

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

B.E. SAFETY AND FIRE ENGINEERING

CURRICULUM & SYLLABI

Regulation 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

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	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	Department of Safety and Fire Engineering	
Programme	B.E.- Safety and Fire Engineering	

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

IM1	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.
IM2	To foster and maintain mutually beneficial partnership with global industries and Institutions through knowledge sharing, collaborative research and innovation.

Vision of the Safety and Fire Engineering

DV	To emerge as a centre of excellence in Safety and Fire Engineering using the framework of quality education through advanced industry, research, entrepreneurship and society.

Mission of the Safety and Fire Engineering

DM1	To provide quality education and to prepare nationally and internationally competitive students for a successful career in safety, occupational health, environmental management and fire protection engineering.
DM2	To inculcate the need for sustainable development in research and innovations.

Programme Educational Objectives (PEOs): (Safety and Fire Engineering)

The graduates of the programme will be able to

PEO 1: Have a sound knowledge in Safety and Fire Engineering aspects to provide solutions for Potential hazards.

PEO 2: Expertise in the area of Thermal, Chemical Reactions, Structural Stability and Environmental Impacts.

PEO 3: Practice their Profession through evaluation, communication, ethics and social responsibility.

Programme Outcomes (POs) of B.E. - Safety and Fire 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 safety, health & environment with the 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 to 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 safety and fire engineering to 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	Design a safety and fire system for industries, building and other area thereby saving the loss due to a fire and accidents.
PSO2	Analyze hazards in a work place and to rectify it by suitable safety and fire engineering solutions.

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Department		Department of Safety and Fire Engineering								
Programme		B.E. - Safety and Fire 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.	20ME144	Engineering Drawing (Common to AU, ME & SF)	ESC	1	2	0	3	30	70	100
MANDATORY COURSES										
5.	20MC052	Environmental Science and Engineering	MC	3	0	0	0	50	50	100
6.	20MC151	Induction Program	MC	-	-	-	-	-	-	-
PRACTICAL										
7.	20PH028	Physics Laboratory (Common to All Branches)	BSC	0	0	3	1	50	50	100
8.	20GE028	Manufacturing Practices Laboratory (Common to AU, CE, ME & SF)	ESC	0	0	3	1	50	50	100
Total				12	3	7	15	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.	20MA241	Engineering Mathematics - II (Common to AU, CE, ME& SF)	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.	20EE041	Basics of Electrical and Electronics Engineerin (Common To AU, CE, CS, IT, ME & SF)	ESC	3	0	0	3	30	70	100
5.	20CS241	Python Programming (Common To AU, CE, EC, EE, ME & SF)	ESC	3	0	0	3	30	70	100
6.	20AU231	Fundamentals of Engineering Mechanics (Common to AU & SF)	ESC	3	1	0	4	30	70	100
PRACTICAL										
7.	20CH028	Chemistry Laboratory (Common to All Branches)	BSC	0	0	3	1	50	50	100
8.	20CS227	Python Programming Laboratory (Common To AU, CE, EC, EE, ME & SF)	ESC	0	0	3	1	50	50	100
Total				17	2	7	22	800		

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Department		Department of Safety and Fire Engineering								
Programme		B.E. - Safety and Fire Engineering								
SEMESTER - III										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20SF311	Chemical Process Principles	PCC	3	0	0	3	30	70	100
2.	20SF312	Engineering Fluid Mechanics and Machinery	PCC	3	1	0	4	30	70	100
3.	20SF313	Principles of Safety Management	PCC	3	0	0	3	30	70	100
4.	20SF314	Manufacturing Technology	PCC	3	0	0	3	30	70	100
5.	20SF315	Safety in Engineering Industry	PCC	3	0	0	3	30	70	100
6.	20MA341	Statistics and Numerical Methods (Common To AU, ME & SF)	BSC	3	1	0	4	30	70	100
PRACTICAL										
7.	20SF321	Fluid Mechanics and Machinery Laboratory	PCC	0	0	3	1	50	50	100
8.	20SF322	Manufacturing Technology Laboratory	PCC	0	0	3	1	50	50	100
9.	20SF323	Safety Engineering Laboratory	PCC	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.	20SF411	Heat and Mass Transfer Operations	PCC	3	1	0	4	30	70	100
2.	20SF412	Fire Engineering Fundamentals	PCC	3	0	0	3	30	70	100
3.	20SF413	Strength of Materials	PCC	3	1	0	4	30	70	100
4.	20SF414	Electrical Technology and Safety	PCC	3	0	0	3	30	70	100
5.	20SF415	Occupational Health and First Aid	PCC	3	0	0	3	30	70	100
6.	20SF416	Safety in Construction	PCC	3	0	0	3	30	70	100
PRACTICAL										
7.	20SF421	Strength of Materials Laboratory	PCC	0	0	3	1	50	50	100
8.	20SF422	Electrical Technology Laboratory	PCC	0	0	3	1	50	50	100
9.	20SF423	Computer Aided Machine Drawing Laboratory	PCC	0	0	3	1	50	50	100
10.	20HR492	Career Development Skills - II	EEC	0	2	0	0	50	50	100
Total				18	4	9	23	1000		

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Department		Department of Safety and Fire Engineering								
Programme		B.E.-Safety and Fire Engineering								
SEMESTER - V										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P		C	CA	ES
THEORY										
1.	20HS051	Universal Human Values & Understanding Harmony (Common to All Branches)	HSMC	3	0	0	3	30	70	100
2.	20SF511	Chemical Technology and Reaction Engineering	PCC	3	0	0	3	30	70	100
3.	20SF512	Principles of Engineering Design	PCC	3	1	0	4	30	70	100
4.	20SF513	Planning and Design of Fire Protection Systems	PCC	3	1	0	4	30	70	100
5.	20SF514	Chemical Process Safety	PCC	3	0	0	3	30	70	100
6.		Open Elective - I	OEC	3	0	0	3	30	70	100
PRACTICAL										
7.	20SF521	Occupational Health and First Aid Laboratory	PCC	0	0	3	1	50	50	100
8.	20SF522	Fire Safety Training	PCC	0	0	3	1	50	50	100
9.	20HR593	Career Development Skills - III	EEC	0	2	0	0	50	50	100
Total				18	4	6	22	900		

SEMESTER - VI										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20SF611	Legal Aspects of Safety, Health & Environment	PCC	3	0	0	3	30	70	100
2.	20SF612	Process Instrumentation and Control	PCC	3	0	0	3	30	70	100
3.	20SF613	Structural Fire safety	PCC	3	0	0	3	30	70	100
4.		Professional Elective - I	PEC	3	0	0	3	30	70	100
5.		Open Elective - II	OEC	3	0	0	3	30	70	100
6.		Open Elective - III	OEC	3	0	0	3	30	70	100
PRACTICAL										
7.	20SF621	Environmental Engineering and Management Laboratory	PCC	0	0	3	1	50	50	100
8.	20SF622	Fire Engineering Laboratory	PCC	0	0	3	1	50	50	100
9.	20SF623	Industrial Training and Seminar	EEC	0	0	3	1	50	50	100
10.	20HR694	Career Development Skills - IV	EEC	0	2	0	0	50	50	100
Total				18	2	9	21	1000		

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Department		Department of Safety and Fire Engineering									
Programme		B.E. - Safety and Fire Engineering									
SEMESTER - VII											
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks			
				L	T	P	C	CA	ES	Total	
THEORY											
1.	20SF711	Safety in Rail and Road Transport	PC	3	0	0	3	30	70	100	
2.	20SF712	Principles of Industrial Management	HSMC	3	0	0	3	30	70	100	
3.	20SF713	Life Safety in Building Fire	PC	3	0	0	3	30	70	100	
4.		Professional Elective - II	PEC	3	0	0	3	30	70	100	
5.		Professional Elective - III	PEC	3	0	0	3	30	70	100	
6.		Open Elective - IV	OEC	3	0	0	3	30	70	100	
PRACTICAL											
7	20SF722	Project Phase - I	EEC	0	0	6	3	50	50	100	
Total				18	0	6	21	700			

SEMESTER - VIII										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20SF811	Human Factors Engineering	PCC	3	0	0	3	30	70	100
2.		Professional Elective - IV	PEC	3	0	0	3	30	70	100
3.		Professional Elective - V	PEC	3	0	0	3	30	70	100
PRACTICAL										
4.	20SF821	Project Phase - II	EEC	0	0	12	6	50	50	100
Total				9	0	12	15	400		

List of Electives											
PROFESSIONAL ELECTIVE - I (SEMESTER - VI)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		CA	ES	Total
1.	20SF661	Power Plant Engineering	S1	PEC	3	0	0	3	30	70	100
2.	20SF662	Safety in Petroleum and Petrochemical Industries	S1	PEC	3	0	0	3	30	70	100
3.	20SF663	Food and Bio safety	S2	PEC	3	0	0	3	30	70	100
4.	20SF664	Fault Detection and Diagnosis	S2	PEC	3	0	0	3	30	70	100
5.	20SF665	Fire Dynamics	S3	PEC	3	0	0	3	30	70	100
6.	20SF666	Hazard Control in Manufacturing	S3	PEC	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVE - II (SEMESTER - VII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		CA	ES	Total
1.	20SF761	Automobile Engineering and Safety	S1	PEC	3	0	0	3	30	70	100
2.	20SF762	Industrial Ecology	S4	PEC	3	0	0	3	30	70	100
3.	20SF763	Hazard Identification and Risk Assessment	S2	PEC	3	0	0	3	30	70	100
4.	20SF764	Reliability Engineering	S3	PEC	3	0	0	3	30	70	100
5.	20SF765	Fluid Power Systems	S4	PEC	3	0	0	3	30	70	100
6.	20SF766	Explosives Technology and Safety	S2	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		CA	ES	Total
1.	20SF767	Advanced Safety Engineering and Management	S2	PEC	3	0	0	3	30	70	100
2.	20SF768	Disaster Management	S2	PEC	3	0	0	3	30	70	100
3.	20SF769	Total Quality Management	S3	PEC	3	0	0	3	30	70	100
4.	20SF771	Intellectual Property Rights	S4	PEC	3	0	0	3	30	70	100
5.	20SF772	Entrepreneurship Development	S5	PEC	3	0	0	3	30	70	100
6.	20SF773	Statistical Methods for Engineers	S5	PEC	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVE - IV (SEMESTER - VIII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		CA	ES	Total
1.	20SF861	Work Study and Ergonomics	S1	PEC	3	0	0	3	30	70	100
2.	20SF862	Computer Aided Hazard Analysis	S2	PEC	3	0	0	3	30	70	100
3.	20SF863	Fire Works Safety	S2	PEC	3	0	0	3	30	70	100
4.	20SF864	Dock Safety	S3	PEC	3	0	0	3	30	70	100
5.	20SF865	Safety in Mines	S4	PEC	3	0	0	3	30	70	100
6.	20SF866	Nuclear Safety	S4	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		CA	ES	Total
1.	20SF867	Plant Layout and Materials Handling	S3	PEC	3	0	0	3	30	70	100
2.	20SF868	OHSAS 18000 and ISO 14000	S5	PEC	3	0	0	3	30	70	100
3.	20SF869	Safety in Powder Handling	S4	PEC	3	0	0	3	30	70	100
4.	20SF871	Professional Ethics	S5	PEC	3	0	0	3	30	70	100
5.	20SF872	Aviation Safety	S2	PEC	3	0	0	3	30	70	100
6.	20SF873	Air Pollution and Control	S2	PEC	3	0	0	3	30	70	100

S1 - Thermal Engineering
 S3 - Design
 S5 - Management

S2 - Safety Engineering
 S4 - Manufacturing Engineering

Open Elective courses offered by other branches

Sl. No.	Course Code	Course Name	Specializa tion	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 Syste	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

Sl. No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		CA	ES	Total
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
27.	20CS909	Big Data and Analytics	CSE	OEC	3	0	0	0	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
ELECTRICAL AND ELECTRONICS ENGINEERING											
37.	20EE901	Electrical Drives and Control	EE	OEC	3	0	0	3	30	70	100
38.	20EE902	Power Semiconductor Devices	EE	OEC	3	0	0	3	30	70	100
39.	20EE903	Electrical Power Generation Systems	EE	OEC	3	0	0	3	30	70	100
40.	20EE904	Control Engineering	EE	OEC	3	0	0	3	30	70	100
41.	20EE905	Industrial Automation	EE	OEC	3	0	0	3	30	70	100
42.	20EE906	Electrical Instruments and Measurements	EE	OEC	3	0	0	3	30	70	100
43.	20EE907	Energy Conservation and Management	EE	OEC	3	0	0	3	30	70	100
44.	20EE908	Electrical Wiring, Estimation and Costing	EE	OEC	3	0	0	3	30	70	100
45.	20EE909	Fundamentals of Electrical Machinery	EE	OEC	3	0	0	3	30	70	100
46.	20EE910	Principles of Soft Computing Techniques	EE	OEC	3	0	0	3	30	70	100
47.	20EE911	Embedded System Technology	EE	OEC	3	0	0	3	30	70	100
INFORMATION TECHNOLOGY											
48.	20IT901	Data Science using R	IT	OEC	3	0	0	3	30	70	100
49.	20IT902	Principles of Cyber Security	IT	OEC	3	0	0	3	30	70	100
50.	20IT903	Fundamentals of Business Intelligence	IT	OEC	3	0	0	3	30	70	100

Sl. No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		CA	ES	Total
51.	20IT904	Block chain Technologies	IT	OEC	3	0	0	3	30	70	100
52.	20IT905	Internet of Things and Applications	IT	OEC	3	0	0	3	30	70	100
53.	20IT906	Principles of Software Testing	IT	OEC	3	0	0	3	30	70	100
54.	20IT907	Foundation Skills in Logic Building	IT	OEC	3	0	0	3	30	70	100
55.	20IT908	Principles of Cloud Computing	IT	OEC	3	0	0	3	30	70	100
56.	20IT909	Open Source Technologies	IT	OEC	3	0	0	3	30	70	100
57.	20IT910	Principles of Software Engineering	IT	OEC	3	0	0	3	30	70	100
MECHANICAL ENGINEERING											
58.	20ME901	Basic Mechanical Engineering	MECH	OEC	3	0	0	3	30	70	100
59.	20ME902	Solar Energy Utilization	MECH	OEC	3	0	0	3	30	70	100
60.	20ME903	Production Technology of Agricultural Machinery	MECH	OEC	3	0	0	3	30	70	100
61.	20ME904	Selection of Materials	MECH	OEC	3	0	0	3	30	70	100
62.	20ME905	Marine Vehicles	MECH	OEC	3	0	0	3	30	70	100
63.	20ME906	Sensors and Transducers	MECH	OEC	3	0	0	3	30	70	100
64.	20ME907	Energy Auditing	MECH	OEC	3	0	0	3	30	70	100
65.	20ME908	Fibre Reinforced Plastics	MECH	OEC	3	0	0	3	30	70	100
66.	20ME909	Lean Manufacturing	MECH	OEC	3	0	0	3	30	70	100
67.	20ME910	Surface Engineering	MECH	OEC	3	0	0	3	30	70	100
SCIENCE AND HUMANITIES											
68.	20SH901	Applications of Statistics	FYA	OEC	3	0	0	3	30	70	100
69.	20SH902	Combinatorics and Graph Theory	FYA	OEC	3	0	0	3	30	70	100
70.	20SH903	Optimization Techniques	FYA	OEC	3	0	0	3	30	70	100
71.	20SH904	Basic Military Education and Training	FYA	OEC	3	0	0	3	30	70	100
72.	20SH905	Professional Communication	FYA	OEC	3	0	0	3	30	70	100
73.	20SH906	Fundamentals of Nanoscience and Technology	FYA	OEC	3	0	0	3	30	70	100

OPEN ELECTIVE COURSES OFFERED BY SAFETY AND FIRE ENGINEERING TO OTHER BRANCHES

LIST OF OPEN ELECTIVES OFFERED BY SAFETY & FIRE ENGINEERING TO OTHER DEPARTMENTS											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		CA	ES	Total
1.	20SF901	Occupational Health and Hygiene	SFE	OEC	3	0	0	3	30	70	100
2.	20SF902	Construction Safety	SFE	OEC	3	0	0	3	30	70	100
3.	20SF903	Building Fire Safety	SFE	OEC	3	0	0	3	30	70	100
4.	20SF904	Safety in Electrical Engineering	SFE	OEC	3	0	0	3	30	70	100
5.	20SF905	Legal Aspects of Safety	SFE	OEC	3	0	0	3	30	70	100
6.	20SF906	Safety in Industries	SFE	OEC	3	0	0	3	30	70	100
7.	20SF907	Food Safety	SFE	OEC	3	0	0	3	30	70	100
8.	20SF908	Safety Management and its Principles	SFE	OEC	3	0	0	3	30	70	100
9.	20SF909	Safety in Automobile Engineering	SFE	OEC	3	0	0	3	30	70	100
10.	20SF910	Safety in Transportation	SFE	OEC	3	0	0	3	30	70	100

LIST OF VALUE-ADDED COURSES

Sl. No.	Course Name	Number of Hours	Offered by Internal / External
1.	Business English Certification	15	Internal / External
2.	Other Linguistic Learning like German, Japanese, etc.	15	Internal / External
3.	Fire Fighting and Training	15	Internal / External
4.	Vehicle Service Management	15	Internal / External
5.	Online Course Certification from edX/ Coursera / NPTEL, etc.	15	Internal/ External
6.	Accident and Insurance Survey	15	Internal / External
7.	Course on First Aid	15	Internal / External
8.	Introduction to Personal Protective Equipments	15	Internal / External
9.	Material Handling and its Safety	15	Internal / External
10.	Course on Intellectual Property Rights	15	Internal / External

COURSE COMPONENT SUMMARY

Sl. 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	7.41
2.	BSC	8	8	4	-	-	-	-	-	20	12.35
3.	ESC	4	11	-	-	-	-	-	-	15	9.26
4.	PCC	-	-	19	23	16	11	6	3	79	48.15
5.	PEC	-	-	-	-	-	3	6	6	15	9.26
6.	OEC	-	-	-	-	3	6	3	-	12	7.41
7.	EEC	-	-	-	-	-	1	3	6	10	6.17
TOTAL		15	22	23	23	22	21	21	15	162	100

Total No. of Credits = 162

Note: HS- Humanities and Social Sciences including Management Courses, BS- Basic Science Courses, ES-Engineering Science Courses, PC-Professional Core Courses, PE-Professional Elective Courses, OE- Open Elective Courses, EEC-Employability Enhancement Courses & MC - Mandatory Courses.

- HUMANITIES AND SOCIAL SCIENCES (HS)
- BASIC SCIENCE (BS)
- ENGINEERING SCIENCES (ES)
- PROFESSIONAL CORE (PC)
- PROFESSIONAL ELECTIVES (PE)
- OPEN ELECTIVES (OEC)
- EMPLOYABILITY ENHANCEMENT COURSES (EEC)
- MANDATORY COURSES (MC)

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

B.E. SAFETY AND FIRE ENGINEERING

CURRICULUM & SYLLABI

Regulation 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 (Autonomous) (Approved by AICTE & Affiliated to Anna University) K.S.R. Kalvi Nagar, Tiruchengode - 637 215	CURRICULUM UG R - 2020
Department	Department of Safety and Fire Engineering	
Programme	B.E.- Safety and Fire Engineering	

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

IM1	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.
IM2	To foster and maintain mutually beneficial partnership with global industries and Institutions through knowledge sharing, collaborative research and innovation.

Vision of the Safety and Fire Engineering

DV	To emerge as a centre of excellence in Safety and Fire Engineering using the framework of quality education through advanced industry, research, entrepreneurship and society.

Mission of the Safety and Fire Engineering

DM1	To provide quality education and to prepare nationally and internationally competitive students for a successful career in safety, occupational health, environmental management and fire protection engineering.
DM2	To inculcate the need for sustainable development in research and innovations.

Programme Educational Objectives (PEOs): (Safety and Fire Engineering)

The graduates of the programme will be able to

PEO 1: Have a sound knowledge in Safety and Fire Engineering aspects to provide solutions for Potential hazards.

PEO 2: Expertise in the area of Thermal, Chemical Reactions, Structural Stability and Environmental Impacts.

PEO 3: Practice their Profession through evaluation, communication, ethics and social responsibility.

Programme Outcomes (POs) of B.E. - Safety and Fire 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 safety, health & environment with the 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 to 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 safety and fire engineering to 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	Design a safety and fire system for industries, building and other area thereby saving the loss due to a fire and accidents.
PSO2	Analyze hazards in a work place and to rectify it by suitable safety and fire engineering solutions.

		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		Department of Safety and Fire Engineering								
Programme		B.E. - Safety and Fire 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.	20ME144	Engineering Drawing (Common to AU, ME & SF)	ESC	1	2	0	3	40	60	100
MANDATORY COURSES										
5.	20MC052	Environmental Science and Engineering	MC	3	0	0	0	40	60	100
6.	20MC151	Induction Program	MC	-	-	-	-	-	-	-
PRACTICAL										
7.	20PH028	Physics Laboratory (Common to All Branches)	BSC	0	0	3	1	60	40	100
8.	20GE028	Manufacturing Practices Laboratory (Common to AU, CE, ME & SF)	ESC	0	0	3	1	60	40	100
Total				12	3	7	15	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.	20MA241	Engineering Mathematics - II (Common to AU, CE, ME& SF)	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.	20EE041	Basics of Electrical and Electronics Engineerin (Common To AU, CE, CS, IT, ME & SF)	ESC	3	0	0	3	40	60	100
5.	20CS241	Python Programming (Common To AU, CE, EC, EE, ME & SF)	ESC	3	0	0	3	40	60	100
6.	20AU231	Fundamentals of Engineering Mechanics (Common to AU & SF)	ESC	3	1	0	4	40	60	100
PRACTICAL										
7.	20CH028	Chemistry Laboratory (Common to All Branches)	BSC	0	0	3	1	60	40	100
8.	20CS227	Python Programming Laboratory (Common To AU, CE, EC, EE, ME & SF)	ESC	0	0	3	1	60	40	100
Total				17	2	7	22	800		

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Department		Department of Safety and Fire Engineering								
Programme		B.E. - Safety and Fire Engineering								
SEMESTER - III										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P		C	CA	ES
THEORY										
1.	20SF311	Chemical Process Principles	PCC	3	0	0	3	40	60	100
2.	20SF312	Engineering Fluid Mechanics and Machinery	PCC	3	1	0	4	40	60	100
3.	20SF313	Principles of Safety Management	PCC	3	0	0	3	40	60	100
4.	20SF314	Manufacturing Technology	PCC	3	0	0	3	40	60	100
5.	20SF315	Safety in Engineering Industry	PCC	3	0	0	3	40	60	100
6.	20MA341	Statistics and Numerical Methods (Common To AU, ME & SF)	BSC	3	1	0	4	40	60	100
PRACTICAL										
7.	20SF321	Fluid Mechanics and Machinery Laboratory	PCC	0	0	3	1	60	40	100
8.	20SF322	Manufacturing Technology Laboratory	PCC	0	0	3	1	60	40	100
9.	20SF323	Safety Engineering Laboratory	PCC	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.	20SF411	Heat and Mass Transfer Operations	PCC	3	1	0	4	40	60	100
2.	20SF412	Fire Engineering Fundamentals	PCC	3	0	0	3	40	60	100
3.	20SF413	Strength of Materials	PCC	3	1	0	4	40	60	100
4.	20SF414	Electrical Safety	PCC	3	0	0	3	40	60	100
5.	20SF415	Occupational Health and First Aid	PCC	3	0	0	3	40	60	100
6.	20SF416	Safety in Construction	PCC	3	0	0	3	40	60	100
PRACTICAL										
7.	20SF421	Strength of Materials Laboratory	PCC	0	0	3	1	60	40	100
8.	20SF422	Electrical Technology Laboratory	PCC	0	0	3	1	60	40	100
9.	20SF423	Computer Aided Machine Drawing Laboratory	PCC	0	0	3	1	60	40	100
10.	20HR492	Career Development Skills - II	EEC	0	2	0	0	60	40	100
Total				18	4	9	23	1000		

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Department		Department of Safety and Fire Engineering									
Programme		B.E.-Safety and Fire Engineering									
SEMESTER - V											
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks			
				L	T	P		C	CA	ES	Total
THEORY											
1.	20HS051	Universal Human Values & Understanding Harmony (Common to All Branches)	HSMC	3	0	0	3	40	60	100	
2.	20SF511	Chemical Technology and Reaction Engineering	PCC	3	0	0	3	40	60	100	
3.	20SF513	Planning and Design of Fire Protection System	PCC	3	1	0	4	40	60	100	
4.	20SF514	Chemical Process Safety	PCC	3	0	0	3	40	60	100	
5.	20SF515	Safety in Textile Industry	PCC	3	0	0	3	40	60	100	
6.		Open Elective - I	OEC	3	0	0	3	40	60	100	
PRACTICAL											
7.	20SF521	Occupational Health and First Aid Laboratory	PCC	0	0	3	1	60	40	100	
8.	20SF522	Fire Safety Training	PCC	0	0	3	1	60	40	100	
9.	20HR593	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.	20SF611	Legal Aspects of Safety, Health & Environment	PCC	3	0	0	3	40	60	100
2.	20SF612	Process Instrumentation and Control	PCC	3	0	0	3	40	60	100
3.	20SF613	Structural Fire safety	PCC	3	0	0	3	40	60	100
4.		Professional Elective - I	PEC	3	0	0	3	40	60	100
5.		Open Elective - II	OEC	3	0	0	3	40	60	100
6.		Open Elective - III	OEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20SF621	Environmental Engineering and Management Laboratory	PCC	0	0	3	1	60	40	100
8.	20SF622	Fire Engineering Laboratory	PCC	0	0	3	1	60	40	100
9.	20SF623	Industrial Training and Seminar	EEC	0	0	3	1	60	40	100
10.	20HR694	Career Development Skills - IV	EEC	0	2	0	0	60	40	100
Total				18	2	9	21	1000		

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Department		Department of Safety and Fire Engineering								
Programme		B.E. - Safety and Fire Engineering								
SEMESTER - VII										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P		C	CA	ES
THEORY										
1.	20SF711	Safety in Rail and Road Transport	PC	3	0	0	3	40	60	100
2.	20SF712	Principles of Industrial Management	HSMC	3	0	0	3	40	60	100
3.	20SF713	Life Safety in Building Fire	PC	3	0	0	3	40	60	100
4.		Professional Elective - II	PEC	3	0	0	3	40	60	100
5.		Professional Elective - III	PEC	3	0	0	3	40	60	100
6.		Open Elective - IV	OEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20SF722	Project Phase - I	EEC	0	0	6	3	60	40	100
Total				18	0	6	21	700		

SEMESTER - VIII										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20SF811	Human Factors Engineering	PCC	3	0	0	3	40	60	100
2.		Professional Elective - IV	PEC	3	0	0	3	40	60	100
3.		Professional Elective - V	PEC	3	0	0	3	40	60	100
PRACTICAL										
4.	20SF821	Project Phase - II	EEC	0	0	12	6	60	40	100
Total				9	0	12	15	400		

List of Electives											
PROFESSIONAL ELECTIVE - I (SEMESTER - VI)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		CA	ES	Total
1.	20SF661	Power Plant Engineering	S1	PEC	3	0	0	3	40	60	100
2.	20SF662	Safety in Petroleum and Petrochemical Industries	S1	PEC	3	0	0	3	40	60	100
3.	20SF663	Food and Biosafety	S2	PEC	3	0	0	3	40	60	100
4.	20SF664	Fault Detection and Diagnosis	S2	PEC	3	0	0	3	40	60	100
5.	20SF665	Fire Dynamics	S3	PEC	3	0	0	3	40	60	100
6.	20SF666	Hazard Control in Manufacturing	S3	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE - II (SEMESTER - VII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		CA	ES	Total
1.	20SF761	Automobile Engineering and Safety	S1	PEC	3	0	0	3	40	60	100
2.	20SF762	Industrial Ecology	S4	PEC	3	0	0	3	40	60	100
3.	20SF763	Hazard Identification and Risk Assessment	S2	PEC	3	0	0	3	40	60	100
4.	20SF764	Reliability Engineering	S3	PEC	3	0	0	3	40	60	100
5.	20SF765	Fluid Power Systems	S4	PEC	3	0	0	3	40	60	100
6.	20SF766	Explosives Technology and Safety	S2	PEC	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		CA	ES	Total
1.	20SF767	Advanced Safety Engineering and Management	S2	PEC	3	0	0	3	40	60	100
2.	20SF768	Disaster Management	S2	PEC	3	0	0	3	40	60	100
3.	20SF769	Total Quality Management	S3	PEC	3	0	0	3	40	60	100
4.	20SF771	Intellectual Property Rights	S4	PEC	3	0	0	3	40	60	100
5.	20SF772	Entrepreneurship Development	S5	PEC	3	0	0	3	40	60	100
6.	20SF773	Statistical Methods for Engineers	S5	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE - IV (SEMESTER - VIII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		CA	ES	Total
1.	20SF861	Work Study and Ergonomics	S1	PEC	3	0	0	3	40	60	100
2.	20SF862	Computer Aided Hazard Analysis	S2	PEC	3	0	0	3	40	60	100
3.	20SF863	Fire Works Safety	S2	PEC	3	0	0	3	40	60	100
4.	20SF864	Dock Safety	S3	PEC	3	0	0	3	40	60	100
5.	20SF865	Safety in Mines	S4	PEC	3	0	0	3	40	60	100
6.	20SF866	Nuclear Safety	S4	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		CA	ES	Total
1.	20SF867	Plant Layout and Materials Handling	S3	PEC	3	0	0	3	40	60	100
2.	20SF868	OHSAS 18000 and ISO 14000	S5	PEC	3	0	0	3	40	60	100
3.	20SF869	Safety in Powder Handling	S4	PEC	3	0	0	3	40	60	100
4.	20SF871	Professional Ethics	S5	PEC	3	0	0	3	40	60	100
5.	20SF872	Aviation Safety	S2	PEC	3	0	0	3	40	60	100
6.	20SF873	Air Pollution and Control	S2	PEC	3	0	0	3	40	60	100

S1 - Thermal Engineering
S3 - Design
S5 - Management

S2 - Safety Engineering
S4 - Manufacturing Engineering

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
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

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
25.	20CS907	Green Technology	CSE	OEC	3	0	0	3	40	60	100
26.	20CS908	Artificial Intelligence and Robotics	CSE	OEC	3	0	0	3	40	60	100
27.	20CS909	Big Data and Analytics	CSE	OEC	3	0	0	0	40	60	100
28.	20CS910	Hardware and Trouble Shooting	CSE	OEC	3	0	0	3	40	60	100
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
ELECTRICAL AND ELECTRONICS ENGINEERING											
37.	20EE901	Electrical Drives and Control	EE	OEC	3	0	0	3	40	60	100
38.	20EE902	Power Semiconductor Devices	EE	OEC	3	0	0	3	40	60	100
39.	20EE903	Electrical Power Generation Systems	EE	OEC	3	0	0	3	40	60	100
40.	20EE904	Control Engineering	EE	OEC	3	0	0	3	40	60	100
41.	20EE905	Industrial Automation	EE	OEC	3	0	0	3	40	60	100
42.	20EE906	Electrical Instruments and Measurements	EE	OEC	3	0	0	3	40	60	100
43.	20EE907	Energy Conservation and Management	EE	OEC	3	0	0	3	40	60	100
44.	20EE908	Electrical Wiring, Estimation and Costing	EE	OEC	3	0	0	3	40	60	100
45.	20EE909	Fundamentals of Electrical Machinery	EE	OEC	3	0	0	3	40	60	100
46.	20EE910	Principles of Soft Computing Techniques	EE	OEC	3	0	0	3	40	60	100
47.	20EE911	Embedded System Technology	EE	OEC	3	0	0	3	40	60	100
INFORMATION TECHNOLOGY											
48.	20IT901	Data Science using R	IT	OEC	3	0	0	3	40	60	100
49.	20IT902	Principles of Cyber Security	IT	OEC	3	0	0	3	40	60	100
50.	20IT903	Fundamentals of Business Intelligence	IT	OEC	3	0	0	3	40	60	100

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		C	CA	ES
51.	20IT904	Block chain Technologies	IT	OEC	3	0	0	3	40	60	100
52.	20IT905	Internet of Things and Applications	IT	OEC	3	0	0	3	40	60	100
53.	20IT906	Principles of Software Testing	IT	OEC	3	0	0	3	40	60	100
54.	20IT907	Foundation Skills in Logic Building	IT	OEC	3	0	0	3	40	60	100
55.	20IT908	Principles of Cloud Computing	IT	OEC	3	0	0	3	40	60	100
56.	20IT909	Open Source Technologies	IT	OEC	3	0	0	3	40	60	100
57.	20IT910	Principles of Software Engineering	IT	OEC	3	0	0	3	40	60	100
MECHANICAL ENGINEERING											
58.	20ME901	Basic Mechanical Engineering	MECH	OEC	3	0	0	3	40	60	100
59.	20ME902	Solar Energy Utilization	MECH	OEC	3	0	0	3	40	60	100
60.	20ME903	Production Technology of Agricultura Machinery	MECH	OEC	3	0	0	3	40	60	100
61.	20ME904	Selection of Materials	MECH	OEC	3	0	0	3	40	60	100
62.	20ME905	Marine Vehicles	MECH	OEC	3	0	0	3	40	60	100
63.	20ME906	Sensors and Transducers	MECH	OEC	3	0	0	3	40	60	100
64.	20ME907	Energy Auditing	MECH	OEC	3	0	0	3	40	60	100
65.	20ME908	Fibre Reinforced Plastics	MECH	OEC	3	0	0	3	40	60	100
66.	20ME909	Lean Manufacturing	MECH	OEC	3	0	0	3	40	60	100
67.	20ME910	Surface Engineering	MECH	OEC	3	0	0	3	40	60	100
SCIENCE AND HUMANITIES											
68.	20SH901	Applications of Statistics	FYA	OEC	3	0	0	3	40	60	100
69.	20SH902	Combinatorics and Graph Theory	FYA	OEC	3	0	0	3	40	60	100
70.	20SH903	Optimization Techniques	FYA	OEC	3	0	0	3	40	60	100
71.	20SH904	Basic Military Education and Training	FYA	OEC	3	0	0	3	40	60	100
72.	20SH905	Professional Communication	FYA	OEC	3	0	0	3	40	60	100
73.	20SH906	Fundamentals of Nanoscience and Technology	FYA	OEC	3	0	0	3	40	60	100

LIST OF OPEN ELECTIVES OFFERED BY SAFETY & FIRE ENGINEERING TO OTHER DEPARTMENTS											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/Week			Credit	Maximum Marks		
					L	T	P		CA	ES	Total
1.	20SF901	Occupational Health and Hygiene	SFE	OEC	3	0	0	3	40	60	100
2.	20SF902	Construction Safety	SFE	OEC	3	0	0	3	40	60	100
3.	20SF903	Building Fire Safety	SFE	OEC	3	0	0	3	40	60	100
4.	20SF904	Safety in Electrical Engineering	SFE	OEC	3	0	0	3	40	60	100
5.	20SF905	Legal Aspects of Safety	SFE	OEC	3	0	0	3	40	60	100
6.	20SF906	Safety in Industries	SFE	OEC	3	0	0	3	40	60	100
7.	20SF907	Food Safety	SFE	OEC	3	0	0	3	40	60	100
8.	20SF908	Safety Management and its Principles	SFE	OEC	3	0	0	3	40	60	100
9.	20SF909	Safety in Automobile Engineering	SFE	OEC	3	0	0	3	40	60	100
10.	20SF910	Safety in Transportation	SFE	OEC	3	0	0	3	40	60	100

	K.S.R. COLLEGE OF ENGINEERING (Autonomous) (Approved by AICTE, Affiliated to Anna University & Accredited by NAAC with "A++" Grade) K.S.R. Kalvi Nagar, Tiruchengode - 637 215	CURRICULUM UG R - 2020
Department	Department of Safety and Fire Engineering	
Programme	B.E.- Safety and Fire Engineering	
List of Emerging Area for Honours		

B.E./B.TECH. Honours (specialization in the same discipline) :Verticals
Emerging Areas: Safety and Fire Engineering

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

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

ii) B.E Honours

- The students should have taken additional courses from more than one vertical of the same Programme and earned a minimum of 18 credits.
- Should have passed all the courses in the first attempt.
- 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 18credits 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 : ENVIRONMENTAL SAFETY		VERTICAL-II: OCCUPATIONAL HEALTH AND HYGIENE	
20SF881	Environmental Safety	20SF887	Industrial Ecology
20SF882	Global Warming & Climate Change	20SF862	Computer Aided Hazard Analysis
20SF883	Air Pollution Management	20SF888	Industrial Noise and Vibration Control
20SF884	Water Pollution Management	20SF861	Work Study and Ergonomics
20SF885	Solid Waste Management	20SF889	First Aid and Emergency Procedures
20SF768	Disaster Management	20SF890	Personality Management
20SF886	Environmental Sustainability	20SF891	Human Resources in Engineering
20SF866	Nuclear Safety	20SF892	Safety in Health Care Waste Management

		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		Department of Safety and Fire Engineering								
Programme		B.E. - Safety and Fire Engineering								
LIST OF EMERGING AREA FOR HONOURS										
VERTICAL -I										
ENVIRONMENTAL SAFETY										
Sl.No.	Course Code	Course Name	Special ization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20SF881	Environmental Safety	S2	3	0	0	3	40	60	100
2.	20SF882	Global Warming & Climate Change	S2	3	0	0	3	40	60	100
3.	20SF883	Air Pollution Management	S2	3	0	0	3	40	60	100
4.	20SF884	Water Pollution Management	S2	3	0	0	3	40	60	100
5.	20SF885	Solid Waste Management	S2	3	0	0	3	40	60	100
6.	20SF768	Disaster Management	S2	3	0	0	3	40	60	100
7.	20SF886	Environmental Sustainability	S2	3	0	0	3	40	60	100
8.	20SF866	Nuclear Safety	S2	3	0	0	3	40	60	100
VERTICAL -II										
OCCUPATIONAL HEALTH AND HYGIENE										
9.	20SF887	Industrial Ecology	S6	3	0	0	3	40	60	100
10.	20SF862	Computer Aided Hazard Analysis	S6	3	0	0	3	40	60	100
11.	20SF888	Industrial Noise and Vibration Control	S6	3	0	0	3	40	60	100
12.	20SF861	Work Study and Ergonomics	S6	3	0	0	3	40	60	100
13.	20SF889	First Aid and Emergency Procedures	S6	3	0	0	3	40	60	100
14.	20SF890	Personality Management	S6	3	0	0	3	40	60	100
15.	20SF891	Human Resources in Engineering	S6	3	0	0	3	40	60	100
16.	20SF892	Safety in Health Care Waste Managemen	S6	3	0	0	3	40	60	100

S2- Safety Engineering
 S6- Health and Hygiene

LIST OF VALUE-ADDED COURSES

Sl. No.	Course Name	Number of Hours	Offered by Internal / External
1.	Business English Certification	15	Internal / External
2.	Other Linguistic Learning like German, Japanese, etc.	15	Internal / External
3.	Fire Fighting and Training	15	Internal / External
4.	Vehicle Service Management	15	Internal / External
5.	Online Course Certification from edX/ Coursera / NPTEL, etc.	15	Internal/ External
6.	Accident and Insurance Survey	15	Internal / External
7.	Course on First Aid	15	Internal / External
8.	Introduction to Personal Protective Equipments	15	Internal / External
9.	Material Handling and its Safety	15	Internal / External
10.	Course on Intellectual Property Rights	15	Internal / External

COURSE COMPONENT SUMMARY

Sl. 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	7.45
2.	BSC	8	8	4	-	-	-	-	-	20	12.42
3.	ESC	4	11	-	-	-	-	-	-	15	9.32
4.	PCC	-	-	19	23	15	11	6	3	77	47.83
5.	PEC	-	-	-	-	-	3	6	6	15	9.32
6.	OEC	-	-	-	-	3	6	3	-	12	7.45
7.	EEC	-	-	-	-	-	1	3	6	10	6.21
TOTAL		15	22	23	23	21	21	21	15	161	100

Total No. of Credits = 161

Note: HS- Humanities and Social Sciences including Management Courses, BS- Basic Science Courses, ES-Engineering Science Courses, PC-Professional Core Courses, PE-Professional Elective Courses, OE- Open Elective Courses, EEC-Employability Enhancement Courses & MC - Mandatory Courses.

- HUMANITIES AND SOCIAL SCIENCES (HS)
- BASIC SCIENCE (BS)
- ENGINEERING SCIENCES (ES)
- PROFESSIONAL CORE (PC)
- PROFESSIONAL ELECTIVES (PE)
- OPEN ELECTIVES (OEC)
- EMPLOYABILITY ENHANCEMENT COURSES (EEC)
- MANDATORY COURSES (MC)

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

B.E. SAFETY AND FIRE ENGINEERING

CURRICULUM & SYLLABI

Regulation 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 (Autonomous) (Approved by AICTE & Affiliated to Anna University) K.S.R. Kalvi Nagar, Tiruchengode - 637 215	CURRICULUM UG R - 2020
Department	Department of Safety and Fire Engineering	
Programme	B.E.- Safety and Fire Engineering	

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

IM1	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.
IM2	To foster and maintain mutually beneficial partnership with global industries and Institutions through knowledge sharing, collaborative research and innovation.

Vision of the Safety and Fire Engineering

DV	To emerge as a centre of excellence in Safety and Fire Engineering using the framework of quality education through advanced industry, research, entrepreneurship and society.

Mission of the Safety and Fire Engineering

DM1	To provide quality education and to prepare nationally and internationally competitive students for a successful career in safety, occupational health, environmental management and fire protection engineering.
DM2	To inculcate the need for sustainable development in research and innovations.

Programme Educational Objectives (PEOs): (Safety and Fire Engineering)

The graduates of the programme will be able to

PEO 1: Have a sound knowledge in Safety and Fire Engineering aspects to provide solutions for Potential hazards.

PEO 2: Expertise in the area of Thermal, Chemical Reactions, Structural Stability and Environmental Impacts.

PEO 3: Practice their Profession through evaluation, communication, ethics and social responsibility.

Programme Outcomes (POs) of B.E. - Safety and Fire 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 safety, health & environment with the 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 to 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 safety and fire engineering to 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	Design a safety and fire system for industries, building and other area thereby saving the loss due to a fire and accidents.
PSO2	Analyze hazards in a work place and to rectify it by suitable safety and fire engineering solutions.

		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		Department of Safety and Fire Engineering								
Programme		B.E. - Safety and Fire 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.	20ME144	Engineering Drawing (Common to AU, ME & SF)	ESC	1	2	0	3	40	60	100
MANDATORY COURSES										
5.	20MC052	Environmental Science and Engineering	MC	3	0	0	0	40	60	100
6.	20MC151	Induction Program	MC	-	-	-	-	-	-	-
PRACTICAL										
7.	20PH028	Physics Laboratory (Common to All Branches)	BSC	0	0	3	1	60	40	100
8.	20GE028	Manufacturing Practices Laboratory (Common to AU, CE, ME & SF)	ESC	0	0	3	1	60	40	100
Total				12	3	7	15	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.	20MA241	Engineering Mathematics - II (Common to AU, CE, ME& SF)	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.	20EE041	Basics of Electrical and Electronics Engineerin (Common To AU, CE, CS, IT, ME & SF)	ESC	3	0	0	3	40	60	100
5.	20CS241	Python Programming (Common To AU, CE, EC, EE, ME & SF)	ESC	3	0	0	3	40	60	100
6.	20AU231	Fundamentals of Engineering Mechanics (Common to AU & SF)	ESC	3	1	0	4	40	60	100
MANDATORY COURSE										
7.	20GE051	Heritage of Tamils (Common to All Branches)	MC	1	0	0	1	40	60	100
PRACTICAL										
8.	20CH028	Chemistry Laboratory (Common to All Branches)	BSC	0	0	3	1	60	40	100
9.	20CS227	Python Programming Laboratory (Common To AU, CE, EC, EE, ME & SF)	ESC	0	0	3	1	60	40	100
Total				18	2	7	23	900		

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Department		Department of Safety and Fire Engineering								
Programme		B.E. - Safety and Fire Engineering								
SEMESTER - III										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20SF311	Chemical Process Principles	PCC	3	0	0	3	40	60	100
2.	20SF312	Engineering Fluid Mechanics and Machinery	PCC	3	1	0	4	40	60	100
3.	20SF313	Principles of Safety Management	PCC	3	0	0	3	40	60	100
4.	20SF314	Manufacturing Technology	PCC	3	0	0	3	40	60	100
5.	20SF315	Safety in Engineering Industry	PCC	3	0	0	3	40	60	100
6.	20MA341	Statistics and Numerical Methods (Common To AU, ME & SF)	BSC	3	1	0	4	40	60	100
MANDATORY COURSE										
7.	20GE052	Tamils and Technology (Common to All Branches)	MC	1	0	0	1	40	60	100
PRACTICAL										
8.	20SF321	Fluid Mechanics and Machinery Laboratory	PCC	0	0	3	1	60	40	100
9.	20SF322	Manufacturing Technology Laboratory	PCC	0	0	3	1	60	40	100
10.	20SF323	Safety Engineering Laboratory	PCC	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.	20SF411	Heat and Mass Transfer Operations	PCC	3	1	0	4	40	60	100
2.	20SF412	Fire Engineering Fundamentals	PCC	3	0	0	3	40	60	100
3.	20SF413	Strength of Materials	PCC	3	1	0	4	40	60	100
4.	20SF414	Electrical Safety	PCC	3	0	0	3	40	60	100
5.	20SF415	Occupational Health and First Aid	PCC	3	0	0	3	40	60	100
6.	20SF416	Safety in Construction	PCC	3	0	0	3	40	60	100
PRACTICAL										
7.	20SF421	Strength of Materials Laboratory	PCC	0	0	3	1	60	40	100
8.	20SF423	Computer Aided Machine Drawing Laboratory	PCC	0	0	3	1	60	40	100
9.	20HR492	Career Development Skills - II	EEC	0	2	0	0	60	40	100
Total				18	4	6	22	900		

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Department		Department of Safety and Fire Engineering								
Programme		B.E.-Safety and Fire Engineering								
SEMESTER - V										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P		C	CA	ES
THEORY										
1.	20HS051	Universal Human Values & Understanding Harmony (Common to All Branches)	HSMC	3	0	0	3	40	60	100
2.	20SF511	Chemical Technology and Reaction Engineering	PCC	3	0	0	3	40	60	100
3.	20SF513	Planning and Design of Fire Protection System	PCC	3	1	0	4	40	60	100
4.	20SF514	Chemical Process Safety	PCC	3	0	0	3	40	60	100
5.	20SF515	Safety in Textile Industry	PCC	3	0	0	3	40	60	100
6.		Open Elective - I	OEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20SF521	Occupational Health and First Aid Laboratory	PCC	0	0	3	1	60	40	100
8.	20SF522	Fire Safety Training	PCC	0	0	3	1	60	40	100
9.	20HR593	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
THEORY										
1.	20SF611	Legal Aspects of Safety, Health & Environment	PCC	3	0	0	3	40	60	100
2.	20SF612	Process Instrumentation and Control	PCC	3	0	0	3	40	60	100
3.	20SF613	Structural Fire safety	PCC	3	0	0	3	40	60	100
4.		Professional Elective - I	PEC	3	0	0	3	40	60	100
5.		Open Elective - II	OEC	3	0	0	3	40	60	100
6.		Open Elective - III	OEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20SF621	Environmental Engineering and Management Laboratory	PCC	0	0	3	1	60	40	100
8.	20SF622	Fire Engineering Laboratory	PCC	0	0	3	1	60	40	100
9.	20SF623	Industrial Training and Seminar	EEC	0	0	3	1	60	40	100
10.	20HR694	Career Development Skills - IV	EEC	0	2	0	0	60	40	100
Total				18	2	9	21	1000		

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Department		Department of Safety and Fire Engineering								
Programme		B.E. - Safety and Fire Engineering								
SEMESTER - VII										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P		C	CA	ES
THEORY										
1.	20SF711	Safety in Rail and Road Transport	PC	3	0	0	3	40	60	100
2.	20SF712	Principles of Industrial Management	HSMC	3	0	0	3	40	60	100
3.	20SF713	Life Safety in Building Fire	PC	3	0	0	3	40	60	100
4.		Professional Elective - II	PEC	3	0	0	3	40	60	100
5.		Professional Elective - III	PEC	3	0	0	3	40	60	100
6.		Open Elective - IV	OEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20SF722	Project Phase - I	EEC	0	0	6	3	60	40	100
Total				18	0	6	21	700		

SEMESTER - VIII										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20SF811	Human Factors Engineering	PCC	3	0	0	3	40	60	100
2.		Professional Elective - IV	PEC	3	0	0	3	40	60	100
3.		Professional Elective - V	PEC	3	0	0	3	40	60	100
PRACTICAL										
4.	20SF821	Project Phase - II	EEC	0	0	12	6	60	40	100
Total				9	0	12	15	400		

List of Electives											
PROFESSIONAL ELECTIVE - I (SEMESTER - VI)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		CA	ES	Total
1.	20SF661	Power Plant Engineering	S1	PEC	3	0	0	3	40	60	100
2.	20SF662	Safety in Petroleum and Petrochemical Industries	S1	PEC	3	0	0	3	40	60	100
3.	20SF663	Food and Biosafety	S2	PEC	3	0	0	3	40	60	100
4.	20SF664	Fault Detection and Diagnosis	S2	PEC	3	0	0	3	40	60	100
5.	20SF665	Fire Dynamics	S3	PEC	3	0	0	3	40	60	100
6.	20SF666	Hazard Control in Manufacturing	S3	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE - II (SEMESTER - VII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		C	CA	ES
1.	20SF761	Automobile Engineering and Safety	S1	PEC	3	0	0	3	40	60	100
2.	20SF762	Industrial Ecology	S4	PEC	3	0	0	3	40	60	100
3.	20SF763	Hazard Identification and Risk Assessment	S2	PEC	3	0	0	3	40	60	100
4.	20SF764	Reliability Engineering	S3	PEC	3	0	0	3	40	60	100
5.	20SF765	Fluid Power Systems	S4	PEC	3	0	0	3	40	60	100
6.	20SF766	Explosives Technology and Safety	S2	PEC	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
1.	20SF767	Advanced Safety Engineering and Management	S2	PEC	3	0	0	3	40	60	100
2.	20SF768	Disaster Management	S2	PEC	3	0	0	3	40	60	100
3.	20SF769	Total Quality Management	S3	PEC	3	0	0	3	40	60	100
4.	20SF771	Intellectual Property Rights	S4	PEC	3	0	0	3	40	60	100
5.	20SF772	Entrepreneurship Development	S5	PEC	3	0	0	3	40	60	100
6.	20SF773	Statistical Methods forEngineers	S5	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE - IV (SEMESTER - VIII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		C	CA	ES
1.	20SF861	Work Study and Ergonomics	S1	PEC	3	0	0	3	40	60	100
2.	20SF862	Computer Aided Hazard Analysis	S2	PEC	3	0	0	3	40	60	100
3.	20SF863	Fire Works Safety	S2	PEC	3	0	0	3	40	60	100
4.	20SF864	Dock Safety	S3	PEC	3	0	0	3	40	60	100
5.	20SF865	Safety in Mines	S4	PEC	3	0	0	3	40	60	100
6.	20SF866	Nuclear Safety	S4	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
1.	20SF867	Plant Layout and Materials Handling	S3	PEC	3	0	0	3	40	60	100
2.	20SF868	OHSAS 18000 and ISO 14000	S5	PEC	3	0	0	3	40	60	100
3.	20SF869	Safety in Powder Handling	S4	PEC	3	0	0	3	40	60	100
4.	20SF871	Professional Ethics	S5	PEC	3	0	0	3	40	60	100
5.	20SF872	Aviation Safety	S2	PEC	3	0	0	3	40	60	100
6.	20SF873	Air Pollution and Control	S2	PEC	3	0	0	3	40	60	100

S1 - Thermal Engineering
S3 - Design
S5 - Management

S2 - Safety Engineering
S4 - Manufacturing Engineering

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
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
27.	20CS909	Big Data and Analytics	CSE	OEC	3	0	0	0	40	60	100
28.	20CS910	Hardware and Trouble Shooting	CSE	OEC	3	0	0	3	40	60	100
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
ELECTRICAL AND ELECTRONICS ENGINEERING											
37.	20EE901	Electrical Drives and Control	EE	OEC	3	0	0	3	40	60	100
38.	20EE902	Power Semiconductor Devices	EE	OEC	3	0	0	3	40	60	100
39.	20EE903	Electrical Power Generation Systems	EE	OEC	3	0	0	3	40	60	100
40.	20EE904	Control Engineering	EE	OEC	3	0	0	3	40	60	100
41.	20EE905	Industrial Automation	EE	OEC	3	0	0	3	40	60	100
42.	20EE906	Electrical Instruments and Measurements	EE	OEC	3	0	0	3	40	60	100
43.	20EE907	Energy Conservation and Management	EE	OEC	3	0	0	3	40	60	100
44.	20EE908	Electrical Wiring, Estimation and Costing	EE	OEC	3	0	0	3	40	60	100
45.	20EE909	Fundamentals of Electrical Machinery	EE	OEC	3	0	0	3	40	60	100
46.	20EE910	Principles of Soft Computing Techniques	EE	OEC	3	0	0	3	40	60	100
47.	20EE911	Embedded System Technology	EE	OEC	3	0	0	3	40	60	100
INFORMATION TECHNOLOGY											
48.	20IT901	Data Science using R	IT	OEC	3	0	0	3	40	60	100
49.	20IT902	Principles of Cyber Security	IT	OEC	3	0	0	3	40	60	100
50.	20IT903	Fundamentals of Business Intelligence	IT	OEC	3	0	0	3	40	60	100
51.	20IT904	Block chain Technologies	IT	OEC	3	0	0	3	40	60	100
52.	20IT905	Internet of Things and Applications	IT	OEC	3	0	0	3	40	60	100

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		C	CA	ES
53.	20IT906	Principles of Software Testing	IT	OEC	3	0	0	3	40	60	100
54.	20IT907	Foundation Skills in Logic Building	IT	OEC	3	0	0	3	40	60	100
55.	20IT908	Principles of Cloud Computing	IT	OEC	3	0	0	3	40	60	100
56.	20IT909	Open Source Technologies	IT	OEC	3	0	0	3	40	60	100
57.	20IT910	Principles of Software Engineering	IT	OEC	3	0	0	3	40	60	100
MECHANICAL ENGINEERING											
58.	20ME901	Basic Mechanical Engineering	MECH	OEC	3	0	0	3	40	60	100
59.	20ME902	Solar Energy Utilization	MECH	OEC	3	0	0	3	40	60	100
60.	20ME903	Production Technology of Agriculture Machinery	MECH	OEC	3	0	0	3	40	60	100
61.	20ME904	Selection of Materials	MECH	OEC	3	0	0	3	40	60	100
62.	20ME905	Marine Vehicles	MECH	OEC	3	0	0	3	40	60	100
63.	20ME906	Sensors and Transducers	MECH	OEC	3	0	0	3	40	60	100
64.	20ME907	Energy Auditing	MECH	OEC	3	0	0	3	40	60	100
65.	20ME908	Fibre Reinforced Plastics	MECH	OEC	3	0	0	3	40	60	100
66.	20ME909	Lean Manufacturing	MECH	OEC	3	0	0	3	40	60	100
67.	20ME910	Surface Engineering	MECH	OEC	3	0	0	3	40	60	100
SCIENCE AND HUMANITIES											
68.	20SH901	Applications of Statistics	FYA	OEC	3	0	0	3	40	60	100
69.	20SH902	Combinatorics and Graph Theory	FYA	OEC	3	0	0	3	40	60	100
70.	20SH903	Optimization Techniques	FYA	OEC	3	0	0	3	40	60	100
71.	20SH904	Basic Military Education and Training	FYA	OEC	3	0	0	3	40	60	100
72.	20SH905	Professional Communication	FYA	OEC	3	0	0	3	40	60	100
73.	20SH906	Fundamentals of Nanoscience and Technology	FYA	OEC	3	0	0	3	40	60	100

LIST OF OPEN ELECTIVES OFFERED BY SAFETY & FIRE ENGINEERING TO OTHER DEPARTMENTS											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		CA	ES	Total
1.	20SF901	Occupational Health and Hygiene	SFE	OEC	3	0	0	3	40	60	100
2.	20SF902	Construction Safety	SFE	OEC	3	0	0	3	40	60	100
3.	20SF903	Building Fire Safety	SFE	OEC	3	0	0	3	40	60	100
4.	20SF904	Safety in Electrical Engineering	SFE	OEC	3	0	0	3	40	60	100
5.	20SF905	Legal Aspects of Safety	SFE	OEC	3	0	0	3	40	60	100
6.	20SF906	Safety in Industries	SFE	OEC	3	0	0	3	40	60	100
7.	20SF907	Food Safety	SFE	OEC	3	0	0	3	40	60	100
8.	20SF908	Safety Management and its Principles	SFE	OEC	3	0	0	3	40	60	100
9.	20SF909	Safety in Automobile Engineering	SFE	OEC	3	0	0	3	40	60	100
10.	20SF910	Safety in Transportation	SFE	OEC	3	0	0	3	40	60	100

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Department	Department of Safety and Fire Engineering	
Programme	B.E.- Safety and Fire Engineering	
List of Emerging Area for Honours		

B.E./B.TECH. Honours (specialization in the same discipline) :Verticals
Emerging Areas: Safety and Fire Engineering

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

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

ii) B.E Honours

- The students should have taken additional courses from more than one vertical of the same Programme and earned a minimum of 18 credits.
- Should have passed all the courses in the first attempt.
- 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 18credits 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 : ENVIRONMENTAL SAFETY		VERTICAL-II: OCCUPATIONAL HEALTH AND HYGIENE	
20SF881	Environmental Safety	20SF887	Industrial Ecology
20SF882	Global Warming & Climate Change	20SF862	Computer Aided Hazard Analysis
20SF883	Air Pollution Management	20SF888	Industrial Noise and Vibration Control
20SF884	Water Pollution Management	20SF861	Work Study and Ergonomics
20SF885	Solid Waste Management	20SF889	First Aid and Emergency Procedures
20SF768	Disaster Management	20SF890	Personality Management
20SF886	Environmental Sustainability	20SF891	Human Resources in Engineering
20SF866	Nuclear Safety	20SF892	Safety in Health Care Waste Management

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Department		Department of Safety and Fire Engineering								
Programme		B.E. - Safety and Fire Engineering								
LIST OF EMERGING AREA FOR HONOURS										
VERTICAL -I										
ENVIRONMENTAL SAFETY										
Sl.No.	Course Code	Course Name	Special ization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20SF881	Environmental Safety	S2	3	0	0	3	40	60	100
2.	20SF882	Global Warming & Climate Change	S2	3	0	0	3	40	60	100
3.	20SF883	Air Pollution Management	S2	3	0	0	3	40	60	100
4.	20SF884	Water Pollution Management	S2	3	0	0	3	40	60	100
5.	20SF885	Solid Waste Management	S2	3	0	0	3	40	60	100
6.	20SF768	Disaster Management	S2	3	0	0	3	40	60	100
7.	20SF886	Environmental Sustainability	S2	3	0	0	3	40	60	100
8.	20SF866	Nuclear Safety	S2	3	0	0	3	40	60	100
VERTICAL -II										
OCCUPATIONAL HEALTH AND HYGIENE										
9.	20SF887	Industrial Ecology	S6	3	0	0	3	40	60	100
10.	20SF862	Computer Aided Hazard Analysis	S6	3	0	0	3	40	60	100
11.	20SF888	Industrial Noise and Vibration Control	S6	3	0	0	3	40	60	100
12.	20SF861	Work Study and Ergonomics	S6	3	0	0	3	40	60	100
13.	20SF889	First Aid and Emergency Procedures	S6	3	0	0	3	40	60	100
14.	20SF890	Personality Management	S6	3	0	0	3	40	60	100
15.	20SF891	Human Resources in Engineering	S6	3	0	0	3	40	60	100
16.	20SF892	Safety in Health Care Waste Management	S6	3	0	0	3	40	60	100

S2- Safety Engineering
S6- Health and Hygiene

LIST OF VALUE-ADDED COURSES

Sl. No.	Course Name	Number of Hours	Offered by Internal / External
1.	Business English Certification	15	Internal / External
2.	Other Linguistic Learning like German, Japanese, etc.	15	Internal / External
3.	Fire Fighting and Training	15	Internal / External
4.	Vehicle Service Management	15	Internal / External
5.	Online Course Certification from edX/ Coursera / NPTEL, etc.	15	Internal/ External
6.	Accident and Insurance Survey	15	Internal / External
7.	Course on First Aid	15	Internal / External
8.	Introduction to Personal Protective Equipments	15	Internal / External
9.	Material Handling and its Safety	15	Internal / External
10.	Course on Intellectual Property Rights	15	Internal / External

COURSE COMPONENT SUMMARY

Sl. 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	7.41
2.	BSC	8	8	4	-	-	-	-	-	20	12.35
3.	ESC	4	11	-	-	-	-	-	-	15	9.26
4.	PCC	-	-	19	22	15	11	6	3	76	46.91
5.	PEC	-	-	-	-	-	3	6	6	15	9.26
6.	OEC	-	-	-	-	3	6	3	-	12	7.41
7.	EEC	-	-	-	-	-	1	3	6	10	6.17
8.	MC	-	1	1	-	-	-	-	-	2	1.23
TOTAL		15	23	24	22	21	21	21	15	162	100

Total No. of Credits = 162

Note: HS- Humanities and Social Sciences including Management Courses, BS- Basic Science Courses, ES-Engineering Science Courses, PC-Professional Core Courses, PE-Professional Elective Courses, OE- Open Elective Courses, EEC-Employability Enhancement Courses & MC - Mandatory Courses.

- HUMANITIES AND SOCIAL SCIENCES (HS)
- BASIC SCIENCE (BS)
- ENGINEERING SCIENCES (ES)
- PROFESSIONAL CORE (PC)
- PROFESSIONAL ELECTIVES (PE)
- OPEN ELECTIVES (OEC)
- EMPLOYABILITY ENHANCEMENT COURSES (EEC)
- MANDATORY COURSES (MC)

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

B.E. SAFETY AND FIRE ENGINEERING

CURRICULUM & SYLLABI

Regulation 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

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Department	Department of Safety and Fire Engineering	
Programme	B.E.- Safety and Fire Engineering	

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

IM1	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.
IM2	To foster and maintain mutually beneficial partnership with global industries and Institutions through knowledge sharing, collaborative research and innovation.

Vision of the Safety and Fire Engineering

DV	To emerge as a centre of excellence in Safety and Fire Engineering using the framework of quality education through advanced industry, research, entrepreneurship and society.

Mission of the Safety and Fire Engineering

DM1	To provide quality education and to prepare nationally and internationally competitive students for a successful career in safety, occupational health, environmental management and fire protection engineering.
DM2	To inculcate the need for sustainable development in research and innovations.

Programme Educational Objectives (PEOs): (Safety and Fire Engineering)

The graduates of the programme will be able to

PEO 1: Have a sound knowledge in Safety and Fire Engineering aspects to provide solutions for Potential hazards.

PEO 2: Expertise in the area of Thermal, Chemical Reactions, Structural Stability and Environmental Impacts.

PEO 3: Practice their Profession through evaluation, communication, ethics and social responsibility.

