DEPARTMENT OF MECHANICAL ENGINEERING

B.E. - MECHANICAL ENGINEERING

CURRICULUM & SYLLABI

Regulation 2020

(Applicable to candidates admitted in the academic year 2020 - 2021 onwards)

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

(Approved by AICTE, Accredited by NAAC with A++ grade & Affiliated to Anna University)
K.S.R. Kalvi Nagar, Tiruchengode – 637 215

Namakkal (Dt), Tamilnadu, India

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

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

(Autonomous)

DEPARTMENT OF MECHANICAL ENIGNEERING

(REGULATION 2020)

Vision of the Institution

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

Mission of the Institution

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

Vision of the Department / Programme: (Mechanical Engineering)

DV	To be a centre of excellence in the field of Mechanical Engineering for providing its students and faculty with opportunities for excel in education and targeted research themes in emerging areas.

Mission of the Department / Programme: (Mechanical Engineering)

DM 1	To excel in academic and research activities that meet the industrial and social needs.
DM 2	To develop competent, innovative and ethical mechanical Engineers.

Programme Educational Objectives (PEOs) : (Mechanical Engineering)

The graduates of the programme will be able to

PEO 1	**Successful career:** Identify, design and apply the technical skills to solve mechanical engineering problems for enhancing the quality of life.
PEO 2	**Lifelong Learning:** Apply the modern tools and techniques to face the challenges in mechanical and related engineering areas.
PEO 3	**Service to society:** Understand the responsibility, communicate and implement innovative ideas in multidisciplinary teams ethically for uplifting the society.

PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs)

Programme 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, resource, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environmental and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadcast context of technological change.
Programme Specific Outcomes (PSOs)	
PSO1	**Research Culture:** Read literature, do research on new mechanical engineering problems and publish the results through patents, journals, conferences and symposium.
PSO2	**Industry Exposure:** Enhance professional Experience through industrial/inplant training.

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Department	Department of Mechanical Engineering
Programme	B.E.- Mechanical 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.	20CH051	Engineering Chemistry (Common to All Branches)	BSC	3	0	0	3	30	70	100
5.	20ME144	Engineering Drawing (Common to AU, ME & SF)	ESC	1	2	0	3	30	70	100
MANDATORY COURSE										
6.	20MC151	Induction Programme * (Common to All Branches)	MC	-	-	-	-	-	-	-
PRACTICAL										
7.	20GE028	Manufacturing Practices Laboratory (Common to All Branches)	ESC	0	0	3	1	50	50	100
8.	20CH028	Chemistry Laboratory (Common to All Branches)	BSC	0	0	3	1	50	50	100
			Total	**12**	**3**	**7**	**18**	**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.	20PH241	Materials Physics	BSC	3	0	0	3	30	70	100
4.	20CS241	Python Programming (Common to AU,CE,EE,EC,ME & SF)	ESC	3	0	0	3	30	70	100
5.	20EE041	Basics of Electrical and Electronics Engineering (Common to AU,CE,CS,IT, ME & SF)	ESC	3	0	0	3	30	70	100
MANDATORY COURSE										
6.	20MC052	Environmental Science and Engineering (Common to All Branches)	MC	3	0	0	0	50	50	100
PRACTICAL										
7.	20AU026	Computer Aided Drawing Laboratory (Common to AU & ME)	ESC	0	0	3	1	50	50	100
8.	20CS227	Python Programming Laboratory (Common to AU,CE,EE,EC,ME & SF)	ESC	0	0	3	1	50	50	100
9.	20PH028	Physics Laboratory (Common to All Branches)	BSC	0	0	3	1	50	50	100
			Total	**17**	**1**	**10**	**19**	**900**		

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SEMESTER – III

Sl.No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20MA341	Statistics and Numerical Methods (Common to AU,ME & SF)	BSC	3	1	0	4	30	70	100
2.	20ME312	Engineering Thermodynamics	ESC	3	1	0	4	30	70	100
3.	20ME313	Fluid Mechanics and Machinery	PCC	3	0	0	3	30	70	100
4.	20ME314	Manufacturing Technology-I	PCC	3	0	0	3	30	70	100
5.	20ME315	Basic Mechanics	ESC	3	1	0	4	30	70	100
6.	20ME316	Engineering Metrology and Measurements	PCC	3	0	0	3	30	70	100
PRACTICAL										
7.	20ME321	Metrology and Measurements Laboratory	PCC	0	0	3	1	50	50	100
8.	20ME322	Fluid Mechanics and Machinery Laboratory	PCC	0	0	3	1	50	50	100
9.	20HR351	Career Development Skills-I (Common to All Branches)	PCC	2	0	0	0	50	50	100
			Total	**20**	**3**	**6**	**23**		**900**	

SEMESTER – IV

Sl.No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20MA434	Operations Research	BSC	3	1	0	4	30	70	100
2.	20ME412	Strength of Materials	PCC	3	1	0	4	30	70	100
3.	20ME413	Thermal Engineering	PCC	3	0	0	3	30	70	100
4.	20ME414	Manufacturing Technology-II	PCC	3	0	0	3	30	70	100
5.	20ME415	Engineering Materials and Metallurgy	PCC	3	0	0	3	30	70	100
6.	20ME416	Machine Drawing	PCC	1	3	0	4	30	70	100
PRACTICAL										
7.	20ME421	Thermal Engineering Laboratory	PCC	0	0	3	1	50	50	100
8.	20ME422	Manufacturing Technology Laboratory	PCC	0	0	3	1	50	50	100
9.	20HR472	Career Development Skills-II	PCC	2	0	0	0	50	50	100
			Total	**18**	**5**	**6**	**23**		**900**	

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SEMESTER – V

Sl.No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20HS051	Universal Human Values and Understanding Harmony (Common to All Branches)	HSMC	3	0	0	3	30	70	100
2.	20ME511	Theory of Machines	PCC	3	1	0	4	30	70	100
3.	20ME512	Design of Machine Elements	PCC	3	1	0	4	30	70	100
4.	20ME513	Gas Dynamics and Jet Propulsion	PCC	3	1	0	4	30	70	100
5.	-	Professional Elective – I	PEC	3	0	0	3	30	70	100
6.	-	Professional Elective – II	PEC	3	0	0	3	30	70	100
PRACTICAL										
7.	20ME521	Design Engineering Laboratory	PCC	0	0	3	1	50	50	100
8.	20ME522	CAD / CAM Laboratory	PCC	0	0	3	1	50	50	100
9.	20ME523	Industry Internship and Technical presentation	PROJ	0	0	3	1	50	50	100
10.	20HR573	Career Development Skills-III	PCC	2	0	0	0	50	50	100
			Total	**20**	**3**	**9**	**24**	**1000**		

SEMESTER – VI

Sl.No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20ME611	Design of Transmission Systems	PCC	3	0	0	3	30	70	100
2.	20ME612	Heat and Mass Transfer	PCC	3	1	0	4	30	70	100
3.	20ME613	Maintenance Engineering	PCC	3	0	0	3	30	70	100
4.	-	Professional Elective – III	PEC	3	0	0	3	30	70	100
5.	-	Open Elective – I	OEC	3	0	0	3	30	70	100
PRACTICAL										
6.	20ME621	Mini project	PCC	0	0	3	1	50	50	100
7.	20ME622	Heat and Mass Transfer Laboratory	PCC	0	0	3	1	50	50	100
8.	20HR674	Career Development Skills-IV	PCC	2	0	0	0	50	50	100
			Total	**17**	**1**	**6**	**18**	**800**		

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SEMESTER – VII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20ME711	Finite Element Analysis	PCC	3	0	0	3	30	70	100
2.	20ME712	Mechatronics	PCC	3	0	0	3	30	70	100
3.	-	Professional Elective – IV	PEC	3	0	0	3	30	70	100
4.	-	Professional Elective – V	PEC	3	0	0	3	30	70	100
5.	-	Open Elective - II	OEC	3	0	0	3	30	70	100
PRACTICAL										
6.	20ME721	Mechatronics Laboratory	PCC	0	0	3	1	50	50	100
7.	20ME722	Computer Aided Simulation and Analysis Laboratory	PCC	0	0	3	1	50	50	100
8.	20ME723	Project Phase - I	PROJ	0	0	6	3	50	50	100
			Total	**15**	**0**	**12**	**20**	**800**		

SEMESTER – VIII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1	20HS002	Total Quality Management (Common to All Branches)	HSMC	3	0	0	3	30	70	100
2	-	Professional Elective – VI	PEC	3	0	0	3	30	70	100
3	-	Open Elective – III	OEC	3	0	0	3	30	70	100
PRACTICAL										
4	20ME821	Project Phase - II	PROJ	0	0	12	6	50	50	100
			Total	**9**	**0**	**12**	**15**	**400**		

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List of Electives

PROFESSIONAL ELECTIVE - I (SEMESTER – V)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20HS003	Innovation, Intellectual Property Rights and Entrepreneurship Development (Common to All Branches)	S1	3	0	0	3	30	70	100
2.	20ME562	Design of Jigs, Fixtures and Press tools	S2	3	0	0	3	30	70	100
3.	20ME563	MEMS and NEMS	S2	3	0	0	3	30	70	100
4.	20ME564	Power Plant Engineering	S3	3	0	0	3	30	70	100
5.	20ME565	Computer Aided Manufacturing	S4	3	0	0	3	30	70	100
6.	20ME566	Flexible Manufacturing Systems	S4	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVE – II (SEMESTER – V)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20HS001	Principles of Management (Common to All Branches)	S1	3	0	0	3	30	70	100
2.	20ME662	Product Design and Development	S2	3	0	0	3	30	70	100
3.	20ME663	Thermal Turbo Machines	S3	3	0	0	3	30	70	100
4.	20ME664	Internal Combustion Engines	S3	3	0	0	3	30	70	100
5.	20ME665	Process Planning and Cost Estimation	S4	3	0	0	3	30	70	100
6.	20ME666	Welding Technology	S4	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVE – III (SEMESTER – VI)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20ME097	Industrial Safety Engineering	S5	3	0	0	3	30	70	100
2.	20ME771	Industrial Tribology	S2	3	0	0	3	30	70	100
3.	20ME772	Design of Aircraft structures	S2	3	0	0	3	30	70	100
4.	20ME773	Renewable Sources of Energy	S3	3	0	0	3	30	70	100
5.	20ME774	Fundamentals of Nano Science	S4	3	0	0	3	30	70	100
6.	20ME775	Industry 4.0	S4	3	0	0	3	30	70	100

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PROFESSIONAL ELECTIVE – IV (SEMESTER – VII)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20HS786	Human Resource Management	S1	3	0	0	3	30	70	100
2.	20ME776	Industrial Robotics	S2	3	0	0	3	30	70	100
3.	20ME777	Hydraulic and Pneumatic systems	S2	3	0	0	3	30	70	100
4.	20ME778	Automobile Engineering	S3	3	0	0	3	30	70	100
5.	20ME779	Computational Fluid Dynamics	S3	3	0	0	3	30	70	100
6.	20ME781	Additive Manufacturing	S4	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVE – V (SEMESTER – VII)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20HS886	Business Concepts	S1	3	0	0	3	30	70	100
2.	20ME881	Value and Re-Engineering	S2	3	0	0	3	30	70	100
3.	20ME882	Vibration and Noise Control	S2	3	0	0	3	30	70	100
4.	20ME883	Pressure Vessel and Piping Design	S2	3	0	0	3	30	70	100
5.	20ME884	Refrigeration and Air Conditioning	S3	3	0	0	3	30	70	100
6.	20ME885	Composite Materials	S4	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVE – VI (SEMESTER – VIII)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20HS887	Enterprise Resource Planning	S1	3	0	0	3	30	70	100
2.	20ME886	Optimization in Design	S2	3	0	0	3	30	70	100
3.	20ME887	Experimental stress Analysis	S2	3	0	0	3	30	70	100
4.	20ME888	Nuclear Engineering	S5	3	0	0	3	30	70	100
5.	20ME889	Unconventional Machining Processes	S4	3	0	0	3	30	70	100
6.	20ME891	Non destructive Testing Materials	S4	3	0	0	3	30	70	100

S1-Management studies S2-Design Engineering
S3-Thermal Engineering S4-Manufacturing Engineering S5-Safety Engineering

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Open Elective courses offered by other branches

Sl. No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
AUTOMOBILE ENGINEERING											
1.	20AU901	Basics of Automobile Engineering	AE	OEC	3	0	0	3	30	70	100
2.	20AU902	Automotive Engine Technology	AE	OEC	3	0	0	3	30	70	100
3.	20AU903	Automotive Vehicle Technology	AE	OEC	3	0	0	3	30	70	100
4.	20AU904	Automotive Safety	AE	OEC	3	0	0	3	30	70	100
5.	20AU905	Hybrid Vehicles	AE	OEC	3	0	0	3	30	70	100
6.	20AU906	Off Highway Vehicles	AE	OEC	3	0	0	3	30	70	100
7.	20AU907	Modern and Intelligent Vehicle System	AE	OEC	3	0	0	3	30	70	100
8.	20AU908	Vehicle Maintenance	AE	OEC	3	0	0	3	30	70	100
CIVIL ENGINEERING											
9.	20CE901	Architectural Heritage of India	CE	OEC	3	0	0	3	30	70	100
10.	20CE902	Building Planning and Construction	CE	OEC	3	0	0	3	30	70	100
11.	20CE903	Elementary Civil Engineering	CE	OEC	3	0	0	3	30	70	100
12.	20CE904	Energy and Environment	CE	OEC	3	0	0	3	30	70	100
13.	20CE905	Environmental Laws and Policies	CE	OEC	3	0	0	3	30	70	100
14.	20CE906	Global Warming and Climate Change	CE	OEC	3	0	0	3	30	70	100
15.	20CE907	Introduction to Disaster Management and Mitigation	CE	OEC	3	0	0	3	30	70	100
16.	20CE908	Introduction to Earthquake Engineering	CE	OEC	3	0	0	3	30	70	100
17.	20CE909	Solid Waste Management	CE	OEC	3	0	0	3	30	70	100
18.	20CE910	Water and Air Pollution Management	CE	OEC	3	0	0	3	30	70	100
Computer Science and Engineering											
19.	20CS901	Programming in Java	CSE	OEC	3	0	0	3	30	70	100
20.	20CS902	Basic concepts of Data Structure	CSE	OEC	3	0	0	3	30	70	100
21.	20CS903	Fundamentals of Database Concepts	CSE	OEC	3	0	0	3	30	70	100
22.	20CS904	Internet Programming	CSE	OEC	3	0	0	3	30	70	100

Sl. No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
23.	20CS905	Fundamentals of Mobile Application Development	CSE	OEC	3	0	0	3	30	70	100
24.	20CS906	Principles of Ethical Hacking	CSE	OEC	3	0	0	3	30	70	100
25.	20CS907	Green Technology	CSE	OEC	3	0	0	3	30	70	100
26.	20CS908	Artificial Intelligence and Robotics	CSE	OEC	3	0	0	3	30	70	100
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	C	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
Safety and Fire Engineering											
58.	20SF901	Occupational Health and Hygiene	SF	OEC	3	0	0	3	30	70	100
59.	20SF902	Construction Safety	SF	OEC	3	0	0	3	30	70	100
60.	20SF903	Building Fire Safety	SF	OEC	3	0	0	3	30	70	100
61.	20SF904	Safety in Electrical Engineering	SF	OEC	3	0	0	3	30	70	100
62.	20SF905	Legal Aspects of Safety	SF	OEC	3	0	0	3	30	70	100
63.	20SF906	Safety in Industries	SF	OEC	3	0	0	3	30	70	100
64.	20SF907	Food Safety	SF	OEC	3	0	0	3	30	70	100
65.	20SF908	Safety Management and its Principles	SF	OEC	3	0	0	3	30	70	100
66.	20SF909	Safety in Automobile Engineering	SF	OEC	3	0	0	3	30	70	100
67.	20SF910	Safety in Transportation	SF	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 MECHANICAL ENGINEERING TO OTHER BRANCHES

Sl. No.	Course Code	Course Name	Specialization	Category	Hours / Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20ME901	Basic Mechanical Engineering	MECH	OEC	3	0	0	3	30	70	100
2.	20ME902	Solar Energy Utilization	MECH	OEC	3	0	0	3	30	70	100
3.	20ME903	Production Technology of Agricultural Machinery	MECH	OEC	3	0	0	3	30	70	100
4.	20ME904	Selection of Materials	MECH	OEC	3	0	0	3	30	70	100
5.	20ME905	Marine Vehicles	MECH	OEC	3	0	0	3	30	70	100
6.	20ME906	Sensors and Transducers	MECH	OEC	3	0	0	3	30	70	100
7.	20ME907	Energy Auditing	MECH	OEC	3	0	0	3	30	70	100
8.	20ME908	Fibre Reinforced Plastics	MECH	OEC	3	0	0	3	30	70	100
9.	20ME909	Lean Manufacturing	MECH	OEC	3	0	0	3	30	70	100
10.	20ME910	Surface Engineering	MECH	OEC	3	0	0	3	30	70	100

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VALUE ADDED COURSES

Sl. No	Course code	Course Name	Number of Hours	Offered by Internal/ External*
1.	20MEV01	Reverse Engineering	15	MECH / KSRCE
2.	20MEV02	Introduction to Oil and Gas Engineering	15	MECH / KSRCE
3.	20MEV03	Green Manufacturing: Conceptual Design and Its Practices	15	MECH / KSRCE
4.	20MEV04	Logistics and Supply Chain Networks	15	MECH / KSRCE
5.	20MEV05	Industrial Safety Engineering	15	MECH / KSRCE
6.	20MEV06	Nano Technology: Mechanical Engineering's New Frontier	15	MECH / KSRCE
7.	20MEV07	Rapid Prototyping	15	MECH / KSRCE
8.	20MEV08	Non-Destructive Evaluation of Materials	15	MECH / KSRCE
9.	20MEV09	Tissue Engineering	15	External
10.	20MEV10	Biofuel Technology	15	External
11.	20MEV11	Food Safety and Quality Auditing	15	External
12.	20MEV12	Food Packaging Technology	15	External
13.	20MEV13	Man Made Fibre Technology	15	External
14.	20MEV14	Export Policies and Documentation	15	External
15.	20MEV15	Startups & Entrepreneurship	15	External

CREDITS

SL. No.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1	HSMC	3	3			3			3	12
2	BSC	11	8	4	4					27
3	ESC	4	8	8						20
4	PCC			11	19	14	12	8		64
5	PEC					6	3	6	3	18
6	OEC						3	3	3	09
7	PROJ					1		3	6	10
8	MC	0	0							0
	TOTAL	**18**	**19**	**23**	**23**	**24**	**18**	**20**	**15**	**160**

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

DEPARTMENT OF MECHANICAL ENGINEERING

B.E. - MECHANICAL ENGINEERING

CURRICULUM & SYLLABI

Regulation 2020

(Applicable to candidates admitted in the academic year 2021 - 2022 onwards)

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

(Approved by AICTE, Accredited by NAAC with A++ grade & Affiliated to Anna University)
K.S.R. Kalvi Nagar, Tiruchengode – 637 215

Namakkal (Dt), Tamilnadu, India

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

K.S.R. COLLEGE OF ENGINEERING: TIRUCHENGODE - 637 215
(Autonomous)
DEPARTMENT OF MECHANICAL ENIGNEERING
(REGULATION 2020)

Vision of the Institution

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

Mission of the Institution

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

Vision of the Department / Programme: (Mechanical Engineering)

DV	To be a centre of excellence in the field of Mechanical Engineering for providing its students and faculty with opportunities for excel in education and targeted research themes in emerging areas.

Mission of the Department / Programme: (Mechanical Engineering)

DM 1	To excel in academic and research activities that meet the industrial and social needs.
DM 2	To develop competent, innovative and ethical mechanical Engineers.

Programme Educational Objectives (PEOs) : (Mechanical Engineering)

The graduates of the programme will be able to

PEO 1	**Successful career:** Identify, design and apply the technical skills to solve mechanical engineering problems for enhancing the quality of life.
PEO 2	**Lifelong Learning:** Apply the modern tools and techniques to face the challenges in mechanical and related engineering areas.
PEO 3	**Service to society:** Understand the responsibility, communicate and implement innovative ideas in multidisciplinary teams ethically for uplifting the society.

PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs)

Programme 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, resource, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environmental and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadcast context of technological change.
Programme Specific Outcomes (PSOs)	
PSO1	**Research Culture:** Read literature, do research on new mechanical engineering problems and publish the results through patents, journals, conferences and symposium.
PSO2	**Industry Exposure:** Enhance professional Experience through industrial/inplant training.

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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.	20CH051	Engineering Chemistry (Common to All Branches)	BSC	3	0	0	3	40	60	100
5.	20ME144	Engineering Drawing (Common to AU, ME & SF)	ESC	1	2	0	3	40	60	100
MANDATORY COURSE										
6.	20MC151	Induction Programme * (Common to All Branches)	MC	-	-	-	-	-	-	-
PRACTICAL										
7.	20GE028	Manufacturing Practices Laboratory (Common to All Branches)	ESC	0	0	3	1	60	40	100
8.	20CH028	Chemistry Laboratory (Common to All Branches)	BSC	0	0	3	1	60	40	100
			Total	**12**	**3**	**7**	**18**	**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.	20PH241	Materials Physics	BSC	3	0	0	3	40	60	100
4.	20CS241	Python Programming (Common to AU,CE,EE,EC,ME & SF)	ESC	3	0	0	3	40	60	100
5.	20EE041	Basics of Electrical and Electronics Engineering (Common to AU,CE,CS,IT, ME & SF)	ESC	3	0	0	3	40	60	100
MANDATORY COURSE										
6.	20MC052	Environmental Science and Engineering (Common to All Branches)	MC	3	0	0	0	40	60	100
PRACTICAL										
7.	20AU026	Computer Aided Drawing Laboratory (Common to AU & ME)	ESC	0	0	3	1	60	40	100
8.	20CS227	Python Programming Laboratory (Common to AU,CE,EE,EC,ME & SF)	ESC	0	0	3	1	60	40	100
9.	20PH028	Physics Laboratory (Common to All Branches)	BSC	0	0	3	1	60	40	100
			Total	**17**	**1**	**10**	**19**	**900**		

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SEMESTER – III

Sl.No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20MA341	Statistics and Numerical Methods (Common to AU,ME & SF)	BSC	3	1	0	4	40	60	100
2.	20ME312	Engineering Thermodynamics	ESC	3	1	0	4	40	60	100
3.	20ME313	Fluid Mechanics and Machinery	PCC	3	0	0	3	40	60	100
4.	20ME314	Manufacturing Technology-I	PCC	3	0	0	3	40	60	100
5.	20ME315	Basic Mechanics	ESC	3	1	0	4	40	60	100
6.	20ME316	Engineering Metrology and Measurements	PCC	3	0	0	3	40	60	100
PRACTICAL										
7.	20ME321	Metrology and Measurements Laboratory	PCC	0	0	3	1	60	40	100
8.	20ME322	Fluid Mechanics and Machinery Laboratory	PCC	0	0	3	1	60	40	100
9.	20HR351	Career Development Skills-I (Common to All Branches)	PCC	2	0	0	0	60	40	100
			Total	**20**	**3**	**6**	**23**		**900**	

SEMESTER – IV

Sl.No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20MA434	Operations Research	BSC	3	1	0	4	40	60	100
2.	20ME412	Strength of Materials	PCC	3	1	0	4	40	60	100
3.	20ME413	Thermal Engineering	PCC	3	0	0	3	40	60	100
4.	20ME414	Manufacturing Technology-II	PCC	3	0	0	3	40	60	100
5.	20ME415	Engineering Materials and Metallurgy	PCC	3	0	0	3	40	60	100
6.	20ME416	Machine Drawing	PCC	1	3	0	4	40	60	100
PRACTICAL										
7.	20ME421	Thermal Engineering Laboratory	PCC	0	0	3	1	60	40	100
8.	20ME422	Manufacturing Technology Laboratory	PCC	0	0	3	1	60	40	100
9.	20HR472	Career Development Skills-II	PCC	2	0	0	0	60	40	100
			Total	**18**	**5**	**6**	**23**		**900**	

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SEMESTER – V

Sl.No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20HS051	Universal Human Values and Understanding Harmony (Common to All Branches)	HSMC	3	0	0	3	40	60	100
2.	20ME511	Theory of Machines	PCC	3	1	0	4	40	60	100
3.	20ME512	Design of Machine Elements	PCC	3	1	0	4	40	60	100
4.	20ME513	Gas Dynamics and Jet Propulsion	PCC	3	1	0	4	40	60	100
5.	-	Professional Elective – I	PEC	3	0	0	3	40	60	100
6.	-	Professional Elective – II	PEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20ME521	Design Engineering Laboratory	PCC	0	0	3	1	60	40	100
8.	20ME522	CAD / CAM Laboratory	PCC	0	0	3	1	60	40	100
9.	20ME523	Industry Internship and Technical presentation	PROJ	0	0	3	1	60	40	100
10.	20HR573	Career Development Skills-III	PCC	2	0	0	0	60	40	100
			Total	**20**	**3**	**9**	**24**	**1000**		

SEMESTER – VI

Sl.No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20ME611	Design of Transmission Systems	PCC	3	0	0	3	40	60	100
2.	20ME612	Heat and Mass Transfer	PCC	3	1	0	4	40	60	100
3.	20ME613	Maintenance Engineering	PCC	3	0	0	3	40	60	100
4.	-	Professional Elective – III	PEC	3	0	0	3	40	60	100
5.	-	Open Elective – I	OEC	3	0	0	3	40	60	100
PRACTICAL										
6.	20ME621	Mini project	PCC	0	0	3	1	60	40	100
7.	20ME622	Heat and Mass Transfer Laboratory	PCC	0	0	3	1	60	40	100
8.	20HR674	Career Development Skills-IV	PCC	2	0	0	0	60	40	100
			Total	**17**	**1**	**6**	**18**	**800**		

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SEMESTER – VII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20ME711	Finite Element Analysis	PCC	3	0	0	3	40	60	100
2.	20ME712	Mechatronics	PCC	3	0	0	3	40	60	100
3.	-	Professional Elective – IV	PEC	3	0	0	3	40	60	100
4.	-	Professional Elective – V	PEC	3	0	0	3	40	60	100
5.	-	Open Elective - II	OEC	3	0	0	3	40	60	100
PRACTICAL										
6.	20ME721	Mechatronics Laboratory	PCC	0	0	3	1	60	40	100
7.	20ME722	Computer Aided Simulation and Analysis Laboratory	PCC	0	0	3	1	60	40	100
8.	20ME723	Project Phase - I	PROJ	0	0	6	3	60	40	100
			Total	**15**	**0**	**12**	**20**	**800**		

SEMESTER – VIII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1	20HS002	Total Quality Management (Common to All Branches)	HSMC	3	0	0	3	40	60	100
2	-	Professional Elective – VI	PEC	3	0	0	3	40	60	100
3	-	Open Elective – III	OEC	3	0	0	3	40	60	100
PRACTICAL										
4	20ME821	Project Phase - II	PROJ	0	0	12	6	60	40	100
			Total	**9**	**0**	**12**	**15**	**400**		

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List of Electives

PROFESSIONAL ELECTIVE - I (SEMESTER – V)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20HS003	Innovation, Intellectual Property Rights and Entrepreneurship Development (Common to All Branches)	S1	3	0	0	3	40	60	100
2.	20ME562	Design of Jigs, Fixtures and Press tools	S2	3	0	0	3	40	60	100
3.	20ME563	MEMS and NEMS	S2	3	0	0	3	40	60	100
4.	20ME564	Power Plant Engineering	S3	3	0	0	3	40	60	100
5.	20ME565	Computer Aided Manufacturing	S4	3	0	0	3	40	60	100
6.	20ME566	Flexible Manufacturing Systems	S4	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – II (SEMESTER – V)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20HS001	Principles of Management (Common to All Branches)	S1	3	0	0	3	40	60	100
2.	20ME662	Product Design and Development	S2	3	0	0	3	40	60	100
3.	20ME663	Thermal Turbo Machines	S3	3	0	0	3	40	60	100
4.	20ME664	Internal Combustion Engines	S3	3	0	0	3	40	60	100
5.	20ME665	Process Planning and Cost Estimation	S4	3	0	0	3	40	60	100
6.	20ME666	Welding Technology	S4	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – III (SEMESTER – VI)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20ME097	Industrial Safety Engineering	S5	3	0	0	3	40	60	100
2.	20ME771	Industrial Tribology	S2	3	0	0	3	40	60	100
3.	20ME772	Design of Aircraft structures	S2	3	0	0	3	40	60	100
4.	20ME773	Renewable Sources of Energy	S3	3	0	0	3	40	60	100
5.	20ME774	Fundamentals of Nano Science	S4	3	0	0	3	40	60	100
6.	20ME775	Industry 4.0	S4	3	0	0	3	40	60	100

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List of Electives

PROFESSIONAL ELECTIVE – IV (SEMESTER – VII)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20HS786	Human Resource Management	S1	3	0	0	3	40	60	100
2.	20ME776	Industrial Robotics	S2	3	0	0	3	40	60	100
3.	20ME777	Hydraulic and Pneumatic systems	S2	3	0	0	3	40	60	100
4.	20ME778	Automobile Engineering	S3	3	0	0	3	40	60	100
5.	20ME779	Computational Fluid Dynamics	S3	3	0	0	3	40	60	100
6.	20ME781	Additive Manufacturing	S4	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – V (SEMESTER – VII)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20HS886	Business Concepts	S1	3	0	0	3	40	60	100
2.	20ME881	Value and Re-Engineering	S2	3	0	0	3	40	60	100
3.	20ME882	Vibration and Noise Control	S2	3	0	0	3	40	60	100
4.	20ME883	Pressure Vessel and Piping Design	S2	3	0	0	3	40	60	100
5.	20ME884	Refrigeration and Air Conditioning	S3	3	0	0	3	40	60	100
6.	20ME885	Composite Materials	S4	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – VI (SEMESTER – VIII)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20HS887	Enterprise Resource Planning	S1	3	0	0	3	40	60	100
2.	20ME886	Optimization in Design	S2	3	0	0	3	40	60	100
3.	20ME887	Experimental stress Analysis	S2	3	0	0	3	40	60	100
4.	20ME888	Nuclear Engineering	S5	3	0	0	3	40	60	100
5.	20ME889	Unconventional Machining Processes	S4	3	0	0	3	40	60	100
6.	20ME891	Non destructive Testing Materials	S4	3	0	0	3	40	60	100

S1-Management studies S2-Design Engineering
S3-Thermal Engineering S4-Manufacturing Engineering S5-Safety Engineering

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Department	Department of Mechanical Engineering
Programme	B.E.- Mechanical Engineering

List of Electives

Open Elective courses offered by other branches

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

Sl. No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
23.	20CS905	Fundamentals of Mobile Application Development	CSE	OEC	3	0	0	3	40	60	100
24.	20CS906	Principles of Ethical Hacking	CSE	OEC	3	0	0	3	40	60	100
25.	20CS907	Green Technology	CSE	OEC	3	0	0	3	40	60	100
26.	20CS908	Artificial Intelligence and Robotics	CSE	OEC	3	0	0	3	40	60	100
27.	20CS909	Big Data and Analytics	CSE	OEC	3	0	0	0	40	60	100
28.	20CS910	Hardware and Trouble Shooting	CSE	OEC	3	0	0	3	40	60	100
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	Total
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
Safety and Fire Engineering											
58.	20SF901	Occupational Health and Hygiene	SF	OEC	3	0	0	3	40	60	100
59.	20SF902	Construction Safety	SF	OEC	3	0	0	3	40	60	100
60.	20SF903	Building Fire Safety	SF	OEC	3	0	0	3	40	60	100
61.	20SF904	Safety in Electrical Engineering	SF	OEC	3	0	0	3	40	60	100
62.	20SF905	Legal Aspects of Safety	SF	OEC	3	0	0	3	40	60	100
63.	20SF906	Safety in Industries	SF	OEC	3	0	0	3	40	60	100
64.	20SF907	Food Safety	SF	OEC	3	0	0	3	40	60	100
65.	20SF908	Safety Management and its Principles	SF	OEC	3	0	0	3	40	60	100
66.	20SF909	Safety in Automobile Engineering	SF	OEC	3	0	0	3	40	60	100
67.	20SF910	Safety in Transportation	SF	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

OPEN ELECTIVE COURSES OFFERED BY MECHANICAL ENGINEERING TO OTHER BRANCHES

Sl. No.	Course Code	Course Name	Specialization	Category	Hours / Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20ME901	Basic Mechanical Engineering	MECH	OEC	3	0	0	3	40	60	100
2.	20ME902	Solar Energy Utilization	MECH	OEC	3	0	0	3	40	60	100
3.	20ME903	Production Technology of Agricultural Machinery	MECH	OEC	3	0	0	3	40	60	100
4.	20ME904	Selection of Materials	MECH	OEC	3	0	0	3	40	60	100
5.	20ME905	Marine Vehicles	MECH	OEC	3	0	0	3	40	60	100
6.	20ME906	Sensors and Transducers	MECH	OEC	3	0	0	3	40	60	100
7.	20ME907	Energy Auditing	MECH	OEC	3	0	0	3	40	60	100
8.	20ME908	Fibre Reinforced Plastics	MECH	OEC	3	0	0	3	40	60	100
9.	20ME909	Lean Manufacturing	MECH	OEC	3	0	0	3	40	60	100
10.	20ME910	Surface Engineering	MECH	OEC	3	0	0	3	40	60	100

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Department	Department of Mechanical Engineering
Programme	B.E.- Mechanical Engineering

List of Emerging Area for Honours

B.E./B.TECH. Honours (specialization in the same discipline) :Verticals
Emerging Areas: Mechanical 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 :SAFETY ENGINEERING		VERTICAL-II:ADVANCED MANUFACTURING	
20ME892	Principles of Safety Management	20ME898	Advances In Manufacturing Processes
20ME893	Environmental Safety	20ME899	Advanced Materials Engineering
20ME894	Electrical Safety	20ME911	Materials Testing and Characterization Techniques
20ME895	Safety in Textile Industry	20ME912	Advanced Metrology and Non Destructive Testing
20ME896	Safety in Chemical Industries	20ME913	Optimization Techniques In Manufacturing
20ME897	Safety in Engineering Industry	20ME914	Smart Manufacturing
20ME097	Industrial Safety Engineering	20ME781	Additive Manufacturing
20ME888	Nuclear Engineering	20ME775	Industry 4.0

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Department	Department of Mechanical Engineering
Programme	B.E.- Mechanical Engineering

List of Emerging Area for Honours

VERTICAL - I

SAFETY ENGINEERING

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20ME892	Principles of Safety Management	S5	3	0	0	3	40	60	100
2.	20ME893	Environmental Safety	S5	3	0	0	3	40	60	100
3.	20ME894	Electrical Safety	S5	3	0	0	3	40	60	100
4.	20ME895	Safety in Textile Industry	S5	3	0	0	3	40	60	100
5.	20ME896	Safety in Chemical Industries	S5	3	0	0	3	40	60	100
6.	20ME897	Safety in Engineering Industry	S5	3	0	0	3	40	60	100
7.	20ME097	Industrial Safety Engineering	S5	3	0	0	3	40	60	100
8.	20ME888	Nuclear Engineering	S5	3	0	0	3	40	60	100

VERTICAL- II

ADVANCED MANUFACTURING

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20ME898	Advances In Manufacturing Processes	S4	3	0	0	3	40	60	100
2.	20ME899	Advanced Materials Engineering	S4	3	0	0	3	40	60	100
3.	20ME911	Materials Testing and Characterization Techniques	S4	3	0	0	3	40	60	100
4.	20ME912	Advanced Metrology and Non Destructive Testing	S4	3	0	0	3	40	60	100
5.	20ME913	Optimization Techniques In Manufacturing	S4	3	0	0	3	40	60	100
6.	20ME914	Smart Manufacturing	S4	3	0	0	3	40	60	100
7.	20ME781	Additive Manufacturing	S4	3	0	0	3	40	60	100
8.	20ME775	Industry 4.0	S4	3	0	0	3	40	60	100

S1-Management studies S2-Design Engineering
S3-Thermal Engineering S4-Manufacturing Engineering S5-Safety Engineering

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Department	Department of Mechanical Engineering
Programme	B.E.- Mechanical Engineering

VALUE ADDED COURSES

Sl. No	Course code	Course Name	Number of Hours	Offered by Internal/ External*
1.	20MEV01	Reverse Engineering	15	MECH / KSRCE
2.	20MEV02	Introduction to Oil and Gas Engineering	15	MECH / KSRCE
3.	20MEV03	Green Manufacturing: Conceptual Design and Its Practices	15	MECH / KSRCE
4.	20MEV04	Logistics and Supply Chain Networks	15	MECH / KSRCE
5.	20MEV05	Industrial Safety Engineering	15	MECH / KSRCE
6.	20MEV06	Nano Technology: Mechanical Engineering's New Frontier	15	MECH / KSRCE
7.	20MEV07	Rapid Prototyping	15	MECH / KSRCE
8.	20MEV08	Non-Destructive Evaluation of Materials	15	MECH / KSRCE
9.	20MEV09	Tissue Engineering	15	External
10.	20MEV10	Biofuel Technology	15	External
11.	20MEV11	Food Safety and Quality Auditing	15	External
12.	20MEV12	Food Packaging Technology	15	External
13.	20MEV13	Man Made Fibre Technology	15	External
14.	20MEV14	Export Policies and Documentation	15	External
15.	20MEV15	Startups & Entrepreneurship	15	External

CREDITS

SL. No.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1	HSMC	3	3			3			3	12
2	BSC	11	8	4	4					27
3	ESC	4	8	8						20
4	PCC			11	19	14	12	8		64
5	PEC					6	3	6	3	18
6	OEC						3	3	3	09
7	PROJ					1		3	6	10
8	MC	0	0							0
	TOTAL	**18**	**19**	**23**	**23**	**24**	**18**	**20**	**15**	**160**

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

DEPARTMENT OF MECHANICAL ENGINEERING

B.E. - MECHANICAL ENGINEERING

CURRICULUM & SYLLABI

Regulation 2020

(Applicable to candidates admitted in the academic year 2022 - 2023 onwards)

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

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K.S.R. COLLEGE OF ENGINEERING: TIRUCHENGODE - 637 215
(Autonomous)
DEPARTMENT OF MECHANICAL ENIGNEERING
(REGULATION 2020)

Vision of the Institution

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

Mission of the Institution

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

Vision of the Department / Programme: (Mechanical Engineering)

DV	To be a centre of excellence in the field of Mechanical Engineering for providing its students and faculty with opportunities for excel in education and targeted research themes in emerging areas.

Mission of the Department / Programme: (Mechanical Engineering)

DM 1	To excel in academic and research activities that meet the industrial and social needs.
DM 2	To develop competent, innovative and ethical mechanical Engineers.

Programme Educational Objectives (PEOs) : (Mechanical Engineering)

The graduates of the programme will be able to

PEO 1	**Successful career:** Identify, design and apply the technical skills to solve mechanical engineering problems for enhancing the quality of life.
PEO 2	**Lifelong Learning:** Apply the modern tools and techniques to face the challenges in mechanical and related engineering areas.
PEO 3	**Service to society:** Understand the responsibility, communicate and implement innovative ideas in multidisciplinary teams ethically for uplifting the society.

PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs)

Programme 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, resource, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environmental and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadcast context of technological change.
Programme Specific Outcomes (PSOs)	
PSO1	**Research Culture:** Read literature, do research on new mechanical engineering problems and publish the results through patents, journals, conferences and symposium.
PSO2	**Industry Exposure:** Enhance professional Experience through industrial/inplant training.

K.S.R. COLLEGE OF ENGINEERING,TIRUCHENGODE

B.E-(MECHANICAL ENGINEERING)

(REGULATION- 2020) (Amendment)

As per the letter received from Centre for academic courses, Anna University, dated 01.03.2023, two tamil language courses **"தமிழர் மரபு - HERITAGE OF TAMILS" & "தமிழரும் தொழில் நுட்பமும்- TAMILS AND TECHNOLOGY"** are introduced in second and third semester of regulation 2020 and offered to the students admitted 2022–2023 (Batch: 2022 – 2026) during the academic year 2022-2023 even semester (II Semester) and 2023-2024 odd semester (III Semester) respectively.

The same courses are introduced for students admitted in 2023-2024 (Batch: 2023–2027) during the academic year 2023-2024 odd semester (I Semester) and 2023-2024 even semester (II Semester) respectively.

