das Begamudre, Extra High Voltage AC Transmission Engineering, New Age International (P) Ltd., New Delhi, First Edition, 2011.
4 Chan-Ki Kim, Gil-Soo Jang, Seok-Jin Lee, Seong-Joo Lim, Vijay K. Sood, HVDC Transmission: Power Conversion Applications in Power Systems, John Wiley & Sons Pvt. Ltd., First Edition, 2009.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester:	**VII**	**Regulation:**	**R 2020**
Course Code:	**20EE763**	**Course Name:**	**High Voltage Direct Current Transmission**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Realize the concept of AC, DC, and HVDC transmission.*	3	3	1	-	-	2	2	-	-	2	-	3	3	2
CO2:	*Analyze the performance of HVDC converters and its characteristics.*	3	3	2	-	-	2	2	-	-	2	-	3	3	2
CO3:	*Interpret the concept of compounding and outline the regulation of HVDC transmission.*	3	3	2	-	-	2	2	-	-	2	-	3	3	2
CO4:	*Design the filters to eliminate the harmonics.*	3	3	3	-	-	2	2	-	-	2	-	3	3	2
CO5:	*Analyze the performance of HVDC cables and modeling of HVDC systems using simulation.*	3	3	3	-	-	2	2	-	-	2	-	3	3	2
	Average	**3**	**3**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**2**	**-**	**3**	**3**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VII

		L	T	P	C
20EE764	**SMART GRID TECHNOLOGY** (Professional Elective - III)	3	0	0	3

Prerequisite(s): *Power System – I, Power System - II*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the components used in smart grid technologies.*	*Understand*
CO2:	Illustrate the concept of smart metering and demand side integration.	*Understand*
CO3:	*Describe the concepts of distribution automation in smart grid.*	*Understand*
CO4:	*Explicate the automated transmission systems in smart grid.*	*Understand*
CO5:	*Enlighten the significance of high performance computing in smart grid.*	*Understand*

UNIT – I INTRODUCTION [09]

Electrical Grid – Definition of Smart Grid – Opportunities, Challenges and Benefits of Smart Grid – Difference between conventional and Smart Grid – Operating Principles and Models of Smart Grid Components, Implementation of Smart Grid – Early Smart Grid initiatives in India – Overview of the technologies required for the Smart Grid.

UNIT – II SMART METERING AND DEMAND-SIDE INTEGRATION [09]

Introduction – Smart metering – Smart meters – An overview of the hardware used – Communications infrastructure and protocols for smart metering, Demand – Side integration – Services provided by DSI, Implementations of DSI, Hardware support to DSI implementations, Flexibility delivered by prosumers from the demand side, System support from DSI.

UNIT – III DISTRIBUTION AUTOMATION [09]

Distribution automation, Automated Meter Reading (AMR), Advanced Metering Infrastructure (AMI), Intelligent Electronic Devices (IED), Fault Location Isolation and Service Restoration (FLISR), Outage Management Systems (OMS), High Efficiency Distribution Transformers.

UNIT – IV TRANSMISSION SYSTEM AUTOMATION [09]

Substation automation, Feeder Automation, Supervisory Control and Data Acquisition (SCADA), Energy Management System (EMS), Phasor Measurement Units (PMU), Wide Area Monitoring Systems (WAMS).

UNIT – V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS [09]

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power Line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

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

Text Books :

1 Stuart Borlase, Smart Grid: Infrastructure, Technology and Solutions, CRC Press, United States, First Edition, 2012.

2 James Momoh, Smart Grid: Fundamentals of Design and Analysis, John Wiley and Sons, United States, First Edition, 2012.

Reference Books :

1 Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, Smart Grid Technology and Applications, John Wiley and Sons, United States, First Edition, 2012.

2 Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang, Smart Grid–The New and Improved Power Grid: A Survey, IEEE Transaction on Smart Grids, 2012.

3 Ryszard Strzelecki, Grzegorz Benysek, Power Electronics in Smart Electrical Energy Networks, Springer, New Zealand, First Edition, 2008.

4 https://nptel.ac.in/courses/108/107/108107113/.

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CO-PO MAPPING

Semester:	**VII**	**Regulation:**	**R 2020**
Course Code:	**20EE764**	**Course Name:**	**Smart Grid Technology**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Describe the components used in smart grid technologies.*	3	2	2	-	2	-	1	-	-	-	-	2	3	2
CO2:	Illustrate the concept of smart metering and demand side integration.	3	2	2	-	2	-	1	-	-	-	-	2	3	2
CO3:	*Describe the concepts of distribution automation in smart grid.*	3	2	2	-	2	-	1	-	-	-	-	2	3	2
CO4:	*Explicate the automated transmission systems in smart grid.*	3	2	2	-	2	-	1	-	-	-	-	2	3	2
CO5:	*Enlighten the significance of high performance computing in smart grid.*	3	2	2	-	2	-	1	-	-	-	-	2	3	2
	Average	**3**	**2**	**2**	**-**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**2**	**3**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20EE765	**FUNDAMENTALS OF NANO TECHNOLOGY** (Professional Elective – III)	3	0	0	3

Prerequisite(s): *Engineering Physics, Engineering Chemistry*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the basics of nanotechnology in engineering..*	*Understand*
CO2:	*Recognize the methods of preparation of nanomaterials.*	*Understand*
CO3:	*Categorize the nanomaterials and its properties.*	*Understand*
CO4:	*Relate the characterization techniques for confirming nanomaterials.*	*Understand*
CO5:	*Identify the area of application and its field.*	*Understand*

UNIT – I INTRODUCTION [09]

Nanoscale Science and Technology – Implications for Physics, Chemistry, Biology and Engineering – 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. Introduction to properties and motivation for study (Qualitative only).

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 NANO MATERIALS [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-property Relationships applications- Nanometal oxides – ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays – functionalization and applications – Quantum wires – Quantum dots: preparation, properties and applications.

UNIT – IV CHARACTERIZATION TECHNIQUES [09]

X-ray diffraction technique – Scanning Electron Microscopy – environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques – AFM, SPM, STM, SNOM, ESCA,SIMS-Nanoindentation.

UNIT – V APPLICATIONS [09]

NanoInfoTech: Information storage – nanocomputer, molecular switch, super chip, nanocrystal; Nano biotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery; Bioimaging – Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS) – Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products – In Photostat, printing, solar cell, battery.

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

Text Books :

1. John Dinardo. N, Nanoscale characterization of surfaces & Interfaces, Weinheim Cambridge, Wiley-VCH, Second Edition, 2000.
2. Chattopadhyay K.K and Banerjee, Introduction to Nanoscience and Nanotechnology, PHI Learning (P) Ltd, New Delhi, First Edition, 2020.

Reference Books :

1. Akhlesh Lakhtakia, The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulation, Prentice-Hall of India (P) Ltd, New Delhi, First Edition, 2007.
2. Charles P. Poole,Jr Frank Owens J, Introduction to Nanotechnology, Wiley India (P) Ltd, New Delhi, First Edition, 2006
3. Das, A.K, An Introduction to Nanomaterials and Nanoscience, CBS Publishers and Distribution (P) Ltd, Kindle Edition, 2020.
4. Timp .G, Nanotechnology, AIP press/Springer, 1999.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester:	**VII**	**Regulation:**	**R 2020**
Course Code:	**20EE765**	**Course Name:**	**Fundamentals of Nano Technology**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Describe the basics of nanotechnology in physics, chemistry and biology.*	3	2	-	1	1	-	2	-	-	-	-	-	-	-
CO2:	*Recognize the methods of preparation of nanomaterials.*	3	2	1	1	2	-	2	-	-	-	-	-	-	-
CO3:	*Categorize the nanomaterials and its properties.*	3	2	1	1	-	-	2	-	-	-	-	-	-	-
CO4:	*Relate the characterization techniques for confirming nanomaterials.*	3	2	1	1	2	-	2	-	-	-	-	-	-	-
CO5:	*Identify the area of application and its field.*	3	2	1	1	-	-	2	-	-	-	-	1	-	-
	Average	**3**	**2**	**1**	**1**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VII

		L	T	P	C
20EE766	**ELECTRIC AND HYBRID VEHICLES** (Professional Elective – IV)	3	0	0	3

Prerequisite(s): *Power Electronics, Electrical Machines –I, Electrical Machines - II*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the working principle of electric and hybrid* electric *vehicles.*	*Understand*
CO2:	*Describe the energy storage systems for electric vehicle and hybrid* electric *vehicles*	*Understand*
CO3:	*Elucidate the architecture of electric and hybrid* electric *Vehicles*	*Understand*
CO4:	*Develop the electric propulsion unit and its control for EV and HEV*	*Understand*
CO5:	Interpret the energy management strategies and vehicle communication system.	*Understand*

UNIT – I ELECTRIC AND HYBRID ELECTRIC VEHICLES [09]

History of electric and hybrid vehicles – Environmental impact – EV/ICE comparison – Vehicle power plant and transmission characteristics - Vehicle performance – Operating fuel economy – Configuration of EVs - Performance of EVs.

UNIT – II BATTERY ENERGY STORAGE SYSTEM [09]

Energy storage requirements – Battery basics – Battery parameters – Battery modeling – Types of batteries – Battery management system – Fuel cell: fuel cell characteristics, Types - Ultra capacitors.

UNIT – III ARCHITECTURE OF ELECTRIC AND HYBRID ELECTRIC VEHICLES [09]

Vehicles Architecture: Electric vehicles, Hybrid electric vehicles, Plug–In hybrid electric vehicles – Architecture of hybrid drive trains: series and parallel drive train – Torque coupling and analysis of parallel drive train – EV/HEV power train component sizing.

UNIT – IV ELECTRIC PROPULSION SYSTEMS [09]

Introduction to electric components used in electric and hybrid vehicles – DC motor drives – Three phase AC machines – Induction motor drives – Permanent magnet BLDC motor drives – Switched Reluctance Motor (SRM) drives.

UNIT – V ENERGY MANAGEMENT STRATEGIES AND VEHICLE COMMUNICATIONS [09]

Energy Management strategies: Classification and Comparison of different energy management strategies.

Vehicle Communications: OSI seven layer models – In-vehicle communication – Controller Area Network: CAN transfer protocol, transfer layer, physical layer and programming.

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

Text Books :

1 Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, Third Edition, 2021.

2 Mehrdad Ehsani, Yimi Gao, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles, CRC Press, Third Edition, 2018.

Reference Books :

1 Chris, Mi, M. Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles Principles and Applications with Practical Perspectives, Wiley Publication, India, Second Edition, 2017.

2 Amir Khajepour, M. Saber Fallah, Avesta Goodarzi, Electric and Hybrid Vehicles Technologies, Modeling and Control - A Mechatronic Approach, Wiley Publication, Second Edition 2014.

3 James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley Publication, India, Second Edition, 2012.

4 https://nptel.ac.in/courses/108106170

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester :	**VII**	**Regulation:**	**R 2020**
Course Code:	**20EE766**	**Course Name:**	**Electric and Hybrid Vehicles**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the working principle of electric and hybrid electric vehicles*	3	2	2	-	-	2	3	-	-	-	-	2	-	1
CO2:	*Describe the energy storage systems for electric vehicle and hybrid electric vehicles*	3	2	2	-	-	2	3	-	-	-	-	2	-	1
CO3:	*Elucidate the architecture of electric and hybrid electric Vehicles*	3	2	2	-	-	2	3	-	-	-	-	2	-	1
CO4:	*Develop the electric propulsion unit and its control for EV and HEV*	3	2	2	-	-	2	3	-	-	-	-	2	-	1
CO5:	*Interpret the energy management strategies and vehicle communication system*	3	2	2	-	-	2	3	-	-	-	-	2	-	1
	Average	**3**	**2**	**2**	**-**	**-**	**2**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**1**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VII

20EE767	**DESIGN OF POWER CONVERTERS** (Professional Elective – IV)	L	T	P	C
		3	0	0	3

Prerequisite(s): *Electric Circuit Analysis, Power Electronics*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Design rectifier circuit with protection circuits.*	*Apply*
CO2:	*Describe the function of isolated converters with capacitor sizing in CCM & DCM operation.*	*Apply*
CO3:	*Design non-isolated converters with capacitor sizing in CCM & DCM operation.*	*Apply*
CO4:	*Analyze the practical aspects in inverter design.*	*Understand*
CO5:	*Understand the paralleling concepts of power converters.*	*Understand*

UNIT – I AC TO DC CONVERTER [09]

Introduction – Design calculation of Half bridge controlled rectifier with R load and Full Bridge Controlled rectifier with RL load – Analysis of CCM and DCM – Surge protection circuit – Load short protection circuit.

UNIT – II ISOLATED CONVERTERS [09]

Buck Converter: Duty cycle determination – Open Loop CCM to DCM transition – Calculation of critical inductance – Closed loop CCM & DCM – Output capacitor sizing. Flyback converter: Open loop CCM & DCM duty cycle determination – Calculation of critical inductance – Peak voltage mode CCM & DCM in closed loop – Peak current mode CCM & DCM in closed loop – Output capacitor sizing.

UNIT – III NON-ISOLATED CONVERTERS [09]

Boost Converter: Duty-Cycle determination – Critical Inductance – Peak current mode closed-loop steady state in CCM & DCM – DCM Output Capacitor Size – CCM Output Capacitor Size – Effects of converter Non-idealities – Switch Utilization Factor.

UNIT – IV DC TO AC CONVERTERS [09]

Practical aspects in building three phase Inverter: design calculation – Selection of power devices – Protection circuits – System protection management – Reduction of common mode EMI – Thermal management – Carrier based PWM implementation: Gate driver faults – Dead time control.

UNIT – V PARALLEL AND INTERLEAVED POWER CONVERTERS [09]

Comparison between high power devices & multiple parallel low power devices – Hardware Constraints in Paralleling IGBTs – Gate Control Designs for Equal Current Sharing – advantages and disadvantages of paralleling inverter – interleaved operation of power converters – circulating currents.

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

Text Books :

1 Keng.C.Wu, Switch Mode Power Converters, Elsevier Academic Press, UK, First Edition, 2006.

2 Dorin O.Neacsu, Power Switching Converters-Medium and High Power, CRC Press, USA, First Edition, 2006.

Reference Books :

1 Robbins Mohan & Undeland, Power Electronics: Converters Applications and Design, Wiley, Third edition, 2007.

2 Issa Batarseh & Ahmad Harb, Power electronic circuit analysis and design, Springer Publications, Second edition, 2018.

3 Teuvo Suntio, Tuomas Messo, Joonas Puukko, Power Electronic Converters, Wiley, First Edition, 2017.

4 Seddik Bacha, Power Electronic Converters Modeling And Control With Case Studies, Springer Publications, Second Edition, 2013.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: VII **Regulation:** R 2020
Course Code: 20EE767 **Course Name:** Design of Power Converters

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Design rectifier circuit with protection circuits.*	3	2	2	-	-	-	-	-	-	-	-	1	2	2
CO2:	*Describe the function of isolated converters with capacitor sizing in CCM & DCM operation.*	3	2	2	-	-	-	-	-	-	-	-	1	2	2
CO3:	*Design non-isolated converters with capacitor sizing in CCM & DCM operation.*	3	2	2	-	-	-	-	-	-	-	-	1	2	2
CO4:	*Analyze the practical aspects in inverter design.*	3	2	-	-	-	-	-	-	-	-	-	1	2	2
CO5:	*Understand the paralleling concepts of power converters.*	3	2	-	-	-	-	-	-	-	-	-	1	2	2
	Average	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20EE768	**FLEXIBLE AC TRANSMISSION SYSTEMS** (Professional Elective - IV)	3	0	0	3

Prerequisite: *Power Electronics, Power System – I, Power System - II*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify the conditions in conventional power system where the installation of FACTS controllers or Devices becomes vital.*	*Understand*
CO2:	Describe *the performance of a conventional transmission system and apply the principles of reactive power compensation for improvement.*	*Understand*
CO3:	*Illustrate the modes of operation of thyristor controlled series capacitor.*	*Understand*
CO4:	*Discuss the various modes of operation of thyristor based and voltage source converter based FACTS controllers.*	*Understand*
CO5:	*Explain the co-ordination of FACTS controllers.*	*Understand*

UNIT – I FACTS CONTROLLERS [09]

Need for FACTS controllers – Concept of FACTS – Flow of power in an AC system – Dynamic stability consideration – Basic types of FACTS controllers: Static shunt compensators, series compensators – Basic concepts of Static VAR Compensator (SVC) – Thyristor Switched Series Capacitor (TSSC) – Unified Power Flow Controller (UPFC).

UNIT – II VAR COMPENSATORS [09]

Methods of controllable VAR generation – Switching converter type VAR generators – Basic operating principle and control approaches – Voltage control by SVC – Dynamic characteristics – Design of SVC as voltage regulator – Modeling of SVC for power flow – Applications – Steady state power transfer – Prevention of voltage instability.

UNIT – III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS [09]

Principle and operation of TCSC – Operating modes of TCSC – Modeling of TCSC – Modeling for power flow studies – Applications: Improvement of system stability limit, enhancement of system damping.

UNIT – IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS [09]

Principle and operation of Static Synchronous Compensator (STATCOM) – V-I Characteristics. Applications: Enhancement of transient stability, prevention of voltage instability – Static Synchronous Series Compensator (SSSC): Operation, control of power flow, modeling of load flow studies – Comparison of different FACTS controllers.

UNIT – V CO-ORDINATION OF FACTS CONTROLLERS [09]

Controller interactions – SVC to SVC interaction – Co-ordination of multiple controllers using linear control techniques – Quantitative treatment of control coordination – Synchronous Reference Frame (SRF) theory based control algorithm for DVR – Case studies of practical applications of various FACTS devices.

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

Text Books :

1 Mohan Mathur. R, Rajiv. K. Varma, Thyristor – Based Facts Controllers for Electrical Transmission Systems, IEEE press and John Wiley & Sons, Inc., 2011.
2 Narain G. Hingorani, Laszlo Gyugyi, Understanding Facts: Concepts and Technology of Flexible AC Transmission Systems, Standard Publishers, Delhi, 2011.

Reference Books :

1 John.A.T, Flexible AC Transmission System, Institution of Electrical and Electronic Engineers (IEEE), 1999.
2 Padiyar.K.R, FACTS Controllers in Power Transmission System and Distribution, New Age International (P) Limited, New Delhi, 2009.
3 Rakosh Das Begamudre, Extra High Voltage AC Transmission Engineering, New Academic Science, Fourth Edition 2011.
4 Miller.T.J.E, Reactive Power Control in Electric Systems, Wiley, John & Sons, 1982.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester : VII **Regulation : R 2020**
Course Code : 20EE768 **Course Name : Flexible AC Transmission Systems**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Identify the conditions in conventional power system where the installation of FACTS controllers or Devices becomes vital*	3	1	2	-	-	-	3	-	-	-	-	1	3	2
CO2:	Describe *the performance of a conventional transmission system and apply the principles of reactive power compensation for improvement*	3	1	-	-	-	2	3	1	-	-	-	1	3	3
CO3:	*Illustrate the modes of operation of thyristor controlled series capacitor*	3	1	-	-	-	-	3	-	-	-	-	-	3	-
CO4:	*Discuss the various modes of operation of thyristor based and voltage source converter based FACTS controllers.*	3	1	2	-	-	-	3	-	-	-	-	1	3	3
CO5:	*Explain the co-ordination of FACTS controllers.*	3	1	2	-	-	2	3	1	-	-	-	1	3	-
	Average	**3**	**1**	**2**	**-**	**-**	**2**	**3**	**1**	**-**	**-**	**-**	**1**	**3**	**3**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20EE769	**BIOMASS ENERGY CONVERSION SYSTEMS** (Professional Elective - IV)	3	0	0	3

Prerequisite(s): *Power System – I*

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

CO1:	*Explain the nature and principle of biomass energy extraction systems.*	*Understand*
CO2:	*Illustrate various biomass conversion process.*	*Understand*
CO3:	*Interpret biogas production and digester design.*	*Understand*
CO4:	*Categorize various techniques for bio-diesel refining process.*	*Understand*
CO5:	*Access different types of biomass combustion process.*	*Understand*

UNIT – I INTRODUCTION [09]

Biomass energy usage – Overall energy needs – Sources of biomass available – Units and conversions – Problems and issues – Advantages and disadvantages in use of biomass as energy source.

UNIT – II BIOMASS CONVERSION [09]

Overview – Chemical and biological conversion processes – Thermal conversion process – Hybrid conversion process – Application of biomass conversion products.

UNIT – III BIOGAS PRODUCTION [09]

Introduction – Biomass parameters in anaerobic digestion – Advantages and disadvantages of anaerobic digestion process – Biogas conversion process and digester designs – Design of biogas digester – Biogas utilization.

UNIT – IV BIO-DIESEL PRODUCTION [09]

Introduction – Vegetable oil and animal fat characteristics – Fatty acid composition – Basic oil properties – Oil Extraction processes – Oil refining process – Transesterification - Engine performance and exhaust emissions.

UNIT – V BIOMASS COMBUSTION [09]

Introduction – Types of biomass combustion systems – Co-combustion of biomass and co-firing with coal – Slagging and fouling issues with agricultural biomass – Determining melting point of biomass ash pellets – Applications of biomass combustion systems.

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

Text Books :

1 Khan.B.H., Non–Conventional Energy Sources, Tata McGraw–Hill, New Delhi, Second Edition, 2009.

2 Rai.G.D., Non-Conventional Energy Sources, Khanna Publishers, New Delhi, First Edition, 2011.

Reference Books :

1 Kothari D.P, Singal, K.C, Rakesh Ranjan., Renewable Energy Sources and Emerging Technologies, PHI Learning Pvt. Ltd, New Delhi, Second Edition, 2011.