Programme Outcomes (POs) of B.E. - Safety and Fire 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 safety, health & environment with the 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 to 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 safety and fire engineering to 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	Design a safety and fire system for industries, building and other area thereby saving the loss due to a fire and accidents.
PSO2	Analyze hazards in a work place and to rectify it by suitable safety and fire engineering solutions.

		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		Department of Safety and Fire Engineering								
Programme		B.E. - Safety and Fire Engineering								
SEMESTER - I										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P		C	CA	ES
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.	20ME144	Engineering Drawing (Common to AU, ME & SF)	ESC	1	2	0	3	40	60	100
MANDATORY COURSES										
5.	20MC052	Environmental Science and Engineering	MC	3	0	0	0	40	60	100
6.	20MC151	Induction Program	MC	-	-	-	-	-	-	-
7.	20GE051	Heritage of Tamils (Common to All Branches)	MC	1	0	0	1	40	60	100
PRACTICAL										
8.	20PH028	Physics Laboratory (Common to All Branches)	BSC	0	0	3	1	60	40	100
9.	20GE028	Manufacturing Practices Laboratory (Common to AU, CE, ME & SF)	ESC	0	0	3	1	60	40	100
Total				13	3	7	16	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
THEORY										
1.	20EN251	Technical English - II (Common to All Branches)	HSMC	3	0	0	3	40	60	100
2.	20MA241	Engineering Mathematics - II (Common to AU, CE, ME & SF)	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.	20EE041	Basics of Electrical and Electronics Engineering (Common To AU, CE, CS,CDS,CDIOT, IT, ME & SF)	ESC	3	0	0	3	40	60	100
5.	20CS241	Python Programming (Common To AU, CE, EC, EE, ME & SF)	ESC	3	0	0	3	40	60	100
6.	20AU231	Fundamentals of Engineering Mechanics (Common to AU & SF)	ESC	3	1	0	4	40	60	100
MANDATORY COURSE										
7.	20GE052	Tamils and Technology (Common to All Branches)	MC	1	0	0	1	40	60	100
PRACTICAL										
8.	20CH028	Chemistry Laboratory (Common to All Branches)	BSC	0	0	3	1	60	40	100
9.	20CS227	Python Programming Laboratory (Common To AU, CE, EC, EE, ME & SF)	ESC	0	0	3	1	60	40	100
Total				18	2	7	23	900		

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Department		Department of Safety and Fire Engineering								
Programme		B.E. - Safety and Fire Engineering								
SEMESTER - III										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20SF311	Chemical Process Principles	PCC	3	0	0	3	40	60	100
2.	20SF312	Engineering Fluid Mechanics and Machinery	PCC	3	1	0	4	40	60	100
3.	20SF313	Principles of Safety Management	PCC	3	0	0	3	40	60	100
4.	20SF314	Manufacturing Technology	PCC	3	0	0	3	40	60	100
5.	20SF315	Safety in Engineering Industry	PCC	3	0	0	3	40	60	100
6.	20MA341	Statistics and Numerical Methods (Common To AU, ME & SF)	BSC	3	1	0	4	40	60	100
PRACTICAL										
7.	20SF321	Fluid Mechanics and Machinery Laboratory	PCC	0	0	3	1	60	40	100
8.	20SF322	Manufacturing Technology Laboratory	PCC	0	0	3	1	60	40	100
9.	20SF323	Safety Engineering Laboratory	PCC	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.	20SF411	Heat and Mass Transfer Operations	PCC	3	1	0	4	40	60	100
2.	20SF412	Fire Engineering Fundamentals	PCC	3	0	0	3	40	60	100
3.	20SF413	Strength of Materials	PCC	3	1	0	4	40	60	100
4.	20SF414	Electrical Safety	PCC	3	0	0	3	40	60	100
5.	20SF415	Occupational Health and First Aid	PCC	3	0	0	3	40	60	100
6.	20SF416	Safety in Construction	PCC	3	0	0	3	40	60	100
PRACTICAL										
7.	20SF421	Strength of Materials Laboratory	PCC	0	0	3	1	60	40	100
8.	20SF423	Computer Aided Machine Drawing Laboratory	PCC	0	0	3	1	60	40	100
9.	20HR492	Career Development Skills - II	EEC	0	2	0	0	60	40	100
Total				18	4	6	22	900		

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Department		Department of Safety and Fire Engineering									
Programme		B.E.-Safety and Fire Engineering									
SEMESTER - V											
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks			
				L	T	P		C	CA	ES	Total
THEORY											
1.	20HS051	Universal Human Values & Understanding Harmony (Common to All Branches)	HSMC	3	0	0	3	40	60	100	
2.	20SF511	Chemical Technology and Reaction Engineering	PCC	3	0	0	3	40	60	100	
3.	20SF513	Planning and Design of Fire Protection Systems	PCC	3	1	0	4	40	60	100	
4.	20SF514	Chemical Process Safety	PCC	3	0	0	3	40	60	100	
5.	20SF515	Safety In Textile Industry	PCC	3	0	0	3	40	60	100	
6.		Open Elective - I	OEC	3	0	0	3	40	60	100	
PRACTICAL											
7.	20SF521	Occupational Health and First Aid Laboratory	PCC	0	0	3	1	60	40	100	
8.	20SF522	Fire Safety Training	PCC	0	0	3	1	60	40	100	
9.	20HR593	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.	20SF611	Legal Aspects of Safety, Health & Environment	PCC	3	0	0	3	40	60	100
2.	20SF612	Process Instrumentation and Control	PCC	3	0	0	3	40	60	100
3.	20SF613	Structural Fire safety	PCC	3	0	0	3	40	60	100
4.		Professional Elective - I	PEC	3	0	0	3	40	60	100
5.		Open Elective - II	OEC	3	0	0	3	40	60	100
6.		Open Elective - III	OEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20SF621	Environmental Engineering and Management Laboratory	PCC	0	0	3	1	60	40	100
8.	20SF622	Fire Engineering Laboratory	PCC	0	0	3	1	60	40	100
9.	20SF623	Industrial Training and Seminar	EEC	0	0	3	1	60	40	100
10.	20HR694	Career Development Skills - IV	EEC	0	2	0	0	60	40	100
Total				18	2	9	21	1000		

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Department		Department of Safety and Fire Engineering								
Programme		B.E. - Safety and Fire Engineering								
SEMESTER - VII										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P		C	CA	ES
THEORY										
1.	20SF711	Safety in Rail and Road Transport	PCC	3	0	0	3	40	60	100
2.	20SF712	Principles of Industrial Management	HSMC	3	0	0	3	40	60	100
3.	20SF713	Life Safety in Building Fire	PCC	3	0	0	3	40	60	100
4.		Professional Elective - II	PEC	3	0	0	3	40	60	100
5.		Professional Elective - III	PEC	3	0	0	3	40	60	100
6.		Open Elective - IV	OEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20SF722	Project Phase - I	EEC	0	0	6	3	60	40	100
Total				18	0	6	21	700		

SEMESTER - VIII										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20SF811	Human Factors Engineering	PCC	3	0	0	3	40	60	100
2.		Professional Elective - IV	PEC	3	0	0	3	40	60	100
3.		Professional Elective - V	PEC	3	0	0	3	40	60	100
PRACTICAL										
4.	20SF821	Project Phase - II	EEC	0	0	12	6	60	40	100
Total				9	0	12	15	400		

List of Electives											
PROFESSIONAL ELECTIVE - I (SEMESTER - VI)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		CA	ES	Total
1.	20SF661	Power Plant Engineering	S1	PEC	3	0	0	3	40	60	100
2.	20SF662	Safety in Petroleum and Petrochemical Industries	S1	PEC	3	0	0	3	40	60	100
3.	20SF663	Food and Biosafety	S2	PEC	3	0	0	3	40	60	100
4.	20SF664	Fault Detection and Diagnosis	S2	PEC	3	0	0	3	40	60	100
5.	20SF665	Fire Dynamics	S3	PEC	3	0	0	3	40	60	100
6.	20SF666	Hazard Control in Manufacturing	S3	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE - II (SEMESTER - VII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		C	CA	ES
1.	20SF761	Automobile Engineering and Safety	S1	PEC	3	0	0	3	40	60	100
2.	20SF762	Industrial Ecology	S4	PEC	3	0	0	3	40	60	100
3.	20SF763	Hazard Identification and Risk Assessment	S2	PEC	3	0	0	3	40	60	100
4.	20SF764	Reliability Engineering	S3	PEC	3	0	0	3	40	60	100
5.	20SF765	Fluid Power Systems	S4	PEC	3	0	0	3	40	60	100
6.	20SF766	Explosives Technology and Safety	S2	PEC	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
1.	20SF767	Advanced Safety Engineering and Management	S2	PEC	3	0	0	3	40	60	100
2.	20SF768	Disaster Management	S2	PEC	3	0	0	3	40	60	100
3.	20SF769	Total Quality Management	S3	PEC	3	0	0	3	40	60	100
4.	20SF771	Intellectual Property Rights	S4	PEC	3	0	0	3	40	60	100
5.	20SF772	Entrepreneurship Development	S5	PEC	3	0	0	3	40	60	100
6.	20SF773	Statistical Methods forEngineers	S5	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE - IV (SEMESTER - VIII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		C	CA	ES
1.	20SF861	Work Study and Ergonomics	S1	PEC	3	0	0	3	40	60	100
2.	20SF862	Computer Aided Hazard Analysis	S2	PEC	3	0	0	3	40	60	100
3.	20SF863	Fire Works Safety	S2	PEC	3	0	0	3	40	60	100
4.	20SF864	Dock Safety	S3	PEC	3	0	0	3	40	60	100
5.	20SF865	Safety in Mines	S4	PEC	3	0	0	3	40	60	100
6.	20SF866	Nuclear Safety	S4	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.	20SF867	Plant Layout and Materials Handling	S3	PEC	3	0	0	3	40	60	100
2.	20SF868	OHSAS 18000 and ISO 14000	S5	PEC	3	0	0	3	40	60	100
3.	20SF869	Safety in Powder Handling	S4	PEC	3	0	0	3	40	60	100
4.	20SF871	Professional Ethics	S5	PEC	3	0	0	3	40	60	100
5.	20SF872	Aviation Safety	S2	PEC	3	0	0	3	40	60	100
6.	20SF873	Air Pollution and Control	S2	PEC	3	0	0	3	40	60	100

S1 - Thermal Engineering
S3 - Design
S5 - Management

S2 - Safety Engineering
S4 - Manufacturing Engineering

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
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	0	40	60	100

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		C	CA	ES
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
ELECTRICAL AND ELECTRONICS ENGINEERING											
37.	20EE901	Electrical Drives and Control	EE	OEC	3	0	0	3	40	60	100
38.	20EE902	Power Semiconductor Devices	EE	OEC	3	0	0	3	40	60	100
39.	20EE903	Electrical Power Generation Systems	EE	OEC	3	0	0	3	40	60	100
40.	20EE904	Control Engineering	EE	OEC	3	0	0	3	40	60	100
41.	20EE905	Industrial Automation	EE	OEC	3	0	0	3	40	60	100
42.	20EE906	Electrical Instruments and Measurements	EE	OEC	3	0	0	3	40	60	100
43.	20EE907	Energy Conservation and Management	EE	OEC	3	0	0	3	40	60	100
44.	20EE908	Electrical Wiring, Estimation and Costing	EE	OEC	3	0	0	3	40	60	100
45.	20EE909	Fundamentals of Electrical Machinery	EE	OEC	3	0	0	3	40	60	100
46.	20EE910	Principles of Soft Computing Techniques	EE	OEC	3	0	0	3	40	60	100
47.	20EE911	Embedded System Technology	EE	OEC	3	0	0	3	40	60	100
INFORMATION TECHNOLOGY											
48.	20IT901	Data Science using R	IT	OEC	3	0	0	3	40	60	100
49.	20IT902	Principles of Cyber Security	IT	OEC	3	0	0	3	40	60	100
50.	20IT903	Fundamentals of Business Intelligence	IT	OEC	3	0	0	3	40	60	100
51.	20IT904	Block chain Technologies	IT	OEC	3	0	0	3	40	60	100
52.	20IT905	Internet of Things and Applications	IT	OEC	3	0	0	3	40	60	100
53.	20IT906	Principles of Software Testing	IT	OEC	3	0	0	3	40	60	100
54.	20IT907	Foundation Skills in Logic Building	IT	OEC	3	0	0	3	40	60	100
55.	20IT908	Principles of Cloud Computing	IT	OEC	3	0	0	3	40	60	100

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks			
					L	T	P		C	CA	ES	Total
56.	20IT909	Open Source Technologies	IT	OEC	3	0	0	3	3	40	60	100
57.	20IT910	Principles of Software Engineering	IT	OEC	3	0	0	3	3	40	60	100
MECHANICAL ENGINEERING												
58.	20ME901	Basic Mechanical Engineering	MECH	OEC	3	0	0	3	3	40	60	100
59.	20ME902	Solar Energy Utilization	MECH	OEC	3	0	0	3	3	40	60	100
60.	20ME903	Production Technology of Agricultural Machinery	MECH	OEC	3	0	0	3	3	40	60	100
61.	20ME904	Selection of Materials	MECH	OEC	3	0	0	3	3	40	60	100
62.	20ME905	Marine Vehicles	MECH	OEC	3	0	0	3	3	40	60	100
63.	20ME906	Sensors and Transducers	MECH	OEC	3	0	0	3	3	40	60	100
64.	20ME907	Energy Auditing	MECH	OEC	3	0	0	3	3	40	60	100
65.	20ME908	Fibre Reinforced Plastics	MECH	OEC	3	0	0	3	3	40	60	100
66.	20ME909	Lean Manufacturing	MECH	OEC	3	0	0	3	3	40	60	100
67.	20ME910	Surface Engineering	MECH	OEC	3	0	0	3	3	40	60	100
SCIENCE AND HUMANITIES												
68.	20SH901	Applications of Statistics	FYA	OEC	3	0	0	3	3	40	60	100
69.	20SH902	Combinatorics and Graph Theory	FYA	OEC	3	0	0	3	3	40	60	100
70.	20SH903	Optimization Techniques	FYA	OEC	3	0	0	3	3	40	60	100
71.	20SH904	Basic Military Education and Training	FYA	OEC	3	0	0	3	3	40	60	100
72.	20SH905	Professional Communication	FYA	OEC	3	0	0	3	3	40	60	100
73.	20SH906	Fundamentals of Nanoscience and Technology	FYA	OEC	3	0	0	3	3	40	60	100

LIST OF OPEN ELECTIVES OFFERED BY SAFETY & FIRE ENGINEERING TO OTHER DEPARTMENTS												
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks			
					L	T	P		C	CA	ES	Total
1.	20SF901	Occupational Health and Hygiene	SFE	OEC	3	0	0	3	3	40	60	100
2.	20SF902	Construction Safety	SFE	OEC	3	0	0	3	3	40	60	100
3.	20SF903	Building Fire Safety	SFE	OEC	3	0	0	3	3	40	60	100
4.	20SF904	Safety in Electrical Engineering	SFE	OEC	3	0	0	3	3	40	60	100
5.	20SF905	Legal Aspects of Safety	SFE	OEC	3	0	0	3	3	40	60	100
6.	20SF906	Safety in Industries	SFE	OEC	3	0	0	3	3	40	60	100
7.	20SF907	Food Safety	SFE	OEC	3	0	0	3	3	40	60	100
8.	20SF908	Safety Management and its Principles	SFE	OEC	3	0	0	3	3	40	60	100
9.	20SF909	Safety in Automobile Engineering	SFE	OEC	3	0	0	3	3	40	60	100
10.	20SF910	Safety in Transportation	SFE	OEC	3	0	0	3	3	40	60	100

	K.S.R. COLLEGE OF ENGINEERING (Autonomous) (Approved by AICTE, Affiliated to Anna University & Accredited by NAAC with “A++” Grade) K.S.R. Kalvi Nagar, Tiruchengode - 637 215	CURRICULUM UG R - 2020
Department	Department of Safety and Fire Engineering	
Programme	B.E.- Safety and Fire Engineering	
List of Emerging Area for Honours		

B.E./B.TECH. Honours (specialization in the same discipline) :Verticals
Emerging Areas: Safety and Fire 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 18credits 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 : ENVIRONMENTAL SAFETY		VERTICAL-II: OCCUPATIONAL HEALTH AND HYGIENE	
20SF881	Environmental Safety	20SF887	Industrial Ecology
20SF882	Global Warming & Climate Change	20SF862	Computer Aided Hazard Analysis
20SF883	Air Pollution Management	20SF888	Industrial Noise and Vibration Control
20SF884	Water Pollution Management	20SF861	Work Study and Ergonomics
20SF885	Solid Waste Management	20SF889	First Aid and Emergency Procedures
20SF768	Disaster Management	20SF890	Personality Management
20SF886	Environmental Sustainability	20SF891	Human Resources in Engineering
20SF866	Nuclear Safety	20SF892	Safety in Health Care Waste Management

		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		Department of Safety and Fire Engineering								
Programme		B.E. - Safety and Fire Engineering								
LIST OF EMERGING AREA FOR HONOURS										
VERTICAL -I										
ENVIRONMENTAL SAFETY										
Sl.No .	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P		C	CA	ES
THEORY										
1.	20SF881	Environmental Safety	S2	3	0	0	3	40	60	100
2.	20SF882	Global Warming & Climate Change	S2	3	0	0	3	40	60	100
3.	20SF883	Air Pollution Management	S2	3	0	0	3	40	60	100
4.	20SF884	Water Pollution Management	S2	3	0	0	3	40	60	100
5.	20SF885	Solid Waste Management	S2	3	0	0	3	40	60	100
6.	20SF768	Disaster Management	S2	3	0	0	3	40	60	100
7.	20SF886	Environmental Sustainability	S2	3	0	0	3	40	60	100
8.	20SF866	Nuclear Safety	S2	3	0	0	3	40	60	100
VERTICAL -II										
OCCUPATIONAL HEALTH AND HYGIENE										
9.	20SF887	Industrial Ecology	S6	3	0	0	3	40	60	100
10.	20SF862	Computer Aided Hazard Analysis	S6	3	0	0	3	40	60	100
11.	20SF888	Industrial Noise and Vibration Control	S6	3	0	0	3	40	60	100
12.	20SF861	Work Study and Ergonomics	S6	3	0	0	3	40	60	100
13.	20SF889	First Aid and Emergency Procedures	S6	3	0	0	3	40	60	100
14.	20SF890	Personality Management	S6	3	0	0	3	40	60	100
15.	20SF891	Human Resources in Engineering	S6	3	0	0	3	40	60	100
16.	20SF892	Safety in Health Care Waste Management	S6	3	0	0	3	40	60	100

S2- Safety Engineering
 S6- Health and Hygiene

LIST OF VALUE-ADDED COURSES

S.No.	Course Code	Course Name	Number of Hours	Offered by Internal / External
1	20SFV01	Course on First Aid	15	SFE / KSRCE
2	20SFV02	Introduction to Personal Protective Equipments	15	SFE / KSRCE
3	20SFV03	Hazardous Waste Management	15	SFE / KSRCE
4	20SFV04	Air pollution Control methods and Equipments	15	SFE / KSRCE
5	20SFV05	Fire Fighting and Training	15	SFE / KSRCE

COURSE COMPONENT SUMMARY

Sl. 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	7.41
2.	BSC	8	8	4	-	-	-	-	-	20	12.35
3.	ESC	4	11	-	-	-	-	-	-	15	9.26
4.	PCC	-	-	19	22	15	11	6	3	76	46.91
5.	PEC	-	-	-	-	-	3	6	6	15	9.26
6.	OEC	-	-	-	-	3	6	3	-	12	7.41
7.	EEC	-	-	-	-	-	1	3	6	10	6.17
8.	MC	1	1	-	-	-	-	-	-	2	1.23
TOTAL		16	23	23	22	21	21	21	15	162	100

Total No. of Credits = 162

Note: HS- Humanities and Social Sciences including Management Courses, BS- Basic Science Courses, ES- Engineering Science Courses, PC-Professional Core Courses, PE-Professional Elective Courses, OE- Open Elective Courses, EEC-Employability Enhancement Courses & MC - Mandatory Courses.

- HUMANITIES AND SOCIAL SCIENCES (HS)
- BASIC SCIENCE (BS)
- ENGINEERING SCIENCES (ES)
- PROFESSIONAL CORE (PC)
- PROFESSIONAL ELECTIVES (PE)
- OPEN ELECTIVES (OEC)
- EMPLOYABILITY ENHANCEMENT COURSES (EEC)
- MANDATORY COURSES (MC)

SEMESTER - I

20EN151	TECHNICAL ENGLISH – I	L	T	P	C
	(Common to All Branches)	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 Comprehend and apply Grammar in context for professional communication.	Understand
CO2 Infer the gist and specific information.	Apply
CO3 Discuss express and interact in the society and place of study.	Create
CO4 Critically interpret and comprehend a given text.	Evaluate
CO5 Prioritize the listening skills for academic and professional purposes.	Apply

UNIT - I [09]

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

UNIT - II [09]

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

UNIT - III [09]

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

UNIT - IV [09]

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

UNIT - V [09]

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

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

Text Books:

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

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. P. Kiranmani Dutt, A course in Communication Skills, Cambridge University Press, New Delhi, First Edition, 2014.
4. M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, First Edition,2005.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : I

Regulation :R2020

Course Code : 20EN151

Course Name :TECHNICAL ENGLISH - I

CO PO MAPPING

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

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

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

R 2020

SEMESTER - I

20MA151

ENGINEERING MATHEMATICS - I

(Common to All Branches)

L	T	P	C
3	1	0	4

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

CO1 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 Applying 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 - Involute and Evolute.

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

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

UNIT -V VECTOR CALCULUS**[12]**

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

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

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

Reference Books:

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

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : I

Regulation : R2020

Course Code : 20MA151

Course Name : ENGINEERING MATHEMATICS - I

CO PO MAPPING

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	Applying 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)

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

R 2020

SEMESTER - I

20PH051

ENGINEERING PHYSICS

(Common to All Branches)

L	T	P	C
3	0	0	3

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

CO1	Describe the impact of engineering solutions in the constructional and designing environment.	Remember
CO2	Categorize the types of lasers 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

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, CO₂ 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. M.N. Avadhanulu and P.G. Kshirsagar, A text book of Engineering Physics, S. Chand and Company, New Delhi, Seventh Edition, 2014.
2. R.K. Jain & S.L. Gupta, Engineering Physics, Dhanpat Rai Publication, New Delhi, Seventh Edition, 2014.

Reference Books:

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

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : I

Regulation :R2020

Course Code : 20PH051

Course Name :ENGINEERING PHYSICS

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 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**20ME144****ENGINEERING DRAWING**

(Common to AU, ME & SF)

L	T	P	C
1	2	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	Gain knowledge on basic drafting convention and perform sketching of basic geometrical constructions and Orthographic projections of Engineering components.	Understanding
CO2	Draw orthographic projection of points, lines and plane surfaces inclined to principle planes.	Creating
CO3	Practicing projections of simple solids which are inclined to reference planes by change of position method.	Analyzing
CO4	Construct sectional views and development of surfaces of simple and truncated solids.	Creating
CO5	Prepare isometric views of simple solids and perspective projections of solids by visual ray method.	Applying

UNIT - I PLANE CURVES AND ORTHOGRAPHIC PROJECTION [09]

Introduction on drafting instruments, BIS conventions and specifications, Lettering and Dimensioning-Conics-Construction of ellipse, parabola and hyperbola by eccentricity method -Construction of cycloid-Construction of involutes-Drawing of tangents and normal to the above curves. Representation of three dimensional objects-General principles of orthographic projection- First angle projection.

UNIT - II PROJECTION OF POINTS, LINES AND PLANE SURFACES [09]

Projection of points and straight lines located in the first quadrant -Determination of true lengths and true inclinations - Projection of polygonal surface and circular lamina inclined to any one reference plane.

UNIT - III PROJECTION OF SOLIDS [09]

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT - IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES [09]

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other- Obtaining true shape of section. Development of lateral surfaces of simple and truncated solids-Prisms, pyramids, cylinders and cones.

UNIT - V ISOMETRIC AND PERSPECTIVE PROJECTIONS [09]

Principles of isometric projection - isometric scale -isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones. Perspective projection of prisms, pyramids and cylinders by visual ray method.

Total (L: 15 T: 30) = 45 Periods**Text Books:**

1. Natarajan, K.V., A text book of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 2019.
2. Kumar, M.S., Engineering Graphics, D.D. Publications, 2019.

Reference Books:

1. Venugopal & Prabhu Raja, V., Engineering Graphics, New Age International (P) Limited, 2009.
2. Bhatt, N.D., Engineering Drawing, Charotar Publishing House, Fifty Third Edition, 2014.
3. Shah, B., and Rana, B.C., Engineering Drawing, Pearson Education ,2009.
4. Gopalakrishna, K.R., Engineering Drawing (Vol.I & II), Subhas Publications, 2010.
5. Basant Agarwal and Agarwal C.M., Engineering Drawing, Tata McGraw Hill Publishing Company Limited,2018.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : I

Regulation :R2020

Course Code : 20ME144

Course Name :ENGINEERING DRAWING

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Gain knowledge on basic drafting convention and perform sketching of basic geometrical constructions and Orthographic projections of Engineering components.	3	3	2	-	1	-	-	-	-	-	-	2	-	-
CO2	Draw orthographic projection of points, lines and plane surfaces inclined to principle planes.	3	3	2	-	1	-	-	-	-	-	-	2	-	-
CO3	Practicing projections of simple solids which are inclined to reference planes by change of position method.	3	3	2	-	1	-	-	-	-	-	-	2	-	-
CO4	Construct sectional views and development of surfaces of simple and truncated solids.	3	2	2	-	1	-	-	-	-	-	-	2	-	-
CO5	Prepare isometric views of simple solids and perspective projections of solids by visual ray method.	3	2	2	-	1	-	-	-	-	-	-	2	-	-
Average		3	3	2	-	1	-	-	-	-	-	-	2	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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

R 2020

SEMESTER – I**ENVIRONMENTAL SCIENCE AND ENGINEERING****20MC052**

(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 Books:**

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

Reference Books:

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

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : I

Regulation :R2020

Course Code : 20MC052

Course Name :ENVIRONMENTAL SCIENCE AND ENGINEERING

CO PO MAPPING

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					
20MC151	INDUCTION PROGRAMME (COMMON TO ALL BRANCHES)	L	T	P	C
		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 chose one skill related to the arts whether visual arts or performing arts such as painting, music, dance, pottery, sculpture etc. The student would pursue it every day for the duration of the program. - These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would help in engineering design later.					
MODULE III : MENTORING AND CONNECTING THE STUDENTS WITH FACULTY					
- Mentoring takes place in the context and setting of <i>Universal Human Values</i>. 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 beshown 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 <i>closure</i> to the program. - Finally, a formal written or online anonymous feedback should be collected at the end of the program.					

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : I

Regulation :R2020

Course Code : 20MC151

Course Name :INDUCTION PROGRAMME

CO PO MAPPING

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**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:	Insightthinai 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, VilluPattu, KaniyanKoothu, 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 Social Life of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and RMRL - (in print)
- 2 Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukarasu) (Published by : International Institute of Tamil Studies)

Reference Books :

- 1 Social Life of the Tamils - The Classical Period (Dr.S.Sigaravelu) (Published by: International Institute of Tamil Studies).
- 2 The Contribution of the Tamil to Indian Culture (Dr.M.Valarmathi) (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 Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author)
- 5 Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu)
- 6 Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.

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

Semester I
Course Code: 20GE051

Regulation: R 2020
Course Name: Heritage of Tamils

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
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:	Insighththina 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)

SEMESTER - I / II

20GE051

தமிழர் மரபு
(அனைத்து துறைகளுக்கும் பொதுவானது)

L	T	P	C
1	0	0	1

முன்கூட்டிய துறைசார் அறிவு: தேவை இல்லை

பாடம் கற்றத்தின் விளைவுகள்: பாடத்தை வெற்றிகரமாக கற்று முடித்த பின்பு, மாணவர்களால் முடியும் விளைவுகள்

அறிவாற்றல்
நிலை

C01: தமிழ்மொழியின் செந்ததன்மை மற்றும் இலக்கியம் குறித்த தெரிதல் புரிதல்

C02: தமிழர்களின் சிற்பக்கலை, ஓவியக்கலை மற்றும் இசைக் கருவிகள் குறித்த தெளிவு புரிதல்

C03: தமிழர்களின் நாட்டுப் புரைக் கலைகள் மற்றும் வீரவிளையாட்டுகள் குறித்த தெளிவு புரிதல்

C04: தமிழர்களின் திணைக் கோட்பாடுகள், சங்ககாலவணிகம் மற்றும் சோழர்களின் வெற்றிகள் குறித்த தகவல்கள். புரிதல்

C05: 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 செவ்விலயக்கியங்கள் - 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 சமூகப்பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு - III நாட்டுப் புறக் கலைகள் மற்றும் வீர விளையாட்டுக்கள்

[03]

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் 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 பிறப்பகுதிகளில் தமிழ் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில் சித்தமருத்துவத்தின் பங்கு கல்வெட்டுகள் கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்கள்களின் அச்ச வரலாறு.

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

Text Books :

- 1 தமிழகவரலாறு-மக்களும்பண்பாடும்-கேகேபிள்ளை (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.(தொல்லியல்துறைவெளியீடு)
- 2 பொருறை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
- 3 Social Life of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and RMRL – (in print)
- 4 Social Life of the Tamils – The Classical Period (Dr.S.Sigaravelu) (Published by: International Institute of Tamil Studies).

CO-PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01:	தமிழ் மொழியின் செந்ததன்மை மற்றும் இலக்கியம் குறித்ததெரிதல்	-	-	-	-	-	-	3	3	-	2	-	3	-	-
C02:	தமிழர்களின் சிற்பக்கலை, ஓவியக்கலை மற்றும் இசைக் கருவிகள் குறித்த தெளிவு	-	-	-	-	-	-	3	3	-	2	-	3	-	-
C03:	தமிழர்களின் நாட்டுப்புரைக் கலைகள் மற்றும் வீரவிளையாட்டுகள் குறித்த தெளிவு	-	-	-	-	-	-	3	3	-	2	-	3	-	-
C04:	தமிழர்களின் திணைக் கோட்பாடுகள், சங்ககால வணிகம் மற்றும் சோழர்களின் வெற்றிகள் குறித்த தகவல்கள்.	-	-	-	-	-	-	3	3	-	2	-	3	-	-
C05:	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

20PH028

PHYSICS LABORATORY

(Common to All Branches)

L	T	P	C
0	0	3	1

Prerequisite: NIL

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

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, Twelfth Edition Chennai 2017.

References:

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

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : I

Regulation :R2020

Course Code : 20PH028

Course Name :PHYSICS LABORATORY

CO PO MAPPING

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

20GE028

MANUFACTURING PRACTICES LABORATORY
(Common to All Branches)

L	T	P	C
0	0	3	1

Prerequisite: No Prerequisites are needed for enrolling into the course.**Course Outcomes:** On successful completion of the course, the student will be able to

- CO1 Prepare green sand mould for simple patterns and carpentry components with simple joints.
 CO2 Perform welding practice to join simple structures.
 CO3 Practice simple operations in lathe and drilling machine.

Cognitive Level

Creating
 Applying
 Understanding

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

- Study of fitting, smithy, plastic moulding and glass cutting.
- Prepare a mould using solid/split patterns in Foundry.
- Make Lap joint / Butt joint / T joint from the given wooden pieces using carpentry tools.
- Make a Butt joint / Lap joint / Tee joints using arc / gas welding equipment.
- Perform simple Facing and Turning operation using Centre Lathe.
- 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	-	2Sets
3. Foundry tools and its accessories	-	5 Sets
4. Carpentry tools and its accessories	-	15 Sets
5. Arc Welding equipment's and its accessories	-	5 Sets
6. Oxy Acetylene welding setup and its accessories	-	1 Set
7. Centre Lathe with its accessories	-	2 Nos.
8. Pillar type drilling machine	-	1 No.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : I

Regulation :R2020

Course Code : 20GE028

Course Name :MANUFACTURING PRACTICES LABORATORY

CO PO MAPPING

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

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

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

R 2020

SEMESTER – I**20GE028****GROUP B (ELECTRICAL & ELECTRONICS)**
(Common to all Branches)

L	T	P	C
0	0	3	1

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

- CO1: Construct different types of wiring used in house.
 CO2: Calibrate single phase Energy meter.
 CO3: Organize different electronic components and logic gates.

Cognitive level

Apply
 Understand
 Understand

List of Experiments:**ELECTRICAL ENGINEERING**

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

ELECTRONICS ENGINEERING

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

Total : 45 Periods**K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215****DEPARTMENT OF SAFETY AND FIRE ENGINEERING****Semester : I****Regulation : R2020****Course Code : 20GE028****Course Name :MANUFACTURING PRACTICES LABORATORY****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	Organize different electronic components and logic gates.	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

20EN251

TECHNICAL ENGLISH - II
(Common to All Branches)

L	T	P	C
2	0	1	3

Prerequisite: No prerequisites are needed for enrolling into the course**Course Objectives:** On successful completion of the course, the student will be able to**Cognitive Level**

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

Understand

CO2 Identify and use Standard English in diverse situations.

Apply

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

Create

CO4 Organize and compose business letters.

Evaluate

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

Apply

UNIT - I**[09]**

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

UNIT - II**[09]**

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

UNIT - III**[09]**

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

UNIT - IV**[09]**

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

UNIT - V**[09]**

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

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

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

Reference Books:

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

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : II

Regulation : R2020

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

20MA241

ENGINEERING MATHEMATICS - II
(COMMON TO AU, CE, ME& SF)

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 analytic functions, conformal mapping and bilinear transformations.
- CO2 Solve the of Complex Integration problems.
- CO3 Solve the Fourier series problems.
- CO4 Analyze the partial differential equations and its applications.
- CO5 Apply Laplace transform, Inverse Laplace transform in the Engineering fields.

Remember

Understand

Understand

Remember

Apply

UNIT - I ANALYTIC FUNCTIONS**[12]**

Functions of a complex variable - Analytic functions - Necessary and sufficient conditions: Cauchy - Riemann Equation (excluding proof) - Harmonic functions - Construction of analytic functions (Milne Thomson method) - Conformal mapping: $w = z+c$, cz , $1/z$ and bilinear transformation.

UNIT - II COMPLEX INTEGRATION**[12]**

Complex integration - Statement and applications of Cauchy's integral theorem and Cauchy's integral formula - Laurent's series expansion - Singular points - Residues - Cauchy's residue theorem - Evaluation of real and definite integrals on unit circle and semi - circular contour (excluding poles on boundaries).

UNIT - III FOURIER SERIES**[12]**

Dirichlet's conditions - General Fourier series - Odd and Even functions - Half range sine and cosine series - Harmonic analysis.

UNIT - IV PARTIAL DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS**[12]**

Formation of partial differential equations - Lagrange's linear equation - Solutions of one-dimensional wave equation - Problems on vibrating string with zero and non - zero initial velocity - One dimensional heat equation - Problems of steady state condition with zero and non- zero boundary values.

UNIT - V LAPLACE TRANSFORMATION**[12]**

Laplace transforms - Conditions for existence - Transform of elementary functions - Basic properties- Transform of Derivatives - Initial and final value theorems (excluding proof). Transform of periodic functions. Inverse Laplace transforms (partial fraction method only) - Solution of linear ordinary differential equations of second order with constant coefficients.

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

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

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India, New Delhi, Seventh Edition, 2016.
2. Bali N.P and Manish Goyal, Engineering Mathematics, Laxmi Publications, Chennai, Seventh Edition, 2016.
3. P. Anuradha and V. Sudhakar, Transforms and Partial Differential Equations, Scitech publication, Chennai, Second edition, 2014.
4. Lan Sneddon, Elements of Partial Differential Equations, McGraw-Hill International Editions, New Delhi, Thirty Fifth Edition, 2012.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : II

Regulation :R2020

Course Code : 20MA241

Course Name :ENGINEERING MATHEMATICS - II

CO PO MAPPING

CO's	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	Apply the concepts of analytic functions, conformal mapping and bilinear transformations.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2	Solve the of Complex Integration problems.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	Solve the Fourier series problems.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	Analyze the partial differential equations and its applications.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	Apply Laplace transform, Inverse Laplace transform in the Engineering fields.	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

20CH051

ENGINEERING CHEMISTRY
(Common to All Branches)

L	T	P	C
3	0	0	3

Prerequisite: NIL

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

Cognitive Level

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

UNIT - I ADVANCED ENGINEERING MATERIALS [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 MoS₂; 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 [CoCl₄]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 its applications in medicine - chemiluminescence; Colorimetry - principle - instrumentation (block diagram only) - estimation of iron by colorimetry; principles of spectroscopy - selection rules - vibrational and rotational spectroscopy - applications; Flame photometry - principle - instrumentation (block diagram only) - estimation of sodium; Atomic absorption spectroscopy - principle - instrumentation (block diagram only) - estimation of nickel.

Total = 45 Periods

Text Books:

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

Reference Books:

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

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : II

Regulation :R2020

Course Code : 20CH051

Course Name :ENGINEERING CHEMISTRY

CO PO MAPPING

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)

SEMESTER - II

20EE041	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
	(Common To AU, CE CSD,CDIOT, CS, IT, ME & SF)	3	0	0	3

Prerequisite: Engineering Mathematics, Engineering Physics

Course Outcomes: On Completion of this course, the student will be able to	Cognitive Level
CO1 Solve the electric circuits by applying basic circuit laws for various combinations of circuit elements.	Apply
CO2 Explain the construction, operating principle and application of DC motor and transformers.	Understand
CO3 Explain the construction, operating principle and application of AC motors and Special Machines.	Understand
CO4 Illustrate the function of various measuring instruments.	Understand
CO5 Discuss the characteristics of Diodes, BJT and Digital systems.	Understand

UNIT - I ELECTRICAL CIRCUITS [09]

Structural of Electrical Power System - Ohm's Law - Kirchhoff's Laws - Circuit Analysis - Introduction to AC Circuits: R, RL & RLC series circuits, Average and RMS Value - Power and Power factor for single phase Circuits - Three Phase Star and Delta Connections - Electrical safety.

UNIT - II DC MOTOR AND TRANSFORMERS [09]

Faraday's Law - Lenz's Law - Fleming's left hand and right-hand rule, DC Motor: Construction - Operation-series and shunt motor Characteristics Applications. Single Phase Transformer: Construction - Operation - EMF Equation - Types - Applications.

UNIT - III AC MOTORS & SPECIAL MACHINES [09]

Single Phase Induction Motor: Construction - Operation - Split Phase Induction Motor and Capacitor Start Induction Run Motor - Applications, Three Phase Induction Motor: Construction - Operation - Types - Applications. Special Machines: Stepper Motor.

UNIT - IV MEASURING INSTRUMENTS [09]

Basic Methods of Measurements: Direct and Indirect, Functional elements of an instrument - Errors in measurements - Analog and Digital Instruments - Basic Principle of Indicating Instruments - Moving Coil and Moving Iron Ammeter and Voltmeter. Dynamometer type Wattmeter - Induction type Energy Meter - Cathode Ray Oscilloscope.

UNIT - V ANALOG AND DIGITAL ELECTRONICS [09]

Semiconductor devices: PN Junction Diode, Zener diode: Operation and Characteristics - Bipolar Junction Transistor -CE Configurations and its Characteristics. Review of number systems - Digital logic gates - Introduction to Microprocessors.

Total = 45 Periods

Text Books:

1. Jegathesan, V., VinothKumar, K., Saravanakumar, R., Basic Electrical and Electronics Engineering, Wiley India, New Delhi, First Edition, 2012.
2. Smarajit Ghosh, Fundamentals of Electrical and Electronics Engineering, PHI Learning Private Limited, New Delhi, Second Edition, 2007.

Reference Books:

1. Mehta, V.K and Rohit Mehta, Principle of Electrical Engineering, S Chand & Company, New Delhi, Second Edition, 2008.
2. Muthu Subramanian, R., Saliva Hanan, S., and Muralitharan, K.A., Basic Electrical, Electronics and Computer Engineering, Tata Mc - Graw Hill, New Delhi, Second Edition, 2006.
3. Nagsarkar, T.K., and Sukhija M.S., Basics of Electrical Engineering, Oxford University press, New Delhi, Ninth Edition, 2005.
4. Mahmood Nahvi and Joseph A. Edminister, Electric Circuits, Schaum Outline Series, McGraw Hill, New Delhi, Fifth Edition, 2002.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : II Regulation : R2020

Course Code : 20EE041 Course Name : BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Solve the electric circuits by applying basic circuit laws for various combinations of circuit elements.	3	2	2	-	-	-	-	-	-	-	-	1	-	-
CO2	Explain the construction, operating principle and application of DC motor and transformers.	3	3	2	-	-	2	1	1	-	-	-	1	-	-
CO3	Enlighten the construction, operating principle and application of AC motors and Special Machines.	3	2	2	-	-	2	1	1	-	-	-	1	-	-
CO4	Illustrate the function of various measuring instruments.	3	3	2	-	-	2	1	1	-	-	-	1	-	-
CO5	Discuss the characteristics of Diodes, BJT and Digital systems.	3	3	2	-	-	2	1	1	-	-	-	1	-	-
Average		3	3	2	-	-	2	1	1		-	-	1	-	-

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

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

R 2020

SEMESTER – II**20CS241****PYTHON PROGRAMMING**

(Common to AU, CE, EE, EC, ME & SF)

L	T	P	C
3	0	0	3

Prerequisite: Basic knowledge of C programming.**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. Wesley J. Chun, Core Python Programming, Pearson Education, Second Edition, 2017.
2. Mark Lutz, Learning Python, O'Reilly Media, Fifth Edition, 2013.

References:

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

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : II

Regulation :R2020

Course Code : 20CS241

Course Name :PYTHON PROGRAMMING

COPO MAPPING

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)

SEMESTER – II

20AU231	FUNDAMENTALS OF ENGINEERING MECHANICS	L	T	P	C
	(Common To AU & SF)	3	1	0	4

Prerequisite: -

Course Outcomes: On successful completion of this course, the student will be able to	Cognitive Level
CO1 Recall the fundamental knowledge on the laws of mechanics and identify the equilibrium conditions of particles to find the resultant force for the given system of forces.	Understand
CO2 Analyze the various types of supports and their reactions to different loading conditions.	Understand
CO3 Apply the parallel and perpendicular axis theorems to find out moment of inertia and polar moment of inertia of various sections.	Apply
CO4 Analyze the relation motion, curvilinear motion, projectile motion, Newton's law, D'Alembert's principle and work energy equation.	Understand
CO5 Recognize the concept of friction at the contact surfaces of various engineering systems.	Understand

UNIT - I BASICS AND STATICS OF PARTICLES [12]

Introduction - Units and dimensions - Laws of mechanics - Lami's theorem, parallelogram and triangular law of forces - Vectorial representation of forces - Vector operations of forces - additions, subtraction, dot product, cross product - Coplanar forces - rectangular components - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces - Principle of transmissibility.

UNIT - II EQUILIBRIUM OF RIGID BODIES [12]

Free body diagram - Types of supports - Action and reaction forces - stable equilibrium - Moments and couples - Moment of a force about a point and about an axis - Vectorial representation of moments and couples - Scalar components of a moment - Varignon's theorem - Single equivalent force - Equilibrium of rigid bodies in two dimensions - Equilibrium of rigid bodies in three dimensions.

UNIT - III PROPERTIES OF SURFACES AND SOLIDS [12]

Determination of areas and volumes - First moment of area and centroid of sections - simple and compound sections by using standard formula - second and product moments of plane area - simple and compound sections by using standard formula - Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia - Principal moments of inertia of plane areas - Principal axes of inertia - Mass moment of inertia.

UNIT- IV DYNAMICS OF PARTICLES [12]

Displacements, velocity and acceleration, their relationship - Relative motion - Curvilinear motion - Newton's laws of motion - D'Alembert's principle - Work energy equation - Impulse and momentum - Impact of elastic bodies.

UNIT - V FRICTION [12]

Friction force - Types of friction - Laws of Coulomb friction - Angle of repose - Simple contact friction - wedge friction, Screw friction, Rolling resistance, Ladder friction, Belt friction.

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

1. Beer, F.P and Johnston Jr. E.R., Vector Mechanics for Engineers (In SI Units): Statics and Dynamics, Tata McGraw-Hill Education, New Delhi, Eleventh Edition, 2017.
2. Vela Murali, Engineering Mechanics, Oxford University Press, New Delhi, First Edition 2010.

Reference Books:

1. Hibbeler. R.C and Ashok Gupta, Engineering Mechanics: Statics and Dynamics, Pearson Education, New Delhi, Eleventh Edition, 2010.
2. Irving H. Shames and Krishna Mohana Rao. G., Engineering Mechanics - Statics and Dynamics, Pearson Education, New Delhi, Fourth Edition, 2005.
3. Rajasekaran S and Sankar Subramanian G., Engineering Mechanics Statics and Dynamics, Vikas Publishing House Pvt. Ltd., Chennai, Third Edition, 2005.
4. Kumar, K.L., Engineering Mechanics, Tata McGraw-Hill Education, New Delhi, Third Revised Edition, 2008.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : II

Regulation :R2020

Course Code : 20AU231

Course Name :FUNDAMENTALS OF ENGINEERING MECHANICS

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	Recall the fundamental knowledge on the laws of mechanics and identify the equilibrium conditions of particles to find the resultant force for the given system of forces.	3	3	2	2	-	-	-	-	-	-	-	-	2	-
CO2	Analyze the various types of supports and their reactions to different loading conditions.	3	3	2	2	-	-	-	-	-	-	-	-	2	-
CO3	Apply the parallel and perpendicular axis theorems to find out moment of inertia and polar moment of inertia of various sections.	3	3	2	2	-	-	-	-	-	-	-	-	2	-
CO4	Analyze the relation motion, curvilinear motion, projectile motion, Newton's law, D'Alembert's principle and work energy equation.	3	3	2	2	-	-	-	-	-	-	-	-	2	-
CO5	Recognize the concept of friction at the contact surfaces of various engineering systems.	3	3	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

SEMESTER – II**20GE052****TAMILS AND TECHNOLOGY**
(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:	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 & 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) -ThirumalaiNayakar 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 beads - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT - IV AGRICULTURE AND IRRIGATION TECHNOLOGY [03]

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

UNIT - V SCIENTIFIC TAMIL & TAMIL COMPUTING [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 Social Life of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and RMRL - (in print)
- 2 Social Life of the Tamils - The Classical Period (Dr.S.Sigaravelu) (Published by: International Institute of Tamil Studies).

Reference Books :

- 1 Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukarasu) (Published by : International Institute of Tamil Studies)
- 2 The Contribution of the Tamils to Indian Culture (Dr.M.Valarmathi)(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 Studies in the History of India with Special Reference to Tamilnadu (dr.K.K.Pillay) (Published by : The Author)
- 5 Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu)
- 6 Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.

SEMESTER – II / III

20GE052

**தமிழரும் தொழில் நுட்பமும்
(அனைத்து துறைகளுக்கும் பொதுவானது)**

L	T	P	C
1	0	0	1

முன் கூட்டிய துறைசார் அறிவு : தேவை இல்லை**பாடம் கற்றத்தின் விளைவுகள் :** பாடத்தை வெற்றிகரமாக கற்று முடித்த பின்பு, மாணவர்களால் முடியும் விளைவுகள்அறிவாற்றல்
நிலை

C01: சங்ககாலத் தமிழர்களின் நெசவு மற்றும் பானைவனைதல் தொழில் நுட்பம் குறித்து கற்றுணர்தல் புரிதல்

C02: சங்ககாலத் தமிழர்களின் கட்டிட தொழில் நுட்பம் கட்டுமான பொருட்கள் மற்றும் அவற்றை விளக்கும் தளங்கள் குறித்து அறிவு புரிதல்

C03: சங்ககாலத் தமிழர்களின் உலோகத் தொழில், நாணயங்கள் மற்றும் மணிகள் சார்ந்த தொல்லியல் சான்றுகள் பற்றிய அறிவு புரிதல்

C04: சங்ககாலத் தமிழர்களின் வேளாண்மை, நீர்ப்பாசன முறைகள் மற்றும் முத்து குளித்தல் குறித்த தெளிவு புரிதல்

C05: நவீன அறிவியல் தமிழ் மற்றும் கணினி தமிழ் குறித்த புரிந்துகொள்ளும் மற்றும் பயன்படுத்தும் 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-சோழர்காலகுமிழித்தாம்பின் 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 :

B.E. - Safety and Fire Engineering

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

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : II

Regulation :R2020

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 விளக்கும் 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)

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

R 2020

SEMESTER – II

20CH028

CHEMISTRY LABORATORY
(Common To All Branches)

L	T	P	C
0	0	3	1

Prerequisite: NIL

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

Cognitive level

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

Understand
 Understand
 Understand
 Understand
 Remember

LIST OF EXPERIMENTS:

1. Conductometric Titration - Strong Acid Vs. Strong Base.
2. Conductometric Titration - Mixture of Weak and Strong Acids Vs. Strong Base.
3. Conductometric Titration - Precipitation, BaCl₂ Vs. Na₂SO₄.
4. Estimation of Ferrous ion by Potentiometry - Fe²⁺ Vs K₂Cr₂O₇.
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 Books:**

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

Reference Books:

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

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : II

Regulation :R2020

Course Code : 20CH028

Course Name :CHEMISTRY LABORATORY

CO PO MAPPING

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

20CS227

PYTHON PROGRAMMING LABORATORY

(Common to AU, CE, EE, EC, ME & SF)

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 Design simple programs using conditionals and loops.

Apply

CO2 Write functions to solve mathematical problems.

Understand

CO3 Demonstrate the use of files in python.

Analyze

CO4 Develop simple applications using python.

Create

CO5 Construct GUI applications using python programming.

Create

List of Experiments

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

Total = 45 Periods

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : II

Regulation :R2020

Course Code : 20CS227

Course Name :PYTHON PROGRAMMING LABORATORY

CO-PO MAPPING

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 - III

20SF311

CHEMICAL PROCESS PRINCIPLES

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 Define system and surrounding and apply laws of thermodynamics to solve practical engineering problems.

Remember

CO2 Explain thermodynamics of chemical reactions and solve engineering problems.

Understand

CO3 Design and explain the functioning of heat engines/pumps and refrigeration cycles.

Create

CO4 Demonstrate and explain the basics of controllers.

Understand

CO5 Explain modern methods of chemical analysis and describe the structure of metals, polymers and ceramics.

Understand

UNIT - I INTRODUCTION**[09]**

Introduction to Chemical Engineering, Chemical thermodynamics, First law, entropy and second law, Carnot cycle, Thermo dynamic functions, Maxwell relations, Joule - Thomson's expansion.

UNIT - II THERMODYNAMICS**[09]**

Thermodynamics of chemical reactions, Enthalpy change, Entropy change and free energy change, Equilibrium constant, Le-Chatelier's principle elementary reaction kinetics, Order of reactions, Effect of temperature in reaction ratio, Type of chemical reactors.

UNIT - III INSTRUMENTATION**[09]**

Instrument technology, Measurement of flow, Primary or quantity methods, Secondary or rate devices - Measurement of pressure gravitational types, Bellows, Measurement of high pressure, Measurement of low pressure- Mc - Leod vacuum gauge - Temperature - Thermometers, Bi - metal thermometers, Pyrometers, Resistance thermometer, Thermo Couples, Measurement of level and volume.

UNIT - IV PROCESS CONTROL**[09]**

Measurement of force, Strain gauge and load cells, Introduction to transducers, Automatic control, Controllers, Proportional derivative, Integral and combined modes, Final control elements and computer controls.

UNIT - V SPECTROSCOPY**[09]**

Modern methods of chemical analysis, Visible spectroscopy, UV spectroscopy, Vibrational, Nuclear magnetic resonance, Mass spectrometry, X-ray diffraction, Structure of metal, polymer and ceramics.

Total = 45 Periods**Text Books:**

1. Cengel, Y. A., & Boles, M. A., Thermodynamics - An Engineering Approach, McGraw-Hill, New York.
2. Austin, E., & Fribance, Industrial Instrumentation Fundamentals, J Wiley and Sons, 1985.

Reference Books:

1. Donald L Pavia., Gary M Lampman., George S Kriz., Introduction to Spectroscopy., Pearson Education, 2017.
2. Milo D Koretsky, Engineering and Chemical Thermodynamics., Second Edition., Wiley Publications, 2012.
3. Sonntag, R. E., Borgnakke, C., Van Wylen, G. J., & Van Wyk, S., Fundamentals of Thermodynamics., Volume Six, Wiley Publications, New York, 2003.
4. Abbott, M. M., Smith, J. M., & Van Ness, H. C., Introduction to Chemical Engineering Thermodynamics., New York., McGraw-Hill, 2001.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : III

Regulation :R2020

Course Code : 20SF311

Course Name :CHEMICAL PROCESS PRINCIPLES

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	Define system and surrounding and apply laws of thermodynamics to solve practical engineering problems.	3	3	3	2	-	-	-	2	-	-	-	-	-	1	
CO2	Explain thermodynamics of chemical reactions and solve engineering problems.	3	3	3	2	-	-	-	2	-	-	-	-	-	1-	
CO3	Design and explain the functioning of heat engines/pumps and refrigeration cycles.	3	3	3	2	-	-	-	2	-	-	-	-	-	1	
CO4	Demonstrate and explain the basics of controllers.	3	3	3	2	-	-	-	2	-	-	-	-	-	1	
CO5	Explain modern methods of chemical analysis and describe the structure of metals, polymers and ceramics.	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

SEMESTER - III

20SF312

ENGINEERING FLUID MECHANICS AND MACHINERY

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	Choose mathematical knowledge to predict the properties and characteristics of a fluid.	Apply
CO2	Compare and calculate major and minor losses associated with pipe flow in piping networks.	Analyze
CO3	Mathematically predict the nature of physical quantities.	Create
CO4	Select and apply the appropriate techniques to predict the performance behavior of turbines.	Evaluate
CO5	Demonstrate the knowledge and understand the working principle of pumps.	Understand

UNIT - I FLUID PROPERTIES AND FLOW CHARACTERISTICS [12]

Fluid properties: Mass density, Specific weight, Specific volume, Specific gravity, Viscosity, Vapour pressure, compressibility, Surface tension and capillarity. Flow characteristics - Concept of control volume - Application of continuity equation, Energy equation and momentum equation.

UNIT - II FLOW THROUGH PIPES [12]

Laminar and turbulent flow characteristics, Laminar flow through the circular pipes - Boundary layer concepts - Types of boundary layer thickness - Hydraulic and energy gradient - Darcy Weisbach equation - Friction factor - Moody diagram - Minor losses - Flow through pipes in series and parallel.

UNIT - III DIMENSIONAL AND MODEL ANALYSIS [12]

Dimensional analysis: Dimensions, Dimensional homogeneity, Methods of dimensional analysis - Buckingham Pi theorem. Model analysis - Advantages and applications of model testing. Similitude, Types of similitude - Dimensionless parameters - Application of dimensionless parameters - Model laws.

UNIT - IV HYDRAULIC TURBINES [12]

Impact of jets - Euler's equation - Theory of roto-dynamics machines - Velocity components at entry and exit of the rotor - Velocity triangles. Classification of turbines - Heads and efficiencies - Velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines - Working principles - Work done by water on the runner - Draft tube. Specific speed - Unit quantities - Performance curves for turbines.

UNIT - V HYDRAULIC PUMPS [12]

Centrifugal pumps - Working principle - Work done by the impeller - Performance curves. Reciprocating pump - Working principle - Indicator diagrams - Work saved by air vessels. Rotary pumps - Classification. Working and performance curves.

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

1. Bansal R.K, Fluid Mechanics and Hydraulic Machines, Laxmi Publications (P) Ltd., New Delhi, Ninth Edition, 2010.
2. Rajput R.K, A Text Book of Fluid Mechanics and Hydraulic Machines, S. Chand & Company Ltd., New Delhi, Fourth Edition. 2010.

Reference Books:

1. Kumar. K.L., Engineering Fluid Mechanics, Eurasia Publishing House (P) Ltd., New Delhi, Seventh Edition, 2016.
2. Modi.P.N. and Seth.S.M, Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, 20th Edition 2015.
3. Graebel. W.P, Engineering Fluid Mechanics, Taylor & Francis, Indian Reprint, 2011.
4. V.L. Streeter and Wylie E.B., Fluid Mechanics, Mc - Graw Hill, 2010.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : III

Regulation :R2020

Course Code : 20SF312

Course Name :ENGINEERING FLUID MECHANICS AND MACHINERY

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Choose mathematical knowledge to predict the properties and characteristics of a fluid.	3	-	-	-	-	-	-	-	-	1	-	1	-	-
CO2	Compare and calculate major and minor losses associated with pipe flow in piping networks.	3	2	-	-	-	-	-	-	-	1	-	-	-	-
CO3	Mathematically predict the nature of physical quantities.	3	2	-	-	1	-	-	-	-	1	-	1	-	-
CO4	Select and apply the appropriate techniques to predict the performance behavior of turbines.	3	3	-	-	-	-	-	-	-	1	-	-	-	-
CO5	Demonstrate the knowledge and understand the working principle of pumps.	3	2	-	-	2	-	-	-	-	1	-	1	-	-
Average		3	2	-	-	1	-	-	-	-	1	-	1	-	-

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

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

R 2020

SEMESTER - III

20SF313

PRINCIPLES OF SAFETY MANAGEMENT

L	T	P	C
3	0	0	3

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

CO1	<i>Demonstrate the knowledge and understanding of basic terms in safety management.</i>	Understand
CO2	<i>Understand safety organizational requirements for effective safety management.</i>	Understand
CO3	<i>Evaluate the workplace hazards and apply controls measures using hierarchy of control.</i>	Evaluate
CO4	<i>Evaluate the safety performance of an organization.</i>	Evaluate
CO5	<i>Understand accident investigation methodologies and apply systematic procedure to identify and unearth the root cause of the incident and accident.</i>	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 ACCIDENT INVESTIGATION [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 - MORT- Multi -Events Sequencing -TOR.

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. Accident Prevention Manual for Industrial Operations: National Safety Council, Chicago.
2. Willie Hammer, Occupational Safety Management and Engineering, Prentice Hall.
3. Ted S. Ferry, Modern Accident Investigation and Analysis, John Wiley & Sons.
4. John V. Grimaldi and Rollin H. Simonds, Safety Management, All India Traveller Book Seller, Delhi.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : III

Regulation :R2020

Course Code : 20SF313

Course Name :PRINCIPLES OF SAFETY MANAGEMENT

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Demonstrate the knowledge and understanding of basic terms in safety management.</i>	3	2	2	-	3	3	3	2	2	2	-	1	-	3
CO2	<i>Understand safety organizational requirements for effective safety management.</i>	3	2	2	-	3	3	3	2	2	2	-	1	-	3
CO3	<i>Evaluate the workplace hazards and apply controls measures using hierarchy of control.</i>	3	2	2	-	3	3	3	2	2	2	-	1	-	3
CO4	<i>Evaluate the safety performance of an organization.</i>	3	3	2	-	3	3	3	2	2	2	-	1	-	3
CO5	<i>Understand accident investigation methodologies and apply systematic procedure to identify and unearth the root cause of the incident and accident.</i>	3	3	2	-	3	3	3	2	2	2	-	1	-	3
Average		3	2	2	-	3	3	3	2	2	2	-	1	-	3

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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

R 2020

SEMESTER - III

20SF314

MANUFACTURING TECHNOLOGY

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	Knowledge of various engineering materials, properties and properties modification methods.	Understand
CO2	Identify the welding processes used for components manufacturing.	Apply
CO3	Utilize basic techniques to manufacture an engineering component in the foundry shop.	Apply
CO4	Recommends modern machine tools to enhance the productivity.	Evaluate
CO5	Know the metal forming and power metallurgy process for making components.	Understand

UNIT - I CASTING [09]

Casting types, procedure to make sand mould, types of core making, moulding tools, machine moulding, special moulding processes - CO2 moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

UNIT - II WELDING [09]

Welding: - Introduction, Weldability, Types of welding, Gas welding, Arc welding - Submerged arc, TIG, MIG. Resistance welding, Solid state welding, Electron beam welding, Laser beam welding, Oxygen cutting - Heat affected zones, Weld defects, Inspection of welded joints.

UNIT - III MACHINING [09]

General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe - shaper - planer - Horizontal milling machine - Universal drilling machine - cylindrical grinding machine - Capstan and turret lathe. General principles and applications of the following processes: Abrasive jet machining - Ultrasonic machining - Electric discharge machining - Electro chemical machining - Plasma arc machining - Electron beam machining and Laser beam machining.

UNIT - IV FORMING AND SHAPING OF PLASTICS [09]

Types of plastics - Characteristics of the forming and shaping processes - Moulding of Thermoplastics - Working principles and typical applications of - Injection moulding - Plunger and screw machines - Blow moulding - Rotational moulding - Film blowing - Extrusion - Typical industrial applications - Thermoforming - Processing of Thermosets - Working principles and typical applications - Compression moulding - Transfer moulding - Bonding of Thermoplastics - Fusion and solvent methods - Induction and Ultrasonic methods.

UNIT - V METAL FORMING AND POWDER METALLURGY [09]

Hot and cold forming - Forging - Rolling - Extrusion - Spinning - Wire drawing, Powder Metallurgy - Steps - Sintering - Merits - Demerits and applications - Types of dies - Progressive and combination die.

Total = 45 Periods**Text Books:**

1. P.C. Sharma, A Text Book of Production Technology: Manufacturing Processes, S. Chand Publisher, 7th Edition. 2008.
2. Hajra Choudhury, Elements of Workshop Technology, Vol. I and II, Media Promoters and Publishers Pvt.Ltd., Mumbai, 2005.

Reference Books:

1. M. Adithan and A.B. Gupta, Manufacturing Technology, New Age International (P) Ltd, 5th Edition, 2012.
2. Serope Kalpajian, Steven R. Schmid, Manufacturing Processes for Engineering Materials, 4/E, Pearson Education, Inc. 2007.
3. R.K. Jain and S.C. Gupta, Production Technology, Khanna Publishers. 16th Edition, 2001.
4. H.M.T. Production Technology - Handbook, Tata McGraw-Hill, 2000.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : III Regulation : R2020

Course Code : 20SF314 Course Name : MANUFACTURING TECHNOLOGY

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Knowledge of various engineering materials, properties and properties modification methods.	2	2	3	2	3	2	2	3	2	1	2	1	2	1
CO2	Identify the welding processes used for components manufacturing.	3	1	3	2	2	1	1	1	1	1	1	2	2	2
CO3	Utilize basic techniques to manufacture an engineering component in the foundry shop.	2	2	2	2	1	1	1	1	2	1	1	1	1	2
CO4	Recommends modern machine tools to enhance the productivity.	2	1	2	2	3	1	1	1	3	1	1	1	2	2
CO5	Know the metal forming and power metallurgy process for making components.	2	2	2	2	1	1	1	1	2	1	1	1	2	2
Average		2	2	2	2	2	2	1	1	1	2	1	1	1	2

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

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

R 2020

SEMESTER - III

20SF315	SAFETY IN ENGINEERING INDUSTRY	L	T	P	C
		3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

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

CO1	Explain the General safety rules, principles, maintenance, Inspections of metal and wood working machinery.	Understand
CO2	Apply the concepts of safety in design, use and maintenance of machines.	Apply
CO3	Learn about welding, common hazards in welding, personal protective equipment and safety precautions in welding.	Understand
CO4	Analyze the safety in cold working and hot working of metals.	Analyze
CO5	Acquire knowledge on safety in finishing, inspection and testing of machines.	Understand

UNIT - I SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES [09]

General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, Wood working machinery, types, safety principles, electrical guards - saws, types and its Hazards.