Course Code & Course Title	Core/Elective/ Mandatory Course	Semester	Credits	Applicable to candidates admitted in the academic year
Heritage of Tamils & தமிழர் மரபு	**Mandatory Course**	**II**	**1**	**2022 – 2023**
Tamils and Technology & தமிழரும் தொழில் நுட்பமும்		**III**	**1**	
Heritage of Tamils & தமிழர் மரபு /		**I**	**1**	**2023- 2024**
Tamils and Technology & தமிழரும் தொழில் நுட்பமும்		**II**	**1**	

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Department	Department of Mechanical Engineering
Programme	B.E.- Mechanical 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.	20CH051	Engineering Chemistry (Common to All Branches)	BSC	3	0	0	3	40	60	100
5.	20ME144	Engineering Drawing (Common to AU, ME & SF)	ESC	1	2	0	3	40	60	100
MANDATORY COURSE										
6.	20MC151	Induction Programme * (Common to All Branches)	MC	-	-	-	-	-	-	-
PRACTICAL										
7.	20GE028	Manufacturing Practices Laboratory (Common to All Branches)	ESC	0	0	3	1	60	40	100
8.	20CH028	Chemistry Laboratory (Common to All Branches)	BSC	0	0	3	1	60	40	100
			Total	**12**	**3**	**7**	**18**	**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.	20PH241	Materials Physics	BSC	3	0	0	3	40	60	100
4.	20CS241	Python Programming (Common to AU,CE,EE,EC,ME & SF)	ESC	3	0	0	3	40	60	100
5.	20EE041	Basics of Electrical and Electronics Engineering (Common to AU,CE,CS,IT, ME & SF)	ESC	3	0	0	3	40	60	100
MANDATORY COURSE										
6.	20MC052	Environmental Science and Engineering (Common to All Branches)	MC	3	0	0	0	40	60	100
7.	20GE051	Heritage of Tamils/ தமிழர் மரபு (Common to All Branches)	MC	1	0	0	1	40	60	100
PRACTICAL										
8.	20AU026	Computer Aided Drawing Laboratory (Common to AU & ME)	ESC	0	0	3	1	60	40	100
9.	20CS227	Python Programming Laboratory (Common to AU,CE,EE,EC,ME & SF)	ESC	0	0	3	1	60	40	100
10.	20PH028	Physics Laboratory (Common to All Branches)	BSC	0	0	3	1	60	40	100
			Total	**18**	**1**	**10**	**20**	**1000**		

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Programme	B.E.- Mechanical Engineering

SEMESTER – III

Sl.No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20MA341	Statistics and Numerical Methods (Common to AU,ME & SF)	BSC	3	1	0	4	40	60	100
2.	20ME312	Engineering Thermodynamics	ESC	3	1	0	4	40	60	100
3.	20ME313	Fluid Mechanics and Machinery	PCC	3	0	0	3	40	60	100
4.	20ME314	Manufacturing Technology-I	PCC	3	0	0	3	40	60	100
5.	20ME315	Basic Mechanics	ESC	3	1	0	4	40	60	100
6.	20ME316	Engineering Metrology and Measurements	PCC	3	0	0	3	40	60	100
MANDATORY COURSE										
7.	20GE052	Tamils and Technology / தமிழரும் தொழில் நுட்பமும் (Common to All Branches)	MC	1	0	0	1	40	60	100
PRACTICAL										
8.	20ME321	Metrology and Measurements Laboratory	PCC	0	0	3	1	60	40	100
9.	20ME322	Fluid Mechanics and Machinery Laboratory	PCC	0	0	3	1	60	40	100
10.	20HR351	Career Development Skills-I (Common to All Branches)	PCC	2	0	0	0	60	40	100
			Total	**21**	**3**	**6**	**24**	**1000**		

SEMESTER – IV

Sl.No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20MA434	Operations Research	BSC	3	1	0	4	40	60	100
2.	20ME412	Strength of Materials	PCC	3	1	0	4	40	60	100
3.	20ME413	Thermal Engineering	PCC	3	0	0	3	40	60	100
4.	20ME414	Manufacturing Technology-II	PCC	3	0	0	3	40	60	100
5.	20ME415	Engineering Materials and Metallurgy	PCC	3	0	0	3	40	60	100
6.	20ME416	Machine Drawing	PCC	1	3	0	4	40	60	100
PRACTICAL										
7.	20ME421	Thermal Engineering Laboratory	PCC	0	0	3	1	60	40	100
8.	20ME422	Manufacturing Technology Laboratory	PCC	0	0	3	1	60	40	100
9.	20HR472	Career Development Skills-II	PCC	2	0	0	0	60	40	100
			Total	**18**	**5**	**6**	**23**	**900**		

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SEMESTER – V

Sl.No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20HS051	Universal Human Values and Understanding Harmony (Common to All Branches)	HSMC	3	0	0	3	40	60	100
2.	20ME511	Theory of Machines	PCC	3	1	0	4	40	60	100
3.	20ME512	Design of Machine Elements	PCC	3	1	0	4	40	60	100
4.	20ME513	Gas Dynamics and Jet Propulsion	PCC	3	1	0	4	40	60	100
5.	-	Professional Elective – I	PEC	3	0	0	3	40	60	100
6.	-	Professional Elective – II	PEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20ME521	Design Engineering Laboratory	PCC	0	0	3	1	60	40	100
8.	20ME522	CAD / CAM Laboratory	PCC	0	0	3	1	60	40	100
9.	20ME523	Industry Internship and Technical presentation	PROJ	0	0	3	1	60	40	100
10.	20HR573	Career Development Skills-III	PCC	2	0	0	0	60	40	100
			Total	**20**	**3**	**9**	**24**	**1000**		

SEMESTER – VI

Sl.No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20ME611	Design of Transmission Systems	PCC	3	0	0	3	40	60	100
2.	20ME612	Heat and Mass Transfer	PCC	3	1	0	4	40	60	100
3.	20ME613	Maintenance Engineering	PCC	3	0	0	3	40	60	100
4.	-	Professional Elective – III	PEC	3	0	0	3	40	60	100
5.	-	Open Elective – I	OEC	3	0	0	3	40	60	100
PRACTICAL										
6.	20ME621	Mini project	PCC	0	0	3	1	60	40	100
7.	20ME622	Heat and Mass Transfer Laboratory	PCC	0	0	3	1	60	40	100
8.	20HR674	Career Development Skills-IV	PCC	2	0	0	0	60	40	100
			Total	**17**	**1**	**6**	**18**	**800**		

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SEMESTER – VII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20ME711	Finite Element Analysis	PCC	3	0	0	3	40	60	100
2.	20ME712	Mechatronics	PCC	3	0	0	3	40	60	100
3.	-	Professional Elective – IV	PEC	3	0	0	3	40	60	100
4.	-	Professional Elective – V	PEC	3	0	0	3	40	60	100
5.	-	Open Elective - II	OEC	3	0	0	3	40	60	100
PRACTICAL										
6.	20ME721	Mechatronics Laboratory	PCC	0	0	3	1	60	40	100
7.	20ME722	Computer Aided Simulation and Analysis Laboratory	PCC	0	0	3	1	60	40	100
8.	20ME723	Project Phase - I	PROJ	0	0	6	3	60	40	100
			Total	**15**	**0**	**12**	**20**	**800**		

SEMESTER – VIII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1	20HS002	Total Quality Management (Common to All Branches)	HSMC	3	0	0	3	40	60	100
2	-	Professional Elective – VI	PEC	3	0	0	3	40	60	100
3	-	Open Elective – III	OEC	3	0	0	3	40	60	100
PRACTICAL										
4	20ME821	Project Phase - II	PROJ	0	0	12	6	60	40	100
			Total	**9**	**0**	**12**	**15**	**400**		

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List of Electives

PROFESSIONAL ELECTIVE - I (SEMESTER – V)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20HS003	Innovation, Intellectual Property Rights and Entrepreneurship Development (Common to All Branches)	S1	3	0	0	3	40	60	100
2.	20ME562	Design of Jigs, Fixtures and Press tools	S2	3	0	0	3	40	60	100
3.	20ME563	MEMS and NEMS	S2	3	0	0	3	40	60	100
4.	20ME564	Power Plant Engineering	S3	3	0	0	3	40	60	100
5.	20ME565	Computer Aided Manufacturing	S4	3	0	0	3	40	60	100
6.	20ME566	Flexible Manufacturing Systems	S4	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – II (SEMESTER – V)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20HS001	Principles of Management (Common to All Branches)	S1	3	0	0	3	40	60	100
2.	20ME662	Product Design and Development	S2	3	0	0	3	40	60	100
3.	20ME663	Thermal Turbo Machines	S3	3	0	0	3	40	60	100
4.	20ME664	Internal Combustion Engines	S3	3	0	0	3	40	60	100
5.	20ME665	Process Planning and Cost Estimation	S4	3	0	0	3	40	60	100
6.	20ME666	Welding Technology	S4	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – III (SEMESTER – VI)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20ME097	Industrial Safety Engineering	S5	3	0	0	3	40	60	100
2.	20ME771	Industrial Tribology	S2	3	0	0	3	40	60	100
3.	20ME772	Design of Aircraft structures	S2	3	0	0	3	40	60	100
4.	20ME773	Renewable Sources of Energy	S3	3	0	0	3	40	60	100
5.	20ME774	Fundamentals of Nano Science	S4	3	0	0	3	40	60	100
6.	20ME775	Industry 4.0	S4	3	0	0	3	40	60	100

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List of Electives

PROFESSIONAL ELECTIVE – IV (SEMESTER – VII)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20HS786	Human Resource Management	S1	3	0	0	3	40	60	100
2.	20ME776	Industrial Robotics	S2	3	0	0	3	40	60	100
3.	20ME777	Hydraulic and Pneumatic systems	S2	3	0	0	3	40	60	100
4.	20ME778	Automobile Engineering	S3	3	0	0	3	40	60	100
5.	20ME779	Computational Fluid Dynamics	S3	3	0	0	3	40	60	100
6.	20ME781	Additive Manufacturing	S4	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – V (SEMESTER – VII)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20HS886	Business Concepts	S1	3	0	0	3	40	60	100
2.	20ME881	Value and Re-Engineering	S2	3	0	0	3	40	60	100
3.	20ME882	Vibration and Noise Control	S2	3	0	0	3	40	60	100
4.	20ME883	Pressure Vessel and Piping Design	S2	3	0	0	3	40	60	100
5.	20ME884	Refrigeration and Air Conditioning	S3	3	0	0	3	40	60	100
6.	20ME885	Composite Materials	S4	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – VI (SEMESTER – VIII)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20HS887	Enterprise Resource Planning	S1	3	0	0	3	40	60	100
2.	20ME886	Optimization in Design	S2	3	0	0	3	40	60	100
3.	20ME887	Experimental stress Analysis	S2	3	0	0	3	40	60	100
4.	20ME888	Nuclear Engineering	S5	3	0	0	3	40	60	100
5.	20ME889	Unconventional Machining Processes	S4	3	0	0	3	40	60	100
6.	20ME891	Non destructive Testing Materials	S4	3	0	0	3	40	60	100

S1-Management studies S2-Design Engineering
S3-Thermal Engineering S4-Manufacturing Engineering S5-Safety Engineering

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List of Electives

Open Elective courses offered by other branches

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

Sl. No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
24.	20CS906	Principles of Ethical Hacking	CSE	OEC	3	0	0	3	40	60	100
25.	20CS907	Green Technology	CSE	OEC	3	0	0	3	40	60	100
26.	20CS908	Artificial Intelligence and Robotics	CSE	OEC	3	0	0	3	40	60	100
27.	20CS909	Big Data and Analytics	CSE	OEC	3	0	0	0	40	60	100
28.	20CS910	Hardware and Trouble Shooting	CSE	OEC	3	0	0	3	40	60	100
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	Total
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
Safety and Fire Engineering											
58.	20SF901	Occupational Health and Hygiene	SF	OEC	3	0	0	3	40	60	100
59.	20SF902	Construction Safety	SF	OEC	3	0	0	3	40	60	100
60.	20SF903	Building Fire Safety	SF	OEC	3	0	0	3	40	60	100
61.	20SF904	Safety in Electrical Engineering	SF	OEC	3	0	0	3	40	60	100
62.	20SF905	Legal Aspects of Safety	SF	OEC	3	0	0	3	40	60	100
63.	20SF906	Safety in Industries	SF	OEC	3	0	0	3	40	60	100
64.	20SF907	Food Safety	SF	OEC	3	0	0	3	40	60	100
65.	20SF908	Safety Management and its Principles	SF	OEC	3	0	0	3	40	60	100
66.	20SF909	Safety in Automobile Engineering	SF	OEC	3	0	0	3	40	60	100
67.	20SF910	Safety in Transportation	SF	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

OPEN ELECTIVE COURSES OFFERED BY MECHANICAL ENGINEERING TO OTHER BRANCHES

Sl. No.	Course Code	Course Name	Specialization	Category	Hours / Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20ME901	Basic Mechanical Engineering	MECH	OEC	3	0	0	3	40	60	100
2.	20ME902	Solar Energy Utilization	MECH	OEC	3	0	0	3	40	60	100
3.	20ME903	Production Technology of Agricultural Machinery	MECH	OEC	3	0	0	3	40	60	100
4.	20ME904	Selection of Materials	MECH	OEC	3	0	0	3	40	60	100
5.	20ME905	Marine Vehicles	MECH	OEC	3	0	0	3	40	60	100
6.	20ME906	Sensors and Transducers	MECH	OEC	3	0	0	3	40	60	100
7.	20ME907	Energy Auditing	MECH	OEC	3	0	0	3	40	60	100
8.	20ME908	Fibre Reinforced Plastics	MECH	OEC	3	0	0	3	40	60	100
9.	20ME909	Lean Manufacturing	MECH	OEC	3	0	0	3	40	60	100
10.	20ME910	Surface Engineering	MECH	OEC	3	0	0	3	40	60	100

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List of Emerging Area for Honours

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

(ii) 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 :SAFETY ENGINEERING		VERTICAL-II:ADVANCED MANUFACTURING	
20ME892	Principles of Safety Management	20ME898	Advances In Manufacturing Processes
20ME893	Environmental Safety	20ME899	Advanced Materials Engineering
20ME894	Electrical Safety	20ME911	Materials Testing and Characterization Techniques
20ME895	Safety in Textile Industry	20ME912	Advanced Metrology and Non Destructive Testing
20ME896	Safety in Chemical Industries	20ME913	Optimization Techniques In Manufacturing
20ME897	Safety in Engineering Industry	20ME914	Smart Manufacturing
20ME097	Industrial Safety Engineering	20ME781	Additive Manufacturing
20ME888	Nuclear Engineering	20ME775	Industry 4.0

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Programme	B.E.- Mechanical Engineering

List of Emerging Area for Honours

VERTICAL - I											
SAFETY ENGINEERING											
Sl.No.	**Course Code**	**Course Name**	**Specialization**	**Hours/ Week**			**Credit**	**Maximum Marks**			
				L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	20ME892	Principles of Safety Management	S5	3	0	0	3	40	60	100
2.	20ME893	Environmental Safety	S5	3	0	0	3	40	60	100
3.	20ME894	Electrical Safety	S5	3	0	0	3	40	60	100
4.	20ME895	Safety in Textile Industry	S5	3	0	0	3	40	60	100
5.	20ME896	Safety in Chemical Industries	S5	3	0	0	3	40	60	100
6.	20ME897	Safety in Engineering Industry	S5	3	0	0	3	40	60	100
7.	20ME097	Industrial Safety Engineering	S5	3	0	0	3	40	60	100
8.	20ME888	Nuclear Engineering	S5	3	0	0	3	40	60	100

VERTICAL- II											
ADVANCED MANUFACTURING											
Sl.No.	**Course Code**	**Course Name**	**Specialization**	**Hours/ Week**			**Credit**	**Maximum Marks**			
				L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	20ME898	Advances In Manufacturing Processes	S4	3	0	0	3	40	60	100
2.	20ME899	Advanced Materials Engineering	S4	3	0	0	3	40	60	100
3.	20ME911	Materials Testing and Characterization Techniques	S4	3	0	0	3	40	60	100
4.	20ME912	Advanced Metrology and Non Destructive Testing	S4	3	0	0	3	40	60	100
5.	20ME913	Optimization Techniques In Manufacturing	S4	3	0	0	3	40	60	100
6.	20ME914	Smart Manufacturing	S4	3	0	0	3	40	60	100
7.	20ME781	Additive Manufacturing	S4	3	0	0	3	40	60	100
8.	20ME775	Industry 4.0	S4	3	0	0	3	40	60	100

S1-Management studies S2-Design Engineering
S3-Thermal Engineering S4-Manufacturing Engineering S5-Safety Engineering

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VALUE ADDED COURSES

Sl. No	Course code	Course Name	Number of Hours	Offered by Internal/ External*
1.	20MEV01	Reverse Engineering	15	MECH / KSRCE
2.	20MEV02	Introduction to Oil and Gas Engineering	15	MECH / KSRCE
3.	20MEV03	Green Manufacturing: Conceptual Design and Its Practices	15	MECH / KSRCE
4.	20MEV04	Logistics and Supply Chain Networks	15	MECH / KSRCE
5.	20MEV05	Industrial Safety Engineering	15	MECH / KSRCE
6.	20MEV06	Nano Technology: Mechanical Engineering's New Frontier	15	MECH / KSRCE
7.	20MEV07	Rapid Prototyping	15	MECH / KSRCE
8.	20MEV08	Non-Destructive Evaluation of Materials	15	MECH / KSRCE
9.	20MEV09	Tissue Engineering	15	External
10.	20MEV10	Biofuel Technology	15	External
11.	20MEV11	Food Safety and Quality Auditing	15	External
12.	20MEV12	Food Packaging Technology	15	External
13.	20MEV13	Man Made Fibre Technology	15	External
14.	20MEV14	Export Policies and Documentation	15	External
15.	20MEV15	Startups & Entrepreneurship	15	External

CREDITS

SL. No.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1	HSMC	3	3			3			3	12
2	BSC	11	8	4	4					27
3	ESC	4	8	8						20
4	PCC			11	19	14	12	8		64
5	PEC					6	3	6	3	18
6	OEC						3	3	3	09
7	PROJ					1		3	6	10
8	MC	0	1	1						02
	TOTAL	**18**	**20**	**24**	**23**	**24**	**18**	**20**	**15**	**162**

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

DEPARTMENT OF MECHANICAL ENGINEERING

B.E. - MECHANICAL ENGINEERING

CURRICULUM & SYLLABI

Regulation 2020

(Applicable to candidates admitted in the academic year 2023 - 2024 onwards)

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

(Approved by AICTE, Accredited by NAAC with A++ grade & Affiliated to Anna University)
K.S.R. Kalvi Nagar, Tiruchengode – 637 215

Namakkal (Dt), Tamilnadu, India

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

K.S.R. COLLEGE OF ENGINEERING: TIRUCHENGODE - 637 215
(Autonomous)
DEPARTMENT OF MECHANICAL ENIGNEERING
(REGULATION 2020)

Vision of the Institution

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

Mission of the Institution

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

Vision of the Department / Programme: (Mechanical Engineering)

DV	To be a centre of excellence in the field of Mechanical Engineering for providing its students and faculty with opportunities for excel in education and targeted research themes in emerging areas.

Mission of the Department / Programme: (Mechanical Engineering)

DM 1	To excel in academic and research activities that meet the industrial and social needs.
DM 2	To develop competent, innovative and ethical mechanical Engineers.

Programme Educational Objectives (PEOs) : (Mechanical Engineering)

The graduates of the programme will be able to

PEO 1	**Successful career:** Identify, design and apply the technical skills to solve mechanical engineering problems for enhancing the quality of life.
PEO 2	**Lifelong Learning:** Apply the modern tools and techniques to face the challenges in mechanical and related engineering areas.
PEO 3	**Service to society:** Understand the responsibility, communicate and implement innovative ideas in multidisciplinary teams ethically for uplifting the society.

PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs)

Programme 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, resource, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environmental and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadcast context of technological change.
Programme Specific Outcomes (PSOs)	
PSO1	**Research Culture:** Read literature, do research on new mechanical engineering problems and publish the results through patents, journals, conferences and symposium.
PSO2	**Industry Exposure:** Enhance professional Experience through industrial/inplant training.

K.S.R. COLLEGE OF ENGINEERING,TIRUCHENGODE

B.E-(MECHANICAL ENGINEERING)

(REGULATION- 2020) (Amendment)

As per the letter received from Centre for academic courses, Anna University, dated 01.03.2023, two tamil language courses **"தமிழர் மரபு - HERITAGE OF TAMILS" & "தமிழரும் தொழில் நுட்பமும்- TAMILS AND TECHNOLOGY"** are introduced in second and third semester of regulation 2020 and offered to the students admitted 2022–2023 (Batch: 2022 – 2026) during the academic year 2022-2023 even semester (II Semester) and 2023-2024 odd semester (III Semester) respectively.

The same courses are introduced for students admitted in 2023-2024 (Batch: 2023–2027) during the academic year 2023-2024 odd semester (I Semester) and 2023-2024 even semester (II Semester) respectively.

Course Code & Course Title	Core/Elective/ Mandatory Course	Semester	Credits	Applicable to candidates admitted in the academic year
Heritage of Tamils & தமிழர் மரபு	**Mandatory Course**	**II**	**1**	**2022 – 2023**
Tamils and Technology & தமிழரும் தொழில் நுட்பமும்		**III**	**1**	
Heritage of Tamils & தமிழர் மரபு /		**I**	**1**	**2023- 2024**
Tamils and Technology & தமிழரும் தொழில் நுட்பமும்		**II**	**1**	

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Programme	B.E.- Mechanical 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.	20CH051	Engineering Chemistry (Common to All Branches)	BSC	3	0	0	3	40	60	100
5.	20ME144	Engineering Drawing (Common to AU, ME & SF)	ESC	1	2	0	3	40	60	100
MANDATORY COURSE										
6.	20MC151	Induction Programme * (Common to All Branches)	MC	-	-	-	-	-	-	-
7.	20GE051	Heritage of Tamils / தமிழர் மரபு (Common to All Branches)	MC	1	0	0	1	40	60	100
PRACTICAL										
8.	20GE028	Manufacturing Practices Laboratory (Common to All Branches)	ESC	0	0	3	1	60	40	100
9.	20CH028	Chemistry Laboratory (Common to All Branches)	BSC	0	0	3	1	60	40	100
			Total	**13**	**3**	**7**	**19**	**800**		

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

SEMESTER – II

Sl.No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	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.	20PH241	Materials Physics	BSC	3	0	0	3	40	60	100
4.	20CS241	Python Programming (Common to AU,CE,EE,EC,ME & SF)	ESC	3	0	0	3	40	60	100
5.	20EE041	Basics of Electrical and Electronics Engineering (Common to AU,CE,CS,CSD,CDIOT,IT, ME & SF)	ESC	3	0	0	3	40	60	100
MANDATORY COURSE										
6.	20MC052	Environmental Science and Engineering(Common to All Branches)	MC	3	0	0	0	40	60	100
7.	20GE052	Tamils and Technology / தமிழரும் தொழில் நுட்பமும் (Common to All Branches)	MC	1	0	0	1	40	60	100
PRACTICAL										
8.	20AU026	Computer Aided Drawing Laboratory (Common to AU & ME)	ESC	0	0	3	1	60	40	100
9.	20CS227	Python Programming Laboratory (Common to AU,CE,EE,EC,ME & SF)	ESC	0	0	3	1	60	40	100
10.	20PH028	Physics Laboratory (Common to All Branches)	BSC	0	0	3	1	60	40	100
			Total	**18**	**1**	**10**	**20**	**1000**		

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SEMESTER – III

Sl.No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20MA341	Statistics and Numerical Methods (Common to AU,ME & SF)	BSC	3	1	0	4	40	60	100
2.	20ME312	Engineering Thermodynamics	ESC	3	1	0	4	40	60	100
3.	20ME313	Fluid Mechanics and Machinery	PCC	3	0	0	3	40	60	100
4.	20ME314	Manufacturing Technology-I	PCC	3	0	0	3	40	60	100
5.	20ME315	Basic Mechanics	ESC	3	1	0	4	40	60	100
6.	20ME316	Engineering Metrology and Measurements	PCC	3	0	0	3	40	60	100
PRACTICAL										
7.	20ME321	Metrology and Measurements Laboratory	PCC	0	0	3	1	60	40	100
8.	20ME322	Fluid Mechanics and Machinery Laboratory	PCC	0	0	3	1	60	40	100
9.	20HR351	Career Development Skills-I (Common to All Branches)	PCC	2	0	0	0	60	40	100
			Total	**20**	**3**	**6**	**23**		**900**	

SEMESTER – IV

Sl.No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20MA434	Operations Research	BSC	3	1	0	4	40	60	100
2.	20ME412	Strength of Materials	PCC	3	1	0	4	40	60	100
3.	20ME413	Thermal Engineering	PCC	3	0	0	3	40	60	100
4.	20ME414	Manufacturing Technology-II	PCC	3	0	0	3	40	60	100
5.	20ME415	Engineering Materials and Metallurgy	PCC	3	0	0	3	40	60	100
6.	20ME416	Machine Drawing	PCC	1	3	0	4	40	60	100
PRACTICAL										
7.	20ME421	Thermal Engineering Laboratory	PCC	0	0	3	1	60	40	100
8.	20ME422	Manufacturing Technology Laboratory	PCC	0	0	3	1	60	40	100
9.	20HR472	Career Development Skills-II	PCC	2	0	0	0	60	40	100
			Total	**18**	**5**	**6**	**23**		**900**	

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SEMESTER – V

Sl.No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20HS051	Universal Human Values and Understanding Harmony (Common to All Branches)	HSMC	3	0	0	3	40	60	100
2.	20ME511	Theory of Machines	PCC	3	1	0	4	40	60	100
3.	20ME512	Design of Machine Elements	PCC	3	1	0	4	40	60	100
4.	20ME513	Gas Dynamics and Jet Propulsion	PCC	3	1	0	4	40	60	100
5.	-	Professional Elective – I	PEC	3	0	0	3	40	60	100
6.	-	Professional Elective – II	PEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20ME521	Design Engineering Laboratory	PCC	0	0	3	1	60	40	100
8.	20ME522	CAD / CAM Laboratory	PCC	0	0	3	1	60	40	100
9.	20ME523	Industry Internship and Technical presentation	PROJ	0	0	3	1	60	40	100
10.	20HR573	Career Development Skills-III	PCC	2	0	0	0	60	40	100
			Total	**20**	**3**	**9**	**24**	**1000**		

SEMESTER – VI

Sl.No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20ME611	Design of Transmission Systems	PCC	3	0	0	3	40	60	100
2.	20ME612	Heat and Mass Transfer	PCC	3	1	0	4	40	60	100
3.	20ME613	Maintenance Engineering	PCC	3	0	0	3	40	60	100
4.	-	Professional Elective – III	PEC	3	0	0	3	40	60	100
5.	-	Open Elective – I	OEC	3	0	0	3	40	60	100
PRACTICAL										
6.	20ME621	Mini project	PCC	0	0	3	1	60	40	100
7.	20ME622	Heat and Mass Transfer Laboratory	PCC	0	0	3	1	60	40	100
8.	20HR674	Career Development Skills-IV	PCC	2	0	0	0	60	40	100
			Total	**17**	**1**	**6**	**18**	**800**		

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SEMESTER – VII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20ME711	Finite Element Analysis	PCC	3	0	0	3	40	60	100
2.	20ME712	Mechatronics	PCC	3	0	0	3	40	60	100
3.	-	Professional Elective – IV	PEC	3	0	0	3	40	60	100
4.	-	Professional Elective – V	PEC	3	0	0	3	40	60	100
5.	-	Open Elective - II	OEC	3	0	0	3	40	60	100
PRACTICAL										
6.	20ME721	Mechatronics Laboratory	PCC	0	0	3	1	60	40	100
7.	20ME722	Computer Aided Simulation and Analysis Laboratory	PCC	0	0	3	1	60	40	100
8.	20ME723	Project Phase - I	PROJ	0	0	6	3	60	40	100
			Total	**15**	**0**	**12**	**20**	**800**		

SEMESTER – VIII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1	20HS002	Total Quality Management (Common to All Branches)	HSMC	3	0	0	3	40	60	100
2	-	Professional Elective – VI	PEC	3	0	0	3	40	60	100
3	-	Open Elective – III	OEC	3	0	0	3	40	60	100
PRACTICAL										
4	20ME821	Project Phase - II	PROJ	0	0	12	6	60	40	100
			Total	**9**	**0**	**12**	**15**	**400**		

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List of Electives

PROFESSIONAL ELECTIVE - I (SEMESTER – V)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20HS003	Innovation, Intellectual Property Rights and Entrepreneurship Development (Common to All Branches)	S1	3	0	0	3	40	60	100
2.	20ME562	Design of Jigs, Fixtures and Press tools	S2	3	0	0	3	40	60	100
3.	20ME563	MEMS and NEMS	S2	3	0	0	3	40	60	100
4.	20ME564	Power Plant Engineering	S3	3	0	0	3	40	60	100
5.	20ME565	Computer Aided Manufacturing	S4	3	0	0	3	40	60	100
6.	20ME566	Flexible Manufacturing Systems	S4	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – II (SEMESTER – V)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20HS001	Principles of Management (Common to All Branches)	S1	3	0	0	3	40	60	100
2.	20ME662	Product Design and Development	S2	3	0	0	3	40	60	100
3.	20ME663	Thermal Turbo Machines	S3	3	0	0	3	40	60	100
4.	20ME664	Internal Combustion Engines	S3	3	0	0	3	40	60	100
5.	20ME665	Process Planning and Cost Estimation	S4	3	0	0	3	40	60	100
6.	20ME666	Welding Technology	S4	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – III (SEMESTER – VI)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20ME097	Industrial Safety Engineering	S5	3	0	0	3	40	60	100
2.	20ME771	Industrial Tribology	S2	3	0	0	3	40	60	100
3.	20ME772	Design of Aircraft structures	S2	3	0	0	3	40	60	100
4.	20ME773	Renewable Sources of Energy	S3	3	0	0	3	40	60	100
5.	20ME774	Fundamentals of Nano Science	S4	3	0	0	3	40	60	100
6.	20ME775	Industry 4.0	S4	3	0	0	3	40	60	100

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Department	Department of Mechanical Engineering
Programme	B.E.- Mechanical Engineering

List of Electives

PROFESSIONAL ELECTIVE – IV (SEMESTER – VII)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20HS786	Human Resource Management	S1	3	0	0	3	40	60	100
2.	20ME776	Industrial Robotics	S2	3	0	0	3	40	60	100
3.	20ME777	Hydraulic and Pneumatic systems	S2	3	0	0	3	40	60	100
4.	20ME778	Automobile Engineering	S3	3	0	0	3	40	60	100
5.	20ME779	Computational Fluid Dynamics	S3	3	0	0	3	40	60	100
6.	20ME781	Additive Manufacturing	S4	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – V (SEMESTER – VII)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20HS886	Business Concepts	S1	3	0	0	3	40	60	100
2.	20ME881	Value and Re-Engineering	S2	3	0	0	3	40	60	100
3.	20ME882	Vibration and Noise Control	S2	3	0	0	3	40	60	100
4.	20ME883	Pressure Vessel and Piping Design	S2	3	0	0	3	40	60	100
5.	20ME884	Refrigeration and Air Conditioning	S3	3	0	0	3	40	60	100
6.	20ME885	Composite Materials	S4	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – VI (SEMESTER – VIII)

Sl.No.	Course Code	Course Name	Specialization	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
1.	20HS887	Enterprise Resource Planning	S1	3	0	0	3	40	60	100
2.	20ME886	Optimization in Design	S2	3	0	0	3	40	60	100
3.	20ME887	Experimental stress Analysis	S2	3	0	0	3	40	60	100
4.	20ME888	Nuclear Engineering	S5	3	0	0	3	40	60	100
5.	20ME889	Unconventional Machining Processes	S4	3	0	0	3	40	60	100
6.	20ME891	Non destructive Testing Materials	S4	3	0	0	3	40	60	100

S1-Management studies S2-Design Engineering
S3-Thermal Engineering S4-Manufacturing Engineering S5-Safety Engineering

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Department	Department of Mechanical Engineering
Programme	B.E.- Mechanical Engineering

List of Electives

Open Elective courses offered by other branches

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

Sl. No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
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
Safety and Fire Engineering											
58.	20SF901	Occupational Health and Hygiene	SF	OEC	3	0	0	3	40	60	100
59.	20SF902	Construction Safety	SF	OEC	3	0	0	3	40	60	100
60.	20SF903	Building Fire Safety	SF	OEC	3	0	0	3	40	60	100
61.	20SF904	Safety in Electrical Engineering	SF	OEC	3	0	0	3	40	60	100
62.	20SF905	Legal Aspects of Safety	SF	OEC	3	0	0	3	40	60	100
63.	20SF906	Safety in Industries	SF	OEC	3	0	0	3	40	60	100
64.	20SF907	Food Safety	SF	OEC	3	0	0	3	40	60	100
65.	20SF908	Safety Management and its Principles	SF	OEC	3	0	0	3	40	60	100
66.	20SF909	Safety in Automobile Engineering	SF	OEC	3	0	0	3	40	60	100
67.	20SF910	Safety in Transportation	SF	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

OPEN ELECTIVE COURSES OFFERED BY MECHANICAL ENGINEERING TO OTHER BRANCHES

Sl. No.	Course Code	Course Name	Specialization	Category	Hours / Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20ME901	Basic Mechanical Engineering	MECH	OEC	3	0	0	3	40	60	100
2.	20ME902	Solar Energy Utilization	MECH	OEC	3	0	0	3	40	60	100
3.	20ME903	Production Technology of Agricultural Machinery	MECH	OEC	3	0	0	3	40	60	100
4.	20ME904	Selection of Materials	MECH	OEC	3	0	0	3	40	60	100
5.	20ME905	Marine Vehicles	MECH	OEC	3	0	0	3	40	60	100
6.	20ME906	Sensors and Transducers	MECH	OEC	3	0	0	3	40	60	100
7.	20ME907	Energy Auditing	MECH	OEC	3	0	0	3	40	60	100
8.	20ME908	Fibre Reinforced Plastics	MECH	OEC	3	0	0	3	40	60	100
9.	20ME909	Lean Manufacturing	MECH	OEC	3	0	0	3	40	60	100
10.	20ME910	Surface Engineering	MECH	OEC	3	0	0	3	40	60	100

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Programme	B.E.- Mechanical Engineering

List of Emerging Area for Honours

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

(iii) 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 :SAFETY ENGINEERING		VERTICAL-II:ADVANCED MANUFACTURING	
20ME892	Principles of Safety Management	20ME898	Advances In Manufacturing Processes
20ME893	Environmental Safety	20ME899	Advanced Materials Engineering
20ME894	Electrical Safety	20ME911	Materials Testing and Characterization Techniques
20ME895	Safety in Textile Industry	20ME912	Advanced Metrology and Non Destructive Testing
20ME896	Safety in Chemical Industries	20ME913	Optimization Techniques In Manufacturing
20ME897	Safety in Engineering Industry	20ME914	Smart Manufacturing
20ME097	Industrial Safety Engineering	20ME781	Additive Manufacturing
20ME888	Nuclear Engineering	20ME775	Industry 4.0

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List of Emerging Area for Honours

VERTICAL - I										
SAFETY ENGINEERING										
Sl.No.	**Course Code**	**Course Name**	**Specialization**	**Hours/ Week**			**Credit**	**Maximum Marks**		
				L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	20ME892	Principles of Safety Management	S5	3	0	0	3	40	60	100
2.	20ME893	Environmental Safety	S5	3	0	0	3	40	60	100
3.	20ME894	Electrical Safety	S5	3	0	0	3	40	60	100
4.	20ME895	Safety in Textile Industry	S5	3	0	0	3	40	60	100
5.	20ME896	Safety in Chemical Industries	S5	3	0	0	3	40	60	100
6.	20ME897	Safety in Engineering Industry	S5	3	0	0	3	40	60	100
7.	20ME097	Industrial Safety Engineering	S5	3	0	0	3	40	60	100
8.	20ME888	Nuclear Engineering	S5	3	0	0	3	40	60	100

VERTICAL- II										
ADVANCED MANUFACTURING										
Sl.No.	**Course Code**	**Course Name**	**Specialization**	**Hours/ Week**			**Credit**	**Maximum Marks**		
				L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	20ME898	Advances In Manufacturing Processes	S4	3	0	0	3	40	60	100
2.	20ME899	Advanced Materials Engineering	S4	3	0	0	3	40	60	100
3.	20ME911	Materials Testing and Characterization Techniques	S4	3	0	0	3	40	60	100
4.	20ME912	Advanced Metrology and Non Destructive Testing	S4	3	0	0	3	40	60	100
5.	20ME913	Optimization Techniques In Manufacturing	S4	3	0	0	3	40	60	100
6.	20ME914	Smart Manufacturing	S4	3	0	0	3	40	60	100
7.	20ME781	Additive Manufacturing	S4	3	0	0	3	40	60	100
8.	20ME775	Industry 4.0	S4	3	0	0	3	40	60	100

S1-Management studies S2-Design Engineering
S3-Thermal Engineering S4-Manufacturing Engineering S5-Safety Engineering

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VALUE ADDED COURSES

Sl. No	Course code	Course Name	Number of Hours	Offered by Internal/ External*
1.	20MEV01	Reverse Engineering	15	MECH / KSRCE
2.	20MEV02	Introduction to Oil and Gas Engineering	15	MECH / KSRCE
3.	20MEV03	Green Manufacturing: Conceptual Design and Its Practices	15	MECH / KSRCE
4.	20MEV04	Logistics and Supply Chain Networks	15	MECH / KSRCE
5.	20MEV05	Industrial Safety Engineering	15	MECH / KSRCE
6.	20MEV06	Nano Technology: Mechanical Engineering's New Frontier	15	MECH / KSRCE
7.	20MEV07	Rapid Prototyping	15	MECH / KSRCE
8.	20MEV08	Non-Destructive Evaluation of Materials	15	MECH / KSRCE
9.	20MEV09	Tissue Engineering	15	External
10.	20MEV10	Biofuel Technology	15	External
11.	20MEV11	Food Safety and Quality Auditing	15	External
12.	20MEV12	Food Packaging Technology	15	External
13.	20MEV13	Man Made Fibre Technology	15	External
14.	20MEV14	Export Policies and Documentation	15	External
15.	20MEV15	Startups & Entrepreneurship	15	External

CREDITS

SL. No.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1	HSMC	3	3			3			3	12
2	BSC	11	8	4	4					27
3	ESC	4	8	8						20
4	PCC			11	19	14	12	8		64
5	PEC					6	3	6	3	18
6	OEC						3	3	3	09
7	PROJ					1		3	6	10
8	MC	1	1							02
	TOTAL	**19**	**20**	**23**	**23**	**24**	**18**	**20**	**15**	**162**

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

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SEMESTER - I

20EN151	**TECHNICAL ENGLISH – I** (common to all branches)	L	T	P	C
		3	0	0	3

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

Course Objectives : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Comprehend and apply Grammar in context for professional communication*	*Understand*
CO2:	*Infer the gist and specific information.*	*Apply*
CO3:	*Ability to speak, express and interact in the society and place of study.*	*Create*
CO4:	*Critically interpret and comprehend a given text.*	*Evaluate*
CO5:	*Prioritize the listening skills for academic and professional purposes.*	*Apply*

UNIT - I **[09]**

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

UNIT - II **[09]**

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

UNIT - III **[09]**

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

UNIT - IV **[09]**

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

UNIT - V **[09]**

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

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

Text Books :

1 Meenakshi Raman, Technical Communcation, Oxford University Press, New Delhi, 2017

2 S.Sumant, Technical English – I, Vijay Nicole, Chennai, 2018

Reference Books :

1 Dr.P.Rathna, English Work Book – I, VRB Publishers Pvt. Ltd., Chennai,2018

2 Seely, The Oxford Guide to Writing and Speaking, Oxford University Press, New Delhi, 2016

3 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, 2005

4 P.Kiranmani Dutt, A course in Communication Skills, Cambridge University Press, New Delhi, 2014

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

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

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

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

SEMESTER – I

20MA151	**ENGINEERING MATHEMATICS – I**	L	T	P	C
	(Common to All Branches)	3	1	0	4

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes : On Completion of this course, the student will be able to		**Cognitive Level**
CO1	*Interpret the concepts of Matrix applications in the field of engineering.*	*Understand*
CO2	*Acquire knowledge in solving ordinary differential equations.*	*Evaluate*
CO3	*Extend and apply the concepts of differential calculus problems.*	*Apply*
CO4	*Develop the skills in solving the functions of several variables.*	*Remember*
CO5	*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 – Involutes and Evolutes.

UNIT – IV FUNCTIONS OF SEVERAL VARIABLES [12]

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

UNIT – V VECTOR CALCULUS [12]

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

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

Text Books :

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

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

Reference Books :

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

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

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

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

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

DEPARTMENT OF MECHANICAL 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**	L	T	P	C
	(Common to All Branches)	3	0	0	3

Prerequisite: NIL

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

UNIT – I ACOUSTICS AND ULTRASONICS [9]

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

UNIT – II LASER TECHNOLOGY [9]

Introduction – Principle of Spontaneous emission and stimulated emission – Population inversion, pumping – Einstein's A and B coefficients (derivation). Types of lasers – Nd-YAG, CO_2 and Semiconductor lasers (homo-junction and hetero-junction) – Qualitative Industrial Applications: Lasers in welding, heat treatment and cutting – Medical applications – Holography (construction and reconstruction of images).

UNIT – III CRYSTAL PHYSICS [9]

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

UNIT – IV QUANTUM PHYSICS [9]

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

UNIT – V OPTOELECTRONIC DEVICES [9]

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

Total = 45 Periods

Text Books :

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

Reference Books :

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

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DEPARTMENT OF MECHANICAL 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

20CH051	**ENGINEERING CHEMISTRY**	L	T	P	C
	(Common to All Branches)	3	0	0	3

Prerequisite: *NIL*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Make use of the manufacture, properties and uses of advanced engineering materials.*	*Understand*
CO2:	*Explain the concept of corrosion and its control.*	*Understand*
CO3:	*Use the concept of thermodynamics in engineering applications.*	*Understand*
CO4:	*Recall the periodic properties such as ionization energy, electron affinity and electro negativity.*	*Remember*
CO5:	*Analyze the usage of various spectroscopic techniques.*	*Understand*

UNIT–I ADVANCED ENGINEERING MATERIALS [9]

Abrasives – Moh's scale of hardness – types – natural [Diamond] – synthetic [SiC]; Refractories – characteristics – classifications [Acidic, basic and neutral refractories] – properties – refractoriness – RUL – porosity – thermal spalling; Lubricants – definition – function – characteristics – properties – viscosity index, flash and fire points, cloud and pour points, oiliness; Solid lubricants – graphite and MoS_2; Nano materials – CNT– synthesis [CVD, laser evaporation, pyrolysis] – applications – medicine, electronics, biomaterials and environment.

UNIT–II ELECTROCHEMISTRY AND CORROSION [9]

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

UNIT–III CHEMICAL THERMODYNAMICS [9]

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

UNIT–IV ATOMIC STRUCTURE AND CHEMICAL BONDING [9]

Effective nuclear charge – orbitals – variations of s, p, d and f orbital – electronic configurations – ionization energy – electron affinity and electro negativity; Types of bonding – ionic, covalent and coordination bonding – hydrogen bonding and its types; Crystal field theory – the energy level diagram for transition metal complexes ($[Fe(CN)_6]^{3-}$, $[Ni(CN)_4]^{2-}$ and $[CoCl_4]^{2-}$ only); Role of transition metal ions in biological system; Band theory of solids.