2 John Twidell, Tony Weir., Renewable Energy Resources, Routledge, New York, Third Edition, 2015.

3 Sergio Capareda, Introduction to Biomass Energy Conversions, CRC press, India, First Edition, 2013.

4 Venkata Ramana, P, Srinivas, S.N., Biomass Energy Systems, Khanna Publishers, New Delhi, Third Edition, 2015.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester : VII **Regulation : R 2020**
Course Code : 20EE769 **Course Name: Biomass Energy Conversion Systems**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the nature and principle of biomass energy extraction systems*	3	2	2	-	-	2	2	-		-	-	2	2	1
CO2:	*Illustrate various biomass conversion process*	2	3	2	-	-	2	2	-	-	-	-	2	2	1
CO3:	*Interpret biogas production and digester design*	2	2	3	-	-	2	2	-	-	-	-	2	2	1
CO4:	*Categorize various techniques for bio-diesel refining process*	2	2	3	-	-	2	2	-	-	-	-	2	2	1
CO5:	*Access different types of biomass combustion process*	2	2	3	-	-	2	2	-	-	-	-	2	2	1
Average		**2**	**2**	**3**	**-**	**-**	**2**	**2**		**-**	**-**	**-**	**2**	**2**	**1**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20EE771	**MICROCONTROLLER BASED SYSTEM DESIGN** (Professional Elective - IV)	3	0	0	3

Prerequisite(s): *Microprocessors and Microcontrollers*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Illustrate the Instruction set, addressing modes and interfacing of 8096 microcontroller.*	*Understand*
CO2:	*Explain the Memory organizations, addressing modes and interfacing of PIC microcontroller.*	*Understand*
CO3:	*Interpret the concept of architecture in ARM processor.*	*Understand*
CO4:	*Describe the ARM Processor organization.*	*Understand*
CO5:	*Explain the Architecture of MSP Processor.*	*Understand*

UNIT – I 8096 MICROCONTROLLER AND INTERFACING [09]

CPU operation – Interrupt structure – Timers – High speed input/output ports – I/O control and status registers – Instruction set – Addressing modes – Serial ports – External ROM and RAM expansion – PWM control – A/D interfacing.

UNIT – II PIC MICROCONTROLLER AND INTERFACING [09]

Memory organizations – Program memory, Data memory – Addressing modes – Interrupts – I/O ports – Timers – CCP modules – Master synchronous serial port – USART – ADC – I^2C.

UNIT – III ARM PROCESSOR [09]

ARM Architecture – ARM programmer's model – ARM Development tools – Memory Hierarchy – ARM assembly language programming – Simple examples – Architectural support for operating systems.

UNIT – IV ARM ORGANIZATION [09]

3-Stage pipeline ARM organization – 5-Stage pipeline ARM organization – ARM instruction execution – ARM implementation – ARM instruction set – ARM coprocessor interface – Architectural support for high level languages – Embedded ARM applications.

UNIT – V MSP PROCESSOR [09]

MSP430 architecture – Addressing modes – Constant generator and Emulsion instructions – Instruction set – Functions – Interrupts – low power modes.

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

Text Books :

1 John B. Peatman, Design with PIC Microcontrollers, Pearson Education, New Delhi, Eighth Edition.2009.

2 Steve Furber, ARM System-on-chip Architecture, Pearson Education, New Delhi, Second Edition, 2009.

Reference Books :

1 N.Senthil Kumar, M.Saravanan, S.Jeevananthan, Microprocessors and Microcontrollers, Oxford University Press, London, Third Edition, 2010.

2 Muhammad Ali Mazidi, Janice Gillipie Mazidi, Microprocessors and Microcontrollers, Pearson Education, New Delhi, Fourth Edition, 2013.

3 Sriram. V.Iyer & Pankaj Gupta, Embedded Real Time Systems Programming, Tata McGraw Hill Publishing Co Ltd., New Delhi, First Edition, 2003.

4 John H. Davies, MSP430 Microcontroller Basics, Newnes publishers, London, First Edition, 2008.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester:	**VII**	**Regulation:**	**R 2020**
Course Code:	**20EE771**	**Course Name:**	**Microcontroller Based System Design**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Illustrate the Instruction set, addressing modes and interfacing of 8096 microcontroller.*	3	2	3	1	-	-	-	-	-	-	-	-	-	-
CO2:	*Explain the Memory organizations, addressing modes and interfacing of PIC microcontroller.*	3	2	3	1	-	-	-	-	-	-	-	-	-	-
CO3:	*Interpret the concept of architecture in ARM processor.*	3	2	-	-	1	-	-	-	-	-	-	2	2	-
CO4:	*Describe the ARM Processor organization.*	3	2	-	-	1	-	-	-	-	-	-	2	-	-
CO5:	*Explain the Architecture of MSP Processor.*	3	2	-	-	2	-	-	-	-	-	-	2	-	-
	Average	**3**	**2**	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VIII

		L	T	P	C
20EE861	**SIMULATION OF POWER ELECTRONIC SYSTEMS** (Professional Elective – V)	3	0	0	3

Prerequisite(s): *Analog Electronics, Power Electronics, Power Electronics Laboratory*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Discuss the mathematical model of power electronic components.*	*Understand*
CO2:	*Explain about PSpice models of power electronics components.*	*Understand*
CO3:	*Discuss the function of MATLAB Simulink.*	*Understand*
CO4:	*Describe about the function of PSIM.*	*Understand*
CO5:	*Simulate the power electronic system using PSpice, MATLAB Simulink.*	*Understand*

UNIT – I INTRODUCTION TO SIMULATION [09]

Need for simulation – Challenges in simulation – Classification of simulation programs – Overview of PSpice, MATLAB Simulink – Static and dynamic model of power electronics switches.

UNIT – II PSPICE [09]

File formats – Description of circuit elements – Circuit description – Output variables – Dot commands – PSpice models of Diode, Thyristors, TRIAC, BJT, MOSFET and IGBT.

UNIT – III MATLAB SIMULINK [09]

MATLAB – Intro variables – Matrix representation and operation, Trigonometric functions, Logical relations, Exponential complex numbers – m-file – function – for loop – while – if else, Graphics: 2D plots. Simulink: Basic block-sources and Sinks model analysis– S-functions – converting S-functions to blocks.

UNIT – IV PSIM [09]

General information – Power circuit components – Control circuit – Other components – Analysis specification – Circuit schematic design – waveform processing – Error and warning messages.

UNIT – V SIMULATION USING PSPICE AND MATLAB SIMULINK [09]

Diode rectifiers-controlled rectifiers – AC voltage controllers – DC choppers – PWM inverters: Voltage source inverters, Current source inverters – Zero current switching and zero voltage switching inverters.

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

Text Books :

1 Rashid, M.H. SPICE for Power Electronics and Electric Power, CRC Press, United States, Third Edition, 2017.

2 Patil, M.B. Ramanarayanan, V. and Ranganathan, V.T. Simulation of Power Electronic Converters, Narosa Publishers, New Delhi, First Edition, Reprint 2013.

Reference Books :

1 Farzin Asadi, Simulation of Power Electronics Circuits with MATLAB/SIMULINK Design, Analyze, and Prototype Power Electronics, Apress Berkeley, California, First Edition, 2022.

2 Schuurman.D.C. and Ramshaw. R.S, PSpice Simulation of Power Electronics Circuits - An introductory guide, Springer, United State, First Edition, 1996.

3 Godoy Simoes.M, Felix A. Farret, Modeling Power Electronics and Interfacing Energy Conversion Systems, IEEE press, Wiley publications,United State, First Edition, 2016 .

4 Patil.M.B, Ramanarayanan.V, and Ranganathan.V.T, Simulation of Power Electronic Circuits, Alpha Science International Ltd, United Kingdom, First edition, 2009.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: **VIII** **Regulations:** **R 2020**
Course Code: **20EE861** **Course Name:** **Simulation of Power Electronic Systems**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Discuss the mathematical model of power electronic components.*	3	2	2	-	3	2	1	-	-	-	2	2	-	2
CO2:	*Explain about PSpice models of power electronics components.*	3	2	2	-	3	2	1	-	-	-	2	2	-	2
CO3:	*Discuss the function of MATLAB Simulink.*	3	2	2	-	3	2	1	-	-	-	2	2	-	2
CO4:	*Describe about the function of PSIM.*	3	2	2	-	3	2	1	-	-	-	2	2	-	2
CO5:	*Simulate the power electronic system using PSpice, MATLAB Simulink.*	3	2	2	-	3	2	1	-	-	-	2	2	-	2
	Average	**3**	**2**	**2**	**-**	**3**	**2**	**1**	**-**	**-**	**-**	**2**	**2**	-	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII

20EE862	MODULATION CONTROL FOR POWER CONVERTERS (Professional Elective – V)	L	T	P	C
		3	0	0	3

Prerequisite(s): *Analog Electronics, Power Electronics*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explore the fundamental concepts of pulse width modulation techniques.*	*Understand*
CO2:	*Enlighten the use of inverter topologies in applying PWM techniques for single phase VSI.*	*Understand*
CO3:	*Enlighten the use of inverter topologies in applying PWM techniques for three phase VSI.*	*Understand*
CO4:	*Discuss the space vector modulation strategies.*	*Understand*
CO5:	*Illustrate the strategies involved for harmonic elimination using PWM.*	*Understand*

UNIT – I FUNDAMENTALS OF PWM [09]

Fundamental concepts of PWM – Evaluation of PWM schemes – Double fourier integral Analysis of a Two-Level PWM waveform – Naturally sampled PWM – PWM analysis by duty cycle variation – Regular sampled PWM – Direct modulation.

UNIT – II MODULATION OF SINGLE PHASE VSI [09]

Topology of a single-phase inverter – Three-level modulation of a single-phase Inverter – Analytic calculation of harmonic losses – Sideband modulation – Switched pulse position – Switched pulse sequence.

UNIT – III MODULATION OF THREE PHASE VSI [09]

Topology of a three-phase VSI – Three-phase modulation with sinusoidal references – Third harmonic reference injection – Analytic calculation of harmonic losses – Discontinuous modulation strategies – Triplen carrier ratios and sub harmonics.

UNIT – IV SPACE VECTOR MODULATION STRATEGIES [09]

Space vector modulation – Phase leg references – Naturally sampled SVM – Analytical solution for SVM harmonic losses for SVM – Placement of the zero space vector – Discontinuous modulation – Phase leg references for discontinuous PWM – Analytical solutions for discontinuous PWM – Single-edge SVM.

UNIT – V PROGRAMMED MODULATION STRATEGIES AND MULTILEVEL CONVERTERS [09]

Optimized spaced vector PWM – Harmonic elimination PWM – Performance index for optimality – Optimum PWM – Minimum loss PWM – Multilevel converter alternatives – Harmonic elimination applied to multilevel inverters – Minimum harmonic distortion.

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

Text Books :

1 Grahame Holmes. D, Thomas A. Lipo, Pulse Width Modulation for Power Converters: Principles and Practice, IEEE Press Series on Power Engineering, Wiley, 2003.

2 Satish Kumar Peddapelli, Pulse Width Modulation: Analysis and Performance in Multilevel Inverters, De Gruyter Oldenbourg, Germany, 2016.

Reference Books :

1 Dong Jiang, Zewei Shen, Qiao Li, Jianan Chen, Zicheng Liu, Advanced Pulse-Width-Modulation: With Freedom to Optimize Power Electronics Converters, CPSS Power Electronics Series, Springer Verlag, Singapore, 2021.

2 Dorin O. Neacsu, Power-Switching Converters: Medium and High Power, Second Edition, CRC Press, United States, 2006.

3 Isaak Mayergoyz, Siddharth Tyagi, Pulse Width Modulation in Power Electronics, World Scientific, 2021.

4 Mohammed H. Rashid, Power Electronics: Circuits, Devices and Applications, Fourth Edition, Eastern Economy Edition, USA, 2004.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO–PO MAPPING

Semester:	**VIII**	**Regulation:**	**R 2020**
Course Code:	**20EE862**	**Course Name:**	**Modulation Control for Power Converters**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explore the fundamental concepts of pulse width modulation techniques.*	*3*	2	2	1	2	-	-	-	-	-	1	2	2	1
CO2:	*Enlighten the use of inverter topologies in applying PWM techniques for single phase VSI.*	3	3	2	1	2	-	-	-	-	-	1	2	2	1
CO3:	*Enlighten the use of inverter topologies in applying PWM techniques for three phase VSI.*	3	3	2	1	2	-	-	-	-	-	1	2	2	1
CO4:	*Discuss the space vector modulation strategies.*	3	3	2	1	2	-	-	-	-	-	1	2	2	1
CO5:	*Illustrate the strategies involved for harmonic elimination using PWM.*	3	3	2	1	2	-	-	-	-	-	1	2	2	1
	Average	**3**	**2**	**2**	**1**	**2**	-	-	-	-	-	**1**	**2**	**2**	**1**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII

		L	T	P	C
20EE863	**POWER QUALITY** (Professional Elective – V)	3	0	0	3

Prerequisite(s): *Power Electronics, Power Systems – I, Power Systems – II*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Distinguish between the various categories of power quality problems, root of the power quality problems in industry and their impacts.*	*understanding*
CO2:	*Explore the sources and effects of voltage sags, interruptions and solution techniques for power quality mitigation.*	*understanding*
CO3:	*Illustrate the concepts of transients and its controlling overvoltage techniques.*	*understanding*
CO4:	*Explain the concepts of harmonics and to know about devices for controlling harmonic distortion.*	*understanding*
CO5:	*Discuss the various methods and applications of expert systems in power quality monitoring.*	*understanding*

UNIT – I INTRODUCTION TO POWER QUALITY [09]

Definitions: Power quality, voltage quality – Need for power quality – Power quality issues: short duration voltage variations, long duration voltage variations, voltage imbalance, voltage fluctuations, waveform distortion, transients, power frequency variations – Computer Business Equipment Manufacturers Associations (CBEMA) curve – IEEE and IEC standards.

UNIT – II VOLTAGE SAGS AND INTERRUPTIONS [09]

Sources of voltage sags and interruptions – Estimating voltage sag performance – Motor starting sags – Estimating the voltage sag severity – Devices for mitigation of voltage disturbances: Active series compensator, Static VAR compensator, Uninterruptable Power Supply (UPS), Buck-Boost regulators, Static transfer and fast transfer switches.

UNIT – III TRANSIENT OVERVOLTAGES [09]

Sources of transient over voltages: Capacitor switching, lightning, Ferro resonance – Principle of overvoltage protection – Mitigation of overvoltage: surge arresters, isolation transformers, low pass filters and low impedance power conditioners – Lightning protection: Shielding, line arresters and cable protection – Computer analysis tools for transients: PSCAD and EMTP.

UNIT – IV WIRING, GROUNDING AND HARMONICS [09]

Introduction to wiring and grounding problems – Solutions to wiring and grounding problems. Definitions: Harmonics, Harmonics indices, Harmonic Distortion Factor (HDF), Total Harmonic Distortion (THD), Total Demand Distortion (TDD) – Voltage Vs Current distortion – Sources and effects of harmonic distortion – Harmonics Vs transients – Sources and effects of harmonic distortion – Mitigation and control techniques – Passive and active filters for harmonic reduction – Standards on harmonics.

UNIT – V POWER QUALITY MONITORING [09]

Introduction – Monitoring considerations – Brief introduction to power quality measurement equipments and power conditioning equipments – Assessment of power quality – Application of intelligent systems – Power quality monitoring standards.

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

Text Books:

1 Roger C.Dugan, Mark F.McGranaghan and H.Wayne Beaty, Electrical Power Systems Quality, McGraw-Hill, New York, Third Edition, 2012.
2 Math H.J.Bollen, Understanding Power Quality Problems: Voltage Sags and Interruptions, IEEE Press, New York, First Edition, 2000.

Reference Books:

1 Barry W.Kennedy, Power Quality Primer, McGraw–Hill, New York, First Edition, 2000.
2 Sankaran. C, Power Quality, CRC Press, New Delhi, First Edition, 2002.
3 Arrillaga.J, Watson.N.R and Chen.S, Power System Quality Assessment, John Wiley & Sons Ltd., England, First Edition, 2000.
4 Arindam Ghos and Gerard Ledwich, Power Quality Enhancement using Custom Power Devices, Springer (India) Pvt. Limited, Second Edition, 2009.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester:	**VIII**	**Regulation:**	**R 2020**
Course Code:	**20EE863**	**Course Name:**	**Power Quality**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Distinguish between the various categories of power quality problems, root of the power quality problems in industry and their impacts.*	3	2	-	-	1	2	2	1	-	-	-	1	3	-
CO2:	*Explore the sources and effects of voltage sags, interruptions and solution techniques for power quality mitigation.*	3	2	-	-	1	2	2	1	-	-	-	1	3	-
CO3:	*Illustrate the concepts of transients and its controlling overvoltage techniques.*	3	2	-	-	1	2	2	1	-	-	-	1	3	-
CO4:	*Explain the concepts of harmonics and to know about devices for controlling harmonic distortion.*	3	2	-	-	1	2	2	1	-	-	-	1	3	-
CO5:	*Discuss the various methods and applications of expert systems in power quality monitoring.*	3	2	-	-	1	2	2	1	-	-	-	1	3	-
	Average	**3**	**2**	**-**	**-**	**1**	**2**	**2**	**1**	**-**	**-**	**-**	**1**	**3**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII

		L	T	P	C
20EE864	**ROBOTICS ENGINEERING** (Professional Elective – V)	3	0	0	3

Prerequisite(s): *Measurement and Instrumentations*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the robot technology as their fundamental principles, laws and robot configurations.*	*Understand*
CO2:	*Illustrate the various drive systems, power sources and the concepts of sensors to control the robots.*	*Understand*
CO3:	*Outline the design configurations of manipulators, grippers and end effector mechanism in robots.*	*Understand*
CO4:	*Outline the robot kinematics, programming language and the concepts of path planning for robotics.*	*Understand*
CO5:	*Interpret the wide range of robotic application of manufacturing and non–manufacturing sector.*	*Understand*

UNIT – I INTRODUCTION TO ROBOTICS **[09]**

Definition – Robotics and automation, Origin of robotics, Historical development – Basic structure of Robots – Complete classification of Robots – Fundamentals about Robot technology – Asimov's laws of Robotics – Dynamic stabilization of Robotics – Basic Robot configurations and their relative merits and demerits.

UNIT – II POWER SOURCES AND SENSORS **[09]**

Types of drive systems – Hydraulic, pneumatic and electric drives block diagram approach – Determination of HP of motor and gearing ratio – Variable speed arrangements – Path determination – Micro machines in Robotics – Machine vision – Ranging, Laser, Acoustic, Magnetic, Fiber Optic, Tactile and Intelligent sensors definition and use.

UNIT – III MANIPULATORS AND GRIPPERS **[09]**

General description of Robot manipulator – Construction of manipulators – Manipulator motions – Manipulator dynamics and force control – Electronics and pneumatic manipulator control circuits – End effectors – Mechanism of gripping – Various types of grippers – Design considerations.

UNIT – IV KINEMATICS AND PATH PLANNING **[09]**

Robot kinematics – Kinematic equations, forward and inverse kinematics – Solution of inverse kinematics problem – Multiple solution Jacobian work envelope – Hill climbing techniques – Robot programming languages.

UNIT – V APPLICATIONS **[09]**

Selection of Robot – Robot applications in industry – Design a modern robot for manufacturing and Non-Manufacturing industry – Robot cell design – Future applications and challenges, Case study.

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

Text Books :

1 Mikell P.Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G.Odrey and Ashish Dutta, Industrial Robotics: Technology, Programming and Applications, Tata McGraw Hill, New Delhi, Second Edition, 2012.

2 Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, First Edition, 1999.

Reference Books :

1 Deb S.R., Robotics Technology and Felxible Automation, John Wiley, USA, Second Edition, 2017.

2 Klafter R.D., Chimielewski T.A., Negin M., Robotic Engineering – An Integrated Approach, Prentice Hall of India, New Delhi, First Edition, 2006.

3 Asfahl C.R., Robotics and Manufacturing Automation, John Wiley, USA, Second Edition, 1992.

4 Roland Siegwart, Illah R. Nourbakhsh, and Davide Scaramuzza, Introduction to Autonomous Mobile Robots, PHI, Second Edition, 2011.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: **VIII** **Regulation:** **R 2020**

Course Code: **20EE864** **Course Name:** **Robotics Engineering**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the robot technology as their fundamental principles, laws and robot configurations.*	3	2	-	-	3	3	2	3	3	-	-	2	-	2
CO2:	*Illustrate the various drive systems, power sources and the concepts of sensors to control the robots.*	3	2	-	-	3	3	2	3	3	-	-	2	-	2
CO3:	*Outline the design configurations of manipulators, grippers and end effector mechanism in robots.*	3	2	-	-	3	3	2	3	3	-	-	2	-	2
CO4:	*Outline the robot kinematics, programming language and the concepts of path planning for robotics.*	3	2	-	-	3	3	2	3	3	-	-	2	-	2
CO5:	*Interpret the wide range of robotic application of manufacturing and non–manufacturing sector.*	3	2	-	-	3	3	2	3	3	-	-	2	-	2
	Average	**3**	**2**	**-**	**-**	**3**	**3**	**2**	**3**	**3**	**-**	**-**	**2**	**-**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII

		L	T	P	C
20EE865	**DIGITAL IMAGE PROCESSING** (Professional Elective – V)	3	0	0	3

Prerequisite(s): *Signals and Systems*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the basic concepts of image signal, sampling and quantization.*	*Understand*
CO2:	*Discuss the image enhancement techniques.*	*Understand*
CO3:	*Illustrate the restoration concepts and filtering techniques.*	*Understand*
CO4:	*Explain the basics of segmentation, features extraction and recognition methods for color models.*	*Understand*
CO5:	*Demonstrate the image compression concepts.*	*Understand*

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

Introduction – Elements of digital image processing systems – Elements of visual perception – brightness, contrast, hue, saturation – Color image fundamental: Color models, Mach band effect, Image sampling, and Quantization – Dither.