UNIT - II SAFETY IN MAINTENANCE OF MACHINES [09]

Basic Principle of Machine guarding during maintenance, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing - guard construction - guard opening. Selection and suitability: lathe - drilling - boring - milling - grinding - shaping, sawing - shearing - presses - forge hammer - flywheels - shafts - couplings - gears - sprockets wheels and chains - Pulleys and belts - benefits of good guarding systems.

UNIT - III SAFETY IN WELDING AND GAS CUTTING [09]

Gas welding and oxygen cutting, resistance welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing - explosive welding, selection, care and maintenance of the associated equipment and instruments - safety in generation, distribution and handling of industrial gases - colour coding - leak detection - Pipe line Safety - storage and handling of gas cylinders.

UNIT - IV SAFETY IN COLD FORMING AND HOT WORKING OF METALS [09]

Cold working, power presses, point of operation, safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot operated presses, power press electric controls, power press set up and die Removal, inspection and maintenance - metal shears - press brakes. Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills - hot bending of pipes, hazards and control measures. Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work environment - Material handling in foundries.

UNIT - V SAFETY IN FINISHING, INSPECTION AND TESTING [09]

Heat treatment operations, electro plating, paint shops, sand and shot blasting, safety in inspection and testing, dynamic balancing, hydro testing, valves, boiler drums and headers, pressure vessels, air leak test, steam testing, safety in radiography, personal monitoring devices, radiation hazards, Health and welfare measures in engineering industry.

Total = 45 Periods

Text Books:

1. N.V. Krishnan, Safety in Industry, Jaico Publisher House, 1996.
2. Accident Prevention Manual - NSC, Chicago, 1982.

Reference Books:

1. Safety in the Use of Wood Working Machines, HMSO, UK 1992.
2. Health and Safety in Welding and Allied Processes, Welding Institute, UK, High Tech. Publishing Ltd., London, 1989.
3. Occupational Safety Manual BHEL, Trichy, 1988.
4. Samarendra Kumar Biswas, Umesh Mathur and Swapan Kumar Hazra, Fundamentals of Process Safety Engineering, First Edition, Taylor and Francis Group.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : III

Regulation :R2020

Course Code : 20SF315

Course Name :SAFETY IN ENGINEERING INDUSTRY

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Explain the General safety rules, principles, maintenance, Inspections of metal and wood working machinery.</i>	2	3	-	3	-	3	3	2	-	-	-	2	2	3
CO2	<i>Apply the concepts of safety in design, use and maintenance of machines.</i>	2	3	-	3	-	3	3	2	-	-	-	2	2	3
CO3	<i>Learn about welding, common hazards in welding, personal protective equipment and safety precautions in welding.</i>	2	3	-	3	-	3	3	2	-	-	-	2	2	3
CO4	<i>Analyze the safety in cold working and hot working of metals.</i>	2	3	-	3	-	3	3	2	-	-	-	2	2	3
CO5	<i>Acquire knowledge on safety in finishing, inspection and testing of machines.</i>	2	3	-	3	-	3	3	2	-	-	-	2	2	3
Average		2	3	-	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 - III

20MA341

STATISTICS AND NUMERICAL METHODS

(COMMON TO B.E. AU, ME & SF)

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 Develop their skills in testing the samples by using various testing of hypothesis methods.

Remember

CO2 Analyze and infer the data using design of experiments.

Apply

CO3 Apply the numerical techniques for solving algebraic, transcendental and simultaneous equations.

Apply

CO4 Evaluate the functions by using the concepts of numerical differentiation and integration.

Evaluate

CO5 Solve the ordinary differential equations with initial conditions numerically.

Understand

UNIT – I TESTING HYPOTHESIS**[12]**

Sampling distributions - Tests for single mean, proportion, Difference of means (large and small samples) - Tests for single variance and equality of variances - Chi-Square- test - Independence of attributes.

UNIT – II DESIGN OF EXPERIMENTS**[12]**

One way and two-way classifications - Completely Randomized Design - Randomized Block Design - Latin Square Design.

UNIT – III SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS**[12]**

Solution to algebraic and transcendental equations - Newton-Raphson method, Regula-falsi method - Solutions to simultaneous linear equations - Gauss Elimination method - Gauss-Seidel method - Eigen value of a matrix by Power method.

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

Numerical differentiation using Newton's forward and backward interpolation methods - Numerical integration by Trapezoidal and Simpson's 1/3rd rule - Double integrals using trapezoidal rule and Simpson's rule.

UNIT – V INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS**[12]**

Solving first order Ordinary Differential Equations - Euler's and Modified Euler's Method - Fourth order Runge-Kutta Method - Milne's predictor and corrector method - Finite difference solution of second order ordinary differential equation.

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

1. Grewal, B.S. and Grewal, J.S., Numerical Methods in Engineering and Science, Khanna Publishers, New Delhi, Tenth Edition, 2015.
2. S.P. Gupta, Statistical Methods, Sultan Chand & Sons, New Delhi, Fortieth edition, 2014.

Reference Books:

1. Burden, R.L and Faires, J.D, Numerical Analysis, Cengage Learning, New Delhi, Ninth Edition, 2016.
2. Devore, J.L., Probability and Statistics for Engineering and the Sciences, Cengage Learning, New Delhi, Eighth Edition, 2016.
3. P. Kandasamy, K. Thilagavathy, K. Gunavathy Numerical Methods, S. Chand Company, New Delhi, Fifth edition, 2016.
4. S.R.K. Iyengar, R.K. Jain, Numerical Methods, New Age International Publishers, New Delhi, First edition, 2015.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : III

Regulation :R2020

Course Code : 20MA341

Course Name :STATISTICS AND NUMERICAL METHODS

CO PO MAPPING

CO's	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Develop their skills in testing the samples by using various testing of hypothesis methods.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2	Analyze and infer the data using design of experiments.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	Apply the numerical techniques for solving algebraic, transcendental and simultaneous equations.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	Evaluate the functions by using the concepts of numerical differentiation and integration.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	Solve the ordinary differential equations with initial conditions numerically.	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

20SF321

FLUID MECHANICS AND MACHINERY LABORATORY

L	T	P	C
0	0	3	1

Prerequisite: NIL

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

CO1	Compute the coefficient of discharge of Orifice meter and Venturi meter.	Analyze
CO2	Estimate the rate of flow of fluid by Rota meter and Pitot-tube.	Evaluate
CO3	Evaluate the major losses of fluid flow through pipes.	Evaluate
CO4	Analyze the performance of centrifugal pump, reciprocating pump and gear pump.	Analyze
CO5	Carryout the performance analysis and draw the characteristic curves of Pelton wheel, Francis turbine and Kaplan turbine.	Evaluate

Cognitive level

LIST OF EXPERIMENTS:

1. Determination of the coefficient of discharge of given Orifice meter.
2. Determination of the coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter and Pitot-tube.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristics curves of centrifugal pump.
6. Conducting experiments and drawing the characteristics curves of reciprocating pump.
7. Conducting experiments and drawing the characteristics curves of gear pump.
8. Conducting experiments and drawing the characteristics curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristics curves of Kaplan turbine.

Total: 30 Periods

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : III

Regulation : R2020

Course Code : 20SF321

Course Name : FLUID MECHANICS AND MACHINERY LABORATORY

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	Compute the coefficient of discharge of Orifice meter and Venturi meter.	3	2	-	-	2	-	-	-	-	1	-	1	-	-
CO2	Estimate the rate of flow of fluid by Rota meter and Pitot-tube.	3	-	-	-	2	-	-	-	-	1	-	-	-	-
CO3	Evaluate the major losses of fluid flow through pipes.	3	2	-	-	0	-	-	-	-	1	-	1	-	-
CO4	Analyze the performance of centrifugal pump, reciprocating pump and gear pump.	3	3	-	-	-	-	-	-	-	1	-	-	-	-
CO5	Carryout the performance analysis and draw the characteristic curves of Pelton wheel, Francis turbine and Kaplan turbine.	3	2	-	-	1	-	-	-	-	1	-	-	-	-
Average		3	3	-	-	2	-	-	-	-	1	-	1	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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

R 2020

SEMESTER – III

20SF322

MANUFACTURING TECHNOLOGY LABORATORY

L	T	P	C
0	0	3	1

Prerequisite: NIL

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

Cognitive level

CO1	Know about the various processes commonly used in manufacturing of components.	Understand
CO2	Interpretation of process plan sheets to be followed for the machining of products.	Analyze
CO3	Use of appropriate method and machine tools for performing lathe and shaper operations.	Understand
CO4	Use of appropriate method and machine tools for performing milling and slotter operations.	Understand
CO5	Use of appropriate method and machine tools for performing drilling and grinding operations.	Understand

LIST OF EXPERIMENTS:

1. LATHE

- 1.1. Facing, plain turning and step turning.
- 1.2. Taper turning and knurling operation.
- 1.3. Thread cutting operation.
- 1.4. Boring and internal thread cutting.

2. SHAPER

- 2.1. Machining to make a cube.
- 2.2. Machining to make a V-Block.

3. SLOTTING

- 3.1. Machining a internal or external key-way.

4. DRILLING

- 4.1. Drilling multiple holes at a given pitch circle on a plate.
- 4.2. Drilling, reaming and tapping.

5. MILLING

- 5.1. Plain milling
- 5.2. Gear milling

6. GRINDING

- 6.1. Cylindrical Grinding

Total: 30 Periods

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : III Regulation : R2020

Course Code : 20SF322 Course Name : MANUFACTURING TECHNOLOGY LABORATORY

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Know about the various processes commonly used in manufacturing of components.	3	2	3	-	-	2	2	-	-	-	-	-	-	-
CO2	Interpretation of process plan sheets to be followed for the machining of products.	3	2	3	-	-	2	2	-	-	-	-	-	-	-
CO3	Use of appropriate method and machine tools for performing lathe and shaper operations.	3	2	3	-	-	2	2	-	-	-	-	-	-	-
CO4	Use of appropriate method and machine tools for performing milling and slotter operations.	3	2	3	-	-	2	2	-	-	-	-	-	-	-
CO5	Use of appropriate method and machine tools for performing drilling and grinding operations.	3	2	3	-	-	2	2	-	-	-	-	-	-	-
Average		3	2	3	-	-	2	2	-	-	-	-	-	-	-

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

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

R 2020

SEMESTER – III

20SF323

SAFETY ENGINEERING LABORATORY

L	T	P	C
0	0	3	1

Prerequisite: NIL

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

Cognitive level

CO1	Understand about Personal Protective Equipment's.	Understand
CO2	Learn about the safety and environment.	Understand
CO3	Analyze the various types of accidents and its control methods.	Analyze
CO4	Learn knowledge on different types of reports and permits.	Understand
CO5	Prepare training Units on safety for workers and other classes of population in industry and society.	Create

LIST OF EXPERIMENTS:

1. Study of Personal protective equipment.
2. Assessment of the safety performance of an industry and classification of accidents.
3. Safety assessment of a construction site.
4. Environmental impact assessment and environmental audit.
5. Accident Reporting - Exercises.
6. Job safety analysis - Exercises.
7. Safety audit - Exercises, e.g., Labs, workshops, academic, administrative and residential buildings.
8. Calculation of cost of accidents.
9. Preparation of work permits.
10. Preparation of a training Unit on any topic of safety for a target audience.

Total: 30 Periods

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : III

Regulation :R2020

Course Code : 20SF323

Course Name :SAFETY ENGINEERING LABORATORY

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	Understand about Personal Protective Equipment's.	3	3	3	3	2	-	3	3	1	-	-	2	3	3
CO2	Learn about the safety and environment.	3	3	3	3	2	-	3	3	1	-	-	2	3	3
CO3	Analyze the various types of accidents and its control methods.	3	3	3	3	2	-	3	3	1	-	-	2	3	3
CO4	Learn knowledge on different types of reports and permits.	3	3	3	3	2	-	3	3	1	-	-	2	3	3
CO5	Prepare training Units on safety for workers and other classes of population in industry and society.	3	3	3	3	2	-	3	3	1	-	-	2	3	3
Average		3	3	3	3	2	-	3	3	1	-	-	2	3	3

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

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

R 2020

SEMESTER - III

20HR351

CAREER DEVELOPMENT SKILLS - I

L	T	P	C
0	2	0	0

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

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

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

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

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

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

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

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

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

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

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

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

Total (L= 0, T = 30) = 30 Periods**Text Books:**

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

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.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : III

Regulation :R2020

Course Code : 20HR351

Course Name :CAREER DEVELOPMENT SKILLS - I

CO PO MAPPING

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

20SF411	HEAT AND MASS TRANSFER OPERATIONS	L	T	P	C
	(Use of standard heat and mass transfer data book permitted)	3	1	0	4

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	Choose the concept of heat conduction in simple and composite systems.	Apply
CO2	Compare the convective heat transfer concepts.	Analyze
CO3	Solve radiation heat transfer problems.	Evaluate
CO4	Experiment the heat exchanger applications.	Apply
CO5	Explore the mass transfer concepts.	Understand

UNIT - I CONDUCTION [12]

Basic concepts - mechanism of heat transfer - conduction, convection and radiation - Fourier law of conduction - general differential equation of heat conduction - Cartesian and cylindrical coordinates - one dimensional steady state heat conduction - conduction through plane wall, cylinders and spherical systems, composite systems - unsteady heat conduction - lumped analysis - use of Heislers chart.

UNIT - II CONVECTION [12]

Basic concepts - heat transfer coefficients - boundary layer concept - types of convection - forced convection - dimensional analysis - external flow - flow over plates, cylinders and spheres - internal flow - laminar and turbulent flow - combined laminar and turbulent - flow over bank of tubes - free convection - dimensional analysis - flow over vertical plate, horizontal plate, inclined plate, cylinders and spheres.

UNIT - III RADIATION [12]

Basic concepts, laws of radiation - Stefan Boltzmann law, Kirchhoff 's law - black body radiation - grey body radiation - shape factor algebra - electrical analogy - radiation shields - introduction to gas radiation.

UNIT - IV HEAT EXCHANGER [12]

Nusselts theory of condensation - pool boiling, flow boiling, correlations in boiling and condensation. Types of heat exchangers - heat exchanger analysis - LMTD method and NTU - effectiveness - overall heat transfer coefficient - fouling factors - extended surfaces.

UNIT - V MASS TRANSFER [12]

Basic concepts - diffusion mass transfer - Fick 's law of diffusion - steady state molecular diffusion - convective mass transfer - momentum, heat and mass transfer analogy - convective mass transfer correlations.

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

Text Books:

1. Yunus Cengel and Afshin Ghajar., Heat and Mass Transfer, Tata McGraw-Hill Book, Fifth Edition. 2015.
2. P.K. Nag, Heat and Mass Transfer - II, Third Edition, Tata McGraw-Hill New Delhi, 2011.

Reference Books:

1. C.P. Kothandaraman - Fundamentals of Heat and Mass Transfer|| Revised Third Edition, New Age International Publishers- 2016.
2. Er. R.K. Rajput, Heat and Mass Transfer S. Chand Second Edition, 2011.
3. R. Rudramoorthi, K. Mailsamy - Heat and Mass Transfer|| Second Edition Pearson Education, 2011.
4. J. P. Holman. Fundamentals of Heat and Mass Transfer, McGraw-Hill, 2010.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : IV

Regulation :R2020

Course Code : 20SF411

Course Name :HEAT AND MASS TRANSFER OPERATIONS

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 concept of heat conduction in simple and composite systems.	3	2	1	-	-	1	2	-	-	-	-	1	-	-
CO2	Compare the convective heat transfer concepts.	3	2	1	-	-	1	2	-	-	-	-	1	-	-
CO3	Solve radiation heat transfer problems.	3	2	1	-	-	1	2	-	-	-	-	1	-	-
CO4	Experiment heat exchanger applications.	3	2	1	-	-	1	2	-	-	-	-	1	-	-
CO5	Explore the mass transfer concepts.	3	2	1	-	-	1	2	-	-	-	-	1	-	-
Average		3	2	1	-	-	1	2	-	-	-	-	1	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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

R 2020

SEMESTER - IV

20SF412

FIRE ENGINEERING FUNDAMENTALS

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	Demonstrate the theory of fire chemistry; learn about different kinds of combustion and their characteristics.	Understand
CO2	Learn about the products of combustion flame, heat, smoke, fire gases and their characteristics.	Analyze
CO3	Acquire the knowledge about the use and operation of fire service equipment, machineries and accessories.	Understand
CO4	Calculate the water requirement and the pump capacity for fire fighting and understand the basic fire ground operations.	Evaluate
CO5	Identify the fire ground operations and Safety in fire engineering.	Apply

UNIT - I FIRE CHEMISTRY**[09]**

Introduction-temperature, heat, specific heat, Flash point, fire point, ignition, combustion; Ignition- pilot ignition, spontaneous ignition, ignition sources; Types of combustion-rapid, spontaneous, explosion. Development of fire-incipient, smoldering, flame and heat stages; Diffusion flames-zones of combustion, smoldering combustion, characteristics of diffusion flame; Premixed flames-burning velocity, limits of flammability, explosion and expansion ratios, deflagration and detonation, characteristics of premixed flame; Explosion- physical explosion, chemical explosion; Special kinds of combustion- Flash fire, Pool fire, Deep seated fire, Spillover, Boil over, Dust explosion, BLEVE, UVCE; Classification of fire based on material.

UNIT - II COMBUSTION FLAME**[09]**

Product of combustion flame, heat, smoke, fire gases; Flame and its characteristics, spread of flames in solids and liquids, linear and three-dimensional fire propagation; spread of fire in rooms and buildings; Effect of heat exposure to human body, body burns. Smoke - constituents of smoke, quantity and rate of production of smoke, quality of smoke, smoke density, visibility in smoke, smoke movement in buildings, modelling of smoke movement; Smoke control in buildings-natural and mechanical ventilation, pressurization; Design principles of smoke control using pressurization technique; Principles of smoke vent design.

UNIT - III FIRE SERVICE EQUIPMENTS AND ACCESSORIES**[09]**

Use, operation and maintenance of fire service equipment's and accessories - Suction and delivery Hose, Hose reel, Hose fittings-coupling, adapters, branches, branch holders, radial branches, collecting heads, stand pipe, monitors, hydrants; Introduction to fire fighting vehicles and appliances- Pumps, primers, crash tenders, rescue tenders, hose laying tenders, control vans, hydraulic platforms; Ladders- extension ladders, hook ladder, turntable ladders, snorkel; Uses and maintenance of small gear and miscellaneous equipment's used during fire fighting; Lamps and lighting sets; Ropes and Lines- Types-wire and rope lines used in fire service. Use and testing of lines, knots, Bends and hitches; General rope work.

UNIT - IV FIRE STREAM PATH**[09]**

Fire stream-path, range; nozzles-types, calculation of discharge capacity, nozzle reaction; Hydraulic and energy grade lines, pressure loss or gain because of elevation, back pressure; friction losses in pipes, fire hoses and fixtures, parallel and series connections; Flow in pipes and fire hoses, branching lines; water relay techniques; Estimation of fire protection water requirements, pump capacity and other parameters relating to fire hydraulics.

UNIT - V FIRE GROUND OPERATIONS AND SAFETY**[09]**

Toxicity of smoke- effect of harmful agents preventing escape and causing injury or death - CO, CO₂, HCN, SO₂, NH₃, Nitrogen oxide. Fire ground operations-preplanning, action on arrival and control, methods of rescue, methods of entry. Personnel safety. Control procedure and use of other safety equipment. Ventilation and salvage operations.

Text Books:

1. Jain V.K., Fire Safety in Buildings, Second Edition, New Age International (P) Ltd, New Delhi., 2010.
2. Gupta R.S, A Hand book of Fire Technology, Second Edition, Universities Press.2010.

Reference Books:

1. HMSO, Manual of Fire Manship - Part -1to13 London, 1991.
2. William E Clark, Fire Fighting Principles & Practices, Fire Engineering Books & Videos, 1991.
3. Ron Hirst, Underdowns Practical Fire Pre - Cautions, Gower Publishing Company Ltd., England. 1989.
4. James F Cassey, Fire Service Hydraulics, Second Edition, Pennwell Books, 1970.

K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215**DEPARTMENT OF SAFETY AND FIRE ENGINEERING****Semester : IV****Regulation :R2020****Course Code : 20SF412****Course Name : FIRE ENGINEERING FUNDAMENTALS****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 theory of fire chemistry; learn about different kinds of combustion and their characteristics.	3	3	2	-	-	3	2	-	-	-	-	2	3	3
CO2	Learn about the products of combustion flame, heat, smoke, fire gases and their characteristics.	3	3	2	-	-	3	2	-	-	-	-	2	3	3
CO3	Acquire the knowledge about the use and operation of fire service equipment, machineries and accessories.	3	3	2	-	-	3	2	-	-	-	-	2	3	3
CO4	Calculate the water requirement and the pump capacity for fire fighting and understand the basic fireground operations.	3	3	2	-	-	3	2	-	-	-	-	2	3	3
CO5	Identify the fire ground operations and Safety in fire engineering.	3	3	2	-	-	3	2	-	-	-	-	2	3	3
Average		3	3	2	-	-	3	2	-	-	-	-	2	3	3

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

SEMESTER - IV**20SF413****STRENGTH OF MATERIALS**

L	T	P	C
3	1	0	4

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 *Acquire knowledge about Rigid, Resistant bodies, stress and strain calculation for steel bars.*
- CO2 *Relate various loads acting on various beams and its application.*
- CO3 *Grasping knowledge about deflection of beams and Buckingham failure analysis.*
- CO4 *Choose the solid and hollow shaft by torsional theory.*
- CO5 *Examine the complex stresses in two dimensions.*

*Understand**Understand**Analyze**Evaluate**Analyze***UNIT - I STRESS STRAIN DEFORMATION OF SOLIDS****[12]**

Rigid and Deformable bodies - Strength, Stiffness and Stability - Stresses; Tensile, Compressive and Shear - Deformation of simple and compound bars under axial load - Thermal stress - Elastic constants - Strain energy and unit strain energy - Strain energy in uniaxial loads.

UNIT - II BEAMS - LOADS AND STRESSES**[12]**

Types of beams: Supports and Loads - Shear force and Bending Moment in beams - Cantilever, Simply supported and Over hanging beams - Stresses in beams - Theory of simple bending - Stress variation along the length and in the beam section - Effect of shape of beam section on stress induced - Shear stresses in beams - Shear flow.

UNIT - III DEFLECTION OF BEAMS**[12]**

Elastic curve of Neutral axis of the beam under normal loads - Evaluation of beam deflection and slope: Double integration method, Macaulay Method, and Moment- Area Method - Columns - End conditions - Equivalent length of a column - Euler equation - Slenderness ratio - Rankine formula for columns.

UNIT - IV TORSION**[12]**

Analysis of torsion of circular bars - Shear stress distribution - Bars of Solid and hollow circular section - Stepped shaft - Twist and torsion stiffness - Compound shafts - Fixed and simply supported shafts - Application to close- Coiled helical springs - Maximum shear stress in spring section including Wahl Factor - Deflection of helical coil springs under axial loads - stresses in helical coil springs under torsion loads.

UNIT - V ANALYSIS OF STRESSES IN TWO DIMENSIONS**[12]**

Biaxial state of stresses - Thin cylindrical and spherical shells - Deformation in thin cylindrical and spherical shells - Biaxial stresses at a point - Stresses on inclined plane - Principal planes and stresses - Mohr 's circle for biaxial stresses - Maximum shear stress - Strain energy in bending and torsion.

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

1. Bansal R.K., Strength of Materials - II, Laxmi Publications, Sixth Edition, 2015.
2. Popov E.P, Engineering Mechanics of Solids - II, Prentice-Hall of India, New Delhi, Third Edition, 2004.

Reference Books:

1. Kazimi S.M.A, Solid Mechanics - II, Tata Mc-Graw-Hill Publishing Co. Ltd, New Delhi, Third Edition, 2004.
2. Ray Hulse, Keith Sherwin & Jack Cain, Solid Mechanics II, Palgrave ANE Books, 2004.
3. Ryder G.H, Strength of Materials - II, Macmillan India Ltd., Third Edition, 2002.
4. Nash W.A, Theory and Problems in Strength of Materials - II, Schaum Outline Series, McGraw-Hill Book Co, New York, Fourth Edition, 1998.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : IV

Regulation :R2020

Course Code : 20SF413

Course Name :STRENGTH 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	Acquire knowledge about Rigid, Resistant bodies, stress and strain calculation for steel bars.	3	3	2	3	-	1	2	-	-	-	-	1	-	-
CO2	Relate various loads acting on various beams and its application.	3	3	2	3	-	1	2	-	-	-	-	1	-	-
CO3	Grasping knowledge about Deflection of beams and Buckingham failure analysis.	3	3	2	3	-	1	2	-	-	-	-	1	-	-
CO4	Choose the solid and hallow shaft by torsional theory.	3	3	2	3	-	1	2	-	-	-	-	1	-	-
CO5	Examine the complex stresses in two dimensions.	3	3	2	3	-	1	2	-	-	-	-	1	-	-
Average		3	3	2	3	-	1	2	-	-	-	-	1	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

SEMESTER - IV**20SF414****ELECTRICALSAFETY**

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 Recall the electrical hazards and leakages with respect to electricity.
 CO2 Explain about the statutory requirements and electricity rules.
 CO3 Outline the electrical Safety during protection and maintenance.
 CO4 Make use of Electrical Systems such as Grounding, Earthing and Insulation.
 CO5 Distinguish various types of Personal Protective Equipment's and fire extinguishers used for electrical applications.

Remember
 Understand
 Understand
 Apply
 Analyze

UNIT - I ELECTRICAL HAZARDS**[09]**

Review of Electrical Concept - Electrostatic - Electromagnetism - Electrical Hazards - Energy Leakage - Clearance and Insulation - Current Surges - Electrical Causes of Fire and Explosion - Human interface with electricity - Human resistance to electricity.

UNIT - II STANDARDS AND REQUIREMENTS**[09]**

National Electrical Safety Code - Standards and Statutory Requirement's - Indian Electricity Act and Rules - Statutory requirements from electrical inspectorate - Hazardous Area and Classification of Electrical Equipment's for Hazardous Area (IS, NFPA, API and OSHA Standards) - Intrinsically safe and explosion proof electrical equipment;s.

UNIT - III ELECTRICAL PROTECTION AND MAINTENANCE**[09]**

Selection of Environment, Protection and Interlock - Discharge rods and earthing device -Safety in the use of portable tools - Preventive maintenance - First Aid - Cardio Pulmonary Resuscitation - Electrical Shocks and their prevention.

UNIT - IV ELECTRICAL GROUNDING, EARTHING AND INSULATION**[09]**

Fuses - types - selection - Advantages and disadvantages. Grounding - Neutral Grounding - Solid Grounding - resistance Grounding - Arc Suppression Coil Grounding. Equipment grounding for Safety - Grounding substation - Grounding of Line Structure. Earthing effect of electric and magnetic fields - Human safety aspects - effect of current and voltage on human beings - Insulation - Classes of Insulation - FRLS Insulation - Continuity test.

UNIT - V ELECTRICITY AND FIRE SAFETY**[09]**

Total quality control and Management, Importance of high load factor - Power factor improvement - equipment's - Importance of P.F. Improvement. Personal Protective equipment's used in safe usage of electricity like Hand Gloves, Rubber Shoes, Waist belt, earthing rod goggles etc. Static Electricity - Lightning Protection - Electrical Safety Audit.

Total = 45 Periods**Text Books:**

1. Rao, S. and Saluja, H.L., "Electrical Safety, Fire safety Engineering and Safety Management", Khanna Publishers, 1988.
2. Cooper.W. F, "Electrical Safety Engineering", Newness-Butterworth Company, 1978.

Reference Books:

1. John Codick, "Electrical Safety Hand Book" Mc Graw Hill Inc., New Delhi, 2000.
2. Charles A Gross, Fundamentals of Electrical Engineering, Taylor and Francis Group, 2012.
3. H. Wayne Beaty, Handbook for Electrical Engineers, 15th Edition, Mc Graw-Hill, 2007.
4. Donald G Fink, Standard Handbook for Electrical Engineers, 12th Edition, Mc Graw-Hill, 1987.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : IV

Regulation :R2020

Course Code : 20SF414

Course Name :ELECTRICAL SAFETY

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	Know the electrical hazards and leakages with respect to electricity.	3	-	3	-	2	3	3	-	-	-	2	3	3	3
CO2	Understand about the statutory requirements and electricity rules.	3	-	3	-	2	3	3	-	-	-	2	3	3	3
CO3	Outline the electrical Safety during protection and maintenance.	3	-	3	-	2	3	3	-	-	-	2	3	3	3
CO4	Make use of Electrical Systems such as Grounding, Earthing and Insulation.	3	-	3	-	2	3	3	-	-	-	2	3	3	3
CO5	Distinguish various types of Personal Protective Equipment's and fire extinguishers used for electrical applications.	3	-	3	-	2	3	3	-	-	-	2	3	3	3
Average		3	-	3	-	2	3	3	-	-	-	2	3	3	3

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

SEMESTER - IV**20SF415****OCCUPATIONAL HEALTH AND FIRST AID**

L	T	P	C
3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course**Course Outcomes:** On successful completion of the course, the student will be able to**Cognitive Level**CO1 *Compare the concept and spectrum of health functional units and activities of occupational health service.**Understand*CO2 *Identify physical chemical and biological hazards in the work environment and its control measures.**Apply*CO3 *React to the emergency situations.**Analyze*CO4 *Demonstrate the principles of first aid.**Understand*CO5 *Develop anatomy and functions of different human systems.**Apply***UNIT - I OCCUPATIONAL HEALTH SERVICE****[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 - Lead-Nickel, Chromium and Manganese toxicity- Gas poisoning (such as CO, ammonia, coal and dust), their effects and prevention - Industrial toxicology - Local and systemic and chronic effects, Temporary and cumulative effects - Threshold limit values, Calculation of TLVs - Carcinogens, Mutagens, Teratogens. Instruments for Radiation detection and measurement. Early recognition of radiation hazard. Personal monitoring devices, Medical support. Hazards associated with the following radiations and preventive measures - Laser, infra-red, ultra violet and ELF.

UNIT - II MEASUREMENT OF BODY 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]**

Thermal stress - Heat disorders and health effects such as heat exhaustion, Heat cramp etc. WBGT index, Acclimatization. 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. 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 - IV FIRST AID**[09]**

Aims and Objectives. First Aid principles-Role of the first aider-sequence of action on arrival at scene. Vital signs- Breathing - pulse. Introduction to the body- Basic anatomical terms- Body cavities - Head- Cranium -Thorax- Abdomen and pelvis. Biomechanics - Structure and functions of musculoskeletal systems, Tendons, Ligaments, Facia, Bone, Muscles, joints and basic mechanisms. The respiratory system- Respiratory failure - Asphyxia- Abdominal thrust in Heimlich manoeuvre. Chest injuries-types-fractured ribs - Pneumothorax- hemothorax. The nervous system - functions-components -brain - cerebrum - cerebellum- medulla oblongata -cerebra - Spinal fluid - Spinal cord-autonomic nervous system. Unconsciousness - causes-level of consciousness- management of unconscious casualty-problems of unconsciousness. Fainting - recognition - management-aftercare. Diabetes -hypoglycemia - hyperglycemia-management. Seizures (epileptic fits, convulsions) features- management, stroke. Head injuries-fractures of the base-vault and sides of skull.

UNIT - V INJURIES AND HUMAN SYSTEMS**[09]**

The circulatory system -Heart attack -Chest compression - CPR Shock - Causes- Signs and Symptoms - Management of shock. Eye - eye injuries-foreign body in eye-eye trauma - corrosive chemical in eye-arc eye. Wounds - bleeding - Classification-Types of wounds-case of wounds bleeding from special sites. Fractures- Classification of fractures - Principles of immobilization - sprains and dislocation. Broad and narrow fold bandages-hand bandages- Slings. The skin. Burns - Rule of nines-pure thermal burns. Electric burns. Chemical burns. Radiation burns. Cold burns. Poisoning. Physical fitness. Lifting - Casualty Handling. Use of Stretchers.

Text Books:

1. Jeanne Mager Stellman(ed) Encyclopedia of Occupational Health and Safety, Fourth Edition, International Labour Office, Geneva.
2. The Industrial Environment -Its Evaluation and Control, DHHS (NIOSH), 1973.

Reference Books:

1. S.K. Halder, Industrial and Occupational Health, Kindle Edition, 2017.
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. Clayton, C. Dand Clayton, F. Patty's Industrial Hygiene and Toxicology. Wiley, Inderscience, New York.

K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215**DEPARTMENT OF SAFETY AND FIRE ENGINEERING****Semester : IV Regulation :R2020****Course Code : 20SF415 Course Name :OCCUPATIONAL HEALTH AND FIRST AID****CO PO MAPPING**

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	3	3
CO2	Identify physical chemical and biological hazards in the work environment and its control measures.	3	2	2	-	-	3	2	2	-	-	-	2	3	3
CO3	React to the emergency situations.	3	2	2	-	-	3	2	2	-	-	-	2	3	3
CO4	Demonstrate the principles of first aid.	3	2	2	-	-	3	2	2	-	-	-	2	3	3
CO5	Develop anatomy and functions of different human systems.	3	2	2	-	-	3	2	2	-	-	-	2	3	3
Average		3	2	2	-	-	3	2	2	-	-	-	2	3	3

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

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

R 2020

SEMESTER - IV

20SF416

SAFETY IN CONSTRUCTION

L	T	P	C
3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

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

Cognitive Level

CO1	List out Hazards from various Construction equipment and activities.	Remember
CO2	Mention various Control measures adopted in each Construction activity to avoid Incidents.	Apply
CO3	Demonstrate the safe use of various types of ladders, Hand held power tools, Hydraulic tools used in Construction industry.	Understand
CO4	Describe various components of cranes, safety features and its function.	Create
CO5	Choose the minimum requirements of BOCW act to the Construction site when they work.	Apply

UNIT - I INTRODUCTION TO CONSTRUCTION INDUSTRY

[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- under- water works- under-pinning & shoring- 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 AND 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) Act, 1996 and Central Rules.

Reference Books:

1. K.N. Vaid (Ed.), Construction Safety Management, National Institute of Construction Management and Research, Bombay.
2. V.J. Davies & K. Tomasin, Construction Safety Handbook, Thomas Telford Publishing, London.
3. James B. Full man, Construction Safety, Security & Loss Prevention, John Wiley & Sons
4. R.T. Ratay, Handbook of Temporary Structures in Construction, Mc Graw-Hill.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : IV Regulation :R2020

Course Code : 20SF416 Course Name :SAFETY IN CONSTRUCTION

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	List out Hazards from various Construction equipment and activities.	3	2	3	2	2	-	3	-	1	-	-	2	3	3
CO2	Mention various Control measures adopted in each Construction activity to avoid Incidents.	3	2	3	2	2	-	3	-	1	-	-	2	3	3
CO3	Demonstrate the safe use of various types of ladders, Hand held power tools, Hydraulic tools used in Construction industry.	3	2	3	2	2	-	3	-	1	-	-	2	3	3
CO4	Describe various components of cranes, safety features and its function.	3	2	3	2	2	-	3	-	1	-	-	2	3	3
CO5	Choosethe minimum requirements of BOCW act to the Construction site when they work.	3	2	3	2	2	-	3	-	1	-	-	2	3	3
Average		3	2	3	2	2	-	3	-	1	-	-	2	3	3

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

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

R 2020

SEMESTER – IV

20SF421

STRENGTH OF MATERIALS LABORATORY

L	T	P	C
0	0	3	1

Prerequisite: NIL

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

- CO1 Compare the mechanical properties of materials.
 CO2 Predict the hardness of the different materials.
 CO3 Demonstrate torsion tests on ductile materials.
 CO4 Categorize the tensile strength of various materials.
 CO5 Assess the compressive strength for different types of materials.

Cognitive level

Analyze
 Create
 Understand
 Analyze
 Evaluate

LIST OF EXPERIMENTS:

1. Tension test on a mild steel rod.
2. Double shear test on Mild steel and Aluminum rods.
3. Torsion test on mild steel rod.
4. Impact test on metal specimen.
5. Hardness test on metals - Brinnell Hardness Number.
6. Hardness test on metals - Rockwell Hardness Number.
7. Deflection test on beams.
8. Compression test on ductile materials - helical spring.
9. Tension test on helical spring.
10. Compression test on brittle materials - concrete cubes.

Total: 30 Periods

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : IV Regulation : R2020

Course Code : 20SF421 Course Name : STRENGTH OF MATERIALS LABORATORY

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Compare the mechanical properties of materials.	3	2	1	-	-	2	2	-	-	-	-	1	-	-
CO2	Predict the hardness of the different materials.	3	2	1	-	-	2	2	-	-	-	-	1	-	-
CO3	Demonstrate torsion tests on ductile materials.	3	2	1	-	-	2	2	-	-	-	-	1	-	-
CO4	Categorize the tensile strength of various materials.	3	2	1	-	-	2	2	-	-	-	-	1	-	-
CO5	Assess the compressive strength for different types of materials.	3	2	1	-	-	2	2	-	-	-	-	1	-	-
Average		3	2	1	-	-	2	2	-	-	-	-	1	-	-

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

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

R 2020

SEMESTER – IV

20SF423

COMPUTER AIDED MACHINE DRAWING LABORATORY

L	T	P	C
0	0	3	1

Prerequisite: NIL

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

Cognitive level

CO1	Demonstrate graphical skills like drafting and modelling using the software packages.	Remember
CO2	Draw the engineering curves and title block with text and projection symbol.	Understand
CO3	Create 2D models of engineering components and residential building, steel truss.	Understand
CO4	Construct the sectional views and isometric projection of the solid objects.	Understand
CO5	Create, render and manipulate 3D drawings and obtain 2D drawings from 3D drawing.	Understand

LIST OF EXPERIMENTS:

1. Study of capabilities of software for Drafting and Modeling - Coordinate systems (absolute, relative, polar, etc.)
- Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, in volute using B spine or cubic spine.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc., and dimensioning.
5. Drawing of front view, top view and side view of objects from the given pictorial views (e.g., V block, base of a mixie, simple stool, objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc.
9. Drawing isometric projection of simple objects.
10. Creation of 3D models of simple objects and obtaining 2D multi-view drawings from 3D model.

Total: 30 Periods

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : IV Regulation :R2020

Course Code : 20SF423 Course Name :COMPUTER AIDED MACHINE DRAWING LABORATORY

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	Demonstrate graphical skills like drafting and modeling using the software packages.	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO2	Draw the engineering curves and title block with text and projection symbol.	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO3	Create 2D models of engineering components and residential building, steel truss.	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO4	Construct the sectional views and isometric projection of the solid objects.	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO5	Create, render and manipulate 3D drawings and obtain 2D drawings from 3D drawing.	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 - IV

20HR492

CAREER DEVELOPMENT SKILLS - II

L	T	P	C
0	2	0	0

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

CO1: Speak and write appropriately by understanding verbal and logical reasoning

Understand

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

Apply

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 = 30 Periods**Text Books:**

1. Anne Laws, Writing Skills, Orient Black Swan, Hyderabad, 2011.
2. R.V.Praveen, Quantitative Aptitude and Reasoning, PHI Learning PVT. LTD., New Delhi, 2011

Reference Books:

1. Abhijit Guha, Quantitative Aptitude, Tata McGraw Hill Education, Third Edition, New Delhi, 2020.
2. M.B. Lal&Goswami, Objective Instant, ArithmeticUpkar Publications, New Delhi, Second Edition, 2012.
3. Norman Lewis. W.R., Word Power Made Easy, Goyal Publications, 2011.
4. Agarwal. R.S., A Modern Approach to Verbal and Non-verbal Reasoning, Revised Edition 2008, Reprint 2009, S. Chand & Co Ltd., New Delhi.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : IV Regulation :R2020

Course Code : 20HR492 Course Name :CAREER DEVELOPMENT SKILLS - II

CO PO MAPPING

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

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

SEMESTER - V

20HS051	UNIVERSAL HUMAN VALUES AND UNDERSTANDING HARMONY	L	T	P	C
	(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 SAFETY AND FIRE ENGINEERING

Semester : V Regulation : R2020

Course Code : 20HS051 Course Name : UNIVERSAL HUMAN VALUES AND UNDERSTANDING HARMONY

CO PO MAPPING

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 - V

20SF511

CHEMICAL TECHNOLOGY AND REACTION ENGINEERING

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 Analyze and improve the manufacturing methods for heavy chemicals and fertilizers.
 CO2 Choose organic chemical elements like sugar, synthetic rubber, reactors and its behaviours etc.,
 CO3 Compare advance reaction technology and its function and application etc.,
 CO4 Classify the reactors and its performance.
 CO5 Perform design calculations of CSTR and PFR.

Analyze

Create

Understand

Understand

Apply

UNIT - I INORGANIC CHEMICAL TECHNOLOGY**[09]**

Inorganic chemical technology: Chlor-alkali industries-soda ash-caustic soda-chlorine hydrochloric acid. Manufacture of Sulphuric acid. Phosphorous industries - phosphoric acid-wet process phosphoric acid, electric furnace phosphoric acid, single super phosphate and triple super phosphate. Nitrogenous industries- ammonia, nitric acid, urea, ammonium sulphate, ammonium phosphate.

UNIT - II ORGANIC CHEMICAL TECHNOLOGY**[09]**

Organic chemical technology: Manufacturing processes for pulp and paper, sugar, industrial alcohol by fermentation-absolute alcohol, beers, wines, oils and fats, soaps and detergents, agrochemicals, introduction to polymers, synthetic rubbers- SBR, neoprene, urethane rubbers.

UNIT - III MECHANISM OF REACTION**[09]**

Classification of reactions, variables affecting rate of reaction, definition of reaction rate. Kinetics of homogeneous reactions - concentration dependent term of a rate equation, temperature dependent term of a rate equation, theories of reaction - collision theory, transition theory, Arrhenius equation.

UNIT - IV PERFORMANCE OF REACTOR**[09]**

Ideal reactors - Design for homogeneous systems, batch, stirred tank and tubular Flow reactor, design of reactors for multiple reactions, combination reactor system, size comparison of reactors. Elementary ideas of non-ideal reactor performance, residence time distribution curves E, F and C...

UNIT - V SELECTION OF REACTORS**[09]**

Size comparison of Single reactors, multiple reactor system, Reactions in Parallel and Series, Yield and Selectivity.

Total = 45 Periods**Text Books:**

1. Tapio Salmi and Jyri-pekka Mikkola, Chemical Reaction Engineering and Technology, CRC Press, Taylor & Francis Group, LLC, 2011.
2. Davis, Mark E. and Davis, Robert J, Fundamentals of chemical reaction engineering, McGraw-Hill, Chemical Engineering series. McGraw-Hill Higher Education, New York.

Reference Books:

1. Dr.Anil Kumar Misra, Building Materials and Construction, S. Chand Publication,2017.
2. Gopal Rao, M. and Sittig, M (Eds), Dryden's outlines of chemical technology for the 21stCentury, Affiliated East West Press, New Delhi, third edition,2010.
3. Leven spiel, O., Chemical reaction engineering, Wiley India Pvt. Ltd., New Delhi, third edition, 2010.
4. S.K.Duggal, Building Materials, New Age International (Pvt) Limited Publishers, third edition, 2000.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : V Regulation : R2020

Course Code : 20SF511 Course Name : CHEMICAL TECHNOLOGY AND REACTION ENGINEERING

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Analyze and improve the manufacturing methods for heavy chemicals and fertilizers.	3	-	-	3	3	-	3	3	-	3	3	2	3	3
CO2	Choose organic chemical elements like sugar, synthetic rubber, reactors and its behaviours etc.,	3	-	-	3	3	-	3	3	-	3	3	2	3	3
CO3	Compare advance reaction technology and its function and application etc.,	3	-	-	3	3	-	3	3	-	3	3	2	3	3
CO4	Classify the reactors and its performance.	3	-	-	3	3	-	3	3	-	3	3	2	3	3
CO5	Perform design calculations of CSTR and PFR.	3	-	-	3	3	-	3	3	-	3	3	2	3	3
Average		3	-	-	3	3	-	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 - V**20SF512****PRINCIPLES OF ENGINEERING DESIGN**

(Use of Machine design Data Book Permitted)

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 Recalling previous knowledge required to the course engineering design.

Remember

CO2 Solve various equations required to design engineering components.

Apply

CO3 Design and solve engineering design problems.

Create

CO4 Explain and design the shaft.

Understand

CO5 Construct and design vessels and storage tanks.

Apply

UNIT - I INTRODUCTION TO DESIGN**[09]**

Steps in design- design factors- practical considerations in design- theories of failure- stress concentration - consideration of creep and thermal stress in design. Detachable joints- design of screws- thread standards- pre-loading of bolts external load with pre-load -fatigue and shock loading- Types of keys- types of pins- design of cotter and pin joint.

UNIT - II RIVETED AND WELDED JOINTS**[09]**

Stresses in riveted joints- design of riveted joints subjected to central & eccentric loads boiler and tank joints - structural joints. Welded joints-types of welded joints- design of welded joints subjected to axial, torsion and bending loads.

UNIT - III SPRINGS**[09]**

Various types of springs, optimization of helical springs - Stresses in helical spring - deflection of helical compression and extension Spring - rubber springs - springs subjected to fatigue loading- concentric and helical torsion spring.

UNIT - IV POWER SHAFT**[09]**

Power Shafting- Design for static loads - Explain- combined stresses- design of shaft for strength and deflection- axial load on shaft.

UNIT - V CYLINDRICAL AND SPHERICAL VESSELS**[09]**

Design of cylindrical and spherical vessels for internal and external pressures - design of head sand enclosures- tall vessels- supports for vessels- nonstandard flanges- pipeline design. Design of storage tanks.

Total = 45 Periods**Text Books:**

1. Richard G. Budynas, J. Keith Nisbett, Shigley's Mechanical Engineering Design, Mc Graw Hill, Tenth Edition, 2011.
2. Avallone, Handbook of Mechanical Design, Mc Graw Hill, Third Edition, 2004.

Reference Books:

1. Bhandari, V.B, Design of Machine Elements, Tata Mc - Graw - Hill Education, New Delhi, Fifth Edition, 2020.
2. Bhattacharya, B.C, Introduction to Chemical Equipment Design - Mechanical Aspects, CBS Publishers and Distributors, New Delhi, 2017.
3. Mahajani, V.V. and Umarji, S.B, Joshy's Process Equipment Design, Trinity Press, New Delhi, Fifth Edition, 2014.
4. Brownell, L. E and Young, E. H, Process Equipment Design, John Wiley & Sons, New York, 2009.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : V

Regulation :R2020

Course Code : 20SF512

Course Name :PRINCIPLES OF ENGINEERING DESIGN

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Recalling previous knowledge required to the course engineering design.	2	3	-	2	-	-	-	3	-	2	-	-	3	-
CO2	Solve various equations required to design engineering components.	2	3	-	2	-	-	-	3	-	2	-	-	3	-
CO3	Design and solve engineering design problems.	2	3	-	2	-	-	-	3	-	2	-	-	3	-
CO4	Explain and design the shaft.	2	3	-	2	-	-	-	3	-	2	-	-	3	-
CO5	Construct and design vessels and storage tanks.	2	3	-	2	-	-	-	3	-	2	-	-	3	-
Average		2	3	-	2	-	-	-	3	-	2	-	-	3	-

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

SEMESTER - V**20SF513****PLANNING AND DESIGN OF FIRE PROTECTION SYSTEMS**

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 Fire Protection Systems and its Control.

Understand

CO2 Choose the Fire Fighting Equipments in the control of Fire.

Apply

CO3 Summarize the sprinklers and its types used for fire control.

Understand

CO4 Explain Fire detection and alarm systems used in fire fighting.

Understand

CO5 Demonstrate the use of Personnel Protective Equipments.

Understand

UNIT - I INTRODUCTION OF FIRE PROTECTION SYSTEMS**[09]**

Fire detection - Need and importance of automatic fire detection system, principle of detection, classification of detectors; Heat detectors - fixed temperature, rate of rise, thermistor rate of rise and rate compensated type detectors; Smoke detectors- optical and ionization type, photo electric light scattering and light obstruction type detectors; Flame detectors - infra red and ultra violet detectors; Flammable gas detection- Pellistor and laser detectors; Testing of fire detection devices as per relevant Indian standards specifications; Comparison of detectors; Performance characteristics of detectors; Lag time associated with fire detection.

UNIT - II FIRE FIGHTING EQUIPMENTS**[09]**

Hose And Hose Fitting - Detail study of hoses - coupling, branches-branch holders, Monitors - Nozzles-Stand pipes - Collecting Head - Suction hose fitting breaching. Adapters and Ramps. Portable Fire Extinguishers - Construction features - Specifications and Application-Extinguishers using water, Foam, CO₂ dry power and dry water. Foam and Foam making Equipment - Types of Foam, Properties and characteristics of good foam-practical consideration, care and maintenance.

UNIT - III FIRE CONTROL SYSTEM**[09]**

Automatic water sprinkler system- requirement and source of water supply, automatic pumps; Automatic sprinkler heads- Quartzoid type, fusible link type, modern types; mounting and protection of sprinkler heads; Sprinkler pipe works-standard and staggered lay out, hangers; Control valves for wet and dry installations; deluge valve. Drenchers; High velocity and medium velocity spray system; Principles of water sprinkler system design as per relevant standards (ISI).

UNIT - IV FIRE DETECTION AND ALARM SYSTEM**[09]**

Fire detection sensors - Fire alarm system- classification of alarm system as per NBC; Manually operated system; Automatic alarm system-Addressable and non-addressable system; Features of Local system, Auxiliary system, Remote station system, Central station system and Proprietary system.

UNIT - V PERSONNEL PROTECTIVE EQUIPMENTS**[09]**

Complete Head to Toe Protection Equipment's - Types, Construction and reliability of Head protection-Helmets, Face protection - Face shields, Body Protection - Aprons, Leg Protection - Shoes and Fall protection - Safety belts.

Total = 45 Periods**Text Books:**

1. Barendra Mohan Sen, Fire Protection and Prevention the Essential Handbook, UBS Publishers and Dist., New Delhi, 2013.
2. William E Clark, Fire Fighting Principles & Practices, Fire Engineering Books & Videos, Second Edition, 1991.

Reference Books:

1. Ron Hirst, Underdowns Practical Fire Precautions, Gower Publishing Company Ltd., England, 1989.
2. Dennis P. Nolan, Handbook of Fire and Explosion Protection Engineering, Principles for Oil, Gas, Chemical and Related Facilities, Saudi Aramco, Gulf Professional Publishing.
3. Daniel E. Della -Giustina, Fire and Safety Management Hand Book.
4. N F P A. Fire Protection Hand Book and Relevant IS codes.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : V Regulation : R2020

Course Code : 20SF513 Course Name : PLANNING AND DESIGN OF FIRE PROTECTION SYSTEMS

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	Explain the Fire Protection Systems and its Control.	3	3	3	-	-	3	-	-	-	-	-	3	3	3
CO2	Choose the Fire Fighting Equipments in the control of Fire.	3	3	3	-	-	3	-	-	-	-	-	3	3	3
CO3	Summarize the sprinklers and its types used for fire control.	3	3	3	-	-	3	-	-	-	-	-	3	3	3
CO4	Explain Fire detection and alarm systems used in fire fighting.	3	3	3	-	-	3	-	-	-	-	-	3	3	3
CO5	Demonstrate the use of Personnel Protective Equipments.	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

SEMESTER - V

20SF514

CHEMICAL PROCESS SAFETY

L	T	P	C
3	0	0	3

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

CO1	Compare between inherent safety and engineered safety and recognize the importance of safety in the design of chemical process plants.	Understand
CO2	Develop thorough knowledge about safety in the operation of chemical plants.	Apply
CO3	Apply the principles of safety in the storage and handling of gases.	Apply
CO4	Identify the conditions that lead to reaction hazards and adopt measures to prevent them.	Apply
CO5	Categorize the need for safety and analysis.	Analyze

UNIT - I SAFETY IN THE STORAGE AND HANDLING OF CHEMICALS AND GASES [09]

Types of storage-general considerations for storage layouts- atmospheric venting, pressure and temperature relief - relief valve- storage and handling of hazardous chemicals and industrial gases, safe disposal methods, reaction with other chemicals, hazards during transportation - pipe line transport - safety in chemical laboratories.

UNIT - II CHEMICAL REACTION HAZARDS [09]

Hazardous inorganic and organic reactions and processes, Reactivity as a process hazard, Detonations, Deflagrations, and Runaways, Assessment and Testing strategies, Self - heating hazards of solids, Explosive potential of chemicals, Structural groups and instability of chemicals, Thermochemical screening,

UNIT - III SAFETY IN THE DESIGN OF CHEMICAL PROCESS PLANTS [09]

Design principles -Process design development -types of designs, feasibility survey, preliminary design, Flow diagrams, piping and instrumentation diagram, batch versus continuous operation, factors in equipment scale up and design, equipment specifications - reliability and safety in designing - inherent safety - engineered safety - safety during start up and shutdown -non-destructive testing methods - pressure and leak testing - emergency safety devices - scrubbers and flares- new concepts in safety design and operation- Pressure vessel testing standards- Inspection techniques for boilers and reaction vessels.

UNIT - IV SAFETY IN THE OPERATION OF CHEMICAL PROCESS PLANTS [09]

Properties of chemicals - Material Safety Data Sheets - the various properties and formats used -methods available for property determination. Operational activities and hazards -standard operating procedures - safe operation of pumps, compressors, heaters, column, reactors, pressure vessels, storage vessels, piping systems - effects of pressure, temperature, Flow rate and humidity on operations - corrosion and control measures- condition monitoring - control valves - safety valves- pressure reducing valves, drains, bypass valves, inert gases. Chemical splashes, eye irrigation and automatic showers.

UNIT - V SAFETY AND ANALYSIS [09]

Safety vs reliability- quantification of basic events, system safety quantification, Human error analysis, Accident investigation and analysis, OSHAS 18001 and OSHMS.

Total = 45 Periods**Text Books:**

1. Maurice Jones. A, Fire Protection Systems, Jones & Bartlett Publishers, Second Edition, 2015.
2. David A Crowl & Joseph F Louvar, Chemical Process Safety, Pearson Publication, Third Edition, 2014.

Reference Books:

1. Ron Hirst, Underdowns Practical Fire Precautions, Gower Publishing Company Ltd., England, 1989.
2. Dennis P. Nolan, Handbook of Fire and Explosion Protection Engineering, Principles for Oil, Gas, Chemical and Related Facilities, Saudi Aramco, Gulf Professional Publishing.
3. Daniel E. Della -Giustina, Fire and Safety Management Hand Book.
4. NFPA Fire Protection Hand Book and Relevant IS codes.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : V Regulation : R2020

Course Code : 20SF514 Course Name : CHEMICAL PROCESS SAFETY

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	Compare between inherent safety and engineered safety and recognize the importance of safety in the design of chemical process plants.	2	3	3	-	2	-	-	-	-	-	-	3	3	3
CO2	Develop thorough knowledge about safety in the operation of chemical plants.	2	3	3	-	2	-	-	-	-	-	-	3	3	3
CO3	Apply the principles of safety in the storage and handling of gases.	2	3	3	-	2	-	-	-	-	-	-	3	3	3
CO4	Identify the conditions that lead to reaction hazards and adopt measures to prevent them.	2	3	3	-	2	-	-	-	-	-	-	3	3	3
CO5	Categorize the need for safety and analysis.	2	3	3	-	2	-	-	-	-	-	-	3	3	3
Average		2	3	3	-	2	-	-	-	-	-	-	3	3	3

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

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

R 2020

SEMESTER - V

20SF515

SAFETY IN TEXTILE INDUSTRY

L	T	P	C
3	0	0	3

Prerequisite: *Manufacturing Technology – II***Course Outcomes:** On successful completion of the course, the student will be able to**Cognitive Level**

CO1	Understand the basic concepts of textile process and its safety.	Understand
CO2	Acquire knowledge on hazards in sizing processes, looms and knitting machines.	Remember
CO3	Demonstrate on various types of mechanical finishing operations.	Understand
CO4	Analyze about the health and welfare measures in textile industry.	Analyze
CO5	Apply the relevant provisions of factories act and rules applicable to textile industry.	Apply

UNIT - I INTRODUCTION**[09]**

Introduction to process flow charts of i) short staple spinning, ii) long staple spinning, iii) viscose rayon and synthetic fibre, manufacturer, iv) spun and filament yarn to fabric manufacture, v) jute spinning and jute fabric manufacture-accident hazard, guarding of machinery and safety precautions in opening, carding, combing, drawing, flyer frames and ring frames, doubles, rotor spinning, winding, warping, softening/spinning specific to jute.

UNIT - II TEXTILE HAZARDS-I**[09]**

Accident hazards i) sizing processes - cooking vessels, transports of size, hazards due to steam ii) Loom shed - shuttle looms and shuttles looms iii) knitting machines iv) non-woven's

UNIT - III TEXTILE HAZARDS-II**[09]**

Scouring, bleaching, dyeing, punting, mechanical finishing operations and effluents in textile processes.

UNIT - IV HEALTH AND WELFARE**[09]**

Health hazards in textile industry related to dust fly and noise generated - control measures - relevant occupational diseases, personal protective equipment - health and welfare measures specific to textile industry, Special precautions for specific hazardous work environments.

UNIT - V SAFETY STATUS**[09]**

Relevant provision of factories act and rules and other statues applicable to textile industry - effluent treatment and waste disposal in textile industry.

Total = 45 Periods**Text Books:**

1. "Safety in Textile Industry" Thane Belapur Industries Association, Mumbai.
2. 100 Textile fibres - analysis, findings and recommendations LPA.

Reference Books:

1. Groover and Henry DS, "Hand book of textile testing and quality control".
2. "Quality tolerances for water for textile industry", BIS.
3. Shenai, V.A. "A technology of textile processing", Vol. I, Textile Fibers.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : V Regulation : R2020

Course Code : 20SF515 Course Name : SAFETY IN TEXTILE INDUSTRY

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 basic concepts of textile process and its safety.	2	3	3	-	2	-	-	-	-	-	-	3	3	3
CO2	Acquire knowledge on hazards in sizing processes, looms and knitting machines.	2	3	3	-	2	-	-	-	-	-	-	3	3	3
CO3	Demonstrate on various types of mechanical finishing operations.	2	3	3	-	2	-	-	-	-	-	-	3	3	3
CO4	Analyze about the health and welfare measures in textile industry.	2	3	3	-	2	-	-	-	-	-	-	3	3	3
CO5	Apply the relevant provisions of factories act and rules applicable to textile industry.	2	3	3	-	2	-	-	-	-	-	-	3	3	3
Average		2	3	3	-	2	-	-	-	-	-	-	3	3	3

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

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

R 2020

SEMESTER – V

20SF521

OCCUPATIONAL HEALTH AND FIRST AID LABORATORY

L	T	P	C
0	0	3	1

Prerequisite: NIL

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

- CO1 Experiment the operation and the use of respirable dust sampler.
 CO2 Find the Noise level and illumination level at different areas.
 CO3 Experiment the CPR and first aid techniques.
 CO4 Explain the different types burns and its types. bandages used for fractures.
 CO5 Compare the respiratory protection

Cognitive level

Apply
 Remember
 Apply
 Understand
 Understand

LIST OF EXPERIMENTS:

1. To study about the operation and the use of respirable dust samples in an area or region.
2. To find out the air samples in the individual area using the respirable sampler.
3. To find out the Noise at different areas and to compare with the standards,
4. To study the illumination level at different regions.
5. To Study about the CPR technique (Cardio Pulmonary Resuscitation)
6. To Study and learn about the first aid kit.
7. To study about the first aid equipment's used in an ambulance.
8. To learn and practice about the usage of bandages for fractures.
9. To study about the Respiratory Protection and its types.
10. To study about the burn and its types.

Total: 30 Periods

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : V Regulation : R2020

Course Code : 20SF521 Course Name : OCCUPATIONAL HEALTH AND FIRST AID LABORATORY

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Experiment the operation and the use of respirable dust sampler.	3	-	3	2	-	3	3	3	-	-	-	3	2	3
CO2	Find the Noise level and illumination level at different areas.	3	-	3	2	-	3	3	3	-	-	-	3	2	3
CO3	Experiment the CPR and first aid techniques.	3	-	3	2	-	3	3	3	-	-	-	3	2	3
CO4	Explain the different types burns and its types. bandages used for fractures.	3	-	3	2	-	3	3	3	-	-	-	3	2	3
CO5	Compare the respiratory protection	3	-	3	2	-	3	3	3	-	-	-	3	2	3
Average		3	-	3	2	-	3	3	3	-	-	-	3	2	3

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

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

R 2020

SEMESTER – V

20SF522

FIRE SAFETY TRAINING

L	T	P	C
0	0	3	1

Prerequisite: NIL

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

- CO1 Explain the types of fire hydrant nozzle, boxes and hoses.
 CO2 Experiment the different types of fire extinguishers.
 CO3 Classify the fire hoses, couplings and branches.
 CO4 Explain the hoses, couplings connection and its disconnection.
 CO5 Demonstrate on fire fighting.

Cognitive level

Understand
 Apply
 Understand
 Understand
 Understand

LIST OF EXPERIMENTS:

1. Study and demonstration of different types of Hydrant Nozzles, Boxes and Hoses.
2. Study and demonstration about Fire Hydrant System.
3. Fire Fighting with CO₂ extinguisher.
4. Fire fighting with water type extinguisher.
5. Fire Fighting with DCP extinguisher.
6. Fire fighting with foam extinguisher.
7. Study about Refilling different types of extinguishers.
8. Study and demonstration of fire hoses, couplings and branches.
9. Hose drills (dry) - laying one hose, connection and disconnection couplings.
10. Table top exercise-scenario based fire fighting.

Total: 30 Periods

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : V

Regulation :R2020

Course Code : 20SF522

Course Name :FIRE SAFETY TRAINING

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	Explain the types of fire hydrant nozzle, boxes and hoses.	3	2	3	-	-	2	-	3	-	-	-	3	3	3
CO2	Experiment the different types of fire extinguishers.	3	2	3	-	-	2	-	3	-	-	-	3	3	3
CO3	Classify the fire hoses, couplings and branches.	3	2	3	-	-	2	-	3	-	-	-	3	3	3
CO4	Explain the hoses, couplings connection and its disconnection.	3	2	3	-	-	2	-	3	-	-	-	3	3	3
CO5	Demonstrate on fire fighting.	3	2	3	-	-	2	-	3	-	-	-	3	3	3
Average		3	2	3	-	-	2	-	3	-	-	-	3	3	3

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

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

R 2020

SEMESTER - V

20HR593

CAREER DEVELOPMENT SKILLS - III

L	T	P	C
2	0	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 Understand the nearness of leading various texts.
 CO2 Perform well in verbal and logical reasoning.
 CO3 Understand and develop the etiquette necessary to present oneself in a professional setting.
 CO4 Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.
 CO5 Enhance the comprehension Skills in core subjects.

Apply

Apply

Understand

Create

Apply

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

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

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

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

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

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

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

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

UNIT - V DOMAIN PROFICIENCY**[06]**

Fundamentals of electric circuits, Construction and operation of Electrical machines, Electrodynamical fields and field equation solution, Introduction to Non-conventional energy sources.