UNIT – V PHOTOCHEMISTRY AND SPECTROSCOPIC TECHNIQUES [9]

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

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

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DEPARTMENT OF MECHANICAL ENGINEERING

Semester : I **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)

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.*	*Understand*
CO2:	*Draw orthographic projection of points, lines and plane surfaces inclined to principle planes.*	*Create*
CO3:	*Practicing projections of simple solids which are inclined to reference planes by change of position method.*	*Analyze*
CO4:	*Construct sectional views and development of surfaces of simple and truncated solids.*	*Create*
CO5:	*Prepare isometric views of simple solids and perspective projections of solids by visual ray method.*	*Apply*

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 MECHANICAL 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

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

Course outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Involve in physical activity, creative arts and culture and feel comfortable in the new environment.*	*Understand*
CO2:	*Build relationship between teachers and students and make familiarizing with departments*	*Understand*
CO3:	*Concentrate on literary activities.*	*Apply*
CO4:	*Develop the required skills through lectures and workshops*	*Remember*
CO5:	*Acquire skills in extracurricular activities*	*Analyze*

List of activities during the three weeks Students Induction Programme (SIP): **3 weeks**

MODULE I : PHYSICAL ACTIVITY

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

MODULE II : CREATIVE ARTS & CULTURE

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

MODULE III : MENTORING AND CONNECTING THE STUDENTS WITH FACULTY

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

MODULE IV: FAMILIRIZATION WITH COLLEGE/DEPARTMENTS & BRANCHES

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

MODULE V: LITERARY ACTIVITIES

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

MODULE VI: PROFICIENCY MODULES:

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

MODULE VII: LECTURES & WORKSHOPS

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

MODULE VIII: EXTRA CURRICULAR ACTIVITIES

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

MODULE IX: FEED BACK & REPORT ON THE PROGRAMMES:

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

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

DEPARTMENT OF MECHANICAL 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**	**-**	**-**

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

SEMESTER – I /II

		L	T	P	C
20GE051	**HERITAGE OF TAMILS** (common to all branches)	1	0	0	1

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

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Recognize the extensive literature of Tamil and its classical nature.*	*Understand*
CO2:	*Apprehend the heritage of sculpture, painting and musical instruments of ancient people.*	*Understand*
CO3:	*Review on folk and martial arts of tamil people.*	*Understand*
CO4:	*Insight thinai concepts, trade and victory of Chozha dynasty.*	*Understand*
CO5:	*Realize the contribution of Tamil in Indian freedom struggle, self-esteem movement and siddha medicine.*	*Understand*

UNIT - I LANGUAGE AND LITERATURE [03]

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

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

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

UNIT - III FOLK AND MARTIAL ARTS [03]

Therukoothu, Karagattam, 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) (Puplished by International Institute of Tamil Studies).

3 Keeladi – 'Sangam City Civilzation 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)

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : I / II **Regulation : R2020**

Course Code : 20GE051 **Course Name : HERITAGE OF TAMILS**

CO-PO MAPPING

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Text Books :

1 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 பொருநை –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
CO1:	தமிழ் மொழியின் செந்ததன்மை மற்றும் இலக்கியம் குறித்ததெரிதல்	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO2:	தமிழர்களின் சிற்பக்கலை, ஓவியக்கலை மற்றும் இசைக் கருவிகள் குறித்த தெளிவு	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO3:	தமிழர்களின் நாட்டுப்புரைக் கலைகள் மற்றும் வீரவிளையாட்டுகள் குறித்த தெளிவு	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO4:	தமிழர்களின் திணைக் கோட்பாடுகள், சங்ககால வணிகம் மற்றும் சோழர்களின் வெற்றிகள் குறித்த தகவல்கள்.	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO5:	இந்திய தேசிய இயக்கம், சுயமரியாதை இயக்கம் மற்றும் சித்த மருத்தவம் பற்றிய புரிதல்.	-	-	-	-	-	-	3	3	-	2	-	3	-	-
	Average	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**-**	**3**	**-**	**-**

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

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

SEMESTER - I

20GE028 **MANUFACTURING PRACTICES LABORATORY** (Common to All Branches)

L	T	P	C
0	0	3	1

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

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Prepare green sand mould for simple patterns and carpentry components with simple joints.*	*Create*
CO2:	*Perform welding practice to join simple structures.*	*Apply*
CO3:	*Practice simple operations in lathe and drilling machine.*	*Understand*

GROUP A (CIVIL & MECHANICAL)

LIST OF EXPERIMENTS

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

LIST OF EQUIPMENT

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

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

List of Experiments:

ELECTRICAL ENGINEERING

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

ELECTRONICS ENGINEERING

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

Total : 45 Periods

CO PO MAPPING

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	*Construct different types of wiring used in house.*	3	2	3	-	-	-	-	1	1	-	-	3	-	-
CO2	*Calibrate single phase Energy meter.*	3	1	2	-	-	-	-	1	1	-	-	3	-	-
CO3	*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 – I

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.*	*Understand*
CO2	*Relate the role of pH in quantitative analysis of a solution.*	*Understand*
CO3	*Perceive the knowledge of the concentration of Iron by electrochemical methods.*	*Understand*
CO4	*Analyze the application of water in various fields.*	*Understand*
CO5	*Recall the nature of corrosion process.*	*Remember*

LIST OF EXPERIMENTS:

1. Conductometric Titration – Strong Acid Vs. Strong Base.
2. Conductometric Titration – Mixture of Weak and Strong Acids Vs. Strong Base.
3. Conductometric Titration – Precipitation, $BaCl_2$ Vs. Na_2SO_4.
4. Estimation of Ferrous ion by Potentiometry – Fe^{2+} Vs $K_2Cr_2O_7$.
5. Estimation of Hydrochloric Acid by pH metry.
6. Estimation of Iron by Spectrophotometry.
7. Estimation of hardness in water by EDTA method.
8. Estimation of chloride in water sample by Argentometry.
9. Estimation of dissolved oxygen (DO) in water by Winkler's method.
10. Determination of rate of corrosion of mild steel by weight loss method.

Total : 30 Periods

Text Book :

1 Department of Chemistry Staff members, Chemistry Laboratory Manual, K.S.R. College of Engineering, Tiruchengode, Fourth Edition, 2020.

2 I. Vogel, Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & sons, Newyork, Eighth Edition, 2014.

Reference Books :

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

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

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

4 B.S. Furniss, A.J, Hannaford, P.W.G. Smith and A.R. Tatchel, Vogels Textbook of practicalorganic chemistry,John Wiley & sons, Newyork, Fifth Edition, 1989.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : I **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

20EN251	**TECHNICAL ENGLISH – II** (common to all branches)	L	T	P	C
		3	0	0	3

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

Course Objectives : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Infer and apply the enriched vocabulary, by knowing the basic grammatical structure, in academic and professional contexts.*	*Understand*
CO2:	*Identify and use Standard English in diverse situations.*	*Apply*
CO3:	*Interpret by reading a text and comprehend a given text.*	*Create*
CO4:	*Organize and compose business letters.*	*Evaluate*
CO5:	*Prioritize the listening skill for academic and personal development purposes.*	*Apply*

UNIT - I **[09]**

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

UNIT - II **[09]**

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

UNIT - III **[09]**

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

UNIT - IV **[09]**

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

UNIT - V **[09]**

Confused and misused words - Discourse markers – Redundancies - Instructions – Describing – Listening to fill up forms and gapped texts - Reading Short texts from Journals and Newspapers - Telephone Etiquette - 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, 2016
2 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, 2004.

Reference Books :

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

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : II **Regulation : R2020**

Course Code : 20EN251 **Course Name : TECHNICAL ENGLISH – II**

CO PO MAPPING

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

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

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

SEMESTER – II

		L	T	P	C
20MA241	**ENGINEERING MATHEMATICS – II** (COMMON TO AU, CE, ME & SF)	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.*	*Remember*
CO2	*Solve the of Complex Integration problems.*	*Understand*
CO3	*Solve the Fourier series problems.*	*Understand*
CO4	*Analyze the partial differential equations and its applications.*	*Remember*
CO5	*Apply Laplace transform, Inverse Laplace transform in the Engineering fields.*	*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 periodicfunctions. 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 Pub, Chennai, Seventh edition, 2016
3. P. Anuradha and V. Sudhakar, Transforms and Partial Differential Equations, Scitech publication, chennai, Second edition, 2014.
4. Ian Sneddon, Elements of Partial Differential Equations, McGraw-Hill International Editions, New Delhi,Thirty Fifth edition, 2012.

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DEPARTMENT OF MECHANICAL 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	PSO1	PSO2
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

20PH241	**MATERIALS PHYSICS**	L	T	P	C
	Mechanical Engineering	3	0	0	3

Prerequisite: *NIL*

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

CO1	*Exploit the conceived concepts for better understanding of solid structures.*	*Apply*
CO2	*Categorize the magnetic materials for various applications based on their properties and employing the advanced concepts of dielectrics in electronic appliances.*	*Analyze*
CO3	*Imbibe the concepts of superconducting phenomenon that can be applied for possible technological and engineering applications.*	*Remember*
CO4	*Apply the techniques for manufacturing of advanced materials aided with Nano properties.*	*Apply*
CO5	*Comprehend the basics of characterization techniques of materials for the confirmation of compounds in crystal structure.*	*Understand*

UNIT - I MOLECULAR BONDING IN SOLIDS [9]

Introduction to solids – Properties of ionic solids - Covalent bond- chemical bond-hybridization- Properties of covalent compounds-Metallic bond-Properties of metallic crystals-Intermolecular bonds-Dispersion bonds-Dipole bonds-hydrogen bonds - Phase diagram – solubility limit – phase equilibrium – phase rule.

UNIT - II MAGNETIC AND DIELECTRIC MATERIALS [9]

Origin of magnetic moment – Bohr magneton – Dia, Para, Ferro and Anti ferromagnetism and its properties - Domain theory– Hysteresis – soft and hard magnetic materials – Ferrites and its applications (Qualitative) – Dielectrics - Dielectric constant – Polarization in dielectrics – Electronic, Ionic, Orientational and Space charge polarizations – Internal or local field - Clausius - Mosotti equation – Dielectric loss – Applications.

UNIT - III SUPERCONDUCTING MATERIALS [9]

Introduction- Properties - Type I and Type II superconductors – High Tc Superconductors – BCS theory of superconductors – Josephson effect – Applications – cryotron, superconducting magnets, SQUIDS and magnetic levitation.

UNIT - IV ADVANCED MATERIALS AND NANOTECHNOLOGY [9]

New Engineering Materials: Metallic glasses – preparation, properties and applications – Shape memory alloys (SMA) – characteristics, properties of Ni-Ti alloy applications – advantages and disadvantages of SMA. Nanomaterials: Properties- Top-down process: Ball Milling method – Bottom-up process: Pulsed Laser Deposition method - Fullerenes – Graphene - Carbon Nano Tube (CNT) - Properties and Applications.

UNIT - V MATERIALS CHARACTERIZATION [9]

Introduction – Principle and working of X-Ray diffraction technique (XRD), Fourier Transform Infrared (FTIR) Spectroscopy, Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Analysis (EDAX) - Transmission Electron Microscopy (TEM), Thermogravimetric analysis (TGA) and Differential Thermal Analysis (DTA).

Total = 45 Periods

Text Book :

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

2 S.O. Pillai, Solid StatePhysics, New Age Publication, Chennai, nineth Edition, 2015.

Reference Books :

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

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

3 Charles Kittel, Introduction to Solid State Physics, John Wiley & Sons, India, seventh Edition, 2008.

4 Arthur Beiser, Concepts of Modern Physics, Tata McGraw Hill, New Delhi, sixth Edition, 2010.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : II **Regulation : R2020**

Course Code : 20PH241 **Course Name : MATERIALS PHYSICS**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Exploit the conceived concepts for better understanding of solid structures.*	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO2	*Categorize the magnetic materials for various applications based on their properties and employing the advanced concepts of dielectrics in electronic appliances.*	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO3	*Imbibe the concepts of superconducting phenomenon that can be applied for possible technological and engineering applications.*	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO4	*Apply the techniques for manufacturing of advanced materials aided with Nano properties.*	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO5	*Comprehend the basics of characterization techniques of materials for the confirmation of compounds in crystal structure.*	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 – II

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

Prerequisite: *Basic knowledge of C programming.*

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

UNIT – I FUNDAMENTALS OF PYTHON [9]

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

UNIT – II DATA STRUCTURES AND PACKAGES [9]

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

UNIT – III OBJECT ORIENTED PROGRAMMING [9]

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

UNIT – IV FILES AND DATA BASES [9]

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

UNIT – V GUI AND WEB [9]

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

Total = 45 Periods

Text Books :

1 Mark Lutz, “Learning Python”, O'Reilly Media, Fifth Edition, 2013

2 Wesley J.Chun, “Core Python Programming”, Pearson Education, Second Edition, 2017

References :

1 Bill Lubanovic, "Introducing Python Modern Computing in Simple Packages", O'Reilly Media, First Edition, 2014.

2 David Beazley, Brian K. Jones, "Python Cookbook", O'Reilly Media, Third Edition, 2013

3 Mark Lutz, “Python Pocket Reference”, O'Reilly Media, Fifth Edition, 2014

4 www.python.org and www.diveintopython3.net

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

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : II **Regulation : R2020**

Course Code : 20CS241 **Course Name : PYTHON PROGRAMMING**

CO-PO 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	-	-	-	-	-	-	-	-	-
CO2:	*Apply the necessary data structures includes list, tuple and dictionary in the required fields.*	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO3:	*Analyze, design and implement the problems using OOPs technology*	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO4:	*Demonstrate the simple file operations*	3	3	3	3	2	-	-	-	-	-	-	-	-	-
CO5:	*Design web site using GUI.*	3	3	3	3	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 – II

20EE041	**BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING** (Common To AU,CE,CS,CSD,CSIOT,IT,ME&SF)	L	T	P	C
		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 circuital laws for various combinations of circuit elements.*	*Apply*
CO2	*Explain the construction, operating principle and application of DC motor and transformers.*	*Understand*
CO3	*Enlighten 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 CharacteristicsApplications. 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. SmarajitGhosh,Fundamentals of Electrical and Electronics Engineering, PHI Learning Private Limited, Second Edition, 2007.
2. Jegathesan,V.,VinothKumar, K.,Saravanakumar,R.,Basic Electrical and Electronics Engineering, Wiley India, First Edition, 2012.

Reference Books :

1. Muthusubramanian,R., Salivahanan, S., and Muraleedharan, K.A., Basic Electrical, Electronics and Computer Engineering,Tata McGraw Hill, Second Edition, 2006.
2. Nagsarkar, T.K., and Sukhija M.S.,Basics of Electrical Engineering, Oxford University press, Ninth Edition, 2005.
3. Mehta, V.K and Rohit Mehta, Principle of Electrical Engineering, S Chand & Company, Second Edition, 2008.
4. MahmoodNahvi and Joseph A. Edminister, Electric Circuits, Schaum Outline Series, McGraw Hill, Fifth Edition, 2002.

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

DEPARTMENT OF MECHANICAL 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 circuital 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

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

Prerequisite:NIL

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

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

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

UNIT – II ECOSYSTEM AND BIODIVERSITY [9]

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

UNIT– III ENVIRONMENTAL POLLUTION [9]

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

UNIT– IV SOCIAL ISSUES AND ENVIRONMENT [9]

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

UNIT– V SUSTAINABILITY AND GREEN CHEMISTRY [9]

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

Total = 45 Periods

Text Book :

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

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

Reference Books :

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

2 Dr. A. Ravikrishnan, Environmental Science and Engineering, Sri krishna Hi-tech Publishing Company Private Limited, Chennai, Tenth Edition, 2014.

3 Raman Sivakumar, Introduction to Environmental Science and Engineering, Tata McGraw Hill Education Private Limited, Fourth Edition, 2012.

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

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : II **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 – II / III

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

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

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Understand the weaving and ceramic technology of ancient Tamil People nature.*	*Understand*
CO2:	*Comprehend the construction technology, building materials in sangam Period and case studies.*	*Understand*
CO3:	*Infer the metal process, coin and beads manufacturing with relevant archeological evidence*	*Understand*
CO4:	*Realize the agriculture methods, irrigation technology and pearl diving.*	*Understand*
CO5:	*Apply the knowledge of scientific Tamil and Tamil computing.*	*Apply*

UNIT - I WEAVING AND CERAMIC TECHNOLOGY [03]

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

UNIT - II DESIGN AND CONSTRUCTION TECHNOLOGY [03]

Designing and Structural construction House & 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 beats – Archeological evidences – Gem stone types described in Silappathikaram.

UNIT - IV AGRICULTURE AND IRRIGATION TECHNOLOGY [03]

Dam, Tank, ponds, Sluice, Significance of KumizhiThoompu 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)(Puplished by International Institute of Tamil Studies).
3 Keeladi – 'Sangam City Civilzation 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)

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : II/III **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:	*Understand the weaving and ceramic technology of ancient Tamil People nature.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO2:	*Comprehend the construction technology, building materials in sangam Period and case studies.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO3:	*Infer the metal process, coin and beads manufacturing with relevant archeological evidence*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO4:	*Realize the agriculture methods, irrigation technology and pearl diving.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO5:	*Apply the knowledge of scientific Tamil and Tamil computing.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
	Average	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**-**	**3**	**-**	**-**

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

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

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

அலகு – I நெசவு மற்றும் பானைத் தொழில்நுட்பம் **[03]**

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

அலகு – II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் **[03]**

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

அலகு – III உற்பத்தித் தொழில்நுட்பம் **[03]**

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

அலகு – IV வேளாண்மை மற்றும் நீர்ப் பாசனத் தொழில்நுட்பம் **[03]**

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

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

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

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

Text Books :

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

Reference Books :

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

2 பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)

3 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)

CO-PO MAPPING

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

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

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

SEMESTER - II

20AU026	**COMPUTER AIDED DRAWING LABORATORY** (Common To AU & ME)	L	T	P	C
		0	0	3	1

Prerequisite: *-*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Demonstrate graphical skills like drafting and modeling 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 = 45 Periods

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : II **Regulation : R2020**

Course Code : 20AU026 **Course Name : COMPUTER AIDED DRAWING LABORATORY**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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 – II

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

Prerequisite: *Basic knowledge of C programming.*

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

List of Experiments

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

Total : 45 Periods

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

DEPARTMENT OF MECHANICAL 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	-	-	-	-	-	-	-	-	-
CO2:	*Write functions to solve mathematical problems.*	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO3:	*Demonstrate the use of files in python.*	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO4:	*Develop simple applications using python.*	3	3	3	1	3	-	-	-	-	-	-	-	-	-
CO5:	*Construct GUI applications using python programming.*	3	3	3	1	3	-	-	-	-	-	-	-	-	-
	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 – II

20PH028	**PHYSICS LABORATORY**	L	T	P	C
	(Common to All Branches)	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, tweleth Edition Chennai 2017.

References :

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

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : II **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 - 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, Forth edition, 2014

Reference Books :

1 Burden, R.L and Faires, J.D, Numerical Analysis, Cengage Learning,New Delhi, Nineth 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 MECHANICAL 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

20ME312	**ENGINEERING THERMODYNAMICS** *(Use of Steam table, Psychometric and Mollier Charts)*	L	T	P	C
		3	1	0	4

Prerequisite: *- Physics & Chemistry*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the basic concepts of thermodynamics and able to differentiate heat and temperature.*	*Analyze*
CO2:	*Apply the law of thermodynamics to open and closed systems and calculate entropy and availability.*	*Apply*
CO3:	*Identify and analyze the phase changes of pure substances.*	*Apply*
CO4:	*Derive simple thermodynamic relations of ideal and real gases and distinguish properties of gas mixture.*	*Evaluate*
CO5:	*Analyze the properties of moist air and its use in psychometric processes.*	*Analyze*

UNIT - I INTRODUCTION [12]

Basic Concepts - Continuum, Micro and Macroscopic approach, Path and Point function, Thermodynamic properties, Equilibrium, Thermodynamic systems, State, Process, Cycle, Quasi static process, Cyclic and Non cyclic process, Indicator diagram, Steady flow energy equation, Heat and Work, Enthalpy, Entropy, Flow and non flow process, Concept of temperature.

UNIT - II LAWS OF THERMODYNAMICS [12]

Zeroth law and its thermometric property, First Law - Flow and Non flow process, Internal energy, Stored energy, Specific heats, Perpetual Motion Machine (PMM), limitations, Heat, Work and Energy for different systems.

Second law - Need, Heat reservoir, Source, Sink, Heat engine, Heat pump and Refrigerators, Kelvin Plank and Clausius Statements and their equivalence, Reversibility and irreversibility, Carnot engine-theorem, cycle, COP and efficiency-Clausius inequality.

UNIT - III PURE SUBSTANCES [12]

Pure substances, Steam formation, Thermodynamic properties, Phase rule, PVT correlations, h-s and T-s relations, dryness fraction, Energy, Quality of steam, use of steam tables and Mollier chart.

UNIT - IV IDEAL & REAL GASES AND THERMODYNAMIC RELATIONS [12]

Ideal and Real gases-characterization, Comparison, Properties, Reduced property, Gas constant, Compressibility, Equation of state, Vander Waals equation, Gas Mixtures - Mole fraction, Mass fraction, Avogadro's law, Dalton's law, Gibbs function, Tds equation, Maxwell's relations, Joule-Kelvin effect, Clausius-clapeyron equation, Compressibility factor.

UNIT - V PSYCHROMETRY [12]

Properties-Property calculations of air vapour mixture-Psychometric chart, Process - Adiabatic saturation, Sensible heating and Cooling, Humidification and Dehumidification, Heating and dehumidification, Cooling and dehumidification, Evaporative Cooling, psychrometer.

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

Text Books :

1 Rajput R.K., A Text book of Engineering Thermodynamics, Laxmi publications (P) ltd., Fifth Edition, 2013.

2 Natarajan E., Engineering Thermodynamics, Anuragam Publications, First Edition, 2012.

Reference Books :

1 Nag P.K., Engineering Thermodynamics, Tata McGraw-Hill, New Delhi, Fifth Edition, 2015.

2 Yunus A.Cengel & Michael A. Boles, Thermodynamics, Eighth Edition 2015.

3 Arora C.P.,Thermodynamics, Tata McGraw-Hill, New Delhi, 2003.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : III **Regulation : R2020**

Course Code : 20ME312 **Course Name : ENGINEERING THERMODYNAMICS**

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 basic concepts of thermodynamics and able to differentiate heat and temperature.*	3	3	3	2	2	2	2	-	-	2	2	2	3	2
CO2:	*Apply the law of thermodynamics to open and closed systems and calculate entropy and availability.*	3	3	3	2	2	2	2	-	-	2	2	2	3	2
CO3:	*Identify and analyze the phase changes of pure substances.*	3	3	3	2	2	2	2	-	-	2	2	2	3	2
CO4:	*Derive simple thermodynamic relations of ideal and real gases and distinguish properties of gas mixture.*	3	3	3	2	2	2	2	-	-	2	2	2	3	2
CO5:	*Analyze the properties of moist air and its use in psychometric processes.*	3	3	3	2	2	2	2	-	-	2	2	2	3	2
	Average	**3**	**3**	**3**	**2**	**2**	**2**	**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 - III

		L	T	P	C
20ME313	**FLUID MECHANICS AND MACHINERY**	3	0	0	3

Prerequisite : *Engineering Physics*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explore the various properties of fluid flow.*	*Understand*
CO2:	*Analyze major and minor losses in pipes.*	*Analyze*
CO3:	*Modeling of fluid flow with dimensional quantities*	*Apply*
CO4:	*Investigate the performance of different pumps.*	*Evaluate*
CO5:	*Evaluate the performance of turbines.*	*Evaluate*

UNIT - I FLUID PROPERTIES AND FLUID FLOW [09]

Units & Dimensions, Properties of fluids - Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws - capillarity and surface tension, Pressure measurement.
Fluid Flow-Types, rate of flow, continuity equation, momentum equation, Bernoulli's equation and its applications.

UNIT - II FLOW THROUGH CIRCULAR CONDUITS [09]

Flow through circular conduits and circular annuli, Boundary layer concepts, Hydraulic and energy gradient, Darcy - Weisbach equation, Friction factor and Moody diagram, Minor losses. Flow through pipes in series and in parallel.

UNIT - III DIMENSIONAL ANALYSIS [09]

Dimension and units: Buckingham's Π theorem, Dimensionless parameters, Models and similitude, Applications of dimensionless parameters.

UNIT - IV PUMPS [09]

Euler's equation- Theory of roto-dynamic machines-Various efficiencies-Velocity components at entry and exit of the rotar-Velocity triangles-Centrifugal pumps- Performance curves- Reciprocating pump- Indicator diagrams-Air vessels-Rotary pumps-Classification and working.

UNIT - V TURBINES [09]

Classification of turbines-head and efficiencies-velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis and Kaplan turbines- working principles- draft tube- performance curve for turbines.

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

Text Books :

1 Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi, (2015).

2 Kumar. K.L., Engineering Fluid Mechanics, Eurasia Publishing House (P) Ltd., New Delhi, Seventh Edition, 1995.

Reference Books :

1 Som S K., Gautam Biswas, Chakraborty S., Introduction to Fluid Mechanics and Fluid Machines, (English), McGraw Hill Education, Third Edition, 2011.

2 Rathakrishnan. E, Fluid Mechanics - An Introduction , PHI Learning, Delhi, India, Third Edition, 2012.

3 Ramamrutham. S, Fluid Mechanics, Hydraulics and Fluid Machines, Dhanpat Rai & Sons, Delhi, 2014.

4 Streeter. V. L., and Wylie, E.B., Fluid Mechanics, McGraw Hill, 1983.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : III **Regulation : R2020**

Course Code : 20ME313 **Course Name : 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:	*Explore the various properties of fluid flow.*	3	3	2	2	2	-	-	-	-	2	-	2	3	2
CO2:	*Analyze major and minor losses in pipes.*	3	3	2	2	2	-	-	-	-	2	-	2	3	2
CO3:	*Modeling of fluid flow with dimensional quantities*	3	3	2	2	2	-	-	-	-	2	-	2	3	2
CO4:	*Investigate the performance of different pumps.*	3	3	2	2	2	-	-	-	-	2	-	2	3	2
CO5:	*Evaluate the performance of turbines.*	3	3	2	2	2	-	-	-	-	2	-	2	3	2
	Average	**3**	**3**	**2**	**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 - III

20ME314	MANUFACTURING TECHNOLOGY - 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:	*Explore the knowledge on metal cutting theory.*	*Remember*
CO2:	*Identify the construction of centre lathe and its operations*	*Apply*
CO3:	*Gain knowledge about metal casting processes.*	*Understand*
CO4:	*Analyze and Select the metal joining processes.*	*Analyze*
CO5:	*Explore various metal forming processes.*	*Evaluate*

UNIT - I THEORY OF METAL CUTTING [09]

Introduction: material removal processes, types of machine tools - theory of metal cutting: chip formation, orthogonal cutting, cutting force calculations - cutting tool materials, tool wear, tool life, surface finish, cutting fluids.

UNIT - II CENTRE LATHE [09]

Centre lathe, constructional features, cutting tool geometry, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation.

UNIT - III METAL CASTING PROCESSES [09]

Sand moulds - Types and properties of Moulding sand – Pattern – Types and selection of patterns - Pattern materials and allowances - Types of Moulding processes - Core making - Methods of Sand testing - Types of moulding machines - Melting furnaces - Working principle of Special casting processes - Shell, investment casting - Ceramic mould - Lost Wax process - Pressure die casting - Centrifugal casting - CO_2 process - Casting defects - Inspection methods.

UNIT - IV METAL JOINING PROCESSES [09]

Fusion welding processes - Arc welding equipments - Electrodes - Coating and specifications- Principles and applications of TIG, MIG, Submerged, Plasma arc welding, Laser beam welding processes. Solid state welding –Friction, Explosive and ultrasonic welding -Gas welding - Equipments used - Flame characteristics - Filler and Flux materials - Brazing and soldering process.- Weld defects

UNIT - V METAL FORMING PROCESSES [09]

Hot working and cold working of metals - Forging process - Types of Forging - Rolling of metals - Principle of wire drawing - Tube drawing - Principles of Extrusion - Types of Extrusion - Hot and Cold extrusion - Sheet metal characteristics - Typical shearing operations, bending and drawing operations - Stretch forming operations.

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

Text Books :

1 Hajra Choudhury, Elements of Workshop Technology, Vol. I and II, Media Promotors Pvt. Ltd., Mumbai, 2008.

2 Gowri, S., Hariharan, P., and Suresh Babu, A., Manufacturing Technology 1, Pearson Education , 2008.

Reference Books :

1 Magendran, B.S., Parashar & Mittal, R.K., Elements of Manufacturing Processes, Prentice Hall of India, 2003.

2 Rao, P.N., Manufacturing Technology,Tata McGraw-Hill Publishing Limited, Third Edition, 2013.

3 Sharma, P.C., A text book of production technology ,S. Chand and Company, Fourth Edition, 2007.

4 Begman, Manufacturing Process, John Wilely & Sons, Eighth Edition, 2005.

5 Serope Kalpajian, Steven R.Schmid, Manufacturing Engineering and Technology, Pearson Education, Inc. 2010.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : III **Regulation : R2020**

Course Code : 20ME314 **Course Name : MANUFACTURING TECHNOLOGY - I**

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 knowledge on metal cutting theory.*	3	2	3	2	3	-	2	-	3	-	-	2	3	3
CO2:	*Identify the construction of centre lathe and its operations*	3	2	3	2	3	-	2	-	3	-	-	2	3	3
CO3:	*Gain knowledge about metal casting processes.*	3	2	3	2	3	-	2	-	3	-	-	2	3	3
CO4:	*Analyze and Select the metal joining processes.*	3	2	3	2	3	-	2	-	3	-	-	2	3	3
CO5:	*Explore various metal forming processes.*	3	2	3	2	3	-	2	-	3	-	-	2	3	3
	Average	**3**	**2**	3	**2**	**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 - III

		L	T	P	C
20ME315	**BASIC MECHANICS**	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 in the Law of mechanics, forces and equilibrium of particles.*	*Understand*
CO2:	*Analyze moments, couples and equilibrium of rigid bodies and frictional forces.*	*Analyze*
CO3:	*Determine centroid and moment of inertia using integration methods.*	*Apply*
CO4:	*Examine the concepts of Kinematics and Kinetics*	*Evaluate*
CO5:	*Interpret the elements of rigid body dynamics.*	*Understand*

UNIT - I BASICS AND EQUILIBRIUM OF PARTICLES [12]

Introduction - units and Dimensions - Laws of Mechanics - Lame's Theorem Parallelogram and triangular Law of forces - Vector operations: addition, subtraction, dot product, cross product -Coplanar Forces - resolution and composition of forces - Equilibrium of a particle - forces in space - equilibrium of a particle in space - equivalent force systems- principle of transmissibility-single equivalent force.

UNIT - II EQUILIBRIUM OF RIGID BODIES AND FRICTION [12]

Moment of a force about point - Varignon's theorem- Moment of a couple-resolution of force in to force couple system-resultant of coplanar non concurrent system -equilibrium of Rigid bodies in two dimensions. Frictional force- Frictional resistance - classification of friction- laws of friction - coefficient of friction-angle of friction - angle of repose - simple contact friction-Wedge friction, screw friction, rolling resistance, Ladder friction, Belt friction.

UNIT - III PROPERTIES OF SURFACES [12]

Properties of sections - area, centroids ,volumes- T section, I section, Angle section, moment of inertia first moment of inertia, second moment of inertia and product moment of inertia, Parallel axis theorem - Perpendicular axis theorem, polar moment of inertia, radius of gyration, mass moment of inertia.

UNIT - IV DYNAMICS OF PARTICLES [12]

Kinematics: Rectilinear & Curvilinear motion of particles, displacements velocity and acceleration.

Kinetics: Newton's law, Work Energy method, Impulse and Momentum, Impact of elastic bodies.

UNIT-V ELEMENTS OF RIGID BODY DYNAMICS [12]

Translation and rotation of rigid bodies-velocity and acceleration -General plane motion, Absolute motion-relative motion Crank - connecting rod mechanism, Instantaneous centre of rotation.

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

Text Books :

1 Palanisamy, M.S., Nagan, S. Engineering Mechanics -Statics and Dynamics, TataMcgraw-Hill, 2001.

2 Natesan, S.C.,Engineering Mechanics Statics and Dynamics, Umesh Publications ,Naisarak ,Delhi,2005.

Reference Books :

1 Beer F.P. and Johnson Jr. E.R., Vector Mechanics for Engineers, Vol. I Statics and Vol. II Dynamics, McGraw-Hill International Edition, 2004.

2 Rajasekaran, S. and Sankarasubramanian, G., Engineering Mechanics Statics and Dynamics, Vikas Publishing House Pvt. Ltd., Third Edition, 2005.

3 Irving H. Shames and Krishna MohanaRao. G., Engineering Mechanics - Statics and Dynamics, Pearson Education, Fourth Edition, 2006.

4 Hibbeller, R.C. and Ashok Gupta, Engineering Mechanics: Statics and Dynamics, Pearson Education, Eleventh Edition, 2010.

5 Kumar, K.L., Engineering Mechanics, Tata McGraw-Hill Publishing company, New Delhi,Third Revised Edition,2008.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : III **Regulation : R2020**

Course Code : 20ME315 **Course Name : BASIC MECHANICS**

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 in the Law of mechanics, forces and equilibrium of particles.*	3	3	2	3	-	-	2	-	-	2	-	2	3	2
CO2:	*Analyze moments, couples and equilibrium of rigid bodies and frictional forces.*	3	3	2	3	-	-	2	-	-	2	-	2	3	2
CO3:	*Determine centroid and moment of inertia using integration methods.*	3	3	2	3	-	-	2	-	-	2	-	2	3	2
CO4:	*Examine the concepts of Kinematics and Kinetics*	3	3	2	3	-	-	2	-	-	2	-	2	3	2
CO5:	*Interpret the elements of rigid body dynamics.*	3	3	2	3	-	-	2	-	-	2	-	2	3	2
	Average	**3**	**3**	**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**

SEMESTER - III

		L	T	P	C
20ME316	**ENGINEERING METROLOGY AND MEASUREMENTS**	3	0	0	3

Prerequisites : *Engineering physics, Fluid Mechanics and Machinery*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Demonstrate the basic concept of measurements and standards.*	*Understand*
CO2:	*Apply linear and angular measurements in engineering applications.*	*Apply*
CO3:	*Analyze the various form measurement techniques.*	*Analyze*
CO4:	*Explore the advances in metrology using LASER and CMM.*	*Create*
CO5:	*Infer various instruments for measuring physical properties.*	*Understand*

UNIT - I CONCEPTS OF MEASUREMENTS [09]

General concepts - generalized measurement system - units and standards – measuring instruments- sensitivity, stability, range, accuracy and precision - static and dynamic response -repeatability - systematic and random errors - correction, calibration - calibration of instruments- vernier, micrometer, vernier height gauge - quality standards - introduction to dimensional and geometric tolerancing - interchangeability.

UNIT - II LINEAR AND ANGULAR MEASUREMENTS [09]

Abbe's principle, linear measuring instruments - vernier, micrometer, slip gauges and classification, tool makers microscope - interferometry, optical flats - limit gauges, Taylor's principle of gauge design. Comparators- mechanical, pneumatic and electrical comparators -applications. Angular measurements- sine bars, sine center, bevel protractor and angle dekkor.

UNIT - III FORM MEASUREMENTS [09]

Measurement of screw threads - thread gauges, floating carriage micrometer - measurement of gear tooth thickness - constant chord and base tangent method - Gleason gear testing machine - radius measurements - surface roughness - equipment and parameters - straightness -flatness and roundness measurements.

UNIT – IV ADVANCES IN METROLOGY [09]

Precision instruments based on laser - principles - laser interferometer - white light - photogrammetric applications in measurements - coordinate measuring machine (CMM) - need, construction, types, applications - computer aided inspection.

UNIT-V MEASUREMENT OF PHYSICAL PROPERTIES [09]

Measurement of force, torque, power:–mechanical, pneumatic, hydraulic and electrical transducer–Flow measurement: Special methods – Temperature: bimetallic strip, pressure thermometers, thermocouples, thermister and Resistance Temperature Detector (RTD)-Pyrometer, 3D scanner CAD model, Video measuring machine.

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

Text Books :

1 Anand K. Bewoor, Vinay A. Kulkarani, Metrology and Measurement, McGraw Hill Publishing Co. Ltd., First Edition, 2014.

2 Tayal A.K., Instrumentation and Mechanical Measurements, Galgotia Publications, New Delhi, Second Edition ,2013.

Reference Books :

1 Gupta I.C., Engineering Metrology, Dhanpat Rai Publication, seventh Edition, 2012.

2 Rajput R.K., Mechanical Measurements and Instrumentation, S.K.Kataria & Sons Publishers, New Delhi, second Edition, 2012.

3 Beckwith, Marangoni, Lienhard, Mechanical Measurement, Pearson Education, sixth edition 2006.

4 http://annauniversityweb.com/me6504-metrology-and-measurements-lecture-notes/

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : III **Regulation : R2020**

Course Code : 20ME316 **Course Name : ENGINEERING METROLOGY AND MEASUREMENTS**

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 basic concept of measurements and standards.*	3	2	2	-	3	-	2	2	-	2	-	2	3	2
CO2:	*Apply linear and angular measurements in engineering applications.*	3	2	2	-	3	-	2	2	-	2	-	2	3	2
CO3:	*Analyze the various form measurement techniques.*	3	2	2	-	3	-	2	2	-	2	-	2	3	2
CO4:	*Explore the advances in metrology using LASER and CMM.*	3	2	2	-	3	-	2	2	-	2	-	2	3	2
CO5:	*Infer various instruments for measuring physical properties.*	3	2	2	-	3	-	2	2	-	2	-	2	3	2
Average		**3**	**2**	**2**	**-**	**3**	**-**	**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 - III

20ME321 **METROLOGY AND MEASUREMENTS LABORATORY**

L	T	P	C
0	0	3	1

Prerequisites: *Manufacturing Technology Laboratory, Strength of Materials Laboratory.*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Measure the dimensions of components and calibrate the measuring instruments.*	*Remember*
CO2:	*Investigate gear tooth dimensions using gear tooth vernier and profile projector.*	*Understand*
CO3:	*Explore the angle, straightness and flatness of the components.*	*Evaluate*
CO4:	*Hands on practice of Comparators and tool maker's microscope.*	*Analyze*
CO5:	*Apply measuring techniques for Force, Torque and Temperature.*	*Apply*

LIST OF EXPERIMENTS

1. Checking dimensions of parts using vernier, micrometer, height and depth gauge.
2. Calibration of micrometer and vernier caliper using slip gauges.
3. Measurement of gear tooth dimensions.
4. Measurement of gear tooth profile using profile projector.
5. Measurement of angle using sine bar / sine center.
6. Measurement of straightness and flatness using autocollimator.
7. Component inspection by electrical comparator and Go - No Go gauges.
8. Tool geometry measurement using tool makers microscope.
9. Measurement of displacement, force and torque.

Measurement of temperature using thermocouple**.**

Total = 30 Periods

LIST OF EQUIPMENT

1.	Micrometer	- 5 Nos.
2.	Vernier Caliper	- 5 Nos.
3.	Vernier Height Gauge	- 2 Nos.
4.	Vernier depth Gauge	- 2 Nos.
5.	Slip Gauge Set	- 1 No.
6.	Gear Tooth Vernier	- 1 No.
7.	Sine Bar	- 1 No.
8.	Sine Center	- 1 No.
9.	Bevel Protractor	- 1 No.
10.	Floating Carriage Micrometer	- 1 No.
11.	Profile Projector	- 1 No.
12.	Tool Makers Microscope	- 1 No.
13.	Mechanical / Electrical Comparator	- 1 No.
14.	Autocollimator	- 1 No.
15.	Temperature Measuring Setup	- 1 No.
16.	Displacement Measuring Setup	- 1 No.
17.	Force Measuring Setup	- 1 No.
18.	Torque Measuring Setup	- 1 No.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : III **Regulation : R2020**

Course Code : 20ME321 **Course Name : METROLOGY AND MEASUREMENTS LABORATORY**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Measure the dimensions of components and calibrate the measuring instruments.*	3	2	2	-	3	-	2	2	-	2	-	2	3	2
CO2:	*Investigate gear tooth dimensions using gear tooth vernier and profile projector.*	3	2	2	-	3	-	2	2	-	2	-	2	3	2
CO3:	*Explore the angle, straightness and flatness of the components.*	3	2	2	-	3	-	2	2	-	2	-	2	3	2
CO4:	*Hands on practice of Comparators and tool maker's microscope.*	3	2	2	-	3	-	2	2	-	2	-	2	3	2
CO5:	*Apply measuring techniques for Force, Torque and Temperature.*	3	2	2	-	3	-	2	2	-	2	-	2	3	2
	Average	**3**	**3**	**2**	**-**	**3**	**-**	**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 - III

20ME322	**FLUID MECHANICS AND MACHINERY LABORATORY**	L	T	P	C
		0	0	3	1

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

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Determine flow properties of fluids through orifice meter and venturi meter.*	*Evaluate*
CO2:	*Demonstrate the role of friction in flow through pipes.*	*Understand*
CO3:	*Measure the flow parameters using Pitot tube.*	*Evaluate*
CO4:	*Obtain the performance characteristics of various pumps.*	*Analyze*
CO5:	*Evaluate the performance of various turbines*	*Evaluate*

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.
4. Determination of friction factor for a given set of pipes.
5. Flow measurement using Pitot tube.
6. Performance test on centrifugal pump.
7. Performance test on reciprocating pump.
8. Performance test on Gear pump.
9. Performance test on Pelton wheel turbine.
10. Performance test on Kaplan turbine.