UNIT – II IMAGE ENHANCEMENT **[09]**

Basic gray level transformations – Histogram equalization and specification – Spatial averaging – Smoothing and Sharpening filters – Median – Geometric mean – Harmonic mean – Contra harmonic mean filter – Homomorphic filtering – Color image enhancement.

UNIT – III IMAGE RESTORATION **[09]**

Image restoration – Degradation model – Noise models – Unconstrained and constrained restoration – Inverse filtering – Wiener filtering – Geometric transformations – Spatial transformations – Gray level interpolation – Application to medical images.

UNIT – IV IMAGE SEGMENTATION AND RECOGNITION **[09]**

Image segmentation – Line and edge detection – Edge linking and boundary detection – Region growing – Region splitting and merging – Image recognition – Patterns and pattern classes – Matching by minimum distance classifier – Matching by correlation.

UNIT – V IMAGE COMPRESSION **[09]**

Need for data compression – Redundancy – Huffman – Arithmetic coding – Run length encoding – Shift codes – Vector quantization – Transform coding: JPEG, MPEG and GIF standards.

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

Text Books:

1 Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson India Education Services Pvt. Ltd., India, Fourth Edition, 2019.
2 Anil K. Jain, Fundamentals of Digital Image Processing, Pearson India Education Services Pvt. Ltd., India, First Edition, 2015.

Reference Books :

1 S. Jayaraman, S. Esakkirajan, T.Veerakumar, Digital Image Processing, Tata McGraw Hill, Noida, India, Second Edition, 2020.
2 David Salomon, Data Compression-The Complete Reference, Springer Verlang, New York, Fourth Edition, 2007.
3 C. Rafael Gonzalez, E. Richard Woods, Steven Eddins, Digital Image Processing using MATLAB, Pearson India Education Services Pvt. Ltd., India, Third Edition, 2010.
4 https://archive.nptel.ac.in/courses/117/105/117105135/.

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CO-PO MAPPING

Semester: VIII **Regulations:** R 2020
Course Code: 20EE865 **Course Name:** Digital Image Processing

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the basic concepts of image signal, sampling and quantization.*	3	3	2	-	2	-	2	-	-	-	-	-	-	2
CO2:	*Discuss the image enhancement techniques.*	3	3	2	-	2	-	2	-	-	-	-	-	-	2
CO3:	*Illustrate the restoration concepts and filtering techniques.*	3	3	2	-	2	-	2	-	-	-	-	-	-	2
CO4:	*Explain the basics of segmentation, features extraction and recognition methods for color models.*	3	3	2	-	2	-	2	-	-	-	-	-	-	2
CO5:	*Demonstrate the image compression concepts.*	3	3	2	-	2	-	2	-	-	-	-	-	-	2
	Average	**3**	**3**	**2**	**-**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII

		L	T	P	C
20EE872	**ELECTRIC VEHICLE ARCHITECTURE** (Professional Elective - V)	3	0	0	3

Prerequisite(s): *Electric and Hybrid Vehicle*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the history and evolution of EVs, Hybrid and plug-in Hybrid EVs.*	*Understand*
CO2:	*Describe the various EV components.*	*Understand*
CO3:	*Describe the concepts related in the plug-in hybrid electric vehicles.*	*Understand*
CO4:	*Discuss the specifications for the various EVs developed.*	*Understand*
CO5:	*Describe the hybrid vehicle control strategy.*	*Understand*

UNIT – I VEHICLE MECHANICS **[09]**

Vehicle mechanics – Roadway fundamentals – Laws of motion – Vehicle kinetics – Dynamics of vehicle motion – propulsion power – Velocity and acceleration – Tire-Road mechanics – Propulsion system design.

UNIT – II VEHICLE ARCHITECTURE AND SIZING **[09]**

Electric vehicle history and evolution of electric vehicles – Series, Parallel and Series-parallel architecture – Micro and Mild architectures – mountain bike – Details and specifications: Motorcycle – Electric cars – Heavy duty EVs.

UNIT – III POWER COMPONENTS AND BRAKES **[09]**

Powertrain component sizing – Gears – Clutches – Differential, transmission and vehicle brakes – EV powertrain sizing – HEV powertrain sizing.

UNIT – IV HYBRID VEHICLE CONTROL STRATEGY **[09]**

Vehicle supervisory controller: Introduction, functions, block diagram – Mode selection strategy of hybrid vehicle – Modal control strategies.

UNIT – V PLUG-IN HYBRID ELECTRIC VEHICLE **[09]**

Introduction – History – Comparison with electrical and hybrid electric vehicle – Construction and working of PHEV – Block diagram and components – Charging mechanisms – Advantages of PHEVs.

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

Text Books :

1 Advanced Electric Drive Vehicles, Ali Emadi, CRC Press, First Edition, 2017.

2 Mehrdad Ehsani, YiminGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, Third Edition, 2018.

Reference Books :

1 Shashank Arora, Alireza Tashakori Abkenar, Shantha Gamini Jayasinghe, Kari Tammi, Heavy-duty Electric Vehicles from Concept to Reality, Elsevier Science, 2021.

2 Nil Patel, Akash Kumar Bhoi, Sanjeevikumar Padmanaban, Jens Bo Holm–Nielsen, Electric Vehicles Modern Technologies and Trends, Springer, 2020.

3 Seth Leitman, Bob Brant, Build Your Own Electric Vehicle, McGraw Hill, Third Edition, 2013.

4 The Electric Vehicle Conversion Handbook: How to Convert Cars, Trucks, Motorcycles, and Bicycles-Includes EV Components, Kits, and Project Vehicles Mark Warner, HP Books, 2011.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: **VIII** **Regulations:** **R 2020**

Course Code: **20EE872** **Course Name:** **Electric Vehicle Architecture**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Summarize the history and evolution of EVs, Hybrid and plug-in Hybrid EVs.*	3	2	2	2	-	2	3	-	-	-	-	2	-	2
CO2:	*Describe the various EV components.*	3	2	2	2	-	2	3	-	-	-	-	2	-	2
CO3:	*Describe the concepts related in the plug-in hybrid electric vehicles.*	3	2	2	2	-	2	3	-	-	-	-	2	-	2
CO4:	*Discuss the specifications for the various EVs developed.*	3	2	2	2	-	2	3	-	-	-	-	2	-	2
CO5:	*Describe the hybrid vehicle control strategy.*	3	2	2	2	-	2	3	-	-	-	-	2	-	2
	Average	**3**	**2**	**2**	**2**	**-**	**2**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII

		L	T	P	C
20EE873	**TESTING OF ELECTRIC VEHICLE** (Professional Elective - V)	3	0	0	3

Prerequisite(s): *Electrical Machines-I, Electrical Machines-II, Power Electronics*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the status and other details of standardization of EVs.*	*Understand*
CO2:	*Illustrate the testing protocols for EVs and HEV components.*	*Understand*
CO3:	*Discuss the safety cycle and need for functions safety for EVs.*	*Understand*
CO4:	*Illustrate the problems related with EMC for EV components.*	*Understand*
CO5:	*Describe the EMI in motor drive and DC–DC converter system.*	*Understand*

UNIT – I EV STANDARDIZATION [09]

Introduction – Current status of electric vehicles and standardization – Standardization bodies active in the field – Standardization activities in countries like Japan. The international electro technical commission – Standardization of vehicle components.

UNIT – II TESTING OF ELECTRIC MOTORS AND CONTROLLERS [09]

Test procedure: M-G set, electric motor, controller – Application of test procedure – Analysis of test items for the type test – Motor test and Controller test – Test procedure using eddy current type engine dynamometer – Test strategy –Test procedure using AC dynamometer – Discussion on test procedure.

UNIT – III FUNDAMENTALS OF FUNCTIONAL SAFETY AND EMC [09]

Functional safety life cycle – Fault tree analysis – Hazard and risk assessment – Software development – Process models – Development assessments – Configuration management – Reliability – Reliability block diagrams and redundancy – Functional safety: EMC, quality – Standards – Functional safety of autonomous vehicles.

UNIT – IV EMC IN ELECTRIC VEHICLES [09]

Introduction – EMC problems of EVs – EMC problems of motor drive – EMC problems of DC-DC converter system – EMC problems of wireless charging system – EMC problems of vehicle controller – EMC problems of battery management system – Vehicle EMC requirements.

UNIT – V EMI IN MOTOR DRIVE AND DC-DC CONVERTER SYSTEM [09]

Overview – EMI mechanism of motor drive system – Conducted emission test of motor drive system – IGBT EMI source – EMI coupling path – EMI modelling of motor drive system – EMI in DC-DC converter – EMI source: The conducted emission high-frequency, equivalent circuit of DC-DC converter system – EMI/EMC filters.

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

Text Books :

1 Ali Emadi, Handbook of Automotive Power Electronics and Motor Drives, Taylor & Francis, First Edition, 2005.

2 Li Zhai, Electromagnetic Compatibility of Electric Vehicle, Springer, First Edition, 2021.

Reference Books :

1 Kai Borgeest, EMC and Functional Safety of Automotive Electronics, IET, First Edition, 2018.

2 Druce Archam beault, colinbranch, Omar M.Ramachi, EMI / EMC Computational Modeling Handbook, Springer, Second Edition, 2012.

3 Mark Steffika, Automotive EMC, Springer, First Edition, 2013.

4 Gereon Meyer, Electric Vehicle Systems Architecture and Standardization Needs, Reports of the PPP European Green Vehicles Initiative, Springer, First Edition, 2015.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: **VIII** **Regulations :** **R 2020**
Course Code: **20EE873** **Course Name :** **Testing of Electric Vehicle**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Describe the status and other details of standardization of EVs.*	3	2	2	-	-	-	2	2	-	-	-	-	-	2
CO2:	*Illustrate the testing protocols for EVs and HEV components.*	3	2	2	-	-	-	2	2	-	-	-	-	-	2
CO3:	*Discuss the safety cycle and need for functions safety for EVs.*	3	2	2	-	-	-	2	2	-	-	-	-	-	2
CO4:	*Illustrate the problems related with EMC for EV components.*	3	2	2	-	-	-	2	2	-	-	-	-	-	2
CO5:	*Describe the EMI in motor drive and DC–DC converter system.*	3	2	2	-	-	-	2	2	-	-	-	-	-	2
Average		**3**	**2**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII

		L	T	P	C
20EE874	**GRID INTEGRATION OF ELECTRIC VEHICLES** (Professional Elective - V)	3	0	0	3

Prerequisite(s): *Electrical Machine – I, Electrical Machines – II, Power Electronics*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the concepts related to V2G.*	*Understand*
CO2:	*Discuss the grid connection of the three-phase inverter.*	*Understand*
CO3:	*Explain the technical, economics, business, regulatory, and political challenges related to V2G.*	*Understand*
CO4:	*Discuss the impact of EV,V2G and G2V on smart grid and renewable energy systems.*	*Understand*
CO5:	*Illustrate the concept of grid integration and management of EVs.*	*Understand*

UNIT – I INTRODUCTION OF VEHICLE TO GRID [09]

Vehicle to Grid (V2G) – History and development of V2G – Incorporating V2G to the EV, Auditing and metering, V2G in practice – Power markets and applications – Electricity markets and V2G suitability – Long-term storage – Renewable energy and other grid applications.

UNIT – II BENEFITS AND CHALLENGES OF V2G [09]

Benefits of V2G – Technical benefits: Storage superiority and grid efficiency – Economic benefits: EV owners and societal savings – Environmental and health benefits – Sustainability in electricity and transport – Other benefits.

UNIT – III CHALLENGES IN V2G [09]

Technical challenges: Battery degradation, charger efficiency, aggregation and communication, V2G in a digital society – the economic and business challenges to V2G – Evaluating V2G costs and revenues, EV costs and benefits, adding V2G costs and benefits, additional V2G costs – The evolving nature of V2G costs and benefits – Regulatory and political challenges to V2G – V2G and regulatory frameworks, market design challenges – Other V2G regulatory and legal challenges.

UNIT – IV EV, V2G AND G2V ON SMART GRID [09]

Introduction – Types of electric vehicles – Motor vehicle ownership and EV migration – Impact of estimated EVs on electrical network – Impact on drivers and the smart grid – standardization and plug-and-play – IEC61850 communication standard and IEC 61850-7-420 extension – Overview of G2V Technology.

UNIT – V GRID INTEGRATION AND MANAGEMENT OF EVs [09]

Introduction – Machine to Machine (M2M) in distributed energy management systems – M2M communication for EVs – M2M communication architecture – Electric vehicle data logging – Scalability of electric vehicles – M2M communication with scheduling.

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

Text Books :

1 Ali Emadi, Advanced Electric Drive Vehicles, CRC Press, First Edition, 2017.

2 Lance Noel, Gerardo Zarazua de Rubens, Johannes Kester, Benjamin K. Sovacool, Vehicle to Grid: A Sociotechnical Transition Beyond Electric Mobility, Energy, Climate and the Environment series, Springer, First Edition, 2019.

Reference Books :

1 Sumedha Rajakaruna, Farhad Shahnia, Arindam Ghosh, Plug-in Electric Vehicles in Smart Grids, Charging Strategies, Springer, First Edition, 2015.

2 Junwei Lu, Jahangir Hossain, Vehicle-to-Grid: Linking Electric Vehicles to the Smart Grid, IET, First Edition, 2015.

3 Nand Kishor, Jesus Fraile-Ardanuy, ICT for Electric Vehicle Integration with the Smart Grid, IET, First Edition, 2020.

4 Qiuwei Wu, Grid Integration of Electric Vehicles in Open Electricity Markets, Wiley, First Edition, 2013.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester: VIII **Regulations:** R 2020

Course Code: 20EE874 **Course Name:** Grid Integration of Electric Vehicles

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Describe the concepts related to V2G.*	3	3	-	-	2	-	2	1	-	2	-	2	2	2
CO2:	*Discuss the grid connection of the three-phase inverter.*	3	3	-	-	2	-	2	1	-	2	-	2	2	2
CO3:	*Explain the technical, economics, business, regulatory, and political challenges related to V2G.*	3	3	-	-	2	-	2	1	-	2	-	2	2	2
CO4:	*Discuss the impact of EV,V2G and G2V on smart grid and renewable energy systems.*	3	3	-	-	2	-	2	1	-	2	-	2	2	2
CO5:	*Illustrate the concept of grid integration and management of EVs.*	3	3	-	-	2	-	2	1	-	2	-	2	2	2
	Average	**3**	**3**	**-**	**-**	**2**	**-**	**2**	**1**	**-**	**2**	**-**	**2**	**2**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII

20EE875	INTELLIGENT CONTROL OF ELECTRIC VEHICLES (Professional Elective - V)	L	T	P	C
		3	0	0	3

Prerequisite(s): *Electrical Machines – I, Electrical Machines – II, Control systems*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Infer the concepts of EV configurations and various EV parameters for better understanding of EV technology.*	*Understand*
CO2:	*Outline the BLDC motor and its control techniques.*	*Understand*
CO3:	*Discuss the basics of* fuzzy logic control in electric vehicle.	*Understand*
CO4:	*Describe the basics of* ANN control in electric vehicle.	*Understand*
CO5:	*Illustrate the basics of VHDL control in electric vehicle.*	*Understand*

UNIT – I INTRODUCTION TO EV [09]

Introduction to EV and HEV – History of EV – Current major issues – Recent development trends – State-of-the Art EVs and HEVs – Comparison of EV Vs IC Engine. EV system – EV configuration: Fixed and variable gearing – Single and multiple motor drives – EV Parameters: Weight, size, force, energy and performance parameters.

UNIT – II SPEED CONTROL FOR ELECTRIC DRIVES [09]

Brushless DC Motor – Mathematical representation brushless DC motor – Closed loop model of BLDC motor drive – P-I controller and I-P controller – PID Controller – Inverter design – Identifying rotor position via hall effect sensors.

UNIT – III FUZZY LOGIC IN ELECTRIC VEHICLE [09]

Membership functions: features, fuzzification, methods of membership value assignments – Defuzzification: lambda cuts, methods – Fuzzy arithmetic and measures – Measures of fuzziness – Fuzzy integrals – Fuzzy rule base and approximate reasoning: fuzzy propositions, formation of rules, decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning –Fuzzy inference systems, overview of fuzzy expert system – Fuzzy decision making – Fuzzy based PID Controller in electric vehicle.

UNIT – IV ANN IN ELECTRIC VEHICLE [09]

Introduction to Artificial Neural Network – BLDC Motor speed controller with ANN-based PID controller.

UNIT – V VHDL IN ELECTRIC VEHICLE [09]

Introduction – FPGA Architecture – Advantages – Review of FPGA family processors – Spartan 3, Spartan 6 and Spartan 7 – VHDL: Basics, Fundamentals, Instruction set, data type, conditional statements – Programs: Arithmetic, sorting, PWM generation, Speed detection – Intelligent fuzzy sliding mode controller based on FPGA for the speed control of a BLDC motor.

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

Text Books :

1 A. Chitra, S. Himavathi, Jens Bo Holm-Nielsen, P. Sanjeevikumar, Artificial Intelligent Techniques for Electric and Hybrid Electric Vehicles, John Wiley & Sons, First Edition, 2020.

2 C.C Chan, K.T Chau, Modern Electric Vehicle Technology, Oxford University Press Inc., New York, 2001.

Reference Books :

1 Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.

2 James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, Second Edition, 2003.

3 Vladimir S. Bagotsky, Alexander M. Skundin, Yurij M. Volfkovich, Electrochemical power sources: batteries, fuel cells, and supercapacitors, John Wiley & Sons, Inc., Hoboken, New Jersey, First Edition, 2015.

4 Shashank Arora, Alireza Tashakori Abkenar, Shantha Gamini Jayasinghe, Kari Tammi, Heavy-duty Electric Vehicles from Concept to Reality, Elsevier Science, 2021.

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CO-PO MAPPING

Semester: **VIII** **Regulations:** **R 2020**

Course Code: **20EE875** **Course Name:** **Intelligent Control of Electric Vehicles**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Infer the concepts of EV configurations and various EV parameters for better understanding of the EV technology.*	3	2	2	–	1	2	3	–	–	–	–	2	–	1
CO2:	*Outline the BLDC motor and its control techniques.*	3	2	2	–	1	2	3	–	–	–	–	2	–	1
CO3:	*Discuss the basics of* fuzzy logic control in electric vehicle.	3	2	2	–	3	2	3	–	–	–	–	2	–	1
CO4:	*Describe the basics of* ANN control in electric vehicle.	3	2	2	–	3	2	3	–	–	–	–	2	–	1
CO5:	*Illustrate the basics of VHDL control in electric vehicle.*	3	2	2	–	3	2	3	–	–	–	–	2	–	1
Average		**3**	**3**	**2**	**–**	**2**	**2**	**2**	**–**	**–**	**–**	**–**	**2**	**–**	**1**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII

		L	T	P	C
20EE876	**EMBEDDED CONTROL FOR ELECTRIC DRIVES** (Professional Elective - V)	3	0	0	3

Prerequisite(s): *Electrical Machines–I, Electrical Machines –II, Embedded systems*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the concepts and optimization techniques of electric drives.*	*Understand*
CO2:	*Describe the embedded system for electrical drive applications.*	*Understand*
CO3:	*Acquire knowledge about fuzzy logic based and embedded system-based speed control of induction motor.*	*Understand*
CO4:	*Discuss about the embedded system based speed control of BLDC motor.*	*Understand*
CO5:	*Infer the concepts and embedded processor based speed control of SRM motor.*	*Understand*

UNIT – I INTRODUCTION TO ELECTRIC DRIVES [09]

Electric drives and its classification – Four-quadrant drive – Solid state controlled drives – Machine learning and optimization techniques for electrical drives.

UNIT – II EMBEDDED SYSTEM FOR MOTOR CONTROL [09]

Embedded Processors choice for motor control – Sensors and interface modules for electric drives – IoT for Electrical drives applications.

UNIT – III INDUCTION MOTOR CONTROL [09]

Speed control methods – PWM techniques – VSI fed three-phase induction motor – Fuzzy logic based speed control for three-phase induction motor – Embedded processor based three-phase induction motor speed control.

UNIT – IV BLDC MOTOR CONTROL [09]

Overview of BLDC Motor – Speed control methods – PWM techniques – Embedded processor based BDLC motor speed control.

UNIT – V SRM MOTOR CONTROL [09]

Overview of SRM Motor – Speed control methods – PWM techniques – Embedded processor based SRM motor speed control.

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

Text Books :

1 Krishnan R, Electric Motor Drives-Modeling, Analysis and Control, Prentice-Hall of India Pvt. Ltd., New Delhi, First Edition, 2010.

2 Steve Kilts, Advanced FPGA Design: Architecture, Implementation, and Optimization, Willey, United States, First Edition, 2007.

Reference Books :

1 Vedam Subramanyam, Electric Drives-Concepts and Applications, Tata McGraw-Hill Publishing Company Ltd., New Delhi, Second Edition, 2002.

2 Venkataratnam, K, Special Electrical Machines, Universities Press, India, First Edition, 2014.

3 Miller, T.J.E. Brushless Permanent Magnet and Reluctance Motor Drives, Clarendon Press, Oxford, First Edition, 1989.

4 Ron Sass and Anderew G.Schmidt, Embedded System Design with Platform FPGAs: Principles and Practices, Elsevier, First Edition, US, 2010.