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

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : V

Regulation :R2020

Course Code : 20HR593

Course Name :CAREER DEVELOPMENT SKILLS - III

CO PO MAPPING

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

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

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

R 2020

SEMESTER - VI

20SF611

LEGAL ASPECTS OF SAFETY, HEALTH & ENVIRONMENT

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 provisions related to the Factories Act.

Understand

CO2 Recall the Dock Workers Safety, Health and Welfare Act.

Remember

CO3 Relate the regulations related to the Explosives Act.

Understand

CO4 Summarize the Workmen's Compensation Act.

Understand

CO5 Conclude about the Water and Air Act.

Analyze

UNIT – I FACTORIES ACT**[09]**

Definitions, Preliminary, inspecting staff, Health, Safety, Provisions relating to hazardous processes, welfare, working hours of adults, Employment of young persons, Special provisions, Penalties, Supplemental.

UNIT – II DOCK WORKERS (SAFETY, HEALTH AND WELFARE) ACT**[09]**

Powers of Inspectors, Power of Govt. to direct Inquiry, Obligation of Dock workers, General Provisions relating to rules and regulations. Dock workers (SHW) Rules- Definitions, Inspection Procedure, Inquiry into certain accidents, advisory Committee, Inquiry in Public. Dock workers (SHW) Regulations- Definitions, Power of Inspectors. Penalties, Responsibilities, Safety Officers, Reporting of accidents, Emergency Action Plan, Safety Committee, Occupational Health services for dock workers, various safety and health regulations in brief.

UNIT – III EXPLOSIVES ACT**[09]**

Definitions, grant of license, notice of accidents, inquiry into ordinary and serious accidents, punishment for offences, extension of definition to other explosive substances. petroleum act - definitions, control over petroleum import, transport, storage, production, refining and blending, need for license, exemption. inspection and sampling for testing, notice of accidents and inquiries. petroleum rules - definitions, brief idea on the rules relating to safety aspects in transport, storage, refining and blending of petroleum, notice of accidents.

UNIT – IV WORKMEN'S COMPENSATION ACT**[09]**

ESI Act & Rules. Public Liability Act & Rules- Substantive provisions in the above Acts and Rules- Short title, extent and commencement - definitions - Employer's Liability for compensation - Amount of compensation - Compensation to be paid for default - Power to require regarding fatal accident's - Report of fatal accidents and serious bodily injury - Medical Examination -Penalties - Power of commissioner - Appeals.

UNIT – V WATER AND AIR 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, safety information to public.

Total = 45 Periods**Text Books:**

1. The Factories Act 1948, Madras Book Agency, Chennai, 2000.
2. The Dock Worker's (Regulation of Employment) Act 1948, Professional Book Publisher's, 2022.

Reference Books:

1. The Explosives Act 1884, Commercial Law Publishers (India) Pvt Ltd., New Delhi, 2022.
2. P.L. Malik., The Workmen's Compensation Act, 1923, The Eastern Book Company, Sixth Edition, 2012.
3. The Environment Act (Protection) 1986, Commercial Law Publishers (India) Pvt. Ltd., New Delhi, Second Edition, 2019.
National seminar on hazardous waste management, National Safety council, Ministry of environment and forests,
4. Government of India, United State - Asia environmental partnership, Tamilnadu pollution control board and Indian chemical manufacturers association, April 2009.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VI

Regulation :R2020

Course Code : 20SF611

Course Name :LEGAL ASPECTS OF SAFETY, HEALTH & ENVIRONMENT

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	Explain the provisions related to the Factories Act.	3	3	3	3	-	3	3	3	-	3	2	3	2	3
CO2	Recall the Dock Workers Safety, Health and Welfare Act.	3	3	3	3	-	3	3	3	-	3	2	3	2	3
CO3	Relate the regulations related to the Explosives Act.	3	3	3	3	-	3	3	3	-	3	2	3	2	3
CO4	Summarize the Workmen's Compensation Act.	3	3	3	3	-	3	3	3	-	3	2	3	2	3
CO5	Conclude about the Water and Air Act.	3	3	3	3	-	3	3	3	-	3	2	3	2	3
Average		3	3	3	3	-	3	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 - VI

20SF612

PROCESS INSTRUMENTATION AND CONTROL

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	Define about the measurement principles and techniques of measuring temperature and pressure.	Remember
CO2	Illustrate suitable methods for the measurement of flow, level, pH and humidity.	Understand
CO3	Compare the open loop and closed loop control system.	Understand
CO4	Categorize the stability of a control system.	Analyze
CO5	Classify on hazards associated with various methods of control.	Analyze

UNIT - I ELEMENTS OF MEASUREMENT [09]

Fundamental standards, Quality of measurement, Meaning of measurement, Errors in measuring instruments, Precision and accuracy, Calibration principle, Static and dynamic characteristics of measuring instruments. Measurement of temperature - Bimetallic and pressure thermometers, Thermocouples, Resistance thermometers, Pyrometry, Calibration. Pressure and vacuum measurement - Manometers, Measuring element, Absolute pressure measurement, Static accuracy of pressure gauges.

UNIT - II FLOW MEASUREMENT [09]

Orifice installation, Pitot tube, Area flow meters, Open channel meters. Level measurement - Direct method, Measurement of level in open and pressure vessels. Measurement of pH and humidity. Recording Instruments, Indicating and signaling instruments, Signal transmission, and codes.

UNIT - III OPEN AND CLOSED LOOP SYSTEMS [09]

Transfer function modeling - block diagram representation of mechanical, thermal and liquid level systems. Transient response analysis - Time response of first and second order system for impulse and step inputs - Effect of damping factors on transient response - Characteristics of proportional, integral, derivative, PI, PD and PID controllers. Frequency response method of analysis - polar plot - Bode Plot.

UNIT - IV INTRODUCTION TO STABILITY [09]

Introduction to stability - Definition via impulse response function - Routh-Hurwitz stability criterion - Nyquist stability criterion - Smith Predictor - Control of distillation towers and heat exchangers - Introduction to computer control of chemical processes.

UNIT - V CONTROL SYSTEM COMPONENTS [09]

Control system components - error detectors - modulators and demodulators - Hydraulic controllers - Pneumatic controllers - PLC. Introduction to computer control in chemical process industry. Comparison between discrete data, digital and analogue control systems. Introduction to digital signal processing.

Total = 45 Periods**Text Books:**

1. Ogata, K., Modern Control Engineering, Prentice Hall, 2010.
2. Johnson C. D., Process control instrumentation technology. Pearson Education Limited, 2013.

Reference Books:

1. Douglas O de Sa., Instrumentation fundamentals for process control. CRC Press, 2001.
2. Dunn, Fundamentals of industrial instrumentation and process control. Tata McGraw- Hill Education, 2005.
3. Kallen H. P. (Ed), Handbook of instrumentation and control. New York: McGraw-Hill Book Company, 1961.
4. Douglas O de Sa, Instrumentation fundamentals for process control. CRC Press, 2001.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VI

Regulation :R2020

Course Code : 20SF612

Course Name :PROCESS INSTRUMENTATION AND CONTROL

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Define about the measurement principles and techniques of measuring temperature and pressure.	3	2	3	-	3	3	2	3	-	-	-	3	-	3
CO2	Illustrate suitable methods for the measurement of flow, level, pH and humidity.	3	2	3	-	3	3	2	3	-	-	-	3	-	3
CO3	Compare the open loop and closed loop control system.	3	2	3	-	3	3	2	3	-	-	-	3	-	3
CO4	Categorize the stability of a control system.	3	2	3	-	3	3	2	3	-	-	-	3	-	3
CO5	Classify on hazards associated with various methods of control.	3	2	3	-	3	3	2	3	-	-	-	3	--	3
Average		3	2	3	-	3	3	2	3	-	-	-	3	-	3

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

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

R 2020

SEMESTER - VI

20SF613

STRUCTURAL FIRE SAFETY

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 Classify the building and its hazards.

Understand

CO2 Choose the process of emergency.

Apply

CO3 Conclude on the evacuation routes and exits.

Analyze

CO4 Develop the economical evaluation of fire safety.

Apply

CO5 Summarize on the inspection of fire safety.

Understand

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

Classification of building based on occupancy. Residential - Educational - Institutional -Assembly - business - Mercantile - Industrial - storage - hazardous. General Requirements.

UNIT - II**EMERGENCY EVACUATION****[09]**

Process of emergency evacuation - special features of personnel movement. Parameter characteristics of the movement of people -practical methods of designing evacuation passages and exists. Evacuations exist and routes - stages of evacuation.

UNIT - III**EVACUATION ROUTES AND EXITS****[09]**

Planning of evacuation routes and exits - Seating arrangement - Passages and corridors - Stairs - Smoke proof stairs - External fire escape ladders.

UNIT - IV**ECONOMICAL EVACUATION OF FIRE SAFETY****[09]**

Technical economical evacuation of fire safety - special fire protection features for modern buildings - Ensuring fire safety and capital investment - Evaluation of cost effectiveness - Case study.

UNIT - V**INSPECTION OF FIRE SAFETY****[09]**

Training and education, Arson, Fire safety audits, Risk Assessment, Fire Insurance. Investigation of fire -evidence and court procedure - law of evidence - cross- examination - giving evidence.

Total = 45 Periods**Text Books:**

1. BIS, NBC Part IV - Fire and Life Safety", Bureau of Indian Standards, New Delhi, 2016.
2. Royetman M Ya - Principles of fire safety standards for building construction.

Reference Books:

1. Jain V K - Fire Safety in Building, New Age International Publishers, New Delhi, 2006.
2. Butcher and Parnell; Designing of Fire Safety, Wiley-Blackwell, 1983.
3. BS 5588: British Standard - Fire precautions in the design, construction and use of buildings.
4. T. Z Harmathy - Fire Safety Science and Engineering.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VI

Regulation :R2020

Course Code : 20SF613

Course Name :STRUCTURAL FIRE SAFETY

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Classify the building and its hazards.	3	-	3	-	3	3	3	3	2	3	-	2	3	3
CO2	Choose the process of emergency.	3	-	3	-	3	3	3	3	2	3	-	2	3	3
CO3	Conclude on the evacuation routes and exits.	3	-	3	-	3	3	3	3	2	3	-	2	3	3
CO4	Develop the economical evaluation of fire safety.	3	-	3	-	3	3	3	3	2	3	-	2	3	3
CO5	Summarize on the inspection of fire safety.	3	-	3	-	3	3	3	3	2	3	-	2	3	3
Average		3	-	3	-	3	3	3	3	2	3	-	2	3	3

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

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

R 2020

SEMESTER – VI**20SF621 ENVIRONMENTAL ENGINEERING AND MANAGEMENT LABORATORY**

L	T	P	C
0	0	3	1

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

CO1 Demonstrate the pH and turbidity of water samples.

Understand

CO2 Experiment the BOD and COD water samples.

Apply

CO3 Experiment the available chlorine, suspended and total solids

Apply

CO4 Compare the fluoride and residual chlorine.

Understand

CO5 Define the pollution prevention and control facilities in industries.

Remember

LIST OF EXPERIMENTS:

1. Determination of pH and turbidity of water samples.
2. Determination of BOD of waste water samples.
3. Determination of COD of waste water samples.
4. Jar test for determining the optimum coagulant dose for water treatment.
5. Determination of available chlorine in Bleaching Powder.
6. Determination of suspended, dissolved and total solids.
7. Determination of Iron in Water.
8. Analysis of Hardness of water.
9. Determination of Fluoride and Residual Chlorine.
10. Study of pollution prevention and control facilities in industries.

Total: 30 Periods

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VI

Regulation:R2020

Course Code : 20SF621

Course Name : ENVIRONMENTAL ENGINEERING AND MANAGEMENT

LABORATORY

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	Demonstrate the pH and turbidity of water samples.	3	-	3	-	-	3	3	3	-	-	-	3	-	3
CO2	Experiment the BOD and COD water samples.	3	-	3	-	-	3	3	3	-	-	-	3	-	3
CO3	Experiment the available chlorine, suspended and total solids	3	-	3	-	-	3	3	3	-	-	-	3	-	3
CO4	Compare the fluoride and residual chlorine.	3	-	3	-	-	3	3	3	-	-	-	3	-	3
CO5	Define the pollution prevention and control facilities in industries.	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

SEMESTER – VI

20SF622

FIRE ENGINEERING LABORATORY

L	T	P	C
0	0	3	1

Prerequisite: NIL

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

- CO1 Demonstrate the method of conducting experiments.
 CO2 Categorize the data and arrive at conclusions.
 CO3 Demonstrate the method of tests for DCP.
 CO4 Demonstrate the method of tests for CO2.
 CO5 Summarize on the fire fighting equipment's by doing safety audit.

Cognitive level

Understand
 Analyze
 Understand
 Understand
 Understand

LIST OF EXPERIMENTS:

1. Determination of flash Point, fire point and pour point of hydrocarbons.
2. Tests on Dry Chemical Powder as per relevant Indian standard specifications.
3. Performance Tests on Portable DCP Fire Extinguisher (Cartridge Type).
4. Performance Tests on Portable CO2 Fire Extinguisher.
5. Performance Tests on Portable Water CO2 Fire Extinguisher.
6. Performance Test on Foam Type Fire Extinguisher.
7. Dispersion Modelling using ALOHA Software an Online Version.
8. Study of non-combustibility of Building Materials.
9. Study on doing Hydrostatic test for Cylinders.
10. Prepare a Check list for doing Safety audit on Fire Fighting Equipments.

Total = 30 Periods

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VI

Regulation :R2020

Course Code : 20SF622

Course Name :FIRE ENGINEERING LABORATORY

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	Demonstrate the method of conducting experiments.	3	-	3	-	-	3	3	3	-	-	-	3	3	3
CO2	Categorize the data and arrive at conclusions.	3	-	3	-	-	3	3	3	-	-	-	3	3	3
CO3	Demonstrate the method of tests for DCP.	3	-	3	-	-	3	3	3	-	-	-	3	3	3
CO4	Demonstrate the method of tests for CO2.	3	-	3	-	-	3	3	3	-	-	-	3	3	3
CO5	Summarize on the fire fighting equipment's by doing safety audit.	3	-	3	-	-	3	3	3	-	-	-	3	3	3
Average		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 – VI

20SF623

INDUSTRIAL TRAINING AND SEMINAR

L	T	P	C
0	0	3	1

Prerequisite: NIL

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

Cognitive level

CO1	Define the process and safety of an industry.	Remember
CO2	Classify the different types of process industry and their safety.	Understand.
CO3	Demonstrate the safety, health and environment polices followed in the industries.	Understand
CO4	Develop solutions to control the methods for accidents, health and environmental issues.	Apply
CO5	Identify the hazards and risk assessment techniques in the process involved in the manufacturing.	Apply

GUIDELINES:

- The students have to undergo practical industrial training for four weeks in recognized industrial establishments during their vacation periods.
- If the student is getting approval during the semester, he/she should get prior approval from the head of the department and the principal and he will be engaged with special classes / remedial classes.
- At the end of the training, they have to submit a report with following information:
 - Profile of Industry
 - Product range
 - Organization structure
 - Plant Layout
 - Processes / Machines / Equipment's / Devices / Safety
 - Details of the training undergone
 - Learning points
- The student will prepare a presentation individually about the industrial training for 15 minutes duration.
- The assessments will be based equally on the report in the prescribed format and viva-voice examination will be conducted thrice in this duration for internal assessment by a committee nominated by the Head of the Department.
- The Final End semester examination will be conducted by one external examiner and one internal examiner appointed by the Institute / controller of examinations (COE).

Total: 30 Periods

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VI

Regulation :R2020

Course Code : 20SF623

Course Name :INDUSTRIAL TRAINING AND SEMINAR

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Define the process and safety of an industry.	3	3	3	3	-	3	3	3	-	-	-	3	3	3
CO2	Classify the different types of process industry and their safety.	3	3	3	3	-	3	3	3	-	-	-	3	3	3
CO3	Demonstrate the safety, health and environment polices followed in the industries.	3	3	3	3	-	3	3	3	-	-	-	3	3	3
CO4	Develop solutions to control the methods for accidents, health and environmental issues.	3	3	3	3	-	3	3	3	-	-	-	3	3	3
CO5	Identify the hazards and risk assessment techniques in the process involved in the manufacturing.	3	3	3	3	-	3	3	3	-	-	-	3	3	3
Average		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 - VI

20SF694

CAREER DEVELOPMENT SKILLS - IV

L	T	P	C
0	2	0	0

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

CO1: 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: Enhance the comprehension Skills in core subjects.

Apply

UNIT - I WRITTEN AND ORAL COMMUNICATION – PART 2 [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 Safety and Health-Fire Safety- Classes of Fire- Fire Extinguishing and Control Methods.

Total (L = 0, T = 30) = 30 Periods**Text Books:**

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

Reference Books:

- 1 Agarwal. R.S, A Modern Approach to Verbal and Non-verbal Reasoning, Revised Edition 2008, Reprint 2009, S.Chand & Co Ltd., New Delhi.
- 2 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2005.
- 3 M.B. Lal & Goswami, Objective Instant Arithmetic, Upkar Publications, New Delhi, second edition, 2012.
- 4 Gupta R.S, A Hand book of Fire Technology, Second Edition, Universities Press, 2010.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VI

Regulation :R2020

Course Code : 20SF694

Course Name :CAREER DEVELOPMENT SKILLS - IV

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Employ critical thinking in personal interviews type situations.	-	-	-	-	2	-	-	-	1	3	-	2	-	-
CO2	Understand the Quantitative Aptitude problems in geometry.	-	-	-	-	2	-	-	-	1	3	-	2	-	-
CO3	Understand the data interpretation and analysis by using various graphs.	-	-	-	-	2	-	-	-	1	3	-	2	-	-
CO4	Enhance the skills in resume writing and presentation.	-	-	-	-	2	-	-	-	1	3	-	2	-	-
CO5	Enhance the comprehension Skills in core subjects.	-	-	-	-	2	-	-	-	1	3	-	2	-	-
Average		-	-	-	-	2	-	-	-	1	3	-	2	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

SEMESTER – VII**20SF711****SAFETY IN RAIL AND ROAD TRANSPORT**

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 Understand functions of rail, sleepers, Ballast, Fittings and control of train movement by various systems.

Understand

CO2 Design the geometric design, Super elevation of a Railway section and Safe method of operation of railways and road.

Analyze

CO3 Understand types of tracks in Indian Railways and its features.

Understand

CO4 Describe Classification of Highways, Consideration for safe designs

Understand

CO5 Understand types of various traffic studies and traffic signals and its features.

Understand

UNIT - I RAILWAY ENGINEERING**[09]**

Permanent way - components. Rails- Functions, requirements, defects, rail joints and fastenings, check and guard rails, coning of wheels, creep of rails. Sleepers - functions, requirements, types, density. Ballast- functions, requirements types.

UNIT - II GEOMETRIC DESIGN**[09]**

Horizontal curves, Super- elevation, Negative super elevation in branches, Length of transition curves- Grade compensation on curves, Widening of Gauge on curves.

UNIT - III RAILWAY OPERATION CONTROL**[09]**

Points and crossings- Design features of a turn out -Types of Railway track- Points- Details of Station Yards and Marshalling Yards- Signaling and interlocking- Principles of track circuiting- Control of train movement by absolute block system- Automatic block system- Centralized traffic control Systems.

UNIT - IV CLASSIFICATION OF HIGHWAYS**[09]**

Historical development of road construction- Typical cross section of roads - Definition of various cross- sectional elements- Requirements & factors controlling alignment of roads - Basic Geometric designs.

UNIT – V TRAFFIC ENGINEERING**[09]**

Traffic characteristics- various traffic studies and their applications - Traffic Regulations and Controls- Traffic Control devices- Traffic signals- Classification of signals- carriage- way markings- Traffic islands- Highway intersections- Principles of highway lighting.

Total= 45 Periods**Text Books:**

1. S.C. Rangwala, Railway Engineering, Charotar Book Distributors, 2012.
2. S. Chandra and M.M. Agarwal, Railway Engineering, Oxford University Press
3. S.K. Khanna and C.E.G. Justo, Highway Engineering, Nem Chand & Brothers
4. L.R. Kadiyali, Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, 2004.
5. Mike Slinn, Peter Guest and Paul Mathews, Traffic Engineering Design: Principles and Practice, Butterworth-Heinemann Elsevier.
6. R. Agor, Railway Track Engineering, Khanna Publishers.
7. R. Srinivasan, Harbour, Dock and Tunnel Engineering, Charotar Publishing House Pvt. Ltd.

Reference Books:

1. Railway Engineering by B.L Gupta, Amit Gupta
2. Highway Engineering by L.R. Kadyali, N,B.Lal

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VII Regulation :R2020

Course Code : 20SF711 Course Name :SAFETY IN RAIL AND ROAD TRANSPORT

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Understand functions of rail, sleepers, Ballast, Fittings and control of train movement by various systems.	3	1	1	-	-	1	1	-	-	-	-	1	-	-
CO2:	Design the geometric design, Super elevation of a Railway section and Safe method of operation of railways and road.	3	1	1	-	-	1	1	-	-	-	-	1	-	-
CO3:	Understand types of tracks in Indian Railways and its features.	3	1	1	-	-	1	1	-	-	-	-	1	-	-
CO4:	Describe Classification of Highways, Consideration for safe designs	3	1	1	-	-	1	1	-	-	-	-	1	-	-
CO5:	Understand types of various traffic studies and traffic signals and its features.	3	1	1	-	-	1	1	-	-	-	-	1	-	-
Average		3	1	1	-	-	1	1	-	-	-	-	1	-	-

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

SEMESTER – VII**20SF712****PRINCIPLES OF INDUSTRIAL MANAGEMENT**

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	Knowledge of various aspects of organization and principles of scientific management.	Understand
CO2	Knowledge of different functions of human resource management including motivation and leadership.	Understand
CO3	Knowledge of various aspects of production management like forecasting, production systems, inventory control and PPC	Understand
CO4	Knowledge of various aspects of capacity planning of industrial management	Understand
CO5	Knowledge of important aspects project management like appraisal, feasibility study, project report and network analysis.	Remember

UNIT - I ORGANISATION**[09]**

Concept of organization, characteristics of organization, elements of organization, organizational structure, organization charts, Types of organization- line and staff organization, functional organization, project organization, matrix organization. Management: Functions, Evolution of management theory, Principles of scientific management.

UNIT - II PERSONNELMANAGEMENT**[09]**

Motivation theories, Leadership theories, Recruitment and training, labour turnover, operator training. Wages and Incentives: feature of wages, time and piece rate, incentive plans, profit sharing. Job evaluation, Merit rating methods- factors of comparison and point rating defects. Industrial Relations: industrial disputes, collective bargaining, trade unions, workers' participation in management, labour welfare.

UNIT - III PRODUCTION MANAGEMENT**[09]**

Production System-Functions-Product Desi On successful completion of the course the student will be aware of gn- Product Life Cycle. Demand forecasting for operations - components of demand - methods of prediction and forecasting - forecasting models - casual & time series PPC-Functions -Models

UNIT - IV CAPACITY PLANNING**[09]**

Evaluating future capacity - capacity requirement - Aggregate Planning. Inventory Control-Objectives-Costs-Models: Basic, Production, Shortage - ABC Analysis.

UNIT - V PROJECT MANAGEMENT**[09]**

Project Appraisal - Feasibility Analysis, Market feasibility, Technical feasibility, Financial feasibility, Economic feasibility, Financial and Economic appraisal of a project, Social Cost- Benefit Analysis in India, Project Report. Project Scheduling: Network Techniques, PERT, CPM, GANTT charts, GERT, Time cost trade off and crashing procedure.

Total= 45 Periods**Text Books:**

1. Kootnz, H (2004). *Principles of Management*. Tata McGraw Hill Education.
2. Buua, E.S. (1983). *Modern Production and Operations Management*. (seventh edition). John Wiley and Sons.

Reference Books:

1. Prasanna Chandra. (1995). *Projects Planning, Analysis, Selection, Implementation & Review*. (4th edn). Tata McGraw Hill, New Delhi.
2. MartandTelsang. *Industrial Engineering and Production management*. (2nd edn). Scand & Co., New Delhi.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VII Regulation : R2020

Course Code : 20SF712 Course Name : PRINCIPLES OF INDUSTRIAL MANAGEMENT

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Knowledge of various aspects of organization and principles of scientific management.	3	2	3	-	-	-	-	1	1	-	-	-	-	-
CO2:	Knowledge of different functions of human resource management including motivation and leadership.	3	2	3	-	-	-	-	1	1	-	-	-	-	-
CO3:	Knowledge of various aspects of production management like forecasting, production systems, inventory control and PPC	3	2	3	-	-	-	-	1	1	-	-	-	-	-
CO4:	Knowledge of various aspects of capacity planning of industrial management	3	2	3	-	-	-	-	1	1	-	-	-	-	-
CO5:	Knowledge of important aspects project management like appraisal, feasibility study, project report and network analysis.	3	2	3	-	-	-	-	1	1	-	-	-	-	-
Average		3	2	3		-	-	-	1	1		-	-	-	-

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

SEMESTER – VII**20SF713****LIFE SAFETY IN BUILDING FIRE**

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	Understand the human behavior under emergency movement and the concept of planning and design of seating arrangements in assembly buildings, evacuation routes and exits.	Understand
CO2	Understand the general life safety requirements applicable to all buildings and to plan, design and locate exits in buildings.	Understand
CO3	Understand the fire and life safety requirements for buildings of specific occupancy.	Understand
CO4	Plan and distribute portable and fixed fire fighting systems in buildings of different occupancies as per BIS	Analyze
CO5	Understand the method of carrying out fire investigation, arson identification, fire training, fire safety audit and fire risk assessment.	Understand

UNIT - I EMERGENCY EVACUATION**[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 GENERAL FIRE SAFETY AND EXIT REQUIREMENTS**[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 AND LIFE SAFETY**[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.

UNIT - IV FIRE DETECTION AND ALARM SYSTEM**[09]**

Sitting of detectors as per relevant Indian standard specifications; Selection and planning of alarm system as per relevant standards (BIS). General requirements and guide lines for the installation of fire detection and alarm system in buildings of different occupancy classification.

UNIT – V FIRE PROTECTION EQUIPMENT**[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

Total= 45 Periods**Text Books:**

1. Roytman, M. Ya. (1975). Principles of fire safety standards for building construction. Amerind Publishing Co. Pvt. Ltd., New Delhi
2. Butcher, E.G. and Parnell, A.C.(1983). Designing of fire safety. John Wiley and Sons Ltd., New York, U.S.A.

Reference Books:

1. Jain, V.K.(2010). Fire safety in buildings (2nd edn.). New Age International (P) Ltd., New Delhi.
2. Barendra Mohan Sen (2013). Fire protection and prevention the essential handbook. UBS Publishers and Dist., New Delhi.
3. Life Safety Code Handbook, National Fire Protection Association, 1991. Lathrop, James K. Ed. NFPA

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VII Regulation :R2020

Course Code : 20SF713 Course Name :LIFE SAFETY IN BUILDING FIRE

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 human behavior under emergency movement and the concept of planning and design of seating arrangements in assembly buildings, evacuation routes and exits.	2	2	3	3	-	1	3	-	-	-	-	-	3	-
CO2	Understand the general life safety requirements applicable to all buildings and to plan, design and locate exits in buildings.	2	2	3	3	-	1	3	-	-	-	-	-	3	-
CO3	Understand the fire and life safety requirements for buildings of specific occupancy.	2	2	3	3	-	1	3	-	-	-	-	-	3	-
CO4	Plan and distribute portable and fixed fire fighting systems in buildings of different occupancies as per BIS	2	2	3	3	-	1	3	-	-	-	-	-	3	-
CO5	Understand the method of carrying out fire investigation, arson identification, fire training, fire safety audit and fire risk assessment.	2	2	3	3	-	1	3	-	-	-	-	-	3	-
Average		2	2	3	3	-	1	3	-	-	-	-	-	3	-

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

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

R 2020

SEMESTER - VII

20SF722

PROJECT PHASE - I

L T P C

0 0 3 1

Prerequisite: No prerequisites are needed for enrolling into the course

Objective(s):

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

Guidelines:

1. The project work in Phase - I and II may contain a theoretical study and analysis, experimental analysis, design, modeling & simulation, fabrication of a model or a prototype or a combination of the above related to automotive area.
2. The project work may include literature review, modeling, analysis, simulation, fabrication, testing and analysis & correlation of test data etc.
3. The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member.
4. The progress of the project is evaluated based on a minimum of three reviews and end semester review.
5. In Phase-I of the project, literature survey, projects task plan and design phases should have been completed
6. A project report is required at the end of the semester.
7. The project work is evaluated based on oral presentation and the project report submitted should be evaluated jointly by external and internal examiners constituted by the Head of the Department.

Total: 30 Periods

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

- Identify a practical problem related to automotive industry.
- Solve the problems with related to feasible solution.
- Understand the project management techniques
- Understand the industrial scenarios.
- Demonstrate their report writing and presentation skills

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VII Regulation :R2020

Course Code : 20SF722 Course Name :PROJECT PHASE - I

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2
CO1	Identify a practical problem related to automotive industry.	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CO2	Solve the problems with related to feasible solution.	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CO3	Understand the project management techniques	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CO4	Understand the industrial scenarios.	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CO5	Demonstrate their report writing and presentation skills	3	3	3	3	3	3	2	2	3	3	3	3	3	3
Average		3		3	3	3	3	2	2	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

20SF811

HUMAN FACTORS ENGINEERING

L	T	P	C
3	0	0	3

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

CO1: Acquire knowledge on ergonomics and its area of application.

Understand

CO2: Gain about human behaviour, behaviour based system and ABC theory.

Understand

CO3: Apply the concept of anthropometry and work design for standing and seated works.

Apply

CO4: Analyze the man machine system and manual handling task and its hazards

.Analyze

CO5: Recall the principles for the design of visual displays and design of controls

. Remember

UNIT – I ERGONOMICS AND ANATOMY**[09]**

Introduction to ergonomics: The focus of ergonomics, ergonomics and its areas of application in the work system, a brief history of ergonomics, attempts to humanize work, modern ergonomics, future directions for ergonomics.

Anatomy, Posture and Body Mechanics: Some basic body mechanics, anatomy of the spine and pelvis related to posture, posture stability and posture adaptation, low back pain, risk factors for musculoskeletal disorders in the workplace, behavioural aspects of posture, effectiveness and cost effectiveness, research directions.

UNIT – II HUMAN BEHAVIOR**[09]**

Individual differences, Factors contributing to personality, Fitting the man to the job, Influence of difference on safety, Method of measuring characteristics, Accident Proneness. Motivation, Complexity of Motivation, Job satisfaction. Management theories of motivation, Job enrichment theory. Frustration and Conflicts, Reaction to frustration, Emotion and Frustration. Attitudes, determination of attitudes, changing attitudes, learning, principles of learning, forgetting, motivational requirements.

UNIT – III ANTHROPOMETRY AND WORK DESIGN**[09]**

Designing for a population of users, percentile, sources of human variability, anthropometry and its uses in ergonomics, principals of applied anthropometry in ergonomics, application of anthropometry in design, design for everyone, anthropometry and personal space, effectiveness and cost effectiveness. Fundamental aspects of standing and sitting, an ergonomics approach to work station design, design for standing workers, design for seated workers, work surface design, visual display units, guidelines for design of static work, effectiveness and cost effectiveness, research directions.

UNIT – IV MAN - MACHINE SYSTEM**[09]**

Applications of human factors engineering, man as a sensor, man as information processor, man as controller - Man vs Machine. Ergonomics interventions in Repetitive works, handle design, key board design- measures for preventing in work related musculoskeletal disorders (WMSDs), reduction and controlling, training Anatomy and biomechanics of manual handling, prevention of manual handling injuries in the work place, design of manual handling tasks, carrying, postural stability.

UNIT – V WORK SPACE ENVIRONMENT**[09]**

A general information-processing model of the users, cognitive system, problem solving, effectiveness. Principles for the design of visual displays - auditory displays - design of controls - combining displays and controls - virtual (synthetic) environments, research issues.

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

- 1 Mark S Sanders, Ernest J McCormick., Human Factors In Engineering & Design, McGraw - hill Book Company - Koga, Seventh Edition, 2019.
- 2 Bridger, R.S., Introduction to Ergonomics, Taylor & Francis, UK, second edition, 2018.
- 3 Dan McLeod, The Ergonomics Manual, Philip Jacobs & Nancy Larson, New Delhi, Second Edition, 2013.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VIII Regulation : R2020

Course Code : 20SF811 Course Name : HUMAN FACTORS ENGINEERING

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	Acquire knowledge on ergonomics and its area of application.	2	2	2	3	-	-	2	2	2	-	-	3	2	3
CO2	Gain about human behaviour, behaviour based system and ABC theory.	2	2	2	3	-	-	2	2	2	-	-	3	2	3
CO3	Apply the concept of anthropometry and work design for standing and seated works.	2	2	2	3	-	-	2	2	2	-	-	3	2	3
CO4	Analyze the man machine system and manual handling task and its hazards	2	2	2	3	-	-	2	2	2	-	-	3	2	3
CO5	Recall the principles for the design of visual displays and design of controls	2	2	2	3	-	-	2	2	2	-	-	3	2	3
Average		2	2	2	3	-	-	2	2	2	-	-	3	2	3

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

SEMESTER - VIII

20SF821

PROJECT PHASE - II

L	T	P	C
0	0	12	6

Prerequisite:**Course Outcomes :** *On successful completion of the course, the student will be able to*CO1: *Design and develop a solution for engineering problems*CO2: *Investigate and synthesis of information to provide solution.*CO3: *Provide solution in social and environmental context for sustainable development.*CO4: *Function effectively in diverse teams in multidisciplinary settings.*CO5: *Demonstrate engineering and management principles in the context of technological change.***Cognitive Level**

Creating

Applying

Applying

Analyzing

Understanding

GUIDELINES:

1. The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study.
2. Every project work shall have a guide who is the member of the faculty of the institution.
3. Twelve periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.
4. The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.
5. The progress of the project is evaluated based on a minimum of three reviews.
6. The review committee may be constituted by the head of the department.
7. The students shall be encouraged to apply for funded projects, patents, publish in journals, conferences and symposiums.
8. Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion.
9. This final report shall be type written form as specified in the guidelines.

The project report should be evaluated jointly by external and internal examiners.

Total = 180 Periods

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VIII Regulation : R2020

Course Code : 20SF821 Course Name : PROJECT PHASE - II

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Design and develop a solution for engineering problems	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CO2	Investigate and synthesis of information to provide solution.	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CO3	Provide solution in social and environmental context for sustainable development.	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CO4	Function effectively in diverse teams in multidisciplinary settings.	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CO5	Demonstrate engineering and management principles in the context of technological change.	3	3	3	3	3	3	2	2	3	3	3	3	3	3
Average		3		3	3	3	3	2	2	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 - VI

20SF661	POWER PLANT ENGINEERING	L	T	P	C
	(Professional Elective-I)	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 layout, construction and working of the components inside a thermal power plant.	Understand
CO2 Explain the layout, construction and working of the components inside a diesel, gas turbine and combined cycle power plants.	Understand
CO3 Explain the layout, construction and working of the components inside nuclear power plants.	Understand
CO4 Explain the layout, construction and working of the components inside renewable energy power plants.	Understand
CO5 Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.	Understand

UNIT - I COAL BASED THERMAL POWER PLANTS [09]

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants - Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

UNIT - II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS [09]

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimization. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT - III NUCLEAR POWER PLANTS [09]

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors: Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), Canada Deuterium- Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants

UNIT - IV POWER FROM RENEWABLE ENERGY [09]

Hydro Electric Power Plants - Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, Solar Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT - V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS [09]

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

Total = 45 Periods

Text Books:

1. Nag. P.K., Power plant Engineering., Tata MC Graw - Hill Publishing Company Ltd, 2011.
2. E.I. Wakil, Power Plant Technology, McGraw Hill education, 2011.

Reference Books:

1. Verma Mahesh, Power Plant Engineering, Metropolitan Book Co., 2007.
2. Lee J.F., Power Station Engineering and Economy, Tata McGraw Hill.,2011.
3. Dr.R.Yadav., Steam and Gas Turbines and Power Plant Engineering, Seventh Edition 2016.
4. Rai GD, Non-Conventional Energy Sources, Khanna Publishers,2011.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VI

Regulation :R2020

Course Code :20SF661

Course Name :POWER PLANT ENGINEERING

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain the layout, construction and working of the components inside a thermal power plant.	3	-	-	-	-	2	3	2	-	-	3	3	3	3
CO2	Explain the layout, construction and working of the components inside a diesel, gas turbine and combined cycle power plants.	3	-	-	-	-	2	3	2	-	-	3	3	3	3
CO3	Explain the layout, construction and working of the components inside nuclear power plants.	3	-	-	-	--	2	3	2	-	-	3	3	3	3
CO4	Explain the layout, construction and working of the components inside renewable energy power plants.	3	-	-	-	-	2	3	2	-	-	3	3	3	3
CO5	Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.	3	-	-	-	-	2	3	2	-	-	3	3	3	3
Average		3	-	-	-	-	2	3	2	-	-	3	3	3	3

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

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

R 2020

SEMESTER - VI

20SF662	SAFETY IN PETROLEUM AND PETROCHEMICAL INDUSTRIES	L	T	P	C
	(Professional Elective-I)	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 <i>Illustrate the various processes employed in petroleum refining and petrochemical industries</i>	<i>Understand</i>
CO2 <i>Design fire protection systems for storage tank farms.</i>	<i>Create</i>
CO3 <i>Design fire protection facilities in oil refineries, depots and terminals.</i>	<i>Create</i>
CO4 <i>Identify the various in transportation of petroleum and petrochemical products.</i>	<i>Apply</i>
CO5 <i>Demonstrate an ability to recognize the hazards involved in on- shore and off-shore drilling.</i>	<i>Understand</i>

UNIT - I REFINERY - DISTILLATION [09]

Simplified flow diagrams of a typical refinery - distillation unit, catalytic cracker, reformer, treating unit (hydro forming, gas purification, Sulphur recovery, lubricating oil unit) Simplified flow diagrams of Petrochemical Industry - steam cracking, butadiene extraction ethane recovery, butyl rubber polymerization.

UNIT - II FIRE HAZARDS IN PETROLEUM AND PETRO-CHEMICAL [09]

Potential fire hazards in petroleum and petrochemical industries (ignition by local sources, spark, flame, hot surface, ignition of oil mists and fumes.). Storage tank farms of petroleum and petrochemical industries - Identification of Hazards, Type of Tanks, Design, Layout, Fire prevention measures including lightning protection. Fire protection arrangements in large tank farms, Design concepts of various fixed fire protection systems like Foam- Water Systems, Halogen & DCP systems. Lock out procedures. Salient features of codes / standards: NFPA, API, OISD and SHELL.

UNIT - III FIRE PROTECTION FACILITIES [09]

Fire protection facilities in Oil Refineries, Depots & Terminals -Transportation of petroleum and petrochemical products (safety considerations, statutory considerations). Design and Construction requirements for cross country hydrocarbon pipelines. Liquefied Petroleum Gas (LPG) Bottling Plant Operations.

UNIT - IV TRANSPORTATION OF PETROLEUM AND PETROCHEMICAL [09]

Design Philosophies. Operating Practices - Safety and Fire Protection in bottling plants. Transportation of Bulk Petroleum Products. Storage and Handling of Bulk Liquefied Petroleum Gas.

UNIT - V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS [09]

On - Shore and Off - shore drilling. Classification of wells. Drilling method. Rotary drilling. Drilling equipment. Ground and off - shore structures for drilling. Off shore platforms and drilling vessels. Drilling mud - functions, classification and properties. Blow-off, well kicks, Blow out preventer. Shallow gas. Directional drilling. Well killing procedure. Emergency shutdown, Methods of Rescue & Fire Fighting. Petroleum and Natural Gas (Safety in Onshore Operations) Rules, 2008.

Total = 45 Periods

Text Books:

1. SaikatMaitra and O.P., Gupta, Elements of Petrochemical Engineering, Khanna Books, Edition - I, 2020.
2. Gopal Rao, M. and Sittig, M (Eds). (2010). Dryden's Outlines of Chemical Technology for the 21st Century. (Third edition). Affiliated East West Press, New Delhi.

Reference Books:

1. Sam Mannan (Editor), Lee's loss prevention in the process industries. (Fourth edition). Butterworth-Heinemann Ltd., UK, 2016.
2. DavorinMatanovic. NedilikaGaurina - Medjimurec. And Katarina Simon. (Editors), Risk analysis for prevention of hazardous situations in petroleum and natural gas engineering. Engineering Science Reference, Hershey PA, 2014.
3. Fire Protection Hand book. NFPA, 2008.
4. Aven, T. and Vinnem, J.E., Risk management with applications from the off - shore petroleum industry. Springer-Verlag, U.K, 2007.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VI

Regulation :R2020

Course Code : 20SF662

Course Name :SAFETY IN PETROLEUM AND PETROCHEMICAL INDUSTRIES

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Illustrate the various processes employed in petroleum refining and petrochemical industries</i>	-	3	3	3	2	3	3	3	-	3	-	3	3	3
CO2	<i>Design fire protection systems for storage tank farms.</i>	-	3	3	3	2	3	3	3	-	3	-	3	3	3
CO3	<i>Design fire protection facilities in oil refineries, depots and terminals.</i>	-	3	3	3	2	3	3	3	-	3	-	3	3	3
CO4	<i>Identify the various in transportation of petroleum and petrochemical products.</i>	-	3	3	3	2	3	3	3	-	3	-	3	3	3
CO5	<i>Demonstrate an ability to recognize the hazards involved in on- shore and off-shore drilling.</i>	-	3	3	3	2	3	3	3	-	3	-	3	3	3
Average		-	3	3	3	2	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 - VI

20SF663

FOOD AND BIO-SAFETY

(Professional Elective-I)

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	Identify the Quality attributes of foods and their chemical and toxicological properties.	Apply
CO2	Identify the food additives and food contaminants and their chemical and toxicological aspects.	Apply
CO3	Conclude the effects of pests on food and the various methods for controlling them.	Evaluate
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 QUALITY ATTRIBUTES OF FOODS**[09]**

Quality attributes of foods, size and shape, colour and gloss, texture-visual and objectively measurable attributes. Aroma of foods - Introductory ideas, formation and chemistry. Introduction to sensory evaluation of foods and beverages.

UNIT - II FOOD CONTAMINANTS**[09]**

Food safety, food additives and food contaminants, their chemical, technological and toxicological aspects, Food laws - development and enforcement. Prevention of Food Adulteration Act and Food Regulations. ISO 9000 series and HACCP. Codex Alimentarius protocols for export.

UNIT - III FOOD STORAGE**[09]**

Principles of food commodity storage, Insect pests - their biology and food preference. Effects of pests on food commodities. Pesticide classification and chemistry. Pesticide formulations. Pesticide appliances. Insect growth regulators, biopesticides and grain protectants. Fumigants, Sanitation in food processing / handling units. Ballooning techniques. Irradiation and other physical methods of control. Pesticide and health hazards. Safety devices, pesticide residues in foods, residue analysis and decontamination. Concept of organic foods.

UNIT - IV BIO SAFETY**[09]**

The legal and socio - economic impacts of biotechnology-Public education of the processes of biotechnology involved in generating new forms of life for informed decision making - Biosafety regulation and national and international guidelines. r-DNA guidelines - Challenges for the Indian biotechnological research and industries - Ethical implications of biotechnological products and techniques.

UNIT - V BIOTECH APPLICATIONS**[09]**

Experimental protocol approvals - Levels of containment - Environmental aspects of biotech applications - Use of genetically modified organisms and their resistance in environment - Special procedures for r-DNA based product production - Social and ethical implications of biological weapons - Good safety practices - GLP standards - Lab contaminants - PI, PII, PIII guidelines.

Total = 45 Periods**Text Books:**

1. Thomas, J. A. and Fuchs, Biotechnology and Safety Assessment, Academic Press, 3rd Edition.
2. Sateesh, M.K., Bioethics and Biosafety. I.K. International Pvt Ltd., New Delhi, 2008.

Reference Books:

1. Ronald H. Schmidt and Gary E. Rodrick, Food Safety Handbook. 1st edition, Wiley.
2. Norman G. Marriott and Robert B. Gravani, Principles of Food Sanitation. 5th edition. Springer, 2006.
3. V Sree Krishna, Bioethics and Biosafety in Biotechnology, New Age International Publishers.
4. Lawrence K. Wang, Volodymyr Lvanov, Joo-Hwa Tay & Yung-Tse Hung, Environmental Bio-technology, Handbook of Environmental Engineering, Volume -10.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VI

Regulation :R2020

Course Code :20SF663

Course Name :FOOD AND BIO-SAFETY

CO-PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	Identify the Quality attributes of foods and their chemical and toxicological properties.	-	-	3	-	-	-	3	3	-	2	-	3	-	-
CO2	Identify the food additives and food contaminants and their chemical and toxicological aspects.	-	-	3	-	-	-	3	3	-	2	-	3	-	-
CO3	Conclude the effects of pests on food and the various methods for controlling them.	-	-	3	-	-	-	3	3	-	2	-	3	-	-
CO4	Explain about the national and international regulations for biosafety.	-	-	3	-	-	-	3	3	-	2	-	3	-	-
CO5	Demonstrate an ability to recognize the environmental, social and ethical implications of biotech applications.	-	-	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

SEMESTER - VI

20SF664	FAULT DETECTION AND DIAGNOSIS (Professional Elective-I)	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 different issues involved in FDD and applications.	Understand
CO2	Demonstrate the analytical redundancy concepts in FDD.	Understand
CO3	Develop basic knowledge on design of structured residuals.	Apply
CO4	Recall the fundamental knowledge about design of directional structured residuals.	Remember
CO5	Develop advanced level issues and design involved in FDD.	Apply

UNIT - I INTRODUCTION TO FAULT DETECTION AND DIAGNOSIS [09]

Introduction to Fault Detection and Diagnosis: Scope of FDD: -Types of faults and different tasks of Fault Diagnosis and Implementation - Different approaches to FDD: Model free and Model based approaches. Classification of Fault and Disturbances- Different issues involved in FDD - Typical applications.

UNIT - II ANALYTICAL REDUNDANCY CONCEPTS [09]

Analytical Redundancy Concepts: Introduction - Mathematical representation of Fault and Disturbances: Additive and Multiplicative types - Residual Generation: Detection, Isolation, Computational and stability properties - Design of Residual generator - Residual specification and Implementation.

UNIT - III DESIGN OF STRUCTURED RESIDUALS [09]

Design of Structured Residuals: Introduction -Residual structure of single fault Isolation: Structural and Canonical structures - Residual structure of Multiple fault Isolation: Diagonal and Full Row canonical concepts - Introduction to parity equation implementation and alternative representation.

UNIT - IV DESIGN OF DIRECTIONAL STRUCTURED RESIDUALS [09]

Design of Directional structured Residuals: Introduction - Directional Specifications: Directional specification with and without disturbances - Parity Equation Implementation - Linearly dependent column.

UNIT - V DESIGN INVOLVED IN FDD [09]

Advanced level issues and design involved in FDD: Introduction of Residual generation of parametric fault - Robustness Issues -Statistical Testing of Residual Generators - Application of Neural and Fuzzy logic schemes in FDD - Case study.

Total = 45 Periods

Text Books:

1. Sachin.C. Patwardhan., Fault Detection and Diagnosis in Industrial Process", IIT Bombay.
2. Janos J. Gertler., Fault Detection and Diagnosis in Engineering systems., Second Edition.

Reference Books:

1. Francesco Ferracuti, Alessandro Freddi and Andrea Monteriu, Algorithms for Fault Detection and Diagnosis, MDPI Books.
2. Rami S. Mangoubi., Robust Estimation and Failure detection. Springer-Verlag, London., 1998.
3. Tom Denton., Advanced Automotive Fault Diagnosis, Institute of the Motor Industry, Fifth Edition.
4. D M HimmelBlau., Fault Detection and Diagnosis in Chemical and Petro-Chemical Processes, Elsevier, Volume - 8, 1978.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VI

Regulation :R2020

Course Code : 20SF664

Course Name :FAULT DETECTION AND DIAGNOSIS

CO-PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	Explain the different issues involved in FDD and applications.	-	-	3	3	-	-	-	3	-	2	-	3	-	-
CO2	Demonstrate the analytical redundancy concepts in FDD.	-	-	3	3	-	-	-	3	-	2	-	3	-	-
CO3	Develop basic knowledge on design of structured residuals.	-	-	3	3	-	-	-	3	-	2	-	3	-	-
CO4	Recall the fundamental knowledge about design of directional structured residuals.	-	-	3	3	-	-	-	3	-	2	-	3	-	-
CO5	Develop advanced level issues and design involved in FDD.	-	-	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

SEMESTER - VI

20SF665

FIRE DYNAMICS

(Professional Elective-I)

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	Choose qualitative description of fire sequence, ignition, flames spreading, heat release rate, mass burning rate, time dependency of heat release rate and effect of the enclosure on heat release rate etc.	Remember
CO2	Demonstrate the importance of fire plumes, flames, mean height, flame height co relations plumes co relations, ceiling jets etc.	Understand
CO3	Develop understanding on pressure profiles and air - Flow in buildings.	Apply
CO4	Summarize about smoke filling, pressure build in the fire enclosure, transient smoke filling models, effect of sprinklers on smoke filling and its correlations, fire safety engineering system for handling.	Understand
CO5	Explain about the control of combustion gases and CFD models.	Understand

UNIT - I DESCRIPTION OF A FIRE [09]

Qualitative description of a fire sequence. Ignition, flame spreading. Various ways of categorizing a fire. The effect of the building on the fire. Heat release rate. Mass burning rate and time-dependency of the heat release rate, the order of magnitude of the heat release rate, the strengths and weaknesses of various test methods, growth of α -t₂, the effect of the enclosure on the heat release rate, extraction of a power curve.

UNIT - II FIRE PLUMES AND FLAMES [09]

Fire plumes and flames. Froude number, mean flame height, flame-height correlations, various profiles in a plume, ideal plumes, strong and weak plumes, plume correlations, ceiling jets, special issues to be considered in the design process, quasi-stationary conditions, selecting a plume model.

UNIT - III PRESSURE PROFILES AND GAS TEMPERATURES [09]

Pressure profiles. Background on air-Flow in buildings. Bernoulli's equation. Various forms of pressure. Computing pressure, rate and mass air-Flow through openings. Gas temperatures. Energy balance, rate of heat transfer, correlations for computing gas temperatures. Fully-developed fires, ISO 834, temperature calculation. The influence of high temperatures on structural elements of steel or wood.

UNIT - IV SMOKE FILLING [09]

Smoke filling. Pressure build-up in the fire enclosure. Transient smoke filling models. Stationary models for control of combustion gases. Various fire safety engineering systems for handling and control of combustion gases. Continuity equations. Effect of sprinklers on smoke filling. Correlations.

UNIT - V COMBUSTION PRODUCTS [09]

Combustion products. Equivalency ratios. Soot production. Visibility, dosage. How soot particles are formed. CO, CO₂. Computer modelling. Sub-models for computer models. Model constraints. CFD models.

Total = 45 Periods**Text Books:**

1. Karlsson, B., Quintiere, J G: Enclosure Fire Dynamics. CRC Press, 1999.
2. Dougal Drysdale., An Introduction to Fire Dynamics, Wiley, 2018.

Reference Books:

1. Gregory E. Gorbett, James L Pharr and Scott R. Rockwell., Brady Fire Series, Second Edition, 2020 .
2. James G. Quintiere, Principles of Fire Behavior, CRC Press, Second Edition, 2010.
3. Benjamin Walker and Shan Raffel, Fire Dynamics for Fire Fighters, Second Edition, 2007.
4. Keisuke Himoto, Large Outdoor Fire Dynamics, CRC Press, 2001.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VI

Regulation :R2020

Course Code : 20SF665

Course Name :FIRE DYNAMICS

CO-PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	Choose qualitative description of fire sequence, ignition, flames spreading, heat release rate, mass burning rate, time dependency of heat release rate and effect of the enclosure on heat release rate etc.	2	-	3	3	3	-	-	3	-	2	-	3	3	3
CO2	Demonstrate the importance of fire plumes, flames, mean height, flame height co relations plumes co relations, ceiling jets etc.	2	-	3	3	3	-	-	3	-	2	-	3	3	3
CO3	Develop understanding on pressure profiles and air - Flow in buildings.	2	-	3	3	3	-	-	3	-	2	-	3	3	3
CO4	Summarize about smoke filing, pressure build in the fire enclosure, transient smoke filing models, effect of sprinklers on smoke filing and its correlations, fire safety engineering system for handling.	2	-	3	3	3	-	-	3	-	2	-	3	3	3
CO5	Explain about the control of combustion gases and CFD models.	2	-	3	3	3	-	-	3	-	2	-	3	3	3
Average		2	-	3	3	3	-	-	3	-	2	-	3	3	3

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

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

R 2020

SEMESTER - VI

20SF666	HAZARD CONTROL IN MANUFACTURING	L	T	P	C
	(Professional Elective-I)	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 various hazards associated with hot working of metals and methods of control.	Understand
CO2	Summarize about the hazards associated with cold working and cutting of metals and methods of control.	Understand
CO3	Define various hazards associated with welding and cutting of metals and methods of control.	Remember
CO4	Compare various material handling methods and systems; the hazards and methods of control.	Understand
CO5	Explain the safety related to Oil and Gas Production.	Understand

UNIT - I SAFE METHOD OF OPERATION [09]

Introduction - Classification of Engineering Industry - Manufacturing Processes. Hot Working - Foundry operations - furnace and equipment, health hazard, safe methods of operation. Forging operations, heat radiation, maintenance of machines, shop equipment and hand tools - safe work practice. Operations in hot and cold rolling mills.

UNIT - II MACHINERY SAFE GUARD [09]

Machinery safe guard Point of Operation, Principle of machine guarding - breakdown of machine guarding - types of guards and devices. Cold Working - Safety in Power Presses, primary & secondary operations - shearing - bending - rolling - drawing. Metal Cutting - safety in turning, boring, milling, planning and grinding. Maintenance of machine tools - health hazards and prevention.

UNIT - III SAFETY OF WELDING [09]

Welding and Cutting - Safety Precautions of Gas welding and Arc Welding, Cutting and Finishing. Gas Cylinders and Equipment's. Heat Treatment- Furnaces and Salt baths-operations and maintenance -safety in handling and storage of salts- disposal of effluents - health precautions, exposure to hazardous fumes, source of fumes, ventilation and fume protection.

UNIT - IV MATERIAL HANDLING [09]

Material Handling - Classification - safety consideration - manual and mechanical handling. Handling assessments and techniques- lifting, carrying, pulling, pushing, palletizing and stocking. Material Handling equipment operation & maintenance. Maintenance of common elements- wire rope, chains slings, hooks, clamps.

UNIT - V SAFETY IN OIL AND GAS PLANT [09]

Well Completion Practices: Well Head Assemble, Installation and Testing, Activation, Well Testing, Self - Flowing Wells, Gas Lift: Sucker Rod and Down Hole Motor Pumping of Oil, Safety Issues in Oil and Gas Production.

Total = 45 Periods

Text Books:

1. James T Tweedy, Introduction to Hazard Control Management, CRC Press, 2013.
2. S C Bhatia, A Hand Book on Health, Safety and Environment, 2007.

Reference Books:

1. National Safety Council, Accident Prevention Manual for Industrial Operations, Chicago, 1982.
2. Balchin N C, Health and Safety in Welding and Allied Process, Jaico Publishers, New Delhi, 1973.
3. Ronal P Blake., Industrial Safety., Prentice Hall, New Delhi.
4. J M Goel., Hazardous Waste Management, Perspective in Nuclear Toxic and Hazardous Waste by Kadambari Sharma.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VI

Regulation :R2020

Course Code :20SF666

Course Name :HAZARD CONTROL IN MANUFACTURING

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain various hazards associated with hot working of metals and methods of control.	2	-	3	3	-	3	3	3	-	-	-	3	3	3
CO2	Summarize about the hazards associated with cold working and cutting of metals and methods of control.	2	-	3	3	-	3	3	3	-	-	-	3	3	3
CO3	Define various hazards associated with welding and cutting of metals and methods of control.	2	-	3	3	-	3	3	3	-	-	-	3	3	3
CO4	Compare various material handling methods and systems; the hazards and methods of control.	2	-	3	3	-	3	3	3	-	-	-	3	3	3
CO5	Explain the safety related to Oil and Gas Production.	2	-	3	3	-	3	3	3	-	-	-	3	3	3
Average		2	-	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 – VII

20SF761

AUTOMOBILE ENGINEERING AND SAFETY
(Professional Elective-II)

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	Knowledge of automobile engines, fuel systems and CMV rules for proto type testing and emission standards	Understand
CO2	Knowledge of electrical systems-ignition, lighting, horn, wipers, HVAC and concerned CMV rules.	Understand
CO3	Knowledge of transmission systems - clutch, gearbox, steering, and differential. Chassis springs, axles, brakes and corresponding CMV rules.	Understand
CO4	Knowledge of lubricating systems, cooling systems and miscellaneous systems. CMV rules for safety devices.	Understand
CO5	Identify the usage of Electrical vehicles / Hybrid vehicles & various pollution control methods.	Apply

UNIT - I MOTOR VEHICLES RULES**[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. Carburetor - Simple and Modern, Fuel injection System. Emission Standards as per CMV Rules.

UNIT - II ELECTRICAL SYSTEM**[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, Traficators. Automobile air conditioning. Central Motor Vehicles Rules regarding Lighting, Winds hields, Wipers.

UNIT - III TRANSMISSION 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 SYSTEMS**[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 ALTERNATE FUELS AND POLLUTION CONTROL METHODS**[09]**

Natural gas, LPG, bio-diesel, alcohol and hydrogen in automobiles - concepts of electric and hybrid vehicles - fuel cells -engine emission standards - pollution control methods - emission control by 3-way catalytic controller - electronic engine management system.

Total= 45 Periods**Text Books:**

1. Kirpal Singh "Automobile Engineering Vol. I & II", Standard Publishers, New Delhi, 2011.
2. Sethi H.M., "Automobile Technology", Tata McGraw-Hill-2003.

Reference Books:

1. Crouse and Anglin, "Automotive Mechanism", 9th Edition. Tata McGraw-Hill, 2003.
2. Jain, K.K., and Asthana .R.B., "Automobile Engineering", Tata McGraw Hill Publishers, New Delhi, 2002.
3. Bob Henderson and John Harold Haynes, "Haynes Tech book OBD - II Manual, Haynes Publication, 2006.
4. Ganesan V., "Internal Combustion Engines", Fourth Edition, Tata McGraw-Hill, 2012.
5. The central motor vehicles Rules.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VII

Regulation :R2020

Course Code :20SF761

Course Name :AUTOMOBILE ENGINEERING AND SAFETY

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	Knowledge of automobile engines, fuel systems and CMV rules for proto type testing and emission standards.	2	-	3	1	-	-	3	-	-	-	-	-	-	-
CO2	Knowledge of electrical systems- ignition, lighting, horn, wipers, HVA Can and concerned CMV rules.	2	-	3	1	-	-	3	-	-	-	-	-	-	-
CO3	Knowledge of transmission systems - clutch, gearbox, steering, and differential. Chassis springs, axles, brakes and corresponding CMV rules.	2	-	3	1	-	-	3	-	-	-	-	-	-	-
CO4	Knowledge of lubricating systems, cooling systems and miscellaneous systems. CMV rules for safety devices.	2	-	3	1	-	-	3	-	-	-	-	-	-	-
CO5	Identify the usage of Electrical vehicles / Hybrid vehicles & various pollution control methods.	2	-	3	1	-	-	3	-	-	-	-	-	-	-
Average		2	-	3	1	-	-	3	-	-	-	-	-	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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

R 2020

SEMESTER - VII

20SF762

INDUSTRIAL ECOLOGY
(Professional Elective-II)

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 Understand the concept of industrial ecology.

Understand

CO2 Identify environmental interactions during product use.

Remembering

CO3 Understand the methodology of LCA

Understand

CO4 Understand the Corporate Industrial Ecology Toolbox.

Understand

CO5 Gain knowledge about metabolic and resource analysis.

Understand

UNIT - I HUMANITY AND THE ENVIRONMENT**[09]**

Humanity and the Environment -The Industrial Ecology Concept Technological Change and Evolving Risk. The Relevance of Biological Ecology to Technology- The Status of Resources- Governments, Laws, and Economics.

UNIT - II INDUSTRIAL PRODUCT & PROCESS DESIGN AND OPERATION**[09]**

Industrial Product & Process Design and Operation - Choosing Materials - Designing for Energy Efficiency. Product Delivery-Environmental Interactions during Product Use - Design for End of Life.

UNIT - III LIFE CYCLE ASSESSMENT**[09]**

An Introduction to Life Cycle Assessment-The LCA Impact and Interpretation Stages - Streamlining the LCA Process.

UNIT - IV INDUSTRIAL ECOLOGY TOOLBOX**[09]**

Corporate Industrial Ecology Toolbox - Managing Industrial Ecology in the Corporation-Indicators and Metrics-Services Technology and Environment.

UNIT - V INDUSTRIAL ECOSYSTEMS**[09]**

Industrial Ecosystems-Metabolic and Resource Analyses -Systems, Analysis, Models and Scenario Development. Earth Systems Engineering and Management - The Future of Industrial Ecology.

Total= 45 Periods**Text Books:**

1. Graedel, T.E. and Allenby, B.R. (2003). Industrial Ecology. (2nd edition).Prentice-Hall.
2. R.R. Barthwal, 2021, Industrial Economics, An Introductory Textbook.

Reference Books:

1. Robert U. Ayres, Leslie W. Ayres, (2002)A Handbook of Industrial Ecology.
2. Graedel,T.E. and Allen by,B.R.(2010).Industrial Ecology and Sustainable Engineering. Pearson.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VII

Regulation :R2020

Course Code :20SF762

Course Name :INDUSTRIAL ECOLOGY

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	Understand the concept of industrial ecology.	3	2	1	-	-	1	2	-	-	-	-	1	-	-
CO2	Identify environmental interactions during product use.	3	2	1	-	-	1	2	-	-	-	-	1	-	-
CO3	Understand the methodology of LCA	3	2	1	-	-	1	2	-	-	-	-	1	-	-
CO4	Understand the Corporate Industrial Ecology Toolbox.	3	2	1	-	-	1	2	-	-	-	-	1	-	-
CO5	Gain knowledge about metabolic and resource analysis.	3	2	1	-	-	1	2	-	-	-	-	1	-	-
Average		3	2	1	-	-	1	2	-	-	-	-	1	-	-

Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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

R 2020

SEMESTER – VII

20SF763	HAZARD IDENTIFICATION AND RISK ASSESSMENT (Professional Elective-II)	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 <i>Attain the ability to use the hazard indices, HAZOP, PHA and What if analysis for the identification of hazards in a process</i>	<i>Apply</i>
CO2 <i>Attain the ability to assess probability of occurrence of an event using fault tree and event tree analysis</i>	<i>Analyze</i>
CO3 <i>Estimate the consequences of fire, explosion and toxic gas release using suitable empirical models</i>	<i>Evaluate</i>
CO4 <i>Quantify the risk involved in a process</i>	<i>Apply</i>
CO5 <i>Identify various Hazards related to the work practices and activity using various technique.</i>	<i>Understand</i>

UNIT - I HAZARD IDENTIFICATION AND RISK ANALYSIS [09]

Hazard and risk, Types of hazards - fire, explosion and toxic gas release, Structure of hazard identification and risk assessment. Identification of hazards : Inventory analysis, Fire and explosion hazard rating of process plants - The Dow Fire and Explosion Hazard Index, The Mond Index, Plant layout and unit hazard rating, Preliminary hazard analysis, Hazard and Operability study (HAZOP), What If analysis, Case studies.