Total = 30 Periods

LIST OF EQUIPMENT

1. Orifice meter setup - 1 No.
2. Venturi meter setup - 1 No.
3. Rotameter setup - 1 No.
4. Pipe Flow analysis setup - 1 No.
5. Pitot tube set up - 1 No.
6. Centrifugal pump setup - 1 No.
7. Reciprocating pump setup - 1 No.
8. Gear pump setup - 1 No.
9. Pelton wheel turbine setup - 1 No.
10. Kaplan turbine setup - 1 No.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : III **Regulation : R2020**

Course Code : 20ME322 **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	PSO1	PSO2
CO1:	*Determine flow properties of fluids through orifice meter and venturi meter.*	3	3	2	3	3	-	2	-	-	2	2	2	3	2
CO2:	*Demonstrate the role of friction in flow through pipes.*	3	3	2	3	3	-	2	-	-	2	2	2	3	2
CO3:	*Measure the flow parameters using Pitot tube.*	3	3	2	3	3	-	2	-	-	2	2	2	3	2
CO4:	*Obtain the performance characteristics of various pumps.*	3	3	2	3	3	-	2	-	-	2	2	2	3	2
CO5:	*Evaluate the performance of various turbines.*	3	3	2	3	3	-	2	-	-	2	2	2	3	2
	Average	**3**	**3**	**2**	**3**	**3**	**-**	**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 - III

		L	T	P	C
20HR351	**CAREER DEVELOPMENT SKILLS – I** (Common to All Branches)	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:	*Have competent knowledge on grammar with an understanding of its basic rules.*	*Understand*
CO2:	*Communicate effectively and enhance interpersonal skills with renewed self – confidence*	*Apply*
CO3:	*Construct sentence in English and make correction*	*Apply*
CO4:	*Perform oral communication in any formal situation*	*Create*
CO5:	*Develop their LSRW skills.*	*Understand*

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

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

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

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

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

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

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

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

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

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

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

Text Books :

1 Anne Laws, Writing Skills, Orient Black Swan., Hyderabad, 2011.

2 Sarah Freeman, Written Communication in English, Orient Black Swan, Hyderabad, First Edition, 2015

Reference Books :

1 Raj N Bakshmi, English Grammar Practice, Orient Black Swan, Hyderabad, First Edition, 2009.

2 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2005.

3 Thakur K B Sinha, Enrich Your English, Vijay Nicole, Chennai, First Edition, 2005.

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

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DEPARTMENT OF MECHANICAL 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

		L	T	P	C
20MA434	**OPERATIONS RESEARCH**				
	(B.E. Mechanical Engineering)	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:	*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 [12]

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 [12]

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 [12]

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 [12]

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 [12]

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 = 15) = 60 Periods

Text Books :

1 P.K. Gupta and Man Mohan, Problems in Operations Research, S. Chand and Co, New Delhi ,Fourteenth edition, 2016.

2 Wayne. L. Winston, Operations research applications and algorithms, Thomson learning, New Delhi, Tenth edition, 2016.

Reference Books :

1 Hira and Gupta, Problems in Operations Research, S. Chand and Co,New Delhi,Eighth edition, 2015.

2 Taha H.A, Operation Research, Pearson Education,New Delhi, sixth edition, 2016.

3 J k Sharma , Operation Research, Macmillan India Pvt. Ltd., New Delhi, Seventh edition,2007

4 https://en.wikipedia.org/wiki/Resource_management

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : IV **Regulation : R2020**

Course Code : 20MA434 **Course Name : OPERATIONS RESEARCH**

CO PO MAPPING

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**

SEMESTER -IV

		L	T	P	C
20ME412	**STRENGTH OF MATERIALS**	3	1	0	4

Prerequisite: Basic Mechanics

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Acquire knowledge about Stress, strain relationships in Rigid and Deformable bodies*	*Understand*
CO2:	*Explore the various loads and stresses acting on beams*	*Analyze*
CO3:	*Apply Deflection of beams and columns for failure analysis*	*Analyze*
CO4:	*Use the torsion theory in circular shafts*	*Remember*
CO5:	*Analyze the complex stresses in two dimensions*	*Analyze*

UNIT - I STRESS, STRAIN, DEFORMATION OF SOLIDS [12]

Rigid and Deformable bodies – Strength, Stiffness and Stability – concept of Stress and strain; stress strain diagrams, Tensile, Compressive and Shear stresses – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants and their relationships – 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 diagrams for different loadings in Cantilever, Simply supported and Overhanging 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 AND COLUMNS [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 IN CIRCULAR SHAFTS [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 .

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

Text Books :

1 *Dr .R,K Bansal ,Strength of materials, Laxmi publications, sixth Edition, 2015.*

2 *Strength of materials by R.Subramanian ,Oxford university press, New Delhi*

Reference Books :

1 *Nash W.A, Theory and problems in Strength of Materials, Schaum Outline Series, McGraw-Hill Book Co, New York, Fourth Edition,1998.*

2 *Kazimi S.M.A, Solid Mechanics, Tata McGraw-Hill Publishing Co., New Delhi, Third Edition,2004*

3 *Ryder G.H, Strength of Materials, Macmillan India Ltd., Third Edition, 2002*

4 *Popov E.P, Engineering Mechanics of Solids, Prentice-Hall of India, New Delhi, Third Edition, 2004*

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : IV **Regulation : R2020**

Course Code : 20ME412 **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 Stress, strain relationships in Rigid and Deformable bodies*	3	3	3	3	-	-	-	-	-	-	-	3	3	2
CO2	*Explore the various loads and stresses acting on beams*	3	3	3	3	-	-	-	-	-	-	-	3	3	2
CO3	*Apply Deflection of beams and columns for failure analysis*	3	3	3	3	-	-	-	-	-	-	-	3	3	2
CO4	*Use the torsion theory in circular shafts*	3	3	3	3	-	-	-	-	-	-	-	3	3	2
CO5	*Analyze the complex stresses in two dimensions*	3	3	3	3	-	-	-	-	-	-	-	3	3	2
	Average	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**2**

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

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

SEMESTER - IV

20ME413	**THERMAL ENGINEERING**	L	T	P	C
	(Use of Steam table and Mollier Chart is Permitted for Examination)	3	0	0	3

Prerequisite: Engineering Thermodynamics

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

CO1:	*Explore various components and working principles of SI and CI engine.*	*Remember*
CO2:	*Investigate the processes of various gas power cycles*	*Analyze*
CO3:	*Demonstrate the knowledge on flow through nozzles and turbines.*	*Understand*
CO4:	*Analyze the performance of air compressor.*	*Analyze*
CO5:	*Evaluate the performances of refrigeration and air conditioning systems.*	*Evaluate*

UNIT - I INTERNAL COMBUSTION ENGINES [09]

I.C. Engines - classification, components and their functions, working principles of two stroke and four stroke (petrol and diesel)engines, actual and ideal valve timing diagram and port timing diagram, carburetor systems, fuel injection systems, lubrication system, cooling and ignition System. Comparison-two stroke and four stroke engines, SI and CI engines. combustion phenomena(description only) - octane and cetane number,pre ignition, detonation and knocking, delay period, supercharging, exhaust emission in SI and CI engines.

UNIT - II GAS POWER CYCLES [09]

. Introduction, Otto, Diesel, Dual, Brayton cycles, calculation of work done, mean effective pressure and air standard efficiency and comparison of gas power cycles.

UNIT - III STEAM NOZZLES AND TURBINES [09]

Steam Nozzles: function of nozzle - applications and types, flow through nozzles - thermodynamic analysis, effect of friction, Maximum discharge, co-efficient of nozzle. supersaturated flow.

Steam Turbines: impulse and reaction principles, compounding methods, velocity triangles, axial and tangential components, speed regulations, power developed, blade or diagram efficiency, condition for maximum efficiency.

UNIT - IV AIR COMPRESSOR [09]

Classification and working principle of various types of compressors, Work of compression with and without clearance, volumetric efficiency, isothermal efficiency and isentropic efficiency of reciprocating compressors, multistage air compressor with inter cooling, work of multistage air compressor.

UNIT - V REFRIGERATION AND AIR CONDITIONING [09]

Refrigeration system: vapour compression refrigeration cycle - super heat, sub cooling, performance calculations (COP calculations). vapour absorption system, ammonia–water, lithium bromide – water systems (description only).

Air conditioning system: processes, types and working principles, concept of RSHF, GSHF, ESHF, cooling load calculations.

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

Text Books :

1 Rajput, R. K., Thermal Engineering , S.Chand Publishers , 2010.

2 Kothandaraman, C.P., Domkundwar, S.Domkundwar, A.V., A Course in Thermal Engineering, DhanpatRai & sons, Fifth edition, 2002.

Reference Books :

1 Arora, C.P., Refrigeration and Air Conditioning, Tata McGraw-Hill Publishers, Third Edition, 2014.

2 Ganesan, V., Internal Combustion Engines , Tata Mcgraw-Hill, Fourth Edition, 2012.

3 Singhal B.L., Thermal Engineering, Macmillan Publishers India Ltd., 2011.

4 Rathore, Thermal Engineering, McGraw Hill Education India, 2010

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : IV **Regulation : R2020**

Course Code : 20ME413 **Course Name : THERMAL 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 various components and working principles of SI and CI engine.*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
CO2:	*Investigate the processes of various gas power cycles*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
CO3:	*Demonstrate the knowledge on flow through nozzles and turbines.*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
CO4:	*Analyze the performance of air compressor.*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
CO5:	*Evaluate the performances of refrigeration and air conditioning systems.*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
	Average	**3**	**2**	**2**	**3**	**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 - IV

20ME414	**MANUFACTURING TECHNOLOGY – II**	L	T	P	C
		3	0	0	3

Prerequisite: *Manufacturing Technology – I.*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1	*Identify the basic concepts of special purpose lathe.*	*Apply*
CO2	*Study the constructional features of reciprocating machine tools*	*Remember*
CO3	*Explore the constructional features of special purpose machines.*	*Apply*
CO4	*Interpret the super finishing methods for machined surfaces*	*Analyze*
CO5	*illustrate the construction of CNC machines and its programming methods*	*Understand*

UNIT - I SPECIAL PURPOSE LATHES [09]

Capstan and turret lathes – tool layout – Automatic lathe - single spindle, Swiss type, Automatic screw type, Multi spindle - Turret indexing mechanism, Bar feed mechanism.

UNIT - II RECIPROCATING MACHINE TOOLS, MILLING AND GEAR CUTTING [09]

Working principles of shaper, planer, slotting machine – specifications, work holding and tool holding devices - Working principles of Milling machines - types, Cutters, indexing mechanisms – Working principles of Gear cutting, forming, generation, construction of gear milling, shaping and gear hobbing – Finishing of gears.

UNIT - III SPECIAL PURPOSE MACHINE TOOLS [09]

Drilling and boring machines- working principles and classifications - Sawing machine: hack saw, band saw, circular saw; broaching machines: broach construction - push, pull, surface and continuous broaching machines.

UNIT - IV SUPER FINISHING PROCESSES [09]

Grinding wheel - specifications and selection, types of grinding process - cylindrical grinding, surface grinding, centreless grinding and internal grinding - honing, lapping, super finishing, polishing and buffing.

UNIT - V NUMERICAL CONTROL MACHINES [09]

Numerical control (NC) machine tools - CNC: types, constructional details. Part programming fundamentals - manual programming - computer assisted part programming. micromachining — wafer machining

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

Text Books :

1 Hajra Choudry, S. K., Elements of Work Shop Technology – Vol. II, Media Promoters. 2006
2 HMT, Production Technology, Tata McGraw-Hill, 2002.
3 Manufacturing Processes By R. K. Rajpu.2016

Reference Books :

1 Rao, P.N., Manufacturing Technology: Metal Cutting and Machine Tools, Tata McGraw–Hill, New Delhi, 2013.
2 Sharma, P.C., A Text Book of Production Engineering, S. Chand and Co. Ltd, Fourth edition, 2010.
3 Helmi A. Youssef, Hassan A. El-Hofy, Mahmoud H. Ahmed, Manufacturing Technology: Materials, Processes, and Equipment, CRC Press, 2011.
4 Nagendra Parashar, B. S., Mittal, R. K., Elements of Manufacturing Processes, PHI Learning Pvt. Ltd, 2004.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : IV **Regulation : R2020**

Course Code : 20ME414 **Course Name : MANUFACTURING TECHNOLOGY – II**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Identify the basic concepts of special purpose lathe.*	3	3	2	3	3	-	2	-	-	2	-	2	3	2
CO2	*Study the constructional features of reciprocating machine tools*	3	3	2	3	3	-	2	-	-	2	-	2	3	2
CO3	*Explore the constructional features of special purpose machines.*	3	3	2	3	3	-	2	-	-	2	-	2	3	2
CO4	*Interpret the super finishing methods for machined surfaces*	3	3	2	3	3	-	2	-	-	2	-	2	3	2
CO5	*illustrate the construction of CNC machines and its programming methods*	3	3	2	3	3	-	2	-	-	2	-	2	3	2
	Average	**3**	**3**	**2**	**3**	**3**	**-**	**2**	**-**	**-**	**2**	**-**	**2**	**3**	**2**

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

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

SEMESTER - IV

20ME415	**ENGINEERING MATERIALS AND METALLURGY**	L	T	P	C
		3	0	0	3

Prerequisite: *Engineering Physics, Applied Physics.*

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

CO1:	*Demonstrate the structure, composition and properties of metals, alloys and non-metals.*	*Understand*
CO2:	*Apply various heat-treatment processes in metals.*	*Apply*
CO3:	*Investigate mechanical properties of metals through various testing methods.*	*Create*
CO4:	*Identify suitable alloy materials for ferrous and non ferrous metal alloys.*	*Apply*
CO5:	*Show the properties and applications of Non-metallic materials.*	*Remember*

UNIT - I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS [09]

Constitution of alloys - Solid solutions, substitutional and interstitial - phase diagrams, Isomorphous, eutectoid, eutectic, peritectic, and peritectoid reactions, Iron - Iron carbide equilibrium diagram. Classification of steels and cast Irons, microstructure, properties and applications.

UNIT - II HEAT TREATMENT [09]

Definition – Full annealing, stress relief, recrystallisation and spheroidizing –normalising, quenching, hardening and tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on Time Temperature Transformation (TTT) diagram, Critical Cooling Rate (CCR) – Hardenability, Jominy end quench test – Austempering, Martempering – case hardening, carburising, nitriding, cyaniding, carbonitriding – Flame and Induction hardening.

UNIT - III MECHANICAL PROPERTIES AND TESTING [09]

Mechanism of plastic deformation, slip and twinning - Types of fracture - Testing of materials under tension, compression and shear loads - Hardness tests (Brinell, Vickers and Rockwell), Impact test - Izod and Charpy, Fatigue and creep tests, fracture toughness tests.

UNIT - IV FERROUS AND NON FERROUS ALLOYS [09]

Effect of alloying additions on steel Manganese (Mn), Silicon (Si), Chromium (Cr), Molybdenum (Mo),Vanadium (V), Titanium (Ti) and Tungsten (W) - stainless and tool steels – HSLA maraging steels – Gray, White, malleable, spheroidal – Graphite - alloy cast irons. Copper and Copper alloys –Brass, Bronze and Cupronickel –Aluminum and Aluminum - Copper –precipitation strengthening treatment.

UNIT - V NON-METALLIC MATERIALS [09]

Polymers – types of polymer, commodity and engineering polymers –Glass transition andmelting temperature of polymers – Structures, Properties and applications of Polyethylene (PE), Polypropylene (PP), Polystyrene (PS), Polyvinylchloride (PVC), Polycarbonate (PC), Polyamide (PA), Polyimide (PI), Polyamide-imide (PAI), Poly Tetra Fluro Ethylene (PTFE) – Urea and Phenol, Polyurethane, Polystyrene, Thermoplastic polyurethane (TPU), Natural Rubber. Formaldehydes –Engineering Ceramics –Properties and applications of Alumina (Al_2O_3), Silicon Carbide (SiC), Silicon Nitride (Si_3N_4) – Glass annealing – Fibre and particulate reinforced composites, Powder metallurgy: Process and applications.

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

Text Books :

1 Dr.V.Jayakumar., A text book of ENGINEERING MATERIALS AND METALLURGY, A.R.S Publication,2019.

2 Khanna, O.P., A text book of Materials Science and Metallurgy, Dhanpat Rai Publications, 2013.

3 Raghavan,V., Materials Science and Engineering, PHI Learning Pvt. Ltd., Sixth Edition, 2015.

Reference Books :

1 Dieter George E., Mechanical Metallurgy, McGraw-Hill, New York, Third Edition, 2013.

2 Raghavan V., Materials Science and Engineering, Prentice Hall of India Pvt. Ltd., New Delhi, Fifth Edition, 2018.

3 Premamoy Ghosh, Polymer Science and Technology-Plastics, Rubber, blends and CompositesII, , Tata McGraw Hill Publishing Company, New Delhi, Third Edition ,2013.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : IV **Regulation : R2020**

Course Code : 20ME415 **Course Name : ENGINEERING MATERIALS AND METALLURGY**

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 structure, composition and properties of metals, alloys and non-metals.*	3	2	2	2	2	-	-	2	-	-	-	3	3	2
CO2	*Apply various heat-treatment processes in metals.*	3	2	2	2	2	-	-	2	-	-	-	3	3	2
CO3	*Investigate mechanical properties of metals through various testing methods.*	3	2	2	2	2	-	-	2	-	-	-	3	3	2
CO4	*Identify suitable alloy materials for ferrous and non ferrous metal alloys.*	3	2	2	2	2	-	-	2	-	-	-	3	3	2
CO5	*Show the properties and applications of Non-metallic materials.*	3	2	2	2	2	-	-	2	-	-	-	3	3	2
	Average	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**3**	**3**	**2**

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

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

SEMESTER - IV

20ME416	**MACHINE DRAWING**	L	T	P	C
		1	3	0	4

Prerequisite: *Engineering Drawing.*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Gain the knowledge of machine drawing standards.*	*Evaluate*
CO2:	*Explore the details of different types of fasteners for machine design.*	*Analyze*
CO3:	*Demonstrate views of sliding bearing details.*	*Understand*
CO4:	*Illustrate the assembly details of stepped cone pulley.*	*Understand*
CO5:	*Development of assembly drawings of machine elements.*	*Create*

PART A (40 Marks)

UNIT - I **I.S. CODE OF PRACTICE FOR ENGINEERING DRAWING** **[09]**

Use of scales –limits, Geometric Dimension and tolerances-fits- Selection and designation of sizes - Types of lines - termination of leader line, hatching of sections - revolved and removed sections.

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

Conventional representation of threads - Internal and external types. Bolts and Nuts - Machine and cap screws, set screws, Grub screws, studs. Types of nuts - cap, castle, wile's, lock nuts - Locking by set screw, grooved nut, plate and spring washer. Hexagonal square bolt and nut assembly.

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

Sliding contact bearings - Solid and bushed journal, Plummer block - foot step bearing with radial and thrust ball bearing - symbols of antifriction bearings.

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

Pulley with arms, pulley with web, step cone pulley for flat belt, Pulley for V-belt, fast and loose pulley.

PART B (60 Marks)

UNIT - V **ASSEMBLY DRAWING** **[09]**

Sleeve and Cotter joint, Knuckle joint, Flexible coupling, Plummer Block, Screw jack, Swivel bearing, Tail stock, Machine vice, Milling fixture, Drilling Jig.

Note:

Question paper pattern:

1(a) or 1(b) – Unit - I = 10 Marks
2(a) or 2(b) – Unit - II = 10 Marks
3(a) or 3(b) – Unit - III = 10 Marks
4(a) or 4(b) – Unit - IV = 10 Marks
5(a) or 5(b) – Unit -V = 60 Marks

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

Text Books :

1 Gopalakrishnan, K.R., Machine Drawing, Subhas publications, Bangalore,Twenty edition, 2007.
2 Narayana, K.L., Kannaiah, P.,& Venkata Reddy, K., Machine Drawing, New Age International Ltd.,Third reprint,2003.

Reference Books :

1 Dhawan, Machine Drawing, Sultan Chand and Sons, New Delhi, First Edition, 1996.
2 Bhatt, N.D., Machine Drawing, Wiley Eastern Pvt. Ltd., 1998.
3 BIS Code 919.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : IV **Regulation : R2020**

Course Code : 20ME416 **Course Name : MACHINE 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 the knowledge of machine drawing standards.*	3	-	2	-	2	-	-	2	-	3	-	2	3	2
CO2	*Explore the details of different types of fasteners for machine design.*	3	-	2	-	2	-	-	2	-	3	-	2	3	2
CO3	*Demonstrate views of sliding bearing details.*	3	-	2	-	2	-	-	2	-	3	-	2	3	2
CO4	*Illustrate the assembly details of stepped cone pulley.*	3	-	2	-	2	-	-	2	-	3	-	2	3	2
CO5	*Development of assembly drawings of machine elements.*	3	-	2	-	2	-	-	2	-	3	-	2	3	2
	Average	**3**	**-**	**2**	**-**	**2**	**-**	**-**	**2**	**-**	**3**	**-**	**2**	**3**	**2**

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

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

SEMESTER - IV

		L	T	P	C
20ME421	**THERMAL ENGINEERING LABORATORY**	**0**	**0**	**3**	**1**

Prerequisite : *Engineering Thermodynamics.*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Analyze the valve / port opening and closing time of an IC engine to ensure the efficient combustion of fuels and Recall the formation of steam and its expansion in turbine*	*Analyze*
CO2:	*Evaluate the viscosity, Flash/Fire points of a fuel.*	*Evaluate*
CO3:	*Examine the various characteristics of a 4 stroke petrol/diesel engine for various loads*	*Analyze*
CO4:	*Estimate the various heat losses in an IC engine.*	*Evaluate*
CO5:	*Develop the Morse and Retardation on an IC engine to calculate IHP, BP and various efficiencies.*	*Evaluate*

LIST OF EXPERIMENTS

1) Measurement of
   a) Actual VALVE opening and closing time of 4-stroke diesel engine and draw the diagram.
   b) Actual PORT opening and closing time of 2-stroke Petrol engine and draw the diagram.
2) Study of various Steam Generators and steam turbines.
3) Determination of Viscosity of oil using Red Wood Viscometer.
4) Determination of Flash Point and Fire Point of a fuel.
5) Performance Test on 4-stroke Diesel Engine.
6) Performance Test on 4-stroke Petrol Engine.
7) Heat Balance Test on 4-stroke Petrol Engine.
8) Heat Balance Test on 4-stroke Diesel Engine.
9) Morse test on a multicylinder petrol engine to determine the indicated horse power
10) Retardation Test to find Frictional Power of a Diesel Engine.

Total = 45 Periods

LIST OF EQUIPMENT

1. I.C Engine – 2 stroke and 4 stroke model. -2 set.
2. Red Wood Viscometer. -1 No.
3. Apparatus for Flash and Fire Point. -1 No.
4. 4-stroke Diesel Engine with mechanical loading. -2 No.
5. 4-stroke Diesel Engine with hydraulic loading. -1 No.
6. 4-stroke Diesel Engine with electrical loading. -2 No.
7. Multi-cylinder Petrol Engine. -3 No.
8. Single cylinder Petrol Engine with electrical loading -2 No.
9. Single cylinder diesel engine with electrical loading -2 No.
10. Steam Boiler with turbine setup. -1 No.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : IV **Regulation : R2020**

Course Code : 20ME421 **Course Name : THERMAL ENGINEERING LABORATORY**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Analyze the valve / port opening and closing time of an IC engine to ensure the efficient combustion of fuels and Recall the formation of steam and its expansion in turbine*	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO2	*Evaluate the viscosity, Flash/Fire points of a fuel.*	3	3	2	3	3	-	-	-	-	-	-	2	2	2
CO3	*Examine the various characteristics of a 4 stroke petrol/diesel engine for various loads*	3	3	3	3	3	-	-	-	-	-	-	2	3	2
CO4	*Estimate the various heat losses in an IC engine.*	3	3	3	3	3	-	-	-	-	-	-	2	3	2
CO5	*Develop the Morse and Retardation on an IC engine to calculate IHP, BP and various efficiencies.*	3	2	2	2	2	-	-	-	-	-	-	2	2	2
	Average	**3**	**3**	**3**	**3**	**3**	-	-	-	-	-	-	**2**	**2**	**2**

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

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

SEMESTER - IV

		L	T	P	C
20ME422	**MANUFACTURING TECHNOLOGY LABORATORY**	0	0	3	1

Prerequisite: *Manufacturing Technology I & II*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Perform the various operations in Centre Lathe.*	*Evaluate*
CO2:	*Determine the parameters in metal cutting theory and perform hole operations in flat surfaces.*	*Evaluate*
CO3:	*Demonstrate the use of slotter and shaper.*	*Understand*
CO4:	*Create the different shapes milling and gear hobbing machines.*	*Create*
CO5:	*Apply super finishing operations in typical engineering applications.*	*Apply*

LIST OF EXPERIMENTS

1. Perform Step Turning, Grooving and also cut a metric thread on the given mild steel rod using Lathe.
2. Perform Taper Turning and Drilling as per the given dimensions on the mild steel rod using Lathe.
3. Measure the Cutting Force using tool dynamometer and determine the Shear Angle of the chip.
4. Make the Drilling, Reaming and Tapping operations on the given MS plate.
5. Cutting a Keyway in the given specimen using a Slotter.
6. V - Groove Cutting in Shaping Machine.
7. Machining the required shape using horizontal / vertical milling machine.
8. Gear generation in hobbing machine.
9. Plain Surface Grinding.
10. Cylindrical Grinding.

Total = 45 Periods

LIST OF EQUIPMENT

1. Centre lathe with accessories	- 15 Nos
2. Tool Dynamometer	- 1 No
3. Radial Drilling Machine	- 1 No
4. Slotter	- 1 No
5. Horizontal Milling Machine	- 1 No
6. Vertical Milling Machine	- 1 No
7. Turret and Capstan Lathes	- 1 No each.
8. Gear Hobbing Machine	- 1 No
9. Surface Grinding Machine	- 1 No
10. Cylindrical Grinding Machine	- 1 No
11. Shaper	- 2 Nos

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : IV **Regulation : R2020**

Course Code : 20ME422 **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:	*Perform the various operations in Centre Lathe*	*3*	*3*	*2*	*3*	*3*	*-*	*2*	*-*	*-*	*2*	*-*	*2*	*3*	*2*
CO2:	*Determine the parameters in metal cutting theory and perform hole operations in flat surfaces*	*3*	*3*	*2*	*3*	*3*	*-*	*2*	*-*	*-*	*2*	*-*	*2*	*3*	*2*
CO3:	*Demonstrate the use of slotter and shaper*	*3*	*3*	*2*	*3*	*3*	*-*	*2*	*-*	*-*	*2*	*-*	*2*	*3*	*2*
CO4:	*Create the different shapes milling and gear hobbing machines*	*3*	*3*	*2*	*3*	*3*	*-*	*2*	*-*	*-*	*2*	*-*	*2*	*3*	*2*
CO5:	*Apply super finishing operations in typical engineering applications*	*3*	*3*	*2*	*3*	*3*	*-*	*2*	*-*	*-*	*2*	*-*	*2*	*3*	*2*
	Average	**3**	**3**	**2**	**.3**	**3**	**-**	**2**	**-**	**-**	**2**	**-**	**2**	**3**	**2**

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

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

SEMESTER - IV

		L	T	P	C
20HR472	**CAREER DEVELOPMENT SKILLS - II**	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:	*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 (L= 0, T = 30) = 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 Agarwal. R.S ,A.Modern Approach to Verbal and Non- verbal Reasoning, Revised Edition 2008, Reprint 2009, S.Chand& Co Ltd., New Delhi.

2 AbhijitGuha, "Quantitative Aptitude", Tata McGraw Hill Education, Third Edition, New Delhi, 2020.

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

4 Norman Lewis. W.R., “Word Power Made Easy”, Goyal Publications,2011.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : IV **Regulation : R2020**

Course Code : 20HR472 **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	*Speak and write appropriately by understanding verbal and logical reasoning.*	-	-	-	-	-	-	-	-	2	3	-	3	2	2
CO2	*Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions*	-	-	-	-	-	-	-	-	2	3	-	3	2	2
CO3	*Enhance their skills on quantitative aptitude*	-	-	-	-	-	-	-	-	2	3	-	3	2	2
CO4	*Speak and write appropriately by understanding and applying the basic grammatical rules*	-	-	-	-	-	-	-	-	2	3	-	3	2	2
CO5	*Critically evaluate problems related to quantitative aptitude*	-	-	-	-	-	-	-	-	2	3	-	3	2	2
	Average	-	-	-	-	-	-	-	-	**2**	**3**	**-**	**3**	**2**	**2**

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

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

SEMESTER - V

		L	T	P	C
20HS051	**UNIVERSAL HUMAN VALUES AND UNDERSTANDING HARMONY** (Common To All Branches)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the basic concepts of value education.*	*Understanding*
CO2:	*Distinguish between the self and the body, implement the meaning of harmony in the Co–existence of Self and the Body.*	*Understanding*
CO3:	*Explain the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human–human relationships.*	*Understanding*
CO4:	*Describe the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.*	*Understanding*
CO5:	*Explain the ethical and unethical practices in work environment.*	*Understanding*

UNIT - I INTRODUCTION TO VALUE EDUCATION [09]

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

UNIT - II HARMONY IN THE HUMAN BEING [09]

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

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

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

UNIT - IV HARMONY IN NATURE AND EXISTENCE [09]

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

UNIT - V PROFESSIONAL ETHICS [09]

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

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

Text Books :

1 Gaur R.R., Sangal, R., Bagaria, G.P., A Foundation Course in Human Values and Professional Ethics, Excell Books Pvt. Ltd., New Delhi, First Edition, 2016.

2 Tripaty, A.N., Human Values, New Age International Publishers, 2003.

Reference Books :

1 Ivan Illich, Energy & Equity, The Trinity Press, USA, 1974.

2 Schumacher E.F., Small is Beautiful: a study of economics as if people mattered, Britain, 1973.

3 Seebauer, E.G., Robert L. Berry, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press, 2000.

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

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

DEPARTMENT OF MECHANICAL 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

		L	T	P	C
20ME511	**THEORY OF MACHINES**	3	1	0	4

Prerequisite: *Basic Mechanics*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Design inversions of different mechanisms.*	*Remember*
CO2:	*Sketch velocity and acceleration path of different mechanisms*	*Apply*
CO3:	*investigate balancing of rotating elements*	*Apply*
CO4:	*Distinguish the concept of gyroscopic effects to control kinematics*	*Analyze*
CO5:	*Analyze free and forced vibrations of machine components*	*Analyze*

UNIT - I BASICS OF MECHANISMS [12]

INTRODUCTION: DEFINITIONS: Link or element, kinematic pairs, degrees of freedom, Kinematic chain, Mechanism, structure, Mobility of Mechanism, Inversion, Machine Gashoff's criteria. Kinematic Chains and Inversions: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.

MECHANISMS: Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Straight line motion mechanisms Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms Geneva mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Davis & Ackerman steering gear mechanism

UNIT - II KINEMATICS OF CAMS [12]

. CAMS: Types of cams, Types of followers, Displacement, Velocity and Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-faced follower, Disc cam with oscillating roller follower, Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion

UNIT - III BALANCING OF MACHINERY [12]

BALANCING OF MACHINERY: Static and Dynamic balancing, balancing of single rotating mass in same plane and in different planes. Balancing of several rotating masses in same plane and in different planes. Balancing of reciprocating masses. Inertia effect of crank and connecting road.

UNIT - IV CONTROL MECHANISMS [12]

Governors - types - centrifugal governors - gravity controlled and spring controlled centrifugal governors. Characteristics - stability - sensitivity - effect of friction - controlling force. Gyroscopes - gyroscopic forces and torques - gyroscope stabilization - gyroscopic effects in automobiles, ships and airplanes

UNIT - V VIBRATION [12]

Undamped free vibration of single degree of freedom system - simple pendulum, compound pendulum - springs in series, springs in parallel and combinations. Damped free vibration of single degree of freedom system - Logarithmic decrement. Forced vibration of single degree of freedom system - measurement of forced vibration

Total (L= 60, T = 0) = 60 Periods

Text Books :

1 Rattan S.S., Theory of Machines, Tata McGraw-Hill Publishing Company Ltd., New Delhi, second edition -2016.

2 Sadhu Singh., Theory of Machines, Pearson Education (Singapore) Pvt. Ltd., Indian Branch, New Delhi, Second edition, 2018.

Reference Books :

1 Khurmi R.S. and Gupta J.K.,Theory of Machines, PHI Publishers, New Delhi, Second Edition,2007

2 Rao J.S. and Dukkipati R.V., Mechanism and Machine Theory, New Age International, New Delhi, Third Edition, 2014.

3 Shigley. J. V. and Uickers, J.J., Theory of Machines & Mechanisms, OXFORD University,press, UK,Third Edition,2009

4 Ravindra A.S., Theory of Machines -I, Sudha Publications, Bangalore, Revised Fifth edition, 2018.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : V **Regulation : R2020**

Course Code : 20ME511 **Course Name : THEORY OF MACHINES**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Design inversions of different mechanisms.*	3	2	3	2	-	-	-	-	-	-	-	2	2	3
CO2	*Sketch velocity and acceleration path of different mechanisms*	3	2	3	2	-	-	-	-	-	-	-	2	2	3
CO3	*investigate balancing of rotating elements*	3	2	3	2	-	-	-	-	-	-	-	2	2	3
CO4	*Distinguish the concept of gyroscopic effects to control kinematics*	3	2	3	2	-	-	-	-	-	-	-	2	2	3
CO5	*Analyze free and forced vibrations of machine components*	3	2	3	2	-	-	-	-	-	-	-	2	2	3
	Average	**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 – V

20ME512	**DESIGN OF MACHINE ELEMENTS** (Use of PSG Design Data Book is permitted)	L	T	P	C
		3	1	0	4

Prerequisite : *Strength of Materials.*

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

CO1:	Analyze the various stresses in machine elements.	*Analyze*
CO2:	Design the shafts and couplings for power transmission.	*Create*
CO3:	Develop temporary and permanent joints under concentric and eccentric loading conditions.	*Apply*
CO4:	Design and analyze energy storing elements under various loads.	*Create*
CO5:	Use bearings for developing various mechanical applications.	*Understand*

UNIT - I STEADY AND VARIABLE STRESSES IN MACHINE MEMBERS [12]

Introduction to the design process - factors influencing machine design, selection of materials - preferred numbers, fits and tolerances - direct, bending and torsional stress equations - impact and shock loading - principal stresses - eccentric loading - design of curved beams - crane hook and 'c' frame - factor of safety - theories of failure - stress concentration - design for variable loading - Soderberg, Goodman and Gerber relations - fracture mechanics.

UNIT - II DESIGN OF SHAFTS AND COUPLINGS [12]

Design of solid and hollow shafts based on strength, rigidity and critical speed - design of keys, key ways and splines - design of crankshafts - design of connecting rod - design of rigid and flexible couplings.

UNIT - III DESIGN OF TEMPORARY AND PERMANENT JOINTS [12]

Threaded fasteners - design of bolted joints including eccentric loading, knuckle joints, cotter joints - design of welded joints, riveted joints for structures - theory of bonded joints.

UNIT - IV DESIGN OF ENERGY STORING ELEMENTS [12]

Design of various types of springs, optimization of helical springs - leaf springs - design of flywheels considering stresses in rims and arms, for engines and punching machines.

UNIT - V DESIGN OF BEARINGS [12]

Sliding contact and rolling contact bearings - design of hydrodynamic journal bearings, Mckee's equation. Sommerfeld number, selection of rolling contact bearings.

Total = 60 Periods

Text Books :

1. Shigley J.E and Mischke C. R., Mechanical Engineering Design, Tata McGraw-Hill ,New Delhi, Seventh Edition, 2016.
2. Bhandari V.B, Design of Machine Elements, Tata McGraw-Hill Book Co, New Delhi,Third Edition, 2016.

Reference Books :

1. Khurmi R.S & Guptha J.K, Machine Design, S.Chand & Co,New Delhi, Fourth Edition, 2005.
2. Sundararajamoorthy T. V, Shanmugam .N, Machine Design, Anuradha Publications, Chennai, Second Edition, 2019.
3. Orthwein W, Machine Component Design, Jaico Publishing Co, Mumbai, Third Edition,2003.
4. Ugural A.C, Mechanical Design - An Integral Approach, McGraw - Hill Book Co, New Delhi, Fourth Edition,2004.
5. Robert L. Norton, Machine Design, Prentice-Hall, New Delhi,Fourth Edition,2016.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : V **Regulation : R2020**

Course Code : 20ME512 **Course Name : DESIGN OF MACHINE ELEMENTS**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Analyze the various stresses in machine elements.	3	2	3	2	-	-	-	2	-	-	-	2	3	3
CO2	Design the shafts and couplings for power transmission.	3	2	3	2	-	-	-	2	-	-	-	2	3	3
CO3	Develop temporary and permanent joints under concentric and eccentric loading conditions.	3	2	3	2	-	-	-	2	-	-	-	2	3	3
CO4	Design and analyze energy storing elements under various loads.	3	2	3	2	-	-	-	2	-	-	-	2	3	3
CO5	Use bearings for developing various mechanical applications.	3	2	3	2	-	-	-	2	-	-	-	2	3	3
	Average	**3**	**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 – V

20ME513	**GAS DYNAMICS AND JET PROPULSION**	L	T	P	C
	(Use of standard Gas Table is permitted)	3	1	0	4

Prerequisite : *Engineering Thermodynamics, Fluid Mechanics and Machinery, Thermal Engineering.*

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

CO1:	*Acquire basic knowledge on compressible flow fundamentals.*	*Remember*
CO2:	*Differentiate the flow in constant area ducts with and without friction.*	*Analyze*
CO3:	*Apply the variation of flow parameters due to various shocks in the flow field.*	*Apply*
CO4:	*Analyze the performance of various jet propulsion engines.*	*Analyze*
CO5:	*Evaluate the space propulsion engines performance.*	*Evaluate*

UNIT - I BASIC CONCEPTS OF COMPRESSIBLE FLOW [12]

Energy and momentum equations for compressible fluid flows - Various regions of flows - Reference velocities, stagnation state, velocity of sound, critical states - Mach number, Mach waves, Mach cone, Mach angle, Effect of Mach number on compressibility - Isentropic flow flow through nozzle and diffuser – Use of Gas tables.

UNIT - II FLOW THROUGH DUCTS [12]

Flow through constant area ducts with heat transfer (Rayleigh flow) - Rayleigh line and Rayleigh flow equation - flow through constant area ducts with friction (Fanno flow) - Fanno curves and Fanno equation - variation of flow properties - variation of Mach number with duct length.

UNIT - III NORMAL AND OBLIQUE SHOCKS [12]

Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl-Meyer relations – Use of table and charts – Applications.

UNIT - IV JET PROPULSION [12]

Theory of jet propulsion – thrust equation – thrust power and propulsion efficiency – operating principle, cycle analysis and use of stagnation state performance of Ram jet engine, Turbojet, Turbofan and Turbo prop engines.

UNIT - V SPACE PROPULSION [12]

Types of rocket engines – Propellants – feeding systems – Ignition and combustion – Theory of rocket propulsion – Performance study – Staging – Terminal and characteristic velocity – Applications – space flights.

Total = 60 Periods

Text Books :

1. Yahya.S.M., Fundamentals of Compressible flow , New Age International (P) Ltd., New Delhi, Second Edition, 2016.
2. Anderson,J.D., Modern Compressible flow, McGraw Hill, New Delhi, Third Edition, 2017.

Reference Books :

1. Ganesan .V., Gas Turbines, Tata McGraw-Hill, New Delhi, Second edition,2010.
2. P.Hill and C.Peterson, Mechanics and Thermodynamics of Propulsion, Addison - Weseley Publishing Company, UK, Third Edition, 2014.
3. N.J.Zucrow, Principles of Jet Propulsion and Gas Turbines, John Wiley, New York, Second Edition,2019.
4. PR.S.L. Somasundaram, Gas Dynamics and Jet Propulsion , New Age International Publishers, Delhi,Third Edition,2019.
5. V. Babu, Fundamentals of Gas Dynamics, ANE Books India, New Delhi, second edition, 2008.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : V **Regulation : R2020**

Course Code : 20ME513 **Course Name : GAS DYNAMICS AND JET PROPULSION**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Acquire basic knowledge on compressible flow fundamentals.*	3	3	2	2	-	-	1	-	-	2	-	2	3	2
CO2	*Differentiate the flow in constant area ducts with and without friction.*	3	3	2	2	-	-	1	-	-	2	-	2	3	2
CO3	*Apply the variation of flow parameters due to various shocks in the flow field.*	3	3	2	2	-	-	1	-	-	2	-	2	3	2
CO4	*Analyze the performance of various jet propulsion engines.*	3	3	2	2	-	-	1	-	-	2	-	2	3	2
CO5	*Evaluate the space propulsion engines performance.*	3	3	2	2	-	-	1	-	-	2	-	2	3	2
	Average	**3**	**3**	**2**	**2**	**-**	**-**	**1**	**-**	**-**	**2**	**-**	**2**	**3**	**2**

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

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

SEMESTER - V

		L	T	P	C
20ME521	**DESIGN ENGINEERING LABORATORY**	0	0	3	1

Prerequisite: *Fluid Mechanics and Machinery Laboratory*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Define the tensile and compressive strength of various materials.*	*Apply*
CO2:	*Analyze the hardness and impact strength of different materials.*	*Analyze*
CO3:	*Investigate the various characteristics of different control mechanisms.*	*Analyze*
CO4:	*Identify the response of single degree of freedom systems.*	*Analyze*
CO5:	*Acquire the inertia forces of different mechanical components*	*Analyze*

LIST OF EXPERIMENTS

10. Tension test on a mild steel rod.
11. Compression test on brittle materials – concrete cubes.
12. Hardness test on metals – Brinnell Hardness Number and Rockwell Hardness Number.
13. Impact test on metal specimen.
14. Governors - determination of sensitivity, effort, etc. for Watt, Porter and Proell
15. Motorized gyroscope - verification of laws - determination of gyroscopic couple.
7. Cam - determination of jump speed and profile of the cam.
8. Determination of moment of inertia by oscillation method for connecting rod and flywheel
9. Vibrating system - spring mass system - determination of damping co-efficient of single degree of freedom system.
10. Determination of moment of inertia for compound pendulum.