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CO-PO MAPPING

Semester:	**VIII**	**Regulations:**	**R 2020**
Course Code:	**20EE876**	**Course Name:**	**Embedded Control for Electric Drives**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the concepts and optimization techniques of electric drives.*	3	2	2	-	-	2	2	-	-	-	-	2	-	2
CO2:	*Describe the embedded system for electrical drive applications.*	3	2	2	-	-	2	2	-	-	-	-	2	-	2
CO3:	*Acquire knowledge about fuzzy logic based and embedded system-based speed control of induction motor.*	3	2	2	-	-	2	2	-	-	-	-	2	-	2
CO4:	*Discuss about the embedded system based speed control of BLDC motor.*	3	2	2	-	-	2	2	-	-	-	-	2	-	2
CO5:	*Infer the concepts and embedded processor based speed control of SRM motor.*	3	2	2	-	-	2	2	-	-	-	-	2	-	2
	Average	**3**	**2**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII

		L	T	P	C
20EE866	**BATTERIES AND CHARGING MANAGEMENT SYSTEMS** (Professional Elective – VI)	3	0	0	3

Prerequisite(s): *Engineering Chemistry and Electric Circuit Analysis*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Discuss the various parameters of battery.*	*Understand*
CO2:	*Interpret the operational factors associated with battery systems.*	*Understand*
CO3:	*Describe the performance of different Li-ion batteries.*	*Understand*
CO4:	*Identify the requirements of the battery management system.*	*Understand*
CO5:	*Familiarize different kinds of traction batteries.*	*Understand*

UNIT – I INTRODUCTION TO BATTERIES [09]

Types of Batteries – Energy conversion in batteries – Battery components – Principle of operation – Electrode selection – Calculating battery cell voltage – Battery cell voltage and Nernst equation – Electrolyte for batteries – Gibbs free energy and battery voltage – Theoretical battery capacity – Practical energy of a battery – Specific energy and power – Battery testing.

UNIT – II OPERATIONAL FACTORS OF BATTERY SYSTEMS [09]

Performance parameters – Battery voltage – Secondary battery systems – Battery limiting factors – Battery current modes of discharge – Discharge current effect on voltage – Discharge current effect on capacity – The effect of temperature on battery performance – Self discharge – Calendar and cycle life – Internal resistance – safety.

UNIT – III ADVANCED BATTERIES [09]

Li-ion Batteries: different formats, chemistry, safe operating area, efficiency and aging – Characteristics: SOC, DOD, SOH – Balancing: Passive Balancing Vs Active Balancing – Other Batteries: NCM and NCA Batteries – NCR18650B specifications.

UNIT – IV BATTERY MANAGEMENT AND LIFE PREDICTION [09]

Introduction to battery management and battery life prediction – Monitoring and measuring – Battery management functions: Charge management, discharge management, safety management and smart battery system – Life prediction.

UNIT – V TRACTION BATTERIES [09]

Introduction to electric vehicles and hybrid electric vehicles – Battery technology for traction: Lead Acid, Nickel-Cadmium, Nickel metal hydride, Sodium nickel chloride battery.

Miscellaneous applications of batteries: Tracking systems, Toll collection, Oil drilling, Car accessories, Oceanography.

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

Text Books :

1 Davide Andrea, Battery Management Systems for Large Lithium-Ion Battery Packs, Artech House Publishers, London, First Edition, 2010.

2 Jiuchun Jiang and Caiping Zhang, Fundamentals and applications of Lithium-Ion batteries in Electric Drive Vehicles, John Wiley & Sons Singapore Pvt. Ltd, First Edition, 2015.

Reference Books :

1 Vladimir S. Bagotsky, Alexander M. Skundin, Yurij M. Volfkovich, Electrochemical power sources: batteries, fuel cells, and super capacitors, John Wiley & Sons, Inc., Hoboken, New Jersey, First Edition, 2015.

2 Slobodan Petrovic, Battery Technology Crash Course a Concise Introduction, Springer Nature Switzerland AG, First Edition, 2021.

3 M. Broussely, G. Pistoia, Industrial Applications of Batteries From Cars to Aerospace and Energy Storage, Elsevier Publishers, The Netherlands, First Edition, 2007.

4 Plett, Gregory L. Battery management systems, Volume I: Battery modeling. Artech House, Kindle Edition, 2015.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester:	**VIII**	**Regulations:**	**R 2020**
Course Code:	**20EE866**	**Course Name:**	**Batteries and Charging Management Systems**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Discuss the various parameters of battery.*	3	2	2	-	-	2	2	-	-	-	-	2	3	1
CO2:	*Interpret the operational factors associated with battery systems.*	3	2	2	-	-	2	2	-	-	-	-	2	3	1
CO3:	*Acquire knowledge of different Li-ion Batteries performance.*	3	2	2	-	-	2	2	1	-	-	-	2	3	1
CO4:	*Identify the requirements of the Battery Management System.*	3	2	2	-	-	2	2	1	-	-	-	2	3	1
CO5:	*Familiarize different kinds of traction batteries.*	3	2	2	-	-	2	2	1	-	-	-	2	3	1
	Average	**3**	**2**	**2**	**-**	**-**	**2**	**2**	**1**	**-**	**-**	**-**	**2**	**3**	**1**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII

		L	T	P	C
20EE867	**SUBSTATION ENGINEERING AND AUTOMATION** (Professional Elective – VI)	3	0	0	3

Prerequisite(s): *Power Systems – I, Power System Protection and Switchgear*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline the concepts behind substation engineering and design.*	*Understand*
CO2:	*Infer the knowledge about substation equipment.*	*Understand*
CO3:	*Illustrate protection system used in a substation.*	*Understand*
CO4:	*Understand about* communication involved in *substation.*	*Understand*
CO5:	*Discuss about substation automation.*	*Understand*

UNIT – I SUBSTATION DESIGN DEVELOPMENT **[09]**

Substation introduction and classifications – Different bus bar switching schemes for substation – Standards and practices, Factors influencing substation design – Altitude, Ambient Temperature, Earthquake and seismic zones, pollution and corrosion – Testing of Electrical Equipment, Concept and development of Single Line Diagram. Requirement of substation calculation.

UNIT – II SUBSTATION EQUIPMENT **[09]**

Selection and sizing of main substation equipment: Transformer, Isolator, Circuit Breaker, surge arrestor, Instrument transformers – Classification of equipment with a practical overview and the performance parameters.

UNIT – III PROTECTION IN SUBSTATION **[09]**

Over current and earth fault protection – Distribution feeder protection – Transformer – Unit/Main protection – Distance/differential protection for transmission line – Substation grounding system – Lightning stroke protection.

UNIT – IV SUBSTATION COMMUNICATIONS **[09]**

Supervisory control and data acquisition – SCADA functional requirements – SCADA communication requirement – Relay communication requirements – Components of a SCADA – SCADA communication protocols – OSI communications model – DNP 3.0 – IEC 60870-5 – IEC 61850 – Security for substation communications – Synchrophasors.

UNIT – V SUBSTATION AUTOMATION **[09]**

Physical challenges – Components of a substation automation system – Control functions – Communication networks inside the substation.

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

Text Books :

1 McDonald John D, Electric Power Substations Engineering, CRC Press, Third Edition, 2012.

2 Partap Singh Satnam, P.V. Gupta, Sub–station Design and Equipment, Dhanpat Rai Publications, First Edition, 2013.

Reference Books :

1 Sunil S. Rao, Switchgear Protection And Power System), Khanna Publications, Fourteenth Edition, 2019.

2 Rao S, Electrical substation and engineering & practice, Third Edition, Khanna Publishers, 2015.

3 Manual on Substation by Central Board of Irrigation and Power (CBIP) Publication No 342, 2006.

4 Evelio Padilla, Substation automation system Design and implementation, Wiley Publications, First Edition, 2015.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO–PO MAPPING

Semester:	**VIII**	**Regulations:**	**R 2020**
Course Code:	**20EE867**	**Course Name:**	**Substation Engineering and Automation**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Outline the concepts behind substation engineering and design.*	3	2	2	-	-	2	2	-	-	-	-	1	1	1
CO2:	*Infer the knowledge about substation equipment.*	3	2	2	-	-	2	2	-	-	-	-	1	1	1
CO3:	*Illustrate protection system used in a substation.*	3	2	2	-	-	2	2	-	-	-	-	1	1	1
CO4:	*Understand about* communication involved in *substation.*	3	2	2	-	-	2	2	-	-	-	-	1	1	1
CO5:	*Discuss about substation automation.*	3	2	2	-	-	2	2	-	-	-	-	1	1	1
	Average	**3**	**2**	**2**	-	-	**2**	**2**	-	-	-	-	**1**	**1**	**1**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII

20EE868	**ELECTRIC POWER UTILIZATION AND CONSERVATION** (Professional Elective – VI)	L	T	P	C
		3	0	0	3

Prerequisite(s): *Electrical Machines – I, Electrical Machines – II*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Illustrate the fundamentals of illumination systems, various types of lamps and design of lighting scheme.*	*Understand*
CO2:	*Describe the various types of heating and welding.*	*Understand*
CO3:	*Discuss the operation of electric traction systems.*	*Understand*
CO4:	*Elucidate the fundamentals of electrolytic process and illustrate the various types of batteries.*	*Understand*
CO5:	*Explain the electrical energy conservation and energy management.*	*Understand*

UNIT – I ILLUMINATION [09]

Nature of radiation – Definitions – Laws of illumination – Photometry – Lighting calculations – Design of lighting scheme for residential, industrial, commercial and street lighting – Types of lamps – Energy efficient lamps.

UNIT – II ELECTRIC HEATING AND WELDING [09]

Advantages of electric heating – Modes of heat transfer – Requirement of heating material – Design of heating element – Heating methods: Resistance heating, induction heating, dielectric heating – Introduction to electric welding – Types of electric welding – Welding transformer and its characteristics.

UNIT – III ELECTRIC TRACTION [09]

Introduction – Requirements of an ideal traction system – Supply systems – Mechanics of train movement – Tractive effort – Traction motors and control – Braking methods – Current collection systems – Recent trends in electric traction.

UNIT – IV ELECTROLYTIC PROCESS AND STORAGE OF ELECTRICITY [09]

Electrolysis – Faraday's law of electrolysis – Polarization factor – Electroplating – Method of charging and maintenance – Nickel–iron, Nickel–Cadmium and Lithium–Ion batteries – Components and materials – Capacity rating of batteries – Battery chargers.

UNIT – V ENERGY CONSERVATION [09]

Introduction – Motivation for energy conservation – Principles of energy conservation – Energy conservation planning – Energy conservation in industries – Energy conservation in household and commercial sectors – Energy conservation in electric vehicle – Energy conservation in HVAC – Energy conservation in agriculture.

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

Text Books :

1 G.C.Garg, Utilization of Electric Power and Electric Traction, Khanna Publishers, Delhi, First Edition, 2019.

2 J.B. Gupta, Utilization of Electric Power and Electric Traction, S.K. Kataria and Sons, New Delhi, Tenth Edition, 2012.

Reference Books :

1 E.Openshaw Taylor, Utilization of Electrical Energy in SI Units, Orient Longman Private Limited, Hyderabed, First Edition, 2003.

2 B.R.Gupta, Generation of Electrical Energy, Eurasia Publishing House Private Limited, New Delhi, Seventh Edition, 2017.

3 P.S.Dhogal, Basic Electrical Engineering, Tata Mc-Graw Hill Publishing Company Limited, New Delhi, Volume 1, Thrity Fifth Reprint, 2008.

4 G.D.Rai, Non–Conventional Energy Sources, Khanna Publishers, Delhi, First Edition, 2011.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Semester:	**VIII**	**Regulations:**	**R 2020**
Course Code:	**20EE868**	**Course Name:**	**Electric Power Utilization and Conservation**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Illustrate the fundamentals of illumination systems, various types of lamps and design of lighting scheme.*	3	2	-	-	1	3	3	2	-	-	-	2	2	2
CO2:	*Describe the various types of heating and welding.*	3	2	-	-	1	2	3	2	-	-	-	2	2	2
CO3:	*Discuss the operation of electric traction systems.*	3	2	-	-	1	2	3	2	-	-	-	2	2	2
CO4:	*Elucidate the fundamentals of electrolytic process and illustrate the various types of batteries.*	3	2	-	-	1	3	3	2	-	-	-	2	2	2
CO5:	*Explain the electrical energy conservation.*	3	2	-	-	1	2	3	3	-	-	-	2	2	2
	Average	**3**	**2**	**-**	**-**	**1**	**2**	**3**	**2**	**-**	**-**	**-**	**2**	**2**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII

		L	T	P	C
20EE869	**DIGITAL SIGNAL PROCESSOR AND ITS APPLICATIONS** (Professional Elective – VI)	3	0	0	3

Prerequisite(s): *Microprocessors and Microcontrollers, Signals and Systems*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the architectural features of DSP Processors.*	*Understand*
CO2:	*Demonstrate the organization of TMS320C54xx DSP processors*	*Understand*
CO3:	*Build solutions using TMS320C6x DSP Processor*	*Understand*
CO4:	*Describe the memory organization in DSP processor and interfacing of input and output devices.*	*Understand*
CO5:	*Interpret the real–time applications of DSP Processors.*	*Understand*

UNIT – I ARCHITECTURES FOR PROGRAMMABLE DSP PROCESSORS [09]

Introduction – Basic architectural features – DSP computational building blocks – Bus architecture and memory – Data addressing capabilities – Address generation unit – Programmability and program execution – Features for external interfacing.

UNIT – II TMS320C5X PROGRAMMABLE DSP PROCESSOR [09]

Architecture of TMS320C54xx DSP processors – Addressing modes – Assembly language Instructions – Memory space – Interrupts – Pipeline operation of TMS320C54xx DSP Processor: On-Chip peripherals, Block diagram of TMS320C54xx DSP starter kit.

UNIT – III TMS320C6X PROGRAMMABLE DSP PROCESSOR [09]

Commercial TI DSP processors – Architecture of TMS320C6x DSP Processor: Linear and Circular addressing modes, TMS320C6x Instruction Set – Assembler directives – Linear Assembly – Interrupts – Multichannel buffered serial ports – Block diagram of TMS320C67xx DSP Starter Kit.

UNIT – IV INTERFACING MEMORY AND I/O PERIPHERALS TO DSP PROCESSOR [09]

Memory space organization – External bus interfacing signals – Memory Interface – Parallel I/O interface – Programmed I/O – Direct memory access – Synchronous serial interface – CODEC interface circuit.

UNIT – V APPLICATIONS OF DSP PROCESSORS [09]

DSP Based Bio-telemetry receiver – Speech processing system – Echo cancellation – Spectrum analyzer – Image processing system.

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

Text Books :

1 Avtar Singh and Srinivasan, S. Digital Signal Processing–Implementations using DSP Microprocessors with Examples from TMS320C54xx, Cengage Learning India Private Limited, Delhi, 2012.

2 Venkataramani, B and Bhaskar, M. Digital Signal Processors Architectures, Programming and Applications, Tata McGraw Hill, New Delhi, Second Edition, 2011.

Reference Books :

1 Sen M. Kuo and Woon–Seng S. Gan, Digital Signal Processors, Architectures, Implementations, Applications, Pearson Education, New Delhi, First Edition, 2013.

2 Lapsleyand Jeff Bier, DSP Processor Fundamentals, Architectures & Features, Wiley India Pvt Ltd, Noida, First Edition, 2009.

3 Rulph Chassaing and Donald Reay, Digital Signal Processing and Applications with the TMS320C6713 and TMS320C6416 DSK, Second Edition, Wiley India (P) Ltd, New Delhi, 2008.

4 https://www.ti.com–TMS320C5416/6713 DSK user manual.

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CO-PO MAPPING

Semester: VIII | **Regulations:** R 2020

Course Code: 20EE869 | **Course Name:** Digital Signal Processor and its Applications

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the architectural features of DSP Processors.*	3	2	3	-	3	-	-	-	-	-	-	2	-	2
CO2:	*Demonstrate the organization of TMS320C54xx DSP processors*	3	2	3	-	3	-	-	-	-	-	-	2	-	2
CO3:	*Build solutions using TMS320C6x DSP Processor*	3	2	3	-	3	-	-	-	-	-	-	2	-	2
CO4:	*Describe the memory organization in DSP processor and interfacing of input and output devices.*	3	2	3	-	3	-	-	-	-	-	-	2	-	2
CO5:	*Interpret the real–time applications of DSP Processors.*	3	2	3	-	3	-	-	-	-	-	-	2	-	2
	Average	**3**	**2**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII

		L	T	P	C
20EE871	**COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS** (Professional Elective – VI)	3	0	0	3

Prerequisite(s): *Electrical Machines – I, Electrical machines – II*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the basic principles of design procedure.*	*Understand*
CO2:	*Develop the basic mathematical formulation techniques of CAD.*	*Understand*
CO3:	*Illustrate the concept of FEM for designing electrical apparatus.*	*Understand*
CO4:	*Implement any design functions using CAD.*	*Understand*
CO5:	*Formulate and solve the optimum design problems with computers.*	*Understand*

UNIT – I INTRODUCTION TO ELECTRICAL APPARATUS [09]

Conventional design procedures – Limitations – Need for field analysis based design – Review of basic principles of energy conversion – Development of Torque/Force.

UNIT – II BASIC CONCEPTS OF DESIGN [09]

Introduction – Specification – Output coefficient – Importance of specific loadings – Electrical Materials: Conducting materials, insulating materials and magnetic materials – Magnetic circuit calculations: General procedure for calculation of Amp-Turns, Heating and cooling, Modes of heat dissipation, Standard ratings of electrical machines – General design procedure – Steps to get optimal design.

UNIT – III PHILOSOPHY OF FEM [09]

Mathematical models – Differential/Integral equations – Finite Difference Method (FDM) – Finite Element Method (FEM) – Energy minimization – Vibrational method – 2D field problems – Discretization – Shape functions – Stiffness matrix – Solution techniques.

UNIT – IV CAD PACKAGES [09]

Elements of a CAD System – Pre-processing – Modeling – Meshing – Material properties – Boundary conditions – Setting up solution – Post processing.

UNIT – V DESIGN APPLICATIONS [09]

Voltage stress in insulators – Capacitance calculation – Design of solenoid actuator – Inductance and force calculation – Torque calculation in switched reluctance motor – Design of field coil – Performance calculation from designed data.

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

Text Books :

1 S.J Salon, Finite Element Analysis of Electrical Machines, Springer, Yes DEE publishers, Chennai, Third Edition, 2007.

2 V.K. Maurya, Ritu Raj Jallan, Shasya Shukla, Computer Aided Design of Electrical Machines, S.K. Kataria & Sons, New Delhi, Second Edition, 2021.

Reference Books :

1 K.M.Vishnu, Computer Aided Design of Electrical Machines, B.S. Publications, Hyderabad, Second Edition, 2015.

2 A.K.Sawhney A Course in Electrical Machine Design, Dhanpat Rai and sons, New Delhi, Fifth Edition, 2004.

3 J.N.Reddy, An Introduction to the Finite Element Method, McGrawHill International Editions, New York, Third Illustrated Edition, 2006.

4 Joao Pedro, A. Bastos and Nelson Sadowski, Electromagnetic Modeling by Finite Element Methods, Marcell Dekker Inc., New York, Fifth Edition, 2003.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO–PO MAPPING

Semester:	**VIII**	**Regulations:**	**R 2020**
Course Code:	**20EE871**	**Course Name:**	**Computer Aided Design of Electrical Apparatus**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Summarize the basic principles of design procedure*	3	2	1	1	3	-	-	-	-	-	-	1	2	2
CO2:	*Develop the basic mathematical formulation techniques of CAD.*	3	2	2	1	3	-	-	-	-	-	-	1	2	2
CO3:	*Illustrate the concept of FEM for designing electrical apparatus.*	3	2	2	1	3	-	-	-	-	-	-	1	2	2
CO4:	*Implement any design functions using CAD.*	3	2	2	1	3	-	-	-	-	-	-	1	2	2
CO5:	*Formulate and solve the optimum design problems with computers.*	3	2	2	1	3	-	-	-	-	-	-	1	2	2
	Average	**3**	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII

		L	T	P	C
20EE877	**SMART SYSTEM AUTOMATION** (Professional Elective - VI)	3	0	0	3

Prerequisite(s): *Embedded Systems, Industrial Automation and Control*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Understand the concepts of smart system design and its present developments.*	*Understanding*
CO2:	*Illustrate different embedded open-source and cost-effective techniques for developing solutions for real-time applications.*	*Understanding*
CO3:	*Acquire knowledge on different platforms and infrastructure for smart system design.*	*Understanding*
CO4:	*Infer about smart appliances and energy management concepts.*	*Understanding*
CO5:	*Improve Employability and entrepreneurship capacity due to knowledge upgradation on embedded system technologies.*	*Understanding*

UNIT – I INTRODUCTION [09]

Overview of a smart system – Hardware and software selection – Smart sensors and Actuators – Communication protocols used for smart systems.

UNIT – II HOME AUTOMATION [09]

Home automation – System architecture – Essential components – Design considerations: Control unit, sensing requirements, communication, data security.

UNIT – III SMART ENERGY MANAGEMENT [09]

Significance of smart energy management – Smart Meters: Significance, Architecture and Energy measurement technique – Security Considerations.

UNIT – IV SMART WEARABLE DEVICES [09]

Body area networks – Sensors – Communication protocol for wearable devices – Application of smart wearable in healthcare and activity monitoring.

UNIT – V EMBEDDED SYSTEMS AND ROBOTICS [09]

Fundamental concepts in Robotics – Robots and controllers components – Robotic switches – Embedded processor based pick and place robot – Mobile robot design – UAV.

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

Text Books :

1 Grimm, Christoph, Neumann, Peter, Mahlknech and Stefan, Embedded Systems for Smart Appliances and Energy Management, Springer, First Edition, 2013.

2 Kazem Sohraby, Daniel Minoli and Taieb Znati, Wireless Sensor Networks Technology, Protocols, and Applications, John Wiley & Sons, First Edition, 2010.