UNIT - II RISK CONTROL & MANAGEMENT [09]

Plant availability and process reliability: ways of improving plant availability, MTBF and MTTF, the reliability function, failure rate, bathtub curve, probability relationships, simple reliability estimation. Estimation of frequency of occurrence of a hazard: The logic tree approach, set theory and Boolean algebra, application to probability, Boolean manipulation. Fault tree analysis - logic symbols, minimal cut set, logic gates, fault tree quantification. Event tree analysis - notation, event tree construction, advantages and disadvantages of ETA. Failure mode and Effect Analysis (FMEA) - methodology, criticality analysis, corrective action and follow-up.

UNIT - III ENVIRONMENTAL HEALTH RISKS [09]

Consequence modeling: Source models - discharge rate models, flash and evaporation, dispersion models. Explosions and fires -vapour cloud explosions, flash fires, physical explosions, BLEVE and fire ball, confined explosions, pool fires, jet fires. Effect models -dose-response functions, probit functions, toxic gas effects, thermal effects, explosion effects - Software application for effect and damage calculations.

UNIT - IV HAZARDS MONITORING AND EMERGENCY MANAGEMENT [09]

Quantification of risk: QRA, Vulnerability analysis, accepted and imposed risk, perception of risk, risk indices, individual risk and societal risk, acceptance criteria for risk, ALARP, Presentation of measures of risk - risk contour, F-N curve. Calculation of individual risk and societal risk. Human reliability analysis (HRA): factors leading to human error, characteristics of HRA techniques, Technique for Human Error Rate Prediction (THERP), Accident Sequence Evaluation Program (ASEP), Techniques using expert judgment, Operator Action tree (OAT).

UNIT – V DISASTER MANAGEMENT IN INDIA AND RELIEF [09]

History of disasters - various disasters in various countries - Disasters in India Relief and rehabilitation in disasters at local, national and global levels, Gaps in disaster management identified on analysis, Worldwide Aid and Agencies, Study of different case studies on natural disaster & manmade disaster.

Total= 45 Periods**Text Books:**

1. Geoff Wells, "Hazard Identification and Risk Assessment", 1997.
2. Marvin Rausand, "Risk Assessment", John Wiley & Sons, Inc, 2011

Reference Books:

1. AIChE/CCPS. "Guidelines for Hazard Evaluation Procedures". (Second edition). Centre for Chemical Process Safety, American Institute of Chemical Engineers, New York, 1992.
2. Government of India, Ministry of Home Affairs, National Disaster Management Division, Disaster Management in India – A Status Report, 2004
3. National Policy on Disaster Management, NDMA, Government of India, 2009.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VII

Regulation :R2020

Course Code : 20SF763

Course Name :HAZARD IDENTIFICATION AND RISK ASSESSMENT

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Attain the ability to use the hazard indices, HAZOP, PHA and What if analysis for the identification of hazards in a process	3	2	1	-	-	1	2	-	-	-	-	1	-	-
CO2	Attain the ability to assess probability of occurrence of an event using fault tree and event tree analysis	3	2	1	-	-	1	2	-	-	-	-	1	-	-
CO3	Estimate the consequences of fire, explosion and toxic gas release using suitable empirical models	3	2	1	-	-	1	2	-	-	-	-	1	-	-
CO4	Quantify the risk involved in a process	3	2	1	-	-	1	2	-	-	-	-	1	-	-
CO5	Identify various Hazards related to the work practices and activity using various technique.	3	2	1	-	-	1	2	-	-	-	-	1	-	-
Average		3	2	1	-	-	1	2	-	-	-	-	1	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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

R 2020

SEMESTER – VII

20SF764

RELIABILITY ENGINEERING
(Professional Elective-II)

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 Study the failure model.

Apply

CO2 Understand the concept of various reliability and system models.

Analyze

CO3 Compare various types of design and analysis of failures.

Evaluate

CO4 Explain the reliability testing

Apply

CO5 Understand the concept of FMEA.

Understand

UNIT - I CONCEPT OF RELIABILITY**[09]**

Definition of reliability - reliability Vs quality - reliability function - MTTF - hazard rate function - bathtub curve - Derivation of the reliability function - constant failure rate model - Time dependent failure models - Weibull distribution - Normal distribution- The logarithmic normal distribution. Choosing the best distribution and assessing the results.

UNIT - II RELIABILITY OF SYSTEM AND MODELS**[09]**

Serial configuration - parallel configuration - combined series parallel systems system structure function, Minimal cuts and Minimal paths - Markov analysis - Load sharing systems, standby system, degraded systems, three state devices - covariate models, static models, dynamic models and physics of failure models.

UNIT - III DESIGN FOR RELIABILITY**[09]**

Reliability design process - system effectiveness - Economic analysis and life cycle cost - Reliability allocation - ARINC, AGREE- Design methods - parts and material selection, Derating, stress-strength analysis - Failure Analysis - Identification of failure mode - Determine of causes - Assessment of effects - classification of severity computation of critically index - corrective action - System safety and FTA.

UNIT - IV THE ANALYSIS OF FAILURE DATA AND RELIABILITY TESTING**[09]**

Data collection - Empirical methods - ungrouped and grouped complete, censored data - static life estimation- test time calculation - Burn in testing, Acceptance, sequential, binomial testing - Accelerated life testing - other acceleration models - Experimental design - Reliability growth process idealized growth curve - various growth models - Identifying failure and repair distributions

UNIT - V RELIABILITY ANALYSIS OF A TRANSMISSION AND FMEA**[09]**

System analysis - Determination of system components and system elements, Classification of system elements, Determination of the reliability structure, Determination of the reliability of system elements, calculation of the system reliability. Failure mode and effects analysis (FMEA) - basic principles and general fundamentals of FMEA methodology, FMEA according to VDA 86 (Form FMEA), Example of a design FMEA according to VDA.86.

Total= 45 Periods**Text Books:**

1. Patrick D T o'connor, Andre kleyner "Practical Reliability Engineering", John-Wiley and Sons Ltd, Fifth edition, 2012.
2. David J Smith, "Reliability, Maintainability and Risk: Practical Methods for Engineers", Butterworth, Eighth Edition, 2011.

Reference Books:

1. Bernd Bertsche, Reliability in Automotive and Mechanical Engineering: Determination of Component and System Reliability, Springer, 2008
2. Way kuo, Rajendra Prasad V, Frank A and Tillman, Ching-lai Hwang,, "Optimal reliability design and applications, Cambridge University Press P Ltd., 2006
3. Charles E Ebling, "An introduction to Reliability and Maintainability Engineering", Waveland Press, 2019.
4. L.S.Srinath, "Reliability Engineering", East West Press, Fourth Edition, 2005.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VII

Regulation :R2020

Course Code : 20SF764

Course Name :RELIABILITY ENGINEERING

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Study the failure model.	2	1	-	3	-	-	-	-	-	-	-	2	-	-
CO2:	Understand the concept of various reliability and system models.	2	1	-	3	-	-	-	-	-	-	-	2	-	-
CO3:	Compare various types of design and analysis of failures.	2	1	-	3	-	-	-	-	-	-	-	2	-	-
CO4:	Explain the reliability testing	2	1	-	3	-	-	-	-	-	-	-	2	-	-
CO5:	Understand the concept of FMEA.	2	1	-	3	-	-	-	-	-	-	-	2	-	-
Average		2	1	-	3		-	-	-	-	-	-	-	-	-

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

SEMESTER – VII**20SF765****FLUID POWER SYSTEMS**

(Professional Elective-II)

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: Know the fundamentals of hydraulic and pneumatic power control and their circuits.

Remembering

CO2: Understand and fluid power actuators, linear hydraulic actuators.

Understand

CO3: Describe the design of hydraulic circuits and applications.

Apply

CO4: Understand pneumatic principles, components and its selection

Understand

CO5: Describe the PLC applications in fluid power control and analyze the failure and troubleshooting in circuits

Analyze

UNIT - I FLUID POWER SYSTEMS AND FUNDAMENTALS**[09]**

Introduction to fluid power, advantages, applications and types, properties of hydraulic fluids - General types of fluids - Fluid power symbols. Basics of hydraulics - Applications of Pascal's law - Laminar and turbulent flow - Reynolds number - Darcy's equation - Losses in pipe, valves and fittings.

UNIT - II HYDRAULIC SYSTEM AND COMPONENTS**[09]**

Sources of hydraulic power: Pumping theory - Pump classification - Gear pump, Vane pump, Piston pump, construction and working of pumps - Pump performance - Variable displacement pumps. Fluid power actuators: Linear hydraulic actuators - Types of hydraulic cylinders - Single acting, Double acting special cylinders like tandem, rod less, telescopic. construction of double acting cylinder, Rotary actuators - Fluid motors, gear, vane and piston motors.

UNIT - III DESIGN OF HYDRAULIC CIRCUITS**[09]**

Construction of control components: Directional control valve - 3/2- way valve - 4/2 way valve - Shuttle valve - check valve - pressure control valve - pressure reducing valve, sequence valve, flow control valve - Fixed and adjustable, electrical control solenoid valves, relays, ladder diagram. Accumulators and Intensifiers: Types of accumulators - Accumulators circuits, sizing of accumulators, intensifier - Applications of Intensifier - Intensifier circuit.

UNIT - IV PNEUMATIC SYSTEM AND COMPONENTS**[09]**

Pneumatic components: Properties of air - compressors - Filter, regulator, and lubricator unit - Air control valves, Quick exhaust valves, and pneumatic actuators. Fluid power circuit design, Speed control circuits, synchronizing circuit, Penumo hydraulic circuit, Sequential circuit design for simple applications using cascade method.

UNIT - V DESIGN OF PNEUMATIC CIRCUITS**[09]**

Servo systems - Hydro mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics - Introduction to fluidic devices, simple circuits, Introduction to electro hydraulic pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and trouble shooting.

Total= 45 Periods**Text Books:**

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education, Seventh Edition, 2008
2. Majumdar S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGraw-Hill, First Edition, 2002

Reference Books:

1. Srinivasan, "Hydraulic and Pneumatic controls", Vijay Nicole, Second Edition, 2008.
2. Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, First Edition, 2009.
3. Majumdar S.R., "Pneumatic systems: Principles and maintenance", Tata McGraw Hill, First Edition, 2010.
4. Michael J, Princes and Ashby J. G, "Power Hydraulics", Prentice Hall, 4th Edition, 1989.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VII

Regulation :R2020

Course Code : 20SF765

Course Name :FLUID POWER SYSTEMS

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1:	Know the fundamentals of hydraulic and pneumatic power control and their circuits.	-	2	3	-	-	3	-	3	-	-	1	-	-	-
CO2:	Understand and fluid power actuators, linear hydraulic actuators.	-	2	3	-	-	3	-	3	-	-	1	-	-	-
CO3:	Describe the design of hydraulic circuits and applications.	-	2	3	-	-	3	-	3	-	-	1	-	-	-
CO4:	Understand pneumatic principles, components and its selection	-	2	3	-	-	3	-	3	-	-	1	-	-	-
CO5:	Describe the PLC applications in fluid power control and analyze the failure and troubleshooting in circuits	-	2	3	-	-	3	-	3	-	-	1	-	-	-
Average		-	2	3	-	-	3		3		-	1		-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous)		R 2020			
SEMESTER – VII					
20SF766	EXPLOSIVES TECHNOLOGY AND SAFETY (Professional Elective-II)	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: Understand the chemistry of explosives and the mechanisms of burning					Apply
CO2: Gain knowledge on the concepts of shock, detonation and initiation					Analyze
CO3: Apply scaling in design and analysis of explosive devices.					Evaluate
CO4: Understand the importance of safety in explosives transportation and storage.					Apply
CO5: Understand the importance of safety in explosives facilities and operations.					Understand
UNIT - I EXPLOSIVES AND BURNING		[09]			
Chemistry of Explosives- Chemical Reactions - Categories of explosives by chemical type-Use forms of Explosives, Propellants, and Pyrotechnics. Mechanics of Burning - Burning model - Geometry shape of grains - Calculating the state of the gas - interior ballistics.					
UNIT - II SOUND, SHOCK AND DETONATION		[09]			
Sound, shock and Detonation - Sound waves- shockwaves-Detonation waves - Explosive output test. Initiation and initiators - Initiation theory and criteria - Initiation sensitivity testing-Non electric initiators -Hot-wire initiators-exploding bridge wire detonators-Slapper detonators.					
UNIT - III SCALING IN DESIGN AND ANALYSIS		[09]			
Scaling in Design and Analysis - Geometric similarity - Accelerating metal with explosives - Shock waves in air - Shock waves in water-Craters from explosives-Conical-shaped chargers. Off-the-Shelf explosive. Devices-Linear explosive products- Mechanical / explosive devices.					
UNIT - IV TRANSPORTATION AND STORAGE OF EXPLOSIVES		[09]			
Classification, Transportation and Storage of Explosives - Explosives classification - Transportation of explosives - Storage of explosives.					
UNIT - V EXPLOSIVE FACILITIES AND EXPLOSIVES OPERATIONS		[09]			
Explosive facilities- Explosive operations - Good work practices-Maintenance-Explosive waste- Spills and general cleaning - Explosive handling - Testing and firing of explosives - Licenses, permits and penalties.					
Total= 45 Periods					
Text Books:					
1. Paul Cooper and Stanley R. Kurowski. (1996).Introduction to the Technology of Explosives. Wiley-VCH, New York					
2. Handbook of FIRE AND EXPLOSION PROTECTION ENGINEERING PRINCIPLES third edition 2014, DENNIS P. NOLAN, 525 B Street, Suite 1900, San Diego, CA 92101-4495, USA					
3. Gupta, R.S., "Hand Book of Fire Technology" Orient Longman, Bombay 1977					
Reference Books:					
1. Handbook of Fire and Explosion Protection Engineering Principles. For Oil, Gas, Chemical and Related by Dennis P. Nolan (Auth.)					
2. Hand book for Explosion Protection by Dipl.-Phys. Dr. rer. nat. Heinrich Groh Copyright © 2004 Expert Verlag GmbH, Renningen, Germany.					
3. Fire fighters hazardous materials reference book Fire Prevention in Factories", an Nostrand Rein Hold. New York, 1991.					

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VII

Regulation :R2020

Course Code : 20SF766

Course Name : EXPLOSIVES TECHNOLOGY AND SAFETY

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 chemistry of explosives and the mechanisms of burning	3	2	1	-	-	1	2	-	-	-	-	1	-	-
CO2:	Gain knowledge on the concepts of shock, detonation and initiation	3	2	1	-	-	1	2	-	-	-	-	1	-	-
CO3:	Apply scaling in design and analysis of explosive devices.	3	2	1	-	-	1	2	-	-	-	-	1	-	-
CO4:	Understand the importance of safety in explosives transportation and storage.	3	2	1	-	-	1	2	-	-	-	-	1	-	-
CO5:	Understand the importance of safety in explosives facilities and operations.	3	2	1	-	-	1	2	-	-	-	-	1	-	-
Average		3	2	1	-	-	1	2	-	-	-	-	1	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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

R 2020

SEMESTER – VII

20SF767	ADVANCED SAFETY ENGINEERING AND MANAGEMENT	L	T	P	C
	(Professional Elective-III)	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: Determine the incidents and used different kind of techniques	Understand
CO2: Acquire knowledge on LOPA methods and control systems	Understand
CO3: Analyze the Risk and developed security strategies	Analyze
CO4: Classify the BBS approaches for industries	Understand
CO5: Gain knowledge on the OSHA	Understand

UNIT - I INTRODUCTION [09]
 Domino incident investigation - technique, logic diagram, input requirements, output, example. Unavailability analysis of protective systems - technique, logic diagram, input requirements, example. Reliability analysis of automatic control systems - PES safety system development logic diagram calculation of fractional system analysis, dead time, application, strengths and weaknesses. Introduction to MORT analysis, Sneak Analysis.

UNIT - II BASIC CONCEPTS ON LOPA [09]
 Layer of Protection Analysis (LOPA) - Overview of relevant standards and guidelines, risk tolerance criteria. Preparation of LOPA-LOPA methodology, the LOPA team. Scenario development - components, inherently safe considerations. Initiating causes / effects - identification, estimation of frequencies. Independent protection layers - IPL criteria, allocation of IPL credit - basic process control systems, operator response, pressure relief device, safety instrumented system, and safety instrumented function. Safety integrity level (SIL) assignment, Interpreting LOPA results and making recommendations.

UNIT - III SECURITY RISK ASSESSMENT AND PROTECTION [09]
 Security for chemical process industries - Assessments and regulatory environment, methods for assessing security vulnerability, emerging security regulations, government development and Industry activities that relate to security for process facilities. Strategies and counter measures - prevention of intentional releases and theft of chemical releases at process facilities. Case study.

UNIT - IV BEHAVIOUR BASED SAFETY IN ORGANIZATIONS [09]
 Behaviour- Based Safety (BBS) - Fundamentals of BBS Management - people based safety, BBS experience, Outcomes of BBS work, psychology of BBS, Implementation problems in BBS, Behavioural safety Observation Process. Manager's role in developing BBS culture. BBS steering committee. Main steps of True BBS approach.

UNIT - V SAFETY MANAGEMENT SYSTEMS [09]
 Safety Management Systems: SHEMS, OHSAS 18001 and OSHA's PSM - Policy, planning, training, Implementation, Management Control and Review.

Total= 45 Periods

Text Books:

1. Fred A. Manuele, "Advanced Safety Management: Focusing on Z10.0, 45001, and Serious Injury Prevention"
2. DAS AKHIL KUMAR "Principles of Fire Safety Engineering: Understanding Fire and Fire Protection"

Reference Books:

1. Centre for Chemical Process Safety, AIChE: Guidelines for Chemical Process Quantitative Risk Analysis, second edition, 2000.
2. ACC: Site Security Guidelines for the U.S Chemical Industry, American Chemistry Council, Washington DC, 2001.
3. Thomas R. Krause. (1996). The Behaviour - based safety process: Managing involvement for an injury-free culture. (Second edition). John Wiley & Sons.
4. Kaila, H.L. (2010). Behaviour based safety in organisations - a practical guide. IK International, New Delhi.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VII

Regulation :R2020

Course Code : 20SF767

Course Name :ADVANCED SAFETY ENGINEERING AND MANAGEMENT

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Determine the incidents and used different kind of techniques	3	2	1	-	-	1	2	-	-	-	-	1	-	-
CO2:	Acquire knowledge on LOPA methods and control systems	3	2	1	-	-	1	2	-	-	-	-	1	-	-
CO3:	Analyze the Risk and developed security strategies	3	2	1	-	-	1	2	-	-	-	-	1	-	-
CO4:	Classify the BBS approaches for industries	3	2	1	-	-	1	2	-	-	-	-	1	-	-
CO5:	Gain knowledge on the OSHA	3	2	1	-	-	1	2	-	-	-	-	1	-	-
Average		3	2	1	-	-	1	2	-	-	-	-	1	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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

R 2020

SEMESTER – VII

20SF768	DISASTER MANAGEMENT (Professional Elective-III)	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 Acquire knowledge on Disasters and control of risks	Understand
CO2 Gain knowledge on Prevention of Disaster Risk	Understand
CO3 Demonstrate about the Different kind of impacts	Understand
CO4 Analyze about the hazards and Risk assessments	Analyze
CO5 Learn about applications and field works for without risks	Understand

UNIT - I INTRODUCTION TO DISASTERS [09]

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks - Disasters: Types of disasters -Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT - II APPROACHES TO DISASTER RISK REDUCTION (DRR) [09]

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- non-structural measures, Roles and responsibilities of- community, Panchayat Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders-Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) - Early Warning System - Advisories from Appropriate Agencies.

UNIT - III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT [09]

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT - IV DISASTER RISK MANAGEMENT IN INDIA [09]

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation - Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster - Disaster Damage Assessment.

UNIT - V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS [09]

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

Total= 45 Periods**Text Books:**

1. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011.
2. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IAS and Sage Publishers, New Delhi, 2010.

Reference Books:

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423.
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt.Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361].
3. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005.
4. Government of India, National Disaster Management Policy, 2009.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VII

Regulation :R2020

Course Code : 20SF768

Course Name :DISASTER MANAGEMENT

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Acquire knowledge on Disasters and control of risks	3	1	1	-	-	1	1	-	-	-	-	1	-	-
CO2	Gain knowledge on Prevention of Disaster Risk	3	1	1	-	-	1	1	-	-	-	-	1	-	-
CO3	Demonstrate about the Different kind of impacts	3	1	1	-	-	1	1	-	-	-	-	1	-	-
CO4	Analyze about the hazards and Risk assessments	3	1	1	-	-	1	1	-	-	-	-	1	-	-
CO5	Learn about applications and field works for without risks	3	1	1	-	-	1	1	-	-	-	-	1	-	-
Average		3	1	1	-	-	1	1	-	-	-	-	1	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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

R 2020

SEMESTER – VII

20SF769

TOTAL QUALITY MANAGEMENT

(Professional Elective-III)

L	T	P	C
3	0	0	3

Prerequisite: This course deals with Quality concepts and TQM principles focusing on process quality to assure product quality to the customers.

Course Outcomes: On successful completion of the course, the student will be able to	Cognitive Level
CO1 Comprehend quality principles and exhibit proper leadership style	Apply
CO2 Interpret the principles and strategies of TQM and apply appropriately	Apply
CO3 Choose appropriate control chart to monitor a process	Analyzing
CO4 Apply various quality tools and techniques in both manufacturing and service industry	Analyzing
CO5 Implement the concepts of quality management system and ISO	Apply

UNIT - I INTRODUCTION [09]

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

UNIT - II TQM PRINCIPLES [09]

Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT - III TQM TOOLS AND TECHNIQUES I [09]

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT - IV TQM TOOLS AND TECHNIQUES II [09]

Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT - V QUALITY MANAGEMENT SYSTEM [09]

Introduction - Benefits of ISO Registration - ISO 9000 Series of Standards - Sector-Specific Standards - AS 9100, TS16949 and TL 9000 - ISO 9001 Requirements - Implementation - Documentation - Internal Audits - Registration - ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction - ISO 14000 Series Standards - Concepts of ISO 14001 - Requirements of ISO 14001 - Benefits of EMS.

Total= 45 Periods**Text Books:**

1. Dale H. Besterfield, Carol B. Michna, Glen H. Besterfield, Mary B. Sacre, Hemant Urdhwarshie and Rashmi Urdhwarshie, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.
2. Besterfield Dale H., Besterfield Carol, Besterfield Glen H., Besterfield Mary, Urdhwarshie Hemant, Urdhwarshie Rashmi. "Total Quality Management", 5th Edition, Pearson Education, Noida, 2018.

Reference Books:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
3. ISO 9001-2015 standards
4. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VII

Regulation :R2020

Course Code : 20SF769

Course Name :TOTAL QUALITY MANAGEMENT

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Comprehend quality principles and exhibit proper leadership style	1	1	-	-	-	2	-	3	3	-	-	1	2	3
CO2	Interpret the principles and strategies of TQM and apply appropriately	1	1	-	-	-	2	-	3	3	-	-	1	2	3
CO3	Choose appropriate control chart to monitor a process	1	1	-	-	-	2	-	3	3	-	-	1	2	3
CO4	Apply various quality tools and techniques in both manufacturing and service industry	1	1	-	-	-	2	-	3	3	-	-	1	2	3
CO5	Implement the concepts of quality management system and ISO	1	1	-	-	-	2	-	3	3	-	-	1	2	3
Average		1	1	-	-	-	2	-	3	3	-	-	1	2	3

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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

R 2020

SEMESTER – VII

20SF771

INTELLECTUAL PROPERTY RIGHTS
(Professional Elective-III)

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 Ability to Basic concepts and need for Intellectual Property

Apply

CO2 Apply and Registration for IPRs

Analyze

CO3 Agreements And Legislations on acts

Evaluate

CO4 Digital Products And Law of IPRs

Apply

CO5 Ability to manage Intellectual Property

Understand

UNIT - I INTRODUCTION**[09]**

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad - Genesis and Development - the way from WTO to WIPO -TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations - Important examples of IPR.

UNIT - II REGISTRATION OF IPRs**[09]**

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT - III AGREEMENTS AND LEGISLATIONS**[09]**

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT - IV DIGITAL PRODUCTS AND LAW**[09]**

Digital Innovations and Developments as Knowledge Assets - IP Laws, Cyber Law and Digital Content Protection - Unfair Competition - Meaning and Relationship between Unfair Competition and IP Laws - Case Studies.

UNIT - V ENFORCEMENT OF IPRs**[09]**

Ability to manage Intellectual Property portfolio to enhance the value of the firm.

Total= 45 Periods**Text Books:**

1. J. ScopleVinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S. V. Satakar, Intellectual Property Rights and Copy Rights, EssEss Publications, New Delhi, 2002

Reference Books:

1. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets, Cengage Learning, Third Edition, 2012.
2. PrabuddhaGanguli, Intellectual Property Rights: Unleashing the Knowledge Economy, McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VII

Regulation :R2020

Course Code : 20SF771

Course Name :INTELLECTUAL PROPERTY RIGHTS

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	<i>Ability to Basic concepts and need for Intellectual Property</i>	1	2	1	-	-	1	2	-	3	-	-	1	3	-
CO2:	<i>Apply and Registration for IPRs</i>	1	2	1	-	-	1	2	-	3	-	-	1	3	-
CO3:	<i>Agreements And Legislations on acts</i>	1	2	1	-	-	1	2	-	3	-	-	1	3	-
CO4:	<i>Digital Products And Law of IPRs</i>	1	2	1	-	-	1	2	-	3	-	-	1	3	-
CO5:	<i>Ability to manage Intellectual Property</i>	1	2	1	-	-	1	2	-	3	-	-	1	3	-
Average		1	2	1	-	-	1	2	-	3	-	-	1	3	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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

R 2020

SEMESTER – VII

20SF772

ENTREPRENEURSHIP DEVELOPMENT

(Professional Elective-III)

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 types, characteristics of entrepreneurship and its role in economic development.	Understand
CO2:	Apply the theories of achievement motivation and the principles of entrepreneurship development program.	Apply
CO3:	Select the appropriate form of business ownership in setting up an enterprise.	Analyze
CO4:	Apply the fundamental concepts of finance and accounting to enterprise.	Apply
CO5:	Identify sickness in industry, select the appropriate corrective measures, and identify the growth strategies in enterprise.	Analyze

UNIT - I ENTREPRENEURSHIP [09]

Entrepreneur - Types of Entrepreneurs - Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT - II MOTIVATION [09]

Entrepreneurial Motivation: Theories and Factors, Achievement Motivation -Entrepreneurial Competencies - Entrepreneurship Development Programs - Need, Objectives - Business Game, Thematic Apperception Test, Self Rating, Stress management.

UNIT - III BUSINESS [09]

Small Enterprises - Definition, Characteristics, Project Identification and selection - Project Formulation: Significance, content, formulation of project report - Project Appraisal: Concept and method - Ownership Structures: Selection & Pattern.

UNIT - IV FINANCING AND ACCOUNTING [09]

Finance: Need, Sources, Capital Structure, Term Loans - Accounting: Need, Objectives, Process, Journal, Ledger, Trial Balance, Final Accounts - Working Capital Management: Significance, Assessment, Factors, Sources, Management.

UNIT - V SUPPORT TO ENTREPRENEURS [09]

Sickness in small Business: Concept, Signals, Symptoms, Magnitude, Causes and Consequences, Corrective Measures - Government Policy for Small Scale Enterprises - Growth Strategies in Small Scale Enterprise - Institutional Support to Entrepreneurs: Need and Support - Taxation Benefits to Small Scale Industry: Need, Depreciation, Rehabilitation, Investment.

Total= 45 Periods**Text Books:**

1. S.S.Khanka, Entrepreneurial Development, S.Chand & Co. Ltd. Ram Nagar, New Delhi, Fourth Edition, 2010.
2. Kuratko & Hodgetts, Entrepreneurship - Theory, process and practices, Thomson learning, New Delhi, Ninth

Reference Books:

1. Hisrich R D and Peters M P, Entrepreneurship, Tata McGraw-Hill Book Co. New Delhi, Fifth Edition 2002.
2. Mathew J Manimala, Entrepreneurship theory at cross roads: paradigms and praxis, Dream tech, New Delhi, Second Edition, 2006.
3. Rabindra N. Kanungo, Entrepreneurship and innovation, Sage Publications, New Delhi, 1998.
4. Singh, A. K., Entrepreneurship Development and Management, University Science Press, Oxford, 2009.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VII

Regulation :R2020

Course Code : 20SF772

Course Name :ENTREPRENEURSHIP DEVELOPMENT

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	<i>Explain the types, characteristics of entrepreneurship and its role in economic development.</i>	2	1	3	-	-	1	-	-	-	-	3	-	-	-
CO2:	<i>Apply the theories of achievement motivation and the principles of entrepreneurship development program.</i>	2	1	3	-	-	1	-	-	-	-	3	-	-	-
CO3:	<i>Select the appropriate form of business ownership in setting up an enterprise.</i>	2	1	3	-	-	1	-	-	-	-	3	-	-	-
CO4:	<i>Apply the fundamental concepts of finance and accounting to enterprise.</i>	2	1	3	-	-	1	-	-	-	-	3	-	-	-
CO5:	<i>Identify sickness in industry, select the appropriate corrective measures, and identify the growth strategies in enterprise.</i>	2	1	3	-	-	1	-	-	-	-	3	-	-	-
Average		2	1	3		-	1		-	-	-	3	-	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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

R 2020

SEMESTER – VII

20SF773

STATISTICAL METHODS FOR ENGINEERS

(Professional Elective-III)

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: Understand the Consistency, efficiency and unbiasedness of estimators.

Apply

CO2: Develop their skills in testing the samples by using various testing of hypothesis methods.

Remember

CO3: Apply concept of linear regression, correlation, and its applications.

Evaluate

CO4: Analyze and infer the data using design of experiments.

Apply

CO5: Understand the Perform exploratory analysis of multivariate data, such as multivariate normal density, calculating descriptive statistics, testing for multivariate normality.

Understand

UNIT - I ESTIMATION THEORY**[12]**

Estimators: Unbiasedness, Consistency, Efficiency and sufficiency - Maximum likelihood estimation - Method of moments.

UNIT – II TESTING OF HYPOTHESIS**[12]**

Sampling distributions - Small and large samples -Tests based on Normal, t, Chi square, and F distributions for testing of means, variance and proportions - Analysis of r x c tables - Goodness of fit.

UNIT - III CORRELATION AND REGRESSION**[12]**

Multiple and partial correlation - Method of least squares - Plane of regression - Properties of residuals - Coefficient of multiple correlation - Coefficient of partial correlation - Multiple correlation with total and partial correlations - Regression and partial correlations in terms of lower order co - efficient.

UNIT - IV DESIGN OF EXPERIMENTS**[12]**

Analysis of variance - One way and two way classifications - Completely randomized design - Randomized block design - Latin square design.

UNIT - V MULTIVARIATE ANALYSIS**[12]**

Random vectors and matrices - Mean vectors and covariance matrices - Multivariate normal density and its properties - Principal components: Population principal components - Principal components from standardized variables.

Total= 60 Periods**Text Books:**

1. Gupta.S.C., and Kapoor, V.K., "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 11th Edition, 2002.
2. Jay L. Devore, "Probability and statistics for Engineering and the Sciences", 8th Edition, Cengage Learning, 2014.

Reference Books:

1. Johnson, R.A. and Wichern, D. W. "Applied Multivariate Statistical Analysis", Pearson Education, Asia, 6th Edition, 2007.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
3. Rice, J.A. "Mathematical Statistics and Data Analysis", 3rd Edition, Cengage Learning, 2015.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VII

Regulation :R2020

Course Code : 20SF773

Course Name :STATISTICAL METHODS FOR ENGINEERS

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1:	Understand the Consistency, efficiency and unbiasedness of estimators.	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO2:	Develop their skills in testing the samples by using various testing of hypothesis methods.	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO3:	Apply concept of linear regression, correlation, and its applications.	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO4:	Analyze and infer the data using design of experiments.	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO5:	Understand the Perform exploratory analysis of multivariate data, such as multivariate normal density, calculating descriptive statistics, testing for multivariate normality.	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

SEMESTER- VIII**WORK STUDY AND ERGONOMICS**

20SF861

(Professional Elective - IV)

L	T	P	C
3	0	0	3

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

CO1: Familiarize on work study and study of operation and its application.

Understand

CO2: Analyze about applications of ergonomic principle in the shop floor and physiology of workers.

Analyze

CO3: Explore the concepts of PPE's and its ergonomic considerations.

Understand

CO4: Recall about various machine tools, process and equipment design.

Understand

CO5: Acquire knowledge on man-machine systems.

Understand

UNIT - I WORK STUDY**[09]**

Study of operations - work content - work procedure - breakdown - human factors - safety and method study - methods and movements at the workplace - substitution with latest devices - robotic concepts - applications in hazardous workplaces - productivity, quality and safety (PQS).

UNIT - II ERGONOMICS**[09]**

Definition - applications of ergonomic principles in the shop floor - work benches - seating arrangements - layout of electrical panels - switch gears - principles of motion economy - location of controls - display locations - machine foundations - work platforms, fatigue, physical and mental strain - incidents of accident - physiology of workers.

UNIT - III PERSONAL PROTECTION**[09]**

Concepts of personal protective equipment - types - selection of PPE - invisible protective barriers - procurement, storage, inspection and testing - quality - standards - ergonomic considerations in personal protective equipment design.

UNIT - IV PROCESS AND EQUIPMENT DESIGN**[09]**

Process design - equipment - instrument - selection - concept modules - various machine tools - in-built safety - machine layout - machine guarding - safety devices and methods - selection, inspection, maintenance and safe usage - statutory provisions, operator training and supervision - hazards and prevention.

UNIT - V MAN MACHINE SYSTEMS**[09]**

Job and personal risk factors - standards - selection and training - body size and posture - body dimension (static/dynamic) - adjustment range - penalties - guide lines for safe design and postures - evaluation and methods of reducing posture strain. Man-machine interface - controls - types of control - identification and selection - types of displays - compatibility and stereotypes of important operations - fatigue and vigilance - measurement characteristics and strategies for enhanced performance.

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

- 1 Lakhwinder Pal Singh, Work Study and Ergonomics, 2018.
- 2 Work Study, National Productivity Council, New Delhi, 1995.
- 3 Introduction to Work Study, ILO, Oxford and IBH Publishing company, Bombay, Fourth Revised Edition, 1991.
- 4 McCormick, E.J., and M.S.Sanders, Human Factors in Engineering and Design, TMH, New Delhi, Seventh Edition, 1982.
- 5 Benjamin Neibal, W., Motion and Time Study, Seventh Edition, 1992.
- 6 Accident Prevention Manual for Industrial Operations, NSC Chicago, Fourth Edition, 1982.
- 7 Hunter, Gomas, Engineering Design for Safety, McGraw Hill Inc., New York, Second Edition, 1992.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VIII

Regulation :R2020

Course Code : 20SF861

Course Name :WORK STUDY AND ERGONOMICS

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Familiarize on work study and study of operation and its application.	2	3	3	2	2	-	-	2	3	-	-	3	-	-
CO2:	Analyze about applications of ergonomic principle in the shop floor and physiology of workers.	2	3	3	2	2	-	-	2	3	-	-	3	-	-
CO3:	Explore the concepts of PPE's and its ergonomic considerations.	2	3	3	2	2	-	-	2	3	-	-	3	-	-
CO4:	Recall about various machine tools, process and equipment design.	2	3	3	2	2	-	-	2	3	-	-	3	-	-
CO5:	Acquire knowledge on man-machine systems.	2	3	3	2	2	-	-	2	3	-	-	3	-	-
Average		2	3	3	2	2	-	-	2	3	-	-	3	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

SEMESTER -VIII**20SF862****COMPUTER AIDED HAZARD ANALYSIS**
(Professional Elective - IV)

L	T	P	C
3	0	0	3

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

CO1: Explore the basic concepts in risk and hazard assessment.

Understand

CO2: Analyze the use of different types of instruments for various testing.

Analyze

CO3: Apply the risk assessment technique to quantify the risk using different software.

Apply

CO4: Determine the consequence analysis for plotting the damages towards hazardous situations.

Evaluate

CO5: Demonstrate the various types of disasters based on past accident analysis.

Remember

UNIT – I**HAZARD, RISK ISSUES AND HAZARD ASSESSMENT****[09]**

Introduction, hazard, hazard monitoring - risk issue, group or societal risk, individual risk, voluntary and involuntary risk, social benefits Vs technological risk, approaches for establishing risk acceptance levels, risk estimation. Hazard assessment, procedure, methodology, safety audit, checklist analysis, what - if analysis, safety review, Preliminary Hazard Analysis (Pre HA), human error analysis, Hazard Operability studies (HAZOP), safety warning systems.

UNIT – II**COMPUTER AIDED INSTRUMENTS****[09]**

Applications of Advanced Equipments and Instruments, Thermo Calorimetry, Differential Scanning Calorimeter(DSC), Thermo Gravimetric Analyzer(TGA), Accelerated Rate Calorimeter(ARC), Reactive Calorimeter(RC), Reaction System Screening Tool(RSST) - Principles of operations, Controlling parameters, applications, advantages. Explosive Testing, Deflagration Test, Detonation Test, Ignition Test, Minimum ignition energy Test, Sensitiveness Test, Impact Sensitiveness Test(BAM) and Friction Sensitiveness Test (BAM), Shock Sensitiveness Test, Card Gap Test.

UNIT – III**RISK ANALYSIS QUANTIFICATION AND SOFTWARES****[09]**

Fault Tree Analysis & Event Tree Analysis, Logic symbols, methodology, minimal cut set ranking - Fire Explosion and Toxicity Index (FETI), various indices - Hazard Analysis(HAZAN) - Failure Mode and Effect Analysis(FMEA), Layer of Protection Analysis(LOPA) and Safety integrity level(SIL) - Software on Risk analysis, ALOHA, Hamsagars modules on Heat radiation, Pool fire, Jet, Explosion. Reliability software on FMEA for mechanical and electrical systems.

UNIT – IV**CONSEQUENCES ANALYSIS****[09]**

Logics of consequences analysis - Estimation - Hazard identification based on the properties of chemicals - Chemical inventory analysis - identification of hazardous processes - Estimation of source term, Gas or vapour release, liquid release, two phase release - Heat radiation effects, BLEVE, Pool fires and Jet fire - Gas / vapour dispersion - Explosion, UVCE and Flash fire, Explosion effects and confined explosion - Toxic effects - Plotting the damage distances on plot plant / layout.

UNIT – V**CREDIBILITY OF RISK ASSESSMENT TECHNIQUES****[09]**

Past accident analysis as information sources for Hazard analysis and consequences analysis of chemical accident, Mexico disaster, Flixborough, Bhopal, Seveso, Pasadena, Feyzin disaster (1966), Port Hudson disaster, Vizag HPCL 1997 incident, LG Polymer Vizag incident 2020- convey report, hazard assessment of non-nuclear installation - Rijnmond report, risk analysis of size potentially Hazardous Industrial objects - Rasmussen masses report, Reactor safety study of Nuclear power plant.

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

- 1 Frank P. Less, Loss Prevention in Process Industries, Butterworth -Hein UK 1990 (Vol.I, II & III), UK ,Third edition , 2005
- 2 Methodologies for Risk and Safety Assessment in Chemical Process Industries, Commonwealth Science Council, UK, 1990.
- 3 Course Material - Intensive Training Programme on Consequence Analysis, Process Safety Centre, Indian Institute of Chemical Technology, Tarnaka& CLRI, Chennai, Second Edition, 1987.
- 4 Major Hazard control- A practical Manual, ILO, Geneva, Third Edition, 1993.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VIII

Regulation :R2020

Course Code : 20SF862

Course Name :COMPUTER AIDED HAZARD ANALYSIS

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 in risk and hazard assessment.	3	2	3	2	3	-	-	-	-	-	-	2	-	3
CO2:	Analyze the use of different types of instruments for various testing.	3	2	3	2	3	-	-	-	-	-	-	2	-	3
CO3:	Apply the risk assessment technique to quantify the risk using different software.	3	2	3	2	3	-	-	-	-	-	-	2	-	3
CO4:	Determine the consequence analysis for plotting the damages towards hazardous situations.	3	2	3	2	3	-	-	-	-	-	-	2	-	3
CO5:	Demonstrate the various types of disasters based on past accident analysis.	3	2	3	2	3	-	-	-	-	-	-	2	-	3
Average		3	2	3	2	3	-	-	-	-	-	-	2	-	3

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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

R 2020

SEMESTER- VIII**FIREWORKS SAFETY**

(Professional Elective - IV)

20SF863

L	T	P	C
3	0	0	3

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

- CO1: Acquire knowledge on the properties of the chemicals used in the fireworks.
 CO2: Familiarize about the static charge and dust in fireworks factories.
 CO3: Recall about the various types of process in risk related fireworks.
 CO4: Analyze the material handling techniques and transportation of explosives in fireworks
 CO5: Determine the concepts of waste control and user safety in fireworks

Cognitive Level

Understand
 Understand
 Understand
 Analyze
 .Understand

UNIT – I PROPERTIES OF FIREWORKS CHEMICALS**[9]**

Fire properties - potassium nitrate (KNO_3), potassium chlorate (KClO_3), barium nitrate (BaNO_3), calcium nitrate (CaNO_3), Sulphur (S), Phosphorous (P), Antimony (Sb), Pyro Aluminum (A1) powder - Reactions - metal powders, Borax, ammonia (NH_3) - Strontium Nitrate, Sodium Nitrate, Potassium per chloride. Fire and explosion, impact and friction sensitivity.

UNIT – II STATIC CHARGE AND DUST**[9]**

Concept - prevention - earthing - copper plates - dress materials - static charge meter lightning, causes - effects - hazards in fireworks factories - lightning arrestor: concept - installation - earth pit - maintenance - resistance - legal requirements - case studies.

Dust: size - respirable, non-respirable - biological barriers - hazards - personal protective equipment - pollution prevention.

UNIT – III PROCESS SAFETY**[8]**

Safe - quantity, mixing - filling - fuse cutting - fuse fixing - finishing - drying at various stages - packing - storage - hand tools - materials, layout: building - distances - factories act - explosive act and rules - fire prevention and control - risk related fireworks industries.

UNIT – IV MATERIAL HANDLING**[10]**

Manual handling - wheel barrows - trucks - bullock carts - cycles - automobiles - fuse handling - paper caps handling -nitric acid handling in snake eggs manufacture - handling the mix in this factory - material movement - godown - waste pit.

Transportation: Packing - magazine - design of vehicles for explosive transports loading into automobiles - transport restrictions - case studies - overhead power lines - driver habits - intermediate parking - fire extinguishers - loose chemicals handling and transport.

UNIT – V WASTE CONTROL AND USER SAFETY**[9]**

Concepts of wastes - wastes in fireworks - disposal - spillages - storage of residues.

Consumer anxiety - hazards in display - methods in other countries - fires, burns and scalds - sales outlets - restrictions - role of fire service.

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

- 1 Morgan J. Hurley, Daniel T. Gottuk, John R. Hall Jr., SFPE Handbook of Fire Protection Engineering , First Edition, 2015.
- 2 John A. Purkiss, Long-Yuan Li , Fire Safety Engineering Design of Structures, CRC press, UK, Third Edition, 2013.
- 3 Proceedings of National seminar on Fireworks Safety - 1999, MSEC -1999.
- 4 Purkiss, J.A., Fireworks - Fire Safety Engineering,UK, Third Edition, 1996
- 5 Bill of Ofca, Fireworks Safety manual,1991
- 6 Ghosh, K.N., Principles of fireworks, Khatsuria, H., Sivakasi, Second Edition, 1987.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VIII

Regulation :R2020

Course Code : 20SF863

Course Name :FIREWORKS SAFETY

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Acquire knowledge on the properties of the chemicals used in the fireworks.	2	3	2	2	-	-	2	2	-	-	-	-	2	3
CO2:	Familiarize about the static charge and dust in fireworks factories.	2	3	2	2	-	-	2	2	-	-	-	-	2	3
CO3:	Recall about the various types of process in risk related fireworks.	2	3	2	2	-	-	2	2	-	-	-	-	2	3
CO4:	Analyze the material handling techniques and transportation of explosives in fireworks	2	3	2	2	-	-	2	2	-	-	-	-	2	3
CO5:	Determine the concepts of waste control and user safety in fireworks	2	3	2	2	-	-	2	2	-	-	-	-	2	3
Average		2	3	2	2	-	-	2	2	-	-	-	-	2	3

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

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

R 2020

SEMESTER- VIII**DOCK SAFETY**

(Professional Elective - IV)

20SF864

L	T	P	C
3	0	0	3

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

CO1: Determine the history of legislation towards dock safety.

Understand

CO2: Recall about the cargo ships and the safety precautions in the use of transport equipment.

Understand

CO3: Classify the different types of lifting appliances and its construction and maintenance.

Understand

CO4: Acquire knowledge on various types of transport equipment and their handling of cargos.

Understand

CO5: Apply the emergency action plan for fire and explosions and understand about the dock regulations.

Apply

UNIT - I HISTORY OF SAFETY LEGISLATION**[09]**

History of dock safety statutes in India-background of present dock safety statutes- dock workers (safety, health and welfare) act 1986 and the rules and regulations framed there under, other statutes like marking of heavy packages act 1951 and the rules framed there under - manufacture, storage and import of hazardous chemicals. Rules 1989 framed under the environment (protection) act, 1989 - few cases laws to interpret the terms used in the dock safety statutes.

Responsibility of different agencies for safety, health and welfare involved in dock work - responsibilities of port authorities - dock labour board - owner of ship master, agent of ship - owner of lifting appliances and loose gear etc. - employers of dock workers like stevedores - clearing and forwarding agents - competent persons and dock worker. Forums for promoting safety and health in ports - safe committees and advisory committees, their functions, training of dock workers.

UNIT - II WORKING ON BOARD THE SHIP**[09]**

Types of cargo ships - working on board ships - Safety in handling of hatch beams - hatch covers including its marking, mechanical operated hatch covers of different types and its safety features - safety in chipping and painting operations on board ships - safe means of accesses - safety in storage etc. - illumination of decks and in holds - hazards in working inside the hold of the ship and on decks - safety precautions needed - safety in use of transport equipment - internal combustible engines like forklift trucks - pay loaders etc. Working with electricity and electrical management - storages - types, hazardous cargo.

UNIT - III LIFTING APPLIANCES**[09]**

Different types of lifting appliances - construction, maintenance and use, various methods of rigging of derricks, safety in the use of container handling / lifting appliances like portainers, transtainer, top lift trucks and other containers - testing and examination of lifting appliances - portainers - transtainers - top lift trucks - derricks in different rigging etc. Use and care of synthetic and natural fiber ropes - wire rope chains, different types of slings and loose gears.

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

The different types of equipment for transporting containers and safety in their use safety in the use of self-loading container vehicles, container side lifter and fork lift truck, dock railways, conveyors and cranes. Safe use of special lift trucks inside containers - testing, examination and inspection of containers - carriage of dangerous goods in containers and maintenance and certification of containers for safe operation Handling of different types of cargo - stacking and un stacking both on board the ship and ashore - loading and unloading of cargo identification of berths/walking for transfer operation of specific chemical from ship to shore and vice versa - restriction of loading and unloading operations.

UNIT - V EMERGENCY ACTION PLAN AND DOCK WORKERS (SHW) REGULATIONS 1990**[09]**

Emergency action Plans for fire and explosions - collapse of lifting appliances and buildings, sheds etc. - gas leakages and precautions concerning spillage of dangerous goods etc. - Preparation of on-site emergency plan and safety report. Dock workers (SHW) rules and regulations 1990 - related to lifting appliances, Container handling, loading and unloading, handling of hatch coverings and beams, cargo handling, conveyors, dock railways, forklift.

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

- 1 BindraSR ,Coursein Dock and Harbour Engineering, DhanpatRai Publications (P) Ltd., New Delhi, 2013.
- 2 Srinivasan,Harbour, Dock and Tunnel Engineering, Charotar Publishing House Pvt. Limited, New Delhi, 29th Edition, 2011.
- 3 International Labour Organization, Safety and Health in Dock Work, New York,second edition, 1997.
- 4 Safety and Health in Dock work, ILO, Third edition, 1992.
- 5 Indian Dock Labourers Act 1934 with rules 1948, Law Publishers (India) Pvt. Ltd., Allahabad, Second Edition, 1932.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VIII

Regulation:R2020

Course Code : 20SF864

Course Name :DOCK SAFETY

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Determine the history of legislation towards dock safety.	2	3	2	3	2	2	-	-	-	-	-	2	-	3
CO2:	Recall about the cargo ships and the safety precautions in the use of transport equipment.	2	3	2	3	2	2	-	-	-	-	-	2	-	3
CO3:	Classify the different types of lifting appliances and its construction and maintenance.	2	3	2	3	2	2	-	-	-	-	-	2	-	3
CO4:	Acquire knowledge on various types of transport equipment and their handling of cargos.	2	3	2	3	2	2	-	-	-	-	-	2	-	3
CO5:	Apply the emergency action plan for fire and explosions and understand about the dock regulations.	2	3	2	3	2	2	-	-	-	-	-	2	-	3
Average		2	3	2	3	2	2	-	-	-	-	-	2	-	3

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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

R 2020

SEMESTER- VIII**SAFETY IN MINES**

(Professional Elective - IV)

20SF865

L	T	P	C
3	0	0	3

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

- CO1: Acquire knowledge on open cast mines and safe handling of explosives.
 CO2: Gain knowledge on underground mines and their working conditions.
 CO3: Demonstrate about the hazards and safety measures in tunneling.
 CO4: Analyze about the concept of risk assessment techniques
 CO5: Learn about accident analysis and its management systems.

Cognitive Level

Understand
 Understand
 Understand
 .Analyze
 Understand

UNIT – I OPEN CAST MINES**[9]**

Causes and prevention of accident from: Heavy machinery, belt and bucket conveyors, drilling, hand tools - pneumatic systems, pumping, water, dust, electrical systems and fire prevention. Garage safety - accident reporting system - working condition - safe transportation - handling of explosives.

UNIT – II UNDERGROUND MINES**[9]**

Fall of roof and sides - effect of gases-fire and explosions - water flooding - warning sensors - gas detectors - occupational hazards - working conditions - winding and transportation.

UNIT – III TUNNELLING**[9]**

Hazards from: ground collapse, inundation and collapse of tunnel face, falls from platforms and danger from falling bodies. Atmospheric pollution (gases and dusts) - trapping - transport - noise - electrical hazards - noise and vibration from: pneumatic tools and other machines - ventilation and lighting - personal protective equipment.

UNIT – IV RISK ASSESSMENT**[9]**

Basic concepts of risk - reliability and hazard potential - elements of risk assessment - statistical methods - control charts - appraisal of advanced techniques - fault tree analysis - failure mode and effect analysis - quantitative structure - activity relationship analysis - fuzzy model for risk assessment.

UNIT – V ACCIDENT ANALYSIS AND MANAGEMENT**[9]**

Accidents classification and analysis - fatal, serious, minor and reportable accidents - safety audits - recent development of safety engineering approaches for mines - frequency rates - accident occurrence - investigation - measures for improving safety in mines - cost of accident - emergency preparedness - disaster management.

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

- 1 Dhillon, S BalbirMine., *safety- A modern Approach*, Springer Publication,2010.
- 2 Hartmann, *Introduction to mining engineering*, Wiley Publications, 2007.
- 3 Fred G. Bell, J. Laurance, *Mining and its impact on environment*, Taylor andFrancis,2006.
- 4 DGMS Circulars-Ministry of Labour, Government of India press, OR Lovely Prakashan-DHANBAD, 2002.
- 5 Kejriwal, B.K., *Safety in Mines*, GyanPrakashan, Dhanbad, 2001.
- 6 Michael Karmis ed., *Mine Health and Safety Management*, SME, Littleton, Co.2001.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VIII

Regulation :R2020

Course Code : 20SF865

Course Name :SAFETY IN MINES

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Acquire knowledge on open cast mines and safe handling of explosives.	2	3	2	3	2	2	-	-	-	-	-	2	-	3
CO2:	Gain knowledge on underground mines and their working conditions.	2	3	2	3	2	2	-	-	-	-	-	2	-	3
CO3:	Demonstrate about the hazards and safety measures in tunneling.	2	3	2	3	2	2	-	-	-	-	-	2	-	3
CO4:	Analyze about the concept of risk assessment techniques	2	3	2	3	2	2	-	-	-	-	-	2	-	3
CO5:	Learn about accident analysis and its management systems.	2	3	2	3	2	2	-	-	-	-	-	2	-	3
Average		2	3	2	3	2	2	-	-	-	-	-	2	-	3

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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

R 2020

SEMESTER- VIII**NUCLEAR SAFETY**

(Professional Elective - IV)

20SF866

L	T	P	C
3	0	0	3

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

- CO1: Explore the basic concepts of fission process and activity
 CO2: Analyze the control requirements in design considerations
 CO3: Classify the reactor types and their role of power generation in India.
 CO4: Apply the safe design principles of nuclear reactors and their safety
 CO5: Acquire knowledge on radiation control, its exposure and their disposal practices.

.Understand
 Analyze
 Understand
 .Apply
 Understand

UNIT - I INTRODUCTION**[9]**

Binding energy - fission process - radio activity - alpha, beta and gamma rays radioactive decay - decay schemes - effects of radiation - neutron interaction - cross section - reaction rate - neutron moderation - multiplication - scattering - collision - fast fission - resonance escape - thermal utilization - criticality.

UNIT - II REACTOR CONTROL**[9]**

Control requirements in design considerations - means of control - control and shut down rods - their operation and operational problems - control rod worth - control instrumentation and monitoring - online central data processing system.

UNIT - III REACTOR TYPES**[9]**

Boiling water reactors - radioactivity of steam system - direct cycle and dual cycle power plants - pressurized water reactors and pressurized heavy water reactors - fast breeder reactors and their role in power generation in the Indian context - conversion and breeding - doubling time - liquid metal coolants - nuclear power plants in India.

UNIT - IV SAFETY OF NUCLEAR REACTORS**[9]**

Safety design principles - engineered safety features - site related factors - safety related systems - heat transport systems - reactor control and protection system - fire protection system - quality assurance in plant components - operational safety - safety regulation process - public awareness and emergency preparedness. Accident Case studies - Three Mile island and Chernobyl accident.

UNIT - V RADIATION CONTROL**[9]**

Radiation shielding - radiation dose - dose measurements - units of exposure - exposure limits - barriers for control of radioactivity release - control of radiation exposure to plant personnel - health physics surveillance - waste management and disposal practices - environmental releases.

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

- 1 Robert E. Masterson, Nuclear Engineering Fundamentals, CRC Press,UK,First Edition, 2017.
- 2 Jhon R. Lamarsh, Anthony J. Baratta ,Introduction to Nuclear Engineering , CRC Press , New York, Third Edition, 2014.
- 3 Dr. G. Vardyanathan., Nuclear reactor Engineering, UK, Second Edition, 2013.
- 4 Charles D. Ferguson, Nuclear Energy, New York, Second Edition, 2011.
- 5 Regulatory control of nuclear power plants Part A, International Atomic Energy Agency, Vienna,Austria,First Edition, 2002

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VIII

Regulation :R2020

Course Code : 20SF866

Course Name :NUCLEAR SAFETY

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1:	Explore the basic concepts of fission process and activity	3	2	3	2	2	-	3	2	2	-	-	-	2	3
CO2:	Analyze the control requirements in design considerations	3	2	3	2	2	-	3	2	2	-	-	-	2	3
CO3:	Classify the reactor types and their role of power generation in India.	3	2	3	2	2	-	3	2	2	-	-	-	2	3
CO4:	Apply the safe design principles of nuclear reactors and their safety	3	2	3	2	2	-	3	2	2	-	-	-	2	3
CO5:	Acquire knowledge on radiation control, its exposure and their disposal practices.	3	2	3	2	2	-	3	2	2	-	-	-	2	3
Average		3	2	3	2	2	-	3	2	2	-	-	-	2	3

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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

R 2020

SEMESTER- VIII

20SF867

PLANT LAYOUT AND MATERIALS HANDLING

(Professional Elective - V)

L	T	P	C
3	0	0	3

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

- CO1: Acquire knowledge on plant locations and the safe storage of chemicals.
 CO2: Analyze the plant layout and their safety for various types of process industry.
 CO3: Determine the principles of good ventilation and illumination
 CO4: Gain knowledge on the benefits of an efficient material handling system and lifting tackles.
 CO5: Classify the various types of mechanical material handling devices.

Cognitive Level

Understand
 Analyze
 Understand
 Understand
 Understand

UNIT – I PLANT LOCATION**[10]**

Selection of plant locations, territorial parameters, considerations of land, water, electricity, location for waste treatment and disposal, further expansions. Safe location of chemical storages, LPG, LNG, CNG, acetylene, ammonia, chlorine, explosives and propellants.

UNIT – II PLANT LAYOUT**[10]**

Safe layout, equipment layout, safety system, fire hydrant locations, fire service rooms, facilities for safe effluent disposal and treatment tanks, site considerations, approach roads, plant railway lines, security towers.

Safe layout for process industries, engineering industry, construction sites, pharmaceuticals, pesticides, fertilizers, refineries, food processing, nuclear power stations, thermal power stations, metal powders manufacturing, fireworks and match works.

UNIT – III WORKING CONDITIONS**[7]**

Principles of good ventilation, purpose, physiological and comfort level types, local and exhaust ventilation, hood and duct design, air conditioning, ventilation standards, application.

Purpose of lighting, types, advantages of good illumination, glare and its effect, lighting requirements for various work, standards - Housekeeping, principles of 5S.

UNIT – IV MANUAL MATERIAL HANDLING AND LIFTING TACKLES**[9]**

Preventing common injuries, lifting by hand, team lifting and carrying, handling specific shape machines and other heavy objects - accessories for manual handling, hand tools, jacks, hand trucks, dollies and wheel barrows - storage of specific materials - problems with hazardous materials, liquids, solids - storage and handling of cryogenic liquids - shipping and receiving, stock picking, dock boards, machine and tools, steel strapping and sacking, glass and nails, pitch and glue, boxes and cartons and car loading - personal protection - ergonomic considerations.

Fiber rope, types, strength and working load inspection, rope in use, rope in storage - wire rope, construction, design factors, deterioration causes, sheaves and drums, lubrication, overloading, rope fitting, inspection and replacement - slings, types, method of attachment, rated capacities, alloy chain slings, hooks and attachment, inspection.

UNIT – V MECHANICAL MATERIAL HANDLING**[9]**

Hoisting apparatus, types - cranes, types, design and construction, guards and limit devices, signals, operating rules, maintenance safety rules, inspection and inspection checklist - conveyors, precautions, types, applications.

Powered industrial trucks, requirements, operating principles, operators selection and training and performance test, inspection and maintenance, electric trucks, gasoline operated trucks, LPG trucks - power elevators, types of drives, hoist way and machine room emergency procedure, requirements for the handicapped, types- Escalator, safety devices and brakes, moving walks - man lifts, construction, brakes, inspection.

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

- 1 C. Ray Asfahl, David W. Rieske., Industrial Safety and Health Management , Prentice Hall,U.K.,seventh edition, 2018.
- 2 Encyclopedia of occupational safety and health, ILO Publication, Francis, Fourth Edition, 1998
- 3 Apple M. James., Plant layout and material handling, John Wiley & sons, New York,Third edition, 1977
- 4 Reymond, A.Kulwice.,Material Handling Hand Book - II, John Wiley and Sons, New York, 1985.
- 5 Safety and good housekeeping, N.P.C. New Delhi, 1985.
- 6 Industrial ventilation (A manual for recommended practice), American conference of government industrial Hygiene, Thirty Edition, USA, 1984.
- 7 Accident prevention manual for industrial operations, N.S.C., Fourth Edition, Chicago, 1982.
- 8 Rudenko, N., Material handling Equipments, Mir Publishers, Fifth Edition, 1981.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VIII

Regulation :R2020

Course Code : 20SF867

Course Name : PLANT LAYOUT AND MATERIALS HANDLING

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Acquire knowledge on plant locations and the safe storage of chemicals.	2	3	2	3	-	2	2	3	2	-	-	-	-	-
CO2:	Analyze the plant layout and their safety for various types of process industry.	2	3	2	3	-	2	2	3	2	-	-	-	-	-
CO3:	Determine the principles of good ventilation and illumination	2	3	2	3	-	2	2	3	2	-	-	-	-	-
CO4:	Gain knowledge on the benefits of an efficient material handling system and lifting tackles.	2	3	2	3	-	2	2	3	2	-	-	-	-	-
CO5:	Classify the various types of mechanical material handling devices.	2	3	2	3	-	2	2	3	2	-	-	-	-	-
Average		2	3	2	3	-	2	2	3	2	-	-	-	-	-

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

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

R 2020

SEMESTER- VIII**OHSAS18000 AND ISO14000**

(Professional Elective - V)

20SF868

L	T	P	C
3	0	0	3

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

- CO1: Acquire knowledge on the basic concepts of OSHA standard
 CO2: Explore the details of OHSAS 18000 policy and planning with their guidelines and methods.
 CO3: Apply the concepts of implementation, review and improvement plan.
 CO4: Analyze about ISO 14000 and 45001 policies with its planning.
 CO5: Acquire knowledge on environmental impact assessment, types & control.

. Understand
 Understand
 Apply
 Analyze
 Understand

UNIT - I OHSAS STANDARD**[9]**

Introduction - development of OHSAS standard - Structure and features of OSHAS 18001 - benefits of certification - certification procedure - OH & S management system element, specification and scope - correspondence between OHSAS 18001, ISO 14001:1996 and ISO 9001:1994 - guidelines (18002:2000) for implementing OHSAS 18001.

UNIT - II OHSAS 18000 POLICY & PLANNING**[9]**

Developing OH & S policy - guidelines - developments - procedure - content of OH & S policy - General principle, strategy and planning, specific goals, compliance - methodology.

Planning - guidelines, methodology steps developing action plan - analysis and identification of priorities, objective & targets, short term action plan, benefits and cost of each option, Development of action plan.

UNIT - III IMPLEMENTATION, REVIEW AND IMPROVEMENT PLAN**[9]**

Guidelines for structure and Responsibilities, Top level management, middle level management, co-ordinator and employees - developing procedures, identifying training needs, providing training, documentation of training, Training methodology consultation and communications.

Checking & Review; performance measurement and monitoring, proactive and reactive monitoring, measurement techniques, inspections, measuring equipment - accidents reports, Process & procedures, recording, investigation corrective action and follow up - records and records management. Handling documentation, information, records.

UNIT - IV ISO 14000 POLICY, ISO 45001 POLICY & PLANNING**[9]**

EMS, ISO 14001, specifications, objectives, Environmental Policy, Guidelines & Principles (ISO 14004), clauses 4.1 to 4.5. Documentation requirements, 3 levels of documentation for an ISO 14000 based EMS, steps in ISO 14001.

Implementation plan, Registration, importance of ISO 14000 to the Management. Auditing ISO14000-General principles of Environmental Audit, Auditor, steps in audit, Audit plan.

ISO 45001 - Scope, Terms and definitions, OH&S Policy, Planning, Objectives, Documentation, Importance, Evaluation, Management Review.