Total = 45 Periods

LIST OF EQUIPMENT

1. Torsion Testing Machine (60 NM Capacity)	-1 No.
2. Impact Testing Machine (300 J Capacity)	-1 No.
3. Brinnell Hardness Testing Machine	-1 No.
4. Rockwell Hardness Testing Machine	-1 No.
5. Torsion Testing Machine (60 NM Capacity)	-1 No.
6. Compression testing machine	-1 No.
7. Universal governor	-1 No
8. Gyroscope	-1 No
9. Cam Analyzer	-1 No
10. Compound Pendulum	- 1 No
11. Spring Mass System	-1 No
12. Axle setup	- 1 No

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : V **Regulation : R2020**

Course Code : 20ME521 **Course Name : DESIGN ENGINEERING LABORATORY**

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 tensile and compressive strength of various materials.*	2	2	2	-	1	-	-	-	-	-	-	1	2	2
CO2	*Analyze the hardness and impact strength of different materials.*	2	2	2	-	1	-	-	-	-	-	-	2	2	2
CO3	*Investigate the various characteristics of different control mechanisms.*	2	2	2	-	1	-	-	-	-	-	-	2	2	2
CO4	*Identify the response of single degree of freedom systems.*	2	2	2	-	1	-	-	-	-	-	-	2	2	2
CO5	*Acquire the inertia forces of different mechanical components*	2	2	2	-	1	-	-	-	-	-	-	2	2	2
	Average	**2**	**2**	**2**	**-**	**1**	-	-	-	-	-	-	**2**	**2**	**2**

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

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

SEMESTER - V

		L	T	P	C
20ME522	**CAD / CAM LABORATORY**	0	0	3	1

Prerequisite: *Computer aided Design laboratory and Manufacturing Technology Laboratory*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Develop 3D models of Knuckle joint and Plummer block assembly.*	*Understand*
CO2:	*Demonstrate 3D models of Screw jack, Flange coupling and Stuffing box assembly.*	*Remember*
CO3:	*Design CNC part programming for turning and facing operations.*	*Create*
CO4:	*Implement the part programming for threading, grooving and contour milling operations.*	*Apply*
CO5:	*Construct the part programming for mirroring and Rectangular pocketing.*	*Apply*

LIST OF EXPERIMENTS

1. 3D modeling and assembly of Knuckle joint.
2. 3D modeling and assembly of Plummer block.
3. 3D modeling and assembly of Screw jack.
4. 3D modeling and assembly of Flange coupling.
5. 3D modeling and assembly of Stuffing box.
6. Part programming for Turning and Facing.
7. Part programming for Threading and grooving.
8. Part programming for Contour milling.
9. Part programming using Mirroring.
10. Part programming for Rectangular pocketing.

Total = 45 Periods

LIST OF EQUIPMENT

1.Computer server	1 No.
2.CNC milling trainer type machine with standard accessories	1 No.
3.CNC lathe trainer type machine with standard accessories	1 No.
4.Computer system	30 Nos. (Including server)
5.EDGE CAM software	30 LICENSES
6.M-TAB (CNC Train) software	30 LICENCES
7.Solid works/Creo/CATIA software	30 LICENSES
8.HP laser jet printer	1 No.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : V **Regulation : R2020**

Course Code : 20ME522 **Course Name:CAD / CAM LABORATORY**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Develop 3D models of Knuckle joint and Plummer block assembly.*	2	-	3	3	-	-	-	-	2	2	3	2	3	2
CO2:	*Demonstrate 3D models of Screw jack, Flange coupling and Stuffing box assembly.*	2	-	3	3	-	-	-	-	2	2	3	2	3	2
CO3:	*Design CNC part programming for turning and facing operations.*	2	--	3	3	-	-	-	-	2	2	3	2	3	2
CO4:	*Implement the part programming for threading, grooving and contour milling operations.*	2	-	3	3	-	-	-	-	2	2	3	2	3	2
CO5:	*Construct the part programming for mirroring and Rectangular pocketing.*	2	-	3	3	-	-	-	-	2	2	3	2	3	2
	Average	**2**	**-**	**3**	**3**		-	-	-	2	**2**	**3**	**2**	**3**	**2**

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

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

SEMESTER - V

		L	T	P	C
20ME523	**INDUSTRY INTERNSHIP AND TECHNICAL PRESENTATION**	0	0	3	1

Prerequisite: *Design, Thermal and Production courses*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Identify real time problems.	*Apply*
CO2:	Acquire knowledge on the industrial oriented projects.	*Remember*
CO3:	Collect the data from the literature surveys and find out the solutions.	*Create*
CO4:	Gain knowledge on the problem by presentation and review	*Understand*
CO5:	Acquire idea on report writing and presentation.	*Remember*

PART-A (50 MARKS)

INDUSTRIAL TRAINING

1.	Industrial Internship for 3 weeks (in the level of MNC / NC / Industry)	20 Marks
2.	Review /Presentation	20 Marks
3.	Report about the internship with Certificate attached.	10 Marks

PART-B (50 MARKS)

TECHANICAL PRESENTATION

1.	The students have to refer the journals and conference proceedings and collect the published literature Review (Patents, National Conference, National Journal, International conference, international journal (min 5 in each))	10 Marks
2.	Using OHP / Power Point, the student has to make presentation for 20 minutes followed by 10 minutes discussion (Summary of literature, identification of problem and Methodology)The student has to make five presentations in the semester.	20 Marks
3.	The student has to write a technical report for about 30 - 50 pages (Title page, One page Abstract, Review of Research paper under various sub - headings, concluding remarks and list of references). The technical report has to be submitted to the course coordinator one week before the final presentation.	20 Marks

Total = 45 Periods

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : V **Regulation : R2020**

Course Code : 20ME523 **Course Name : INDUSTRY INTERNSHIP AND TECHNICAL PRESENTATION**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Identify real time problems.	1	2	2	2	2	2	2	1	2	1	3	3	3	3
CO2:	Acquire knowledge on the industrial oriented projects.	1	2	2	2	2	2	2	1	2	1	3	3	3	3
CO3:	Collect the data from the literature surveys and find out the solutions.	1	2	2	2	2	2	2	1	2	1	3	3	3	3
CO4:	Gain knowledge on the problem by presentation and review	1	2	2	2	2	2	2	1	2	1	3	3	3	3
CO5:	Acquire idea on report writing and presentation.	1	2	2	2	2	2	2	1	2	1	3	3	3	3
	Average	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**3**	**3**	**3**	**3**

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

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

SEMESTER - V

		L	T	P	C
20HR573	**CAREER DEVELOPMENT SKILLS - III**	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.*	*Apply*
CO2:	*Perform well in verbal and logical reasoning.*	*Apply*
CO3:	*Understand and develop the etiquette necessary to present oneself in a professional setting.*	*Understand*
CO4:	*Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.*	*Create*
CO5:	*Enhance the comprehension Skills in core subjects.*	*Apply*

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

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

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

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

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

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

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

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

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

Theory of machines, Design of machine Elements, Gas dynamics and jet propulsion.

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

Text Books :

1 Anne Laws, Writing Skills, Orient Black Swan., Hyderabad, 2011.

2 AbhijitGuha, Quantitative Aptitude, TMH, New Delhi,Third Edition,2009

Reference Books :

1 Agarwal. R.S ,A.Modern Approach to Verbal and Non- verbal Reasoning, Revised Edition 2008, Reprint 2009, S.Chand& Co Ltd., New Delhi.

2 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2005.

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

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

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : V **Regulation : R2020**

Course Code : 20HR573 **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	PSO1	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

		L	T	P	C
20ME611	**DESIGN OF TRANSMISSION SYSTEMS**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Choose the design specification of chain and belt drives.*	*Remembering*
CO2:	*Identify the specification and to design the spur and helical gear.*	*Apply*
CO3:	*Design bevel and worm gear by identifying the requirements.*	*Analyze*
CO4:	*Construct the gear boxes according to step ratio using ray diagrams.*	*Apply*
CO5:	*Select the parameters and to design the clutches and brakes.*	*Evaluating*

UNIT - I FLEXIBLE TRANSMISSION ELEMENTS [09]

Introduction to transmission systems - design of flat belts, V-belts and pulleys - design of chains and sprockets.

UNIT - II SPUR GEAR AND HELICAL GEAR [09]

Speed ratios and number of teeth-Force analysis -Tooth stresses – Dynamic effects – Fatigue strength – Factor of safety – Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations – Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces for helical gears.

UNIT - III BEVEL GEAR AND WORM GEAR [09]

Design of Straight and spiral bevel gear-Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight and spiral bevel gears. Design of Worm Gear- Merits and demerits - terminology. Thermal capacity, materials-forces, stresses, efficiency, estimating the size of the worm gear pair.

UNIT - IV GEAR BOXES [09]

Geometric progression - standard step ratio - ray diagram, kinematics layout - design of sliding mesh gear box -constant mesh gear box - design of multi speed gear box for machine tool applications.

UNIT - V CLUTCHES AND BRAKES [09]

Design of plate clutches – axial clutches - cone clutches - internal expanding rim clutches - Electromagnetic clutches– Band and Block brakes – external shoe brakes – Internal expanding shoe brake.

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

Text Books :

1 Austin N, Design of Transmission Elements, Sia publisher and Distributer Pvt. Ltd, Maharashtra, 2020.

2 Robert L Norton, Machine Design - An Integrated Approach, Pearson Education, second edition, 2013.

Reference Books :

1 Bhandari V. B., Design of Machine Elements, Tata McGraw-Hill, New Delhi, Fourth Edition, 2017.

2 Shigley J. E. & Mischke C. R., Mechanical Engineering Design, McGraw Hill International Education, New York, Eleventh Edition,2019.

3 Richard G Budynas, J Keith Nisbett , Shigley"s Mechanical Engineering Design, McGraw Hill Publishers Co. Ltd., Tenth Edition,2017

4 Sundararajamoorthy T.V., Shanmugam N., Machine Design, Anuradha Publications, Chennai, second edition, 2015.

5 Rattan, S.S.,Theory of Machines, Tata McGraw-Hill Publishing Company Ltd.,New Delhi, second edition, 2009.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VI **Regulation : R2020**

Course Code : 20ME611 **Course Name : DESIGN OF TRANSMISSION SYSTEMS**

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 design specification of chain and belt drives.*	3	3	3	2	-	-	-	-	-	-	-	2	2	3
CO2:	*Identify the specification and to design the spur and helical gear.*	3	3	3	2	-	-	-	-	-	-	-	2	2	3
CO3:	*Design bevel and worm gear by identifying the requirements.*	3	3	3	2	-	-	-	-	-	-	-	2	2	3
CO4:	*Construct the gear boxes according to step ratio using ray diagrams.*	3	3	3	2	-	-	-	-	-	-	-	2	2	3
CO5:	*Select the parameters and to design the clutches and brakes.*	3	3	3	2	-	-	-	-	-	-	-	2	2	3
	Average	**3**	**3**	**3**	**2**	-	-	-	-	-	-	-	**2**	**2**	**3**

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

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

SEMESTER - VI

		L	T	P	C
20ME612	**HEAT AND MASS TRANSFER**	3	1	0	4

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Apply heat conduction equations to different surface configurations under steady state and transient conditions and solve problems.	Apply
CO2:	Apply free and forced convective heat transfer correlations to internal and external flows through/over various surface configurations and solve problems.	Analyze
CO3:	Explain basic laws for Radiation and apply these principles to radiative heat transfer between different types of surfaces to solve problems	Analyze
CO4:	Explain the phenomena of boiling and condensation, apply LMTD and NTU methods of thermal analysis to different types of heat exchanger configurations and solve problems	Evaluate
CO5:	Apply diffusive and convective mass transfer equations and correlations to solve problems for different applications	Apply

UNIT - I CONDUCTION [09]

General Differential equation of Heat Conduction– Cartesian and Polar Coordinates – One Dimensional Steady State Heat Conduction — plane and Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Semi Infinite and Infinite Solids –Use of Heisler's charts.

UNIT - II CONVECTION [09]

Free and Forced Convection – Hydrodynamic and Thermal Boundary Layer. Free and Forced Convection during external flow over Plates and Cylinders and Internal flow through tubes.

UNIT - III RADIATION [09]

Black Body Radiation – Grey body radiation – Shape Factor – Electrical Analogy – Radiation Shields. Radiation through gases.

UNIT - IV PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS [09]

Nusselt's theory of condensation – Regimes of Pool boiling and Flow boiling. Correlations in boiling and condensation. Heat Exchanger Types – Overall Heat Transfer Coefficient – Fouling Factors – Analysis – LMTD method – NTU method.

UNIT - V MASS TRANSFER [09]

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 = 0) = 45 Periods

Text Books :

1 Sachdeva R C, Fundamentals of Engineering Heat and Mass transfer, New Age International Publishers, Delhi, Second edition, 2019.

2 Yunus A. Cengel, Heat Transfer A Practical Approach, Tata McGraw Hill, New delhi, Fifth edition ,2018.

Reference Books :

1 Frank P. Incropera and David P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley and Sons, seventh edition, 2014.

2 Holman, J.P., Heat and Mass Transfer, Tata McGraw Hill, Second edition, 2010.

3 Kothandaraman, C.P., Fundamentals of Heat and Mass Transfer, New Age International, New Delhi, Third edition,2016

4 Ozisik, M.N., Heat Transfer, McGraw Hill Book Co., New delhi, Second Edition, 1994.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VI **Regulation : R2020**

Course Code : 20ME612 **Course Name : HEAT AND MASS TRANSFER**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Apply heat conduction equations to different surface configurations under steady state and transient conditions and solve problems	3	3	2	3	2	2	2	2	-	-	2	2	2	2
CO2	Apply free and forced convective heat transfer correlations to internal and external flows through/over various surface configurations and solve problems	3	3	2	3	2	3	2	2	-	-	2	2	2	2
CO3	Explain basic laws for Radiation and apply these principles to radiative heat transfer between different types of surfaces to solve problems	3	3	2	3	2	2	2	3	-	-	2	2	2	2
CO4	Explain the phenomena of boiling and condensation, apply LMTD and NTU methods of thermal analysis to different types of heat exchanger configurations and solve problems	3	3	2	3	2	2	2	2	-	-	2	2	2	2
CO5	Apply diffusive and convective mass transfer equations and correlations to solve problems for different applications	3	3	2	3	2	3	2	2	-	-	2	2	2	2
	Average	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**2**	**2**	**2**	**2**

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

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

SEMESTER – VI

		L	T	P	C
20ME613	**MAINTENANCE ENGINEERING**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Illustrate the basic principles of maintenance planning.*	*Remember*
CO2:	*Analyze maintenance policies and preventive maintenance.*	*Analyze*
CO3:	*Apply condition monitoring techniques for machine elements.*	*Apply*
CO4:	*Investigate failure characteristics of r machine elements.*	*Analyze*
CO5:	*Identify repair methods for material handling equipments.*	*Understand*

UNIT - I PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING [09]

Maintenance –Introduction to the concept of planning - Objectives of maintenance planning - Importance and benefits of sound maintenance systems - reliability, maintainability - MTTF, MTBF and MTTR - maintenance organization - maintenance economics.

UNIT - II MAINTENANCE POLICIES - PREVENTIVE MAINTENANCE [09]

Maintenance categories - comparative merits of each category - Preventive maintenance, repair cycle- Lubrication - methods of lubrication – TPM-Implementation -Pillars of TPM.

UNIT - III CONDITION MONITORING [09]

Condition monitoring - cost comparison with, without CM - on-load testing, off - load testing – methods and instruments for Condition monitoring - Temperature monitoring- Crack monitoring-Leakage monitoring-Corrosion monitoring.

UNIT - IV REPAIR METHODS FOR BASIC MACHINE ELEMENTS [09]

Repair methods for beds, sideways, spindles, gears, lead screws and bearings - failure modes and effects analysis(FMEA)

UNIT - V REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT [09]

Material handling equipment – Need For Maintenance of Material handling equipment- Maintenance strategies for hoists and cranes-equipment records - job order systems – Computerized maintenance management system (CMMS). Computerization of Maintenance system-advantages.

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

Text Books :

1 Srivastava, Sushil Kumar., Industrial Maintenance Management, S. Chand and Co., Delhi, 2018.

2 Bhattacharya SN, Installation, Servicing and Maintenance, S. Chand and Co.,Delhi, Second Edition, 2018.

Reference Books :

1 Mishra RC and Pathak K, Maintenance Engineering and Management, Prentice Hall of India Pvt. Ltd., Delhi, April 2012.

2 Higgins L.R, Maintenance Engineering Hand book, McGraw Hill, New Delhi, Fifth Edition, March 2016.

3 Garg M.R.,Industrial Maintenance, S. Chand & Co., Delhi, Third Edition,2018.

4 White E.N, Maintenance Planning, I Documentation, Gower Press, UK, Second Edition, 2017.

5 Srinath L. S - Reliability Engineering, Affiliated East West Press, Delhi, Second Edition, 2020.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VI **Regulation : R2020**

Course Code : 20ME613 **Course Name : MAINTENANCE ENGINEERING**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Illustrate the basic principles of maintenance planning.*	3	3	3	2	2	-	-	2	-	-	2	2	2	2
CO2:	*Analyze maintenance policies and preventive maintenance.*	3	3	3	2	2	-	-	2	-	-	2	2	2	2
CO3:	*Apply condition monitoring techniques for machine elements.*	3	3	3	2	2	-	-	2	-	-	2	2	2	2
CO4:	*Investigate failure characteristics of r machine elements.*	3	3	3	2	2	-	-	2	-	-	2	2	2	2
CO5:	*Identify repair methods for material handling equipments.*	3	3	3	2	2	-	-	2	-	-	2	2	2	2
Average		**3**	**3**	**3**	**2**	**2**	-	-	**2**	-	-	**2**	**2**	**2**	**2**

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

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

SEMESTER – VI

		L	T	P	C
20ME621	**MINI PROJECT**	0	0	3	1

Prerequisite: Design, Manufacturing, Thermal Specialization

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

1) The students in a group of 3 to 4, works on a topic approved by the head of the department and prepare a comprehensive mini project report after completing the work to the satisfaction.

2) The progress of the project is evaluated based on a minimum of two reviews.

3) The review committee may be constituted by the Head of the Department.

4) A mini project report is required at the end of the semester.

5) The mini project work is evaluated based on oral presentation and the mini project report jointly by external and internal examiners constituted by the Head of the Department.

Total = 45 Periods

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VI **Regulation : R2020**

Course Code : 20ME621 **Course Name: MINI PROJECT**

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	2	2	3	2	2	2	3	2	3	2	3	3
CO2:	*Investigate and synthesis of information to provide solution.*	3	3	2	2	3	2	2	2	3	2	3	2	3	3
CO3:	*Provide solution in social and environmental context for sustainable development.*	3	3	2	2	3	2	2	2	3	2	3	2	3	3
CO4:	*Function effectively in diverse teams in multidisciplinary settings.*	3	3	2	2	3	2	2	2	3	2	3	2	3	3
CO5:	*Demonstrate engineering and management principles in the context of technological change.*	3	3	2	2	3	2	2	2	3	2	3	2	3	3
Average		**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**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

20ME622	**HEAT AND MASS TRANSFER LABORATORY**	L	T	P	C
		0	0	3	1

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1	*To obtain the thermal conductivity in different materials by using lagged pipe and guarded plate apparatus.*	*Understand*
CO2:	*To compute the heat transfer coefficient in natural and forced convection apparatus.*	*Analyze*
CO3:	*To gain the basic knowledge of Radiation.*	*Understand*
CO4:	*To explore the basic concepts of heat, transfer in heat exchangers*	*Understand*
CO5:	*To compute the COP of refrigeration and air-conditioning systems.*	*Analyze*

LIST OF EXPERIMENTS

1. Thermal conductivity measurement by guarded plate method.
2. Thermal conductivity of pipe insulation using lagged pipe apparatus.
3. Natural convection heat transfers from a vertical cylinder.
4. Forced convection inside tube.
5. Heat transfer from pin-fin (natural & forced convection modes).
6. Determination of Stefan-Boltzmann constant.
7. Determination of emissivity of a grey surface.
8. Effectiveness of Parallel/counter flow heat exchanger.
9. Determination of COP of a refrigeration system.
10. Experiments on air-conditioning system.

Total = 45 Periods

LIST OF EQUIPMENT

1.	Guarded plate apparatus	1 No.
2.	Lagged pipe apparatus	1 No.
3.	Natural convection-vertical cylinder apparatus	1 No.
4.	Forced convection inside tube apparatus	1 No.
5.	Pin-fin apparatus	1 No.
6.	Stefan-Boltzmann apparatus	1 No.
7.	Emissivity measurement apparatus	1 No.
8.	Parallel/counter flow heat exchanger apparatus	1 No.
9.	Refrigeration test rig	1 No.
10.	Air-conditioning test rig	1 No.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VI **Regulation : R2020**

Course Code : 20ME622 **Course Name : HEAT AND MASS TRANSFER LABORATORY**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*To obtain the thermal conductivity in different materials by using lagged pipe and guarded plate apparatus.*	3	3	2	3	2	2	2	2	-	-	2	2	2	-
CO2	*To compute the heat transfer coefficient in natural and forced convection apparatus.*	3	3	2	3	2	2	2	2	-	-	2	2	2	-
CO3	*To gain the basic knowledge of Radiation.*	3	3	2	3	2	2	2	3	-	-	2	2	2	-
CO4	*To explore the basic concepts of heat, transfer in heat exchangers*	3	3	2	3	2	2	2	2	-	-	2	2	2	-
CO5	*To compute the COP of refrigeration and air-conditioning systems.*	3	3	2	3	2	2	2	2	-	-	2	2	2	-
	Average	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**2**	**2**	**2**	**-**

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

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

SEMESTER - VI

		L	T	P	C
20HR674	**CAREER DEVELOPMENT SKILLS - IV**	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:	*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 – Newspaperand Book Review Writing – Skimmingand Scanning – Interpretation of Pictorial Representations – SentenceCompletion – SentenceCorrection – JumbledSentences – Synonyms& Antonyms – Usingthe Same Word as Different Parts of Speech – Editing.

UNIT - II **QUANTITATIVE APTITUDE** **[06]**

Geometry – StraightLine – 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 – Typesof Resumes – CommonResume Errors – Anatomyof a Resume – What is a Cover Letter? – Typesof Cover Letters – Enhancingthe 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 – KnowYourself – Organizeit, Write the Script – Practice – Deliveringa Presentation.

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

Competitive exam training: Design of transmission systems-Heat and mass transfer.

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

Text Books :

1 Anne Laws, Writing Skills, Orient Black Swan., Hyderabad, 2011.

2 AbhijitGuha, 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 V.K. Mehta &Rohit Mehta, Objective Electrical Technology, S Chand publications,First Edition, 2012.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VI **Regulation : R2020**

Course Code : 20ME674 **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)

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

SEMESTER - VII

		L	T	P	C
20ME711	**FINITE ELEMENT ANALYSIS**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*To design the FEA/FEM procedure for an engineering components.*	*Understand*
CO2:	*To formulate finite element metrics for one dimensional elements.*	*Remember*
CO3:	*To review finite element modeling of two dimensional - scalar variable problems.*	*Apply*
CO4:	*To evaluate FEA modeling of two dimensional – vector variable problems.*	*Evaluate*
CO5:	*To analyze the isoperimetric elements for two dimensional problems.*	*Analyze*

UNIT - I INTRODUCTION OF FEA [09]

Historical background - Basic Concept of FEM- relevance of FEA to design problems, application to the continuum - discretisation - matrix approach, matrix algebra - Gaussian elimination - governing equations for continuum - weighted residual method - Ritz method, Galerkin method.

UNIT - II ONE DIMENSIONAL PROBLEMS [09]

Coordinates and shape functions - potential energy approach - element matrices and vectors - higher order elements -- applications to axial loadings of rods - extension to plane trusses - bending of beams - finite element formulation of stiffness matrix and load vectors - assembly to global equations - boundary conditions - solutions and post processing - example problems.

UNIT - III TWO DIMENSIONAL PROBLEMS - SCALAR VARIABLE PROBLEMS [09]

Constant strain triangle element - element equations, load vectors and boundary conditions - assembly - application to heat transfer - examples

UNIT - IV TWO DIMENSIONAL PROBLEMS - VECTOR VARIABLE PROBLEMS [09]

Vector variable problems - elasticity equations - plane stress, plane strain and axisymmetric problems -formulation - element matrices - assembly - boundary conditions and solutions - examples.

UNIT - V ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL PROBLEMS [09]

Natural coordinates, iso parametric elements, four node quadrilateral element - shape functions - element stiffness matrix and force vector - numerical integration - stiffness integration - displacement and stress calculations – examples

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

Text Books :

1 Seshu.P, “Textbook of Finite Element Analysis”, PHI Learning Pvt. Ltd., NewDelhi, 2012.

2 Chennakesava. R. Alavala ., Finite Element Methods-Basic Concepts and Applications, PHI Learning (P) Limited, New Delhi, second edition,2014.

Reference Books :

1 Klaus-Jurgen Bathe, Finite Element Procedures, PHI Learning (P) Limited, New Delhi, second edition,2010.

2 Chandrupatla T.R., and Belegundu A.D., Introduction to Finite Elements in Engineering, Pearson Education, Delhi, 2011,

3 Logan D.L., A First course in the Finite Element Method, Thomson Learning, Delhi, Third Edition, 2010.

4 David V Hutton., Fundamentals of Finite Element Analysis. , McGraw-Hill Int., New Delhi, 2017.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VII **Regulation: R2020**

Course Code : 20ME711 **Course Name :FINITE ELEMENT ANALYSIS**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	To design the FEA/FEM procedure for an engineering components.	3	3	2	-	3	-	2	-	-	-	-	2	3	2
CO2:	To formulate finite element metrics for one dimensional elements.	3	3	2	-	3	-	2	-	-	-	-	2	3	2
CO3:	To review finite element modeling of two dimensional - scalar variable problems.	3	3	2	-	3	-	2	-	-	-	-	2	3	2
CO4:	To evaluate FEA modeling of two dimensional – vector variable problems.	3	3	2	-	3	-	2	-	-	-	-	2	3	2
CO5:	To analyze the isoperimetric elements for two dimensional problems.	3	3	2	-	3	-	2	-	-	-	-	2	3	2
	Average	**3**	**3**	**2**	**-**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**3**	**3**

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

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

SEMESTER - VII

		L	T	P	C
20ME712	**MECHATRONICS**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Get acquainted with the sensors and transducers to control mechatronics systems.*	*Remembering*
CO2:	*Demonstrate suitable actuator for mechanical and electrical drives.*	*Understanding*
CO3:	*Provide system models and insight into the signal conditioning circuit.*	*Understanding*
CO4:	*Develop competency in PLC programming and control.*	*Applying*
CO5:	*Inculcate skills in the design and development of mechatronics systems.*	*Applying*

UNIT - I INTRODUCTION , SENSORS AND TRANSDUCERS [09]

Mechatronics :Introduction to mechatronics -systems - measurement systems - control systems –mechatronics Approach.

Sensors and Transducers :Introduction-Performance, Terminology-Displacement, Position and Proximity-Velocity and Motion, Fluid Pressure-Temperature Sensors-Light Sensors-Selection of Sensors.

UNIT - II ACTUATION SYSTEMS [09]

Hydraulic& Pneumaticactuation systems - Directional Control Valves(DCV), Mechanical actuation systems, Electrical actuation systems - construction and working principle of AC and DC motors - speed control of AC and DC drives, Types of stepper and servo motors-construction-working principle –Advantages and Disadvantages.

UNIT - III SYSTEM MODELS AND CONTROLLERS [09]

Building blocks of mechanical, electrical, fluid and thermal systems, rotational-translational systems, electromechanical systems - hydraulic-mechanical systems. Continuous and discrete process controllers -control mode - two-step mode - proportional mode - Derivative mode-Integral mode - PID controllers-digital controllers - velocity control - adaptive control - digital logic control.

UNIT - IV PROGRAMMABLE LOGIC CONTROLLERS [09]

Introduction-Basic structure-Input/Output Processing-Programming-Mnemonics-Timers, Internal relays and counters-Data handling-Analog Input/Output-Selection of a PLC.

UNIT - V DESIGN OF MECHATRONICS SYSTEMS [09]

Stages in Designing mechatronic systems - Traditional and Mechatronic design -Possible design solutions-Case studies of mechatronic systems - Pick and place robot - automatic car park system -engine management system..

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

Text Books :

1 Bolton.W, Mechatronics, Pearson education, New Delhi, second Edition, 2018.

2 Rajput.R.K., A text book of Mechatronics, S. Chand and Co, Delhi, Second Edition, 2018.

Reference Books :

1 NitaigorPremchandMahadik., Mechatronics, Tata McGraw-hill publishing company Ltd, New Delhi, Second Edition, 2017.

2 David G. Alciatore Michael B. Histand., Introduction to mechatronics and measurement system, TMH, Delhi, Second edition, 2019.

3 Michael, B.histand and David G. Alciatore, Introduction to mechatronics systems , TMH, Delhi, Second edition, 2018.

4 Dan necsulesu, Mechatronics, Pearson education Asia, Delhi, Second Edition, 2012.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VII **Regulation : R2020**

Course Code : 20ME712 **Course Name : MECHATRONICS**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Get acquainted with the sensors and transducers to control mechatronics systems.*	3	2	2	1	3	-	-	-	1	-	2	1	1	2
CO2:	*Demonstrate suitable actuator for mechanical and electrical drives.*	3	2	2	1	3	-	-	-	1	-	2	1	1	2
CO3:	*Provide system models and insight into the signal conditioning circuit.*	3	2	2	1	3	-	-	-	1	-	2	1	1	2
CO4:	*Develop competency in PLC programming and control.*	3	2	2	1	3	-	-	-	1	-	2	1	1	2
CO5:	*Inculcate skills in the design and development of mechatronics systems.*	3	2	2	1	3	-	-	-	1	-	2	1	1	2
	Average	**2**	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**1**	**-**	**2**	**1**	**1**	**2**

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

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

SEMESTER - VII

		L	T	P	C
20ME721	**MECHATRONICS LABORATORY**	0	0	3	1

Prerequisite: Electronics and Microprocessor Laboratory

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Study the Characteristics of Servo Controller Interface System.*	*Remembering*
CO2:	*Demonstrate the Sequential Operation of Pneumatics Hydraulic Systems.*	*Applying*
CO3:	*Design the Logic Sequences for Electro Pneumatic trainer Kit*	*Creating*
CO4:	*Analyze the Sequential Operation Using Simulation Software*	*Analyzing*
CO5:	*Inspect the Analog Process Variables Such as Pressure, Flow, Temperature to Digital Outputs.*	*Creating*

LIST OF EXPERIMENTS

1. Study the characteristics of servo controller interfacing for open loop and closed loop.
2. Study on the characteristics of Speed control when PID controller interfaced with AC and DC motor.
3. Study a circuit for Recovery of child from Bore wells.
4. Design of pneumatic circuit for a sequential operation of two cylinders using basic trainer kit.
5. Design of circuits with logic sequence using electro pneumatic trainer kit.
6. Design of pneumatic circuit for a continuous operation using PLC trainer kit.
7. Design of a hydraulic circuit for continuous operation using simulation software.
8. Design of a pneumatic circuit for sequential operation of multiple cylinders using simulation software.
9. Design and testing of fluid power circuit to control (i) velocity, (ii) direction and (iii) force of single and double acting actuators.
10. Compare the analog process variables such as pressure, flow and temperature with digital outputs obtained through data logging with computer.

Total=45 Periods

LIST OF EQUIPMENT

1. Basic pneumatic trainer kit	- 1 No
2. Electro pneumatic trainer kit	- 1 No
3. Electro pneumatic trainer kit with PLC control	- 1 No
4. Hydraulic Trainer kit	- 1 No
5. PID Controller Interfacing	- 1 No
6. Speed Control of AC and DC Drives	- 1 No
7. Hydraulic/ pneumatic systems simulation software	-10 users

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VII **Regulation : R2020**

Course Code : 20ME721 **Course Name : MECHATRONICS LABORATORY**

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 Characteristics of Servo Controller Interface System.*	2	2	2	1	3	-	-	-	1	-	2	1	1	2
CO2:	*Demonstrate the Sequential Operation of Pneumatics Hydraulic Systems.*	2	2	2	1	3	-	-	-	1	-	2	1	1	2
CO3:	*Design the Logic Sequences for Electro Pneumatic trainer Kit*	2	2	2	1	3	-	-	-	1	-	2	1	1	2
CO4:	*Analyze the Sequential Operation Using Simulation Software*	2	2	2	1	3	-	-	-	1	-	2	1	1	2
CO5:	*Inspect the Analog Process Variables Such as Pressure, Flow, Temperature to Digital Outputs.*	2	2	2	1	3	-	-	-	1	-	2	1	1	2
	Average	**2**	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**1**	**-**	**2**	**1**	**1**	**2**

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

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

SEMESTER - VII

		L	T	P	C
20ME722	**COMPUTER AIDED SIMULATION AND ANALYSIS LABORATORY**	0	0	3	1

Prerequisite: Finite Element Analysis

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

CO1:	*Obtain the stress, strain and displacement for the simple specimen in ANSYS software.*	*Understanding*
CO2:	*Analyze the structure of different types of Beams with the help of ANSYS software.*	*Analyzing*
CO3:	*Explore the Harmonic and Modal analysis in various beams by using ANSYS software.*	*Understanding*
CO4:	*Demonstrate the thermal stress problems by using ANSYS software.*	*Analyzing*
CO5:	*Execute Simulation and analysis of vibration and heat exchanger process using software.*	*Creating*

LIST OF EXPERIMENTS

1. Stress analysis of a Bar element.
2. Stress analysis of a plate with a circular hole.
3. Stress analysis of a rectangular L Bracket.
4. Stress analysis of beams (Cantilever, Simply supported, Fixed).
5. Modal analysis of beams (Cantilever, Simply supported, Fixed).
6. Harmonic analysis of a 2D component.
7. Thermal stress analysis of a 2D component.
8. Conductive, convective, insulated heat transfer analysis of a 2D component.
9. Simulation of Spring Mass Damper System Control.
10. Simulation of heat exchanger process.

Total=45 Periods

LIST OF EQUIPMENT

(For a batch of 30 students)

1. Computer system - 30 Nos.
2. 17" VGA Color Monitor,
3. Pentium IV Processor,
4. 40 GB HDD, 512 MB RAM
5. Color desk Jet Printer - 01 Nos.
6. Software
7. Simulation and analysis software like ANSYS, SOLIDWORKS, C, MATLAB, NXNASTRAN, ADAMS, MATHCAD, AUTOMATION STUDIO - 30 licenses

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VII **Regulation : R2020**

Course Code : 20ME722 **Course Name : Computer Aided Simulation and Analysis Laboratory**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	Obtain the stress, strain and displacement for the simple specimen in ANSYS software.	3	2	3	2	3	-	-	-	-	2	-	2	3	2
2	Analyze the structure of different types of Beams with the help of ANSYS software.	3	2	3	2	3	-	-	-	-	2	-	2	3	2
3	Explore the Harmonic and Modal analysis in various beams by using ANSYS software.	3	2	3	2	3	-	-	-	-	2	-	2	3	2
4	Demonstrate the thermal stress problems by using ANSYS software.	3	2	3	2	3	-	-	-	-	2	-	2	3	2
5	Execute Simulation and analysis of vibration and heat exchanger process using software.	3	2	3	2	3	-	-	-	-	2	-	2	3	2
	Average	3	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 – VII

		L	T	P	C
20ME723	**PROJECT PHASE – I**	0	0	6	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:	*Design and develop a solution for engineering problems*	*Creating*
CO2:	*Investigate and synthesis of information to provide solution.*	*Applying*
CO3:	*Provide solution in social and environmental context for sustainable development.*	*Applying*
CO4:	*Function effectively in diverse teams in multidisciplinary settings.*	*Analyzing*
CO5:	*Demonstrate engineering and management principles in the context of technological change.*	*Understanding*

Guidelines:

1. The project work in Phase – I and II may contain a theoretical study and analysis, experimental analysis, design, modelling & 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 jointly by external and internal examiners constituted by the Head of the Department.

Total : 60 Periods

Course Outcomes: On completion of this course, the students 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.*

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VII **Regulation : R2020**

Course Code : 20ME723 **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	PSO1	PSO2
CO1:	*Design and develop a solution for engineering problems*	3	2	2	2	2	2	2	1	2	1	2	3	3	3
CO2:	*Investigate and synthesis of information to provide solution.*	3	2	2	2	2	2	2	1	2	1	2	3	**3**	**3**
CO3:	*Provide solution in social and environmental context for sustainable development.*	3	2	2	2	2	2	2	1	2	1	2	3	**3**	**3**
CO4:	*Function effectively in diverse teams in multidisciplinary settings.*	3	2	2	2	2	2	2	1	2	1	2	3	3	3
CO5:	*Demonstrate engineering and management principles in the context of technological change.*	3	2	2	2	2	2	2	1	2	1	2	3	3	3
Average		3	2	2	2	2	2	2	1	2	1	2	3	3	3

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

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

SEMESTER – VIII

		L	T	P	C
20HS002	**TOTAL QUALITY MANAGEMENT (Common to All Branches)**	3	0	0	3

Prerequisites:

Course outcome: On completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Explain the fundamental concepts of total quality management .*	*Understand*
CO2:	*Illustrate the Various TQM principles for continuous process improvement*	*Understand*
CO3:	*Classify the statistical tools to control and improve the quality of the products and services.*	*Understand*
CO4:	*Describe the tools and techniques to improve the quality concept*	*Create*
CO5:	*Explain the quality system in manufacturing and service sectors.*	*Analysis*

UNIT - I INTRODUCTION [09]

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM implementation steps – Quality council-Importance of leadership and motivation in TQM - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT - II TQM PRINCIPLES [09]

Quality statements - Customer perception of quality – Customer complaints, Customer retention. Employee involvement, Empowerment, Team and Teamwork, Recognition and Reward - Continuous process improvement – Juran trilogy, PDSA cycle, 5s, 8D Methodology - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT - III STATISTICAL PROCESS CONTROL [09]

The seven traditional tools of quality – Measurement of central tendency and dispersion, population and sample, normal curve, control chart (X,R,p) for variable and attributes, process capability - Seven new management tools – Six-sigma Concepts.

UNIT - IV TQM TOOLS [09]

Bench marking – reason , process – Quality circles concepts - FMEA – stages, types– Quality Function Deployment (QFD) – Taguchi quality loss function –TPM – concepts, improvement needs –Performance measures-criteria – Quality Cost.

UNIT - V QUALITY SYSTEMS [09]

Need for ISO 9000 – ISO 9001-2014, ISO 14000 Quality System – elements, implementation, Documentation. Quality auditing – concepts, requirements and benefits, non-conformance report – Case studies of TQM implementation in manufacturing and service sectors.

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

Text Books :

1. Dale H.Besterfiled, et at., Total Quality Management, Pearson Education Asia, Indian Reprint, New Delhi, Third Edition, 2016.
2. Janakiraman,B and Gopal, R.K, Total Quality Management – Text and Cases,Prentice Hall (India) Pvt. Ltd., New Delhi, Third Edition, 2015.

Reference Books :

1. Suganthi,L and Anand Samuel, Total Quality Management, Prentice Hall (India)Pvt. Ltd., New Delhi, Frist Edition, 2014
2. James R. Evans and William M. Lindsay, The Management and Control of Quality,South-Western (Thomson Learning), New Delhi,Ninety Edition, 2015.
3. Subburaj R, Total Quality Management, Tata McGraw Hill, New Delhi, Frist Edition, 2014
4. EugenceMckenna and Nic Beach, Total Quality Management, Pearson Education Limited, New Delhi, Second Edition, 2014.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VIII **Regulation : R2020**

Course Code : 20HS002 **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:	*Explain the fundamental concepts of total quality management .*	2	-	-	-	-	3	-	2	2	2	-	-	2	3
CO2:	*Illustrate the Various TQM principles for continuous process improvement*	2	-	-	-	-	3	-	2	2	2	-	-	2	**3**
CO3:	*Classify the statistical tools to control and improve the quality of the products and services.*	2	-	-	-	-	3	-	2	2	2	-	-	2	**3**
CO4:	*Describe the tools and techniques to improve the quality concept*	2	-	-	-	-	3	-	2	2	2	-	-	2	3
CO5:	*Explain the quality system in manufacturing and service sectors.*	2	-	-	-	-	3	-	2	2	2	-	-	2	3
Average		2	-		-	-	3	-	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

		L	T	P	C
20ME821	**PROJECT PHASE - II**	**0**	**0**	**12**	**6**

Prerequisite:

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

Semester : VIII **Regulation :R2020**

Course Code : 20ME821 **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	2	2	2	2	2	2	1	2	1	2	3	3	3
CO2:	*Investigate and synthesis of information to provide solution.*	3	2	2	2	2	2	2	1	2	1	2	3	3	3
CO3:	*Provide solution in social and environmental contextfor sustainable development.*	3	2	2	2	2	2	2	1	2	1	2	3	3	3
CO4:	*Function effectively in diverse teams in multidisciplinary settings.*	3	2	2	2	2	2	2	1	2	1	2	3	3	3
CO5:	*Demonstrate engineering and management principles in the context of technological change.*	3	2	2	2	2	2	2	1	2	1	2	3	3	3
	Average	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**1**	**2**	**1**	**2**	**3**	**3**	**3**

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

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

SEMESTER – V

		L	T	P	C
20HS003	**INNOVATION, INTELLECTUAL PROPERTY RIGHTS AND ENTREPRENEURSHIP DEVELOPMENT** (Common to ALL BRANCHES) **(PROFESSIONAL ELECTIVE – I)**	3	0	0	3

Objective(s):

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Explain the fundamentals of innovation management*	*Understand*
CO2:	*Discuss the various fundamental of IPR*	*Understand*
CO3:	*Describe the various Types of IPR.*	*Understand*
CO4:	*Illustrate the various activities in Financial and Accounting in entrepreneurship.*	*Create*
CO5:	*Explain the various activities to support the entrepreneurs*	*Analysis*

UNIT - 1 INNOVATION [09]

Innovation : Meaning, Concept, Characteristics, Importance, Principles of Innovation, Process of Innovation - Innovation Management : Concept, Scope, Characteristics, Evolution of Innovation Management, Significance, Factors Influencing Innovation

UNIT - II FUNDAMENTALS OF IPR [09]

IPR: Introduction, Needs, General framework, Legislations in India - Agreement on Trade, related aspects of IPR - WIPO - Consequences of IPR Protection in developing countries - Practical IPR issues in developing business plan.