Reference Books :

1 Nilanjan Dey, Amartya Mukherjee, Embedded Systems and Robotics with Open-Source Tools, CRC press, First Edition, 2016.

2 Karim Yaghmour, Embedded Android, O'Reilly, 2013.

3 Robert Faludi, Wireless Sensor Networks, O’Reilly, 2011.

4 Craig, J. J. Introduction to Robotics Mechanics and Control, Pearson Education, 2004.

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CO--PO MAPPING

Semester: VIII **Regulations:** R 2020

Course Code: 20EE877 **Course Name:** Smart System Automation

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Understand the concepts of smart system design and its present developments.	3	1	2	-	3	-	-	-	-	-	-	2	-	2
CO2:	Illustrate different embedded open-source and cost-effective techniques for developing solutions for real-time applications.	3	1	2	-	3	-	-	-	-	-	-	2	-	2
CO3:	Acquire knowledge on different platforms and Infrastructure for Smart system design.	3	1	2	-	3	-	-	-	-	-	-	2	-	2
CO4:	Infer about smart appliances and energy management concepts.	3	1	2	-	3	-	-	-	-	-	-	2	-	2
CO5:	Improve Employability and entrepreneurship capacity due to knowledge upgradation on embedded system technologies.	3	1	2	-	3	-	-	-	-	-	-	2	-	2
	Average	**3**	**1**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII

20EE878	EMBEDDED SYSTEM FOR AUTOMOTIVE APPLICATIONS (Professional Elective - VI)	L	T	P	C
		3	0	0	3

Prerequisite(s): *Electric and Hybrid Vehicle*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Insight into the significance of the role of embedded systems for automotive applications.*	*Understand*
CO2:	*Illustrate the need, selection of sensors and actuators and interfacing with ECU.*	*Understand*
CO3:	*Develop the embedded concepts for vehicle management and control systems.*	*Understand*
CO4:	*Demonstrate the need of electrical vehicle and able to apply the embedded system technology for various aspects of EVs*	*Understand*
CO5:	*Improved employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design and its application in automotive systems.*	*Understand*

UNIT – I INTRODUCTION TO AUTOMOTIVE SYSTEMS [09]

Overview of Automotive systems – Fuel economy – Air-fuel ratio – Emission limits and vehicle performance – Electronic control unit – Open source ECU.

UNIT – II SENSORS AND ACTUATORS FOR AUTOMOTIVES [09]

Review of automotive sensors – Sensors interface to the ECU – Smart sensor and actuators for automotive applications.

UNIT – III VEHICLE MANAGEMENT SYSTEMS [09]

Energy management system – Adaptive cruise control – Anti-locking braking system – Safety and collision avoidance – Vehicle informative system.

UNIT – IV ONBOARD DIAGNOSTICS AND COMMUNICATION [09]

OBD – Vehicle communication protocols – Bluetooth – CAN – LIN – FLEXRAY and MOST.

UNIT – V RECENT TRENDS [09]

Navigation – Autonomous car – Role of IoT in automotive Systems.

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

Text Books :

1 William B. Ribbens, Understanding Automotive Electronics, Elsevier, Eighth Edition, 2017.
2 L.Vlacic, M.Parent, F.Harahima, Intelligent Vehicle Technologies, SAE International, 2001, First Edition, 2017.

Reference Books :

1 Automotive Electricals / Electronics System and Components, Tom Denton, Fifth Edition, 2017.
2 Automotive Hand Book, Robert Bosch, Bently Publishers, Tenth Edition, 2018.
3 Automotive Electricals Electronics System and Components, Robert Bosch GMBH, Fifth Edition, 2014.
4 Jack Erjavec, Jeff Arias, Alternate Fuel Technology–Electric, Hybrid & Fuel Cell Vehicles, Cengage, Second Edition, 2012

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO–PO MAPPING

Semester: VIII **Regulations:** R 2020

Course Code: 20EE878 **Course Name:** Embedded System for Automotive Applications

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Insight into the significance of the role of embedded systems for automotive applications.*	3	2	3	-	3	3	2	-	-	2	-	3	-	-
CO2:	*Illustrate the need, selection of sensors and actuators and interfacing with ECU.*	3	2	3	-	3	3	2	-	-	2	-	3	-	-
CO3:	*Develop the embedded concepts for vehicle management and control systems.*	3	2	3	-	3	3	2	-	-	2	-	3	-	-
CO4:	*Demonstrate the need of electrical vehicle and able to apply the embedded system technology for various aspects of EVs*	3	2	3	-	3	3	2	-	-	2	-	3	-	-
CO5:	*Improved employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design and its application in automotive systems.*	3	2	3	-	3	3	2	-	-	2	-	3	-	-
	Average	**3**	**2**	**3**	-	**3**	**3**	**2**	-	-	**2**	**-**	**3**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII

		L	T	P	C
20EE879	**INDUSTRIAL IoT** (Professional Elective - VI)	3	0	0	3

Prerequisite(s): Embedded Systems

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the steps to getting started with Raspberry Pi.*	*Understand*
CO2:	*Generate programming code to do basic experiments in Raspberry Pi.*	*Understand*
CO3:	*Discuss the pin diagram of Raspberry Pi and its access through GUI.*	*Understand*
CO4:	*Explain the components of Arduino and discuss IDE.*	*Understand*
CO5:	*Develop various programs in Arduino IDE and communication through the serial monitor.*	*Understand*

UNIT – I GETTING STARTED WITH RASPBERRY PI [09]

Basic functionality of Raspberry Pi B+ board – setting up the board – configuration and use, implications of an operating system on the behavior of the Raspberry Pi as an IoT device, booting Raspberry Pi 3 – Downloading an Operating System – format an SD card and booting the OS. Basics of Linux and its use, main features including navigating the file system and managing processes, text based user interface through the shell.

UNIT – II INTERFACING AND BASICS OF PYTHON PROGRAMMING [09]

Interfacing Hardware with the Raspberry Pi – Raspberry Pi Remote Access, operate the Raspberry Pi in "headless mode", Bash Command line – operating Raspberry Pi without needing a GUI interface – Basics of the Python programming language – programming on the Raspberry Pi – Python on Raspberry Pi – Python Programming Environment, Python Expressions, Strings, Functions and Function arguments, Lists, List Methods, Control Flow.

UNIT – III RASPBERRY PI CONFIGURATION [09]

Communication with devices through the pins of the Raspberry Pi – RPi. GPIO library – Python Functions, setting up the pins – General purpose IO Pins – Protocol Pins – GPIO Access, applying digital voltages, and generating Pulse Width Modulated signals – Tkinter Python library – Accessing pins through a graphic user interface.

UNIT – IV THE ARDUINO ENVIRONMENT [09]

The Arduino Environment – Introduction to the Arduino environment – the Arduino board, the Arduino IDE, and the Arduino compatible shields together with their libraries – Arduino board main components, inputs, and outputs.Arduino Integrated Development Environment (IDE) – Compiling Code – Arduino Shields – Libraries.

UNIT – V ARDUINO IDE [09]

Basics of C programming – composition of Arduino programs – Arduino tool chain – Arduino IDE – basic structure of a sketch, including the use of the setup() and loop() functions. Accessing the pins from a sketch for input and output, introduction on debugging embedded software on an Arduino – UART communication protocol – Synchronization, parity and stop – the use of the Serial library to communicate with the Arduino through the serial monitor.

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

Text Books :

1 Simon Monk, Programming the Raspberry Pi: Getting Started with Python", McGraw Hill Professional, New Delhi, Second Edition, 2016.

2 Massimo Banzi, Getting Started with Arduino, O'Reilly Media Pearson Education, New Delhi, First Edition, 2009.

Reference Books :

1 Eben Upton and Gareth Halfacree, Raspberry Pi User Guide, John Wiley & Sons Packt Publishing limited, Fourth Edition, 2016.

2 Alex Bradbury and Ben Everard, Learning Python with Raspberry Pi, John Wiley & Sons, New Delhi, Second Edition, 2014.

3 Michael Margolis, Arduino Cookbook, O'Reilly Media, India, First Edition, 2011.

4 Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, Mahendra Swain, Internet of Things with Raspberry Pi and Arduino Hardcover, CRC press, First Edition, 2019.

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CO-PO MAPPING

Semester: VIII **Regulation:** R 2020

Course Code: 20EE879 **Course Name:** Industrial IoT

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the steps to getting started with Raspberry Pi.*	3	2	2	-	2	-	-	-	2	-	-	1	-	-
CO2:	*Generate programming code to do basic experiments in Raspberry Pi.*	3	2	2	-	2	-	-	-	2	-	-	1	-	-
CO3:	*Discuss the pin diagram of Raspberry Pi and its access through GUI.*	3	2	2	-	2	-	-	-	2	-	-	1	-	-
CO4:	*Explain the components of Arduino and discuss IDE.*	3	2	2	-	2	-	-	-	2	-	-	1	-	-
CO5:	*Develop various programs in Arduino IDE and communication through the serial monitor.*	3	2	2	-	2	-	-	-	2	-	-	1	-	-
	Average	**3**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**1**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII

		L	T	P	C
20EE881	**SENSOR CONCEPTS AND TECHNIQUES** (Professional Elective - VI)	3	0	0	3

Prerequisite(s): *Measurement and Instrumentations*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the classification and concepts of sensors and transducers.*	*Understand*
CO2:	*Illustrate the working operation of various thermal and magnetic sensors.*	*Understand*
CO3:	*Outline the basic characteristics and working of radiation and electro-analytical sensors.*	*Understand*
CO4:	*Describe the introduction and working of smart sensors and the automation.*	*Understand*
CO5:	*Interpret the wide range of actuators for various process control operations.*	*Understand*

UNIT – I SENSORS / TRANSDUCERS [09]

Principles – Classification – Parameters – Characteristics – Environmental Parameters – Characterization – Inductive Sensors: Sensitivity and linearity of the sensor – Types – Capacitive sensors – Electrostatic Transducer– Force/Stress Sensors using quartz resonators – Ultrasonic sensors.

UNIT – II THERMAL AND MAGNETIC SENSORS [09]

Introduction – Gas thermometric sensors – Thermal expansion type thermometric sensors – Acoustic temperature sensor – Dielectric constant and refractive index thermos sensors – Helium low temperature thermometer – Nuclear thermometer – Magnetic thermometer – Resistance change sensors and the principles behind – Magnet-resistive sensors – Anisotropic magneto resistive sensing – Semiconductor magneto resistors – Inductance and eddy current sensors – Angular/Rotary Movement transducers – Synchros – Synchro resolvers – Eddy current sensors – Electromagnetic flowmeter.

UNIT – III RADIATION AND ELECTRO ANALYTICAL SENSORS [09]

Introduction – Basic Characteristics – Types of Photo sensistors/Photo detectors – X-ray and nuclear radiation sensors – Fiber optic sensors, the electrochemical cell – The cell potential – Standard Hydrogen Electrode (SHE) – Liquid junction and other potentials – Polarization – Concentration polarization– Reference electrodes – Sensor electrodes – Electroceramics in gas media.

UNIT – IV SMART SENSORS [09]

Introduction – Primary sensors – Excitation – Amplification – Filters – Converters – Compensation – Information Coding/Processing – Data communication – Standards for smart sensor interface – The automation.

UNIT – V ACTUATORS [09]

Pneumatic and hydraulic actuation systems – Actuation systems – Pneumatic and hydraulic systems – Directional control valves – Pressure control valves – Cylinders – Servo and proportional control valves – Process control valves – Rotary actuators.

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

Text Books :

1 D. Patranabis D., Sensors and Transducers, PHI Learning Private Limited, Second Edition, 2003.
2 Bolton W., Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, Pearson Education; Fourth Edition, 2010.

Reference Books :

1 Patranabis D., Sensors and Actuators, PHI Learning Private Limited, Second Edition, 2013.
2 Clarence W. de Silva, Sensors and Actuators: Engineering System Instrumentation, CRC Press, Second Edition, 2015.
3 Jacob Fraden, Handbook of Modern Sensors: Physics, Designs, and Applications, Springer, Fifth Edition, 2016.
4 Jon S. Wilson, Sensor Technology Handbook, Elsevier, Netherland, First Edition, 2011.

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CO-PO MAPPING

Semester: VIII **Regulations:** R 2020

Course Code: 20EE881 **Course Name:** Sensor Concepts and Techniques

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explain the classification and concepts of sensors and transducers.*	3	-	-	-	1	2	3	-	-	-	2	2	2	3
CO2	*Illustrate the working operation of various thermal and magnetic sensors.*	3	-	-	-	1	2	3	-	-	-	2	2	2	3
CO3	*Outline the basic characteristics and working of radiation and electro-analytical sensors.*	3	-	-	-	1	2	3	-	-	-	2	2	2	3
CO4	*Describe the introduction and working of smart sensors and the automation.*	3	-	-	-	1	2	3	-	-	-	2	2	2	3
CO5	*Interpret the wide range of actuators for various process control operations.*	3	-	-	-	1	2	3	-	-	-	2	2	2	3
Average		**3**	**-**	-	-	**1**	**2**	**3**	-	-	-	**2**	**2**	**2**	**3**

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**			
20AU901	**BASICS OF AUTOMOBILE ENGINEERING**	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:	*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, Dhanpat Rai and sons, New Delhi, Second Edition, 2016.

4 Ramalingam K.K, Automobile Engineering, Scitech Publications (India) Pvt. Ltd, Chennai, Second Edition, 2011.

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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	*Provide basic platform knowledge of automobile engineering*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	*Explain the working principal of petrol and diesel engines*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	*Interpret the method of power transmission unit*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	*Built knowledge of steering and brake*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	*Illustrate the knowledge of automotive electrical systems and functioning*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**			
20AU902	**AUTOMOTIVE ENGINE 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:	*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.

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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	*Illustrate the fundamental concepts and functions of an automotive engine and working cycles*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	*Explain the combustion phenomena in SI engines.*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	*Identify the CI engines injection, ignition and combustion phenomena*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	*Outline the emission control techniques.*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	*Demonstrate the measurement techniques and emission standards.*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)			R 2020	
20AU903	AUTOMOTIVE VEHICLE 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 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	*Identify the construction and working of various types of automobile engines.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	*Evaluate the significance of clutch and transmission system.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	*Illustrate the types of axle, suspension and classification of steering system.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	*Discuss the various vehicle control systems.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	*Demonstrate the various new generation vehicles.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	-	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**			
20AU904	**AUTOMOTIVE SAFETY**	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:	*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 Ljubo Vlacic, 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 Hand Book, 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.

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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	*Explain the automotive safety and its importance.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO2	*Analyze the safety concepts.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3	*Illustrate the various safety equipment functions and importance*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4	*Identify the various crash test and impact test mechanics.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5	*Examine the function of warning and avoidance systems.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
Average		**3**	**3**	**3**	-	-	-	-	-	**-**	**-**	**-**	**3**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)			**R 2020**		
20AU905	**HYBRID VEHICLES**	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:	*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 Hod Kinson, 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.

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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	*Summarize the electric and hybrid vehicle operation and architectures.*	3	3	2	-	-	-	3	-	-	-	-	-	-	-
CO2	*Explain the different subsystems of hybrid and electric vehicle*	3	3	2	-	-	-	3	-	-	-	-	-	-	-
CO3	*Demonstrate the energy requirement for vehicles*	3	3	3	-	-	-	3	-	-	-	-	-	-	-
CO4	*Model and simulate the vehicle characteristics, operating modes, and performance parameters of the vehicles.*	3	3	2	-	-	-	3	-	-	-	-	-	-	-
CO5	*Design and develop the systems of hybrid and electric vehicles.*	3	2	2	-	-	-	3	-	-	-	-	-	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**			
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 scrappers, 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, scrappers, drag and self powered types, Bush cutters, stumpers, tree dozer, rippers etc. – Power and capacity of earth moving machines.

UNIT - III SCRAPPERS ,GRADERS, SHOVELS AND DITCHERS [09]

Scrappers, elevating graders, motor graders, self powered scrappers 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, guncarriers 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 HillPublishing 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	*Describe the construction and requirement of off road vehicles.*	3	3	2	-	-	-	3	3	-	-	-	-	-	-
CO2	*Explain the different types of earth moving machines and explain the different sub systems.*	3	3	2	-	-	-	3	-	-	-	-	-	-	-
CO3	*Describe the specifications, functions, merits and demerits of different types and subsystems of scrappers, graders and ditchers.*	3	3	3	-	-	-	3	3	-	-	-	-	-	-
CO4	*Discuss the construction and working principle of farm equipment, military and combat vehicles.*	3	3	2	-	-	-	3	3	-	-	-	-	-	-
CO5	*Explain the vehicle systems and features.*	3	2	2	-	-	-	3	-	-	-	-	-	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)		**R 2020**			
20AU907	**MODERN AND INTELLIGENT VEHICLE SYSTEM**	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 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 SYSYTEMS [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 Ljubo Vlacic, 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, Bently Publishers, Cambridge, Tenth Edition, 2018.

4 Robert Bosch, Bosch Automotive Electrics and Automotive Electronics, Springer Vieweg Wiesbaden, Switzerland, Fifth Edition, 2013.

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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	*Identify the various systems involved in driver support systems and their working principle.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO2	*Familiarize with global positioning systems, geographical information systems and navigation systems.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3	*Comprehend the constructional and working features of safety systems and security systems*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4	*Recognize about the various comfort systems.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5	*Explain the various adaptive control systems.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**3**	**-**	-	-	-	-	-	**-**	**-**	**3**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)			**R 2020**	
20AU908	**VEHICLE MAINTENANCE**	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:	*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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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	*Describe the importance, types and requirements of vehicle maintenance and related records and schedules.*	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO2	*Practice the engine overhauling, reconditioning; methods, procedures, tools of power plants, ignition system, cooling system and other engine components.*	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO3	*Demonstrate the maintenance procedures of clutch, gear box, propeller shaft and steering systems.*	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO4	*Demonstrate the construction, testing, fault diagnosis and maintenance of body panel and body tinkering.*	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO5	*Describe the maintenance procedures of electrical systems.*	3	3	2	-	-	-	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	R 2020			
20CE901	**ARCHITECTURAL HERITAGE OF INDIA**	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:	*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 – Muskin Bhanvi – 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 – Qutub Minar – Taj Mahal – 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

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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	*Illustrate various materials used and construction style of Indus Valley Civilization*	3	3	-	2	-	2	2	-	-	-	-	3	-	-
CO2	*Demonstrate the materials used and construction style of Chera, Chola and Pandya architecture*	3	3	-	2	-	2	2	-	-	-	-	3	-	-
CO3	*Describe the materials used and construction style of Mughal architecture*	3	3	-	1	-	2	2	-	-	-	-	3	-	-
CO4	*Explain the various materials and construction style of British* architecture	3	3	-	2	-	2	2	-	-	-	-	3	-	-
CO5	*Describe various materials and construction style of* Portuguese, Dutch, French and Danish	3	3	-	1	-	2	2	-	-	-	-	3	-	-
Average		**3**	**3**	**-**	**2**	**-**	**2**	**2**	**-**	**-**	**-**	-	**3**	-	-

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)			**R 2020**		
20CE902	**BUILDING PLANNING AND CONSTRUCTION**	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 ashlars 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

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CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE902** **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	*Outline the factors to be considered in planning and construction of buildings*	3	2	1	1	-	3	2	-	-	-	-	2	-	-
CO2	*Infer the different components and Foundations of building in their construction practices.*	3	2	-	2	-	2	3	-	-	-	-	2	-	-
CO3	*Interpret masonry and alternative materials of wood, aluminum and glass.*	2	-	-	2	-	3	2	-	-	-	-	2	-	-
CO4	*Discuss different types of floors, roofs and the materials which are commonly used for construction.*	3	2	-	2	-	3	2	-	-	-	-	2	-	-
CO5	*Explain about dampness and fire resistance in buildings*	3	2	-	2	-	3	3	-	-	-	-	2	-	-
	Average	**3**	**2**	**1**	**2**	**1**	**3**	**3**	**-**	-	-	**-**	**2**	-	-

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

Regulation: **R 2020**

Course Code: **20CE903** **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	*Provide an overview of civil engineering*	1	-	-	-	-	1	-	-	-	-	-	1	-	-
CO2	*Explain the basics of surveying and modern tools of surveying and mapping*	2	1	-	-	-	2	-	-	-	-	-	1	-	-
CO3	*Summarize the fundamentals of building materials in civil engineering*	2	1	-	-	-	2	2	-	-	-	-	1	-	-
CO4	*Explain the components of building structures.*	2	1	-	-	-	2	-	-	-	-	-	1	-	-
CO5	*Interpret various infrastructures of civil engineering in construction*	3	2	1	-	-	3	2	-	-	-	-	1	-	-
Average		**3**	**2**	**1**	**-**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	-

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CE904	**ENERGY AND ENVIRONMENT** (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 earth's energy, environment and the processes leading to climate change.*	*Understand*
CO2:	*Infer the atmospheric issues related to the chemistry, green house 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

Regulation: **R 2020**
Course Code: **20CE904** **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	*Outline The Earth's Energy, Environment and the processes leading to climate change.*	3	3	-	-	-	2	2	-	-	-	-	2	-	-
CO2	*Infer the Atmospheric issues related to the chemistry, Green House Gases*	3	3	-	-	-	2	2	-	-	-	-	2	-	-
CO3	*Summarize the role of the Terrestrial Energy-Environment-Climate System*	3	3	-	-	-	2	2	-	-	-	-	2	-	-
CO4	*Interpret the Possible effects of Global Warming and climate change.*	3	3	-	-	-	2	2	-	-	-	-	2	-	-
CO5	*Outline the Natural and Anthropogenic and Green House Gas theory*	3	3	-	-	-	2	2	-	-	-	-	2	-	-
	Average	**3**	**3**	**-**	-	**-**	**2**	**2**	**-**	-	-	**-**	**2**	**-**	-

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CE905	**ENVIRONMENTAL LAWS AND POLICIES** (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:	*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 Change1992, 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	*Summarize the basic concepts in Environmental laws and its judicial activism*	3	2	2	-	-	2	-	-	-	-	2	3	-	-
CO2	*Interpret different water acts and marine laws in India*	3	2	2	-	-	-	-	-	-	-	-	3	-	-
CO3	*Summarize Various Environment protection laws and acts in the framework of Mega projects*	3	2	3	-	-	2	-	-	-	-	2	3	-	-
CO4	*Explain the management and Handling of various hazardous waste management*	3	2	3	1	-	3	1	-	-	-	2	3	-	-
CO5	*Summarize the International Environmental laws framed at various conferences.*	3	2	3	2	-	3	-	-	-	-	2	3	-	-
	Average	**3**	**2**	**3**	**3**	**-**	**3**	**1**	**-**	**-**	**-**	**2**	**3**	-	-

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**			
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 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

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	*Outline the concept of the causes and effects of global warming*	3	2	2	-		3	2	-	-	-	-	2	-	-
CO2	*Summarize about physical and chemical characteristics of atmosphere*	3	2	-	-	-	3	3	-	-	-	2	2	-	-
CO3	*Interpret knowledge about the causes and effects of climate change*	3	-	-	2	-	3	2	-	-	-	2	3	-	-
CO4	*Infer the agreements took place among the countries regarding climate change*	3	2	-	2	-	3	2	-	2	-	-	2	-	-
CO5	*Summarize skills about the concept of mitigation measures against climate change*	3	2	-	-	-	3	3	-	3	-	2	3	-	-
	Average	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**-**	**3**	-	**2**	**3**	-	-

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

		L	T	P	C
	K.S.R. COLLEGE OF ENGINEERING (Autonomous)				**R 2020**
20CE907	**INTRODUTION TO DISASTER MANAGEMENT AND MITIGATION** (Open Elective)	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

Regulation: R 2020

Course Code: 20CE907 **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:	Explain the concepts of disaster and its effect in Indian scenario.	3	3	1	-	-	2	-	-	-	-	-	3	-	-
CO2:	Elaborate the difference between natural and manmade disasters.	3	3	1	-	-	3	-	-	-	-	-	3	-	-
CO3:	Outline the disaster management cycle and its operation	3	3		-	-	2	-	-	-	-	-	3	-	-
CO4:	Outline the disaster management in India and its profile	3	3	1	-	-	3	-	-	-	-	-	3	-	-
CO5:	Propose the application of geo-informatics for disaster management and mitigation.	3	3	3	-	2	3	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**1**	-	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	-

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**			
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
<u>CO-PO MAPPING</u>

		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	*Illustrate the causes and effects of earthquake.*	3	2	2	-	-	-	2	-	-	-	-	3	-	-
CO2	*Explain the basic concepts in seismology and correlate to earthquake engineering.*	3	2	2	-	-	-	2	-	-	-	-	3	-	-
CO3	*Summarize the theory of vibrations.*	3	2	3	-	-	-	2	-	-	-		3	-	-
CO4	*Outline the design process for earthquake resisting structures*	3	2	3	2	-	-	2	-	-	-		3	-	-
CO5	*Predict the performance of building and structures under the earthquake.*	3	2	3	2	-	-	2	-	-	-	-	3	-	-
	Average	**3**	**2**	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**		**3**	-	-

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**			
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 & 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.