UNIT - V ENVIRONMENT IMPACT ASSESSMENT**[9]**

ISO 14040 (LCA), General principles of LCA, Stages of LCA, Report and Review. ISO 14020 (Eco labeling) - history, 14021, 14024, Type I labels, Type II labels, ISO 14024, principles, rules for eco labeling before company attempts for it, advantages, EIA in EMS, types of EIA, EIA methodology - EIS, Scope, Benefits. Audit - methodology, auditors audit results, management review - Continual improvement.

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

- 1 ISO 9000 to OHSAS 18001, Dr. K.C. Arora, S.K. Kataria & Sons, Delhi, First Edition, 2003.
- 2 NQA-ISO-45001-Implementation-Guide.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VIII

Regulation :R2020

Course Code : 20SF868

Course Name : OHSAS18000 AND ISO14000

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Acquire knowledge on the basic concepts of OSHA standard	3	2	2	3	2	-	3	2	-	-	-	2	-	-
CO2:	Explore the details of OHSAS 18000 policy and planning with their guidelines and methods.	3	2	2	3	2	-	3	2	-	-	-	2	-	-
CO3:	Apply the concepts of implementation, review and improvement plan.	3	2	2	3	2	-	3	2	-	-	-	2	-	-
CO4:	Analyze about ISO 14000 and 45001 policies with its planning.	3	2	2	3	2	-	3	2	-	-	-	2	-	-
CO5:	Acquire knowledge on environmental impact assessment, types & control.	3	2	2	3	2	-	3	2	-	-	-	2	-	-
Average		3	2	2	3	2	-	3	2	-	-	-	2	-	-

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

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

R 2020

SEMESTER- VIII**SAFETY IN POWDER HANDLING**

(Professional Elective - V)

20SF869

L	T	P	C
3	0	0	3

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

- CO1: Acquire knowledge on powder classification, its physical, chemical and other properties.
- CO2: Demonstrate about the metal powders and their characterization.
- CO3: Familiarize about Industrial dust and their explosion.
- CO4: Gain knowledge on dust handling plants and electro static hazards.
- CO5: Analyze about the dust evaluation methods and their control.

Understand

Understand

Understand

Understand

Analyze

UNIT - I INTRODUCTION**[8]**

Powder classification - physical, chemical and other properties - metal powders - other non-metallic powders, Safety in cement, fly ash, quarry, sawdust, paint - handling methods - manual, mechanical, automatic - charges on powders -charge distribution - charging of powders.

UNIT - II METAL POWDERS AND CHARACTERIZATION**[10]**

Atomization, types - milling - electro deposition - spray drying, Production of iron powder, Aluminium powder, Titanium - screening & cleaning of metals - explosivity and pyrophoricity - toxicity.

Particle size and size distribution - measurement, types and significance - particle shape analysis, methods, surface area, density, porosity, flow rate - testing.

Metal powders, applications as fuel, solid propellants, explosives, pyrotechnics. Hazards in metal powder industries and safety principles.

UNIT - III DUST EXPLOSION**[9]**

Industrial dust, dust explosion accidents - explosibility characteristics, minimum explosive concentration, minimum ignition energy, explosion pressure characteristics, maximum permissible oxygen concentration - explosibility tests, Hartmann vertical tube apparatus, horizontal tube apparatus, inflammatory apparatus, Godbert and Green ward furnace. Explosibility classification - hybrid test - gas mixtures - dust ignition sources - dust explosion prevention - dust explosion protection - dust explosion venting, vent coefficient, various methods of design - venting of ducts and pipes - dust fire.

UNIT - IV DUST HANDLING PLANTS AND ELECTRO STATIC HAZARDS**[9]**

Grinding mills, conveyors, bucket elevators, dust separators, dust filters, cyclones, driers, spray driers, silos, grain elevators, typical applications, hazards and safety practices.

Electrostatic charges-energy released - type of discharge - spark - carona - insulating powders - propagating brush discharge - discharge in bulk lightning hazards in powder coating - electroplating.

UNIT - V DUST EVALUATION AND CONTROL**[9]**

Dust Evaluation, methodology, Quantitative, sampling, measurements - control approaches and strategies - control of dust sources, dust transmission - role of workers, PPE and work practice - housekeeping - storage - labeling - warning sign - restricted areas - Environmental protections.

Evaluation procedures and control measures for particulates (Respirable), Asbestos and other fibers, silica in coal mine - NIOSH guide to the selection and use of particulate respirators - case studies.

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

- 1 Martin Glor, Electro Static Hazard in Powder Handling, Research studies Press Ltd., England, Fourth Edition, 1988.
- 2 Major hazard control - ILO Geneva, 1987.
- 3 Seminar on Hazard recognition and prevention in the work place - airborne dust, Vol.I and 2, SRMC, Chennai, Second Edition, 4/5, Sept.2000.
- 4 ASM Metals hand book, Ninth edition, Vol.7, Powder Metallurgy.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VIII

Regulation:R2020

Course Code : 20SF869

Course Name : SAFETY IN POWDER HANDLING

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Acquire knowledge on powder classification, its physical, chemical and other properties.	2	3	2	3	2	-	-	2	-	-	-	-	3	2
CO2:	Demonstrate about the metal powders and their characterization.	2	3	2	3	2	-	-	2	-	-	-	-	3	2
CO3:	Familiarize about Industrial dust and their explosion.	2	3	2	3	2	-	-	2	-	-	-	-	3	2
CO4:	Gain knowledge on dust handling plants and electro static hazards.	2	3	2	3	2	-	-	2	-	-	-	-	3	2
CO5:	Analyze about the dust evaluation methods and their control.	2	3	2	3	2	-	-	2	-	-	-	-	3	2
Average		2	3	2	3	2	-	-	2	-	-	-	-	3	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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

R 2020

SEMESTER- VIII**Professional Ethics**

20SF871

(Professional Elective - V)

L	T	P	C
3	0	0	3

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

- CO1: Explain the basic perceptions of ethics, moral and values.
 CO2: Describe the current industrial standards.
 CO3: Discuss the risk and safety benefits in the industry
 CO4: Explain the professional rights and responsibilities of engineers
 CO5: Illustrate the Various global issues and apply the ethical principles in professional life.

Understand
 Analyze
 Understand
 Apply
 Apply

UNIT - I ENGINEERING ETHICS [9]

Senses of 'Engineering Ethics' - Variety of Moral Issues - Types of Inquiry - Moral dilemmas - Moral autonomy - Kohlberg's theory - Gilligan's theory - Consensus and Controversy - Models of Professional roles - Professional Ideals and Virtues- Uses of Ethical Theories.

UNIT - II ENGINEERING AS SOCIAL EXPERIMENTATION [9]

Engineering as Experimentation - Engineers as responsible Experimenters - Codes of Ethics -Industrial standards-Balanced Outlook on Law - The Challenger Case Study.

UNIT - III ENGINEER'S RESPONSIBILITY FOR SAFETY [9]

Safety and Risk - Assessment of Safety and Risk - Risk Benefit Analysis - Reducing Risk - Liability-The Chernobyl and Bhopal case studies.

UNIT - IV RESPONSIBILITIES AND RIGHTS [9]

Collegiality and Loyalty - Respect for Authority - Collective Bargaining - Confidentiality - Conflicts of Interest - Occupational Crime - Professional Rights - Employee Rights - Intellectual Property Rights (IPR) - Discrimination.

UNIT - V GLOBAL ISSUES [9]

Multinational Corporations - Environmental Ethics - Computer Ethics - Weapons Development - Engineers as Managers- Consulting Engineers-Engineers as Expert Witnesses and Advisors -Corporate Social Responsibility (CSR)-Moral Leadership- Code of Conduct.

Total (L= 45, T = 0) = 45 Periods**TEXT BOOKS:**

1. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw-Hill, New Delhi, Fifth Edition, 2017.
2. Dr.K.R.Govindan and S.Senthilkumar, Professional Ethics, Anuradha Agencies, Chennai ,Revised Edition, 2014.

REFERENCES:

1. Govindarajan M, Natarajan S, Senthil Kumar V. S, Engineering Ethics, Prentice Hall of India, New Delhi, Fourth Edition, 2016.
2. Charles D. Fleddermann, Engineering Ethics, Pearson Education / Prentice Hall, New Delhi, Seventh Edition, 2015.
3. Charles E Harris, Michael S. Protchard and Michael J Rabins, Engineering Ethics - Concepts and Cases, Thompson Learning, New Delhi , Sixth Edition, 2015.
4. A.B Rao, Business Ethics & Professional Values- Excel books, New Delhi , Fifth Edition, 2014.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VIII

Regulation:R2020

Course Code : 20SF871

Course Name : Professional Ethics

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Explain the basic perceptions of ethics, moral and values.	2	2	-	-	-	2	2	3	-	-	-	2	-	-
CO2:	Describe the current industrial standards.	2	2	-	-	-	2	2	3	-	-	-	2	-	-
CO3:	Discuss the risk and safety benefits in the industry	2	2	-	-	-	2	2	3	-	-	-	2	-	-
CO4:	Explain the professional rights and responsibilities of engineers	2	2	-	-	-	2	2	3	-	-	-	2	-	-
CO5:	Illustrate the Various global issues and apply the ethical principles in professional life.	2	2	-	-	-	2	2	3	-	-	-	2	-	-
Average		2	2	-	-	-	2	2	3	-	-	-	2	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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

R 2020

SEMESTER- VIII

20SF872

Aviation Safety
(Professional Elective - V)

L	T	P	C
3	0	0	3

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

CO1: Analyse the various safety aspects at airport

Analyze

CO2: Understand the concept of security management.

Understand

CO3: Understand the threats involved in aviation

Understand

CO4: Enhance decision making skills in combating Terrorism and Hijacking

Analyze

CO5: Understand Technological Improvements on Aviation Safety

Understand

UNIT - I INTRODUCTION TO AIR TRANSPORTATION SAFETY**[9]**

Introduction - Importance of Air transportation - Aviation Safety and Security - Deregulation- Consequences of 9/11 to the industry - Emergency Funding - Protecting Public Air transportation.

UNIT - II SAFETY MANAGEMENT**[9]**

Passenger screening- Baggage scanning - Maintenance of aircraft and airports - Crowd control- Technological issues- Human errors - Safety management in Airports(Landside and Airside) - Objects prohibited in the airport/aircraft- safety management in the aircraft

UNIT - III SECURITY MANAGEMENT.**[9]**

Threats to aviation- Incidents of security failures- Unclaimed Baggage handling- Carriage of weapons onboard- Unruly pax - Hijack - Sabotage - Bomb threat - Security measures at the airside/landside and aircraft.

UNIT - IV CONTINGENCY PLANNING**[9]**

Meaning, definition of contingency, role of Airports authority during emergency- Airline responsibilities- Air Navigation Service Provider (ANSP)

UNIT - V RECENT DEVELOPMENTS**[9]**

Technological Improvements on Aviation Safety and Security -Introduction- Microwave Holographic Imaging -Body or Fire Security Scanner -New Generation of video Security Systems -Biosimmer - Biometric Systems.

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

- 1 Aviation in Crisis - Ruwantissa I.R. Abeyratne - Ashgate Publishing Ltd.
- 2 Aviation Safety Programs -Richard H. Wood - Jeppesen Sanderson Inc.
- 3 Aviation and Airport Security - Kathleen M. Sweet-Pearson Education Inc.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VIII

Regulation :R2020

Course Code : 20SF872

Course Name :Aviation Safety

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Analyse the various safety aspects at airport	2	3	2	3	-	3	-	-	-	-	-	-	2	3
CO2:	Understand the concept of security management.	2	3	2	3	-	3	-	-	-	-	-	-	2	3
CO3:	Understand the threats involved in aviation	2	3	2	3	-	3	-	-	-	-	-	-	2	3
CO4:	Enhance decision making skills in combating Terrorism and Hijacking	2	3	2	3	-	3	-	-	-	-	-	-	2	3
CO5:	Understand Technological Improvements on Aviation Safety	2	3	2	3	-	3	-	-	-	-	-	-	2	3
Average		2	3	2	3	-	3	-	-	-	-	-	-	2	3

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

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

R 2020

SEMESTER- VIII

20SF873

Air Pollution and Control
(Professional Elective - V)

L	T	P	C
3	0	0	3

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

- CO1: Understand of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management
- CO2: Ability to identify, formulate and solve air and noise pollution problems
- CO3: Ability to design stacks and particulate air pollution control devices to meet applicable standards.
- CO4: Ability to select control equipments.
- CO5: Ability to ensure quality, control and preventive measures

Understand

Analyze

Create

Analyze

Analyze

UNIT - I INTRODUCTION**[7]**

Structure and composition of Atmosphere - Definition, Scope and Scales of Air Pollution - Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility- Ambient Air Quality and Emission standards.

UNIT - II METEOROLOGY**[6]**

Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Atmospheric Diffusion Theories - Dispersion models, Plume rise.

UNIT - III CONTROL OF PARTICULATE CONTAMINANTS**[11]**

Factors affecting Selection of Control Equipment - Gas Particle Interaction - Working principle - Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators.

UNIT - IV CONTROL OF GASEOUS CONTAMINANTS**[10]**

Factors affecting Selection of Control Equipment - Working principle - absorption, Adsorption, condensation, Incineration, Bio filters – Process control and Monitoring.

UNIT - V INDOOR AIR QUALITY MANAGEMENT**[11]**

Sources, types and control of indoor air pollutants, sick building syndrome and Building related illness Sources and Effects of Noise Pollution - Measurement - Standards -Control and Preventive measures.

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

- 1 Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, "Air Pollution Control Engineering", Tokyo, springer science + science media LLC,2004.
- 2 Noel de Nevers, "Air Pollution Control Engineering", Waveland press, Inc 2017.
- 3 Anjaneyulu. Y, "Air Pollution and Control Technologies", Allied Publishers (P) Ltd., India 2002.
- 4 David H.F. Liu, Bela G. Liptak, "Air Pollution", Lweis Publishers, 2000.
- 5 Arthur C. Stern, "Air Pollution (Vol.I - Vol.VIII)", Academic Press, 2006.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Semester : VIII

Regulation :R2020

Course Code :20SF873

Course Name :Air Pollution and Control

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Understand of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management	2	3	2	2	2	-	3	-	-	-	-	2	-	-
CO2:	Ability to identify, formulate and solve air and noise pollution problems	2	3	2	2	2	-	3	-	-	-	-	2	-	-
CO3:	Ability to design stacks and particulate air pollution control devices to meet applicable standards.	2	3	2	2	2	-	3	-	-	-	-	2	-	-
CO4:	Ability to select control equipments.	2	3	2	2	2	-	3	-	-	-	-	2	-	-
CO5:	Ability to ensure quality, control and preventive measures	2	3	2	2	2	-	3	-	-	-	-	2	-	-
Average		2	3	2	2	2	-	3	-	-	-	-	2	-	-

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

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

R 2020

20AU901

BASICS OF AUTOMOBILE ENGINEERING

(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: 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- Universaljoint - Differential - Rear axle drives - Wheels and Tyres.

UNIT - IV STEERING AND BRAKE**[09]**

Steering system - function and principle - Ackerman and Davis steering principles - wheel alignment -steering gear boxes.Brakes - Mechanical - hydraulic and vacuum brake - master cylinder - wheel cylinder -Bleeding of brakes.

UNIT - V ELECTRICAL SYSTEMS**[09]**

Battery - types - Dynamo and Alternator - Cut-out relay - Diagram of Wiring system - Lighting System and Accessories - Headlight - switches - Windscreen Wipers - Horn - Speedometer - Heater and Air conditioning.

Total = 45 Periods**Text Books :**

- 1 Kirpal Singh, Automobile Engineering, Vol. I & II, Standard Publishers, New Delhi, Fourteenth Edition, 2018.
- 2 Gupta, S. K., A Textbook of Automobile Engineering, S.Chand Publishing, New Delhi, Second Edition, 2020.

Reference Books :

- 1 Rajput, R K, A Textbook of Automobile Engineering, Laxmi Publications (P) Ltd, New Delhi, Second Edition, 2017.
- 2 Ganesan. V, Internal Combustion Engines, Tata McGraw-Hill Publishing Co., New Delhi, Fourth Edition, 2012.
- 3 Mathur M.L. and Sharma R.P, A Course in Internal Combustion Engines, DhanpatRai and sons, New Delhi, Second Edition, 2016.
- 4 Ramalingam K.K, Automobile Engineering, Scitech Publications (India) Pvt. Ltd, Chennai, Second Edition, 2011.

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

Regulation: R 2020

Course Code: 20AU901

Course Name: Basics of Automobile Engineering

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Provide basic platform knowledge of automobile engineering</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	<i>Explain the working principal of petrol and diesel engines</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	<i>Interpret the method of power transmission unit</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	<i>Built knowledge of steering and brake</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	<i>Illustrate the knowledge of automotive electrical systems and functioning</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
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 (Open Elective)	L	T	P	C
		3	0	0	3
Prerequisite: -					
Course Outcomes : On successful completion of the course, the student will be able to					Cognitive Level
CO1:	Illustrate the fundamental concepts and functions of an automotive engine and working cycles	Understand			
CO2:	Explain the combustion phenomena in SI engines	Understand			
CO3:	Identify the CI engines injection, ignition and combustion phenomena	Understand			
CO4:	Outline the emission control techniques.	Understand			
CO5:	Demonstrate themeasurement 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, Chemiluminescentanalyzers, Gas Chromatograph, smoke meters, emission standards, driving cycles - USA, Japan, Euro and India. Test procedures - ECE, FTP Tests. SHED Test - Chassis dynamometers, dilution tunnels.					

Total = 45 Periods

Text Books :

- 1 Ganesan. V, Internal Combustion Engines, Tata McGraw-Hill Publishing Co., New Delhi, Fourth Edition, 2012.
- 2 Mathur M.L. and Sharma R.P, A Course in Internal Combustion Engines, Dhanpat Rai and sons, New Delhi, Second Edition, 2016.

Reference Books :

- 1 Ramalingam K.K, Automobile Engineering, Scitech Publications (India) Pvt. Ltd, Chennai, Second Edition, 2011.
- 2 John B. Heywood, Internal Combustion Engine Fundamentals, Tata McGraw Hill Education, New Delhi, Second Edition, 2018.
- 3 Gupta H.N, Fundamentals of Internal Combustion Engines, PHI Learning Private Ltd., New Delhi, Second Edition, 2013.
- 4 Obert, E.F., Internal Combustion Engineering and Air Pollution, Intext Education Publishers, New York, Third Edition, 1988.

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

Regulation: R 2020

Course Code: 20AU902

Course Name: Automotive Engine Technology

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Illustrate the fundamental concepts and functions of an automotive engine and working cycles</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	<i>Explain the combustion phenomena in SI engines.</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	<i>Identify the CI engines injection, ignition and combustion phenomena</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	<i>Outline the emission control techniques.</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	<i>Demonstrate the measurement techniques and emission standards.</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
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 (Open Elective)	L	T	P	C
		3	0	0	3
Prerequisite: -					
Course Outcomes : On successful completion of the course, the student will be able to					Cognitive Level
CO1: Identify the construction and working of various types of automobile engines.					Understand
CO2: Evaluate the significance of clutch and transmission system.					Understand
CO3: Illustrate the types of axle, suspension and classification of steering system.					Understand
CO4: Discuss the various vehicle control systems.					Understand
CO5: Demonstrate the various new generation vehicles.					Understand
UNIT - I	AUTOMOBILE ENGINE	[09]			
Construction layout, types and components of engines, SI - CI - Wankel engine, working of engines, lubrication system, coolant system, power supply, alternate and dynamo, flywheel and damper.					
UNIT - II	CLUTCH AND TRANSMISSION	[09]			
Types of clutches, construction and working procedure of single plate clutch, multi-plate clutch, cone clutch, gears - types of gears, terminology of spur gear, gear trains, construction and working of manual and automatic gear box.					
UNIT - III	AXLE, SUSPENSION AND STEERING	[09]			
Types of axles, necessity of axle for an automobile, suspension system, types and construction of suspension system, significance of suspension system, steering system and vehicle handling, classification of steering system, merits and demerits of power steering.					
UNIT - IV	VEHICLE CONTROL SYSTEM	[09]			
Cruise control, antilock braking system, tyre slip controller, electronic steering control, global positioning system, autonomous navigation system.					
UNIT - V	NEW GENERATION VEHICLES	[09]			
Electric vehicles, hybrid vehicles, flexible fuel vehicles, solar powered vehicles, high energy and power density batteries, regenerative braking, safety air bags.					
Total = 45 Periods					

Text Books :

- 1 David A. Crolla, Automotive Engineering - Powertrain, Chassis system and Vehicle body, Butterworth-Heinemann, New Delhi, First Edition, 2009.
- 2 Ganesan. V, Internal Combustion Engines, Tata McGraw-Hill Publishing Co., New Delhi, Fourth Edition, 2012.

Reference Books :

- 1 Heinz Heisler, Advance Vehicle Technology, Butterworth-Heinemann, London, Second Edition, 2002.
- 2 Mathur M.L. and Sharma R.P, A Course in Internal Combustion Engines, Dhanpat Rai and sons, New Delhi, Second Edition, 2016.
- 3 James Larminie and John Lowry, Electric Vehicle Technology Explained, John Wiley & Sons, New York, Second Edition, 2012.
- 4 William B Ribbens, Understanding Automotive Electronics, Butterworth-Heinemann, Woburn, Eighth edition, 2017.

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DEPARTMENT OF SAFETY AND FIRE 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 (Open Elective)	L	T	P	C
		3	0	0	3
Prerequisite: -					
Course Outcomes : On successful completion of the course, the student will be able to					Cognitive Level
CO1: Explain the automotive safety and its importance.					Understand
CO2: Analyze the safety concepts.					Understand
CO3: Illustrate the various safety equipment functions and importance					Understand
CO4: Identify the various crash test and impact test mechanics.					Understand
CO5: Examine the function of warning and avoidance systems.					Understand
UNIT - I	INTRODUCTION	[09]			
Evolution of automotive safety - Active safety: driving safety, conditional safety, perceptibility safety, operatingsafety- 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 LjuboVlagic, Michel Parent and Fumio Harashima, Intelligent Vehicle Technologies, Butterworth-Heinemann publications, Oxford, First Edition, 2001.
- 2 Robert Bosch GmbH, Safety, Comfort and Convenience Systems, John Wiley& Sons, New Delhi, Third edition, 2007

Reference Books :

- 1 Bosch, Automotive HandBook, SAE International, New York, Eighth Edition, 2011.
- 2 Vivek D. Bhise, Ergonomics in the automotive design process. CRC Press, New York, 2012.
- 3 Ronald K Jurgen, Automotive Electronics Handbook, Tata McGraw-Hill Inc., New York, Second Edition, 1999.
- 4 William B Ribbens, Understanding Automotive Electronics, Butterworth-Heinemann, Woburn, Eighth edition, 2017.

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DEPARTMENT OF SAFETY AND FIRE 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	PS01	PS02
CO1	<i>Explain the automotive safety and its importance.</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO2	<i>Analyze the safety concepts.</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3	<i>Illustrate the various safety equipment functions and importance</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4	<i>Identify the various crash test and impact test mechanics.</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5	<i>Examine the function of warning and avoidance systems.</i>	3	3	3	-	-	-	-	-	-	-	-	3	-	-
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

(Open Elective)

L	T	P	C
3	0	0	3

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

CO1: Summarize the electric and hybrid vehicle operation and architectures.

Understand

CO2: Explain the different subsystems of hybrid and electric vehicle

Understand

CO3: Demonstrate the energy requirement for vehicles

Understand

CO4: Model and simulate the vehicle characteristics, operating modes, and performance parameters of the vehicle

Understand

CO5: Design and develop the systems of hybrid and electric vehicles

Understand

UNIT - I NEED FOR ALTERNATIVE SYSTEM**[09]**

Need for hybrid and electric vehicles - main components and working principles of a hybrid and electric vehicles, Different configurations of hybrid and electric vehicles. Comparative study of diesel, petrol, hybrid and electric Vehicles. Advantages and Limitations of hybrid and electric Vehicles.

UNIT - II SUBSYSTEMS OF HYBRID AND ELECTRIC VEHICLES**[09]**

Basics - Types, Parameters - Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Battery pack Design, Properties of Batteries.

UNIT - III ENERGY SOURCES**[09]**

Battery Parameters- - Different types of batteries - Lead Acid- Nickel Metal Hydride - Lithium ion- Sodium based- Metal Air. Battery Modeling- Equivalent circuits, Battery charging- Quick Charging devices. Fuel Cell- Fuel cell Characteristics- Fuel cell types-Half reactions of fuel cell. Ultra capacitors. Battery Management System.

UNIT - IV MOTORS AND CONTROLLERS**[09]**

Types of Motors, Characteristic of DC motors, AC single phase and 3-phase motor, PM motors, Switched reluctance motors, Motor Drives and speed controllers, Torque Vectoring, Regenerative Braking. Rectifiers, Inverters, DC/DC converters.

UNIT - V DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES**[09]**

Design requirement for electric vehicles- Range, maximum velocity, acceleration, power requirement, mass of the vehicle. Various Resistance- Transmission efficiency- Electric vehicle chassis and Body Design, Electric Vehicle Recharging and Refueling Systems, performance of electrical vehicles.

Total = 45 Periods**Text Books :**

- 1 Iqbal Husain, Electric and Hybrid Vehicles-Design Fundamentals, CRC Press, New York, Second Edition, 2010.
- 2 MehrdadEhsani, 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 LinoGuzzella, Vehicle Propulsion Systems, Springer-Verlag Berlin, Heidelberg, Third Edition, 2013
- 3 Ron Hodkinson, Light Weight Electric/ Hybrid Vehicle Design, Butterworth Heinemann Publication, London, 2001
- 4 Ronald K Jurgen, Electric and Hybrid - Electric Vehicles, SAE International, New York, First Edition, 2011.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20AU905

Course Name: Hybrid Vehicles

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	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, treedozer, 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 Hill Publishing company Ltd, New Delhi, Ninth Edition, 2018.
- 2 Nakra C.P., Farm machines and equipment, Dhanparai Publishing company, New Delhi, First Edition, 2003.

Reference Books :

- 1 Wong, J.Y., Theory of Ground Vehicles, John Wiley & Sons, New York, Fifth Edition, 2022.
- 2 Ageikin S., Off the road wheeled and combined traction devices - Ashgate Publishing Co. Ltd., New Delhi, First Edition, 1988
- 3 Heinz Heisler, Vehicle and Engine Technology, , SAE International, New York, Second Edition, 1999
- 4 Sean Bennet and Ian Andrew Norman, Heavy Duty Truck systems, Delmar Cengage learning, New York, Fifth Edition, 2011.

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DEPARTMENT OF SAFETY AND FIRE 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 scrapers, 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 (Open Elective)	L	T	P	C
		3	0	0	3
Prerequisite: -					
Course Outcomes : On successful completion of the course, the student will be able to					Cognitive Level
CO1:	Identify the various systems involved in driver support systems and their working principle.	Understand			
CO2:	Familiarize with global positioning systems, geographical information systems and navigationsystems.	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 SYSYEMS	[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 LjuboVlagic, 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 SAFETY AND FIRE 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 (Open Elective)	L	T	P	C
		3	0	0	3
Prerequisite: -					
Course Outcomes : On successful completion of the course, the student will be able to					Cognitive Level
CO1:	Describe the importance, types and requirements of vehicle maintenance and related records and schedules.				Understand
CO2:	Practice the engine overhauling, reconditioning; methods, procedures, tools of power plants, ignition system, cooling system and other engine components.				Understand
CO3:	Demonstrate the maintenance procedures of clutch, gear box, propeller shaft and steering systems.				Understand
CO4:	Demonstrate the construction, testing, fault diagnosis and maintenance of body panel and body tinkering.				Understand
CO5:	Describe the maintenance procedures of electrical systems. .				Understand
UNIT - I	MAINTENANCE TOOL, SHOP, SCHEDULE, RECORDS	[09]			
Standard tool set, torque wrenches, compression and vacuum gauges, engine analyzer and scanner, computerized wheelalignment and balancing, gauges for engine tune up and pollution measurement, spark plug cleaner, cylinder re-boringmachine, 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 reconditioningmethods for all engine components. Maintenance of ignition system, fuel injection system, cooling system-lubricationsystem. Engine trouble shooting chart.					
UNIT - III	MAINTENANCE, REPAIR AND OVERHAULING OF THE CHASSIS	[09]			
Maintenance, servicing and repair of clutch, fluid coupling, gearbox, torque converter, propeller shaft. Maintenance of front axle, rear axle, brakes, steering systems.					
UNIT - IV	MAINTENANCE AND REPAIR OF VEHICLE BODY	[09]			
Body panel tools for repairing. Tinkering and painting. Use of soldering, metalloid paste. Tyre maintenance, metallic,plastics					
UNIT - V	MAINTENANCE AND REPAIR OF ELECTRICAL SYSTEMS	[09]			
Care, maintenance, testing and troubleshooting of battery, starter motor, dynamo, alternator and regulator.Transistorized regulator problems.					

Total = 45 Periods

Text Books :

- 1 John E. Dolce, Analytical Fleet Maintenance Management, SAE International, New York, Third Edition, 2009.
- 2 James D. Halderman, Advanced Engine Performance Diagnosis, Pearson Education, New Delhi, Seventh Edition, 2019.

Reference Books :

- 1 Bosch Automotive Handbook, SAE International, New York, Tenth Edition, 2018
- 2 Willam H. Crouse and Donald L. Anglin, Automotive Mechanics, Tata McGraw Hill Publishing Company, New Delhi, Tenth Edition, 2007.
- 3 Service Manuals from different vehicle manufacturers.
- 4 Judge. A.N, Motor vehicle engine servicing, Pitman Paper pack, London, Third Edition, 1969.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20AU908

Course Name: Vehicle Maintenance

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	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 (Open Elective)	L	T	P	C
		3	0	0	3
Prerequisite: No prerequisites are needed for enrolling into the course					
Course Outcomes : On successful completion of the course, the student will be able to					Cognitive Level
CO1:	Illustrate various materials used and construction style of Indus Valley Civilization	Understand			
CO2:	Demonstrate the materials used and construction style of Chera, Chola and Pandya architecture	Understand			
CO3:	Describe the materials used and construction style of Mughal architecture	Understand			
CO4:	Explain the various materials and construction style of British architecture	Understand			
CO5:	Describe various materials and construction style of Portuguese, Dutch, French and Danish	Understand			
UNIT - I	INDUS VALLEY CIVILIZATION	[09]			
Indus valley civilization - Chronological introduction - Construction style - Materials used - The cities Harappa, lothal and Mohenjo-Daro, The great bath - The granary at Harappa - The assembly hall - Ajanta-Ellora Cave temples - Mahabodhi temple complex					
UNIT - II	SOUTH INDIAN ARCHITECTURE	[09]			
Chera-Chola-Pandya architecture - Chronological introduction - Construction style - Materials used - Brihadeeswarar Temple - Meenakshi Temple - Kalinga - Chalukya - Pallava architecture - Mahabalipuram stone temples - Khajuraho - MuskinBhanvi - Konark Sun Temple - Hoysala - Vijayanagara architecture - twin temples Mosale - Virupaksha temple Raya Gopura at Hampi					
UNIT - III	MUGHAL ARCHITECTURE	[09]			
Mughal architecture - Chronological introduction - Construction style - Materials used - QutubMinar - TajMahal - Humayun's Tomb - Redfort - FatehpurSikri - 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					

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

Text Books :

- 1 BindiaThapar, Surat Kumar Manto, and SuparnaBhalla., Introduction to Indian Architecture: Arts of Asia, Periplus Editions (HK) Ltd, Hong Kong, First Edition, 2005
- 2 SandhyaKethkar., The History of Indian Art, JyotsnaPrakashan 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

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

Course Code: 20CE901 **Regulation: R 2020**
Course Name: Architectural Heritage of India

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Illustrate various materials used and construction style of Indus Valley Civilization</i>	3	3	-	2	-	2	2	-	-	-	-	3	-	-
CO2	<i>Demonstrate the materials used and construction style of Chera, Chola and Pandya architecture</i>	3	3	-	2	-	2	2	-	-	-	-	3	-	-
CO3	<i>Describe the materials used and construction style of Mughal architecture</i>	3	3	-	1	-	2	2	-	-	-	-	3	-	-
CO4	<i>Explain the various materials and construction style of British architecture</i>	3	3	-	2	-	2	2	-	-	-	-	3	-	-
CO5	<i>Describe various materials and construction style of Portuguese, Dutch, French and Danish</i>	3	3	-	1	-	2	2	-	-	-	-	3	-	-
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

(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 factors to be considered in planning and construction of buildings	Understand
CO2:	Infer the different components and Foundations of building in their construction practices.	Understand
CO3:	Interpret masonry and alternative materials of wood, aluminum and glass.	Understand
CO4:	Discuss different types of floors, roofs and the materials which are commonly used for construction.	Understand
CO5:	Explain about dampness and fire resistance in buildings	Understand

UNIT - I FUNCTIONAL PLANNING OF BUILDINGS**[09]**

Types of Buildings, Aspects and Principles of Building Planning, Building By - laws and Regulations, Site Selection criteria, Orientation of Building and its relation to surrounding environment, Sustainability and Green Buildings - Building Bye - laws and Building code of India 2016.

UNIT - II BUILDING COMPONENTS AND FOUNDATIONS**[09]**

Lintels, arches, different types of floors-concrete, mosaic, terrazzo floors, pitched, flat and curved roofs, lean-to roof, coupled roofs, trussed roofs, king and queen post trusses; RCC roofs, madras terrace/shell roofs. Foundations: Shallow foundations, spread, combined, strap and mat footings.

UNIT - III ALTERNATIVE MATERIALS AND MASONRY**[09]**

Structure, properties, seasoning of timber; Classification of various types of woods used in buildings, defects in timber; Alternative materials for wood, galvanized iron, fibre-reinforced plastics, steel, aluminium and glass; Types of masonry, English and Flemish bonds, rubble and ashlar masonry, cavity and partition walls - Light weight concrete blocks - merits and demerits.

UNIT - IV FLOORS, ROOFS AND STAIRCASES**[09]**

Components of a floor, materials used for floor construction, Different types of flooring, Ground floor and upper floors, Types of roofs, Basic roofing elements and Roof coverings. Functional requirements of a good stair, type of stairs, planning a stair case.

UNIT - V DAMP PROOFING AND FIRE PROTECTION**[09]**

Damp proofing and Fire protection: Causes and effect of dampness on buildings, Materials and methods used for damp proofing, Fire hazards, Grading of buildings according to fire resistance, Fire resisting properties of common building materials, Fire resistant construction.

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

- 1 Varghese P. C., Building construction, PHI Learning Pvt. Ltd, New Delhi ,Second Edition, 2016.
- 2 B. C. Punmia , Ashok Kumar Jain, Arun Kumar Jain, Building Construction, Laxmi Publications, New Delhi ,Eleventh Edition, 2019.

Reference Books :

- 1 S. K. Duggal, Building Materials II, New Age International (P) Limited, New Delhi ,Fourth Edition, 2016,
- 2 Building Bye-laws 2019
- 3 National Building Code of India, 2016.

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

Course Code: 20CE902

Regulation: R 2020

Course Name: Building Planning and Construction

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
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)

20CE903

ELEMENTARY CIVIL ENGINEERING
(Open Elective)

R 2020

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 AnuragKandya, 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.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO-PO MAPPING

Course Code: 20CE903

Regulation: R 2020

Course Name: Elementary Civil Engineering

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	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	-	-	-	-	-	1	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous)		R 2020			
20CE904	ENERGY AND ENVIRONMENT (Open Elective)	L	T	P	C
		3	0	0	3
Prerequisite: No prerequisites are needed for enrolling into the course					
Course Outcomes : On successful completion of the course, the student will be able to					Cognitive Level
CO1: Outline the earth's energy, environment and the processes leading to climate change.					Understand
CO2: Infer the atmospheric issues related to the chemistry, green housegases					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				
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.					[09]
UNIT - II	GLOBAL ATMOSPHERIC ISSUES				
Composition of the present day atmosphere-Introduction to Atmospheric chemistry-Green House Gases, and the O3 - depletion problem-Post Industrial Revolution Scenario					[09]
UNIT - III	ENERGY BALANCE				
Earth Atmosphere System- Solar and Terrestrial Radiation- Absorption of Radiation by gases.-Energy balance- Solar variability and the Earth's Energy Balance.					[09]
UNIT - IV	ATMOSPHERIC CHEMISTRY AND CLIMATE				
The Global Temperature Record.-Possible effects of Global Warming. - Indian Context. Atmospheric Chemistry and Climate Change- Atmospheric Aerosol and Cloud Effects on Climate.					[09]
UNIT - V	ENVIRONMENTAL VARIABILITY				
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					[09]
Total (L= 40, T = 5) = 45 Periods					

Text Books :

- 1 Peter E Hodgson, Energy the Environment and Climate Change, Imperial College Press, London, FirstEdition, 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 inSupport 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

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING

CO-PO MAPPING

Course Code: 20CE904

Regulation: R 2020

Course Name: Energy and Environment

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
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			
20CE905	ENVIRONMENTAL LAWS AND POLICIES (Open Elective)	L	T	P	C
		3	0	0	3
Prerequisite: No prerequisites are needed for enrolling into the course					
Course Outcomes : On successful completion of the course, the student will be able to					Cognitive Level
CO1:	Summarize the basic concepts in environmental laws and its judicial activism	Understand			
CO2:	Interpret different water acts and marine laws in India	Understand			
CO3:	Summarize various Environment protection laws and acts in the framework of Mega projects	Understand			
CO4:	Explain the management and handling of various hazardous waste management	Understand			
CO5:	Summarize the International Environmental laws framed at various conferences.	Understand			
UNIT - I	BASIC CONCEPTS IN ENVIRONMENTAL LAW	[09]			
An introduction to the legal system - Constitution - Acts - Rules - Regulations - Indian Judiciary - Doctrine of precedents - judicial review - Writ petitions - PIL- liberalization of the rule of locus standi - Judicial activism - Introduction to environmental laws in India - Constitutional provisions - Stockholm conference - Bhopal gas tragedy - Rio conference - General principles in Environmental law - Precautionary principle - Polluter pays principle - Sustainable development- Public trust doctrine - Overview of legislations and basic concepts.					
UNIT - II	AIR- WATER - MARINE LAWS	[09]			
National Water Policy and some state policies - Laws relating to prevention of pollution, access and management of water and institutional mechanism - Water Act, 1974 - Water Cess Act, 1977 - EPA, 1986 - Pollution Control Boards Ground water and law Judicial remedies and procedures Marine laws of India - Coastal zone regulations - Legal framework on Air pollution - Air Act, 1981 - EPA, 1986					
UNIT - III	ENVIRONMENT PROTECTION LAWS - LARGE PROJECTS	[09]			
Legal framework on environment protection - Environment Protection Act as the framework legislation - strength and weaknesses of EIA - National Green tribunal the courts infrastructure projects					
UNIT - IV	HAZARDOUS SUBSTANCES AND ACTIVITIES	[09]			
Legal framework - EPA and rules made there under PLI Act, 199 - Principles of strict and absolute liability - Hazardous Wastes (Management, Handling and Transboundary) Rules, 2008 - Biomedical Waste (Management and Handling) Rules, 1998 - Municipal Solid Wastes (Management and Handling) Rules, 2000 - E - Waste (Management and Handling) Rules, 2011 - Batteries (Management & Handling) Rules, 2001					
UNIT - V	INTERNATIONAL ENVIRONMENTAL LAW	[09]			
Development of international environmental law, nature and scope of key international environmental law principles and rights (substantive and procedural), Establishment of Environmental Institutions like UNEP, Ozone Protection - Montreal Protocol for the Protection of Ozone Layer, 1987 as amended; U.N. Convention on Climate Change 1992, Kyoto Protocol, 1997; Public Participation in Decision-making and Access to Justice in Environmental Matters, 1998 (Aarhus Convention); Johannesburg Conference, 2002.					
Total (L= 45, T = 0) = 45 Periods					

Text Books :

- 1 Divan, S and Rosencranz, A., Environmental Law and Policy in India, Oxford India Paperbacks, New Delhi, Second edition, 2005.
- 2 Kanchan Chopra., Development and Environmental Policy in India: The Last Few Decades, Springer Publication, New Delhi, First edition, 2017.

Reference Books :

- 1 Birnie, P Boyle, and Red well's., International Law and the Environment ,Oxford University Press, United Kingdom, Fourth edition, 2021.
- 2 Upadhyay S. and Upadhyay V., Hand Book on Environmental Law- Forest Laws, Wildlife Laws and the Environment; Vols. I, II and III, Lexis NexisButterworths, 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 SAFETY AND FIRE ENGINEERING
CO-PO MAPPING

Course Code: 20CE905 **Regulation: R 2020**
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 KandarpTarkeshprasadVaishnav., 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 SAFETY AND FIRE 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)

K.S.R. COLLEGE OF ENGINEERING (Autonomous)		R 2020			
20CE907	INTRODUCTION TO DISASTER MANAGEMENT AND MITIGATION (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: Nil

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

	Cognitive Level
CO1: Explain the concepts of disaster and its effect in Indian scenario.	Understand
CO2: Elaborate the difference between natural and manmade disasters.	Understand
CO3: Outline the disaster management cycle and its operation.	Understand
CO4: Outline the disaster management in India and its profile.	Understand
CO5: Propose the application of geo-informatics for disaster management and mitigation.	Apply

UNIT - I INTRODUCTION TO DISASTER [09]

Definition of Disaster, hazard, global and Indian scenario, general perspective, importance of study in human life, Direct and indirect effects of disasters, long term effects of disasters. Introduction to global warming and climate change.

UNIT - II NATURAL DISASTER AND MANMADE DISASTERS [09]

Natural Disaster: Meaning and nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion.

Manmade Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.

UNIT - III DISASTER MANAGEMENT CYCLE AND FRAMEWORK [09]

Disaster Management Cycle, Paradigm Shift in Disaster Management Pre-Disaster Risk Assessment and Analysis, Risk Mapping, zonation and Micro zonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development, Awareness During Disaster Evacuation, Disaster Communication, Search and Rescue, Emergency Operation Centre, Incident Command System, Relief and Rehabilitation, Damage and Needs Assessment, Restoration of Critical Infrastructure, Early Recovery, Reconstruction and Redevelopment, IDNDR, Yokohama Strategy, Hyogo Framework of Action.

UNIT - IV DISASTER MANAGEMENT IN INDIA DISASTER PROFILE OF INDIA [09]

Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005, Institutional and Financial Mechanism, National Policy on Disaster Management, National Guidelines and Plans on Disaster Management, Role of Government, Non-Government and Inter-Governmental Agencies.

UNIT - V APPLICATIONS OF SCIENCE AND TECHNOLOGY FOR DISASTER MANAGEMENT & MITIGATION [09]

Geo-informatics in Disaster Management, Disaster Communication System, Land Use Planning and Development Regulations, Structural and Non Structural Mitigation of Disasters, S&T Institutions for Disaster Management in India.

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

Text Books :

- 1 R B Singh., Disaster Management and Mitigation, World focus Publisher, New Delhi, First Edition, 2016.
- 2 SatishModh, 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 PardeepSahni, 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 SAFETY AND FIRE ENGINEERING
CO-PO MAPPING

Course Code: 20CE907

Regulation: R 2020

Course Name: Introduction to Disaster Management and Mitigation

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
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.

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

Regulation: R 2020
Course Code: 20CE908 Course Name: Introduction to Earthquake Engineering

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Illustrate the causes and effects of earthquake.</i>	3	2	2	-	-	-	2	-	-	-	-	3	-	-
CO2	<i>Explain the basic concepts in seismology and correlate to earthquake engineering.</i>	3	2	2	-	-	-	2	-	-	-	-	3	-	-
CO3	<i>Summarize the theory of vibrations.</i>	3	2	3	-	-	-	2	-	-	-	-	3	-	-
CO4	<i>Outline the design process for earthquake resisting structures</i>	3	2	3	2	-	-	2	-	-	-	-	3	-	-
CO5	<i>Predict the performance of building and structures under the earthquake.</i>	3	2	3	2	-	-	2	-	-	-	-	3	-	-
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.

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

Course Code: 20CE909

Regulation: R 2020

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 FUNDAMENTALS OF ATMOSPHERIC POLLUTANTS	[09]			
Water purification systems in natural systems- physical processes-chemical processes and biological processes primary, secondary and tertiary treatment-Unit operations-unit processes. Mixing, clarification - sedimentation; Types; aeration and gas transfer - coagulation and flocculation, coagulation processes - stability of colloids -Disinfection - Fundamentals of meteorology - Wind roses - Atmospheric stability - Atmospheric diffusion of pollutants - Transport, transformation and deposition of air contaminants - Plume behaviour - Atmospheric diffusion theories - Plume rise.					
UNIT - III	PARTICULATE AIR POLLUTION	[09]			
Control principles - Principles and equipment description of control technologies - Particulates control by Gravitation, centrifugal, filtration, scrubbing, electrostatic precipitation - Absorption, adsorption, condensation, incineration and biofiltration for control of gaseous air pollutants.					
UNIT - IV	AIR POLLUTION CONTROL TECHNOLOGIES	[09]			
Biological air pollution control technologies - Bioscrubbers, biofilters. Air pollutants in indoor environments - Levels of pollutants in indoor and outdoor air - Indoor air pollution from outdoor sources - Measurement methods - Control Technologies.					
UNIT - V	AIR POLLUTION CONTROL EQUIPMENT	[09]			
Introduction - Installation of Settling chambers, Inertial separators, Dust trap, Involute cyclone, Multiple cyclone, Filters, Electrostatic precipitators, Scrubbers, Separating devices - Efficiency of equipment.					

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

Text Books :

- 1 Rao, C. S., Environmental Pollution Control Engineering, New Age International, New Delhi, First Edition, 2006.
- 2 Davis M. L. and Cornwell D. A., Introduction to Environmental Engineering, Tata McGraw Hill Education Pvt. Ltd., New Delhi, First Edition, 2010.

Reference Books :

- 1 Rao, C. S., Environmental Pollution Control Engineering, New Age International, New Delhi, First Edition, 2006.
- 2 Anjaneyulu, D., Air Pollution and Control Technologies, Allied Publishers, Mumbai, First Edition 2002.
- 3 S.K. Garg, "Water Supply Engineering", Khanna Publishers, New Delhi, Thirty three Edition, 2010.

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

Course Code: **20CE910** Regulation: **R 2020**
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			
20CS901	PROGRAMMING IN JAVA	L	T	P	C
	(Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to	Cognitive Level
CO1: Discover java programming fundamentals to solve real world problem.	Understand
CO2: Implement the concept of class and constructor.	Apply
CO3: Examine important features of java like inheritance and interfaces.	Understand
CO4: Illustrate the features of package and exception handling.	Understand
CO5: Apply the concepts of string manipulations.	Apply

UNIT - I JAVA FUNDAMENTALS [09]

The Java Buzzwords - Data Types - Variables- Local Variable - Instant Variable - Static variable - Array-Single Dimensional Array-Multi Dimensional Array - Operators - Control Statements -if - if else - nested if- else if- for - for each - while - do while - Switch - Break- Continue.

UNIT - II CLASS FUNDAMENTALS AND CONSTRUCTORS [09]

Class Fundamentals -Declaring Objects -Methods- Instant Method- Static Method- Method Overloading- Recursion - this keyword - Garbage Collection-Constructors - Argument constructor- No-Argument Constructor - Constructor Overloading - Access Control.

UNIT - III INHERITANCE AND INTERFACES [09]

Inheritance -Single - Multilevel - Hierarchical - Super keyword- Method Overriding - Abstract class - Final variable- Final class- Interfaces - Default Interface Methods - Static Methods in Interface.

UNIT - IV PACKAGES AND EXCEPTION HANDLING [09]

Packages -User define Package - Predefine Package - Access Protection - Importing Packages -Array List- Wrapper Classes - Exception Handling Fundamentals - Exceptions Types -Try and Catch - Multiple Catch - Nested Try - Throw - Throws - Finally.

UNIT - V STRING AND STRINGBUFFER [09]

The String Constructors - String Length - Character Extraction - String Comparison - Searching Strings - Modifying a String - Data Conversion using valueOf method - Methods in StringBuffer - 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.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CS901

Course Name: PROGRAMMING IN JAVA

CO	Course Outcomes	Programme Outcomes														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1:	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	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: 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 ReemaThareja, 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, FirstEdition, 2011.
- 3 Ellis Horowitz, SartajSahni, Susan Anderson-Freed, Fundamentals of Data Structures in C++,University Press, United States.Second Edition, 2008

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

DEPARTMENT OF SAFETY AND FIRE 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 [9]

Database System Applications - Purpose of Database Systems - Views of Data - Database Languages -Database and Application Architecture. Overview of the Design Process - The Entity-Relationship model - Complex Attributes - Mapping Cardinalities and Keys.

UNIT – II RELATIONAL MODEL AND SQL FUNDAMENTALS [9]

Introduction to Relational Model: Structure of Relational Databases - Database Schema -Keys - Schema Diagrams. Overview of the SQL Query Language - SQL Data Definition - Basic Structure of SQL Queries - Additional Basic Operations - Set operations - Null values - Aggregate functions - Modification of the Database.

UNIT - III INTERMEDIATE SQL AND ADVANCED SQL [09]

Join Expressions - Views - Transactions - Integrity Constraints - Authorization -Accessing SQL from Programming Language - Functions and Procedures - Triggers -Recursive Queries.

UNIT - IV NORMALIZATION [09]

Functional Dependencies - Non-loss Decomposition - First, Second and Third Normal Forms, Dependency Preservation - Boyce/Codd Normal Form - Multi-valued Dependencies and Fourth Normal Form - Join Dependencies and Fifth Normal Form.

UNIT - V TRANSACTIONS AND QUERY PROCESSING [09]

Transaction Concept - A Simple Transaction Model-Storage Structure - Transaction Atomicity and Durability - Transaction Isolation - Serializability - Concurrency Control - Lock-Based protocols - Query Processing overview

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

- 1 Abraham Silberschatz, Henry F. Korth and S. Sudharshan, Database System Concepts, Tata McGraw Hill, New Delhi, Seventh Edition, 2019.
- 2 RamezElmasri and Shamkant B. Navathe, Fundamentals of Database Systems, Pearson Education, New Delhi, Seventh Edition, 2016.

Reference Books :

- 1 Abraham Silberschatz, Henry F. Korth and S. Sudharshan, Database System Concepts, Tata McGraw Hill, New Delhi, Sixth Edition, 2015.
- 2 S.K.Singh, Database Systems Concepts, Design and Applications, Pearson Education, New Delhi, Second Edition, 2011.
- 3 C.J.Date, A.Kannan and S.Swamynathan, An Introduction to Database Systems, Pearson Education, New DelhiEighth Edition, 2006.
- 4 <http://freevideolectures.com/course/2668/database-management-system#>

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

DEPARTMENT OF SAFETY AND FIRE 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

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

CO-PO MAPPING

Course Code: 20CS904

Regulation: R 2020

Course Name: INTERNET PROGRAMMING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	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 ZigurdMednieks, Laird Dornin, BlakeMeike G, Masumi Nakamura, Programming Android: Java Programming for the New Generation of Mobile Devices, O'Reilly Media, USA, Second Edition, 2011.
- 3 2016Reto Meier, Professional Android 4 Application Development, WroxPublications, John Wiley, New York, First Edition, 2012.
- 4 <https://developer.android.com/training/basics/firstapp>

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DEPARTMENT OF SAFETY AND FIRE 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	PS01	PS02
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			
20CS906	PRINCIPLES OF ETHICAL HACKING (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to	Cognitive Level
CO1: Discuss the basics of hacking with its ethics	Understand
CO2: Extend the possibilities and types of Attacks	Understand
CO3: Summarize the testing process with programming Language.	Understand
CO4: Infer about the impact of hacking wireless network	Understand
CO5: Outline about the protection scheme.	Understand

UNIT - I ETHICAL HACKING OVERVIEW [9]

Introduction to Ethical Hacking - What You Can Do Legally - What You Cannot Do Legally - TCP/IP Concepts Review - IP Addressing - Overview of Numbering Systems

UNIT - II NETWORK ATTACKS AND ITS IMPACT [9]

Malicious Software - Protecting Against Malware Attacks - Intruder Attacks on Networks and Computers - Addressing Physical Security - Using Web Tools for Foot printing - Conducting Competitive Intelligence - Introduction to Social Engineering - Using Port-Scanning Tools - Conducting Ping Sweeps - Understanding Scripting.

UNIT - III SECURITY TESTING [9]

Enumerating Operating Systems - Introduction to Computer Programming - Understanding C,HTML, Pearl and Object Oriented Programming Basics - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows - Windows and Other Embedded Operating Systems - Vulnerabilities of Embedded OSs.

UNIT - IV WEB APPLICATION AND WIRELESS NETWORK [9]

Understanding Web Applications - Understanding Web Application Vulnerabilities - Tools for Web Attackers and Security Testers - Hacking Wireless Networks

UNIT - V PROTECTION SYSTEM [9]

Understanding Cryptography Basics - Understanding Symmetric and Asymmetric Algorithms - Understanding Public Key Infrastructure - Understanding Cryptography Attacks - Understanding Routers and Firewalls - Understanding Intrusion Detection and Prevention Systems - Understanding 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, Cengage 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.

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

DEPARTMENT OF SAFETY AND FIRE 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	PS01	PS02
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

20CS907	GREEN TECHNOLOGY (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to	Cognitive Level
CO1: Identify 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 BhuvanUnhelkar, 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.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO-PO MAPPING

Course Code: 20CS907

Regulation: R 2020

Course Name: GREEN TECHNOLOGY

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Identify Green IT with its different dimensions and Strategies.	3	3	3	-	3	-	-	-	-	-	-	2	-	-
CO2:	Describe Green data centres and storage along with its green software methodologies.	3	2	2	-	3	-	-	-	-	-	-	1	-	-
CO3:	Outline the concepts o to manage the green IT with necessary components.	3	3	2	-	3	-	-	-	-	-	-	2	-	-
CO4:	Recognize various green enterprise activities, functions and their role with IT.	3	3	3	-	3	-	-	-	-	-	-	1	-	-
CO5:	Categorize various laws, standards and protocols for regulating green IT.	3	3	3	-	3	-	-	-	-	-	-	2	-	-
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	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 agents structure and predict uninformed search algorithms for any AI problem	Understand
CO2: Illustrate appropriate AI methods to solve a given problem.	Apply
CO3: Explain a problem using first order and predicate logic.	Understand
CO4: Identify planning algorithms and illustrate about learning	Apply
CO5: Infer about robotics concept.	Understand

UNIT - I FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE [9]

Intelligent Agents - Agents and environments - Good behavior - The Nature of Environments - The Structure of Agents - Solving Problems by Searching: Problem-Solving Agents - Example problems - Searching for solutions - Uninformed search strategies.

UNIT - II INFORMED SEARCHING TECHNIQUES [9]

Informed (Heuristic) Search Strategies - Heuristic functions - Local Search and Optimization Problems - Adversarial Search - Games - Optimal decisions in games - Alpha-Beta Pruning - Constraint Satisfaction Problems - Defining Constraint Satisfaction Problems.

UNIT - III LOGICAL REASONING [9]

First order logic - Representation revisited - Syntax and semantics for first order logic - Using first order logic - Knowledge engineering in first order logic - Inference in First order logic - Propositional versus first order logic - Unification and lifting - Forward chaining - Backward chaining.

UNIT - IV PLANNING AND LEARNING [9]

Classical Planning: Definition of Classical Planning - Algorithm for Planning as State - Space Search - Planning graphs - Analysis of Planning Approaches - Learning from Examples: Forms of Learning - Supervised learning - Learning Decision trees - Ensemble Learning - Explanation-Based Learning.

UNIT - V ROBOTICS [9]

Introduction - Robot Hardware - Robot Perception - Planning to Move - Planning Uncertain Movements - Moving - Robotic Software Architectures - Application Domains.

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

Text Books :

- 1 Stuart Russell and Peter Norvig, Artificial Intelligence - A Modern Approach, Pearson Education, New Delhi, Third Edition, 2016
- 2 Kevin Night and Elaine Rich, Nair B., Artificial Intelligence (SIE) , McGraw Hill, New Delhi, Third Edition, 2008

Reference Books :

- 1 Dan W. Patterson, Introduction to AI and ES, Pearson Education, New Delhi, Third Edition, 2007.
- 2 Peter Jackson, Introduction to Expert Systems, Pearson Education, New Delhi, Third Edition, 2007.
- 3 Deepak Khemani, Artificial Intelligence, Tata McGraw Hill, New Delhi, Third Edition, 2013.
- 4 David L. Poole and Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, England, First Edition, 2010.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING

CO-PO MAPPING

Course Code: 20CS908

Regulation: R 2020

Course Name: ARTIFICIAL INTELLIGENCE AND ROBOTICS

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	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

20CS909

BIG DATA AND ANALYTICS

(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: Discover the insights of big data analytics

Understand

CO2: Identify the file systems and to know the mapreduce technique

Understand

CO3: Summarize data by utilizing various statistical and data mining approaches

Understand

CO4: Deploy and Perform analytics on real-time streaming data

Understand

CO5: Comprehend the various NoSql alternative database models

Understand

UNIT - I INTRODUCTION TO BIG DATA**[9]**

Big Data - Definition, Characteristic Features - Big Data Applications - Big Data vs Traditional Data - Risks of Big Data -Structure of Big Data -Web Data - Evolution of Analytic Scalability - Evolution of Analytic Processes, Tools and methods - Analysis Vs Reporting - Modern Data Analytic Tools.

UNIT - II HADOOP FRAMEWORK**[9]**

Distributed File Systems - Large-Scale File System Organization - HDFS concepts - MapReduce Execution, Algorithms using MapReduce, Matrix-Vector Multiplication - Hadoop YARN.

UNIT - III DATA ANALYSIS**[9]**

Statistical Methods : Regression modelling- Multivariate Analysis - Classification: SVM & Kernel Methods - Rule Mining - Cluster Analysis- Types of Data in Cluster Analysis - Predictive Analytics - Data analysis using R.

UNIT - IV MINING DATA STREAMS**[9]**

Streams: Concepts - Stream Data Model and Architecture - Sampling data in a stream - Mining Data Streams and Mining Time-series data - Real Time Analytics Platform Applications - Real Time Sentiment Analysis- Stock Market Predictions.

UNIT - V BIG DATA FRAMEWORKS**[9]**

Introduction to NoSQL - Aggregate Data Models - Hbase: Data Model and Implementations - Hbase Clients - Examples - Cassandra: Data Model - Examples - Cassandra Clients - Hadoop Integration. Pig - Grunt - Pig Data Model - Pig Latin - developing and testing Pig Latin scripts.

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

- 1 Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, John Wiley & Sons, Incorporated, United States, First Edition, 2012.
- 2 David Loshin, Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph, Elsevier Science, Netherlands, First Edition, 2013.

Reference Books :

- 1 Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, Germany, Second Edition, 2014.
- 2 Michael Minelli, Michelle Chambers, and AmbigaDhiraj, 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.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING

CO-PO MAPPING

Course Code: 20CS909

Regulation: R 2020

Course Name: BIG DATA AND ANALYTICS

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Discover the insights of big data analytics	3	3	2	-	3	2	-	-	-	-	-	1	-	-
CO2:	Identify the file systems and to know the mapreduce 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 (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to	Cognitive Level
CO1: Identify with the Basic functional units of a computer system.	Understand
CO2: Discover the working Concepts of I/O devices in computer.	Understand
CO3: Examine the interfaces and controllers connected to PC.	Understand
CO4: Outline the system configuration, Installation and maintenance of PC.	Understand
CO5: Summarize about faults, diagnostics and troubleshooting in PC.	Understand

UNIT – I INTRODUCTION [9]

Introduction - Computer Organization - Number Systems and Codes - Memory - ALU - CU - Instruction prefetch - Interrupts - I/O Techniques - Device Controllers - Error Detection Techniques - Microprocessor - Personal Computer Concepts - Advanced System Concepts - Microcomputer Concepts - OS - Multitasking and Multiprogramming - Virtual Memory - Cache Memory - Modern PC and User.

UNIT – II PERIPHERAL DEVICES [9]

Introduction - Keyboard - CRT Display Monitor - Printer - Magnetic Storage Devices -FDD - HDD - Special Types of Disk Drives - Mouse and Trackball - Modem - Fax Modem - CD ROM Drive - Scanner - Digital Camera - DVD - Special Peripherals.

UNIT – III PC HARDWARE OVERVIEW [9]

Introduction - Hardware BIOS DOS Interaction - The PC family - PC hardware - Inside the System Box - Motherboard Logic - Memory Space - Peripheral Interfaces and Controllers - Keyboard Interface - CRT Display interface - FDC - HDC - Microprocessors in PC.

UNIT – IV INSTALLATION AND PREVENTIVE MAINTENANCE [9]

Introduction - system configuration - pre installation planning - Installation practice - routine checks - PC Assembling and integration - BIOS setup - Engineering versions and compatibility - preventive maintenance - DOS - Virus - Data Recovery.

UNIT – V TROUBLESHOOTING [9]

Introduction - computer faults - Nature of faults - Types of faults - Diagnostic programs and tools - Microprocessor and Firmware - Programmable LSI's - Bus Faults - Faults Elimination process - Systematic Troubleshooting - Symptoms observation and analysis - fault diagnosis - fault rectification - Troubleshooting levels - FDD, HDD, CD ROM Problems.

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

Text Books :

- 1 B. Govindarajulu, 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.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING

CO-PO MAPPING

Course Code: 20CS910

Regulation: R 2020

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 (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On the successful completion of the course, students will be able to	Cognitive Level
CO1 Describe the recording methods of various bio-potentials.	Understand
CO2 Illustrate the working of various equipment that deal with bio-chemical and non-electrical parameter measurement.	Understand
CO3 Discuss the different types of therapeutic equipment.	Understand
CO4 Interpret the principles of various medical imaging modalities.	Understand
CO5 Outline the recent trends in medical instrumentation.	Understand

UNIT – I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING [09]

The origin of bio-potentials - Bio-potential electrodes - Carrier, chopper and isolation amplifiers -Transducers for biomedical applications: Strain gauge, piezoelectric transducer, thermocouple, thermistor, biosensors - ECG, EEG, EMG, PCG, ERG and EOG: Lead systems, recording methods.

UNIT - II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT [09]

Blood gas analyzers - Electrophoresis - Colorimeter & Photometer - Auto analyzer - Blood flow meter - Cardiac output - Respiratory measurement - Blood pressure measurement - Temperature measurement - Pulse measurement -Blood cell counters: Coulter counters.

UNIT - III THERAPEUTIC EQUIPMENTS [09]

Cardiac pacemakers - DC defibrillator - Dialyzers - Surgical diathermy - Physiotherapy and electrotherapy equipment - Oxygenators - Heart lung machine.

UNIT - IV MEDICAL IMAGING [09]

X-Ray - Computer Axial Tomography - Positron Emission Tomography - MRI and NMR - Ultrasonic Imaging systems.

UNIT - V RECENT TRENDS IN MEDICAL INSTRUMENTATION - [09]

Thermograph - Endoscopy unit - LASER in medicine - Biomedical telemetry - Radio-pill - Cardiac catheterization laboratory - Electrical safety of medical equipment.

Total (L: 45) = 45 Periods

Text Books :

- 1 R.S.Khandpur, Handbook of Biomedical Instrumentation, Tata McGraw Hill, New Delhi, Third Edition, 2014
- 2 Leslie Cromwel, Fred J.Weibel, Erich A. Pfeiffer, Biomedical Instrumentation and Measurements, Pearson/Prentice Hall India, New Delhi, Second Edition, 2011.