UNIT - III TYPES OF IPR [09]

Patents: patent information, Needs. Design Act 2000 - Trademark: Concept, Purpose, Characteristics and functions of Trademark, Trademark Act - Integrated Circuit: Concept of Integrated Circuit Layout design- Copyright: Concept of copyright, Works protected by copyright, Indian Copyright Law - Geographical Indications: Concept of Geographical Indications in India.

UNIT - IV ENTREPRENEURSHIP [09]

Entrepreneur - Types of entrepreneurs - Difference between entrepreneur and intrapreneur -Entrepreneurship in economic growth, factors affecting entrepreneurial growth. Case studies of successful entrepreneurs.

UNIT - III BUSINESS [09]

Small enterprises - Definition, classification - Characteristics, ownership structures – Project formulation - Steps involved in setting up a business - Identifying, selecting a good business opportunity, market survey and research, techno economic feasibility assessment - Preparation of preliminary project reports - Project appraisal - Sources of information - Classification of needs and agencies.

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

Text Books :

1. S.S. Khanka, Entrepreneurial Development, S.Chand and Company Limited, New Delhi, Twenty Edition, 2017.
2. R. Radhakrishnan, S.Balasubramaniam, Intellectual Property Rights: Text and Cases, 1st Edition Excel Books, Chennai, 2018.

Reference Books :

1. Scott Shane, Handbook of Technology and Innovation Management, John Wiley & Sons, 5th edition, 2019.
2. Madhurimalall, Entrepreneurship, Excel Books, New Delhi, First Edition, 2016
3. Richard Stim, Intellectual Property: Patents, Trademarks and Copyrights, 3rd Indian reprint, Cengage learning, New Delhi, 2015.
4. Asawthappa, Entrepreneurship, Tata Mcgraw Hill, , New Delhi, Seventh Edition, 2016

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : V **Regulation : R2020**

Course Code : 20HS003 **Course Name : INNOVATION, INTELLECTUAL PROPERTY RIGHTS AND 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	*Explain the fundamentals of innovation management*	3	3	3	-	3	-	-	-	-	-	-	3	2	3
CO2	*Discuss the various fundamental of IPR.*	3	3	3	-	3	-	-	-	-	-	-	3	2	3
CO3	*Describe the various Types of IPR.*	3	3	3	-	3	-	-	-	-	-	-	3	2	3
CO4	*Illustrate the various activities in Financial and Accounting in entrepreneurship.*	3	3	3	-	3	-	-	-	-	-	-	3	2	3
CO5	*Explain the various activities to support the entrepreneurs.*	3	3	3	-	3	-	-	-	-	-	-	3	2	3
	Average	**3**	**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

20ME562	**DESIGN OF JIGS, FIXTURES AND PRESS TOOLS** (Use of PSG Design Data Book is permitted) **(PROFESSIONAL ELECTIVE – I)**	L	T	P	C
		3	0	0	3

Prerequisite: *Manufacturing Technology-I and II.*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Design tools for manufacturing of engineering components*	*Understand*
CO2:	*Develop various locating and clamping devices for tools and work pieces.*	*Apply*
CO3:	*Design jigs & fixtures for various engineering applications*	*Evaluate*
CO4:	*Design press and cutting dies for making engineering components.*	*Create*
CO5:	*Construct dies for bending, forming, and drawing to produce various components.*	*Remember*

UNIT - I TOOL ENGINEERING [09]

Introduction - classifications - tool design objectives - *tool* design in manufacturing - challenges and requirements - standards in tool design - tool drawings - surface finish - tooling materials - ferrous and non ferrous tooling materials - carbides, ceramics and diamond - non metallic tool materials.

UNIT - II LOCATING AND CLAMPING PRINCIPLES [09]

. Objectives - function - advantages of jigs, fixtures - basic elements - principles of location - degrees of freedom - degrees of mobility - locating methods, devices - redundant location - principles of clamping - mechanical actuation – pneumatic, hydraulic actuation standard parts - drill bushes, jig buttons - tolerances, materials used.

UNIT - III JIGS AND FIXTURES [09]

Design, development of jigs, fixtures for given component - types of jigs - post, turnover, channel, latch, box, pot, angular post jigs, indexing jigs.

General principles of milling, lathe, boring, broaching and grinding fixtures - assembly, inspection and welding fixtures - modular fixturing systems - quick change fixtures

UNIT - IV PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES [09]

Press working terminologies - operations - types of presses - press accessories - computation of press capacity - strip layout - material utilization - shearing action - clearances - press work materials - center of pressure- design of various elements of dies - die block - punch holder, die set, guide plates - stops - strippers - pilots - selection of standard parts - design, preparation of four standard views of simple blanking, piercing, compound, progressive dies - design of moulds for plastic injection.

UNIT - V BENDING FORMING AND DRAWING DIES [09]

Difference between bending, forming, drawing - blank development for above operations - types of bending dies - press capacity - spring back - knockouts - direct, indirect - pressure pads - ejectors - variables affecting metal flow in drawing operations - draw die inserts - draw beads - ironing - design, development of bending, forming, drawing reverse re-drawing, combination dies - blank development for axi-symmetric, rectangular and elliptic parts - single, double action dies - forging.

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

Text Books :

1 Joshi, P.H, Jigs and Fixtures, Tata McGraw Hill Publishing Co. Ltd., New Delhi, Third Edition, 2020.

2 Donaldson, Lecain and Goold, Tool Design , Tata McGraw Hill, New Delhi, Third Edition, 2018.

Reference Books :

1 Hoffman. , Jigs and Fixture Design, Thomson Delmar Learning, Singapore, Second Edition, 2016.

2 Venkataraman K, Design of Jigs Fixtures & Press Tools, Tata McGraw Hill, New Delhi, Second Edition, 2020

3 ASTME, Fundamentals of Tool Design, Prentice Hall of India, Delhi, Second Edition,2010.

4 Chapman W.A.J Workshop technology, Edward Arnold , London,U.K, Second Edition, 1975

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : V **Regulation : R2020**

Course Code : 20ME562 **Course Name : DESIGN OF JIGS, FIXTURES AND PRESS TOOLS**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Design tools for manufacturing of engineering components*	3	-	2	2	3	-	-	-	3	-	-	-	3	-
CO2:	*Develop various locating and clamping devices for tools and work pieces.*	3	-	2	2	3	-	-	-	3	-	-	-	3	-
CO3:	*Design jigs & fixtures for various engineering applications*	3	-	2	2	3	-	-	-	3	-	-	-	3	-
CO4:	*Design press and cutting dies for making engineering components.*	3	-	2	2	3	-	-	-	3	-	-	-	3	-
CO5:	*Construct dies for bending, forming, and drawing to produce various components.*	3	-	2	2	3	-	-	-	3	-	-	-	3	-
	Average	**3**	**-**	**2**	**2**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**3**	**-**

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

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

SEMESTER - V

20ME563	**MEMS AND NEMS**	L	T	P	C
	(PROFESSIONAL ELECTIVE – I)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explore the operation of micro devices, micro systems and their applications*	*Understand*
CO2:	*Design the micro devices, micro systems using the MEMS fabrication process*	*Apply*
CO3:	*Describe basic approaches for various micro system design and its applications.*	*Evaluate*
CO4:	*Describe the various types of nano electronics devices*	*Understand*
CO5:	*Develop MEMS architecture design and its applications.*	*Create*

UNIT - I INTRODUCTION [09]

Fundamentals – Micro systems and microelectronics - working principle of microsystems – Micro sensors, acoustic sensor, Bio sensor, chemical sensor, pressure sensor, Temperature sensor - micro actuation techniques – Actuation using thermal forces, actuation using SMA, Actuation using piezo electric effect, Actuation using electro static forces – micro gripper – micro motors – micro valves – micro pumps, types – micro heat pipes.

UNIT - II MICRO FABRICATION AND MANUFACTURING TECHNIQUES [09]

Materials for micro systems – Substrates and wafer- Silicon, Quartz, Piezoelectric crystals, polymers - Photo Lithography – Diffusion- Oxidation – CVD- PVD, Etching, types - Bulk micro manufacturing – Surface micro machining - Micro system packaging-materials, die level, device level, system level - Packaging techniques – die preparation - Surface bonding-wire bonding - sealing.

UNIT - III MECHANICS FOR MICRO SYSTEM DESIGN AND APPLICATIONS [09]

Basic concepts – Bending of thin plates – Mechanical vibration – Thermo mechanics – Fracture mechanics – Fluid mechanics at micro systems- Design considerations - Process design-mask layout design – Mechanical design-Applications of micro system in automotive industry, bio medical, aerospace and telecommunications

UNIT - IV NANO ELECTRONICS [09]

Basics of nano electronics – Nano electronics with tunneling devices – Nano electronics with super conducting devices - Molecular nano technology – Applications of MNT - Direct self-assembly- device assembly - Electrostatic self-assembly-nano tubes – Nano wire and carbon-60 - Dielectrophoretic nano assembly.

UNIT - V ARCHITECTURE AND APPLICATIONS [09]

Architecture of MEMS – Requirements of nano systems - Development of nano electronics and structuring – Application of NEMS – Deposition of coatings – Three dimensional materials – Dewatering.

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

Text Books :

1 Goser. K , Dienstuhl .J , Nano Electronics & Nanosystems , Springer International Edition,New York, Second Edition, 2016.

2 Michael Pycraft Inrushes , Nano Electro Mechanics in Engineering & biology ,CRC press ,New York, Third Edition, 2018.

Reference Books :

1 Charles P.Poojlejr Fran K J.Owners , Introduction to Nano Technology , Willey student Edition, New Delhi, Second edition,2008.

2 Gregory Timp, Nano Technology ,Spinger International Edition , ,New York, Second Edition, 1999.

3 Julian W.Gardner,Vijay K.Varadan,Osama O.Awadel Karim, Microsensors MEMS and Smart Devices, John Wily & sons Ltd., New jercy, Fourth Edition, 2001.

4 Tai – Ran Hsu,MEMS & Microsystems: Design and Manufacture , Tata Mc Graw Hill, New Delhi, second edition 2008.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : V **Regulation : R2020**

Course Code : 20ME563 **Course Name : MEMS AND NEMS**

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 operation of micro devices, micro systems and their applications*	3	3	3	3	-	-	-	-	-	-	-	-	3	3
CO2	*Design the micro devices, micro systems using the MEMS fabrication process*	3	3	3	3	-	-	-	-	-	-	-	-	3	3
CO3	*Describe basic approaches for various micro system design and applications.*	3	3	3	3	-	-	-	-	-	-	-		3	3
CO4	*Describe the various types of nano electronics devices*	3	3	3	3	-	-	-	-	-	-	-	-	3	3
CO5	*Develop MEMS architecure design and its applications.*	3	3	3	3	-	-	-	-	-	-	-		3	3
	Average	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**		**3**	**3**

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

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

SEMESTER - V

		L	T	P	C
20ME564	**POWER PLANT ENGINEERING (PROFESSIONAL ELECTIVE – I)**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify elements and their functions and operations of steam power plants.*	*Understand*
CO2:	*Identify the diesel and gas turbine power plant Layouts.*	*Understand*
CO3:	*Explore the nuclear power plant layouts and reactors*	*Analyze*
CO4:	*Explain the layout, construction and working of the components inside Renewable energy power plants*	*Remember*
CO5:	*Extend their knowledge to power plant economics and estimate the costs of electrical energy production.*	*Evaluate*

UNIT - I STEAM POWER PLANT [09]

Layout and types of Steam Power Plants –Site selection of coal fired power plant- Steam Boilers – Fuel and Ash handling systems – combustion equipment for burning coal – Mechanical stokers – Pulverizers – Electrostatic precipitator – Draught – different types, Surface condenser types, Cooling towers, Pollution Controls.

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

. Layout and types of Diesel power plants and components, selection of engine type, Emission control, applications. Gas Turbine power plant – Layout - Fuels, gas turbine material, types of combustion chambers - reheating, regeneration and inter - cooling.

UNIT - III NUCLEAR POWER PLANT [09]

Nuclear energy - Fission, Fusion reaction - Layout of nuclear power plants - Types of reactors, pressurized water reactor - Boiling water reactor - Gas cooled reactor - Fast breeder reactor – Fuel cycle -Waste disposal and safety.

UNIT - IV RENEWABLE ENERGY POWER PLANTS [09]

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

UNIT - V POWER PLANT ECONOMICS [09]

Economics of power plant – Actual load curves-cost of electric energy-fixed and operating costs-energy rates – Types of Tariffs – Economics of load sharing – variable load operation - comparison of economics of various power plants.

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

Text Books :

1 Arora S.C. and Domkundwar .S.,A Course in Power Plant Engineering, Dhanpatrai, New Delhi, Second Edition, 2019

2 Nag P.K., Power Plant Engineering, Tata-McGraw Hill, New Delhi, Second Edition, 2019.

Reference Books :

1 Frank D.Graham,Power Plant Engineers Guide, D.B. Taraporevala Sons &Co., New Delhi, Second Edition,2010.

2 T.Morse Frederick,Power Plant Engineering, Prentice Hall of India, Delhi, Second Edition, 2014.

3 R.K.Rajput,Power Plant Engineering, Laxmi Publications, Chennai, Fourth Edition, 2016.

4 El-Wakil. M.M., Power Plant Technology, Tata McGraw – Hill Publishing Company Ltd., New Delhi, Second Edition, 2010.

5. G.D.Rai, Introduction to Power Plant Technology, Khanna Publishers ,New Delhi, Third Edition, 1995.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : V **Regulation : R2020**

Course Code : 20ME564 **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	Identify elements and their functions and operations of steam power plants.	3	2	3	1	1	3	3	2	3	2	3	2	3	2
CO2	Identify the diesel and gas turbine power plant Layouts.	3	2	3	1	1	3	3	2	3	2	3	2	3	2
CO3	Explore the nuclear power plant layouts and reactors	3	2	3	1	1	3	3	2	3	2	3	2	3	2
CO4	Explain the layout, construction and working of the components inside Renewable energy power plants	3	2	3	1	1	3	3	2	3	2	3	2	3	2
CO5	Extend their knowledge to power plant economics and estimate the costs of electrical energy production.	3	2	3	1	1	3	3	2	3	2	3	2	3	2
	Average	**3**	**2**	**3**	**1**	**1**	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**

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

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

SEMESTER - V

		L	T	P	C
20ME565	**COMPUTER AIDED MANUFACTURING (PROFESSIONAL ELECTIVE – I)**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Learn the production process planning techniques through CAD/CAM interface.*	*Understand*
CO2:	*Apply the control systems for CNC machine tools.*	*Apply*
CO3:	*Explore the constructional features of CNC machines.*	*Remember*
CO4:	*Comprehend the part programming for CNC machine.*	*Analyze*
CO5:	*Demonstrate the functions of CAPP and modeling.*	*Understand*

UNIT - I CAD / CAM INTERFACE [09]

Introduction to CAD/CAM - Current trends in manufacturing engineering - design for manufacturing, assembly - process planning techniques - total approach to product development - concurrent engineering - rapid prototyping - CAD / CAM software.

UNIT - II FUNDAMENTALS OF CNC MACHINES [09]

CNC technology - functions of CNC control in machine tools - classification of CNC systems - contouring system - interpolators, open loop, closed loop CNC systems - CNC controllers, hardware features - direct numerical control (DNC Systems). Five axis CNC machines – horizontal / vertical machining center - cycle time reduction.

UNIT - III CONSTRUCTIONAL FEATURES OF CNC MACHINES [09]

Design considerations of CNC machines for improving machining accuracy - structural members - slide ways - side linear bearings - ball screws - spindle drives; feed drives - work holding devices, tool holding devices - automatic tool changers. Feedback devices - principles of operation - machining centres - tooling for CNC machines.

UNIT - IV PART PROGRAMMING FOR CNC MACHINES [09]

Numerical control codes - standards - manual programming - canned cycles, subroutines - computer assisted programming, CAD / CAM approach to NC part programming - APT language, machining from 3D models.

UNIT - V COMPUTER AIDED PROCESS PLANNING AND MODELING [09]

Process planning - role of process planning in CAD / CAM integration - approaches to computer aided process planning - variant approach, generative approaches - Group Technology. Emerging challenges in CAD / CAM, product data management - product modeling - assembly modeling - tolerance modeling.

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

Text Books :

1 Radhakrishnan P, Computer Numerical Control , New Central Book Agency, Delhi, Fourth Edition, 2018.

2 Mikell P Groover., Automation, Production Systems and computer integrated manufacturing, Pearson Education ,Delhi, Second Edition, 2015.

Reference Books :

1 Yoram Koren., Computer Control of Manufacturing Systems, McGraw-Hill Book Company, Delhi, Second Edition, 2017.

2 Koren, Y., Computer Control of Manufacturing systems, McGraw Hill (2008).

3 Smith G.T, CNC - Machining, Techniques - Vol. 1, 2 & 3, verlag, UK, Second Edition, 2011.

4 Kant Vajpayee S, Principles of Computer Integrated Manufacturing, Prentice Hall of India Ltd., Delhi, Second Edition, 2013.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : V **Regulation : R2020**

Course Code : 20ME565 **Course Name : COMPUTER AIDED MANUFACTURING**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Learn the production process planning techniques through CAD/CAM interface.*	3	-	3	2	3	-	-	-	-	2	-	3	2	3
CO2:	*Apply the control systems for CNC machine tools.*	3	-	3	2	3	-	-	-	-	2	-	3	2	3
CO3:	*Explore the constructional features of CNC machines.*	3	-	3	2	3	-	-	-	-	2	-	3	2	3
CO4:	*Comprehend the part programming for CNC machine.*	3	-	3	2	3	-	-	-	-	2	-	3	2	3
CO5:	*Demonstrate the functions of CAPP and modeling.*	3	-	3	2	3	-	-	-	-	2	-	3	2	3
	Average	**3**	**-**	**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 - V

		L	T	P	C
20ME566	**FLEXIBLE MANUFACTURING SYSTEMS (PROFESSIONAL ELECTIVE – I)**	3	0	0	3

Prerequisite: *Manufacturing Technology –I, Manufacturing Technology-II.*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Implement and measure the performance of FMS.*	*Remember*
CO2:	*Explore the knowledge on Automated Material handling and storage Systems.*	*Analyze*
CO3:	*Apply the control mechanisms of FMS using computers*	*Understand*
CO4:	*Comprehend the software, simulation and data base of FMS.*	*Apply*
CO5:	*Evaluate the scheduling of FMS and material handling systems*	*Evaluate*

UNIT - I INTRODUCTION [09]

Definition, need, types and configuration of FMS - types of flexibilities and performance measures. Economic justification of FMS - development and implementation of FMS- planning phases, integration, system configuration, FMS layouts, simulation.

UNIT - II AUTOMATED MATERIAL HANDLING AND STORAGE [09]

. Functions – types - analysis of material handling systems, primary and secondary material handling systems- conveyors, automated guided vehicles - working principle, types, and traffic control of AGVS. Role of robots in material handling. Automated storage systems- storage system performance - AS/RS-carousel storage system, WIP storage systems, interfacing handling and storage with manufacturing.

UNIT - III COMPUTER CONTROL OF FMS [09]

Planning, scheduling and computer control of FMS, Hierarchy of computer control, supervisory computer. Features of DNC systems - communication between DNC computer and machine control unit.

UNIT - IV COMPUTER SOFTWARE, SIMULATION AND DATA BASE OF FMS [09]

System issues, types of software – specification and selection- trends application of simulation and its software, Manufacturing Data systems planning - FMS data base. Modelling of FMS- analytical, heuristics, queuing, simulation and petrinets modeling techniques.

UNIT - V SCHEDULING OF FMS [09]

Scheduling of operations on a single machine- two machine flow shop scheduling, two machine job shop scheduling, - three machine flow shop scheduling- scheduling 'm' operations on 'n' machines, knowledge based scheduling, scheduling rules, tool management of FMS, material handling system schedule.

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

Text Books :

1 N.K.Jha., Handbook of Flexible Manufacturing Systems, Academic press, First Edition, 2013.

2 Talichi Ohno., Production system beyond large scale production, Toyota productivity, Press India Pvt. Ltd, First Edition 2010.

Reference Books :

1 Radhakrishnan P. and Subramanyan S., CAD/CAM/CIM, Wiley Eastern Ltd., New Age International Ltd., Delhi, Fourth Edition, 2017.

2 Farid Amiranche, Principles of computer aided design and manufacturing, Second Edition, 2004.

3 Raouf, A. and Ben-Daya, M., Editors, Flexible manufacturing systems recent development, Elsevier Science, Second Edition, 2019.

4 Buffa .E.S. and Sarin, Modern Production and Operations Management, Wiley Eastern, UK, Fifth Edition,1987.

5 Groover. M. P., Automation production systems and computer integrated manufacturing, Prentice hall of India pvt.Ltd, Delhi, Second Edition, 2010.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : V **Regulation : R2020**

Course Code : 20ME566 **Course Name : FLEXIBLE MANUFACTURING SYSTEMS**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Implement and measure the performance of FMS.*	3	-	3	-	2	3	2	-	2	2	1	2	3	1
CO2:	*Explore the knowledge on Automated Material handling and storage Systems.*	3	-	3	-	2	3	2	-	2	2	1	2	3	1
CO3:	*Apply the control mechanisms of FMS using computers*	3	-	3	-	2	3	2	-	2	2	1	2	3	1
CO4:	*Comprehend the software, simulation and data base of FMS.*	3	-	3	-	2	3	2	-	2	2	1	2	3	1
CO5:	*Evaluate the scheduling of FMS and material handling systems*	3	-	3	-	2	3	2	-	2	2	1	2	3	1
	Average	**3**	**-**	**3**	**-**	**2**	**3**	**2**	**-**	**2**	**2**	**1**	**2**	**3**	**1**

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

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

SEMESTER – V

		L	T	P	C
20HS001	**PRINCIPLES OF MANAGEMENT** (Common to All Branches) **(PROFESSIONAL ELECTIVE – II)**	3	0	0	3

Prerequisites:

Outcome(s): On completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Explain the fundamentals of Management thoughts and the conceptual frame work of Management*	*Understand*
CO2:	*Discuss the various concepts of planning, MBO and Strategy to help solving managerial problems*	*Understand*
CO3:	*Explain the concepts of organizing, Delegation and Decision making.*	*Understand*
CO4	*Describe the management concepts and styles in Leading.*	*Create*
CO5:	*Illustrate the various controlling and emerging concepts in management thought and philosophy.*	*Analysis*

UNIT - I OVERVIEW OF MANAGEMENT [09]

Definition of Management – Importance of management – Management functions – Levels of management – Role of managers – Management a science or an art – Evolution of Management thought: Scientific management and Administrative Principles of management – Ethical issues in Management.

UNIT - II PLANNING [09]

Planning: Meaning, purpose, Steps and Types of Plans - Management by objectives (MBO) – Decision Making: Types of Decisions, Steps in Rational Decision making, Common difficulties in Management Decision Making.

UNIT – III ORGANISING [09]

Nature and purpose of organizing : Organization structure, Process and Principles of organizing – Line & Staff authority – Departmentation – Span of Control – Centralization and Decentralization – Delegation of authority – Staffing : Sources of Recruitment, Selection process – Training methods – Performance appraisal methods.

UNIT - IV DIRECTING [09]

Creativity and Innovation – Motivation and Satisfaction: Motivation Theories – Leadership: Leadership theories and Styles – Communication: Barriers to communication, Principles of effective Communication

UNIT - V CONTROLLING [09]

Steps in a control Process: Need for control system, Budgetary and Non-Budgetary control techniques, Problems of the control system, Essentials of effective control system, and Benefits of control.

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

Text Books :

1. L.M.Prasad, Principles and Practices of Management, Sultan Chand & Sons, New Delhi, Eleventh Edition, 2015.
2. P.C.Tripathi and Reddy Principles of Management, McGraw Hill , New Delhi, Eighth Edition,2015.

Reference Books :

1. Hellriegel, Slocum & Jackson, Management A Competency Based Approach, Thomson South Western, London, Fifteenth Edition, 2017.
2. Harold Koontz, Heinz Weihrich and mark V Cannice, Management – A Global Entrepreneurial Perspective, Tata McGraw Hill, New Delhi, Twelveth Edition, 2014.
3. Andrew J. Dubrin, Essentials of Management, Thomson Southwestern, London, Tenth edition, 2014.
4. Robbins S.P., Fundamentals of Management, Pearson, New Delhi, Second Edition, 2003

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : V **Regulation : R2020**

Course Code : 20HS001 **Course Name : PRINCIPLES OF MANAGEMENT**

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 fundamentals of Management thoughts and the conceptual frame work of Management .*	-	-	-	-	-	1	1	3	1	2	3	2	-	-
CO2:	*Discuss the various concepts of planning, MBO and Strategy to help solving managerial problems*	-	-	-	-	-	1	1	3	1	2	3	2	-	-
CO3:	*Explain the concepts of organizing, Delegation and Decision making.*	-	-	-	-	-	1	1	3	1	2	3	2	-	-
CO4:	*Describe the management concepts and styles in Leading.*	-	-	-	-	-	1	1	3	1	2	3	2	-	-
CO5:	*Illustrate the various controlling and emerging concepts in management thought and philosophy*	-	-	-	-	-	1	1	3	1	2	3	2	-	-
	Average	**-**	**-**		**-**	**-**	**1**	**1**	**3**	**1**	**2**	**3**	**2**	**-**	**-**

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

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

SEMESTER - V

		L	T	P	C
20ME662	**PRODUCT DESIGN AND DEVELOPMENT (PROFESSIONAL ELECTIVE – II)**	3	0	0	3

Prerequisite: Design of machine elements.

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explore the characteristics of Product design and development.*	*Remember*
CO2:	*Demonstrate the knowledge on method of concept development and testing.*	*Understand*
CO3:	*Evaluate the cost of manufacturing and concurrent engineering.*	*Evaluate*
CO4:	*Investigate the product architecture and industrial design.*	*Analyze*
CO5:	*Evaluate patent, intellectual properties rights and product development economics.*	*Evaluate*

UNIT - I INTRODUCTION [09]

Introduction - characteristics of successful product development - who designs and develops product - duration and cost of product development - challenges of product development. Development process and organization - a generic development process - concept development - product development process flow - product development organizations. Product planning - product planning process - identifying customer needs - product specifications.

UNIT - II CONCEPT DEVELOPMENT [09]

Concept generation - activity of concept generation. Concept selection - method for choosing a concept. Concept screening - concept scoring - concept testing - steps of concept testing.

UNIT - III DESIGN FOR MANUFACTURING , PROTOTYPING AND ROBUST DESIGN [09]

Design for manufacturing - definition - estimation of manufacturing costs - methods of reducing costs and other supporting production cost. Prototyping - principles of prototyping - prototyping technologies - planning for prototyping. Robust design - introduction - steps for robust design - concurrent engineering.

UNIT - IV PRODUCT ARCHITECTURE AND INDUSTRIAL DESIGN [09]

Product architecture - introduction of product architecture - implications of product architecture - establishing product architecture - platform planning - related system level design issues. Industrial design - introduction - need - management of Industrial design process - quality of industrial design.

UNIT - V PATENTS AND INTELLECTUAL PROPERTY, PRODUCT DEVELOPMENT ECONOMICS [09]

Patents and intellectual property - what is intellectual property - steps for patents and intellectual property. Product development economics - introduction - elements of economic analysis.

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

Text Books :

1 Karl T.Ulrich, Steven D.Eppinger, and Anita Goyal, Product Design and Development, TMH, Fourth edition, 2011.

2 George Dietor, A Material and Processing Approach, McGraw Hill, Delhi, second edition, 2000.

Reference Books :

1 Kevin Otto, Kristin Wood, Product Design, Pearson Education, Delhi, second edition, 2008.

2 Imad Moustapha, Concurrent Engineering in Product Design and Development, New Age International, Delhi, second edition, 2003.

3 A. K. Chitale, R. C. Gupta, Product Design and Manufacturing, PHI Private Ltd., Delhi, Third Edition,2007.

4 Pahl and Pitz, Engineering Design Process, Springer, Second Edition, 2007.

5 Thomke, stefan and Ashok Nimgade, IDEO Product Development. MA: Harvard Business School Case 9-600-143, June 22, 2000

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : V **Regulation : R2020**

Course Code : 20ME662 **Course Name : PRODUCT DESIGN AND DEVELOPMENT**

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 characteristics of Product design and development.*	3	3	3	3	2	2	2	2	-	2	-	2	2	2
CO2:	*Demonstrate the knowledge on method of concept development and testing.*	3	3	3	3	2	2	2	2	-	2	-	2	2	2
CO3:	*Evaluate the cost of manufacturing and concurrent engineering.*	3	3	3	3	2	2	2	2	-	2	-	2	2	2
CO4:	*Investigate the product architecture and industrial design.*	3	3	3	3	2	2	2	2	-	2	-	2	2	2
CO5:	*Evaluate patent, intellectual properties rights and product development economics.*	3	3	3	3	2	2	2	2	-	2	-	2	2	2
	Average	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**-**	**2**	**-**	**2**	**2**	**2**

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

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

SEMESTER - V

20ME663	**THERMAL TURBO MACHINES**	L	T	P	C
	(PROFESSIONAL ELECTIVE – II)	3	0	0	3

Prerequisites *: Engineering Thermodynamics, Thermal Engineering.*

Course Outcomes : On successful completion of the course, the student will be able to	***Cognitive Level***
CO1: Recognize the turbo machines.	*Understand*
CO2: Describe the centrifugal fans and compressors.	*Create*
CO3: Categorize the axial fans and compressors.	*Analyze*
CO4: Construct the axial flow turbines.	*Apply*
CO5: Perform the radial flow turbines and wind turbines.	*Evaluate*

UNIT - I INTRODUCTION TO TURBO MACHINES [09]

Turbo machines - fans, blowers and compressors - stages, energy transfer between fluid and rotor - stage velocity triangles - general energy equation - modified to turbo machines - compression and expansion process - velocity triangles - work - T-S and H-S diagram - total-to-total and total-to-static efficiencies.

UNIT - II CENTRIFUGAL FANS AND COMPRESSORS [09]

Definition - selection and classifications - types of blading design - velocity triangles - stage parameters - flow analysis in impeller blades - design parameter - volute and diffusers - efficiencies and losses - fan noises - causes and remedial measures. Centrifugal compressors: constructional details - stage velocity triangles - stage work - stage pressure rise - stage efficiency - degree of reaction - slip factor - H-S diagram - efficiencies - performance characteristics.

UNIT - III AXIAL FANS AND COMPRESSORS [09]

Definition and classifications - stage parameters - types of fan stages - performance characteristics - cascade of blades - cascade tunnel - blade geometry - cascade variables - energy transfer and loss in terms of lift and drag. Axial flow compressors: definition and classifications - constructional details - stage velocity triangles - stage work - stage pressure rise - H-S diagram - stage efficiencies and losses - degree of reaction - radial equilibrium - surging and stalling - performance characteristics.

UNIT - IV AXIAL FLOW TURBINES [09]

Construction details - 90° IFR turbine - stage work - stage velocity triangles - stage pressure rise - impulse and reaction stage - effect of degree of reaction - H-S diagram - efficiencies and losses - performance characteristics.

UNIT - V RADIAL FLOW TURBINES AND WIND TURBINES [09]

Constructional details - stage velocity triangles - H-S diagram - stage efficiencies and losses - performance characteristics - wind turbines: definition and classifications - constructional details - horizontal axis wind turbine - power developed - axial thrust - efficiency.

Total = 45 Periods

Text Books:

1. Yahya, S.M., Turbines, Compressors and Fans, Tata McGraw-Hill Publishing Company,New Delhi,Second Edition, 2010.
2. Dixon, S.L., ―Fluid Mechanics, Thermodynamics of Turbo-machinesǁ, Elsevier Science, Sixth Edition, 2010

Reference Books:

1. Kadambi, V. and Manohar Prasad, An Introduction to energy conversion - Vol. III, Turbomachines, Wiley Eastern India Ltd, UK,Fourth Edition,1977.
2. Shepherd, D.H., Principles of Turbo machinery, The Macmillan Company, New York, Second Edition,1969.
3. Issac M. Daniel and Ori Ishai, Engineering Mechanics of Composite Materials, Oxford University Press, UK, First Indian Edition ,2007.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : V **Regulation : R2020**

Course Code : 20ME663 **Course Name : THERMAL TURBO MACHINES**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Recognize the turbo machines.*	3	2	2	3	3	2	-	-	-	-	2	2	2	3
CO2:	*Describe the centrifugal fans and compressors.*	3	2	2	3	3	2	-	-	-	-	2	2	2	3
CO3:	*Categorize the axial fans and compressors.*	3	2	2	3	3	2	-	-	-	-	2	2	2	3
CO4:	*Construct the axial flow turbines.*	3	2	2	3	3	2	-	-	-	-	2	2	2	3
CO5:	*Perform the radial flow turbines and wind turbines.*	3	2	2	3	3	2	-	-	-	-	2	2	2	3
	Average	**3**	**2**	**2**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**3**

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

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

SEMESTER - V

		L	T	P	C
20ME664	**INTERNAL COMBUSTION ENGINES (PROFESSIONAL ELECTIVE – II)**	3	0	0	3

Prerequisites *: Thermal Engineering, Thermodynamics.*

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

CO1:	*Evaluate the combustion characteristics of SI engines.*	*Evaluate*
CO2:	*Explore the combustion parameters of CI engines.*	*Understand*
CO3:	*Suggest the alternate fuels for automobiles.*	*Analyze*
CO4:	*Enhance the performance of IC engines through design modification.*	*Understand*
CO5:	*Demonstrate the emission control techniques for IC engines.*	*Remenber*

UNIT - I SPARK IGNITION ENGINES [09]

Introduction - mixture requirements - carburetors - fuel injection systems - single point and multi point injection - stages of combustion - normal, abnormal combustion - factors affecting knock - measurement of knock - anti knock agent - types of combustion chambers.

UNIT - II COMPRESSION IGNITION ENGINES [09]

Introduction - states of combustion - direct, indirect injection systems - combustion chambers - fuel spray behaviors - spray structure, spray penetration, evaporation - air motion.

UNIT - III ALTERNATIVE FUELS [09]

Introduction - Methanol, ethanol, hydrogen, natural gas, biogas, bio diesel, liquefied petroleum gas - properties, suitability, engine modifications, merits and demerits as fuels.

UNIT - IV EMERGING ENGINE TECHNOLOGIES [09]

Introduction - Lean burn engines - stratified charge engines - gasoline direct injection engine - homogeneous charge compression ignition - plasma ignition - zero emission vehicle, variable compression ratio engines, and turbocharged engines.

UNIT - V POLLUTANT FORMATION AND CONTROL [09]

Pollutant - sources and types - formation of NOx - hydrocarbon emission mechanism - carbon monoxide formation - particulate emissions - effect of pollutant, emission standards - methods of controlling emissions - catalytic converters, particulate traps.

Total = 45 Periods

Text Books:

1. Ganesan, V., Internal Combustion Engines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Fourth Edition, 2015.
2. Gupta, H. N., Internal Combustion Engines, PHI Learning Private Limited, New Delhi, Second Edition, 2012.

Reference Books:

1. Willard, W. Pulkrabek ., Engineering fundamentals of the Internal Combustion Engine, PHI Learning Private Limited, New Delhi, Third Edition, 2008.
2. John, B.Heywood., Internal combustion engines fundamentals, Tata McGraw Hill, New Delhi, Second Edition, 2013.
3. Mathur, R.B.and Sharma R.P., Internal Combustion Engines, NIT, Tiruchirappalli, 2016.
4. Mohanty, R.K., A text book of internal combustion engines, Standard book House, New Delhi, Second Edition, 2015.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : V **Regulation : R2020**

Course Code : 20ME664 **Course Name : INTERNAL COMBUSTION ENGINES**

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 combustion characteristics of SI engines.*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
CO2:	*Explore the combustion parameters of CI engines.*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
CO3:	*Suggest the alternate fuels for automobiles.*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
CO4:	*Enhance the performance of IC engines through design modification.*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
CO5:	*Demonstrate the emission control techniques for IC engines.*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
	Average	**3**	**2**	**2**	**3**	**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 - V

		L	T	P	C
20ME665	**PROCESS PLANNING AND COST ESTIMATION (PROFESSIONAL ELECTIVE – II)**	3	0	0	3

Prerequisite: *Manufacturing Technology-II, Computer Aided Manufacturing*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Understand the work study and ergonomics.*	*Remember*
CO2:	*Evaluate the process planning.*	*Understand*
CO3:	*Apply the cost estimation and cost accounting.*	*Analyze*
CO4:	*Assess the types of estimation, standard data and allowances.*	*Remember*
CO5:	*Choose the production cost estimation.*	*Evaluate*

UNIT - I INTRODUCTION TO PROCESS PLANNING [09]

Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in process selection-.Production equipment and tooling selection

UNIT - II INTRODUCTION TO COST ESTIMATION [09]

Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labour cost, material cost- allocation of overhead charges- Calculation of depreciation cost

UNIT - III PRODUCTION COST ESTIMATION [09]

Estimation of material cost, labour cost and over heads, allocation of overheads - estimation for different types of jobs-estimation of machining time.

UNIT - IV TYPES OF ESTIMATION, STANDARD DATA AND ALLOWANCES [09]

Types of estimates – materials available to develop estimate-methods of estimates – realistic estimates -data requirements and sources - collection of cost - estimating procedure -allowances in estimation.

UNIT - V MACHINING TIME CALCULATION [09]

Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations ,Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding.

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

Text Books :

1 Narang G.B.S and V.Kumar, Production and Costing, Khanna Publishers, Delhi, Second Edition, 2005.

2 Sinha.B.P., Mechanical Estimating and Costing, Tata McGraw-Hill, Publishing Co.,New Delhi,Second Edition,1995.

Reference Books :

1 Russell.R.S and Tailor, B.W, Operations Management, PHI,Delhi, Fourth Edition, 2003.

2 Chitale.A.V. and Gupta.R.C., Product Design and Manufacturing, PHI,New Delhi,Second Edition, 2002.

3 Phillip.FOstwalal and Jairo Munez, Manufacturing Processes and systems, John Wiley, UK, Ninth Edition, 1998.

4 Mikell P. Groover, Automation, Production, Systems and Computer Integrated Manufacturing, Pearson Education Second Edition, 2001.

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DEPARTMENT OF MECHANICAL ENGINEERING

Semester :V **Regulation : R2020**

Course Code : 20ME665 **Course Name : PROCESS PLANNING AND COST ESTIMATION**

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 work study and ergonomics.*	3	-	2	2	3	-	-	-	3	-	-	-	3	2
CO2	*Evaluate the process planning.*	3	-	2	2	3	-	-	-	3	-	-	-	3	2
CO3	*Apply the cost estimation and cost accounting.*	3	-	2	2	3	-	-	-	3	-	-	-	3	2
CO4	*Assess the types of estimation, standard data and allowances.*	3	-	2	2	3	-	-	-	3	-	-	-	3	2
CO5	*Choose the production cost estimation.*	3	-	2	2	3	-	-	-	3	-	-	-	3	2
	Average	**3**	**-**	**2**	**2**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**3**	**2**

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

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

SEMESTER – V

20ME666	**WELDING TECHNOLOGY**	L	T	P	C
	(PROFESSIONAL ELECTIVE – II)	3	0	0	3

Prerequisite: Manufacturing Technology-I

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explore the working principles and application of arc and gas welding process.*	*Remember*
CO2:	*Investigate the characteristics of submerged arc welding.*	*Understand*
CO3:	*Evaluate the Construction and working principle of gas tungsten arc welding.*	*Evaluate*
CO4:	*Analyze the performance of metal arc welding.*	*Analyze*
CO5:	*Evaluate the various advanced welding processes and its applications.*	*Evaluate*

UNIT - I INTRODUCTION [09]

Gas welding: gases - setup of equipment - flame characteristics - different kinds of flame and their areas of application - weld quality - applications - variants of oxy-gas welding.

Manual metal arc welding: process - power sources - function of flux covering - different type of electrodes and their application - electrode designations - defects in welding.

UNIT - II SUBMERGED ARC WELDING [09]

The process - power sources - advantages - limitations - process variables and their effects - SAW consumables - significance of flux-metal combination - modern developments - applications - defects.

UNIT - III GAS TUNGSTEN ARC WELDING [09]

Electrode polarity - shielding gas - use of D.C. suppressors - arc starting and stopping - choice of filler metal composition - use of pulsed arc and GTA spot welding - other recent developments - applications.

UNIT - IV GAS METAL ARC WELDING [09]

Considerations of electrodes polarity - shield gas and filler composition -nature of conditions of spray transfer - difficulties for thin sheet - dip transfer and CO2 welding. Flux cored and pulsed MIG welding - other recent developments - applications.

UNIT - V ADVANCED WELDING PROCESSES [09]

Solid state welding processes - high energy beam welding - electro slag welding - plasma arc welding - principles of operation - advantages - limitations - applications.