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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	*Overview the concept of Solid waste and management.*	3	3	3	-	-	-	-	-	2	-	-	-	-	-
CO2	*Summarize about on-site storage and processing of solid waste.*	3	3	3	-	-	-	-	-	2	-	-	-	-	-
CO3	*Summarize about Collection and transportation of waste.*	3	3	3	-	-	-	-	-	2	-	-	-	-	-
CO4	*Summarize about off-Site Processing of solid waste.*	3	3	3	-	-	-	-	-	2	-	-	-	-	-
CO5	*Interpret about safe disposal of solid waste.*	3	3	3	-	-	-	-	-	2	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)			**R 2020**		
20CE910	**WATER AND AIR POLLUTION 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:	*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 bio filtration for control of gaseous air pollutants.

UNIT - IV AIR POLLUTION CONTROL TECHNOLOGIES [09]

Biological air pollution control technologies – Bioscrubbers, bio filters. 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

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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	*Explain water and air quality standards*	3	3	-	-	-	-	2	-	-	-	-	3	-	-
CO2	*Discuss water treatment and fundamentals of air pollution*	3	3	-	-	-	-	-	-	-	-	-	2	-	-
CO3	*Demonstrate the particulate of air pollution.*	3	2	-	-	-	-	2	-	-	-	-	3	-	-
CO4	*Classify air pollution control technologies*	3	3	-	-	-	-	2	-	-	-	-	3	-	-
CO5	*Describe air pollution control equipment.*	3	3	-	-	-	-	2	-	-	-	-	3	-	-
Average		**3**	**3**	**-**	-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	-	-

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CS901	**PROGRAMMING IN JAVA** (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 value Of 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

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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:	*Discover java programming fundamentals to solve real world problem.*	3	3	2	3	3	-	-	-	-	-	-	3	-	-
CO2:	*Implement the concept of class and constructor.*	3	3	2	3	2	-	-	-	-	-	-	3	-	-
CO3:	*Examine important features of java like inheritance and interfaces.*	3	3	1	3	2	-	-	-	-	-	-	2	-	-
CO4:	*Illustrate the features of package and exception handling.*	3	3	2	2	3	-	-	-	-	-	-	3	-	-
CO5:	*Apply the concepts of string manipulations.*	3	3	2	3	2	-	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)			**R 2020**	
20CS902	**BASIC CONCEPTS OF DATA STRUCTURE** (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:	*Elaborate the different linear data structure to solve simple problems.*	*Understand*
CO2:	*Build the various tree structures with its operations.*	*Understand*
CO3:	*Describe the concept of AVL tree, splay tree, B tree and B+ tree.*	*Understand*
CO4:	*Apply graph data structure to solve real time problems.*	*Apply*
CO5:	*Discover various sorting, hashing and searching techniques.*	*Apply*

UNIT– I ARRAY AND LINKED LIST [09]

Abstract Data Types (ADT) – List ADT – Array Based Implementation – Linked List Implementation – Singly Linked Lists – Doubly Linked Lists – Circularly Linked Lists – Applications of Lists: Polynomial Manipulation – Radix sort.

UNIT– II STACK AND QUEUE [09]

Stack ADT – Implementation of Stack using Array and Linked List – Applications of Stack : Evaluating arithmetic expressions – Conversion of Infix to postfix expression Recursion – Queue ADT – Implementation of Queue using Array and Linked List – Applications of Queues

UNIT – III TREE STRUCTURES [09]

Tree ADT – Binary Tree ADT – Binary Tree Traversal – Expression Trees – Applications of Trees – Binary Search Tree – AVL Trees – B Tree – B+ Tree.

UNIT – IV GRAPHS [09]

Introduction to Graphs and its Types – Breadth First Traversal – Depth First Traversal – Topological Sorting – Minimum Spanning Tree: Prim's and Kruskal's algorithms –- Shortest Path Algorithms: Dijkstra's Algorithm – Applications of Graphs.

UNIT – V SEARCHING,HASHING AND SORTING [09]

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

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

Text Books :

1 M. A. Weiss, Data Structures and Algorithm Analysis in C, Pearson Education, India, Second Edition, 2015.
2 Reema Thareja, Data Structures Using C, Oxford University Press, England, Second Edition, 2011

Reference Books :

1 R. F. Gilberg, B. A. Forouzan, Data Structures, Thomson, India, Second Edition, 2005.
2 A.K. Sharma, Data Structures using C, Pearson Education, India, First Edition, 2011.
3 Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Fundamentals of Data Structures in C++,University Press, United States, Second Edition, 2008
4 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: **20CS902** **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:	*Elaborate the different linear data structure to solve simple problems.*	3	2	3	-	2	-	-	-	-	-	-	2	-	-
CO2:	*Build the various tree structures with its operations.*	3	2	3	-	2	-	-	-	-	-	-	2	-	-
CO3:	*Describe the concept of AVL tree, splay tree, B tree and B+ tree.*	3	3	2	-	2	-	-	-	-	-	-	2	-	-
CO4:	*Apply graph data structure to solve real time problems.*	3	2	2	-	2	-	-	-	-	-	-	2	-	-
CO5:	*Discover various sorting, hashing and searching techniques.*	3	2	2	-	2	-	-	-	-	-	-	2	-	-
	Average	**3**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**			
20CS903	**FUNDAMENTALS OF DATABASE CONCEPTS** (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:	*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 [09]

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 [09]

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 Ramez Elmasri 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

Regulation: **R 2020**

Course Code: **20CS903** **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:	*Outline database architecture and the E-R Model for Database design.*	3	3	3	-	2	2	-	-	-	-	-	2	-	-
CO2:	*Apply Structured query language to create and manipulate a relational database.*	3	3	3	-	2	2	-	-	-	-	-	2	-	-
CO3:	*Build functions, triggers and recursive queries.*	3	3	3	-	2	2	-	-	-	-	-	2	-	-
CO4:	*Demonstrate the purpose of normalization.*	3	3	3	-	2	2	-	-	-	-	-	2	-	-
CO5:	*Discover about transaction and query processing concepts.*	3	3	3	-	2	2	-	-	-	-	-	2	-	-
Average		**3**	**3**	**3**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**			
20CS904	**INTERNET PROGRAMMING** (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 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

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CS904** **Course Name:** **Internet Programming**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Summarize the technologies around the internet.*	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO2:	*Construct the idea of web designing at user interface.*	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO3:	*Discuss the concept of data processing on client and server side.*	3	3	3	-	3	1	-	-	-	-	-	2	-	-
CO4:	*Construct the web oriented response at server side in PHP and XML format*	3	3	3	-	3	1	-	-	-	-	-	2	-	-
CO5:	*Illustrate the web service architecture and to enable rich client presentation using AJAX.*	3	2	3	-	3	2	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**3**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**
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, OReilly 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

Regulation: **R 2020**

Course Code: **20CS905** **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:	*Identify various concepts of mobile programming that make it unique from programming for other platforms.*	3	2	2	-	1	-	-	-	-	-	-	1	-	-
CO2:	*Critique mobile applications on their design pros and cons.*	3	2	3	-	2	-	-	-	-	-	-	2	-	-
CO3:	*Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.*	3	2	3	-	2	-	-	-	-	-	-	2	-	-
CO4:	*Program mobile applications for the Android operating system that use basic and advanced phone features.*	3	2	2	-	2	-	-	-	-	-	-	1	-	-
CO5:	*Deploy applications to the Android marketplace for distribution.*	3	2	3	-	2	-	-	-	-	-	-	2	-	-
	Average	**3**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CS906	**PRINCIPLES OF ETHICAL HACKING** (Open Elective)	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 [09]

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 [09]

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 [09]

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 [09]

Understanding Web Applications – Understanding Web Application Vulnerabilities – Tools for Web Attackers and Security Testers – Hacking Wireless Networks

UNIT - V PROTECTION SYSTEM [09]

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 Honeypots

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

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:	*Discuss the basics of hacking with its ethics*	3	3	3	-	3	3	-	3	-	-	-	2	-	-
CO2:	*Extend the possibilities and types of Attacks*	3	3	2	-	1	2	-	1	-	-	-	1	-	-
CO3:	*Summarize the testing process with programming Language.*	3	3	2	-	3	3	-	2	-	-	-	3	-	-
CO4:	*Infer about the impact of hacking wireless network*	3	3	2	-	3	2	-	1	-	-	-	2	-	-
CO5:	*Outline about the protection scheme.*	3	3	2	-	3	2	-	1	-	-	-	3	-	-
	Average	**3**	**3**	**2**	**-**	**3**	**2**	**-**	**1**	**-**	**-**	**-**	**2**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CS907	**GREEN TECHNOLOGY** (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

Regulation: **R 2020**

Course Code: **20CS907** **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	-	-
	Average	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**			
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 [09]

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 [09]

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 [09]

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 – Prepositional versus first order logic – Unification and lifting – Forward chaining – Backward chaining.

UNIT – IV PLANNING AND LEARNING [09]

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 [09]

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 Agents‖, Cambridge University Press, England, First Edition, 2010.

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

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CO-PO MAPPING

PING

Regulation: **R 2020**

Course Code: **20CS908** **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:	*Describe agents structure and predict uninformed search algorithms for any AI problem*	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO2:	*Illustrate appropriate AI methods to solve a given problem.*	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO3:	*Explain a problem using first order and predicate logic.*	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO4:	*Identify planning algorithms and illustrate about learning*	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO5:	*Infer about robotics concept.*	3	3	3	-	3	2	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**3**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CS909	**BIG DATA AND ANALYTICS** (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 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 [09]

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 [09]

Distributed File Systems – Large-Scale File System Organization – HDFS concepts – MapReduce Execution, Algorithms using MapReduce, Matrix-Vector Multiplication – Hadoop YARN.

UNIT – III DATA ANALYSIS [09]

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 [09]

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 [09]

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

Regulation: **R 2020**

Course Code: **20CS909** **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:	*Discover the insights of big data analytics*	3	3	2	-	3	2	-	-	-	-	-	1	-	-
CO2:	*Identify the file systems and to know the map reduce technique*	3	2	1	-	3	3	-	-	-	-	-	1	-	-
CO3:	*Summarize data by utilizing various statistical and data mining approaches*	3	3	2	-	3	2	-	-	-	-	-	1	-	-
CO4:	*Deploy and Perform analytics on real-time streaming data*	3	3	2	-	3	2	-	-	-	-	-	1	-	-
CO5:	*Comprehend the various NoSql alternative database models*	3	3	1	-	3	2	-	-	-	-	-	1	-	-
	Average	**3**	**3**	**2**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)			**R 2020**		
20CS910	**HARDWARE AND TROUBLE SHOOTING**	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 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 [09]

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 [09]

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 [09]

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 [09]

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 [09]

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.

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

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

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	-	-
Average		**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)			**R 2020**		
20EC901	**BASICS OF MEDICAL ELECTRONICS**	L	T	P	C
	(Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On the successful completion of the course, students will be able to		***Cognitive Level***
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 Jersy, Fourth Edition, 2009.

2 Joseph J.Carr and John M.Brown, Introduction to Biomedical Equipment Technology, John Wiley &Sons, New Jersy, 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:	*Describe the recording methods of various bio-potentials.*	2	1	2	-	-	1	-	-	-	-	-	1	-	-
CO2:	*Illustrate the working of various equipment that deal with bio-chemical and non-electrical parameter measurement.*	2	1	2	-	-	1	-	-	-	-	-	1	-	-
CO3:	*Discuss the different types of therapeutic equipment.*	2	1	2	-	-	1	-	-	-	-	-	1	-	-
CO4:	*Interpret the principles of various medical imaging modalities.*	2	1	2	-	-	1	-	-	-	-	-	1	-	-
CO5:	*Outline the recent trends in medical instrumentation.*	2	1	2	-	-	1	-	-	-	-	-	1	-	-
	Average	**2**	**1**	**2**		**-**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EC902	**NANO TECHNOLOGY**	L	T	P	C
	(Open Elective)	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, First Edition, 2007.

2 Mick Wilson, Kamali Kannargare., Geoff Smith, Nano technology: Basic Science and Emerging technologies, Overseas Press, New Delhi, First Edition, 2005.

Reference Books :

1 Nalwa H S, Encyclopedia of Nanoscience and Nanotechnology, Vol 1-10, American Scientific Publishers, California, First Edition 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

Regulation: **R 2020**

Course Code: 20EC902 **Course Name:** **Nano Technology**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Describe the evolution and associated techniques of Nano science.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2:	*Interpret the diversities in Nano systems.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3:	*Classify different Nano particles, shells and their Characterization.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4:	*Illustrate the importance of nanotechnology in biotechnology.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5:	*Outline the applications of nanotechnology in industry and society.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**			
20EC903	**ELECTRONICS AND MICROPROCESSOR**	L	T	P	C
	(Open Elective)	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

Regulation: **R 2020**

Course Code: 20EC903 **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:	*Interpret the fundamental concepts of semiconductor device.*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2:	*Explain the various characteristics of amplifiers.*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3:	*Outline the fundamental concepts of Digital Electronics*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4:	*Describe about 8085 microprocessors*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5:	*Explain the applications using microprocessor*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**			
20EC904	**ANALOG AND DIGITAL COMMUNICATION**	L	T	P	C
	(Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes: On the successful completion of the course, students will be able to		***Cognitive Level***
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 Jersy, 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:	*Describe analog communication techniques*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2:	*Describe Digital communication techniques*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3:	*Use data and pulse communication techniques*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4:	*Explain Source and Error control coding*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5:	*Utilize multi-user radio communication*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
Average		**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20EC905	**PRINCIPLES OF COMMUNICATION** (Open Elective)	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 Superheterodyne 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 :

1 Wayne Tomasi, Advanced Electronic Communication Systems, Pearson Education, London, Sixth Edition, 2009.

2 Simon Haykin, Communication Systems, John Wiley & Sons, New Jersy, Fourth Edition2004.

Reference Books :

1 H.Taub & D.L.Schilling, Principles of Communication Systems, TMH, New Delhi, First Edition, 2011.

2 H.Taub, D L Schilling and G Saha, Principles of Communication, Pearson Education, London, Fourth Edition, 2017.

3 B. P.Lathi, Modern Analog and Digital Communication Systems, Oxford University Press, Oxford, Third Edition 2007.

4 Blake, Electronic Communication Systems, Thomson Delmar Publications, USA, First Edition, 2002.

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
CO PO MAPPING

Regulation: **R 2020**

Course Code: 20EC905 **Course Name:** **Principles of Communication**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	*Determine the performance of analog modulation schemes in time and frequency domains.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
2	*Determine the performance of systems for generation and detection of modulated analog signals.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
3	*Characterize analog signals in time domain as random processes and in frequency domain using Fourier transforms*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
4	*Determine the performance of analog communication systems in the presence of Noise*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
5	*Interpret the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
Average		**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

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 Jersy, 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

Regulation: **R 2020**

Course Code: 20EC906 **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:	*Describe the basis of Robotics*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2:	*Describe the technologies applicable for Robotics in computer based vision*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3:	*Interpret the different sensing elements of robot*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4:	*Develop the algorithms applicable for robotics*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5:	*Develop 4-axis and 6-axis robot*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)			**R 2020**		
20EC907	**INTERNET OF THINGS SENSING AND ACTUATOR DEVICES**	L	T	P	C
	(Open Elective)	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 Jersy, 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:	*Describe what IoT is and how it works today.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2:	Design and program IoT devices.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3:	*Describe the functions and characteristics of IoT sensors.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4:	*Illustrate the wireless, energy, power, RF and sensing modules.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5:	*Describe the applications and technological challenges faced by IoT devices.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**			
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 Jersy, 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.

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
CO PO MAPPING

Regulation: **R 2020**

Course Code: 20EC908 **Course Name:** **Consumer Electronics**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Describe the evolution and fundamentals of consumer electronics*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	*Discuss various entertainment electronics appliances*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	*Demonstrate various smart home systems*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	*Outline various home appliances*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	*Illustrate various communication equipment's used In day to day life*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)				**R 2020**
20IT901	**DATA SCIENCE USING R**	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:	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 [09]

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 [09]

Data Manipulation – Data Import and Export – Manipulation Data – Vectoring Functions – Infix Operator – Replacement Functions – Function with arguments and return statement.

UNIT – III MACHINE LEARNING [09]

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 [09]

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 [09]

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 R Studio 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	-	-
	Average	**3**	**2**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20IT902	**PRINCIPLES OF CYBER SECURITY** (Open Elective)	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 **[09]**

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 **[09]**

Cyber Forensics: Definition – Disk Forensics – Network Forensics – Wireless Forensics – Database Forensics – Malware Forensics – Mobile Forensics – Email Forensics.

UNIT – III ETHICAL HACKING **[09]**

Ethical Hacking – Hacking Windows – Network Hacking – Web Hacking – Password Hacking – Malware – Scanning – Cracking.

UNIT – IV DIGITAL EVIDENCE IN CRIMINAL INVESTIGATIONS **[09]**

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 **[09]**

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 Dejey, 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. Rittinghouse, 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

4 https://www.simplilearn.com/tutorials/cyber-security-tutorial/cyber-security-for-beginners

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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:	*Describe the basic concepts in cyber security and cybercrime.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO2:	*Explore about classification of cyber forensics.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO3:	*Summarize the latest trends in ethical hacking.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO4:	*Discuss the fundamentals of computer forensics and evidence collection.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO5:	*Describe the vulnerabilities in cyber security.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
Average		**3**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)				**R 2020**
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

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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:	*Summarize the nuances of extracting information from the various sources of digital data*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO2:	*Infer the techniques involved in Online Transaction Processing and Online Analytical processing systems.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3:	*Discuss the concept of data integration.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO4:	*Summarize the various methods of data integration.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO5:	*Describe the various process involved in the Enterprise Reporting.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
Average		3	2	3	-	-	-	-	-	-	-	-	3	-	-

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)					**R 2020**
20IT904	**BLOCKCHAIN TECHNOLOGIES**	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:	*Infer the theoretical aspects of blockchain and apply in real casescenarios.*	*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 [09]

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 [09]

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 [09]

History of Money – Working with Bitcoins – Bitcoin Blockchain – The Bitcoin Network – Bitcoin Scripts – Full NodesvsSPVs – Bitcoin Wallets.

UNIT – IV ETHEREUM AND HYPERLEDGER [09]

Bitcoin to Ethereum – Ethereum Blockchain – Ethereum Smart Contracts – Ethereum Virtual Machine and Code Execution–Ethereum Ecosystem – Swarm – Whisper – DApp – Development components – Hyperledger: Iroha – Blockchain Explorer – Fabric Chain tool.

UNIT – V APPLICATIONS OF BLOCKCHAIN [09]

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, A Press, New York, First Edition, 2018.

2 Brenn Hill, Samanyu Chopra, Paul Valencourt, 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

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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:	*Infer the theoretical aspects of blockchain and apply in real case scenarios.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO2:	*Discuss the core components and working of blockchain.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3:	*Explain the technical concepts of bit coin.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO4:	*Interpret the Ethereum blockchain for different use cases.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO5:	*Outline the end-to-end development of a decentralized application.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
	Average	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**		**-**	**-**	**3**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20IT905	**INTERNET OF THINGS AND APPLICATIONS** (Open Elective)	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 Madisetti, 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, David Boswarthick, Omar Elloumi, The Internet of Things – Key Applications and Protocols, Wiley, New York, 2015.