Reference Books :

- 1 John G.Webster, Medical Instrumentation Application and Design, John Wiley & Sons Inc, New Jersey, Fourth Edition, 2009.
- 2 Joseph J.Carr and John M.Brown, Introduction to Biomedical Equipment Technology, John Wiley & Sons, New Jersey, Fourth Edition, 2008.
- 3 M. Arumugam, Biomedical Instrumentation, Anuradha Publications, Chennai, Second Edition, Reprint 2009.
- 4 R.L. Reka& C. Ravikumar, Biomedical Instrumentation/ Medical Electronics, Lakshmi Publications, Chennai, Second Edition, Reprint 2010.

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF SAFETY AND FIRE 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
1	Describe the recording methods of various bio-potentials.	2	1	2	-	-	1	-	-	-	-	-	1	-	-
2	Illustrate the working of various equipment that deal with bio-chemical and non-electrical parameter measurement.	2	1	2	-	-	1	-	-	-	-	-	1	-	-
3	Discuss the different types of therapeutic equipment.	2	1	2	-	-	1	-	-	-	-	-	1	-	-
4	Interpret the principles of various medical imaging modalities.	2	1	2	-	-	1	-	-	-	-	-	1	-	-
5	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)

20EC902	K.S.R. COLLEGE OF ENGINEERING (Autonomous)		R 2020			
	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, FirstEdition, 2007.
- 2 Mick Wilson, KamaliKannargare., Geoff Smith, Nano technology: Basic Science and Emerging technologies, Overseas Press, New Delhi, FirstEdition, 2005.

Reference Books :

- 1 Nalwa H S, Encyclopedia of Nanoscience and Nanotechnology, Vol 1-10, American Scientific Publishers, California, FirstEdition 2004.
- 2 Rao C N R and Govindaraj A, Nanotubes and Nanowires, Royal Society of Chemistry, London, Third Edition, 2005.
- 3 Richard A L Jones, Soft Machines: Nanotechnology and Life, Oxford University Press, Oxford, FirstEdition, 2007
- 4 Charles P. Poole, Frank J. Owens, Introduction to Nanotechnology, Wiley Inter science, New Jersey, First Edition, 2003.
- 5 Mark A. Ratner, Daniel Ratner, Nanotechnology: A gentle introduction to the next Big Idea, Pearson Education, London, 2003.

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF SAFETY AND FIRE 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
1	Describe the evolution and associated techniques of Nano science.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
2	Interpret the diversities in Nano systems.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
3	Classify different Nano particles, shells and their Characterization.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
4	Illustrate the importance of nanotechnology in biotechnology.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
5	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

(Open Elective)

L	T	P	C
3	0	0	3

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

CO1 Interpret the fundamental concepts of semiconductor device.

Understand

CO2 Explain the various characteristics of amplifiers.

Understand

CO3 Outline the fundamental concepts of Digital Electronics

Understand

CO4 Describe about 8085 microprocessors

Understand

CO5 Explain the applications using microprocessor

Understand

UNIT – I SEMICONDUCTORS AND RECTIFIERS**[09]**

Classification of solids based on energy band theory - Intrinsic semiconductors - Extrinsic semiconductors - PN junction diode: Characteristics - Half wave and full wave rectifiers - Zener diode: Characteristics - Voltage regulator.

UNIT – II TRANSISTORS AND AMPLIFIERS**[09]**

Bipolar junction transistor: Construction and characteristics - CE configuration and characteristics - Transistor biasing: Fixed and voltage divider biasing - Construction and characteristics: FET, SCR and UJT - Concept of feedback: Negative feedback - Application in temperature and motor speed control - Common Emitter Amplifier (Qualitative treatment only).

UNIT – III DIGITAL ELECTRONICS**[09]**

Number system: Binary, Octal, Hexadecimal - Boolean algebra - Logic gates - Half adder and full adder - Flip flops - Shift Registers: SISO, SIPO, PISO, PIPO - Counters: 3-bit Synchronous up & down, 3-bit Asynchronous up & down - A/D conversion: Single slope, Successive approximation - D/A conversion: Binary weighted resistor type.

UNIT – IV 8085 MICROPROCESSOR**[09]**

Block diagram of Microcomputer - 8085: Architecture, Pin configuration, Addressing modes, Instruction set and Simple programs using arithmetic and logical operations.

UNIT – V INTERFACING AND APPLICATIONS OF MICROPROCESSOR**[09]**

Basic interfacing concepts - Interfacing of Input and Output devices - Applications of microprocessor: Temperature control, Stepper motor control, Traffic light control - Case study: Mining problem, Turbine monitor using 8085.

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

- 1 Jacob Millman and Christos C. Halkias, Integrated Electronics, Tata McGraw-Hill publishers, US, Second Edition, 2011.
- 2 Ramesh Gaonkar, Microprocessor Architecture II, Programming and Applications with 8085, Penram International Publishing, USA, Sixth Edition, 2013.

Reference Books :

- 1 Malvino Leach and Saha, Digital Principles and Applications, Tata McGraw-Hill Education, New Delhi, Eighth Edition, 2014.
- 2 Mehta V.K, Principles of Electronics, S. Chand and Company Ltd., New Delhi, Seventh Edition, 2014.
- 3 Salivahanan S, Suresh Kumar N, Vallavaraj A, Electronic Devices and Circuits, Tata McGraw-Hill Education, New Delhi, Third Edition, 2012.
- 4 Krishna Kant, Microprocessors and Microcontrollers, PHI Learning Private Ltd., New Delhi, Second Edition, 2013.

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF SAFETY AND FIRE ENGINEERING

CO PO MAPPING

Course Code: 20EC903

Regulation:

R 2020

Course Name:

Electronics and Microprocessor

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	Interpret the fundamental concepts of semiconductor device.	3	3	2	-	-	-	-	-	-	-	-	-	-	-
2	Explain the various characteristics of amplifiers.	3	3	2	-	-	-	-	-	-	-	-	-	-	-
3	Outline the fundamental concepts of Digital Electronics	3	3	2	-	-	-	-	-	-	-	-	-	-	-
4	Describe about 8085 microprocessors	3	3	2	-	-	-	-	-	-	-	-	-	-	-
5	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 Jersey, Fourth Edition, 2004.

Reference Books :

- 1 H.Taub, D L Schilling and G Saha, Principles of Communication, McGraw Hill Education, New York, Fourth Edition, 2017.
- 2 B. P. Lathi, Modern Analog and Digital Communication Systems, Oxford University Press, Oxford, Third Edition, 2007.
- 3 Rappaport T.S, Wireless Communications: Principles and Practice, Pearson Education, London, Third Edition 2007.
- 4 Blake, Electronic Communication Systems, Thomson Delmar Publications, USA, Second Edition, 2001.

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF SAFETY AND FIRE 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
1	Describe analog communication techniques	3	3	3	-	-	-	-	-	-	-	-	-	-	-
2	Describe Digital communication techniques	3	3	3	-	-	-	-	-	-	-	-	-	-	-
3	Use data and pulse communication techniques	3	3	3	-	-	-	-	-	-	-	-	-	-	-
4	Explain Source and Error control coding	3	3	3	-	-	-	-	-	-	-	-	-	-	-
5	Utilize multi-user radio communication	3	3	3	-	-	-	-	-	-	-	-	-	-	-
Average		3	3	3	-	-	-	-	-	-	-	-	-	-	-

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

20EC905	PRINCIPLES OF COMMUNICATION (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

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

CO1	Determine the performance of analog modulation schemes in time and frequency domains.	Understand
CO2	Determine the performance of systems for generation and detection of modulated analog signals.	Understand
CO3	Characterize analog signals in time domain as random processes and in frequency domain using Fourier transforms	Understand
CO4	Determine the performance of analog communication systems in the presence of Noise	Understand
CO5	Interpret the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems.	Understand

UNIT – I AMPLITUDE MODULATION [09]

Introduction, Amplitude Modulation: Time & Frequency - Domain description, Switching modulator, Envelop detector. Time and Frequency - Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing. SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television.

UNIT – II ANGLE MODULATION [09]

Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase-Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The 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 Jersey, Fourth Edition 2004.

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 SAFETY AND FIRE 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 INTEGRATION TO ROBOT [09]

Building of 4 axis or 6 axis robot - Vision system for pattern detection - Sensors for obstacle detection - AI algorithms for path finding - Decision making.

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

- 1 Duda, Hart and Stork, Pattern Recognition, Wiley-Inter science, New Jersey, First Edition, 2000.
- 2 Mallot, Computational Vision: Information Processing in Perception and Visual Behavior, MIT Press, USA, First Edition, 2000.

Reference Books :

- 1 Stuart Russell and Peter Norvig, Artificial Intelligence-A Modern Approach, Pearson Education Series in Artificial Intelligence, USA, First Edition, 2004.
- 2 Robert Schilling and Craig., Fundamentals of Robotics, Analysis and control, PHI, New Delhi, First Edition 2003.
- 3 Forsyth and Ponce, Computer Vision, A modern Approach, Pearson Education, USA, First Edition 2003.

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF SAFETY AND FIRE 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
1	Describe the basis of Robotics	3	3	3	-	-	-	-	-	-	-	-	-	-	-
2	Describe the technologies applicable for Robotics in computer based vision	3	3	3	-	-	-	-	-	-	-	-	-	-	-
3	Interpret the different sensing elements of robot	3	3	3	-	-	-	-	-	-	-	-	-	-	-
4	Develop the algorithms applicable for robotics	3	3	3	-	-	-	-	-	-	-	-	-	-	-
5	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 (Open Elective)	L	T	P	C
		3	0	0	3

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

CO1	Describe what IoT is and how it works today.	Understand
CO2	Design and program IoT devices.	Understand
CO3	Describe the functions and characteristics of IoT sensors.	Understand
CO4	Illustrate the wireless, energy, power, RF and sensing modules.	Understand
CO5	Describe the applications and technological challenges faced by IoT devices.	Understand

UNIT - I BASICS OF IOT [09]

Definitions and Functional Requirements -Motivation - Architecture - Web 3.0 View of IoT- Ubiquitous IoT Applications - Four Pillars of IoT - DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview - Communication middleware for IoT -IoT Information Security.

UNIT - II IOT PROTOCOLS [09]

Protocol Standardization for IoT - Efforts - M2M and WSN Protocols - SCADA and RFID Protocols - Issues with IoT Standardization - Unified Data Standards - Protocols - IEEE 802.15.4 - BAC Net Protocol - Modbus - KNX - Zigbee Architecture - Network layer - APS layer - Security

UNIT - III IOT SENSORS [09]

Industrial sensors - Description & Characteristics-First Generation - Description & Characteristics- Advanced Generation - Description & Characteristics-Integrated IoT Sensors - Description & Characteristics-Polytronics Systems - Description & Characteristics-Sensors' Swarm - Description & Characteristics-Printed Electronics -Description & Characteristics-IoT Generation Roadmap.

UNIT- IV TECHNOLOGICAL ANALYSIS [09]

Wireless Sensor Structure-Energy Storage Module-Power Management Module - RF Module- Sensing Module.

UNIT - V APPLICATIONS [09]

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronization and Software Agents. Applications - Smart Grid - Electrical Vehicle Charging.

Total = 45 Periods**Text Books:**

- 1 David Easley and Jon Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, London, First Edition, 2010.
- 2 Guillaume Girardin, Antoine Bonnabel, Dr. Eric Mounier, Technologies & Sensors for the Internet of Things Businesses & Market Trends, First Edition, 2014.

Reference Books:

- 1 Honbo Zhou, Dieter Uckelmann; Mark Harrison, The Internet of Things in the Cloud: A Middleware Perspective - CRC Press, USA, First Edition, 2012.
- 2 Florian Michahelles, Architecting the Internet of Things -- Springer, Berlin, First Edition, 2011.
- 3 Ida N, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.
- 4 Olivier Hersent, Omar Elloumi and David Boswarthick, The Internet of Things: Applications to the Smart Grid and Building Automation, Wiley, New Jersey, First Edition, 2012.

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF SAFETY AND FIRE 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	PS01	PS02
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 Jersey, First Edition, 2014.

Reference Books:

- 1 Lyla B Das, Embedded Systems-An Integrated Approach, Pearson, London, First Edition, 2013
- 2 Marilyn Wolf, Computers as Components - Principles of Embedded Computing System Design, Third Edition Morgan Kaufmann Publisher (An imprint from Elsevier), 2012
- 3 Peckol, Embedded system Design, John Wiley & Sons, USA, First Edition, 2010
- 4 Thomas M. Coughlin, Digital Storage in Consumer Electronics, Elsevier and Newness, Amsterdam, Netherlands First Edition, 2012.
- 5 Philip Hoff, Consumer Electronics for Engineers, Cambridge University Press. London, First Edition, 1998.

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF SAFETY AND FIRE ENGINEERING

CO PO MAPPING

Course Code: 20EC908

Regulation:

R 2020

Course Name:

Consumer Electronics

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
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

20EE901

ELECTRICAL DRIVES AND CONTROL

(Open Elective)

L	T	P	C
3	0	0	3

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

CO1:	Categorize and explain the operation of electrical drives	Understand
CO2:	Explain the characteristics of various electrical drives	Understand
CO3:	Interpret the operation of starting and braking methods of AC and DC machines	Understand
CO4:	Choose the appropriate speed control techniques for DC motor drives	Understand
CO5:	Choose the appropriate speed control techniques for AC motor drives	Understand

UNIT - I INTRODUCTION [09]

Electrical drives - Need - Advantage of electrical drives - Basic elements of electrical drives - Factors influencing the choice of electrical drives - Four quadrant operation of a motor driving a hoist load - Load torques - Selection of motors with regard to thermal overloading - Classes of motor duty.

UNIT - II CHARACTERISTICS OF ELECTRIC DRIVES [09]

DC Motors: DC shunt, DC series, DC compound and Permanent Magnet DC motors - AC Motors: Single phase and three phase Induction motors - Speed-Torque characteristics of various types of loads and drive motors.

UNIT - III MOTOR STARTING AND BRAKING METHODS [09]

Types of Starters: Two Point Starter, Three Point Starter, Four Point Starter, DOL Starter, Y-Δ Starter. Braking of Electrical Motors: Shunt Motor, Series Motor, Single Phase Induction Motor.

UNIT - IV DC DRIVES [09]

Speed control of DC series and shunt motors – Armature and field control - Ward-Leonard control system - Controlled Rectifiers Fed DC motor Drive - Chopper fed DC motor Drive: Buck, Boost and Buck-Boost - Applications.

UNIT - V AC DRIVES [09]

Speed control of three phase induction motor - Voltage control, voltage / frequency control, slip power recovery scheme - Inverter and AC Voltage Controller Based Induction Drives - Applications.

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

- 1 Dubey G.K, Fundamentals of Electrical Drives, Narosa Publishing House, New Delhi, Second Edition, 2019.
- 2 VedamSubramaniam, Electric Drives: Concepts and Applications, Tata McGraw Hill Publishing Company, New Delhi, Second Edition, 2010.

Reference Books :

- 1 Krishnan. R, Electric Motor Drives: Modeling, Analysis and Control, Prentice Hall Pvt. Ltd, New Delhi, Second Edition, 2003.
- 2 Pillai.S.K, A First Course on Electric Drives, Wiley Eastern Limited, New Delhi, Fourth Edition, 2012.
- 3 Nagrath I.J and Kothari D. P, Electrical machines, Tata McGraw Hill Publishing Company Ltd, New Delhi, Fifth Edition, 2017.
- 4 M.D. Singh and K.B. Khanchandani, Power Electronics, Tata McGraw Hill Publishing Co Ltd., New Delhi, Second Edition, 2013.

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

Regulation: R 2020

Course Code: 20EE901

Course Name: Electrical Drives and Control

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	<i>Categorize and explain the operation of electrical drives</i>	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO2:	<i>Explain the characteristics of various electrical drives</i>	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO3:	<i>Interpret the operation of starting and braking methods of AC and DC machines</i>	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO4:	<i>Choose the appropriate speed control techniques for DC motor drives</i>	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO5:	<i>Choose the appropriate speed control techniques for AC motor drives</i>	3	-	1	-	-	2	2	1	-	-	-	2	-	-
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.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING

CO-PO MAPPING

Course Code: 20EE902 **Regulation: R 2020**
Course Name: Power Semiconductor Devices

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	<i>Explain the power diode characteristics and applications for adjustable speed motor control</i>	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO2:	<i>Infer the static and dynamic characteristics of current controlled power semiconductor devices</i>	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO3:	<i>Realize the static and dynamic characteristics of voltage controlled power semiconductor devices</i>	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO4:	<i>Examine the gate drive requirements for power devices and isolation techniques between the gate and power circuits</i>	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO5:	<i>Discuss the electrical analog of thermal models and the methods for cooling power devices</i>	3	2	-	-	-	-	-	-	-	-	-	2	-	-
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 :

- Domkundwa, Arora Domkundwar, A Course in Power Plant Engineering, Dhanpat Rai and Co. Pvt. Ltd., New Delhi, Eighth edition, 2016.
- P.K. Nag, Power Plant Engineering, Tata McGraw Hill Publishing Co Ltd., New Delhi, Third Edition, 2010.

Reference Books :

- Philip Kiamah, Power Generation Handbook, Tata McGraw Hill Publishing Co Ltd., New Delhi, Third Edition, 2013.
- P.C. Sharma, Power Plant Engineering, S.K. Kataria and Sons, New Delhi, First Edition, 2013.
- Raja, A.K., Amit Prakash Manish Dwivedi, Power Plant Engineering, New Age International, New Delhi, First Edition, 2012.
- 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 SAFETY AND FIRE ENGINEERING
CO-PO MAPPING

Course Code: 20EE903

Regulation: R 2020

Course Name: Electrical Power Generation Systems

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	<i>Describe the layout and function of various parts inside the thermal power plant.</i>	3	1	-	-	-	2	3	2	-	-	-	1	-	-
CO2:	<i>Outline the layout, construction, working of the components inside the hydro power plant.</i>	3	2	-	-	-	2	3	1	-	-	-	1	-	-
CO3:	<i>Explain the principle of operation, layout and types of nuclear reactor in a nuclear power plant.</i>	3	2	-	-	-	3	3	2	-	-	-	1	-	-
CO4:	<i>Discuss about the types, performance and layout of gas and diesel power plants.</i>	3	2	-	-	-	2	3	1	-	-	-	1	-	-
CO5:	<i>Infer the basic concepts of different non-conventional energy sources.</i>	3	1	-	-	-	3	3	2	-	-	-	1	-	-
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 SAFETY AND FIRE ENGINEERING
CO-PO MAPPING

Course Code: 20EE904

Regulation: R 2020
 Course Name: Control Engineering

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Obtain the transfer function of electrical and mechanical systems.	3	3	2	2	-	-	-	-	-	-	-	2	-	-
CO2:	Determine the time-domain response of first and second order systems.	3	3	2	2	-	-	-	-	-	-	-	2	-	-
CO3:	Examine the stability of open loop system using bode / polar plot.	3	3	3	2	-	-	2	-	-	-	-	2	-	-
CO4:	Analyze the stability of the system by Root locus and Routh Hurwitz criterion.	3	3	3	2	-	-	2	-	-	-	-	2	-	-
CO5:	Design lag, lead, lag-lead compensator using bode plot.	3	3	3	2	-	-	2	-	-	-	-	2	-	-
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	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 major components of Programmable Logic Controller and its applications.	Understand
CO2:	Summarize the logical functions, timers and counters of PLC	Understand
CO3:	Discuss the various instructions and modes of operation related to PLC.	Understand
CO4:	Realize the architecture and various interfacing techniques of Distributed Control Systems	Understand
CO5:	Examine the different applications of PLC and Distributed Control Systems (DCS).	Understand

UNIT - I INTRODUCTION TO PROGRAMMABLE LOGIC CONTROLLER (PLC) [09]

Introduction - PLC Evolution - PLC Vs Computers - Block Diagram of PLC - Parts of a PLC- Principles of Operation- Modifying the Operation- PLC Hardware Components: I/O modules, Power Supply, CPU - PLC size and Applications.

UNIT - II LOGIC FUNDAMENTALS, TIMER AND COUNTER [09]

Logic functions - Boolean instructions and functions - Hardwired logic Vs Programmed Logic - Developing circuits from Boolean instructions – PLC timer: classification and instructions - PLC counter: classification, instructions and applications

UNIT - III PLC PROGRAMMING [09]

PLC-memory map - Program scan - Relay type instructions - Instruction addressing - Branch instructions - Internal relay instructions - EXAMINE IF CLOSED and EXAMINE IF OPEN instructions - Modes of operation - Basic relay ladder logic and its control flow chart

UNIT - IV DISTRIBUTED CONTROL SYSTEM [09]

Distributed control system: Evolution - Architectures - Comparison - Local control unit - Process interfacing issues - Communication facilities - HMI Interface - Low and high level operator interfaces - Operator displays - Low and high level engineering interfaces – Introduction to SCADA.

UNIT - V APPLICATIONS OF PLC AND DCS [09]

PLC applications: Automatic Control of WareHouse Door - Automatic Lubricating Oil Supplier - Conveyor Belt motor Control - Automatic Car Washing Machine - DCS applications: Pulp and paper environment, Petroleum and refining environment.

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

Text Books :

- 1 Frank D. and Petruzella, Programmable Logic controllers, Tata McGraw Hill Publishing Company Limited, New Delhi, Fifth Edition, 2017
- 2 Lucas ,M.P., Distributed Control System, Van Nostrand and Reinhold Co., New york, First Edition, 1986.

Reference Books :

- 1 Gary Dunning, Introduction to Programmable Logic Controllers, Delmar Thomson Learning, New york, Third Edition, 2010
- 2 John W.Webb and Ronald A.Reis, Programmable Logic Controllers: Principles and Applications, PHI Private Ltd., New Delhi, Fifth Edition, 2003
- 3 Krishna Kant, Computer - Based Industrial Control, Prentice Hall, New Delhi, Second Edition(Revised), 2011
- 4 MadhuchandaMitra and SmarajitSen 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 SAFETY AND FIRE ENGINEERING

CO-PO MAPPING

Course Code: 20EE905

Regulation:

R 2020

Course Name:

Industrial Automation

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	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	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 construction and calibration of moving coil and Moving iron meters	Understand
CO2: Discuss the operation and error correction method of wattmeter and Energy meter.	Understand
CO3: Describe the various types of potentiometer and their limitations	Understand
CO4: Determine the values of resistor, inductor, capacitor and frequency using bridges.	Understand
CO5: Explain the concepts of storage and display devices.	Understand

UNIT - I MEASUREMENT OF VOLTAGE AND CURRENT [9]

Galvanometers - Ballistic, D'Arsonvalgalvanometer - Principle, construction, operation and comparison of moving coil, moving iron meter - Extension of range and calibration of voltmeter and ammeter - Errors and compensation.

UNIT - II MEASUREMENT OF POWER AND ENERGY [9]

Wattmeters: Induction, Electro-dynamometer - Theory & its errors - Methods of correction - Calibration of wattmeter - Energy meter: Single Phase Energy Meter - Construction, Theory, Errors - Adjustment of Errors - Construction and principle of working of single phase dynamometer type power factor meter.

UNIT - III POTENTIOMETERS & INSTRUMENT TRANSFORMERS [9]

DC potentiometer - Basic circuit, standardization - Laboratory type (Crompton's) - AC potentiometer - Drysdale (polar type) type - Gall-Tinsley (coordinate) type - Limitations & applications - C.T and P.T construction, theory, operation, phasor diagram- Applications.

UNIT - IV BRIDGE MEASUREMENT [9]

Measurement of resistance: Wheatstone bridge, Kelvin double bridge, Megger- Measurement of Inductance: Maxwell Bridge, Anderson bridge - Measurement of Capacitance: Schering bridge, Desauty's Bridge - Determination of frequency using Wein Bridge.

UNIT - V STORAGE AND DISPLAY DEVICES [9]

Recorders: Strip Chart, X-Y Recorders - Digital Plotters - Digital Storage Oscilloscope - Digital multimeters - LED - DLP - Dot Matrix Display - Data Loggers

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

Text Books :

- 1 Golding, E.W and Widdis F.C, Electrical Measurements & Measuring Instruments, A.H.Wheeler& Co, Allahabad,India, Sixth Edition,2019.
- 2 Sawhney, A.K., A course in Electrical & Electronic Measurements and Instrumentation, DhanpatRai& 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.

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

Course Code: 20EE906 **Regulation:** R 2020
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			
20EE907	ENERGY CONSERVATION AND MANAGEMENT	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: 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, targeting 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. CengelDr, 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 SAFETY AND FIRE ENGINEERING
CO-PO MAPPING

Course Code: 20EE907

Regulation: R 2020

Course Name: Energy Conservation and Management

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	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 SAFETY AND FIRE ENGINEERING
CO-PO MAPPING

Course Code: 20EE908

Regulation: R 2020
Course Name: Electrical Wiring,
Estimation and Costing

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Describe the various wiring materials and protective devices.	3	-	1	-	-	-	-	-	-	-	-	-	-	-
CO2:	Discuss the internal wiring system and illumination.	3	-	1	-	-	-	-	-	-	-	-	-	-	-
CO3:	Outline the external wiring system and installations.	3	-	1	-	-	-	-	-	-	-	-	-	-	-
CO4:	Explain the electrical estimation for domestic installation.	3	2	1	-	1	-	-	-	-	-	-	-	-	-
CO5:	Describe the electrical estimation details for industrial installation.	3	2	1	-	1	-	-	-	-	-	-	-	-	-
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 SAFETY AND FIRE ENGINEERING
CO-PO MAPPING

Course Code: 20EE909

Regulation: R 2020

Course Name: Fundamentals of Electrical Machinery

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	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 SAFETY AND FIRE ENGINEERING
CO-PO MAPPING

Course Code: 20EE910 **Regulation:** R 2020
Course Name: Principles of Soft Computing Techniques

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
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			
20EE911	EMBEDDED SYSTEM TECHNOLOGY (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to	Cognitive Level
CO1: Illustrate the 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 SAFETY AND FIRE ENGINEERING
CO-PO MAPPING

Course Code: 20EE911 **Regulation:** R 2020
Course Name: Embedded System Technology

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	<i>Illustrate the fundamentals of embedded systems</i>	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO2:	<i>Outline the various types of embedded communication protocols</i>	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO3:	<i>Explain the concept of software development process and tools.</i>	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO4:	<i>Describe the functions of real time operating systems.</i>	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO5:	<i>Discuss the applications of real time embedded systems</i>	3	2	3	-	3	3	-	-	-	-	-	3	-	-
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

20IT901

DATA SCIENCE USING R

(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 life cycle of data science.

Understand

CO2: Interpret the data manipulation statements and functional programming in R.

Understand

CO3: Outline the packages to implement machine learning techniques.

Understand

CO4: Explore the concepts of object-oriented programming in R.

Understand

CO5: Discuss the data visualization packages in R.

Understand

UNIT – I DATA SCIENCE**[9]**

Data Science : Data Science Lifecycle - Dealing with Missing Values - Using R Packages - Expression - Data Types - Control Structures - Functions - Recursive Functions - Simple Programs.

UNIT – II DATA MANIPULATION AND FUNCTIONAL PROGRAMMING**[9]**

Data Manipulation - Data Import and Export - Manipulation Data - Vectoring Functions - Infix Operator - Replacement Functions - Function with arguments and return statement.

UNIT – III MACHINE LEARNING**[9]**

Dealing with large Dataset - Sampling - Supervised Learning Methods: Linear Regression - Logistic Regression - Evaluating and Validating Models - Decision Trees - Neural Network - Support Vector Machine - Unsupervised Learning - Clustering - Association Rule Mining.

UNIT – IV CLASS AND OBJECTS**[9]**

Immutable objects and Polymorphic functions - Data structures - Classes - Programming with New Classes - Inheritance and Inter-Class Relations - Virtual Classes - Creating and Validating Objects.

UNIT – V DATA VISUALIZATION AND PACKAGES**[9]**

Data Visualization: XY Plot - Graphics Package - ggplot2 - Package concept and tools - Creating R package - Namespace - R Oxygen - Adding data to Package - Documentation for Packages.

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

- 1 Thomas Mailund, Beginning Data Science in R - Data Analysis, Visualization and Modeling for the Data Scientist, Apress Publication, New York, First Edition, 2017.
- 2 Hadley Wickham and Garrett Grolemund, R for Data Science, Import, Tidy, Transform, Visualize, and Model Data, O'Reilly, India, First Edition, 2017.

Reference Books :

- 1 Nicholas J. Horton, Ken Kleinman, Using R and 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 SAFETY AND FIRE ENGINEERING
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
20IT902	PRINCIPLES OF CYBER SECURITY (Open Elective)	L T P C	
		3 0 0 3	

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to	Cognitive Level
CO1: Describe the basic concepts in cyber security and cybercrime.	Remember
CO2: Explore about classification of cyber forensics.	Understand
CO3: Summarize the latest trends in ethical hacking.	Understand
CO4: Discuss the fundamentals of computer forensics and evidence collection.	Understand
CO5: Describe the vulnerabilities in cyber security.	Remember

UNIT – I CYBER CRIME [9]

Cyber Crime - Types of Cyber Crime - Classification of Cyber Criminals - Tools used in Cyber Crime - Challenges - Strategies - Crypto Currency - Bitcoin and Block chain - Ransomware.

UNIT – II CYBER FORENSICS [9]

Cyber Forensics: Definition - Disk Forensics - Network Forensics - Wireless Forensics - Database Forensics - Malware Forensics - Mobile Forensics - Email Forensics.

UNIT – III ETHICAL HACKING [9]

Ethical Hacking- Hacking Windows - Network Hacking - Web Hacking - Password Hacking - Malware - Scanning - Cracking.

UNIT – IV DIGITAL EVIDENCE IN CRIMINAL INVESTIGATIONS [9]

Digital Evidence in Criminal Investigations: The Analog and Digital World - Training and Education - Evidence Collection and Data Seizure: Collection Options Obstacles - Types of Evidence -Rules of Evidence -Volatile Evidence.

UNIT – V CYBER SECURITY VULNERABILITIES [9]

Vulnerabilities in software - System administration - Complex Network Architectures - Open Access to Organizational Data – Unprotected Broadband communications - Poor Cyber Security Awareness - Encryption Tool: KeePass.

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

Text Books:

- 1 Deje, Dr.Murugan, Cyber Forensics, Oxford University Press, India, First Edition, 2018.
- 2 William Stallings and Lawrie Brown, Computer Security: Principles and Practice, Prentice Hall, United States, Third Edition, 2017.

Reference Books :

- 1 John W. 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>

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
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	PS01	PS02
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 SoheilBakhshi, Expert Data Modelling with Power BI, Packt Publishing , Mumbai, First Edition, 2021.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
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	BLOCK CHAIN 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: 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 Ethereumblockchain for different use cases.	Understand
CO5: Outline the end-to-end development of a decentralized application.	Understand

UNIT – I BLOCKCHAIN ARCHITECTURE [9]

History -Blockchain -Centralized vs. Decentralized Systems-Layers of Blockchain-Versions of Blockchain: 3.0 and 4.0
-Blockchain Uses and Use Cases - Laying the Blockchain Foundation - Cryptography.

UNIT – II WORKING OF BLOCKCHAIN [9]

Game Theory -Prisoner's Dilemma -Byzantine Generals' Problem - The Blockchain - Merkle Trees - Properties of Blockchain Solutions - Blockchain Transactions - Distributed consensus mechanisms - Blockchain applications.

UNIT – III BITCOIN [9]

History of Money - Working with Bitcoins - BitcoinBlockchain - The Bitcoin Network - Bitcoin Scripts - Full NodesvsSPVs - Bitcoin Wallets.

UNIT – IV ETHEREUM AND HYPERLEDGER [9]

Bitcoin to Ethereum - EthereumBlockchain - 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 [9]

Decentralized Applications - Blockchain Application Development - Interacting with BitcoinBlockchain - Sending Transactions-Creating a Smart Contract - Executing Smart Contract Functions - Public vs. Private Blockchains.

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

Text Books:

- 1 BikramadityaSinghal, GautamDhameja, PriyansuSekhar 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, ChellammalSuria Narayanan, Kavita Saini, Blockchain Technology and Applications, CRC Press, United States, First Edition, 2021.
- 3 E. Golden Julie, J. JesuVedhaNayahi, Noor ZamanJhanjhi, Blockchain Technology Fundamentals, Applications, and Case Studies, CRC Press , United States, First Edition, 2021.

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

Regulation: R 2020

Course Code: 20IT904

Course Name: BLOCK CHAIN TECHNOLOGIES

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1:	<i>Infer the theoretical aspects of blockchain and apply in real case scenarios.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO2:	<i>Discuss the core components and working of blockchain.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3:	<i>Explain the technical concepts of bit coin.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO4:	<i>Interpret the Ethereum blockchain for different use cases.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO5:	<i>Outline the end-to-end development of a decentralized application.</i>	3	2	3	-	-	-	-	-	-	-	-	3	-	-
Average		3	2	3	-	-	-	-	-	-	-	-	3	-	-

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

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	R 2020
20IT905	INTERNET OF THINGS AND APPLICATIONS (Open Elective)	L T P C 3 0 0 3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to	Cognitive Level
CO1: Explain the physical and logical design of IoT.	Understand
CO2: Summarize the various design methodologies of IoT.	Understand
CO3: Outline the various packages in Python for IoT real world application.	Understand
CO4: Discuss IoT applications using Raspberry Pi and Python.	Remember
CO5: Infer the knowledge on design of smart IoT applications.	Understand

UNIT-I FUNCTIONAL BLOCKS OF IoT [09]

Definition and Characteristics of IoT - Physical Design: Layers and Protocols - Logical Design: IoT Functional Blocks - IoT Communication models and APIs - IoT Enabling Technologies -IoT Levels and Deployment Templates.

UNIT-II IoT DESIGN METHODOLOGY [09]

M2M - M2M Vs IoT - Software Defined Networks - Network function Virtualization - IoT Platform Design Methodologies - Domain Specific IoT.

UNIT - III PYTHON PACKAGES FOR IOT AND RASPBERRY PI [09]

JSON - XML - HTTPLib and URLLib - SMTPLib. Raspberry Pi : Pin Configurations - Interfaces : Serial, SPI, I2C 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 ArshdeepBahga and Vijay Madiseti, Internet of Things -A Hands-on Approach, Orient Blackswan Private Limited, New Delhi, First Edition, 2015.
- 2 David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Pearson Education, First Edition, 2017.

Reference Books :

- 1 Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Apress Publications, New York, First Edition, 2013.
- 2 Rajkamal, Internet of Things: Architecture, Design Principles And Applications, McGraw Hill Education, New York, First Edition, 2017.
- 3 Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things - Key Applications and Protocols, Wiley, New York, 2015.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
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	PS01	PS02
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

(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 strategies for software testing.

Understand

CO2: Infer the need and conduct of testing levels.

Understand

CO3: Discuss the various techniques used in testing.

Understand

CO4: Interpret the various types of testing used in real world application.

Understand

CO5: Explain the test case templates and reviews process.

Understand

UNIT - I SOFTWARE TESTING**[9]**

Software Testing - Definition of Software Testing - Objective and limits of testing - Testing Strategy - Roles and Responsibilities of a Software Tester - Independent Verification and Validation.

UNIT - II SOFTWARE TESTING REQUIREMENTS**[9]**

Software Testing Requirements - Analyzing the requirements -Functional and Non-Functional Requirements. Software Testing Review Process - Types of Reviews: Peer Review - Walkthrough - Inspection - Checklists of Review Process.

UNIT - III WHITE AND BLACK BOX TESTING**[9]**

White Box Testing Techniques: Decision/Branch Coverage - Basic Path Testing - Control Flow Graph Coverage - Conditional Coverage. Black Box Test Techniques: Boundary Value Analysis - Equivalent Class Partition - Cause-Effect Analysis - State Transition Table.

UNIT - IV TESTING TECHNIQUES**[9]**

Functional Testing: Smoke Testing - Integration and System Testing User Acceptance Testing - Non-Functional Testing: - Performance Testing - Recovery Testing - Security Testing - Compatibility Testing - Usability Testing - Ad Hoc Testing.

UNIT - V TEST CASE DESIGN**[9]**

Test Case :Standards, Characteristics , Guidelines and Naming Conventions - Test Case Templates - Creation of Test Case - Requirement Coverage -Traceability Matrix - Test Case Review Process - Test Execution - Test Log - Reporting of Test Execution

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

- 1 S.Subashni, N.Satheesh Kumar, Dr.B.G.Geetha, Dr.G.Singaravel, Software Testing, Umayam Publications, First Edition, 2013.
- 2 Srinivasan Desikan, 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 GlenfordJ.Myess, The Art of Testing, Wiley, India, Third Edition, 2003.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
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 (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 various approaches in problem solving.	Understand
CO2: Discuss the different algorithm design techniques.	Remember
CO3: Demonstrate the various array based problem.	Understand
CO4: Summarize the concept of sorting and searching.	Understand
CO5: Outline the various methods to solve number based problem.	Understand

UNIT – I PROBLEM SOLVING PROCESS [9]

Problem Solving Process -Approaches in Problem Solving: System Centric- Problem Centric- Solution Centric and Solver Centric Approach - Algorithm- Pseudocode- Flowchart- Important Problem Types.

UNIT – II ALGORITHMIC PROBLEM SOLVING [9]

Notion of the Algorithm - Algorithm Design and Analysis Process - Time and Space Complexity - Algorithm Design Techniques: Divide and Conquer - Dynamic Programming - Greedy Technique - Backtracking.

UNIT – III ARRAY BASED PROBLEMS [9]

Array Order Reversal - Array Counting - Removal duplicates - Finding the kth smallest element - Swapping of elements - Subarray with given Sum - Find the longest consecutive subsequence.

UNIT – IV SORTING AND SEARCHING [9]

Searching: Linear Search - Binary Search. Sorting: Bubble Sort- Selection Sort- Insertion Sort- Merge Sort- Quicksort - Heap Sort.

UNIT – V NUMBER BASED PROBLEMS [9]

Swapping the values -Summation of Set of Number - Fibonacci Sequence and Factorial Computation - Integer Reversal - Euclid's algorithm - Prime Numbers Generation.

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

Text Books:

- 1 R.G.Dromey, How to Solve it by Computer, Pearson Education, India, Fifth Edition, 2008.
- 2 ISRD GROUP, Programming and Problem Solving Using C Language, McGraw Hill Education, India , First Edition 2017.

Reference Books :

- 1 ITL Educational Solutions Limited, Introduction to Information Technology, Pearson Education, India, Second Edition, India, 2012.
- 2 G. Polya, How to Solve It : A New Aspect of Mathematical Method, Princeton University Press, New Jersey, Second Edition, 2008
- 3 Ellis Horowitz, Fundamentals of Programming languages, Galgotia Publications, New Delhi, Second Edition, 2012.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
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****[9]**

Origins of Cloud Computing - Cloud Components - Essential Characteristics – Broad Network Access - Location Independent Resource Pooling - Rapid Elasticity - Measured Service - Roots of Cloud Computing.

UNIT – II CLOUD INSIGHTS**[9]**

Architectural Influences - High-Performance Computing - Utility and Enterprise Grid Computing - Cloud Scenarios - Benefits- Application Development - Security level of Third Party - Security Benefits - Regularity Issues.

UNIT – III CLOUD ARCHITECTURE**[9]**

Layers in Cloud Architecture - Software as a Service- Features of SaaS and benefits- Platform as a Services - Features of PaaS and benefits- Infrastructure as a Service- Features of IaaS and benefits- Cloud Service Providers - Challenges and risks in cloud adoption -Types of Cloud.

UNIT – IV CLOUD SIMULATORS**[9]**

CloudSim Simulator -Architecture- User code-CloudSim- GridSim- SimJava - Working platform for CloudSim- GreenCloud.

UNIT-V VMWARE SIMULATOR**[9]**

VMWare- Advantages of VMWare virtualization-VMWare workstation-Virtual Machines - Create a new virtual machine on local host – Cloning virtual machine – Recent Trends.

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

- 1 Anthony T.Velte , Toby J. Velte Robert Elsenpeter, Cloud computing : A Practical Approach, Tata McGraw- Hill , New Delhi ,Second Edition, 2017.
- 2 Dan C Marinescu, Cloud Computing: Theory and Practice, MK Elsevier, Second Edition, United States,2017.

Reference Books :

- 1 Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, Cloud computing for Dummies, Wiley, India, Second Edition,2020.
- 2 RajkumarBuyya, James Broberg, AndrzejGoscinski, Cloud Computing: Principles and Paradigms, Wiley, India, First Edition, 2011.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
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	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 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.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
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	PS01	PS02
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)

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)	R 2020
20IT910	PRINCIPLES OF SOFTWARE ENGINEERING (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 software engineering process and its various models	Understand
CO2: Summarize how requirements may be organized in software requirements document	Understand
CO3: Illustrate the architectural design decisions and apply real time systems.	Understand
CO4: Outline the methods rely on documented specifications and Design.	Understand
CO5: Discuss the process involved in verification and validation.	Understand

UNIT - I SYSTEMS ENGINEERING [9]

Professional and Ethical Responsibility - Systems Engineering - Legacy Systems - Critical System - Software Process Models - Process Iteration - The Rational Unified Process - Project Planning - Project Scheduling.

UNIT - II REQUIREMENTS ANALYSIS [9]

Software Requirements: Functional and Non-Functional Requirements - User Requirements - System Requirements - Requirements Validation - Requirements Management - System Models: Context Models, Behavioral Models, Data Models, Object Models, Structured Methods- Risk-Driven Specification, Safety Specification.

UNIT - III ARCHITECTURAL DESIGN [9]

Architectural Design Decisions - System Organization - Multiprocessor Architectures - Client - Server Architectures - Data Processing Systems - Objects and Object Classes - Real-Time Operating Systems - Monitoring and Control Systems - User Interface Design : Issue, Process, Analysis.

UNIT - IV CRITICAL SYSTEMS [9]

Agile Methods - Rapid Application Development - Software Prototyping - Components and Component Models - Fault Tolerance - Fault-Tolerance Architectures - Software Maintenance - Evolution Processes - Legacy System Evolution .

UNIT - V VERIFICATION AND VALIDATION [9]

Planning Verification and Validation - Software Inspections - Verification and Formal Methods - Systems Testing - Component Testing - Test Case Design - Test Automation - Safety Assurance - Security Assessment.

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

Text Books:

- 1 LanSommerville, 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 JaloteP,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.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
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

20ME901

BASIC MECHANICAL ENGINEERING

L	T	P	C
3	0	0	3

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

CO1: Explore the fundamental knowledge on basics of mechanical engineering

Understand

CO2: Demonstrate the concepts of manufacturing technology.

Understand

CO3: Describe the knowledge of power plants and pumps.

Understand

CO4: Interpret the basic concepts of IC Engines.

Understand

CO5: Analyze the Refrigeration and air conditioning systems

Analyze

UNIT - I FUNDAMENTALS**[09]**

Introduction to mechanical engineering, concepts of thermal engineering, mechanical machine design, industrial engineering, and manufacturing technology.

UNIT - II MANUFACTURING TECHNOLOGY**[09]**

Manufacturing, classification, lathe, drilling machines, milling machines, metal joining, metal forming, casting, forging, and introduction to powder metallurgy.

UNIT - III POWER PLANT ENGINEERING**[09]**

Introduction, Classification of Power Plants - Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants - Merits and Demerits - Pumps and turbines - working principle of Reciprocating pumps (single acting and double acting) - Centrifugal Pump.

UNIT - IV I C ENGINES**[09]**

Internal combustion engines as automobile power plant - Working principle of Petrol and Diesel Engines - Four stroke and two stroke cycles - Comparison of four stroke and two stroke engines.

UNIT - V REFRIGERATION AND AIR CONDITIONING SYSTEM**[09]**

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system-Layout of typical domestic refrigerator-Window and Split type room Air condition.

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

- 1 Shantha Kumar S R J., Basic Mechanical Engineering, Hi-tech Publications, Mayiladuthurai, Second Edition, 2000.
- 2 Venugopal K and Prahu Raja V, Basic Mechanical Engineering, Anuradha Publishers, Kumbakonam , Fourth Edition 2000.

Reference Books :

- 1 Lecture notes prepared by Department of Mechanical Engineering, NITT, 2020.
- 2 R. K. Rajput, Manufacturing Processes, University Science Press, New Delhi, Fourth Edition, 2020.
- 3 HajraChoudry, 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 SAFETY AND FIRE 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

20ME902

SOLAR ENERGY UTILIZATION

L	T	P	C
3	0	0	3

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

CO1:	Explore the measurement of solar radiation and their application to various systems.	Understand
CO2:	Illustrate the principles of non-concentrating collectors and apply the principles in various real time applications.	Apply
CO3:	Describe the concept of concentrating collectors and their application to a wide range of systems.	Apply
CO4:	Analyze the various material characteristics of solar cell and determine maximum efficiency of solar cells.	Analyze
CO5:	Demonstrate the solar storage equipment and evaluate the economic analysis of various solar equipment.	Understand

UNIT - I INTRODUCTION TO SOLAR ENERGY [09]

Introduction - Sun-Earth relationships- solar constant- solar radiation at the earth surface- depletion of solar radiation- measurement of solar radiation- solar radiation data- solar time- solar radiation geometry- solar radiation on tilted surfaces-Sun as the source of energy sun angles - overview of applications.

UNIT - II NON CONCENTRATING COLLECTORS [09]

Types and classification of solar collectors - terminology related to flat plate collectors - evacuated collectors-Heat transfer processes and efficiency of a solar collector -solar drying- solar desalination- solar mechanical cooling- solar desiccant cooling- detailed study on heat pump - it needed.

UNIT - III CONCENTRATING COLLECTORS [09]

Tracking systems - compound parabolic concentrators - parabolic trough concentrators - concentrators with point focus - Heliostats- comparison of various designs - central receiver systems - parabolic trough systems - solar performance analysis - solar power plant - solar furnace.

UNIT - IV SOLAR PHOTOVOLTAIC [09]

Fundamentals of solar cells- - types of solar cell- P-N junction photodiode- description and principle of working of a solar cell- cell structure- solar module and panel- I-V characteristics of a PV module- maximum power point- cell efficiency- fill factor- Manufacturing of solar cell.

UNIT - V SOLAR ENERGY STORAGE AND ECONOMIC ANALYSIS [09]

Storage of solar energy - thermal storage-sensible and latent heat storage-Economic Analysis: Initial and annual costs- definition of economic terms for a solar system- present worth calculation-repayment of loan in equal annual installments- annual savings- cumulative savings and life cycle savings- payback period- clean development mechanism -solar vehicle -BIPV(Building Integrated photo voltaic) - house hold appliances.

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

- 1 Garg H P and Prakash J, Solar Energy: Fundamentals & Applications, McGraw Hill, New Delhi, First Revised Edition 2014 .
- 2 Duffie.J.A and Beckman W.A, Solar Engineering of Thermal processes, John Wiley And Sons, New York, Fourth Edition,2013 .

Reference Books :

- 1 Sukhatme. K and Sukhatme S.P., Solar Energy principles of thermal collection and storage, Tata McGraw Hill education, New Delhi, Third Edition,2008.
- 2 Rai G.D., Solar energy Utilization, Khanna Publishers, New Delhi, Fifth Edition, 2020.
- 3 Bhattachariya.T , Terrestrial Solar Photovoltaic, Narosa Publishers, New Delhi, Fourth Edition,2008.
- 4 Sukhatme S.P., Solar Energy, Tata McGraw Hills P Co., Third Edition, 2008.

K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215
DEPARTMENT OF DEPARTMENT OF SAFETY AND FIRE 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

20ME903

PRODUCTION TECHNOLOGY OF AGRICULTURAL MACHINERY

L	T	P	C
3	0	0	3

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

CO1:	Acquire various engineering materials, classifications, compositions and properties	Understand
CO2:	Explore the concept and basic mechanics of metal cutting, working of standard machine tools and allied machines.	Understand
CO3:	Apply the manufacturing process in welding for component production.	Apply
CO4:	Demonstrate various advanced manufacturing process in engineering field.	Understand
CO5:	Describe the basic concepts of Computer Numerical Control (CNC) machine tool and CNC programming.	Understand

UNIT – I ENGINEERING MATERIALS**[09]**

Engineering materials - their classification - Mechanical properties of materials, strength, elasticity, plasticity, stiffness, malleability, ductility, brittleness, toughness, hardness, resilience, machinability, formability, weldability. Steels and cast irons: Carbon steels, their classification based on percentage of carbon as low, mild, medium & high carbon steel, their properties & applications. Wrought iron, cast iron. Alloy steels: Stainless steel, tool steel.

UNIT - II MACHINING**[09]**

Basic principles of lathe - machine and operations performed on it. Basic description of machines and operations of Shaper-Planner, Drilling, Milling & Grinding.

UNIT - III WELDING**[09]**

Introduction, classification of welding processes. Gas welding, types of flames and their applications. Electric Arc welding. Resistance welding, Soldering & Brazing processes and their uses.

UNIT - IV ADVANCED MANUFACTURING PROCESS**[09]**

Abrasive flow machining - abrasive jet machining - water jet machining - Electro Discharge Machining (EDM) - Wire cut EDM - Electro Chemical Machining (ECM) - Ultrasonic Machining / Drilling (USM / USD) - Electron Beam Machining (EBM) - Laser Beam Machining (LBM).

UNIT - V CNC MACHINE**[09]**

Numerical control (NC) machine tools - CNC: types, constitutional details, special features - design considerations of CNC machines for improving machining accuracy - structural members - slide ways - linear bearings - ball screws - spindle drives and feed drives. Part programming fundamentals - manual programming.

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

- 1 Kalpakjian and Schmid ,Manufacturing Engineering and Technology, Pearson, New Delhi, Eighth Edition, 2016.
- 2 HajraChoudry, Elements of workshop technology - Vol II, Media promoters, New Delhi ,Fourth Edition,2018

Reference Books :

- 1 Gupta. K.N., and Kaushik, J.P., Workshop Technology Vol I and II, New Heights, Daryaganj, New Delhi, Second Edition, 1998,.
- 2 Arthur. D., et. al., General Engineering Workshop Practice, Asia Publishing House, Bombay,Third Edition,2001.
- 3 Chapman W.A.J., Workshop Technology, Part I, II, III, E.L.B.S. and Edward Arnold Publishers Ltd, London, First Edition,1992.
- 4 Dr. P. Kamaraj, Dr. V. R. Ramachandran, Production Technology of Agricultural Machinery,Kerala,First Edition,2020.

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

DEPARTMENT OF SAFETY AND FIRE 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

20ME904

SELECTION OF MATERIALS

L	T	P	C
3	0	0	3

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

- CO1: Explore the classification and properties of engineering materials
 CO2: Acquire the knowledge on mechanical properties of various metal alloys.
 CO3: Identify different types of availability materials.
 CO4: Examine required materials for engineering applications.
 CO5: Select suitable material for various applications

Understand
 Understand
 Analyze
 Analyze
 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.

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

DEPARTMENT OF SAFETY AND FIRE 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

20ME905

MARINE VEHICLES

L	T	P	C
3	0	0	3

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

CO1: Explore the various types of marine vehicles and its applications

Understand

CO2: Acquire marine vehicle Safety, Operations and controls of bunkering.

Understand

CO3: Demonstrate remotely operable vehicle design, construction and its components.

Apply

CO4: Analyze submersible and autonomous under water vehicles.

Analyze

CO5: Design and operational consideration of manned and un manned submersible.

Create

UNIT - I MARINE VEHICLES**[09]**

Types - general - by function - commercial marine vehicles- passenger ship, cargo ships, oil and chemical tankers , cattle carriers, harbor crafts, off shore platform, container ships.

UNIT - II REEFERS AND GAS CARRIERS**[09]**

.Introduction - Types , design considerations, safety - operation and controls, precaution during bunkering.

UNIT - III REMOTELY OPERABLE VEHICLE (ROV), UMS SHIPS**[09]**

Remotely Operable Vehicles (ROV) - The ROV business - Design theory and standards - control and simulation - design and stability - components of ROV - applications, UMS operation, and controls.

UNIT - IV SUBMERSIBLES AND AUTONOMOUS UNDERWATER VEHICLE (AUV)**[09]**

submersibles types - applications, AUV - Design and construction considerations - components - sensors - Navigation -control strategies - applications.

UNIT - V MANNED AND UN MANNED SUBMERSIBLE**[09]**

Introduction - Design and operational consideration - pressure hull exo-structure - ballasting and trim - maneuvering and control - Life support and habitability - emergency devices and equipment's - certification and classification, towed vehicles - gliders - crawler - Design and construction.

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

- Jonathan M. Ross, human factors for naval marine vehicle design and operation, CRC Press, US, Second Edition, 2001.
- Sabiha A. Wadoo, Pushkin Kachroo, Autonomous underwater vehicles, modeling, control design and Simulation, CRC press,US,Second Edition, 2011.

Reference Books :

- Ferial L hawry, The ocean engineering handbook, CRC press, US,First Edition, 2000.
- Richard A Geyer, Submersibles and their use in oceanography and ocean engineering, Elsevier, New Delhi, First Edition, 1997.
- Robert D. Christ,Robert L. Wernli, Sr., The ROV Manual A User Guide for Remotely Operated Vehicles, Elsevier, New Delhi, second edition, 2014.
- Frank Busby. R, Manned Submersibles, Office of the oceanographer of the Navy, United states, First Edition, 1976.

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

DEPARTMENT OF SAFETY AND FIRE 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

20ME906

SENSORS AND TRANSDUCERS

L	T	P	C
3	0	0	3

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

CO1: Explore the basic concepts of various sensors and transducers.

Understand

CO2: Develop knowledge in mechanical and electromechanical sensor.

Apply

CO3: Differentiate the types of thermal sensor which are used in various applications.

Apply

CO4: Identify various types of magnetic sensors and working principles

Analyze

CO5: Acquire suitable sensors and its applications.

Understand

UNIT - I INTRODUCTION**[09]**

Definition, classification, static and dynamic parameters, Characterization - Electrical, mechanical, thermal and chemical. Classification of errors - Error analysis, Static and dynamic characteristics of transducers.

UNIT - II MECHANICAL AND ELECTROMECHANICAL SENSORS**[09]**

Resistive Potentiometer - strain gauge - Inductive sensors and transducer - capacitive sensors - ultrasonic sensors.

UNIT - III THERMAL SENSOR**[09]**

Gas thermometric sensors - acoustic temperature sensors - magnetic thermometer, resistance change -type thermometric sensors.

UNIT - IV MAGNETIC SENSOR**[09]**

Force and displacement measurement - Magneto resistive sensors - Hall Effect sensor, Inductance and eddy current sensors - Angular/rotary movement transducer - Electromagnetic flow meter, squid sensor.

UNIT - V SENSORS AND THEIR APPLICATIONS**[09]**

Automobile sensor - Home appliance sensor - Aerospace sensors - sensors for manufacturing medical diagnostic sensors - environmental monitoring.

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

- 1 Ernest O Doebelin, Measurement Systems - Applications and Design, Tata McGraw-Hill, New Delhi, Fourth edition, 2016.
- 2 Sawney A K and 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.

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

Regulation : R2020

Course Code : 20ME906

Course Name : SENSORS AND TRANSDUCERS

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
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

20ME907

ENERGY AUDITING

L	T	P	C
3	0	0	3

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

CO1:	Describe the energy crisis & environmental concerns associated with the energy management and the importance of energy auditing.	Understand
CO2:	Identify the tools, techniques, management practices for the audit and management of electrical energy.	Understand
CO3:	Recognize the techniques of energy analysis and the associated energy efficient technologies for the routinely used thermal energy systems.	Apply
CO4:	State about the typical electrical energy powered utilities, services of industrial facilities & organizations and be able to identify the opportunities and options for the conservation & management of electrical energy.	Understand
CO5:	Interpret the basic economic concepts of underlay energy production and end use.	Evaluate

UNIT - I INTRODUCTION**[09]**

Energy - Power - Past & Present scenario of world; National energy consumption data - Environmental aspects associated with energy utilization - Energy Auditing: Need, Types, Methodology and Barriers. Role of energy managers. Instruments for energy auditing.

UNIT - II ELECTRICAL SYSTEMS**[09]**

Components of EB billing - HT and LT supply, Transformers, Cable sizing, Concept of capacitors, Power factor improvement, Harmonics, Electric motors - Motors efficiency computation, Energy efficient motors, Illumination - Lux, Lumens, Types of lighting, Efficacy, LED lighting and scope of economics in illumination - Auditing in electrical systems.

UNIT - III THERMAL SYSTEMS**[09]**

Stoichiometry, Boilers, Furnaces and Thermal fluid heaters - Efficiency computation and economic measures. Steam: Distribution & usage, Steam traps, Condensate recovery, Flash steam utilization, Insulators & Refractories - Auditing in thermal systems.

UNIT - IV ENERGY CONSERVATION IN MAJOR UTILITIES**[09]**

Pumps, Fans, Blowers, Compressed air systems, Refrigeration and Air Conditioning systems - Cooling towers - D.G. sets - Auditing and energy conservation.

UNIT - V ECONOMICS**[09]**

Energy economics - Discount rate, Payback period, Internal rate of return, Net present value, Life cycle costing - ESCO concept - Auditing and Economics.

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

- 1 Energy manager training manual (4 Volumes) available at www.energymanagertraining.com, a website administered by Bureau of energy efficiency (BEE), a statutory body under ministry of power, Government Of India, 2004.
- 2 Abbi, Y.B , Energy Audit, Open University, The Energy and Resources Institute, Government Of India, 2012 .

Reference Books :

- 1 Witte. L.C., P. S. Schmidt, D.R. Brown, Industrial Energy Management and Utilization, Hemisphere Pub, Washington, First Edition, 1988 .
- 2 Sonal Desai, Handbook of Energy Audit, Tata McGraw Hill, New Delhi, Second Edition, 2015.
- 3 Dryden. I.G.C., The Efficient Use Of Energy, Butterworth's, London, Fourth Edition, 2013.
- 4 Turner W.C., Energy Management Handbook, Wiley, New York, Eighth Edition, 2014.

K.S.R COLLEG OF ENGINEERING, TIRUCHENGODE-637215

DEPARTMENT OF SAFETY AND FIRE 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.
 CO2: Apply knowledge of fracture mechanics of composites during designing of composite structures.
 CO3: Analyze critically damping capacity of composite materials.
 CO4: Correlate various manufacturing/fabricating techniques for composite structures based on design.
 CO5: Explore various composite applications.

Understand
 Apply
 Analyze
 Analyze
 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 Materials, Springer Science in progress, USA, Sixth Edition, 2019.
- 2 Balasubramaniam, Composite Materials, John Wiley & Sons, Indian Ed., New York, Fourth Edition, 2016.

Reference Books :

- 1 Sharma S.C., Composite materials, Narosa Publications, NewDelhi, Third Edition, 2015.
- 2 Isaac M. Daniel and Orilshai, Engineering Mechanics of Composite Materials, Oxford University Press, UK, Second Edition, 2017.

K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215
DEPARTMENT OF SAFETY AND FIRE 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

20ME909

LEAN MANUFACTURING

L	T	P	C
3	0	0	3

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

CO1:	Demonstrate the lean manufacturing principles to find and eliminate wastes.	Understand
CO2:	Identify the lean manufacturing tools and their potential applications.	Understand
CO3:	Summarize the usage of visual management, TPM and lean practices.	Apply
CO4:	Acquire the technology drivers of lean manufacturing.	Understand
CO5:	Describe technology drivers of lean manufacturing.	Analyze

UNIT - I LEAN MANUFACTURING PRINCIPLES [09]

Lean manufacturing paradigms - lean manufacturing - origin - Toyota Production System - types of wastes -tools and techniques to eliminate wastes - value stream mapping (VSM) - primary icons - secondary icons - developing the VSM.

UNIT - II LEAN MANUFACTURING TOOLS [09]

5S concepts - stages of 5S and waste elimination - Kaizen - steps of Kaizen - lean manufacturing through Kaizen - Single Minute Exchange of Die - theory of SMED - design for SMED - strategic SMED and waste elimination - pull production through Kanban - one piece flow production.

UNIT - III VISUAL MANAGEMENT, TPM AND LEAN IMPLEMENTATION [09]

Visual management - tools for eliminating wastes - overproduction, inventory, delay, transportation, processing, unnecessary motion, defective parts, underutilization of people - implementation - total productive maintenance - implementation of lean practices.

UNIT - IV MANAGEMENT AND TECHNOLOGY DRIVERS OF LEAN MANUFACTURING [09]

Lean manufacturing - twenty criteria model - management driver - organizational structure - devolution of authority - employee status and involvement - nature of management - business and technical processes - time management - agility through technology driver.

UNIT - V MANUFACTURING STRATEGY AND COMPETITIVE DRIVERS OF LEAN MANUFACTURING [09]

Quick manufacturing setups - quick response - product life cycle management - product service elimination - automation - competitive driver - status of quality and productivity - compatible cost accounting system.

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

- 1 Devadasan.S.R, Mohan Sivakumar.V, Muruges.R and Shalij.P.R, Lean Manufacturing: Theoretical, Practical and Research Futurities, PHI Learning Private Limited, New Delhi, Second Edition, 2012.
- 2 Pascal Dennis, Lean Production Simplified, Productivity Press, New York, Third Edition, 2007.

Reference Books :

- 1 Bill Carreira, Lean Manufacturing That Works, PHI Learning Private Limited, New Delhi, Third Edition, 2016.
- 2 Dennis P. Hobbs, LEAN Manufacturing Implementation, Cengage Learning, New Delhi, Fifth Edition, 2015.

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DEPARTMENT OF SAFETY AND FIRE 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

20ME910

SURFACE ENGINEERING

L	T	P	C
3	0	0	3

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

- CO1: Demonstrate the various factors influencing wear in materials
 CO2: Identify wear resistance techniques in engineering materials
 CO3: Acquire various surface treatment methods for alloy metals
 CO4: Describe various surface treatment techniques and its applications
 CO5: Explore the corrosion behaviour of engineering materials

Understand
 Apply
 Understand
 Analyze
 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.

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DEPARTMENT OF SAFETY AND FIRE 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)

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 ANALYSIS	[09]			
Types of Correlation-Karl Pearson's Coefficient of Correlation- Spearman's Rank Correlation-Regression Analysis-Uses-Regression equations-X on Y and Y on X Estimation.					
UNIT - III	TESTING OF HYPOTHESIS	[09]			
Large sample test based on Normal distribution for single mean and difference of means - Tests based on t - F distributions for testing means and variances-Chi-Square Test.					
UNIT - IV	DESIGN OF EXPERIMENTS	[09]			
Analysis of variance - One-way and two-way classifications - Completely randomized design - Randomized block design - Latin square design.					
UNIT - V	NON PARAMETRIC TESTS	[09]			
The Sign Test- Rank Sum Test- Mann-Whitney U Test, One Sample run Test-Spearman's Rank Correlation and Kruskal-Wallis Test (H-test).					
Total (L: 45 T:0) = 45 Periods					

Text Books :

- 1 Gupta. S.P., Statistical Methods , Sultan Chand & Sons Educational Publishers, New Delhi, Thirty first Edition, 2002.
- 2 Ross, S.M., Introduction to Probability and Statistics for Engineers and Scientists, Elsevier, Third Edition, 2004.