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

Text Books :

1 *Parmer R.S., Welding Processes and Technology, Khanna Publishers, Delhi, Third edition, 2013.*
2 *AWS - Welding Hand Book, Volume-1, Welding Process, Tenth Edition, 2019.*

Reference Books :

1 *Schwartz M.M., Metals Joining Manual, McGraw Hill Books, New Delhi, second edition, 1979.*
2 *Tylecote R.F., The Solid Phase Welding of Metals, Edward Arnold Publishers Ltd. London, Third Edition, 1968.*
3 *Nadkarni S.V., Modern Arc Welding Technology, Oxford IBH Publishers, UK, Sixth Edition, 2008*
4 *Christopher Davis, Laser Welding - Practical Guide, Jaico Publishing House, Mumbai, Second Edition, 1994.*

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : V **Regulation : R2020**

Course Code : 20ME666 **Course Name : WELDING TECHNOLOGY**

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 working principles and application of arc and gas welding process.*	3	3	3	3	2	2	2	2	-	2	-	2	2	2
CO2:	*Investigate the characteristics of submerged arc welding.*	3	3	3	3	2	2	2	2	-	2	-	2	2	2
CO3:	*Evaluate the Construction and working principle of gas tungsten arc welding.*	3	3	3	3	2	2	2	2	-	2	-	2	2	2
CO4:	*Analyze the performance of metal arc welding.*	3	3	3	3	2	2	2	2	-	2	-	2	2	2
CO5:	*Evaluate the various advanced welding processes and its applications.*	3	3	3	3	2	2	2	2	-	2	-	2	2	2
	Average	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**-**	**2**	**-**	**2**	**2**	**2**

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

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

SEMESTER -VI

		L	T	P	C
20ME097	**INDUSTRIAL SAFETY ENGINEERING (PROFESSIONAL ELECTIVE-III)**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Achieve an understanding of principles of safety management.*	*Understand*
CO2:	*Know the safety rules and regulations, standard and codes applicable for engineering industry.*	*Remember*
CO3:	*Gain knowledge about safety construction machinery*	*Remember*
CO4:	*Know the various fire prevention systems and protective equipment's.*	*Understand*
CO5:	*Familiarize students with evaluation of safety performance*	*Evaluate*

UNIT - I INTRODUCTION TO INDUSTRIAL SAFETY [09]

Evolution of modern safety concept - Safety Management functions - planning for safety for optimization of productivity - productivity, quality and safety - line and staff functions for safety - safety committee - budgeting for safety - safety policy - Statutory Provisions for safety management.

UNIT - II SAFETY IN ENGINEERING INDUSTRY [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, work area, material handling, inspection, standards and codes - saws, types, Hazards.

UNIT - III SAFETY IN CONSTRUCTION [09]

Selection, operation, inspection and testing of hoisting cranes, mobile cranes, tower cranes, crane inspection checklist - builder's hoist, winches, chain pulley blocks - use of conveyors - concrete mixers, concrete vibrators - safety in earth moving equipment, excavators, dozers, loaders, dumpers, motor grader, concrete pumps, welding machines, use of portable electrical tools, drills, grinding tools, manual handling scaffolding, hoisting cranes - use of conveyors and mobile cranes - manual handling.

UNIT - IV INDUSTRIAL FIRE PROTECTION SYSTEMS [09]

Sprinkler - hydrants - stand pipes - special fire suppression systems like deluge and emulsifier, selection criteria of the above installations, reliability, maintenance, evaluation and standards - alarm and detection systems. Other suppression systems - CO_2 system, foam system, ABC system - smoke venting. Portable extinguishers - flammable liquids - tank farms - indices of inflammability - fire fighting.

UNIT - V SAFETY EDUCATION AND TRAINING [09]

Importance of training - identification of training needs - training methods such as hands on training and tabletop exercise - Programme, seminars, conferences, competitions - method of promoting safe practice – motivation - communication - safety attitude and culture - role of government agencies and private consulting agencies in safety training - creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign - Domestic Safety and Training

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

Text Books :

1 Blake, R.B., Industrial Safety, Prentice Hall, Inc., New Jersey, Second edition,2019

2 Krishnan, N.V., Safety Management in Industry, Jaico Publishing House, Bombay, Fifth Edition,2017.

Reference Books :

1 Derek, James, Fire Prevention Hand Book, Butter Worths and Company, London, Ninth edition, 2016 .

2 Rita Yi Man Li, Sun WahPoon, Construction Safety, Springer Heidelberg New York, Dordrecht London, Second edition,2013.

3 Krishnan, N.V., Safety in Industry, Jaico Publishers House, 2016.

4 Raghavan, K.V. and Khan A.A., Methodologies in Hazard Identification and Risk Assessment Manual by CLRI, Second Edition, 2019

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester :VI **Regulation :R2020**

Course Code :20ME097 **Course Name :INDUSTRIAL SAFETY 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 the concepts and techniques of safety management functions.*	3	2	-	-	3	-	2	-	-	2	-	-	3	2
CO2	*Determine the General safety rules, principles, maintenance, Inspections of metal and wood working machinery.*	3	2	-	-	3	-	2	-	-	2	-	-	**3**	**2**
CO3	*Apply knowledge selecting, operations, inspection and testing of various construction machinery.*	3	2	-	-	3	-	2	-	-	2	-	-	**3**	**2**
CO4	*Acquire knowledge on different sources of ignition, classes of fires and their extinguishing medium*	3	2	-	-	3	-	2	-	-	2	-	-	**3**	**2**
CO5	*Recall the role of various agencies in safety education and training.*	3	2	-	-	3	-	2	-	-	2	-	-	3	2
	Average	**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 - VI

		L	T	P	C
20ME771	**INDUSTRIAL TRIBOLOGY (PROFESSIONAL ELECTIVE – III)**	3	0	0	3

Prerequisite: *Design of Machine Elements, Fluid Mechanics and Machinery.*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explore the friction topography of engineering material surfaces.*	*Understand*
CO2:	*Analyze the different types of wear mechanisms.*	*Analyze*
CO3:	*Investigate the types of lubrication methods.*	*Analyze*
CO4:	*Demonstrate the film lubrication theory for bearings.*	*Remember*
CO5:	*Explore the concepts of surface coatings techniques for bearing materials.*	*Apply*

UNIT - I SURFACES AND FRICTION [09]

Topography of engineering surfaces - contact between surfaces - sources of sliding friction - adhesion - energy dissipation mechanisms.

Friction characteristics of metals, ceramic materials and polymers - friction of lamellar solids - rolling friction - sources of rolling friction - measurement of friction.

UNIT - II WEAR [09]

Types of wear - Mechanisms of sliding wear - Abrasive wear - Materials for adhesive and abrasive wear situations - Corrosive wear - Surface fatigue wear situations - Wear of ceramics and polymers - Wear measurements.

UNIT - III LUBRICANTS AND LUBRICATION TYPES [09]

Types and properties of lubricants - Testing methods - Concepts of Hydrodynamic, Hydrostatic, Elasto Hydrodynamic and boundary lubrication. Thin film and thick film lubrication - Methods of lubrication - Semi solid and solid lubricants.

UNIT - IV FILM LUBRICATION THEORY [09]

Fluid film in simple shear - Viscous flow between very close parallel plates - Shear stress variation - Reynolds equation for film lubrication - High speed unloaded journal bearings - Loaded journal bearings - Reaction torque on the bearings - Virtual co-efficient of friction - The Sommerfeld diagram.

UNIT - V SURFACE ENGINEERING AND ITS MATERIALS [09]

Surface modifications – Transformation, hardening, surface fusion - Thermo chemical processes - Surface coatings - Plating and anodizing – Surface Techniques-Fusion processes - Vapour phase processes.

Materials for rolling element bearings - Materials for fluid film bearings - Materials for marginally lubricated and dry bearings.

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

Text Books :

1 Harnoy, A., Bearing Design in Machinery, Marcel Dekker Inc, New York, Second Edition, 2003.

2 Basu, S.K., et. Al., Fundamentals of Tribology, PHI Learning Private Limited, Delhi, Third Edition, 2019.

Reference Books :

1 Khonsari, M.M and Booser, E.R., Applied Tribology, John Willey &Sons, Third Edition, 2017.

2 Neale, M. J. (Editor), Tribology Handbook, Newnes. Butter worth - Heinemann, U.K., Second Edition, 1995.

3 Cameron, A., Basic Lubrication theory, Longman, U.K., Second Edition, 2001.

4 E.P.Bowden, E.P., Tabor, D., Friction and Lubrication, Heinemann Educational Books Ltd., U.S., Second Edition, 2004.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VI **Regulation : R2020**

Course Code : 20ME771 **Course Name : INDUSTRIAL TRIBOLOGY**

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 friction topography of engineering material surfaces.*	3	3	3	3	2	2	2	-	-	2	-	2	3	2
CO2:	*Analyze the different types of wear mechanisms.*	3	3	3	3	2	2	2	-	-	2	-	2	3	2
CO3:	*Investigate the types of lubrication methods.*	3	3	3	3	2	2	2	-	-	2	-	2	3	2
CO4:	*Demonstrate the film lubrication theory for bearings.*	3	3	3	3	2	2	2	-	-	2	-	2	3	2
CO5:	*Explore the concepts of surface coatings techniques for bearing materials.*	3	3	3	3	2	2	2	-	-	2	-	2	3	2
	Average	**3**	**3**	**3**	**3**	**2**	**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 – VI

		L	T	P	C
20ME772	**DESIGN OF AIRCRAFT STRUCTURES**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Develop the structural design considerations of an aircraft.*	*Remember*
CO2:	*Explore various forces acting on aircraft structures*	*Analyze*
CO3:	*Investigate various aircraft materials manufacturing processes*	*Understand*
CO4:	*Examine the air worthiness and certifications of aircrafts.*	*Evaluate*
CO5:	*Implement the maintenance and repair of Aircraft structure.*	*Analyze*

UNIT - I OVERVIEW AND FUNDAMENTALS OF AIRCRAFT DESIGN PROCESS [09]

Phases of Aircraft design, Aircraft conceptual design process, preliminary design, detailed design- methodologies. Hooke's law, principal stresses, determinate structures, St venants principle, stress transformation, Stress strain relationship.

UNIT - II INTRODUCTION TO AIRCRAFT STRUCTURES [09]

Types of structural members of fuselage and wing section ribs, spars, Frames, Stringers, longeron, splices, Sectional properties of structural members and their loads. Types of structural joints. Aerodynamic loads- inertia load due to engine, Actuator loads, maneuver loads, VN loads, Gust loads, ground loads, ground conditions.

UNIT - III AIRCRAFT MATERIALS AND MANUFACTURING PROCESSES [09]

Material selection criteria, aluminium, titanium, steel, magnesium and copper alloys- Non metallic materials, Composite materials, uses of advanced smart materials, Manufacturing of AC structural members, Manufacturing processes for composite materials, sheet metal fabrication, welding and super plastic forming and diffusion coating.

UNIT - IV AIR WORTHINESS AND AIRCRAFT CERTIFICATION [09]

Airworthiness regulations, Regulatory bodies, Type certification, general requirements, requirements related to Aircraft design covers, Performance and flight requirements, Airframe requirements, Landing requirements. Fatigue and failsafe requirements- Emergency provisions, Emergency landing requirements.

UNIT - V AIRCRAFT STRUCTURAL REPAIR [09]

Types of structural damage, non-conformance, Rework, allowable damage limit, Repairable damage limit, overview of ADL analysis, types of repair, Repair considerations and best practices.

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

Text Books :

1 Mickel .C.Y. Niu, Airframe structural analysis and sizing, Adaso Adastra Engineering centre, Third Edition, 2016.

2 Mickel .C.Y. Niu, Airframe structural design,Adaso Adastra Engineering centre, Second Edition,2018.

Reference Books :

1 David J. Peery, Aircraft Structures, Dover publications, New york, Third Edition, 2013.

2 Richard Won mises, Theory of Flight, TMH, Delhi, second edition, 2012.

3 T.H.G.Megson, Introduction to Aircraft Structural analysis, Butterworth Heinmann, US, Second Edition, 2014.

4 Sun, C.T., Mechanics of Aircraft Structures, John Wiley & Sons, 2004.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VI **Regulation : R2020**

Course Code : 20ME772 **Course Name : DESIGN OF AIRCRAFT STRUCTURES**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Develop the structural design considerations of an aircraft.*	3	3	3	2	3	-	2	-	2	-	-	3	3	2
CO2:	*Explore various forces acting on aircraft structures*	3	3	3	2	3	-	2	-	2	-	-	3	3	2
CO3:	*Investigate various aircraft materials manufacturing processes*	3	3	3	2	3	-	2	-	2	-	-	3	3	2
CO4:	*Examine the air worthiness and certifications of aircrafts.*	3	3	3	2	3	-	2	-	2	-	-	3	3	2
CO5:	*Implement the maintenance and repair of Aircraft structure.*	3	3	3	2	3	-	2	-	2	-	-	3	3	2
	Average	**3**	**3**	**3**	**2**	**3**	**-**	**2**	**-**	**2**	-	-	**3**	**3**	**2**

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

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

SEMESTER – VI

		L	T	P	C
20ME773	**RENEWABLE SOURCES OF ENERGY (PROFESSIONAL ELECTIVE-III)**	3	0	0	3

Prerequisite: *Power Plant Engineering*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Apply solar energy principles to obtain electric power.*	*Apply*
CO2:	*Recall wind energy generation techniques.*	*Remember*
CO3:	*Demonstrate the Bio gas energy. Conversion principles.*	*Understand*
CO4:	*Categorize the Bio gas energy. Conversion principles.*	*Analyze*
CO5:	*Discuss the advances in alternate energy sources.*	*Create*

UNIT - I SOLAR ENERGY [09]

Solar radiation and its measurements, solar energy conversion, solar energy collectors - flat plate collector, concentrating collector, advantages and disadvantages, storage systems, applications, solar thermal power plants.

UNIT - II WIND ENERGY [09]

Introduction, classifications, energy conversion principles, advantages and disadvantages. wind energy generators, forces acting on the blades, storage systems, applications, safety systems

UNIT - III BIO ENERGY [09]

Bio mass - conversion techniques, thermal gasification, photosynthesis. bio gas – types of plants, materials, site selection, design consideration, properties, utilization, pyrolysis, thermo chemical process, liquid fuels.

UNIT - IV GEO THERMAL AND TIDEL ENERGY [09]

Geo thermal energy - introduction, hydrothermal resources and geo pressured resources, hot dry rock resources, magma resources and prime movers, materials selection, advantages and disadvantages. tidel energy – introduction, ocean thermal electric conversion (OTEC), energy from tides, mini and micro hydel plants.

UNIT - V ADDITIONAL ALTERNATE ENERGY SOURCES [09]

Magneto hydro dynamic (MHD) power generation- principles, design and developments, materials. thermo nuclear fusion energy – nuclear fusions, reactions, requirements, types, advantages and disadvantages, fusion hybrids.

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

Text Books :

1 Chetan Singh Solanki, Renewable Energy Technologies, PHI Learning Private Limited., New Delhi, Second Edition, 2016.

2 G.D. Rai, Non Conventional Energy Sources, Khanna Publishers, New Delhi, Second Edition, 2011.

Reference Books :

1 Twidell, J.W. & Weir, A., Renewable Energy Sources, EFN Spon Ltd., UK, Second Edition,2001

2 B.H. Khan, Non Conventional Energy Resources, Tata McGraw Hill Publishing Company Ltd., New Delhi, Second Edition, 2006.

3 G.S. Sawhney, Non Conventional Energy Resources, PHI Learning Private Limited., New Delhi, Second Edition, 2012.

4 D.S. Chauhan, S.K. Srivastava, Non Conventional Energy Resources, New Age International (P) Ltd. New Delhi, Second Edition, 2009.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VI **Regulation : R2020**

Course Code : 20ME773 **Course Name : RENEWABLE SOURCES OF ENERGY**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Apply solar energy principles to obtain electric power.*	3	3	2	-	2	3	2	2	3	2	2	-	2	-
CO2:	*Recall wind energy generation techniques.*	3	3	2	-	2	3	2	2	3	2	2	-	2	-
CO3:	*Demonstrate the Bio gas energy. Conversion principles.*	3	3	2	-	2	3	2	2	3	2	2	-	2	-
CO4:	*Categorize the Bio gas energy. Conversion principles.*	3	3	2	-	2	3	2	2	3	2	2	-	2	-
CO5:	*Discuss the advances in alternate energy sources.*	3	3	2	-	2	3	2	2	3	2	2	-	2	-
	Average	**3**	**3**	**2**	**-**	**2**	**2**	**3**	**2**	**3**	**2**	**2**	**-**	**2**	-

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

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

SEMESTER – VI

		L	T	P	C
20ME774	**FUNDAMENTALS OF NANO SCIENCE (PROFESSIONAL ELECTIVE – III)**	3	0	0	3

Prerequisite: *Applied Physics.*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Retrieving the impact of engineering solutions using Nano science and technology.*	*Remember*
CO2:	*Categorize the preparation methods of Nano materials*	*Analyze*
CO3:	*Apply the patterning and lithography techniques*	*Apply*
CO4:	*Develop a preparation environment of Nano materials and their hazards*	*Understand*
CO5:	*Explore characterization techniques for analyzing the material behaviour.*	*Analyze*

UNIT - I INTRODUCTION OF NANO SCIENCE AND TECHNOLOGY [09]

Introduction and framework of Nano science and technology - implications on physics, chemistry, biology and engineering -classifications of nano structured materials - nano particles - quantum dots, wells and wires. Ultra-thin films - multilayered material. Properties: mechanical, electronic, optical, magnetic and motivation for study (qualitative only).

UNIT - II PREPARATION METHODS [09]

Bottom-up and top-down approach: mechanical milling, colloidal routes, self assembly, vapour phase deposition, MOCVD, sputtering, evaporation, molecular beam epitaxy, atomic layer epitaxy, MOMBE, Sol-gel technique.

UNIT - III PATTERNING AND LITHOGRAPHY [09]

Introduction to optical /UV electron beam and X RAY lithography systems and processes, wet etching, dry (plasma/reactive ion) etching, etch resists - dip pen lithography, nano imprint lithography and soft lithography..

UNIT - IV PREPARATION ENVIRONMENT AND HAZARDS [09]

Clean rooms: specifications and design, air and water purity, requirements for particular processes, vibration free environments: services and facilities required. Working practices, sample cleaning, chemical purification, chemical and biological contamination, safety issues, flammable and toxic hazards and bio-hazards.

UNIT - V CHARACTERISATION TECHNIQUES [09]

mechanical characterization. Optical microscopy - AFM, SPM, STM, SNOM, ESCA, SIMS, XRD, SEM, TEM

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

Text Books :

1 The Oxford hand book of Nano science and technology, edited by A.V.Narlivar, 2018.

2 Encyclopedia of Nano technology, Elwood D.Carlson , 2018.

Reference Books :

1 Akhlesh Lakhtakia, The Hand Book of Nano-technology, New Delhi, Second Edition, 2017.

2 N John Dinardo, Nano-scale Characterization Of Surfaces And Interfaces, Weinheim Cambridge, Willy-VCH, UK, Second Edition, 2012.

3 Gregory.C.Timp, Nano-technology, Aip Press/Springer, 1999.

4 A.S Edelstein And R.C Cammearata, Eds, Nano-materials; synthesis, properties and application, institute of physics publishing, Bristol and Philadelphia, Second Edition, 1996.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VI **Regulation : R2020**

Course Code : 20ME774 **Course Name : FUNDAMENTALS OF NANO SCIENCE**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Retrieving the impact of engineering solutions using Nano science and technology*	3	-	3	-	-	-	-	-	-	-	-	-	3	2
CO2:	*Categorize the preparation methods of Nano materials*	3	2	3	2	-	-	-	-	-	-	-	-	3	2
CO3:	*Apply the patterning and lithography techniques*	3	-	3	2	3	-	-	-	-	-	-	-	3	2
CO4:	*Develop a preparation environment of Nano materials and their hazards*	3	2	3	-	-	-	-	-	-	-	-	-	3	2
CO5:	*Explore characterization techniques for analyzing the material behaviour.*	3	-	3	2	-	-	-	-	-	-	-	-	3	2
	Average	**3**	**2**	**3**	**2**	**3**	-	-	-	-	-	-	-	**3**	**2**

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

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

SEMESTER - VI

		L	T	P	C
20ME775	**INDUSTRY 4.0 (PROFESSIONAL ELECTIVE – III)**	3	0	0	3

Prerequisite: Industrial Robotics

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explore the basic concepts of Industry 4.0.*	*Remember*
CO2:	*Identify the features of Artificial Intelligence and IoT.*	*Apply*
CO3:	*Summarize the Big data domain and machine learning .*	*Understand*
CO4:	*Review the various tools and applications of Industry 4.0.*	*Analyze*
CO5:	*Demonstrate the skills required for future industry.*	*Understand*

UNIT - I INDUSTRY 4.0 [09]

Reason for Adopting Industry 4.0 - Definition – Goals and Design Principles - Technologies of Industry 4.0 – Big Data – Artificial Intelligence (AI) – Industrial Internet of Things - Cyber Security – Cloud – Augmented Reality.

UNIT - II ARTIFICIAL INTELLIGENCE [09]

Artificial Intelligence: Artificial Intelligence (AI) – What & Why? - History of AI - Foundations of AI -The AI - Environment - Societal Influences of AI - Application Domains and Tools - Associated Technologies of AI - Future Prospects of AI - Challenges of AI

UNIT - III BIG DATA AND IOT [09]

Big Data : Evolution - Data Evolution - Data : Terminologies - Big Data Definitions - Essential of Big Data in Industry 4.0 - Big Data Merits and Advantages - Big Data Components : Big Data Characteristics - Big Data Processing Frameworks - Big Data Applications - Big Data Tools - Big Data Domain Stack : Big Data in Data Science - Big Data in IoT - Big Data in Machine Learning - Big Data in Databases - Big Data Use cases : Big Data in Social Causes - Big Data for Industry - Big Data Roles and Skills - Big Data Roles - Learning Platforms; Internet of Things (IoT) : Introduction to IoT - Architecture of IoT - Technologies for IoT - Developing IoT Applications - Security in IoT.

UNIT - IV APPLICATIONS AND TOOLS OF INDUSTRY 4.0 [09]

Applications of IoT – Manufacturing – Healthcare – Education – Aerospace and Defence – Agriculture – Transportation and Logistics – Impact of Industry 4.0 on Society: Impact on Business, Government, People. Tools for Artificial Intelligence, Big Data and Data Analytics, Virtual Reality, Augmented Reality, IoT, Robotics.

UNIT - V JOBS 2030 [09]

Industry 4.0 – Education 4.0 – Curriculum 4.0 – Faculty 4.0 – Skills required for Future - Tools for Education – Artificial Intelligence Jobs in 2030 – Jobs 2030 - Framework for aligning Education with Industry 4.0.

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

Text Books :

1 P. Kaliraj, T. Devi, Higher Education for Industry 4.0 and Transformation to Education 5.0

2 The Fourth Industrial Revolution by Klaus Schwab 2 The Industries of Future by Alec Ross 3. A course on “Industry 4.0: How to Revolutnize your business” on edx

Reference Books :

1 Alasdair Gilchrist. Industry 4.0: The Industrial Internet of Things, A press Publications

2 Prof.SudipMisra, Introduction to Industry 4.0 and Industrial Internet of Things.

3 Dr.A.W.Unas A Complete Guide to Industry 4.0

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VI **Regulation : R2020**

Course Code : 20ME775 **Course Name : INDUSTRY 4.0**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explore the basic concepts of Industry 4.0.*	2	-	-	2	2	-	-	2	-	-	-	-	3	3
CO2:	*Identify the features of Artificial Intelligence and IOT.*	3	-	-	2	2	-	-	1	-	-	-	-	3	3
CO3:	*Summarize the Big data domain and machine learning .*	2	-	-	2	2	-	-	2	-	-	-	-	3	3
CO4:	*Review the various tools and applications of Industry 4.0.*	2	-	-	2	2	-	-	2	-	-	-	-	3	3
CO5:	*Demonstrate the skills required for future industry*	2	-	-	2	2	-	-	2	-	-	-	-	3	3
	Average	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**3**

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

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

SEMESTER - VII

		L	T	P	C
20HS786	**HUMAN RESOURCE MANAGEMENT (PROFESSIONAL ELECTIVE – IV)**	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 policies and systems for all HR sub-functions*	*Remembering*
CO2:	*Analyze the factors to deal with multi-cultural workforce.*	*Analyzing*
CO3:	*Estimate the training methods for developing workforce to meet dynamic environment.*	*Evaluating*
CO4:	*Explain the performance of workforce in organization.*	*Understanding*
CO5:	*Illustrate the different competencies required for managing global workforce.*	*Understanding*

UNIT - I INTRODUCTION [09]

Nature and Scope of Human Resource Management (HRM)-Meaning and Definition of HRM-Objectives and Functions of HRM-Models of HRM-HR policies-HRM in the changing environment.

UNIT - II STAFFING [09]

Human Resource Planning-Job Analysis- Job Description- Job Specification- Recruitment-Selection-Induction-Placement- Social networking.

UNIT - III TRAINING AND EXECUTIVE DEVELOPMENT [09]

Types of training methods - purpose – benefits &resistance-Executive Development Programmes– Benefits–Self Development–Knowledge Management - Case study.

UNIT - IV INTERNATIONAL HRM [09]

Domestic versus international Human Resource management-Perspective and practices of International Human Resource Management- Competencies required for International Managers-Changing roles of HR during the transition from Local to Global.

UNIT - V PERFORMANCEEVALUATION ANDCONTROLPROCESS [09]

Compensation plan–Reward–Motivation-Method of Performance Evaluation – Feedback– Industry practices. Promotion, Demotion, Transfer and Separation–Implication of job change. The control process–Importance– Methods– Requirement of effective control systems grievances–Causes–Implications– Redressal methods.

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

Text Books :

1 K.Aswathappa, Human Resource and Personnel Management- Text and Cases, Tata McGraw Hill, New Delhi, Eighth Edition, 2016

2 Biswajeet Pattanayak, Human Resource Management, Prentice Hall of India, New Delhi, Fourth Edition, 2015.

Reference Books :

1 Gary Dessler, Human Resource Management, Prentice Hall of India, New Delhi, Fifth Edition, 2013.

2 Bernardin H John, Human Resource Management-An experiential Approach, Tata McGraw Hill, New Delhi, Third Edition, 2015

3 Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy, Managing Human Resource, PHI Learning, New Delhi, 2014

4 Eugence Mckenna and Nic Beach, Human Resource Management, Pearson Education Limited, New Delhi, 2012.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VII **Regulation : R2020**

Course Code : 20HS786 **Course Name : HUMAN RESOURCE MANAGEMENT**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Describe the Various policies and systems for all HR sub-functions*	3	-	-	-	-	2	2	-	3	2	2	-	2	3
CO2:	*Analyse the factors to deal with multi-cultural workforce.*	3	-	-	-	-	2	2	-	3	2	2	-	2	3
CO3:	*Estimate the training methods for developing workforce to meet dynamic environment.*	3	-	-	-	-	2	2	-	3	2	2	-	2	3
CO4:	*Explain the performance of workforce in organization.*	3	-	-	-	-	2	2	-	3	2	2	-	2	3
CO5:	*Illustrate the different competencies required for managing global workforce.*	3	-	-	-	-	2	2	-	3	2	2	-	2	3
	Average	**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 - VII

		L	T	P	C
20ME776	**INDUSTRIAL ROBOTICS (PROFESSIONAL ELECTIVE –IV)**	3	0	0	3

Prerequisite: *Computer Aided Manufacturing.*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Understand the fundamentals of robotics.*	*Understanding*
CO2:	*Apply the concepts of Robot drive systems and end effectors.*	*Applying*
CO3:	*Gain the Knowledge of sensors and machine vision.*	*Remembering*
CO4:	*Construct the robot kinematics and robot programming.*	*Applying*
CO5:	*Apply the robots in industrial applications and evaluate their economics.*	*Applying*

UNIT - I FUNDAMENTALS OF ROBOTICS [09]

Robot - Definition - Robot Anatomy - Co-ordinate Systems, Work Envelope, types and classification -Specifications - Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load - Robot Parts and Their Functions - Need for Robots – Different Applications.

UNIT - II ROBOT DRIVE SYSTEMS AND END EFFECTORS [09]

Pneumatic Drives - Hydraulic Drives - Mechanical Drives - Electrical Drives - D.C. Servo Motors, Stepper Motor, A.C. Servo Motors - Salient Features, Applications and Comparison of all these Drives.

End Effectors - Grippers - Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT - III SENSORS AND MACHINE VISION [09]

Requirements of a sensor, Principles and Applications of the following types of sensors - Position sensors, Range Sensors , Proximity Sensors, Touch Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors. Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis - Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms. Applications - Inspection, Identification, Visual Serving and Navigation.

UNIT - IV ROBOT KINEMATICS AND ROBOT PROGRAMMING [09]

Forward Kinematics, Inverse Kinematics and Differences - Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) - DH matrices - Deviations and Problems.

Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands and Simple Programs.

UNIT - V IMPLEMENTATION AND ROBOT ECONOMICS [09]

RGV, AGV; Implementation of Robots in Industries - Various Steps; Safety Considerations for Robot Operations; EconomicAnalysis of Robots - Pay back Method, EUAC Method, Rate of Return Method.

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

Text Books :

1 M.P.Groover, “Industrial Robotics – Technology, Programming and Applications”, McGraw-Hill, 2015.

2 YoramKoren, “Robotics for Engineers”, McGraw-Hill Book Co., 2019.

Reference Books :

1 Fu.K.S. Gonzalz.R.C., and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw-Hill Book Co., 2001.

2 Janakiraman.P.A., “Robotics and Image Processing”, Tata McGraw-Hill, 2016.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VII **Regulation : R2020**

Course Code : 20ME776 **Course Name :INDUSTRIAL ROBOTICS**

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 fundamentals of robotics.*	2	2	3	2	3	-	-	2	-	-	2	2	2	2
CO2:	*Apply the concepts of Robot drive systems and end effectors.*	2	2	3	2	3	-	-	2	-	-	2	2	2	2
CO3:	*Gain the Knowledge of sensors and machine vision.*	2	2	3	2	3	-	-	2	-	-	2	2	2	2
CO4:	*Construct the robot kinematics and robot programming.*	2	2	3	2	3	-	-	2	-	-	2	2	2	2
CO5:	*Apply the robots in industrial applications and evaluate their economics.*	2	2	3	2	3	-	-	2	-	-	2	2	2	2
	Average	**2**	**2**	**3**	**2**	**3**	**-**	**-**	**2**	**-**	**-**	**2**	**2**	**2**	**2**

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

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

SEMESTER - VII

		L	T	P	C
20ME777	**HYDRAULIC AND PNEUMATIC SYSTEMS (PROFESSIONAL ELECTIVE – IV)**	3	0	0	3

Prerequisite : *Fluid Mechanics and Machinery.*

Course Outcomes : On successful completion of the course, the student will be able to	***Cognitive Level***
CO1: Explore the working principles of fluid power system.	*Understand*
CO2: Recognize the types, performance of pumps and actuator in fluid power systems.	*Remember*
CO3: Demonstrate the different types of hydraulic, pneumatic valves & servo valves.	*Apply*
CO4: Analyze the hydraulic and pneumatic circuits of simple industrial application.	*Analyze*
CO5: Categorize the fluidic devices and PLC application in fluid power system.	*Apply*

UNIT - I FLUID POWER SYSTEMS [09]

Fluids - compressible, incompressible - properties - introduction to fluid power systems - types, advantages, applications - fluid power symbols. Pascal's law - laminar and turbulent flow - Reynolds's number - Darcy's equation - losses in pipes, valves and fittings.

UNIT - II PUMPS AND ACTUATORS [09]

Pumping theory - positive, non positive displacement pumps - fixed, variable displacement pumps - gear pump, vane pump, piston pump - pump performance. Actuators - linear hydraulic actuators - types of hydraulic cylinders - single acting, double acting, special cylinders like tandem, rod less, telescopic, cushioning mechanism. Rotary actuators - fluid motors, gear, vane, piston motors.

UNIT - III HYDRAULIC SYSTEMS AND CIRCUITS [09]

Types of valves - direction control - 3/2, 4/2 valves, shuttle valve, check valve. Pressure control - pressure reducing valve, sequence valve. Flow control - fixed, adjustable. Controls - manual, solenoid, pilot, relays. Accumulators - types, circuits, sizing. Intensifier - intensifier circuits - meter-in, meter-out circuits.

UNIT - IV PNEUMATIC SYSTEMS AND CIRCUITS [09]

Properties of air - pneumatic components - compressors, filters, regulators, lubricators and control valves, quick exhaust valves, pneumatic actuators. Fluid power circuit design - speed control circuit, synchronizing circuit, sequential circuit for simple applications using cascade method - pneumo - hydraulic circuit.

UNIT - V ADVANCED FLUID POWER SYSTEMS [09]

Servo systems - hydro mechanical servo systems, electro hydraulic servo systems, proportional valves. Fluidics - introduction to fluidic devices, simple circuits, introduction to electro hydraulic pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Troubleshooting in fluid power circuits.

Total = 45 Periods

Text Books :

1. Anthony Esposito, Fluid Power with Applications, Pearson Education, Delhi, Seventh Edition, 2014.
2. Srinivasan R, Hydraulic and Pneumatic Controls, TMH, Delhi, Second Edition, 2011.

Reference Books :

1. Majumdar S.R., Pneumatic systems - Principles and Maintenance, McGraw Hill, Delhi, First Edition, 2017.
2. Majumdar S.R., Oil Hydraulics, Tata McGraw-Hill, Delhi, Third Edition, 2011.
3. Shanmugasundaram K, Hydraulic and Pneumatic Controls, Chand & Co, Delhi, Third Edition, 2019.
4. Dudley A. Pease and John T. Pippenger, Basic Fluid Power, Prentice Hall, Delhi, Second Edition, 1987.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VII **Regulation :R2020**

Course Code : 20ME777 **Course Name :HYDRAULIC AND PNEUMATIC SYSTEMS**

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 working principles of fluid power system.*	3	3	3	3	3	2	2	-	-	-	-	3	3	3
CO2:	*Recognize the types, performance of pumps and actuator in fluid power systems.*	3	3	3	3	3	2	2	-	-	-	-	3	3	3
CO3:	*Demonstrate the different types of hydraulic, pneumatic valves & servo valves.*	3	3	3	3	3	2	2	-	-	-	-	3	3	3
CO4:	*Analyze the hydraulic and pneumatic circuits of simple industrial application.*	3	3	3	3	3	2	2	-	-	-	-	3	3	3
CO5:	*Categorize the fluidic devices and PLC application in fluid power system.*	3	3	3	3	3	2	2	-	-	-	-	3	3	3
	Average	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**3**

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

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

SEMESTER - VII

		L	T	P	C
20ME778	**AUTOMOBILE ENGINEERING (PROFESSIONAL ELECTIVE – IV)**	3	0	0	3

Prerequisite : *Engineering Materials and Metallurgy.*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explore the construction and working principle of an automobile.*	*Remembering*
CO2:	*Analyze the functions of various engine auxiliary Systems.*	*Analyzing*
CO3:	*Demonstrate the conventional and automatic transmission system in an automobile.*	*Understanding*
CO4:	*Design steering, braking and suspension systems.*	*Creating*
CO5:	*Identify the alternate fuels, EVs and various pollution control methods.*	*Applying*

UNIT - I VEHICLE STRUCTURE AND ENGINES [09]

Types of automobiles - vehicle construction - chassis - frame and body. Engine - classification, components, functions and materials - cooling and lubrication systems - turbo charger and super charger- electrical vehicles.

UNIT - II ENGINE AUXILIARY SYSTEMS [09]

Carburetor - basic types and working principle only - electronic fuel injection system - single point and MPFI system - diesel injection - CRDI system - construction, operation and maintenance of lead acid battery - electrical systems - generator, starting motor and drives, lighting and ignition (magneto coil and electronic type), regulators, cut outs.

UNIT - III TRANSMISSION SYSTEMS [09]

Clutch - types, construction, linkages - gear boxes - manual, automatic - simple floor mounted shift mechanism - over drives - transfer box - fluid flywheel - torque converters - propeller shaft - slip joint - differential and rear axle - Hotchkiss drive and torque tube drive.

UNIT - IV STEERING, BRAKES, SUSPENSION SYSTEMS AND SAFETY DEVICES [09]

Steering geometry - power steering - types of steering gear box - types of front axle - braking systems - types and construction - diagonal braking system. Suspension systems - front, rear, conventional, air suspension - wheels - tyres - wheel alignment parameters - casher, camber, toe, king pin alignment. Anti lock braking system - airbags - stabilizers.

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. 1 & 2”, Standard Publishers, New Delhi, 2020.
2. Sethi H.M, “Automobile Technology”, Tata McGraw-Hill-2020

Reference Books:

1 Crouse and Anglin, “Automotive Mechanism”, 9th Edition. Tata McGraw-Hill, 2022.
2 Jain,K.K.,and Asthana .R.B, “Automobile Engineering” Tata McGraw Hill Publishers,New Delhi, 2012
3 Bob Henderson and John Harold Haynes, “Haynes Tech book OBD – II Manual, Haynes Publication, 2016.
4 Ganesan V., “Internal Combustion Engines”, Fourth Edition, Tata Mcgraw-Hill , 2022.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VII **Regulation : R2020**

Course Code : 20ME778 **Course Name :AUTOMOBILE 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 construction and working principle of an automobile.*	3		2	1	3	2	2		1	2	1	3	2	1
CO2	*Analyze the functions of various engine auxiliary Systems.*	3	1	2		3	2	2	1	1	2	1		2	1
CO3	*Demonstrate the conventional and automatic transmission system in an automobile.*	3		2	1	3	2	2		1	2	1	3	2	1
CO4	*Design steering, braking and suspension systems.*	3		2		3	2	2	1	1	2	1		2	1
CO5	*Identify the alternate fuels, EVs and various pollution control methods.*	3	1	2		3	2	2		1	2	1	3	2	1
	Average	**3**	**1**	**2**	**1**	**3**	**2**	**2**	**1**	**1**	**2**	**1**	**3**	**2**	**1**

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

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

SEMESTER - VII

		L	T	P	C
20ME779	**COMPUTATIONAL FLUID DYNAMICS (PROFESSIONAL ELECTIVE –IV)**	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 Governing Equations of vicous fluid flows.	*Remember*
CO2:	Explain the numerical modeling and its role in the field of fluid flow and heat transfer.	*Analyze*
CO3:	Discuss the various discretization methods, solutionprocedures and turbulence models.	*Understand*
CO4:	Analyse the convection diffusion problems by finite volume method.	*Analyze*
CO5:	Evaluate the complex problems in the field of fluid flow and heattransfer by using high speed computers.	*Evaluate*

UNIT - I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS [09]

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momemtum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behaviour of PDEs on CFD - Elliptic, Parabolic and hyperbolic equation.

UNIT - II FINITE DIFFERENCE METHOD [09]

Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – solution methods for finite difference equations – Elliptic equations – Iterative solution Methods – Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations.

UNIT - III FINITE VOLUME METHOD (FVM) FOR DIFFUSION [09]

Finite volume formulation for steady state One, Two and Three -dimensional diffusion problems. One dimensional unsteady heat conduction through Explicit, Crank – Nicolson and fully implicit schemes.

UNIT - IV FINITE VOLUME METHOD FOR CONVECTION DIFFUSION [09]

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes-properties of discretization schemes – Conservativeness, Boundedness, Trasnportiveness, Hybrid, Power-law, QUICK Schemes.

UNIT - V CALCULATION FLOW FIELD BY FVM [09]

Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants. Turbulence models, mixing length model, Two equation (k-Є) models – High and low Reynolds number models.

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

Text Books :

1 Prodip Niyogi, Chakrabarty .S.K., Laha .M.K. Introduction to Computational Fluid Dynamics, Pearson Education, 2005.

2 Anil W. Date, Introduction to Computational Fluid Dynamics Cambridge University Press, 2005.

Reference Books :

1 T.J. Chung, Computational Fluid Dynamics, Cambridge University, Press, 200.

2 Patankar, S.V. Numerical Heat Transfer and Fluid Flow, Hemisphere Publishing Corporation, 2004.

3 Ghoshdastidar P.S., Heat Transfer, Oxford Unversity Press, 2005.

4 Muralidhar, K., and Sundararajan, T., computationsl Fluid Flow and Heat Transfer,Narosa Publishing House, NewDelhi, 1995.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VII **Regulation : R2020**

Course Code : 20ME779 **Course Name :COMPUTATIONAL FLUID DYNAMICS**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explore various methods for determining stresses and terminology.*	3	2	3	3	2	2	-	-	-	2	-	2	3	2
CO2:	*Investigate the processes of various stress analysis of vessel shell components.*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
CO3:	*Demonstrate the knowledge on design of vessels*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
CO4:	*Analyze the Buckling phenomenon of vessels.*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
CO5:	*Evaluate the piping design and stress analysis.*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
	Average	**3**	**2**	**2**	**3**	**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 - VII

		L	T	P	C
20ME781	**ADDITIVE MANUFACTURING (PROFESSIONAL ELECTIVE – IV)**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explore the significance of additive manufacturing on product development.*	*Remember*
CO2:	*Analyze the reverse engineering and CAD modeling techniques.*	*Analyze*
CO3:	*Investigate liquid and solid based additive manufacturing systems.*	*Apply*
CO4:	*Demonstrate the influence of power metallurgy in Additive manufacturing process.*	*Understand*
CO5:	*Evaluate the advance techniques in AM process.*	*Evaluate*

UNIT - I INTRODUCTION [09]

Need - Development of AM systems – AM process chain - Impact of AM on Product Development - Virtual Prototyping- Rapid Tooling – RP to AM -Classification of AM processes-Benefits- Applications.

UNIT - II REVERSE ENGINEERING AND CAD MODELING [09]

Basic concept- Digitization techniques – Model reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data requirements – Geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation- Software for AM- Case studies.

UNIT - III LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS [09]

Stereolithography Apparatus (SLA): Principle, pre-build process, part-building and post-build processes, photo polymerization of SL resins, part quality and process planning, recoating issues, materials, advantages, limitations and applications.

Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications. Fused deposition Modeling (FDM): Principle, details of processes, process variables, types, products, materials and applications. Laminated Object Manufacturing (LOM): Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies

UNIT - IV POWDER BASED ADDITIVE MANUFACTURING SYSTEMS [09]

Selective Laser Sintering (SLS): Principle, process, Indirect and direct SLS- powder structures, materials, post processing, surface deviation and accuracy, Applications. Laser Engineered Net Shaping (LENS): Processes, materials, products, advantages, limitations and applications– Case Studies.