4 https://onlinecourses.nptel.ac.in/noc22_cs53/preview

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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
CO1:	*Explain the physical and logical design of IoT.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO2:	*Summarize the various design methodologies of IoT.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3:	*Outline the various packages in Python for IoT real world application.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO4:	*Discuss IoT applications using Raspberry PI and Python.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO5:	*Infer the knowledge on design of smart IoT applications.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
	Average	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)				**R 2020**
20IT906	**PRINCIPLES OF SOFTWARE TESTING**	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 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 [09]

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 [09]

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 [09]

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 [09]

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 [09]

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, Gopalaswamy Ramesh, Software Testing: Principles and Practice, Pearson Education, India, Second Edition, 2017.

Reference Books :

1 Marnie L.Hutchson, Software Testing Fundamentals Methods and Metrics, Wiley, India, Second Edition, 2003.

2 Glenford J.Myess, The Art of Testing, Wiley, India, Third Edition, 2003.

3 https://onlinecourses.nptel.ac.in/noc22_cs12/preview

4 https://www.digimat.in/nptel/courses/video/106105150/L01.html

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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
CO1:	*Outline the strategies for software testing.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO2:	*Infer the need and conduct of testing levels.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3:	*Discuss the various techniques used in testing.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO4:	*Interpret the various types of testing used in real world application.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO5:	*Explain the test case templates and reviews process.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
	Average	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**		**-**	**-**	**3**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)				**R 2020**	
20IT907	**FOUNDATION SKILLS IN LOGIC BUILDING**	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:	*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 [09]

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 ALGORTHMIC PROBLEM SOLVING [09]

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 PROBLMES [09]

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 [09]

Searching: Linear Search – Binary Search. Sorting: Bubble Sort– Selection Sort– Insertion Sort – Merge Sort – Quicksort – Heap Sort.

UNIT – V NUMBER BASED PROBLEMS [09]

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

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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:	*Summarize the various approaches in problem solving.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO2:	*Discuss the different algorithm design techniques.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3:	*Demonstrate the various array based problem.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4:	*Summarize the concept of sorting and searching.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5:	*Outline the various methods to solve number based problem.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**
20IT908	**PRINCIPLES OF CLOUD COMPUTING** (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 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 [09]

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 [09]

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 [09]

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 IaaSand benefits – Cloud Service Providers – Challenges and risks in cloud adoption –Types of Cloud.

UNIT – IV CLOUD SIMULATORS [09]

CloudSim Simulator – Architecture – User code – CloudSim – GridSim – SimJava – Working platform for CloudSim – GreenCloud.

UNIT-V VMWARE SIMULATOR [09]

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

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:	*Explain the characteristics of cloud computing.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO2:	*Interpret the performance of cloud computing in various computing environment.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO3:	*Discuss the concept of cloud architecture.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO4:	*Infer the knowledge on cloud simulators.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO5:	*Outline the usage of simulators like VMWare simulator.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**
20IT909	**OPEN SOURCE TECHNOLOGIES** (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:	*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, TataMcGraw 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

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
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:	*Outline the need and importance of Linux Open Source Software.*	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO2:	*Discuss the manipulations on Array and String using PHP.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3:	*Summarize various functions in String and Date object*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4:	*Describe simple code segment using list and tuple in Python.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5:	*Outline the usage of decision and looping statements in PERL.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

R 2020

K.S.R. COLLEGE OF ENGINEERING (Autonomous)

		L	T	P	C
20IT910	**PRINCIPLES OF SOFTWARE ENGINEERING** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
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 [09]

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 [09]

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 [09]

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 [09]

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 [09]

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:	*Explain the software engineering process and its various models*	3	2	3	-		-	-	-		-	-	3	-	-
CO2:	*Summarize how requirements may be organized in software requirements document*	3	2	3	-		-	-	-		-	-	3	-	-
CO3:	*Illustrate the architectural design decisions and apply real time systems.*	3	2	3	-		-	-	-		-	-	3	-	-
CO4:	*Outline the methods rely on documented specifications and Design.*	3	2	3	-		-	-	-		-	-	3	-	-
CO5:	*Discuss the process involved in verification and validation.*	3	2	3	-		-	-	-		-	-	3	-	-
	Average	**3**	**2**	**3**	**-**		**-**	**-**	**-**		**-**	**-**	**3**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

		L	T	P	C
20ME901	**BASIC MECHANICAL ENGINEERING**	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

Regulation : R2020

Course Code : 20ME901 **Course Name : Basic Mechanical Engineering**

CO PO MAPPING

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	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

		L	T	P	C
20ME902	**SOLAR ENERGY UTILIZATION**	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

Regulation : R2020

Course Code : 20ME902 **Course Name : SOLAR ENERGY UTILIZATION**

CO PO MAPPING

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	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

		L	T	P	C
20ME903	**PRODUCTION TECHNOLOGY OF AGRICULTURAL MACHINERY**	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 Amold 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

Regulation : R2020

Course Code : 20ME903 **Course Name : Production Technology of Agricultural Machinery**

CO PO MAPPING

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	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

		L	T	P	C
20ME904	**SELECTION OF MATERIALS**	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,- non metallic 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.

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DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME904 **Course Name : SELECTION OF MATERIALS**

CO PO MAPPING

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	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

		L	T	P	C
20ME905	**MARINE VEHICLES**	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 :

1 Jonathan M. Ross, human factors for naval marine vehicle design and operation, CRC Press, US, Second Edition, 2001.
2 Sabiha A. Wadoo, Pushkin Kachroo, Autonomous underwater vehicles, modeling, control design and Simulation, CRC press, US, Second Edition, 2011.

Reference Books :

1 Ferial L hawry, The ocean engineering handbook, CRC press, US, First Edition, 2000.
2 Richard A Geyer, Submersibles and their use in oceanography and ocean engineering, Elsevier, New Delhi, First Edition, 1997.
3 Robert D. Christ, Robert L. Wernli, Sr., The ROV Manual A User Guide for Remotely Operated Vehicles, Elsevier, New Delhi, second edition, 2014.
4 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

Regulation : R2020

Course Code : 20ME905 **Course Name : MARINE VEHICLES**

CO PO MAPPING

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	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

		L	T	P	C
20ME906	**SENSORS AND TRANSDUCERS**	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 of 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 Puneet Sawney, A Course in Mechanical Measurements and Instrumentation and Control, Dhanpat Rai 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

Regulation : R2020

Course Code : 20ME906 **Course Name : Sensors and Transducer**

CO PO MAPPING

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	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

		L	T	P	C
20ME907	**ENERGY AUDITING**	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, a website administered by Bureau of energy efficiency (BEE), a statuary 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

Regulation : R2020

Course Code : 20ME907 **Course Name : ENERGY AUDITING**

CO PO MAPPING

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	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**2**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

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, New Delhi, 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

Regulation : R2020

Course Code: 20ME908 **Course Name : Fibre Reinforced Plastics**

CO PO MAPPING

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	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

		L	T	P	C
20ME909	**LEAN MANUFACTURING**	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, Murugesh.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

Regulation : R2020

Course Code : 20ME909 **Course Name : Lean Manufacturing**

CO-PO MAPPING

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	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

		L	T	P	C
20ME910	**SURFACE ENGINEERING**	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 Willey & Sona, New York, Second Edition,1995.

Reference Books :

1 Sudarshan T S, Surface modification technologies - An Engineer's guide, Marcel Dekker, New york, 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, Oxboarduniv. 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

Regulation : R2020

Course Code : 20ME910 **Course Name : Surface Engineering**

CO-PO MAPPING

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 behaviour of engineering materials*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SF901	**OCCUPATIONAL HEALTH AND HYGIENE (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	*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 Cohrssen, Patty´sIndustrial Hygiene and Toxicology, Wiley, Inderscience, New York. 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	*Compare the concept and spectrum of health functional units and activities of occupational health service.*	3	2	2	-	-	3	2	2	-	-	-	2	-	-
CO2	*Identify physical chemical and biological hazards in the work environment and its control measures.*	3	2	2	-	-	3	2	2	-	-	-	2	-	-
CO3	*Explain the principles of ventilation and its requirements.*	3	2	2	-	-	3	2	2	-	-	-	2	-	-
CO4	*Demonstrate about the lighting and its requirements.*	3	2	2	-	-	3	2	2	-	-	-	2	-	-
CO5	*Reduce the gas poisoning and its effects.*	3	2	2	-	-	3	2	2	-	-	-	2	-	-
	Average	**3**	**2**	**2**	**-**	**-**	**3**	**2**	**2**	**-**	**-**	**-**	**2**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SF902	**CONSTRUCTION SAFETY (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	*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:

1. National Building Code of India, Bureau of Indian Standards, New Delhi, 2005.
2. Building & Other Construction Workers (RE &CS) Actand Central Rules, 1966.

Reference Books:

1. V.J. Davies & K. Tomasin, Construction Safety Handbook, Thomas Telford Publishing, London. 1990.
2. K.N. Vaid (Ed.), Construction Safety Management, National Institute of Construction Management and Research, Bombay,1988.
3. James B. Full man, Construction Safety, Security & Loss Prevention, John Wiley & Sons. 1984.
4. 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	-	-
	Average	**3**	**2**	**3**	**-**	**2**	**-**	**3**	**-**	**1**	**-**	**-**	**2**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)			R 2020	
20SF903	**BUILDING FIRE SAFETY**	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	*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 fire fighting 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. Sitting 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 fire fighting 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:

1. Butcher, E.G. and Parnell, A.C., Designing of fire safety. John Wiley and Sons Ltd., New York, U.S.A, 1983.
2. Roytman, M. Ya., Principles of Fire Safety Standards for Building Construction, Amerind Publishing Co. Pvt. Ltd., New Delhi, 1975.

Reference Books:

1. Barendra Mohan Sen, Fire Protection and Prevention the Essential Handbook, UBS Publishers and Dist., New Delhi, 2013.
2. Jain, V.K., Fire Safety in Buildings, New Age International (P) Ltd., New Delhi, Second Edition, 2010.
3. Huang, Kai, Population and Building Factors That Impact Residential Fire Rates in Large U.S. Cities, Applied Research Project, Texas State University.
4. 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: R 2020

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	*Explain the human behaviour under emergency movement and the concept of planning and design of seating arrangements in assembly buildings, evacuation routes and exits.*	3	3	3	-	-	-	2	-	-	1	-	2	-	-
CO2	*Outline the general life safety requirements applicable to all buildings and to plan, design and locate exits in buildings.*	3	3	3	-	-	-	2	-	-	1	-	2	-	-
CO3	*Illustrate the fire and life safety requirements for buildings of specific occupancy.*	3	3	3	-	-	-	2	-	-	1	-	2	-	-
CO4	*Choose and distribute portable and fixed fire fighting systems in buildings of different occupancies as per BIS.*	3	3	3	-	-	-	2	-	-	1	-	2	-	-
CO5	*Develop the method of carrying out fire investigation, arson identification, fire training, fire safety audit and fire risk assessment.*	3	3	3	-	-	-	2	-	-	1	-	2	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**1**	**-**	**2**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)			**R 2020**	
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 INTRODUCTIONTO 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, Mc GrawHill, Fifteenth Edition, 2007.
3. Donald G Fink, Standard Handbook for Electrical Engineers, Mc GrawHill, Twelth Edition, 1987.
4. Donald G Fink, Electrical Engineering, Mc Graw Hill, Fifteenth Edition, 1907.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R 2020

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	*Explain the working principles and applications of various kinds of Electrical Machines and/or systems.*	3	1	2	-	-	2	1	-	-	-	-	-	-	-
CO2	*Choose & brief the hazards associated with electricity at work place.*	3	1	2	-	-	2	1	-	-	-	-	-	-	-
CO3	*Recall human safety aspects over electric and magnetic fields.*	3	1	2	-	-	2	1	-	-	-	-	-	-	-
CO4	*Compare various protective equipment and enumerate their working and application.*	3	1	2	-	-	2	1	-	-	-	-	-	-	-
CO5	*Identify hazardous areas/locations in a given industrial site for selection, installation, operation and maintenance of electrical equipment.*	3	1	2	-	-	2	1	-	-	-	-	-	-	-
	Average	**3**	**1**	**2**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**			
20SF905	**LEGAL ASPECTS OF SAFETY**	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	*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.*	*Understand*
CO5	*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.*	*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.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
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	*Describe about the factories act and rules.*	3	-	3	-	-	3	3	2	-	-	-	2	-	-
CO2	*Illustrate the legal obligations regarding any injury by gaining knowledge of Workmen's Compensation Act. ESI Act & Rules.*	3	-	3	-	-	3	3	2	-	-	-	2	-	-
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.*	3	-	3	-	-	3	3	2	-	-	-	2	-	-
CO4	*Explain the Environment (Protection) act and Rules.*	3	-	3	-	-	3	3	2	-	-	-	2	-	-
CO5	*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.*	3	-	3	-	-	3	3	2	-	-	-	2	-	-
	Average	**3**	**-**	**3**	**-**	**-**	**3**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)		**R 2020**		
20SF906	**SAFETY IN INDUSTRIES**	L	T	P	C
	(Open Elective)	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.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R 2020

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	*Explain the General safety rules, principles, maintenance, Inspections in Foundry Operations.*	2	3	-	-	-	3	3	2	-	-	-	2	-	-
CO2	*Apply the concepts of safety in design of building fire safety.*	2	3	-	-	-	3	3	2	-	-	-	2	-	-
CO3	*Develop the safety in industrial operations.*	2	3	-	-	-	3	3	2	-	-	-	2	-	-
CO4	*Recall about welding, common hazards in welding, personal protective equipment and safety precautions in welding.*	2	3	-	-	-	3	3	2	-	-	-	2	-	-
CO5	*Illustrate on safety in finishing, inspection and testing of machines.*	2	3	-	-	-	3	3	2	-	-	-	2	-	-
	Average	**2**	**3**	**-**	**-**	**-**	**3**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)			**R 2020**		
20SF907	**FOOD SAFETY**	L	T	P	C	
	(Open Elective)	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 Interscience, 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.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R 2020

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	*Apply the knowledge on food quality in food industry.*	3	3	3	-	-	3	3	3	-	-	-	3	-	-
CO2	*Identify the food additives and food contaminants and their chemical and toxicological properties.*	3	3	3	-	-	3	3	3	-	-	-	3	-	-
CO3	*Summarize the effects of pests on food and the various methods for controlling them.*	3	3	3	-	-	3	3	3	-	-	-	3	-	-
CO4	*Explain about the national and international regulations for biosafety.*	3	3	3	-	-	3	3	3	-	-	-	3	-	-
CO5	*Demonstrate an ability to recognize the environmental, social and ethical implications of biotech applications.*	3	3	3	-	-	3	3	3	-	-	-	3	-	-
Average		**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)			**R 2020**		
20SF908	**SAFETY MANAGEMENT AND ITS PRINCIPLES (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	*Demonstrate the knowledge and understanding of basic terms in safety management.*	*Understand*
CO2	*Compare safety organizational requirements for effective safety management.*	*Understand*
CO3	*Solve the workplace hazards and apply controls measures using hierarchy of control.*	*Apply*
CO4	*Develop the safety performance of an organization.*	*Apply*
CO5	*Explain accident investigation methodologies and apply systematic procedure to identify and unearth the root cause of the incident and accident.*	*Understand*

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.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
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	*Demonstrate the knowledge and understanding of basic terms in safety management.*	3	2	2	-	-	3	3	2	2	-	-	1	-	-
CO2	*Compare safety organizational requirements for effective safety management.*	3	2	2	-	-	3	3	2	2	-	-	1	-	-
CO3	*Solve the workplace hazards and apply controls measures using hierarchy of control.*	3	2	2	-	-	3	3	2	2	-	-	1	-	-
CO4	*Develop the safety performance of an organization.*	3	3	2	-	-	3	3	2	2	-	-	1	-	-
CO5	*Explain accident investigation methodologies and apply systematic procedure to identify and unearth the root cause of the incident and accident.*	3	3	2	-	-	3	3	2	2	-	-	1	-	-
Average		**3**	**2**	**2**	**-**	**-**	**3**	**3**	**2**	**2**	**-**	**-**	**1**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**			
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 UTILLIZATION [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 crumble 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: R 2020

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	Explain about automobile engines, fuel systems and CMV rules for proto type testing and emission standards.	3	3	2	-	-	3	3	3	-	-	-	2	-	-
CO2	Demonstrate the electrical systems - ignition, lighting, horn, wipers, HVAC and concerned CMV rules.	3	3	2	-	-	3	3	3	-	-	-	2	-	-
CO3	Classify the transmission systems - clutch, gearbox, steering, and differential. Chassis - springs, axles and brakes and corresponding CMV rules.	3	3	2	-	-	3	3	3	-	-	-	2	-	-
CO4	Outline the lubricating systems, cooling systems and miscellaneous systems. CMV rules for safety devices.	3	3	2	-	-	3	3	3	-	-	-	2	-	-
CO5	Choose passive and active safety.	3	3	2	-	-	3	3	3	-	-	-	2	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**			
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 TRAFFFIC 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, Ninth 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
CO1	*Explain the Working of railways and safety aspects in railway operation*	3	3	3	-	-	2	-	2	-	-	-	3	-	-
CO2	*Apply the Basic geometric design features of roads*	3	3	3	-	-	2	-	2	-	-	-	3	-	-
CO3	*Summarize about traffic studies and traffic safety*	3	3	3	-	-	2	-	2	-	-	-	3	-	-
CO4	*Outline the basic layout and facilities of docks and harbour*	3	3	3	-	-	2	-	2	-	-	-	3	-	-
CO5	*Choose the Working of airways and safety aspects in airway operation*	3	3	3	-	-	2	-	2	-	-	-	3	-	-
Average		**3**	**3**	**3**	**-**	**-**	**2**	**-**	**2**	**-**	**-**	**-**	**3**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)			**R 2020**		
20SH901	**APPLICATIONS 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 ANLYSIS [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 : Applications 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	-	-	-	-	-	-	-	-	-	-
	Average	**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	*Interpret the concept of combinatorics Principles in Computer applications.*	*Understand*
CO2	*Acquire knowledge in Recurrences and Generating Functions.*	*Evaluate*
CO3	*Applying the concepts of graph theory*	*Apply*
CO4	*Constructing algorithm using Trees..*	*Remember*
CO5	*Developing Skills in Colouring and Directed Graphs.*	*Analyze*

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 polyr 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	*Interpret the concept of combinatorics Principles in Computer applications.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2	*Acquire knowledge in Recurrences and Generating Functions.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	*Applying the concepts of graph theory*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	*Constructing algorithm using Trees.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	*Developing Skills in Colouring and Directed Graphs.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SH903	**OPTIMIZATION TECHNIQUES** (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	*Enable to develop the decision making during the uncertain situations by linear programming approach.*	*Apply*
CO2	*Identify to minimize the Transportation and Assignment cost and maximize the profit in Industries.*	*Analyze*
CO3	*Developing the network techniques in project scheduling.*	*Apply*
CO4	*Study the importance of stock controlling to maximize the profit.*	*Remember*
CO5	*Understand and apply the Replacement and sequencing methods in manufacturing engineering.*	*Understand*

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' machines.

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	*Enable to develop the decision making during the uncertain situations by linear programming approach.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2	*Identify to minimize the Transportation and Assignment cost and maximize the profit in industries*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	*Developing the network techniques in project scheduling.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	*Study the importance of stock controlling to maximize the profit.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	*Understand and apply the Replacement and sequencing methods in manufacturing engineering.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
Average		**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SH904	**BASIC MILITARY EDUCATION AND TRAINING** (Open Elective)	3	0	0	3

Prerequisite: *Only NCC Cadets are eligible for opting into the course*

Course Outcomes: On Completion of this course , the student will be able to		***Cognitive level***
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 - Various 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	-	-	-	-
Average		3	2	1	1	3	3	3	3	3	3	-	-	-	-

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)				**2020**
20SH905	**PROFESSIONAL COMMUNICATION (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	*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 GrawHill, New Delhi, 28th 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	-	-
Average		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**-**	**-**

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

			L	T	P	C
	K.S.R. COLLEGE OF ENGINEERING (Autonomous)					**R 2020**
20SH906	**FUNDAMENTALS OF NANOSCIENCE AND TECHNOLOGY** (Open Elective)		3	0	0	3

Prerequisite: NIL

Course Outcomes: On Completion of this course , the student will be able to		***Cognitive level***
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, TiO2,MgO, ZrO2, NiO, nano alumina, CaO, AgTiO2, 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: nanoprobes 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. Second 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	-	-
Average		**3**	**3**	**-**	**-**	**2**	**-**	**-**	**1**	**-**	**2**	**-**	**2**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)			**R 2020**	
20EE901	**ELECTRICAL DRIVES AND CONTROL**	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:	*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 McCraw 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:	*Categorize and explain the operation of electrical drives*	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO2:	*Explain the characteristics of various electrical drives*	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO3:	*Interpret the operation of starting and braking methods of AC and DC machines*	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO4:	*Choose the appropriate speed control techniques for DC motor drives*	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO5:	*Choose the appropriate speed control techniques for AC motor drives*	3	-	1	-	-	2	2	1	-	-	-	2	-	-
Average		**3**	**-**	**1**	**-**	**-**	**2**	**2**	**1**	**-**	**-**	**-**	**2**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)				**R 2020**
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.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**
Course Code: **20EE902** **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:	*Explain the power diode characteristics and applications for adjustable speed motor control*	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO2:	*Infer the static and dynamic characteristics of current controlled power semiconductor devices*	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO3:	*Realize the static and dynamic characteristics of voltage controlled power semiconductor devices*	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO4:	*Examine the gate drive requirements for power devices and isolation techniques between the gate and power circuits*	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO5:	*Discuss the electrical analog of thermal models and the methods for cooling power devices*	3	2	-	-	-	-	-	-	-	-	-	2	-	-
Average		**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	-	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**			
20EE903	**ELECTRICAL POWER GENERATION SYSTEMS**	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:	*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.