Reference Books :

- 1 Srivatsava TN and Shailaja Rego, Statistics for Management, Tata McGraw Hill, Fifth Edition, 2008.
- 2 Walpole. R.E., Myers. R.H., and Ye. K., Probability and Statistics for Engineers and Scientists, Pearson Education, Asia, Eighth Edition, 2007.
- 3 Richard I. Levin, David S. Rubin, Statistics for Management, Pearson Education, Seventh Edition, 2011.
- 4 Pillai R.S.N and Bagavathi.V , Statistics , S.Chand Publishers , New Delhi, Seventeenth Reprint Edition 2008.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO-PO MAPPING

Regulation : R 2020

Course Code: 20SH901

Course Name : APPLI CATIONS OF STATISTICS

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Analyze the measures of central tendency and dispersion.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2	Applying the concepts of Correlation and Regression analysis	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	Testing the samples using method of hypothesis to obtain inferences.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	Develop their skills in Design of Experiments	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	Solving Non Parametric data to obtain inferences.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
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 polyn 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 - Fourcolor 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 NarsinghDeo, 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

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING

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

20SH903

OPTIMIZATION TECHNIQUES

(Open Elective)

L	T	P	C
3	0	0	3

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

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

Cognitive Level

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 Ira 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 SAFETY AND FIRE ENGINEERING

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			
BASIC MILITARY EDUCATION AND TRAINING		L	T	P	C
20SH904	(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 [9]

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 [9]

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 [9]

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 [9]

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) [9]

Basic structure of Armed Forces- Military History - War heroes- battles of Indo-Pak war- ParamVir 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.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO-PO MAPPING

Regulation : R 2020

Course Code: 20SH904

BASIC MILITARY EDUCATION AND
Course Name: 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
	PROFESSIONAL COMMUNICATION	L	T	P	C
20SH905	(Open Elective)	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, McGrawHill, 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 SAFETY AND FIRE ENGINEERING
CO-PO MAPPING

Course Code: 20SH905

Regulation : R 2020
 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)

	K.S.R. COLLEGE OF ENGINEERING (Autonomous)				R 2020
	FUNDAMENTALS OF NANOSCIENCE AND TECHNOLOGY	L	T	P	C
20SH906	(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 [9]

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 [9]

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 [9]

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 [9]

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 [9]

Nano InfoTech: Information storage- nano computer, molecular switch, super chip, nanocrystal, Nano biotechnology: nanoprobe in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nano sensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sun barrier products - In Photostat, printing, solar cell, battery.

Total = 45 Periods

Text Books :

- 1 John Dinardo. N, Nanoscale characterization of surfaces & Interfaces. 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 Akhlesh Lakhtakia (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

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING
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

20SF901

OCCUPATIONAL HEALTH AND HYGIENE
(Open Elective)

L	T	P	C
3	0	0	3

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

- CO1 Compare the concept and spectrum of health functional units and activities of occupational health service.
- CO2 Identify physical chemical and biological hazards in the work environment and its control measures.
- CO3 Explain the principles of ventilation and its requirements.
- CO4 Demonstrate about the lighting and its requirements.
- CO5 Reduce the gas poisoning and its effects.

Understand

Apply

Understand

Understand

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 MagerStellman(ed)Encyclopedia of Occupational Health and Safety, International LabourOffice, Geneva, Fourth Edition, 1998.
2. The Industrial Environment -Its Evaluation and Control, DHHS (NIOSH),1973.

Reference Books:

1. Barbara Cohnssen, Patty'sIndustrial Hygiene and Toxicology, Wiley, Inderscience, NewYork. Seventh Edition, 2021.
2. Yudenich, V.V., Accident First Aid, Mir Publishers, Moscow, 1986.
3. Cantlie, James, First aid to the injured. St John Ambulance Association, 1932.
4. S.K. Halder, Industrial and Occupational Health, Kindle Edition, 2017.

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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			
20SF902	CONSTRUCTION SAFETY (Open Elective)	L	T	P	C
		3	0	0	3
Prerequisite: No prerequisites are needed for enrolling into the course					
Course Outcomes: On successful completion of the course, the student will be able to					Cognitive Level
CO1	List out Hazards from various Construction equipment and activities.				Remember
CO2	Mention various Control measures adopted in each Construction activity to avoid Incidents.				Apply
CO3	Demonstrate the safe use of various types of ladders, Hand held power tools, Hydraulic tools used in Construction industry.				Understand
CO4	Compare various components of cranes, safety features and its function.				Understand
CO5	Choose the minimum requirements of BOCW act to the Construction site when they work.				Apply
UNIT - I	INTRODUCTION				
Safety aspects of construction planning- Human factors in construction safety management. Roles of various groups in ensuring safety in construction industry.					[09]
UNIT - II	SAFETY IN VARIOUS CONSTRUCTION OPERATIONS				
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.					[09]
UNIT - III	SAFETY IN MATERIAL HANDLING EQUIPMENTS				
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.					[09]
UNIT - IV	CONTRACT CONDITIONS ON SAFETY				
Health, Welfare, Social Security and Insurance. Application of ergonomics for construction safety.					[09]
UNIT - V	CONTRACT LABOUR ACT AND CENTRAL RULES				
Buildings and other Construction Workers (RE & CS) Act and Central Rules. Provisions regarding Licensing, safety, health, welfare and social security aspects only.					[09]
					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) Act and 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, McGraw-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	PS01	PS02
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
(Open Elective)

L	T	P	C
3	0	0	3

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

CO1	Explain the human behaviour under emergency movement and the concept of planning and design of seating arrangements in assembly buildings, evacuation routes and exits.	Understand
CO2	Outline the general life safety requirements applicable to all buildings and to plan, design and locate exits in buildings.	Understand
CO3	Illustrate the fire and life safety requirements for buildings of specific occupancy.	Understand
CO4	Choose and distribute portable and fixed firefighting systems in buildings of different occupancies as per BIS.	Apply
CO5	Develop the method of carrying out fire investigation, arson identification, fire training, fire safety audit and fire risk assessment.	Apply

UNIT - I BASIC BUILDING PLANNING AND DESIGN**[09]**

Process of emergency evacuation - special features of personnel movement. Parameter characteristics of the movement of people; Stages of evacuation; Planning and design of evacuation routes and exits; planning of seating arrangements in large assembly buildings.

UNIT - II NBC CODES FOR BUILDINGS**[09]**

Classification of buildings based on occupancy and type of construction according to fire resistance as per NBC; Fire zone; General fire safety requirements applicable to all individual occupancies. General exit requirements as per NBC; Internal staircases; horizontal exits; fire tower; ramps; fire lifts; external fire escape ladders; Planning of location and calculation of capacity, number and width of exit as per NBC for different occupancy classification.

UNIT - III FIRE PREVENTION AND BIS STANDARD**[09]**

Fire and life safety requirements in different groups of buildings-Hotel, Schools & Colleges, Hospitals, Theatres, shopping malls, etc., Fire protection and prevention in high rise buildings - Fire protection in underground structures and in buildings under construction. 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:**

- Butcher, E.G. and Parnell, A.C., Designing of fire safety. John Wiley and Sons Ltd., New York, U.S.A, 1983.
- Roytman, M. Ya., Principles of Fire Safety Standards for Building Construction, Amerind Publishing Co. Pvt. Ltd., New Delhi, 1975.

Reference Books:

- Barendra Mohan Sen, Fire Protection and Prevention the Essential Handbook, UBSPublishers and Dist., New Delhi, 2013.
- Jain, V.K., Fire Safety in Buildings, New Age International (P) Ltd., New Delhi, Second Edition, 2010.
- Huang, Kai, Population and Building Factors That Impact Residential Fire Rates in Large U.S. Cities, Applied Research Project, Texas State University.
- Life Safety Code Handbook, National Fire Protection Association, Lathrop, James K. Ed. NFPA, 1991.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF903

Course Name: Building Fire Safety

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	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 firefighting 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.
- CO2 Choose & brief the hazards associated with electricity at work place.
- CO3 Recall human safety aspects over electric and magnetic fields.
- CO4 Compare various protective equipment and enumerate their working and application.
- CO5 Identify hazardous areas/locations in a given industrial site for selection, installation, operation and maintenance of electrical equipment.

Understand

Apply

Remember

Understand

Apply

UNIT - I INTRODUCTION TO ELECTRICAL EQUIPMENTS**[09]**

Transformers, DC Machines, Alternators, Induction Machines- Characteristics, application Protection Relays: Requirements of relay- types of protection, Classification: Distance Relay, Differential Relay, Static Relay- Definitions and types.

UNIT - II CIRCUIT BREAKERS**[09]**

Function switch gear, Arc Phenomenon- Initialization of an Arc, Arc interruption, Recovery voltage, and Restriking voltage classification and working, Working of MCB and ELCB. Faults in Power System: Causes and types, Fuses: Definition, types of fuses, selection of fuses, advantages and disadvantages.

UNIT - III EFFECT OF ELECTRIC FIELD AND MAGNETIC FIELD**[09]**

Human Safety Aspects, Effect of Current and Voltage on Human being- distance from the source, Typical V-I characteristics of skin - Nervous System, Electrical Shocks and their prevention, Insulation: Classes of Insulation, FRLS insulation, Continuity test.

UNIT - IV SAFETY DURING INSTALLATION OF PLANT AND EQUIPMENT**[09]**

Safe sequences in installation -Risk during installation, Safety during testing and commissioning- steps, Test on relays- Protection and interlock system on safety.

UNIT - V HAZARDOUS ZONES**[09]**

Classification of hazardous zones. Intrinsically safe and explosion proof electrical apparatus, Selection of equipment in hazardous area. Electrical Fires: Hazards of static electricity, Safety procedures in electrical maintenance, Statutory requirements from Electrical Inspectorate. Introduction to Indian Electricity Act and Rules.

Total = 45 Periods**Text Books:**

1. S. Rao, Electrical Safety, Fire Safety Engineering and Safety Management, Khanna Publishers, New Delhi, Third Edition, 2019.
2. John Cadick, Electrical Safety Hand book, John Cadick, TMH Publishers, Sixth Edition, 2019.

Reference Books:

1. Charles A Gross, Fundamentals of Electrical Engineering, Taylor and Francis Group, 2012.
2. H. Wayne Beaty, Handbook for Electrical Engineers, McGrawHill, Fifteenth Edition, 2007.
3. Donald G Fink, Standard Handbook for Electrical Engineers, McGrawHill, Twelfth Edition, 1987.
4. Donald G Fink, Electrical Engineering, McGraw Hill, Fifteenth Edition, 1907.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF904

Course Name: Safety in Electrical Engineering

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	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
(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 Describe about the factories act and rules.
- CO2 Illustrate the legal obligations regarding any injury by gaining knowledge of Workmen's Compensation Act. ESI Act & Rules.
- 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.
- CO4 Explain the Environment (Protection) act and Rules.
- 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.

Understand

Understand

Understand

Understand

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	PS01	PS02
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
(Open Elective)

L	T	P	C
3	0	0	3

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

CO1	Explain the General safety rules, principles, maintenance, Inspections in Foundry Operations.	Understand
CO2	Apply the concepts of safety in design of building fire safety.	Apply
CO3	Develop the safety in industrial operations.	Apply
CO4	Recall about welding, common hazards in welding, personal protective equipment and safety precautions in welding.	Remember
CO5	Illustrate on safety in finishing, inspection and testing of machines.	Understand

UNIT - I FOUNDRY OPERATIONS SAFETY [09]

Foundry Operations - Furnace - health hazard - safe methods of operation. Forging operations heat radiation - maintenance of machines - final checking of tools, guards, lubrication, shop equipment and hand tools - safe work practice. Operations in hot and cold rolling mills. Shearing - bending - rolling - drawing - turning - boring - milling - planning - grinding. Selection and care of tools - health hazards and prevention.

UNIT - II BUILDING FIRE SAFETY [09]

Building Fire Safety Objectives of fire safe building design, Fire load, fire resistant material and fire testing - structural fire protection - structural integrity - concept of exit design - exits 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 warehouse, 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. ElahiNaseer, Industrial Safety Management, Kalpaz Publication, 2006.
2. Dr. Shaileshkrumar 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: R2020

Course Code: 20SF906

Course Name: Safety in Industries

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	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
(Open Elective)

L	T	P	C
3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

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

Cognitive Level

CO1	Apply the knowledge on food quality in food industry.	Apply
CO2	Identify the food additives and food contaminants and their chemical and toxicological properties.	Apply
CO3	Summarize the effects of pests on food and the various methods for controlling them.	Understand
CO4	Explain about the national and international regulations for biosafety.	Understand
CO5	Demonstrate an ability to recognize the environmental, social and ethical implications of biotech applications.	Understand

UNIT - I FOOD QUALITY [09]

Objective and importance of quality control, classification of quality attributes and its role in food quality, quality assessment of food materials (fruits, cereals, milk and meat), types of quality characteristics of food, methods used for determination of the quality in food industry, factors influencing the quality of food, sample and sampling methods of quality evaluation.

UNIT - II FOOD SANITATION [09]

Factors contributing to physical, chemical and biological contamination in food chain, prevention and control of food borne hazards, definition and regulation of food sanitation, sources of contamination, personal hygiene-food handlers, cleaning compounds, sanitation methods and pest control, sanitation and safety in food services.

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: R2020

Course Code: 20SF907

Course Name: Food Safety

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	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	<i>Demonstrate the knowledge and understanding of basic terms in safety management.</i>	3	2	2	-	-	3	3	2	2	-	-	1	-	-
CO2	<i>Compare safety organizational requirements for effective safety management.</i>	3	2	2	-	-	3	3	2	2	-	-	1	-	-
CO3	<i>Solve the workplace hazards and apply controls measures using hierarchy of control.</i>	3	2	2	-	-	3	3	2	2	-	-	1	-	-
CO4	<i>Develop the safety performance of an organization.</i>	3	3	2	-	-	3	3	2	2	-	-	1	-	-
CO5	<i>Explain accident investigation methodologies and apply systematic procedure to identify and unearth the root cause of the incident and accident.</i>	3	3	2	-	-	3	3	2	2	-	-	1	-	-
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 UTILIZATION [09]

Electrical System - Storage Battery Operations and Maintenance. Ignition System - Coil and Magneto Ignition System. Starting System, Lighting System, Horn System-Wind Shield Wiper Motors, Fans, Heaters, Trafficators. Automobile air conditioning. Central Motor Vehicles Rules regarding Lighting, Windshields, Wipers.

UNIT - III TRANSMISSION SYSTEM AND BRAKING SYSTEM [09]

Transmission System - Clutches - operation and fault finding of clutches, Fluid Flywheel, Gear Box types, Steering Systems, Chassis Springs, and Suspension. Differential, Dead and Live axles, Rims, Tyre etc. Brakes - Types, construction and fault finding. CMV Rules-Brakes, Steering & Tyre.

UNIT - IV LUBRICATION AND COOLING SYSTEM [09]

Lubrication Systems-Types, Components, Lubricating oil, Cooling system- Details of components, Study of Systems, Types. Miscellaneous - Special gadgets and accessories for fire fighting vehicles. Automobile accidents. CMV Rules regarding Safety devices for drivers, passengers.

UNIT - V PASSIVE AND ACTIVE SAFETY [09]

Design of body for safety, deceleration of vehicle, passenger. Concept of crumple zone, Safety Cage. Optimum crash pulse. Barrier test - Crash tests - Antilock braking system, Stability Control. Adaptive cruise control, Lane Keep Assist System, Collision warning, avoidance system, Blind Spot Detection system, Driver alertness detection System. ADAS, DAT.

Total = 45 Periods

Text Books:

1. Robert Bosch GmbH, Safety, Comfort and Convenience Systems, Wiley, Third Edition, 2007.
2. Ljubo Vlacic, Michel Parent, Fumio Harashima, Intelligent Vehicle Technologies Theory and Applications, Butterworth-Heinemann, 2001.

Reference Books:

1. GBS Narang, Automobile Engineering, Khanna Publishers, Delhi, 2014.
2. Kirpal Singh, Automobile Engineering, Vol. I & II. Standard publishes, Delhi, Thirteenth Edition, 2012.
3. Joseph Heitner, Automotive Mechanics-Principles & Practices, CBS Publisher-Delhi, Second Edition, 2006.
4. P. L. Kohli, Automotive Electrical Equipment's, McGraw Hill, New Delhi, 1993.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF909

Course Name: Safety in Automobile Engineering

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	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	-	-
		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 TRAFFIC ENGINEERING [09]

Introduction of Traffic Engineering: Traffic characteristics. Various traffic studies and their applications. Traffic signals. Carriage-way markings. Traffic islands. Highway intersections. Principles of highway lighting. Road Accidents prevention, investigation and reduction.

UNIT - IV HARBOUR AND DOCK ENGINEERING [09]

Introduction of Harbour & Dock Engineering: Water transportation, classification of harbours, accessibility and size, ports, Indian ports. Layout of ports, breakwater, facilities (in brief) for docking, repair, approach, loading and unloading, storing and guiding.

UNIT - V AIR TRANSPORTATION ENGINEERING [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)		2020			
20SF881	Environmental Safety (Honours)	L	T	P	C
		1	0	2	3
Prerequisite:					
Course Outcomes : On Successful Completion of the Course, the student will be able to		Cognitive Level			
CO1	Fundamental understanding of environmental safety, recognizing its importance, and being able to identify key principles and regulations governing environmental protection.	Understand			
CO2	Safely identify, handle, and manage hazardous materials, as well as respond effectively to chemical spills.	Analyze			
CO3	Apply various monitoring techniques and suggest pollution control measures for air, water, and soil while promoting sustainable practices.	Apply			
CO4	Understand workplace hazards, utilize personal protective equipment effectively.	Understand			
CO5	Capable of creating comprehensive emergency response plans, communicating effectively during crises.	Create			
UNIT – I	Introduction to Environmental Safety	[09]			
Definition and scope of environmental safety, Importance of environmental safety in various industries, Overview of environmental regulations and standards, Key principles of risk assessment and management, Historical case studies of environmental disasters					
UNIT – II	Hazardous Materials and Chemical Safety	[09]			
Identification and classification of hazardous materials, Handling, storage, and transportation of chemicals, Risk communication and labeling of hazardous substances, Emergency response procedures for chemical spills, Case studies on chemical accidents and their prevention					
UNIT - III	Environmental Monitoring and Pollution Control	[09]			
Techniques for environmental monitoring, Air quality monitoring and control measures, Water pollution prevention and treatment methods, Soil contamination and remediation techniques, Sustainable practices for pollution control					
UNIT - IV	Occupational Safety and Health in the Environment	[09]			
Workplace hazards and their impact on health, Personal protective equipment (PPE) and its usage, Ergonomics and its role in preventing occupational injuries, Mental health considerations in the workplace, Developing and implementing safety programs					
UNIT - V	Environmental Emergency Response and Preparedness	[09]			
Developing emergency response plans for environmental incidents, Crisis communication and coordination during emergencies, Evacuation procedures and shelter management, Post-incident assessment and recovery planning, International collaboration in environmental emergency response.					
Total = 45 Periods					
Text Books :					
1	Environmental Health and Safety for Hazardous Waste Sites" by Michael Saleh				
2	Environmental Engineering and Safety, Sangeeta Raut, Sudip Kumar Sen ·Scientific Publishers 2017				
Reference Books :					
1	Introduction to Environmental Impact Assessment" by John Glasson, Riki Therivel, and Andrew Chadwick				
2	Occupational Safety and Health for Technologists, Engineers, and Managers" by David L. Goetsch and Eugene Reville				
3	Principles of Environmental Management" by Adrian Belcham				

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF881

Course Name: Environmental Safety

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Fundamental understanding of environmental safety, recognizing its importance, and being able to identify key principles and regulations governing environmental protection.	2	3	-	2	-	3	3	2	-	-	-	2	-	2
CO2	Safely identify, handle, and manage hazardous materials, as well as respond effectively to chemical spills.	2	3	-	2	-	3	3	2	-	-	-	2	-	2
CO3	Apply various monitoring techniques and suggest pollution control measures for air, water, and soil while promoting sustainable practices.	2	3	-	2	-	3	3	2	-	-	-	2	-	2
CO4	Understand workplace hazards, utilize personal protective equipment effectively,	2	3	-	2	-	3	3	2	-	-	-	2	-	2
CO5	Capable of creating comprehensive emergency response plans, communicating effectively during crises.	2	3	-	2	-	3	3	2	-	-	-	2	-	2
Average		2	3	-	2	-	3	3	2	-	-	-	2	-	2

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

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

2020

20SF882

Global Warming and Climate Change
(Honours)

L	T	P	C
1	0	2	3

Prerequisite:**Course Outcomes : On Successful Completion of the Course, the student will be able to****Cognitive Level**CO1 *Demonstrate a comprehensive understanding of the concepts of global warming and climate change**Understand*CO2 *Possess a solid understanding of climate science principles, including the role of greenhouse gases.**Understand*CO3 *Recognize and analyze the diverse impacts of climate change on biodiversity and ecosystems,**Analyze*CO4 *Proficient in evaluating and proposing effective adaptation and mitigation strategies**Evaluate*CO5 *Equipped to analyze, critique, and contribute to climate policies, understanding the role of governments, NGOs, and individuals in climate action.**Analyze***UNIT – I Introduction to Global Warming and Climate Change****[09]**

Definition and differentiation between global warming and climate change, Historical context and evidence of climate change, Causes and contributors to global warming, Impacts on ecosystems, weather patterns, and human societies, Overview of international efforts and agreements to address climate change.

UNIT - II Climate Science and Greenhouse Gas Emissions**[09]**

Fundamentals of climate science, Greenhouse gases and their role in the greenhouse effect, Anthropogenic sources of greenhouse gas emissions, Measurement and monitoring of greenhouse gas concentrations, Technological and policy solutions to reduce emissions.

UNIT - III Climate Change Effects on Biodiversity and Ecosystems**[09]**

Impact of climate change on biodiversity, Changes in ecosystems and habitats, Sea-level rise and its effects on coastal ecosystems Case studies on vulnerable species and ecosystems, Conservation strategies to mitigate climate change impacts.

UNIT - IV Adaptation and Mitigation Strategies**[09]**

Adaptation strategies for communities, industries, and ecosystems, Mitigation measures to reduce greenhouse gas emissions, Renewable energy technologies and sustainable practices, International collaboration on climate change mitigation, Case studies on successful adaptation and mitigation projects.

UNIT - V Climate Policy and Advocacy**[09]**

Overview of global and national climate policies, Role of governments, NGOs, and businesses in climate action, Climate justice and equity considerations, Climate change communication and public awareness, Strategies for individual and collective climate advocacy

Total = 45 Periods**Text Books :**

- 1 Global Warming The Causes and Consequences By Ishita Haldar, 2011, Readworthy Publisher
- 2 "Climate Change: A Very Short Introduction" by Mark Maslin

Reference Books :

- 1 "The Uninhabitable Earth: Life After Warming" by David Wallace-Wells
- 2 "Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming" by Paul Hawken
- 3 Climate Change: The Science, Impacts, Solutions" by A. Barrie Pittock

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF882

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	Demonstrate a comprehensive understanding of the concepts of global warming and climate change	2	3	2	2	-	2	3	2	-	-	-	2		2
CO2	Possess a solid understanding of climate science principles, including the role of greenhouse gases.	2	3	2	2	-	2	3	2	-	-	-	2		2
CO3	Recognize and analyze the diverse impacts of climate change on biodiversity and ecosystems,	2	3	2	2	-	2	3	2	-	-	-	2		2
CO4	Proficient in evaluating and proposing effective adaptation and mitigation strategies	2	3	2	2	-	2	3	2	-	-	-	2		2
CO5	Equipped to analyze, critique, and contribute to climate policies, understanding the role of governments, NGOs, and individuals in climate action.	2	3	2	2	-	2	3	2	-	-	-	2		2
Average		2	3	2	2	-	2	3	2	-	-	-	2		2

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

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

2020

20SF883

AIR POLLUTION MANAGEMENT
(Honours)

L	T	P	C
1	0	2	3

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

- CO1 Comprehensive understanding of the fundamental concepts related to air pollution, including the sources, types, and impacts of air pollutants.
- CO2 Proficient in designing, implementing, and interpreting air quality monitoring and measurement techniques.
- CO3 Identify, analyze, and comprehend the major air pollutants and their diverse effects on human health, ecosystems, and the environment.
- CO4 Possess a comprehensive understanding of various air pollution control technologies and strategies.
- CO5 Proficient in analyzing and formulating air quality management strategies and policies.

Understand

Apply

Analyze

Understand

Analyze

UNIT – I Introduction to Air Pollution**[09]**

Definition and types of air pollutants, Sources and emissions of air pollutants, Health and environmental impacts of air pollution
Regulatory frameworks for air quality management, Historical perspectives and trends in air pollution

UNIT – II Air Quality Monitoring and Measurement**[09]**

Methods of air quality measurement, Monitoring networks and instrumentation, Criteria pollutants and air quality indices, Data analysis and interpretation, Case studies on successful air quality monitoring programs

UNIT - III Major Air Pollutants and Their Effects**[09]**

Particulate matter (PM) and its health effects, Ground-level ozone and its impact on respiratory health, Nitrogen dioxide (NO₂) and its sources, Sulfur dioxide (SO₂) and acid rain, Volatile organic compounds (VOCs) and their role in air pollution

UNIT - IV Air Pollution Control Technologies and Strategies**[09]**

Technologies for controlling particulate matter, Scrubbers and filters for gas-phase pollutants, Catalytic converters and emission standards for vehicles, Renewable energy and its role in reducing air pollution, Case studies on successful air pollution control initiatives

UNIT - V Air Quality Management and Policy**[09]**

Development and implementation of air quality management plans, Role of government agencies and regulatory bodies, International collaboration on air quality issues, Economic and social implications of air pollution, Public awareness and community engagement in air quality management.

Total = 45 Periods**Text Books :**

- 1 Air Pollution Control Engineering" by Noel de Nevers, 3rd Edition -Waveland Pr Inc
- 2 Introduction to Air Pollution Science: A Public Health Perspective" by Robert F. Phalen and Robert N. Phalen

Reference Books :

- 1 Air Quality, Fifth Edition" by Thad Godish and Wayne T. Davis
- 3 Air Pollution: Measurement, Modelling and Mitigation" by Jeremy Colls and Abhishek Tiwary
- 4 Air Quality, Fifth Edition" by Thad Godish and Wayne T. Davis

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF883

Course Name: AIR POLLUTION MANAGEMENT

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Comprehensive understanding of the fundamental concepts related to air pollution, including the sources, types, and impacts of air pollutants.</i>	2	3	2	3	-	2	3	2	-	-	-	2	2	3
CO2	<i>Proficient in designing, implementing, and interpreting air quality monitoring and measurement techniques.</i>	2	3	2	3	-	2	3	2	-	-	-	2	2	3
CO3	<i>Identify, analyze, and comprehend the major air pollutants and their diverse effects on human health, ecosystems, and the environment.</i>	2	3	2	3	-	2	3	2	-	-	-	2	2	3
CO4	<i>Possess a comprehensive understanding of various air pollution control technologies and strategies.</i>	2	3	2	3	-	2	3	2	-	-	-	2	2	3
CO5	<i>Proficient in analyzing and formulating air quality management strategies and policies.</i>	2	3	2	3	-	2	3	2	-	-	-	2	2	3
Average		2	3	2	3	-	2	3	2	-	-	-	2	2	3

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous)			2020		
20SF884	WATER POLLUTION MANAGEMENT (Honours)	L	T	P	C
		1	0	2	3
Prerequisite:					
Course Outcomes : On Successful Completion of the Course, the student will be able to			Cognitive Level		
CO1	Understand the fundamental concepts related to water pollution, including the sources, types, and impacts of water pollutants.	Understand			
CO2	Proficient in designing, implementing, and interpreting water quality assessment and monitoring techniques.	Apply			
CO3	Identify, analyze, and comprehend the major water pollutants and their diverse effects on aquatic ecosystems and human health.	Analyze			
CO4	Possess a comprehensive understanding of various water pollution control technologies and strategies.	Understand			
CO5	Proficient in analyzing and formulating integrated water quality management strategies and policies.	Analyze			
UNIT – I	Introduction to Water Pollution	[09]			
Definition and types of water pollutants, Sources of water pollution (point and non-point sources),Categories of water pollutants (chemical, biological, physical),Health and environmental impacts of water pollution, Regulatory frameworks for water quality management.					
UNIT – II	Water Quality Assessment and Monitoring	[09]			
Methods of water quality measurement, Sampling techniques for surface water and groundwater, Parameters used for water quality assessment, Data analysis and interpretation, Application of remote sensing and GIS in water quality monitoring.					
UNIT - III	Major Water Pollutants and Their Effects	[09]			
Nutrient pollution (nitrogen and phosphorus),Organic pollutants and biochemical oxygen demand (BOD),Heavy metals in water and their toxicity, Pathogens and microbial contamination, Emerging contaminants in water.					
UNIT - IV	Water Pollution Control Technologies and Strategies	[09]			
Municipal wastewater treatment processes, Industrial wastewater treatment and best practices, on-structural measures for water pollution control,Stormwater management and urban runoff control, Sustainable and nature-based solutions for water pollution					
UNIT - V	Integrated Water Quality Management and Policy	[09]			
Development and implementation of water quality management plans, Role of government agencies and regulatory bodies, International collaboration on water quality issues, Economic and social implications of water pollution, Public awareness, education, and community engagement in water management					

Total = 45 Periods

Text Books :

- 1 Water Pollution Management, Control and Treatment By Rajni Kant, Keshav Kant · 2010 New Age International
- 2 Water Pollution By Agarwal S. K. · 2005 A.P.H. Publishing Corporation

Reference Books :

- 1 Water Pollution & Management by C.K.Varshney-2008 First Edition ,New Age Publisher
- 2 Water Pollution: Causes, Treatments and Solutions! by Luxmy Begum - October 2015,Createspace Independent Pub
- 3 Water Pollution by Misra R N- Edition: 2016, Discovery Publishing House Pvt Ltd

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF884

Course Name: WATER POLLUTION MANAGEMENT

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Understand the fundamental concepts related to water pollution, including the sources, types, and impacts of water pollutants.	2	3	2	3	-	2	3	2	-	-	-	2	2	3
CO2	Proficient in designing, implementing, and interpreting water quality assessment and monitoring techniques.	2	3	2	3	-	2	3	2	-	-	-	2	2	3
CO3	Identify, analyze, and comprehend the major water pollutants and their diverse effects on aquatic ecosystems and human health.	2	3	2	3	-	2	3	2	-	-	-	2	2	3
CO4	Possess a comprehensive understanding of various water pollution control technologies and strategies.	2	3	2	3	-	2	3	2	-	-	-	2	2	3
CO5	Proficient in analyzing and formulating integrated water quality management strategies and policies.	2	3	2	3	-	2	3	2	-	-	-	2	2	3
Average		2	3	2	3	-	2	3	2	-	-	-	2	2	3

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

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

2020

20SF885

SOLID WASTE MANAGEMENT
(Honours)

L	T	P	C
1	0	2	3

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

CO1 Analyze the diverse nature of solid waste, assess the environmental and health consequences of improper waste management

Analyze

CO2 Possess the skills to design and optimize efficient waste collection and transportation systems

Evaluate

CO3 Evaluate and recommend appropriate solid waste treatment methods,

Evaluate

CO4 Demonstrate the ability to plan and manage landfills, including site selection, design

Remember

CO5 Develop a comprehensive understanding of sustainable waste management practices.

Understand

UNIT – I Introduction to Solid Waste Management**[09]**

Definition and types of solid waste, Generation and composition of solid waste, Global and regional trends in solid waste production, Environmental and health impacts of improper waste management, Overview of solid waste management hierarchy.

UNIT – II Waste Collection and Transportation**[09]**

Methods of waste collection (curbside, drop-off, recycling centers), Transportation systems for solid waste, Collection and transportation equipment and technologies, Optimization of collection routes, Case studies on successful waste collection and transportation programs

UNIT - III Solid Waste Processing and Treatment**[09]**

Mechanical, biological, and thermal methods of waste treatment, Composting and anaerobic digestion, Incineration technologies and energy recovery, Recycling and material recovery facilities, Hazardous waste treatment and disposal

UNIT - IV Landfill Management and Design**[09]**

Landfill site selection and design principles, Landfill liners, leachate collection, and gas management, Landfill regulations and permitting, Alternative landfill technologies, Landfill closure and post-closure care

UNIT - V Sustainable Waste Management and Policy**[09]**

Sustainable waste management practices, Waste reduction and source separation, Extended Producer Responsibility (EPR) Public awareness and community engagement, Waste management policies and regulations at local and global levels

Total = 45 Periods**Text Books :**

- 1 Textbook of Solid Wastes Management by I.H. Khan N. Ahsan First Edition, 2017, CBS publishers and distributors pvt ltd
- 2 Solid and Liquid Waste Management by Rajaram Vasudevan , PHI Learning publisher

Reference Books :

- 1 "Solid and Hazardous Waste Management: Science and Engineering " by M. N. Rao , 2016, Elsevier Science Publisher
- 2 " Solid Waste Management" by Subhash Anand · 2010, Mittal Publications
- 3 A Comprehensive book on Solid Waste Management, By Dr. H.S. Bhatia · 2019, Misha Books Publisher

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF885

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	Analyze the diverse nature of solid waste, assess the environmental and health consequences of improper waste management	2	3	2	3	-	3	3	2	2	-	-	2	2	3
CO2	Possess the skills to design and optimize efficient waste collection and transportation systems	2	3	2	3	-	3	3	2	2	-	-	2	2	3
CO3	Evaluate and recommend appropriate solid waste treatment methods,	2	3	2	3	-	3	3	2	2	-	-	2	2	3
CO4	Demonstrate the ability to plan and manage landfills, including site selection, design	2	3	2	3	-	3	3	2	2	-	-	2	2	3
CO5	Develop a comprehensive understanding of sustainable waste management practices.	2	3	2	3	-	3	3	2	2	-	-	2	2	3
Average		2	3	2	3	-	3	3	2	2	-	-	2	2	3

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

K.S.R. COLLEGE OF ENGINEERING (Autonomous)			2020		
20SF886	ENVIRONMENTAL SUSTAINABILITY (Honours)	L	T	P	C
		1	0	2	3
Prerequisite:					
Course Outcomes : On Successful Completion of the Course, the student will be able to				Cognitive Level	
CO1	Understanding of the fundamental principles of environmental sustainability, analyzes historical conservation efforts.	Understand			
CO2	Evaluate sustainable practices in resource management, analyze water and energy systems, and propose strategies for implementing a circular economy.	Evaluate			
CO3	Develop the ability to assess and design sustainable agricultural practices,	Apply			
CO4	Analyze and propose sustainable urban development solutions.	Analyze			
CO5	Evaluate the role of businesses in environmental sustainability, analyze CSR practices and supply chain management.	Evaluate			
UNIT – I	Foundations of Environmental Sustainability	[09]			
Definition and principles of environmental sustainability, Historical perspectives on environmental conservation, Ecological systems and biodiversity, Environmental ethics and values, International frameworks for sustainable development					
UNIT – II	Sustainable Resource Management	[09]			
Sustainable use of natural resources, Conservation and sustainable harvesting practices, Water resource management, Renewable energy sources, Circular economy and resource efficiency					
UNIT - III	Sustainable Agriculture and Food Systems	[09]			
Principles of sustainable agriculture, Agroecology and permaculture, Food security and access, Sustainable fisheries and aquaculture, Farm-to-table initiatives and local food systems					
UNIT - IV	Sustainable Urban Development	[09]			
Sustainable urban planning and design, Green infrastructure and smart cities, Transportation and sustainable mobility, Waste management in urban areas, Social equity in urban development					
UNIT - V	Corporate Social Responsibility and Environmental Sustainability	[09]			
Role of businesses in environmental sustainability, Corporate social responsibility (CSR) practices, Sustainable supply chain management, Environmental certifications and standards, Business models for sustainability					
Total = 45 Periods					

Text Books :

- 1 Environment & Sustainable Development by Dr. Neelim Singh , 2023, Anu Books publisher
- 2 Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.

Reference Books :

- 1 Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
- 2 R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38 . Edition 2010.
- 3 Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF886

Course Name: ENVIRONMENTAL SUSTAINABILITY

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Understanding of the fundamental principles of environmental sustainability, analyzes historical conservation efforts.</i>	2	3	2	3	-	3	3	2	2	-	-	2	2	3
CO2	<i>Evaluate sustainable practices in resource management, analyze water and energy systems, and propose strategies for implementing a circular economy.</i>	2	3	2	3	-	3	3	2	2	-	-	2	2	3
CO3	<i>Develop the ability to assess and design sustainable agricultural practices,</i>	2	3	2	3	-	3	3	2	2	-	-	2	2	3
CO4	<i>Analyze and propose sustainable urban development solutions.</i>	2	3	2	3	-	3	3	2	2	-	-	2	2	3
CO5	<i>Evaluate the role of businesses in environmental sustainability, analyze CSR practices and supply chain management.</i>	2	3	2	3	-	3	3	2	2	-	-	2	2	3
Average		2	3	2	3	-	3	3	2	2	-	-	2	2	3

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

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

2020

20SF887

Industrial Ecology
(Honours)

L	T	P	C
1	0	2	3

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

CO1	Understand the principles of industrial ecology; analyze historical developments in industrial symbiosis.	Understand
CO2	Possess the skills to conduct a life cycle assessment, define goals and scope, perform inventory analysis, conduct impact assessment	Evaluate
CO3	Analyze and propose industrial symbiosis initiatives, understand circular economy principles, and design supply chains with a circular approach.	Analyze
CO4	Possess the skills to plan and design eco-industrial parks, assess their environmental and economic performance	Evaluate
CO5	Analyze and recommend sustainable practices for industrial processes, understand the regulatory environment.	Analyze

UNIT – I Introduction to Industrial Ecology [09]

Definition and principles of industrial ecology, Historical perspectives on industrial symbiosis, Systems thinking and life cycle assessment, Industrial metabolism and material flow analysis, Role of industrial ecology in sustainable development

UNIT – II Life Cycle Assessment (LCA) [09]

Basics of life cycle assessment, Goal and scope definition in LCA, Life cycle inventory analysis, Life cycle impact assessment
Interpretation of LCA results

UNIT - III Industrial Symbiosis and Circular Economy [09]

Concepts and principles of industrial symbiosis, Case studies on successful industrial symbiosis projects. Circular economy principles and practices, Designing circular supply chains, Economic and environmental benefits of circular approaches

UNIT - IV Eco-Industrial Parks [09]

Planning and design of eco-industrial parks, Infrastructure and resource sharing in industrial parks, Environmental and economic performance of eco-industrial parks, Case studies on successful eco-industrial park implementations, Challenges and future trends in eco-industrial park development

UNIT - V Sustainable Industrial Practices and Policy [09]

Best practices for sustainable industrial processes, Environmental regulations and policies related to industrial ecology Corporate strategies for sustainable production, Role of government and international collaboration in promoting industrial ecology
Evaluating the effectiveness of industrial ecology policies

Total = 45 Periods**Text Books :**

- 1 Industrial Ecology: Concepts and Practices by Asis Kumar Pain, Somnath Hazra, 2008, Db Db Publisher
- 2 A Handbook of Industrial Ecology by Leslie Ayres, Robert U. Ayres, 2002, Edward Elgar Pub.

Reference Books :

- 1 "Industrial Ecology and Sustainable Engineering" by T.E. Graedel and B.R. Allenby. 2009, Pearson Publishers
- 2 Industrial Ecology and Sustainability by Thomas E Graedel, Matthew J Eckelman, 2023, World Scientific Publishing Company

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF887

Course Name: Industrial Ecology

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Understand the principles of industrial ecology; analyze historical developments in industrial symbiosis.	2	3	2	3	2	3	-	2	2	2	2	2	2	3
CO2	Possess the skills to conduct a life cycle assessment, define goals and scope, perform inventory analysis, conduct impact assessment	2	3	2	3	2	3	-	2	2	2	2	2	2	3
CO3	Analyze and propose industrial symbiosis initiatives, understand circular economy principles, and design supply chains with a circular approach.	2	3	2	3	2	3	-	2	2	2	2	2	2	3
CO4	Possess the skills to plan and design eco-industrial parks, assess their environmental and economic performance	2	3	2	3	2	3	-	2	2	2	2	2	2	3
CO5	Analyze and recommend sustainable practices for industrial processes, understand the regulatory environment.	2	3	2	3	2	3	-	2	2	2	2	2	2	3
Average		2	3	2	3	2	3	-	2	2	2	2	2	2	3

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

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

2020

20SF888	Industrial Noise and Vibration Control (Honours)	L 1	T 0	P 2	C 3

Prerequisite:

Course Outcomes : On Successful Completion of the Course, the student will be able to

Cognitive Level

CO1 Understand the fundamentals of industrial noise and vibration, assess their impacts on human health, and comprehend the regulatory framework governing noise and vibration levels.

Understand

CO2 Possess the skills to design and implement effective noise control measures, evaluate the use of soundproofing materials, and understand the application of active noise control technologies.

Evaluate

CO3 Analyze and implement vibration control techniques, understand the principles of vibration isolation, and design strategies for balancing and aligning rotating machinery.

Analyze

CO4 Possess the ability to assess the impact of noise and vibration on human performance, implement ergonomic design principles, and integrate human factors into control measures.

Analyze

CO5 Evaluate the environmental impact of industrial noise and vibration, ensure compliance with regulations, address community concerns, and propose sustainable approaches to noise and vibration control.

Evaluate

UNIT – I Introduction to Industrial Noise and Vibration [09]

Definition and sources of industrial noise and vibration, Effects of noise and vibration on human health, Regulatory standards and occupational exposure limits, Basics of noise measurement and characterization, Introduction to vibration measurement and analysis techniques

UNIT – II Noise Control Engineering [09]

Principles of noise control and reduction strategies, Designing quiet industrial machinery and equipment, Soundproofing materials and techniques, Active noise control technologies, Case studies on successful noise control engineering projects

UNIT - III Vibration Control Techniques [09]

Vibration isolation and damping methods, Balancing and alignment of rotating machinery, Tuned mass dampers and absorbers Structural modification for vibration reduction, Case studies on successful vibration control techniques

UNIT - IV Human Factors and Ergonomics in Noise and Vibration Control [09]

Human response to noise and vibration, Effects of noise and vibration on work performance, Ergonomic design principles for minimizing exposure, Occupational health and safety considerations, Case studies on the integration of human factors in control measures

UNIT - V Environmental and Regulatory Aspects [09]

Environmental impact of industrial noise and vibration, Compliance with environmental regulations, Community noise and public perception, Reporting and documentation requirements, Sustainable approaches to noise and vibration control

Total = 45 Periods**Text Books :**

- 1 Noise and Vibration Control, By Manchar Lal Munjal, 2013 World Scientific publisher
- 2 Industrial Noise and Vibration Control, By J. David Irwin, Edward R. Graf, Edward Raymond Graf, 2007, Prentice-Hall publisher

Reference Books :

- 1 "Industrial Noise Control and Acoustics" by Randall F. Barron
- 2 "Noise Control: From Concept to Application" by Bert D'hooge and Peter A. Stubbs
- 3 "Handbook of Industrial Noise Control" by Ralph T. Moller

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DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF888

Course Name: Industrial Noise and Vibration Control

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Understand the fundamentals of industrial noise and vibration, assess their impacts on human health, and comprehend the regulatory framework governing noise and vibration levels.	3	3	2	3	2	-	2	2	-	-	-	2	2	3
CO2	Possess the skills to design and implement effective noise control measures, evaluate the use of soundproofing materials, and understand the application of active noise control technologies.	3	3	2	3	2	-	2	2	-	-	-	2	2	3
CO3	Analyze and implement vibration control techniques, understand the principles of vibration isolation, and design strategies for balancing and aligning rotating machinery.	3	3	2	3	2	-	2	2	-	-	-	2	2	3
CO4	Possess the ability to assess the impact of noise and vibration on human performance, implement ergonomic design principles, and integrate human factors into control measures.	3	3	2	3	2	-	2	2	-	-	-	2	2	3
CO5	Evaluate the environmental impact of industrial noise and vibration, ensure compliance with regulations, address community concerns, and propose sustainable approaches to noise and vibration control.	3	3	2	3	2	-	2	2	-	-	-	2	2	3
Average		3	3	2	3	2	-	2	2	-	-	-	2	2	3

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

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

2020

20SF889	First Aid and Emergency Procedures (Honours)	L 1	T 0	P 2	C 3

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

CO1	Understand the importance of first aid, assess emergency situations, and communicate effectively with emergency medical services.	Understand
CO2	Possess the skills to recognize cardiac arrest, perform effective chest compressions and rescue breathing.	Evaluate
CO3	Identify and manage common medical emergencies, including choking, seizures, allergic reactions, diabetic emergencies.	Remember
CO4	Possess the skills to assess and provide first aid for wounds, bleeding, fractures, head and spinal injuries, burns, and soft tissue injuries.	Apply
CO5	Develop and implement emergency evacuation plans, understand sheltering procedures, contribute to disaster preparedness.	Analyze

UNIT – I Introduction to First Aid and Emergency Response [09]

Definition and importance of first aid, Legal and ethical considerations in providing first aid, Primary survey and assessment of emergency situations, Emergency medical services and communication, Personal safety and infection control measures

UNIT - II Basic Life Support (BLS) and Cardiopulmonary Resuscitation (CPR) [09]

Recognition of cardiac arrest and respiratory distress, Chest compressions and rescue breathing techniques, Use of automated external defibrillators (AEDs), Special considerations for CPR in infants and children, Team dynamics in performing BLS and CPR

UNIT - III Common Medical Emergencies [09]

Recognition and management of choking, First aid for seizures and convulsions, Allergic reactions and anaphylaxis, Diabetic emergencies and hypoglycaemia, Stroke recognition and initial care

UNIT - IV Trauma and Injury Management [09]

Assessment and first aid for wounds and bleeding, Fracture recognition and splinting techniques, Head and spinal injuries, Burns and scalds, Soft tissue injuries and sprains

UNIT - V Emergency Evacuation and Disaster Preparedness [09]

Evacuation procedures and techniques, Sheltering in place and lockdown protocols, Disaster preparedness and response plans, Psychological first aid, Community and workplace emergency drills

Total = 45 Periods**Text Books :**

- 1 First Aid and Emergency Care by N. HARRIS AITBS Publishers India
- 2 "Advanced First Aid, CPR, and AED" by American Academy of Orthopaedic Surgeons (AAOS)

Reference Books :

- 1 "Emergency First Response Participant Manual" by Emergency First Response Corp
- 2 Best Practices Guide ,Fundamentals of a Workplace First-Aid Program,By U. S. Department Labor, Occupational Safety Administration · 2014 CreateSpace Independent Publishing Platform

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF889

Course Name: First Aid and Emergency Procedures

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Understand the importance of first aid, assess emergency situations, and communicate effectively with emergency medical services.	-	2	3	2	-	-	-	2	-	2	-	2	-	2
CO2	Possess the skills to recognize cardiac arrest, perform effective chest compressions and rescue breathing.	-	2	3	2	-	-	-	2	-	2	-	2	-	2
CO3	Identify and manage common medical emergencies, including choking, seizures, allergic reactions, diabetic emergencies.	-	2	3	2	-	-	-	2	-	2	-	2	-	2
CO4	possess the skills to assess and provide first aid for wounds, bleeding, fractures, head and spinal injuries, burns, and soft tissue injuries.	-	2	3	2	-	-	-	2	-	2	-	2	-	2
CO5	Develop and implement emergency evacuation plans, understand sheltering procedures, contribute to disaster preparedness.	-	2	3	2	-	-	-	2	-	2	-	2	-	2
Average		-	2	3	2	-	-	-	2	-	2	-	2	-	2

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

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

2020

20SF890	Personality Management (Honours)	L	T	P	C
		1	0	2	3

Prerequisite:

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

CO1	Understand the foundational concepts of personality, analyze the factors influencing personality development, and critically evaluate various personality assessments.	Understand
CO2	Possess the skills to enhance self-awareness, manage emotions effectively, cope with stress, set and achieve personal goals, and develop a positive self-image.	Remember
CO3	Demonstrate effective interpersonal communication, apply conflict resolution techniques, build positive relationships, and exhibit empathy towards others.	Apply
CO4	Possess leadership skills, understand team dynamics, make effective decisions in a team setting, motivate others, and demonstrate ethical leadership practices.	Understand
CO5	Plan and manage their careers effectively, engage in lifelong learning, build professional networks, maintain work-life balance.	Apply

UNIT – I Foundations of Personality [09]

Definition and theories of personality, Nature vs. nurture debate in personality development, Personality traits and factors influencing personality, Personality assessments and tests, Cultural and societal influences on personality

UNIT – II Self-awareness and Self-Management [09]

Importance of self-awareness in personal development, Emotional intelligence and its role in self-management, Coping mechanisms for stress and anxiety, Goal setting and time management, Strategies for enhancing self-esteem and self-confidence

UNIT - III Interpersonal Skills and Communication [09]

Effective communication and active listening, on-verbal communication and body language, Conflict resolution and negotiation skills, Building and maintaining healthy relationships, Empathy and understanding diverse perspectives

UNIT - IV Leadership and Team Dynamics [09]

Leadership styles and qualities, Team dynamics and collaboration, Decision-making and problem-solving in a team, Motivation and empowerment, Ethical considerations in leadership

UNIT - V Personal and Professional Development [09]

Career planning and goal setting, Lifelong learning and skill development, Networking and professional relationships, Work-life balance and stress management, Continuous self-improvement and adaptability.

Total = 45 Periods

Text Books :

- 1 Personality Management, By George Mutuale · 2010, Leadstart Publishing Pvt Limited
- 2 Personality and Organizations by Benjamin Schneider, D. Brent Smith, 2004 Lawrence Erlbaum Associates publisher

Reference Books :

- 1 "Leadership: Theory and Practice" by Peter G. Northouse
- 2 "Human Resource Management" by Gary Dessler
- 3 Organizational Behavior: Improving Performance and Commitment in the Workplace" by Jason A. Colquitt, Jeffrey A. Lepine, and Michael J. Wesson

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF890

Course Name: Personality Management

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Understand the foundational concepts of personality, analyze the factors influencing personality development, and critically evaluate various personality assessments.	2	3	2	-	-	-	-	3	3	2	-	2	-	-
CO2	Possess the skills to enhance self-awareness, manage emotions effectively, cope with stress, set and achieve personal goals, and develop a positive self-image.	2	3	2	-	-	-	-	3	3	2	-	2	-	-
CO3	Demonstrate effective interpersonal communication, apply conflict resolution techniques, build positive relationships, and exhibit empathy towards others.	2	3	2	-	-	-	-	3	3	2	-	2	-	-
CO4	Possess leadership skills, understand team dynamics, make effective decisions in a team setting, motivate others, and demonstrate ethical leadership practices.	2	3	2	-	-	-	-	3	3	2	-	2	-	-
CO5	Plan and manage their careers effectively, engage in lifelong learning, build professional networks, maintain work-life balance.	2	3	2	-	-	-	-	3	3	2	-	2	-	-
Average		2	3	2	-	-	-	-	3	3	2	-	2	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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

2020

20SF891	Human Resources in Engineering (Honours)	L	T	P	C
		1	0	2	3

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

CO1	Understand the fundamentals of HRM in the engineering context, recognize its significance, and identify legal and ethical considerations specific to the field.	Understand
CO2	Possess the skills to design effective recruitment strategies, analyze engineering resumes, and conduct technical interviews.	Analyze
CO3	Assess training needs in engineering teams, design and implement effective technical training programs.	Analyze
CO4	Possess the skills to establish performance metrics, conduct effective performance appraisals, address performance issues.	Remember
CO5	Contribute to building a positive workplace culture, design employee engagement strategies, manage work-life balance, and implement retention initiatives.	Evaluate

UNIT – I Introduction to Human Resources in Engineering [09]

Overview of human resources management (HRM) in engineering, Importance of HRM in engineering organizations, Legal and ethical considerations in HRM, Role of HR professionals in engineering firms, HRM challenges specific to the engineering industry

UNIT – II Recruitment and Talent Acquisition in Engineering [09]

Recruitment strategies for engineering talent, Job analysis and design in engineering roles, Evaluation of resumes and engineering portfolios, Conducting technical interviews and assessments, Diversity and inclusion in engineering recruitment

UNIT - III Training and Development in Engineering [09]

Assessing training needs in engineering teams, Designing and delivering technical training programs, Professional development for engineers, Evaluating the effectiveness of training initiatives, Continuous learning and skills enhancement in engineering

UNIT - IV Performance Management and Appraisal in Engineering [09]

Establishing performance metrics for engineering roles, Conducting performance appraisals and feedback sessions, Addressing performance issues and providing coaching, Recognition and rewards in engineering organizations, Performance management challenges unique to engineering teams

UNIT - V Workplace Culture and Employee Engagement in Engineering [09]

Building a positive workplace culture in engineering firms, Employee engagement strategies for engineers, Managing work-life balance in engineering teams, Employee retention in the engineering industry, Handling workplace conflicts and promoting teamwork

Total = 45 Periods**Text Books :**

- 1 Human Resource Management and Technological Challenges, Carolina Machado, J. Paulo Davim 2013, Springer International Publishing
- 2 "Human Resource Management in the Oil and Gas Industry" by H. James Dyer

Reference Books :

- 1 "Engineering Management: People and Projects" by Dennis B. Buede and William D. LaForge
- 2 "Engineering Management: Challenges in the New Millennium" by C.M. Chang and M. S. Shun-Ching Lee
- 3 "Human Resource Management in Construction Projects: Strategic and Operational Approaches" by Martin Loosemore and Andrew Dainty

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF891

Course Name: Human Resources in Engineering

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Understand the fundamentals of HRM in the engineering context, recognize its significance, and identify legal and ethical considerations specific to the field.	3	2	2	3	-	2	-	2	2	-	-	2	2	-
CO2	Possess the skills to design effective recruitment strategies, analyze engineering resumes, and conduct technical interviews.	3	2	2	3	-	2	-	2	2	-	-	2	2	-
CO3	Assess training needs in engineering teams, design and implement effective technical training programs.	3	2	2	3	-	2	-	2	2	-	-	2	2	-
CO4	Possess the skills to establish performance metrics, conduct effective performance appraisals, address performance issues.	3	2	2	3	-	2	-	2	2	-	-	2	2	-
CO5	Contribute to building a positive workplace culture, design employee engagement strategies, manage work-life balance, and implement retention initiatives.	3	2	2	3	-	2	-	2	2	-	-	2	2	-
Average		3	2	2	3	-	2	-	2	2	-	-	2	2	-

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

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

2020

20SF892	Safety in Health Care Waste Management (Honours)	L 1	T 0	P 2	C 3

Prerequisite:

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

CO1	Identify and differentiate between general, infectious, sharps, hazardous, and other specific categories of health care waste.	Understand
CO2	Develop practical skills in the safe handling, proper segregation, and appropriate packaging of health care waste	Create
CO3	Ensure the safe transportation of health care waste from generation points to treatment or disposal facilities.	Analyze
CO4	Well-versed in various treatment and disposal methods for health care waste, including incineration, autoclaving, chemical treatment, and landfilling.	Evaluate
CO5	Design, implement, and manage effective health care waste safety programs within health care facilities.	Create

UNIT – I Introduction to Health Care Waste Management [09]

Definition and Types of Health Care Waste, Importance of Proper Health Care Waste Management, Risks Associated with Inadequate Waste Management, Legal and Regulatory Framework

UNIT – II Health Care Waste Segregation and Classification [09]

Segregation Practices in Health Care Facilities, Classification of Health Care Waste (General, Infectious, Sharps, Hazardous, etc.) Color Coding and Labeling of Waste Bins, Best Practices in Waste Segregation

UNIT - III Safe Handling and Transportation [09]

Safe Handling Procedures for Different Types of Health Care Waste, Packaging and Containerization, Transportation Guidelines and Regulations, Emergency Response in Transit

UNIT - IV Treatment and Disposal Methods [09]

Treatment Technologies for Health Care Waste, Incineration, Autoclaving, Chemical Treatment, and Alternative Methods, Landfilling and Safe Burial Practices, Environmental Impact Considerations

UNIT - V Training, Monitoring, and Compliance [09]

Training Programs for Health Care Workers, Monitoring and Auditing Health Care Waste Management Practices, Compliance with Occupational Safety and Health Standards, Continuous Improvement in Health Care Waste Management

Total = 45 Periods

Text Books :

- 1 Safe Management of Wastes from Health-care Activities by Yves Chartier ,2014, World Health Organization
- 2 Hospital Waste Management,A Guide for Self Assessment and Review,By Shishir Basarkar · · 2021 Jaypee Brothers Medical Publishers

Reference Books :

- 1 "Healthcare Hazard Control and Safety Management" by James T. Tweedy
- 2 "Biomedical Waste Management: Principles and Cases" by Sally J. Gainsbury and Raymond K. O'Rourke
- 3 "Principles of Healthcare Reimbursement" by Anne Casto and Elizabeth Layman

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF892

Course Name: Safety in Health Care Waste Management

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Identify and differentiate between general, infectious, sharps, hazardous, and other specific categories of health care waste.	2	2	2	2	-	-	2	2	-	-	-	2	3	3
CO2	Develop practical skills in the safe handling, proper segregation, and appropriate packaging of health care waste	2	2	2	2	-	-	2	2	-	-	-	2	3	3
CO3	Ensure the safe transportation of health care waste from generation points to treatment or disposal facilities.	2	2	2	2	-	-	2	2	-	-	-	2	3	3
CO4	Well-versed in various treatment and disposal methods for health care waste, including incineration, autoclaving, chemical treatment, and landfilling.	2	2	2	2	-	-	2	2	-	-	-	2	3	3
CO5	Design, implement, and manage effective health care waste safety programs within health care facilities.	2	2	2	2	-	-	2	2	-	-	-	2	3	3
Average		2	2	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

VALUE ADDED COURSE

20SFV01

Course on First Aid

L	T	P	C
3	0	0	0

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

- CO1 *Take immediate action to save lives and stabilize individuals in critical conditions.*
- CO2 *Recognize and respond to a variety of common injuries and illnesses.*

Apply

Apply

Contents:

- Introduction to First Aid
- Basic Life Support
- Wound Care and Bleeding Control
- Fractures, Sprains, and Strains
- Medical Emergencies
- Environmental Emergencies
- Special Populations and First Aid Kits
- First Aid Kit Assembly and Usage

Total = 15 Hours

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

DEPARTMENT OF SAFETY AND FIRE ENGINEERING

CO PO MAPPING

Regulation: R2020

Course Code: 20SFV01

Course Name: Course on First Aid

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Take immediate action to save lives and stabilize individuals in critical conditions.</i>	-	2	2	2	-	-	2	3	-	-	-	2	3	2
CO2	<i>Recognize and respond to a variety of common injuries and illnesses.</i>	-	2	2	2	-	-	2	3	-	-	-	2	3	2
Average		-	2	2	2	-	-	2	3	-	-	-	2	3	2

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

VALUE ADDED COURSE

20SFV02

Introduction to Personal Protective Equipments

L	T	P	C
3	0	0	0

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

CO1 Understand the specific requirements for head, eye, hearing, hand, respiratory, and other forms of protection.

Understand

CO2 Contribute to a safety culture by ensuring the proper use, maintenance, and regular assessment of personal protective equipment.

Apply

Contents:

- Introduction to Personal Protective Equipment
- Types of Personal Protective Equipment
- Overview of Body Protection
- Understanding Hazard Assessments
- PPE Program Management
- Specialized PPE
- Emergency Response and PPE

Total = 15 Hours**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215****DEPARTMENT OF SAFETY AND FIRE ENGINEERING****CO PO MAPPING****Regulation: R2020****Course Code: 20SFV02****Course Name: Introduction to Personal Protective Equipments**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Understand the specific requirements for head, eye, hearing, hand, respiratory, and other forms of protection.	-	2	2	2	-	-	2	3	-	-	-	2	3	2
CO2	Contribute to a safety culture by ensuring the proper use, maintenance, and regular assessment of personal protective equipment.	-	2	2	2	-	-	2	3	-	-	-	2	3	2
Average		-	2	2	2	-	-	2	3	-	-	-	2	3	2

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

VALUE ADDED COURSE

20SFV03

Hazardous Waste Management

L	T	P	C
3	0	0	0

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

- CO1 *Understand the hazardous waste regulations and legal frameworks.*
- CO2 *Implement best practices in waste minimization, storage, transportation, treatment, and disposal.*

*Understand**Apply***Contents:**

- Introduction to Hazardous Waste
- Hazardous Waste Generation
- Hazardous Waste Storage
- Hazardous Waste Transportation
- Hazardous Waste Treatment Technologies
- Hazardous Waste Disposal
- Recycling and Resource Recovery
- Hazardous Waste Minimization and Pollution Prevention

Total = 15 Hours**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215****DEPARTMENT OF SAFETY AND FIRE ENGINEERING****CO PO MAPPING****Regulation: R2020****Course Code: 20SFV03****Course Name: Hazardous Waste Management**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Understand the hazardous waste regulations and legal frameworks.</i>	3	2	2	3	2	2	-	2	3	-	-	2	3	2
CO2	<i>Implement best practices in waste minimization, storage, transportation, treatment, and disposal.</i>	3	2	2	3	2	2	-	2	3	-	-	2	3	2
Average		3	2	2	3	2	2	-	2	3	-	-	2	3	2

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

VALUE ADDED COURSE

20SFV04

Air Pollution Control Methods and Equipments

L	T	P	C
3	0	0	0

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

CO1 *Assess different types of pollutants, identify suitable control measures, and implement effective strategies to mitigate air pollution.*

Analyze

CO2 *Apply this knowledge in real-world scenarios to improve air quality and comply with environmental regulations.*

Apply

Contents:

- Introduction to Air Pollution
- Regulatory Framework
- Air Quality Monitoring
- Particulate Matter Control
- Gaseous Pollutant Control
- Industrial Emission Control
- NOx Emission Control
- Emerging Technologies

Total = 15 Hours**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215****DEPARTMENT OF SAFETY AND FIRE ENGINEERING****CO PO MAPPING****Regulation: R2020****Course Code: 20SFV04****Course Name: Air Pollution Control Methods and Equipments**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Assess different types of pollutants, identify suitable control measures, and implement effective strategies to mitigate air pollution.</i>	2	3	2	3	-	2	3	2	-	-	-	2	2	3
CO2	<i>Apply this knowledge in real-world scenarios to improve air quality and comply with environmental regulations.</i>	2	3	2	3	-	2	3	2	-	-	-	2	2	3
Average		2	3	2	3	-	2	3	2	-	-	-	2	2	3

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

VALUE ADDED COURSE

20SFV05

Fire Fighting and Training

L	T	P	C
3	0	0	0

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

CO1 *Assess the situation, use firefighting equipment correctly, and implement appropriate strategies to control and extinguish fires.*

Understand

CO2 *Identify potential fire hazards, implement preventive measures*

Apply

Contents:

- Understanding Fire Basics
- Fire Prevention and Safety
- Fire Extinguisher Training
- Fire Detection and Alarm Systems
- Emergency Response and Rescue
- Building Construction and Fire Spread
- Specialized Fire fighting Techniques
- Fire Drill

Total = 15 Hours**K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215****DEPARTMENT OF SAFETY AND FIRE ENGINEERING****CO PO MAPPING****Regulation: R2020****Course Code: 20SFV05****Course Name: Fire Fighting and Training**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Assess the situation, use firefighting equipment correctly, and implement appropriate strategies to control and extinguish fires.</i>	2	3	2	2	3	-	-	-	2	-	-	-	2	2
CO2	<i>Identify potential fire hazards, implement preventive measures</i>	2	3	2	2	3	-	-	-	2	-	-	-	2	2
Average		2	3	2	2	3	-	-	-	2	-	-	-	2	2

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