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

		Regulation:	**R 2020**
Course Code:	**20EE903**	**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:	*Describe the layout and function of various parts inside the thermal power plant.*	3	1	-	-	-	2	3	2	-	-	-	1	-	-
CO2:	*Outline the layout, construction, working of the components inside the hydro power plant.*	3	2	-	-	-	2	3	1	-	-	-	1	-	-
CO3:	*Explain the principle of operation, layout and types of nuclear reactor in a nuclear power plant.*	3	2	-	-	-	3	3	2	-	-	-	1	-	-
CO4:	*Discuss about the types, performance and layout of gas and diesel power plants.*	3	2	-	-	-	2	3	1	-	-	-	1	-	-
CO5:	*Infer the basic concepts of different non-conventional energy sources.*	3	1	-	-	-	3	3	2	-	-	-	1	-	-
	Average	**3**	**2**	**-**	**-**	**-**	**2**	**3**	**2**	**-**	**-**	**-**	**1**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)			R 2020	
20EE904	**CONTROL ENGINEERING** (Open Elective)	L	T	P	C
		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.

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

Regulation: **R 2020**
Course Code: **20EE904** **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	-	-
	Average	**3**	**3**	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EE905	INDUSTRIAL AUTOMATION (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 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 Ware House 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

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

Regulation: **R 2020**
Course Code: **20EE905** **Course Name:** **Industrial Automation**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the major components of Programmable Logic Controller and its applications.*	3	2	3	-	2	-	-	-	-	-	-	1	-	-
CO2:	*Summarize the logical functions, timers and counters of PLC*	3	2	3	-	2	-	-	-	-	-	-	1	-	-
CO3:	*Discuss the various instructions and modes of operation related to PLC.*	3	2	3	-	2	-	-	-	-	-	-	1	-	-
CO4:	*Realize the architecture and various interfacing techniques of Distributed Control Systems*	3	2	3	-	1	-	-	-	-	-	-	1	-	-
CO5:	*Examine the different applications of PLC and Distributed Control Systems (DCS)*	3	2	3	-	2	-	-	-	-	-	-	1	-	-
	Average	**3**	**2**	**3**	-	**2**	**–**	**-**	**-**	**-**	**-**	**-**	**1**	-	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**
20EE906	**ELECTRICAL INSTRUMENTS AND MEASUREMENTS** (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 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 [09]

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 [09]

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 [09]

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 [09]

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 [09]

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:	*Explain the construction and calibration of moving coil and Moving iron meters*	3	3	2	-	-	1	1	-	-	-	-	3	2	3
CO2:	*Discuss the operation and error correction method of wattmeter and Energy meter.*	3	3	2	-	-	1	1	-	-	-	-	3	2	3
CO3:	*Describe the various types of potentiometer and their limitations*	3	3	2	-	-	1	1	-	-	-	-	3	2	3
CO4:	*Determine the values of resistor, inductor, capacitor and frequency using bridges.*	3	3	2	-	-	1	1	-	-	-	-	3	2	3
CO5:	*Explain the concepts of storage and display devices.*	3	3	2	-	-	1	1	-	-	-	-	3	2	3
	Average	**3**	**3**	**2**	**-**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**3**	**2**	**3**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20EE907	**ENERGY CONSERVATION AND MANAGEMENT** (Open Elective)	3	0	0	3

Prerequisite:

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

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

Regulation: **R 2020**
Course Code: **20EE907** **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:	*Give the introduction about energy conservation principle and practices*	2	1	2	-	-	-	1	3	1	-	-	3	-	-
CO2:	*Describe the concept of energy efficiency in the building.*	2	2	2	-	-	-	1	3	1	-	-	3	-	-
CO3:	*Explain the concept of energy efficiency in the industry*	2	2	2	-	-	-	1	3	1	-	-	3	-	-
CO4:	*Illustrate the concept of energy efficiency in the power plant*	2	2	2	-	-	-	1	3	1	-	-	3	-	-
CO5:	*Describe the importance energy management and Demand Control Techniques*	2	2	2	-	-	-	1	3	-	-	-	3	-	-
	Average	**2**	**2**	**2**	**-**	**-**	**-**	**1**	**3**	**1**	**-**	**-**	**3**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**
20EE908	**ELECTRICAL WIRING, ESTIMATION AND COSTING** (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 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.

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

Regulation: **R 2020**

Course Code: **20EE908** **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	-	-	-	-	-	-	-	-	-
	Average	**3**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-	-

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	**R 2020**			
20EE909	**FUNDAMENTALS OF ELECTRICAL MACHINERY**	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:	*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

Regulation: **R 2020**

Course Code: **20EE909** **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:	*Discuss fundamentals in various electrical circuits.*	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2:	*Explain the operation and characteristics of DC machines.*	3	1	-	-	-	-	2	-	-	-	-	-	-	-
CO3:	*Determine the efficiency and regulation of the transformer.*	3	1	-	-	-	-	2	-	-	-	-	-	-	-
CO4:	*Explain the operation and starting methods of Induction Motors.*	3	1	-	-	-	-	2	-	-	-	-	-	-	-
CO5:	*Describe the applications of Synchronous Machines.*	3	1	-	-	-	-	2	-	-	-	-	-	-	-
	Average	**3**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)		**R 2020**		
20EE910	**PRINCIPLES OF SOFT COMPUTING TECHNIQUES**	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:	*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

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

Regulation: **R 2020**

Course Code: **20EE910** **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:	*Describe the concepts of artificial neural network*	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO2:	*Summarize the various types of neural network.*	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO3:	*Discuss the basic concepts of fuzzy logic system.*	3	2	-	-	3	-	-	-	-	-	-	1	-	-
CO4:	*Illustrate various methods used in fuzzy systems*	3	2	-	-	3	-	-	-	-	-	-	1	-	-
CO5:	*Outline the genetic algorithm and hybrid genetic algorithm concepts*	3	2	-	-	3	-	-	-	-	-	-	1	-	-
	Average	**3**	**2**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20EE911	**EMBEDDED SYSTEM TECHNOLOGY** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
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 I²C,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.

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

Regulation: **R 2020**

Course Code: **20EE911** **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:	*Illustrate the fundamentals of embedded systems*	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO2:	*Outline the various types of embedded communication protocols*	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO3:	*Explain the concept of software development process and tools.*	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO4:	*Describe the functions of real time operating systems.*	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO5:	*Discuss the applications of real time embedded systems*	3	2	3	-	3	3	-	-	-	-	-	3	-	-
	Average	**3**	**2**	**3**	**-**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

		L	T	P	C
20EEV01	**CONTROL OF MOTORS USING DRIVES**	0	0	3	1

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

CO1:	*Enhance knowledge on motor drive systems, control techniques, and practical applications.*	*Create*
CO2:	*Apply learned knowledge in real-world scenarios.*	*Create*

Contents

- Introduction to Motor Drives and Types
- Power Electronics for Motor Drives
- Power Wiring and Control Wiring Basics
- Parameter Settings in Motor Drives
- 2-Wire and 3-Wire Connection
- Jogging in Motor Control
- Practical Application and Hands-on Exercises
- Case Studies and Real-world Applications

Total = 15 Periods

CO-PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Enhance knowledge on motor drive systems, control techniques, and practical applications.*	3	3	3	3	3	-	-	2	-	-	-	2	3	3
CO2:	*Apply learned knowledge in real-world scenarios.*	3	3	3	3	3	-	-	2	-	-	-	2	3	3
	Average	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**3**	**3**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

		L	T	P	C
20EEV02	**CONTROL PANEL WIRING**	0	0	3	1

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Discuss the types, components, and wiring details of the panels.*	*Apply*
CO2:	*Construct the control panel wiring.*	*Create*

Contents

- Introduction to Control Panel Wiring
- Types of panels
- Components in panels
- Wiring details of panels
- Fundamental tools
- Relays & Relay logic circuit
- Earthing
- Piping and Instrumentation diagram
- Components selection and implementation of control panel wiring

Total = 15 Periods

CO-PO MAPPING

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1:	*Discuss the types, components, and wiring details of the panels.*	3	3	-	-	3	-	3	3	-	-	-	3	2	2
CO2:	*Construct the control panel wiring.*	3	3	-	-	3	-	3	3	-	-	-	3	2	2
	Average	**3**	**3**	**-**	**-**	**3**	**-**	**3**	**3**	**-**	**-**	**-**	**3**	**2**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

20EEV03	ELECTRICAL CADD	L	T	P	C
		0	0	3	1

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

CO1:	*Describe the symbol naming conventions, usage of symbol libraries and generate layout modules.*	*Understand*
CO2:	*Acquire the knowledge of drawings, wiring and to design the panel layout with PLC modules.*	*Apply*

Contents

- Introduction to Electrical CADD
- Overview of Symbol libraries
- Starting with Electrical CAD and basic drawing commands
- Different types of Wiring and connection diagram
- Panel layout and design
- Use with PLC modules
- 2D, 3D drawings and animations

Total = 15 Periods

CO-PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Describe the symbol naming conventions, usage of symbol libraries and generate layout modules.*	3	-	3	-	3	2	2	1	2	-	-	2	-	2
CO2:	*Acquire the knowledge of drawings, wiring and to design the panel layout with PLC modules.*	3	-	3	-	3	2	2	1	2	-	-	2	-	2
	Average	**3**	**-**	**3**	**-**	**3**	**2**	**1**	**1**	**2**	**-**	**-**	**2**	**-**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

		L	T	P	C
20EEV04	**MATLAB FOR ELECTRICAL ENGINEERS**	0	0	3	1

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify and use MATLAB math functions to create two and three-dimensional plots.*	*Create*
CO2:	*Develop the electrical and electronics system models using MATLAB Simulink.*	*Create*

Contents

- Introduction to MATLAB
- Creating Arrays
- Mathematical Operations with Arrays
- Using Script Files and Managing Data
- Two-Dimensional Plots
- Programming in MATLAB
- User-Defined Functions and Function Files
- Three-Dimensional Plots
- Model Developments in MATLAB
- Simulation of Electrical and Electronics Systems

Total = 15 Periods

CO-PO MAPPING

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1:	*Identify and use MATLAB math functions to create two and three-dimensional plots.*	3	3	3	3	3	-	-	-	2	-	-	2	3	3
CO2:	*Develop the electrical and electronics system models using MATLAB Simulink.*	3	3	3	3	3	-	-	-	2	-	-	2	3	3
	Average	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**3**	**3**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

		L	T	P	C
20EEV05	**PCB DESIGN & FABRICATION**	0	0	3	1

Prerequisite:

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify the various components required for PCB design and their electrical ratings.*	*Apply*
CO2:	*Develop the footprints and PCB for an electronic circuit.*	*Create*

Contents

- Introduction to Printed Circuit Board (PCB)
- Need of PCB
- Types of PCBs
- Component selection and Footprints
- Ground and power planes
- PCB manufacturing process
- Soldering and Techniques
- Assembly and Testing

Total = 15 Periods

CO-PO MAPPING

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1:	*Describe the various components required for PCB design and their electrical ratings.*	-	-	3	3	3	2	-	2	2	-	-	2	-	-
CO2:	Develop the footprints and PCB for an electronic circuit.	-	-	3	3	3	2	-	2	2	-	-	2	-	-
	Average	**-**	**-**	**3**	**3**	**3**	**2**	**-**	**2**	**2**	**-**	**-**	**2**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

		L	T	P	C
20EEV06	**ELECTRICAL SAFETY STANDARDS AND PRACTICES**	0	0	3	1

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Acquire the knowledge of the Indian Electricity (IE) rules, electrical safety in residential, commercial, agriculture, hazardous areas and use of fire extinguishers.*	*Understand*
CO2:	*Outline the best practices during installation, testing and commissioning of electrical apparatus.*	*Apply*

Contents

- Introduction to electrical safety, shocks and their prevention
- Indian Electricity (IE) rules
- Electrical safety in residential, commercial and agricultural installations
- Electrical safety in hazardous areas
- Types of fire extinguishers
- Electrical best practices during installation, testing and commissioning of electrical apparatus

Total = 15 Periods

CO-PO MAPPING

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1:	*Acquire the knowledge of the Indian Electricity (IE) rules, electrical safety in residential, commercial, agriculture, hazardous areas and use of fire extinguishers.*	3	2	2	-	3	2	2	2	2	-	-	3	3	3
CO2:	*Outline the best practices during installation, testing and commissioning of electrical apparatus.*	3	2	2	-	3	2	2	2	2	-	-	3	3	3
Average		**3**	**3**	**2**	**-**	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**3**	**3**	**3**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

		L	T	P	C
20EEV07	**SOLAR PV SYSTEMS: DESIGN AND SIMULATION**	0	0	3	1

Course Outcomes: On successful completion of the course, the student will be able to		**Cognitive Level**
CO1:	*Select the power rating and type of solar modules for various applications.*	*Understand*
CO2:	*Design the PV-powered converters, inverters, and Electric Vehicle.*	*Apply*

Contents

- Introduction to Solar PV system
- Fundamentals of MATLAB-Simulink
- Solar PV panels and Mounting Structure
- Types and Selection of Solar Modules
- Power converter design
- MPPT design with PO algorithm
- Inverter design
- Design of PV-powered electric vehicle
- Protection of PV system

Total = 15 Periods

CO-PO MAPPING

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1:	*Select the power rating and type of solar modules for various applications.*	3	3	-	-	3	-	3	3	-	-	-	3	2	2
CO2:	*Design the PV-powered converters, inverters, and Electric Vehicle.*	3	3	-	-	3	-	3	3	-	-	-	3	2	2
	Average	**3**	**3**	**-**	**-**	**3**	**-**	**3**	**3**	**-**	**-**	**-**	**3**	**2**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

		L	T	P	C
20EEV08	**INSTALLATION OF SECURITY SYSTEMS**	0	0	3	1

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify the components, power supply units, camera and other accessories.*	*Understand*
CO2:	*Demonstrate site survey, installation process, post installation checking, maintenance and servicing methodology.*	*Create*

Contents

- Introduction to CCTV
- Different types of lenses and sensors in a CCTV camera
- Use of various types of cables used in CCTV surveillance system, connectors of Co-axial, and Siamese cable
- Survey, planning, installation and maintence of CCTV
- Setup of surveillance system
- Function, features and use of various types of DVR in CCTV surveillance system

Total = 15 Periods

CO-PO MAPPING

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1:	*Identify the components, power supply units, camera and other accessories.*	3	-	3	-	3	2	1	3	2	-	-	3	-	-
CO2:	*Demonstrate site survey, installation process, post installation checking, maintenance and servicing methodology.*	3	-	3	-	3	2	1	3	2	-	-	3	-	-
	Average	**3**	**-**	**3**	**-**	**3**	**2**	**1**	**3**	**2**	**-**	**-**	**3**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

		L	T	P	C
20EEV09	**PLC PROGRAMMING**	0	0	3	1

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the functional blocks of PLC, fundamentals of Logic, PLC instructions and different PLC programming languages.*	*Apply*
CO2:	*Develop the PLC ladder logic program for real time applications.*	*Create*

Contents

- Introduction to PLC
- Functional Blocks of PLC and Input and Output Module of PLC
- Fundamentals of Logic
- PLC Instructions
- Different Programming Methods of PLC
- Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs
- Programming Timers with an appropriate application
- Programming Timers with an appropriate application
- Developing PLC Ladder logic program for real time applications

Total = 15 Periods

CO-PO MAPPING

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1:	*Describe the functional blocks of PLC, fundamentals of Logic, PLC instructions and different PLC programming languages.*	3	3	3	3	3	-	-	-	2	-	-	2	3	3
CO2:	*Develop the PLC ladder logic program for real time applications.*	3	3	3	3	3	-	-	-	2	-	-	2	3	3
	Average	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**3**	**3**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

		L	T	P	C
20EEV10	**ECONOMICS AND MANAGEMENT FOR ENGINEERS**	0	0	3	1

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the market structures and acquire the knowledge on basic financial management aspects.*	*Understand*
CO2:	*Inference the accounting systems and financial statements.*	*Understand*

Contents

- **Fundamentals of Economics:** Wealth, Welfare and Scarce Definitions of Economics; Micro and Macro Economics; Demand- Law of Demand, Elasticity of Demand
- **Forms of Business Organizations:** Features, merits and demerits of Sole Proprietorship, Partnership
- **Introduction to Management:** Functions of Management - Taylor's Scientific Management
- **Human Resource Management:** Basic functions of Human Resource Management
- **Production Management:** Production Planning and Control
- **Financial Management:** Types of Capital: Fixed and Working Capital and Methods
- **Marketing Management and Entrepreneurship:** Marketing Management: Functions of marketing, Entrepreneurship: Definition, Characteristics and Functions of an Entrepreneur

Total = 15 Periods

CO-PO MAPPING

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1:	*Describe the market structures and acquire the knowledge on basic financial management aspects.*	3	2	-	-	-	2	-	2	3	3	3	1	-	-
CO2:	*Inference the accounting systems and financial statements.*	3	2	-	-	-	2	-	2	3	3	3	1	-	-
	Average	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**2**	**3**	**3**	**3**	**1**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

		L	T	P	C
20EEV11	**INTELLECTUAL PROPERTY RIGHTS (IPR)**	0	0	3	1

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the awareness about IPRs, especially patents and copy rights.*	*Apply*
CO2:	*Establish the changing dimensions and commercialization of intellectual property.*	*Apply*

Contents:

- Introduction to Intellectual Property Rights (IPR)
- Economic, Scope and Analysis of Intellectual Property
- Infringement analysis and Enforcement of patents with Case Laws.
- Procedure for Filing a Patent (National and International)
- Trademark, copy rights and its Changing Dimensions in India
- Parallel Imports and Trademark Infringement: An Indian Outlook
- Piercing the Patent Paradigm
- Exclusions and Limitations of Patent Rights
- Changing Dimensions of Patent Laws in India
- IP Commercialization

Total = 15 Periods

CO-PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Describe the awareness about IPRs, especially patents and copy rights.*	-	-	2	-	3	3	3	3	-	3	-	3	2	2
CO2:	*Establish the changing dimensions and commercialization of intellectual property.*	-	-	2	-	3	3	3	3	-	3	-	3	2	2
Average		**-**	**-**	**2**	**-**	**3**	**3**	**3**	**3**	**-**	**3**	**-**	**3**	**2**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

		L	T	P	C
20EEV12	**DRONE TECHNOLOGIES**	0	0	3	1

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Demonstrate the types of Drones, components required and its applications.*	*Understand*
CO2:	*Design a drone for commercial and industrial applications.*	*Apply*

Contents

- Introduction to Drones
- Types of drones and their application
- Drone components and terminology
- Selecting and assembling drone components: motors, batteries, flight controllers, and cameras
- Basic wiring and soldering techniques
- Assembling Drone
- Overview of commercial and industrial drone applications

Total = 15 Periods

CO-PO MAPPING

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1:	*Demonstrate the types of Drones, components required and its applications.*	3	3	-	-	3	-	3	3	-	-	-	3	-	-
CO2:	*Design a drone for commercial and industrial applications.*	3	3	-	-	3	-	3	3	-	-	-	3	-	-
	Average	**3**	**3**	**-**	**-**	**3**	**-**	**3**	**3**	**-**	**-**	**-**	**3**	**-**	**-**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

		L	T	P	C
20EEV13	**PROGRAMMING WITH ARDUINO BOARDS**	0	0	3	1

Course Outcomes: On successful completion of the course, the student will be able to	***Cognitive Level***
CO1: Choose the components required for an IoT based applications.	*Understand*
CO2: Develop the Arduino based modules for different applications.	*Apply*

Contents:

- Smart water heater using Arduino
- IOT based intelligent gas leakage detector using Arduino
- Arduino ultrasonic sonar/radar monitor
- Sun tracking solar panel using Arduino
- Alcohol sensing display with alarm using Arduino
- GSM based weather reporting (temperature/light/humidity) using Arduino
- Smart charger monitoring system using Arduino
- Garage door automation using motors and sensors using Arduino
- Station name with distance indicator in railways using Arduino
- Railway track security system using Arduino
- Automatic road reflector light using Arduino
- Induction motor timer using auto delta star starter using Arduino

Total = 15 Periods

CO-PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Choose the components required for an IoT based applications.*	3	3	2	-	3	-	3	3	-	-	-	3	-	2
CO2:	*Develop the Arduino based modules for different applications.*	3	3	2	-	3	-	3	3	-	-	-	3	-	2
	Average	**3**	**3**	**2**	**-**	**3**	**-**	**3**	**3**	**-**	**-**	**-**	**3**	**-**	**2**

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

		L	T	P	C
20EEV14	**INSTALLATION MAINTENANCE & REPAIR OF ELECTRICAL EQUIPMENT'S**	0	0	3	1

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe key elements of electrical and electronics appliances.*	*Understand*
CO2:	*Construct domestic wiring and layout.*	*Create*

Contents

- Various types of earthing for electrical appliances/systems, Practice of earthing and Measurement of Earth resistance of Campus premises.
- Design, Estimation and costing of earthing pit and earthing connection for computer lab, Electrical Machines Lab, HT Substation.
- Troubleshooting of electrical equipment based on actual visit to repair workshop.
  - (i) Three phase induction motor (ii) Transformer (iii) Power Cable. (Any One)
- Measurement of Dielectric Absorption Ratio and Polarization Index of insulation.

Total = 15 Periods

CO-PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Understand key elements of electrical and electronics appliances.*	2	-	-	-	2	-	-	3	-	-	-	3	-	3
CO2:	*Understand domestic wiring and layout.*	2	-	-	-	2	-	-	3	-	-	-	3	-	3
	Average	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**-**	**-**	**-**	**3**	**-**	**3**

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