UNIT - V OTHER ADDITIVE MANUFACTURING SYSTEMS [09]

Three dimensional Printing (3DP): Principle, basic process, Physics of 3DP, types of printing, process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, strength and weakness, Applications and case studies. Shape Deposition Manufacturing (SDM), Ballastic Particle Manufacturing (BPM), Selective Laser Melting, Electron Beam Melting.

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

Text Books :

1 Yeon-Gil Jung , Additive Manufacturing: Materials, Processes, Quantifications and Applications- Elsevier Science· 2018.

2 Ian Gibson, David Rosen, Brent Stucker, Additive Manufacturing Technologies· Springer New York, 2014

Reference Books :

1 Gibson, I., Rosen, D.W. and Stucker, B., Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, 2010.

2 Chua, C.K., Leong K.F. and Lim C.S., Rapid prototyping: Principles and applications, World Scientific Publishers, UK, second edition, 2010.

3 Gebhardt, A., Rapid prototyping, Hanser Gardener Publications, UK, Third Edition, 2003.

4 Liou, L.W. and Liou, F.W., Rapid Prototyping and Engineering applications: A tool box for prototype development, CRC Press, Second Edition, 2011.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VII **Regulation : R2020**

Course Code : 20ME781 **Course Name : Additive Manufacturing**

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 significance of additive manufacturing on product development.*	3		2	3	3	2	3			3		2	3	2
CO2	*Analyze the reverse engineering and CAD modeling techniques.*	3		2	3	3	2	3			3		2	**3**	**2**
CO3	*Investigate liquid and solid based additive manufacturing systems.*	3		2	3	3	2	3			3		2	**3**	**2**
CO4	*Demonstrate the influence of power metallurgy in Additive manufacturing process.*	3		2	3	3	2	3			3		2	**3**	**2**
CO5	*Evaluate the advance techniques in AM process.*	3		2	3	3	2	3			3		2	3	2
	Average	**3**		**2**	**3**	**3**	**2**	**3**			**3**		**2**	**3**	**2**

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

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

SEMESTER - VII

		L	T	P	C
20HS886	**BUSINESS CONCEPTS (PROFESSIONAL ELECTIVE-V)**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Explain the basics of business concepts and environment	*Understanding*
CO2:	Illustrate the different types of business forms in India	*Understanding*
CO3:	Describe the various functions of business organization	*Remembering*
CO4:	Illustrate the different activities of human resources department	*Understanding*
CO5:	Explain the Fundamental concepts of International Trade and Banking Activities.	*Understanding*

UNIT - I BUSINESS ENVIRONMENT [09]

Nature and purpose of business, classification of business activities - industry, commerce and trade, objective of business and essential of successful business, economic environment - basic problems of scarcity and choice, allocation of resources, opportunity cost, Business growth and measurement of size, international environment - balance of trade, the trade gap and balance of payments, role and methods of trade protection, business ethics

UNIT - II ELEMENTS OF BUSINESS ACTIVITY [09]

Historical view of business development forms of business organization - sole proprietorship, partnership, join stock companies, co-operative societies, public enterprise - definition, meaning, characteristics, advantages and disadvantages, role of government in business activity, organization charts.

UNIT - III FUNCTIONS OF BUSINESS ACTIVITY [09]

Purchasing - choosing suppliers, overview of stock control, production - scale of production, main features of job, mass, and batch production systems, marketing - concept and role of marketing, marketing mix, channels of distribution, finance - sources of finance, assessing business performance.

UNIT - IV HUMAN RESOURCES [09]

Demographic trends and their impact on business concerns, local trends in employment in various sectors, selection, recruitment, training of workers, motivation, basic knowledge of working age, contract of work, minimum wage, statutory hours of work, statutory benefits.

UNIT - V FOREIGN TRADE AND BANKING [09]

Foreign trade - meaning, nature, importance, procedure of export and import, globalization, MNC and MNE, introductory idea about commercial banks - functions and services, insurance -meaning, types, principles, benefits.

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

Text Books :

1 P.C. Tulsian , Vishal Pandy, Business organisation and management, Pearson Education, New Delhi, Third edition, 2018.

2 M.C.Shukla, Business organisation and Management, S.Chand & Sons publisher, New Delhi, Fourth Edition,2019

Reference Books :

1 Barbara Tolley Dowling, Business concepts for English practices, Newbury House Publishers, U.S, Second Editions, 2016.

2 Philip Kotler, “Marketing Management”, Pearson Education, New Delhi, - Millennium Edition, 2018.

3 Gary Dessler, "Human Resource Management", Prentice-Hall of India Pvt. Ltd., New Delhi, Seventh edition, 2018.

4 Jyotsna sethi, Nishwan Bhatia, Elements of Banking and Insurance, PHI Learning Pvt Ltd, New Delhi, Seventh Edition,2018.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VII **Regulation : R2020**

Course Code : 20HS886 **Course Name : BUSINESS CONCEPTS**

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 basics of business concepts and environment	3	-	-	-	-	2	-	3	-	2	-	-	2	3
CO2:	Illustrate the different types of business forms in India	3	-	-	-	-	2	-	3	-	2	-	-	2	3
CO3:	Describe the various functions of business organization	3	-	-	-	-	2	-	3	-	2	-	-	2	3
CO4:	Illustrate the different activities of human resources department	3	-	-	-	-	2	-	3	-	2	-	-	2	3
CO5:	Explain the Fundamental concepts of International Trade and Banking Activities.	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**

SEMESTER - VII

		L	T	P	C
20ME881	**VALUE AND RE-ENGINEERING (PROFESSIONAL ELECTIVE-V)**	3	0	0	3

Prerequisite: *Quality, Reliability and Maintenance Engineering.*

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

CO1:	*Acquire the knowledge on value Engineering.*	*Remembering*
CO2:	*Identify the phases and approaches in value Engineering.*	*Applying*
CO3:	*Implement the decisions and value stream matrix.*	*Applying*
CO4:	*Analyze the concepts and techniques in Re-Engineering.*	*Analyzing*
CO5:	*Evaluate the case studies.*	*Evaluating*

UNIT - I INTRODUCTION TO VALUE ENGINEERING [09]

Introduction - life cycle of a product - definition - objectives and methodology of value engineering - comparison with other cost reduction techniques - unnecessary cost. Quantitative definition of values - alternatives to increase value - types of values - estimation of product quality/performance.

UNIT - II PHASES AND APPROACHES IN VALUE ENGINEERING [09]

Functions – definition, types and relationship between different functions in design of a product - functional cost - functional worth - test for poor value - aim of value engineering. Systematic approach - phases of value engineering in job plan - general phase, information phase, function phase creation/speculation phase, evaluation phase, investigation phase, recommendation and implementation phase.

UNIT - III DECISIONS AND VALUE STREAM MATRIX [09]

Decision / evaluation matrix: quantitative comparison of alternatives, estimation of weight factors and efficiency. FAST diagramming: critical path of function, how, why and when logic, supporting and all time functions, ground rule for FAST diagram.

UNIT - IV CONCEPTS AND TECHNIQUES IN RE-ENGINEERING [09]

Basic concept - digitization techniques - model reconstruction - data processing for rapid prototyping - data formats - data interfacing, part orientation and support generation, support structure design, model slicing and contour data organization, direct and adaptive slicing, tool path generation.

UNIT - V CASE STUDIES [09]

Applications case studies - automotive, aerospace and electronic industries.

Total = 45 Periods

Text Books:

1. "Value Engineering analysis and methodology", Del L.Younker, 2012
2. "Rapid prototyping: Principles and applications", second edition, Chua C.K., Leong K.F., and Lim C.S., World Scientific Publishers, 2003.

References:

1. LiouW.Liou, Frank W. Liou, "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press, 2009.
2. Peter D. Hilton, Paul F. Jacobs, "Rapid Tooling: Technologies and Industrial Applications", CRC press, 2008.
3. L.D. Miles, "Techniques of value analysis and value engineering".,2020.
4. "Value engineering for cost reduction and product improvement", H S Mittal, 2001.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VII **Regulation : R2020**

Course Code : 20ME881 **Course Name : VALUE AND RE-ENGINEERING**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Acquire the knowledge on value Engineering.*	3	3	3	-	-	2	-	-	1	-	-	-	3	3
CO2:	*Identify the phases and approachesin value Engineering.*	3	3	3	-	-	2	-	-	1	-	-	-	3	3
CO3:	*Implement the decisions and valuestream matrix.*	3	3	3	-	-	2	-	-	1	-	-	-	3	3
CO4:	*Analyze the concepts and techniques in Re-Engineering.*	3	3	3	-	-	2	-	-	1	-	-	-	3	3
CO5:	*Evaluate the case studies.*	3	3	3	-	-	2	-	-	1	-	-	-	3	3
	Average	**3**	**3**	**3**	**-**	**-**	2	-	-	1	-	-	**-**	**3**	**3**

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

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

SEMESTER – VII

		L	T	P	C
20ME882	**VIBRATION AND NOISE CONTROL (PROFESSIONAL ELECTIVE – V)**	3	0	0	3

Prerequisite: Theory of Machines

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

CO1:	*Analyze the characteristics of vibrations in machineries.*	*Analyzing*
CO2:	*Describe the measurement and analysis of noise.*	*Applying*
CO3:	*Acquire knowledge on sources of vibration and noise in automobiles.*	*Remembering*
CO4:	*Design various controlling techniques of vibration in IC engines.*	*Creating*
CO5:	*Apply automotive noise control techniques.*	*Applying*

UNIT - I BASICS OF VIBRATION [09]

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies.

UNIT - II BASICS OF NOISE [09]

Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.

UNIT - III AUTOMOTIVE NOISE SOURCES [09]

Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine necessary contributed noise, transmission noise, aerodynamic noise, tire noise, brake noise.

UNIT - IV SOURCE OF VIBRATION CONTROL TECHNIQUES [09]

Vibration isolation, tuned absorbers, un-tuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

UNIT - V SOURCE OF NOISE CONTROL TECHNIQUES [09]

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers.

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

Text Books :

1 SingiresuS.Rao., Mechanical Vibrations, Pearson Education, Delhi, Sixth Edition, 2016.

2 Ambedkar, A.G., Mechanical Vibrations and Noise Engineering, PHI Publications, New Delhi, Second Edition, 2006.

Reference Books :

1 Benson H. Tongue, Principles of Vibrations, Oxford University, UK, Second Edition, 2007.

2 David Bies and Colin Hansen, Engineering Noise Control – Theory and Practice, Fourth Edition, Taylore & Francise e-Library, UK, Second Edition,2009.

3 William T. Thomson, Marie Dillon Dahleh and Chandramouli Padmanabhan, Theory of Vibration with Application, Pearson Education, Delhi, Fifth Edition,2011.

4 Grover. G.T., Mechanical Vibrations, Nem Chand and Bros, UK, Second Edition,1996.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VII **Regulation : R2020**

Course Code :20ME882 **Course Name : VIBRATION AND NOISE CONTROL**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Analyze the characteristics of vibrations in machineries.*	3	3	3	-	-	-	-	-	-	-	-	3	2	3
CO2:	*Describe the measurement and analysis of noise*	3	3	3	-	-	-	-	-	-	-	-	3	2	3
CO3:	*Acquire knowledge on sources of vibration and noise in automobiles.*	3	3	3	-	-	-	-	-	-	-	-	3	2	3
CO4:	*Design various controlling techniques of vibration in IC engines.*	3	3	3	-	-	-	-	-	-	-	-	3	2	3
CO5:	*Apply automotive noise control techniques*	3	3	3	-	-	-	-	-	-	-	-	3	2	3
	Average	**3**	**3**	**3**	**-**	**-**	-	-	-	-	-	-	**3**	**3**	**3**

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

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

SEMESTER - VII

		L	T	P	C
20ME883	**PRESSURE VESSEL AND PIPING DESIGN**	3	0	0	3

Prerequisite:

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

CO1:	*Explore various methods for determining stresses and terminology.*	*Remember*
CO2:	*Investigate the processes of various stress analysis of vessel shell components.*	*Analyze*
CO3:	*Demonstrate the knowledge on design of vessels*	*Understand*
CO4:	*Analyze the Buckling phenomenon of vessels.*	*Analyze*
CO5:	*Evaluate the piping design and stress analysis.*	*Evaluate*

UNIT - I INTRODUCTION [09]

Introduction Methods for determining stresses – Terminology and Ligament Efficiency – Applications.

UNIT - II STRESSES IN PRESSURE VESSELS [09]

.Introduction – Stresses in a circular ring, cylinder – Membrane stress Analysis of Vessel Shell components – Cylindrical shells, spherical Heads, conical heads.

UNIT - III DESIGN OF VESSELS [09]

Design of Tall cylindrical self supporting process columns – Supports for short, vertical and horizontal vessels – stress concentration – at a variable Thickness transition section in a cylindrical vessel, about a circular hole, elliptical openings.

UNIT - IV BUCKLING OF VESSELS [09]

Buckling phenomenon – Elastic Buckling of circular ring and cylinders under external pressure – collapse of thick walled cylinders or tubes under external pressure – Effect of supports on Elastic Buckling of Cylinders.

UNIT - V PIPING DESIGN [09]

Introduction – Flow diagram – piping layout and piping stress Analysis.

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

Text Books :

1 John F. Harvey, Theory and Design of Pressure Vessels, CBS Publishers and Distributors, 2018

2 Henry H. Bedner, “Pressure Vessels, Design Hand Book, CBS publishers and Distributors, 2016

Reference Books :

1 Stanley, M. Wales, “Chemical process equipment, selection and Design. Butterworth’s series in Chemical Engineering, 2008.

2 S.S.GILL, The stress analysis of pressure vessel and pressure vessel components, PergamonPress,OXFORD 2016

3 Michael M Basic, Pressure Vessel Design Manual, Butterworth-Heinemann in 2013

4 John Kihiu and George Rading, Boiler, Piping and Pressure Vessel Cross-Bore Design Stresses, VDM Verlag (22 February 2011)

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VII **Regulation : R2020**

Course Code : 20ME883 **Course Name :PRESSURE VESSEL AND PIPING DESIGN**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explore various methods for determining stresses and terminology.*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
CO2:	*Investigate the processes of various stress analysis of vessel shell components.*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
CO3:	*Demonstrate the knowledge on design of vessels*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
CO4:	*Analyze the Buckling phenomenon of vessels.*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
CO5:	*Evaluate the piping design and stress analysis.*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
	Average	**3**	**2**	**2**	**3**	**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 - VII

		L	T	P	C
20ME884	**REFRIGERATION AND AIR CONDITIONING (PROFESSIONAL ELECTIVE –V)**	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 Refrigeration.	*Remember*
CO2:	Explain the Vapour compression Refrigeration systems and to solve problems.	*Analyze*
CO3:	Discuss the various types of Refrigeration systems.	*Understand*
CO4:	Analyse the Psychrometric properties and its use in psychrometric processes.	*Analyze*
CO5:	Evaluate the concepts of Air conditioning and to solve problems.	*Evaluate*

UNIT - I REFRIGERATION CYCLE [09]

Review of thermodynamic principles of refrigeration. Carnot refrigeration cycle – Vapour compression refrigeration cycle – use of P.H. charts – multistage and multiple evaporator systems – cascade system – COP comparison. Air Refrigeration cycles.

UNIT - II REFRIGERANTS AND SYSTEM COMPONENTS [09]

Compressors – reciprocating and rotary (elementary treatment), Types of condensers, evaporators, cooling towers – Functional aspects. Refrigerants – properties – selection of refrigerants, Alternate Refrigerants, Cycling controls.

UNIT - III PSYCHROMETRY [09]

Psychrometric processes use of psychrometric charts – Grand and Room Sensible Heat Factors – bypass factor – air washers, requirements of comfort air conditioning, summer and Winter Air conditioning.

UNIT - IV AIR CONDITIONING SYSTEMS [09]

Cooling load calculation working principles of – Centralized Air conditioning systems, Split, Ductable split, Packaged Air conditioning, VAV & VRV Systems. Duct Design by equal friction method, Indoor Air quality concepts.

UNIT - V UNCONVENTIONAL REFRIGERATION CYCLES [09]

Vapor Absorption system – Ejector jet, Steam jet refrigeration, thermo electric refrigeration. APPLICATIONS – ice plant – food storage plants – milk – chilling plants.

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

Text Books :

1 Arora C.P., “Refrigeration and Air Conditioning”, Tata McGraw Hill, New Delhi, 2010.

2 Manohar Prasad, “Refrigeration and Air Conditioning”, Wiley Eastern Ltd., 2015

Reference Books :

1 Jones W.P., “Air conditioning engineering”, 5th edition, Elsevier Butterworth-Heinemann, 2007

2 Roy J. Dossat, “Principles of Refrigeration”, 4th edition, Pearson Education Asia, 2009.

3 Stoecker, W.F. and Jones J. W., “Refrigeration and Air Conditioning”, McGraw Hill, New Delhi, 1986

4 ASHRAE Hand book, Fundamentals, 2010

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VII **Regulation : R2020**

Course Code : 20ME884 **Course Name :REFRIGERATION AND AIR CONDITIONING**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explore various methods for determining stresses and terminology.*	3	2	3	3	2	2	-	-	-	2	-	2	3	2
CO2:	*Investigate the processes of various stress analysis of vessel shell components.*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
CO3:	*Demonstrate the knowledge on design of vessels*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
CO4:	*Analyze the Buckling phenomenon of vessels.*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
CO5:	*Evaluate the piping design and stress analysis.*	3	2	2	3	2	2	-	-	-	2	-	2	3	2
	Average	**3**	**2**	**2**	**3**	**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 - VII

		L	T	P	C
20ME885	**COMPOSITE MATERIALS (PROFESSIONAL ELECTIVE-V)**	3	0	0	3

Prerequisite ***:*** *Engineering Materials and Metallurgy.*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Build the knowledge about theory of composite materials.*	*Applying*
CO2:	*Develop the skills on polymer matrix composite fibers.*	*Applying*
CO3:	*Gain the knowledge about metal matrix composite.*	*Remembering*
CO4:	*Build the knowledge on ceramic matrix composite.*	*Applying*
CO5:	*Gain the knowledge on advances in composites.*	*Remembering*

UNIT - I INTRODUCTION TO COMPOSITES [09]

Fundamentals of composites - need for composites - enhancement of properties - classification of composites - matrix - polymer matrix composites (PMC), metal matrix composites (MMC), ceramic matrix composites (CMC) - reinforcement - particle reinforced composites, fibre reinforced composites.

UNIT - II POLYMER MATRIX COMPOSITES [09]

Polymer matrix resins - thermosetting resins, thermoplastic resins - reinforcement fibres - roving's - woven fibres - non-woven random mats - various types of fibres. PMC processes - hand lay-up processes - spray up processes - compound moulding - reinforcement reaction - injection moulding - resin transfer moulding - pultrusion - filament winding. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GRP).

UNIT - III METAL MATRIX COMPOSITES [09]

Characteristics of MMC, various types of metal matrix composites alloy Vs MMC, Advantages & limitations of MMC, reinforcement - particles and fibres - effect of reinforcement - volume fraction - rule of mixture - processing of MMC - powder metallurgy process - diffusion bonding - stir casting - squeeze casting.

UNIT - IV CERAMIC MATRIX COMPOSITES [09]

Engineering ceramic materials - properties - advantages - limitations - monolithic ceramics - need for CMC - various types of ceramic matrix composites – oxide & non-oxide ceramics - aluminium oxide - silicon nitride - reinforcement - particle and fibres - whiskers. Sintering - hot pressing - cold isostatic pressing (CL ping) - hot isostatic pressing (HI ping).

UNIT - V ADVANCES IN COMPOSITES [09]

Carbon / carbon composites - advantage &limitations of carbon matrix, carbon fibre -chemical vapour deposition of carbon on carbon fibre. Composites for aerospace applications- Nano Composites- Laser Processing Technology, Advantages and Application of various types of composites

Total = 45 Periods

Text Books:

1 Mallick, P.K., "Fiber Reinforced Composites: Materials, Manufacturing and Design", Third Edition, Marcel Dekker Inc, 2018.

2 K.Srinivasan, "Composites Materials-Production, Properties, Testing and Applications", Published by N.K. Mehra for Narosa Publishing House Pvt. Ltd, 2013.

Reference Books:

1. Ronald Gibson, "Principles of Composite Material Mechanics", CRC Press, Taylor & Francis Group, Fourth Edition 2007.
2. Agarwal, B.D., and Broutman L.J., "Analysis and Performance of Fiber Composites", John Wiley and Sons, UK, Fourth Edition 2017.
3. Autar K. Kaw, "Mechanics of Composite Materials" CRC Press, 2006.
4. Robert M. Jones, "Mechanics of Composite Materials" Taylor and Francis, 1999.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VII **Regulation : R2020**

Course Code : 20ME885 **Course Name : COMPOSITE MATERIALS**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Build the knowledge about theory of composite materials.*	3		2	1	3	2	2		1	2	1	3	2	1
CO2	*Develop the skills on polymer matrix composite fibers.*	3	1	2		3	2	2	1	1	2	1		2	1
CO3	*Gain the knowledge about metal matrix composite.*	3		2	1	3	2	2		1	2	1	3	2	1
CO4	*Build the knowledge on ceramic matrix composite.*	3		2		3	2	2	1	1	2	1		2	1
CO5	*Gain the knowledge on advances in composites.*	3	1	2		3	2	2		1	2	1	3	2	1
	Average	**3**	**1**	**2**	**1**	**3**	**2**	**2**	**1**	**1**	**2**	**1**	**3**	**2**	**1**

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

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

SEMESTER - VIII

		L	T	P	C
20HS887	**ENTERPRISE RESOURCE PLANNING (PROFESSIONAL ELECTIVE – VI)**	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 ERP.*	*Understanding*
CO2:	*Estimate their skills in implementation process of ERP developments.*	*Evaluating*
CO3:	*Illustrate the Various ERP Business modules.*	*Understanding*
CO4:	*Describe the various model of different ERP Market.*	*Analyzing*
CO5:	*Explain the recent emerging present and future trends on ERP software*	*Understanding*

UNIT - I INTRODUCTION [09]

Overview of an Enterprise – Benefits of ERP– ERP and Related Technologies – Business Process Reengineering (BPR)– Data Warehousing – Data Mining – OLAP – SCM.

UNIT - II IMPLEMENTATION [09]

Implementation Challenges – Strategies – Life Cycle – Pre-implementation Tasks – Requirements Definition – Methodologies – Package selection – Project Teams – Process Definitions – Vendors and Consultants – Data Migration – Project management – Post Implementation Activities.

UNIT - III THE BUSINESS MODULES [09]

Business modules in an ERP Package – Finance – Manufacturing – Human Resources – Plant Maintenance – Materials Management – Quality Management – Marketing – Sales, Distribution and Service.

UNIT - IV ERP MARKET [09]

Market place – Dynamics – SAP AG – Oracle – PeopleSoft – JD Edwards – QAD Inc – SSA Global – Lawson Software – Epicor – Intutive – BI - BO .

UNIT - V ERP PRESENT AND FUTURE [09]

Enterprise Application Integration – ERP and E-Business – ERP II – Total quality management – Future Directions – Trends in ERP– Case studies.

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

Text Books :

1 Alexis Leon, ERP Demystified, Tata McGraw-Hill, New Delhi, Second Edition,2008.

2 P Goyal, Enterprise Resource Planning, Tata McGraw-Hill Education, New Delhi, Third Edition, 2011.

Reference Books :

1 Mary Sumner, Enterprise Resource Planning, Pearson Education, Chennai, Second Edition, 2007.

2 Jim Mazzullo, SAP R/3 for Everyone, Pearson Education, Chennai, 2007.

3 Vinod Kumar Garg and Venkitakrishnan N K, Enterprise Resource Planning – Concepts and Practice, PHI, Delhi, 2003.

4 Ellen Monk and Bret Wagner, Concepts in Enterprise Resource Planning, Thompson Course Technology, New Delhi, Fourth Edition, 2012.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VIII **Regulation : R2020**

Course Code : 20HS887 **Course Name : ENTERPRISE RESOURCE PLANNING**

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 ERP.*	2	-	2	2	-	3	2	2	-	-	-	-	2	2
CO2:	*Estimate their skills in implementation process of ERP developments.*	2	-	2	2	-	3	2	2	-	-	-	-	**2**	**2**
CO3:	*Illustrate the Various ERP Business modules.*	2	-	2	2	-	3	2	2	-	-	-	-	**2**	**2**
CO4:	*Describe the various model of different ERP Market.*	2	-	2	2	-	3	2	2	-	-	-	-	**2**	**2**
CO5:	*Explain the recent emerging present and future trends on ERP software*	2	-	2	2	-	3	2	2	-	-	-	-	2	2
	Average	**2**	**-**	**2**	**2**	**-**	**3**	**2**	**2**		**-**	**-**	**-**	**2**	**2**

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

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

SEMESTER - VIII

		L	T	P	C
20ME886	**OPTIMIZATION IN DESIGN (PROFESSIONAL ELECTIVE – VI)**	**3**	**0**	**0**	**3**

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explore various optimization techniques for engineering design.*	*Understanding*
CO2:	*Develop optimum design techniques with constraints.*	*Applying*
CO3:	*Apply the dynamic programming methods for optimum design.*	*Applying*
CO4:	*Formulate the unconventional optimization techniques.*	*Understanding*
CO5:	*Review the various optimization techniques for engineering applications.*	*Analyzing*

UNIT - I UNCONSTRAINED OPTIMIZATION TECHNIQUES [09]

Introduction to optimum design - general principles of optimization – problem formulation & their classifications - single variable and multivariable optimization, techniques of unconstrained minimization – golden section, random, pattern and gradient search methods – interpolation methods.

UNIT - II CONSTRAINED OPTIMIZATION TECHNIQUES [09]

Optimization with equality and inequality constraints - direct methods – indirect methods using penalty functions, Lagrange multipliers - geometric programming

UNIT - III DYNAMIC PROGRAMMING [09]

Introduction - multi stage optimization - dynamic programming methods – stochastic programming- multi objective optimization.

UNIT - IV UNCONVENTIONAL OPTIMIZATION TECHNIQUES [09]

Genetic algorithms, Simulated Annealing and Ant Colony techniques; Neural network & Fuzzy logic principles in optimization.

UNIT - V APPLICATIONS [09]

Structural applications - design applications - design of simple truss members - design of simple axial, transverse loaded members for minimum cost and weight - design of shafts and torsionally loaded members - design of springs.

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

Text Books :

1 Joaquim R. R. A. Martins, Andrew Ning,Engineering Design Optimization,Cambridge University Press, 2021.

2 Rao, Singaresu, S., Engineering Optimization – Theory & Practice, New Age International (P) Limited, New Delhi, Fourth Edition, 2019.

Reference Books :

1 Johnson Ray, C., Optimum Design of Mechanical Elements, Wiley, John & Sons, UK, Re printed 2003.

2 Goldberg, D.E., Genetic algorithms in search, optimization and machine, Barnen, Addison- Wesley, New York, re printed 2003.

3 Kalyanamoy Deb, Optimization for Engineering design algorithms and Examples, Prentice Hall of India Pvt. Ltd. Delhi,Second Edition,2006.

4 Purna Chandra Biswal, Optimization in Engineering, SCITECH publications, 2009.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester :VIII **Regulation :R2020**

Course Code : 20ME886 **Course Name :OPTIMIZATION IN DESIGN**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explore various optimization techniques for engineering design.*	2	3	3	2	-	2	-	-	-	-	2	-	2	2
CO2:	*Develop optimum design techniques with constraints.*	2	3	3	2	-	2	-	-	-	-	2	-	2	2
CO3:	*Apply the dynamic programming methods for optimum design.*	2	3	3	2	-	2	-	-	-	-	2	-	2	2
CO4:	*Formulate the unconventional optimization techniques.*	2	3	3	2	-	2	-	-	-	-	2	-	2	2
CO5:	*Review the various optimization techniques for engineering applications.*	2	3	3	2	-	2	-	-	-	-	2	-	2	2
	Average	**2**	**3**	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**2**	**2**

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

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

SEMESTER - VIII

		L	T	P	C
20ME887	**EXPERIMENTAL STRESS ANALYSIS (PROFESSIONAL ELECTIVE – VI)**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Explore the application of sensors and extensometers.	*Remembering*
CO2:	Apply electrical resistance strain gauges for various engineering measurements.	*Understanding*
CO3:	Implement photo elasticity principle for measurements and calibration	*Applying*
CO4:	Investigate brittle coating and moiré technique for stress analysis.	*Analyzing*
CO5:	Develop suitable non destructive testing method for industrial products	*Evaluating*

UNIT - I EXTENSOMETERS AND DISPLACEMENT SENSORS [09]

Principles of measurements, Accuracy, Sensitivity and range of measurements, Mechanical, Optical, Acoustical and Electrical extensometers and their uses, Advantages and disadvantages, Capacitance gauges, Laser displacement sensors

UNIT - II ELECTRICAL RESISTANCE STRAIN GAUGES [09]

Principle of operation and requirements, Types and their uses, Materials for strain gauges, Calibration and temperature compensation, cross sensitivity, Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators, Rosette analysis, stress gauges, load cells, Data acquisition, six component balance.

UNIT - III PHOTOELASTICITY [09]

Two dimensional photo elasticity, Photo elastic materials, Concept of light - photo elastic effects, stress optic law, Transmission photo elasticity, Jones calculus, plane and circular polar scopes, Interpretation of fringe pattern, Calibration of photo elastic materials, Compensation and separation techniques, Introduction to three dimensional photo elasticity

UNIT - IV BRITTLE COATING AND MOIRE TECHNIQUES [09]

Relation between stresses in coating and specimen, use of failure theories in brittle coating, Moire method of strain analysis.

UNIT - V NON – DESTRUCTIVE TESTING [09]

Fundamentals of NDT, Radiography, ultrasonic, magnetic particle inspection, Fluorescent penetrant technique, Eddy current testing, Acoustic Emission Technique, Fundamentals of brittle coating methods, Holography, Ultrasonic C- Scan, Thermograph, Fiber – optic Sensors.

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

Text Books :

1 Balaji P.S, KarthikSelva Kumar Karuppasamy,Applications and Techniques for Experimental Stress Analysis,IGI Global,2019.

2 Dally, J.W., and Riley, W.F., Experimental Stress Analysis, McGraw Hill Inc., New York, Third Edition, 2012.

Reference Books :

1 Experimental stress Analysis, Srinath L.S tata Mc Graw Hill, New York,Third Edition,2010.

2 Holman, Experimental Methods for Engineers Tata McGraw Hill Companies, New York, seventh Edition, 2007.

3 Max Mark Frocht, Photo Elasticity, John Wiley and Sons Inc., New York, Fourth Edition,2006.

4 Sadhu Singh, Experimental Stress Analysis, Khanna Publishers, New Delhi, Second Edition,2007.

5 Hetenyi, M., Hand book of Experimental Stress Analysis, John Wiley and Sons Inc., New York, Second Edition, 1972.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VIII **Regulation :R2020**

Course Code :20ME887 **Course Name :EXPERIMENTAL STRESS 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 application of sensors and extensometers.	3	3	2	-	3	-	-	-	2	-	2	3	3	2
CO2:	Apply electrical resistance strain gauges for various engineering measurements.	3	3	2	-	3	-	-	-	2	-	2	3	3	2
CO3:	Implement photo elasticity principle for measurements and calibration	3	3	2	-	3	-	-	-	2	-	2	3	3	2
CO4:	Investigate brittle coating and moiré technique for stress analysis.	3	3	2	-	3	-	-	-	2	-	2	3	3	2
CO5:	Develop suitable non destructive testing method for industrial products	3	3	2	-	3	-	-	-	2	-	2	3	3	2
	Average	**3**	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**2**	**-**	**2**	**3**	**3**	**2**

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

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

SEMESTER - VIII

		L	T	P	C
20ME888	**NUCLEAR ENGINEERING (PROFESSIONAL ELECTIVE – VI)**	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 nuclear reaction and heat transfer techniques.*	*Remembering*
CO2:	*Identify characteristics of various reactor materials.*	*Understanding*
CO3:	*Describe the principle of spent material characteristics and reprocessing methods.*	*Remembering*
CO4:	*Analyze various types of nuclear reactors*	*Understanding*
CO5:	*Examine nuclear waste disposal and hazards prevention methods.*	*Understanding*

UNIT - I NUCLEAR REACTIONS [09]

Mechanism of nuclear fission - nuclides - radioactivity – decay chains - neutron reactions - the fission process - reactors - types of fast breeding reactor - design and construction of nuclear reactors - heat transfer techniques in nuclear reactors - reactor shielding

UNIT - II REACTOR MATERIALS [09]

Nuclear Fuel Cycles - characteristics of nuclear fuels - Uranium - production and purification of Uranium - conversion to UF4 and UF6 - other fuels like Zirconium, Thorium – Berylium

UNIT - III REPROCESSING [09]

Nuclear fuel cycles - spent fuel characteristics - role of solvent extraction in reprocessing - solvent extractionequipment.

UNIT - IV REACTOR TYPES [09]

Boiling water reactors - pressurized water reactors and pressurized heavy water reactors - fast breeder reactors

UNIT - V WASTE DISPOSAL AND RADIATION PROTECTION [09]

Types of nuclear wastes - safety control and pollution control and abatement - international convention on safety aspects - radiation hazards prevention.

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

Text Books :

1 Dr.G.K.Vijayaraghavan&Dr.L.Govindarajan,Nuclear Engineering,ARS Publications, Fifth Edition,2018

2 Nuclear Engineering handbook-kenneth D.Kok-2016.

Reference Books :

1 Nuclear Reactor Engineering: Reactor Design Basics / Reactor. Samuel Glasstone, Alexander Sesonske, 2013

2 Fundamentals of Nuclear Science and Engineering J. Kenneth Shultis, Richard E. Faw, 2016

3 Nuclear Reactor Engineering (Principles And Concepts) by Vaidyanathan G. S Chand &Company,Delhi,Scond Edition,2013.

4 Thomas J.Cannoly, Fundamentals of nuclear Engineering, John Wiley, UK, Second Edition, 1998

5 Nuclear Engineering, N.Vaishnavi, R.Rajeswari. Anuradhapublications,Delhi,Second Edition, 2011

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VIII **Regulation :R2020**

Course Code : 20ME888 **Course Name :NUCLEAR 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 basic concepts of nuclear reaction and heat transfer techniques.*	3	3	-	-	2	-	-	-	-	-	-	2	3	2
CO2:	*Identify characteristics of various reactor materials.*	3	3	-	-	2	-	-	-	-	-	-	2	3	2
CO3:	*Describe the principle of spent material characteristics and reprocessing methods.*	3	3	-	-	2	-	-	-	-	-	-	2	3	2
CO4:	*Analyze various types of nuclear reactors*	3	3	-	-	2	-	-	-	-	-	-	2	3	2
CO5:	*Examine nuclear waste disposal and hazards prevention methods.*	3	3	-	-	2	-	-	-	-	-	-	2	3	2
	Average	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**

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

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

SEMESTER - VIII

		L	T	P	C
20ME889	**UNCONVENTIONAL MACHINING PROCESSES (PROFESSIONAL ELECTIVE – VI)**	**3**	**0**	**0**	**3**

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the considerations in selection of unconventional machining processes.*	*Understanding*
CO2:	*Explore the principles of various mechanical metal removal process*	*Remembering*
CO3:	*Establish the fundamentals of electro-chemical metal removal processes.*	*Applying*
CO4:	*Illustrate the constructions and functions of thermal-electric metal removal processes.*	*Understanding*
CO5:	*Apply the working principlesof thermal metal removal processes.*	*Applying*

UNIT - I INTRODUCTION [09]

Need for non-traditional machining methods-Classification of Unconventional machining processes - considerations in process selection - Materials - Economic consideration- applications and limitations - recent development.

UNIT - II MECHANICAL METAL REMOVAL PROCESSES [09]

Abrasive jet machining - Water jet machining and abrasive water jet machining - Basic principles, equipments used, process variables, mechanics of metal removal, MRR, applications and limitations. Ultrasonic Machining - Working Principles, equipment used Process parameters, MRR, applications and limitations.

UNIT - III ELECTRO – CHEMICAL METAL REMOVAL PROCESSES [09]

Fundamentals of Electro-Chemical Machining, Electro-Chemical Grinding, Electro-Chemical Honing and Deburring processes - MRR, Tool design, Surface finish and accuracy economic aspects. Simple problems for estimation of MRR. Advantages, limitations and applications. Fundamentals of Maskants - Etchants.

UNIT - IV THERMAL-ELECTRIC METAL REMOVAL PROCESSES [09]

General Principle and applications of Electric Discharge Machining, Electric Discharge Grinding and Electric Discharge Wire Cutting processes. Power circuits for EDM, Mechanics of metal removal, Process parameters, selection of tool electrode and dielectric fluids, surface finish, machining accuracy and other characteristics of spark eroded surface, Magnetic Abrasive Finishing, Abrasive flow finishing.

UNIT - V THERMAL METAL REMOVAL PROCESSES [09]

Generation and control of Electron Beam for machining, theory of Electron Beam machining, comparison of thermal and non-thermal processes - General Principles and applications of Laser Beam machining - thermal features, cutting speed and accuracy of cut. Plasma arc welding- Application of Plasma Arc machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of Plasma in manufacturing industries.

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

Text Books :

1 Dr.P.N.Karthikeyan, Dr.SanthakumaranVetrivel, Dr. Ram Subbiah, Dr.M.Balasubramanian, Non traditional Machining Processes, Forschung Publications,2021.

2 P.K.Mishra, Non ConventionalMachining,Narosa Publishing House, New Delhi, Second Edition, 2009.

Reference Books :

1 Vijay.K. Jain, Advanced Machining Processes, Allied Publishers Pvt. Ltd., New Delhi, Second Edition, 2010, ISBN 81-7764-294-4.

2 P. C. Pandey and H. S. Shan., Modern Machining Processes, Tata McGraw-Hill, New Delhi ,Second Edition,2008.

3 J.A. McGeough, Advanced Methods of Machining, Chapman and Hall, London, Second Edition, 1998.

4 G. F. Benedict, Nontraditional Manufacturing Processes, Marcel Dekker, Inc., New York, Second Edition, 1987.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VIII **Regulation :R2020**

Course Code :20ME889 **Course Name :UNCONVENTIONAL MACHINING PROCESSES**

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 considerations in selection of unconventional machining processes.*	2	2	3	-	3	-	-	-	-	-	-	2	3	2
CO2:	*Explore the principles of various mechanical metal removal process*	2	2	3	-	3	-	-	-	-	-	-	2	3	2
CO3:	*Establish the fundamentals of electro-chemical metal removal processes.*	2	2	3	-	3	-	-	-	-	-	-	2	3	2
CO4:	*Illustrate the constructions and functions of thermal-electric metal removal processes.*	2	2	3	-	3	-	-	-	-	-	-	2	3	2
CO5:	*Apply the working principlesof thermal metal removal processes.*	2	2	3	-	3	-	-	-	-	-	-	2	3	2
	Average	**2**	**2**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**

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

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

SEMESTER - VIII

		L	T	P	C
20ME891	**NON DESTRUCTIVE TESTING MATERIALS (PROFESSIONAL ELECTIVE – VI)**	**3**	**0**	**0**	**3**

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explore the working principle, types and characteristics of various NDT processes.*	*Remembering*
CO2:	*Recognize different surface NDT methods and its applications*	*Understanding*
CO3:	*Analyze the application of Thermography and Eddy current testing.*	*Remembering*
CO4:	*Identify defects using relevant NDT methods.*	*Understanding*
CO5:	*Classify various working principle and applications of Radiography techniques*	*Remembering*

UNIT - I OVERVIEW OF NDT [09]

NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterization. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT. Visual inspection – Unaided and aided.

UNIT - II SURFACE NDT METHODS [09]

Liquid Penetrant Testing - Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing- Theory of magnetism, inspection materials Magnetisation methods, Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism.

UNIT - III THERMOGRAPHY AND EDDY CURRENT TESTING [09]

Thermography- Principles, Contact and non contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation - infrared radiation and infrared detectors, Instrumentations and methods, applications. Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.

UNIT - IV ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION [09]

Ultrasonic Testing-Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A/Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction. Acoustic Emission Technique – Principle, AE parameters, Applications

UNIT - V RADIOGRAPHY [09]

Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films - graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed Tomography

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

Text Books :

1 Baldev Raj, T.Jayakumar, M.Thavasimuthu.,Practical Non-Destructive Testing, Narosa Publishing House,Delhi,Second Edition,2018.

2 Ravi Prakash, Non-Destructive Testing Techniques, New Age International Publishers, Delhi,First revised edition, 2010.

Reference Books :

1 ASM Metals Handbook, Non-Destructive Evaluation and Quality Control, American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.

2 ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT Handbook,Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. 5, Electromagnetic Testing, Vol. 6, Acoustic Emission Testing, Vol. 7, Ultrasonic Testing.

3 Charles, J. Hellier, Handbook of Nondestructive evaluation, McGraw Hill, New York , Second Edition,2001

4 Paul E Mix, “Introduction to Non-destructive testing: a training guide”, Wiley, New Jersey, Second Edition,2005

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : VIII **Regulation:R2020**

Course Code :20ME891 **Course Name :NON DESTRUCTIVE TESTING 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 working principle, types and characteristics of various NDT processes.*	2	2	3	2	3	2	-	-	-	-	-	2	3	3
CO2:	*Recognize different surface NDT methods and its applications*	2	2	3	2	3	2	-	-	-	-	-	2	3	3
CO3:	*Analyze the application of Thermography and Eddy current testing.*	2	2	3	2	3	2	-	-	-	-	-	2	3	3
CO4:	*Comprehend the Ultrasonic Testing and Acoustic Emission process*	2	2	3	2	3	2	-	-	-	-	-	2	3	3
CO5:	*Apply the working principle and applications of Radiography techniques*	2	2	3	2	3	2	-	-	-	-	-	2	3	3
	Average	**2**	**2**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**

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

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

		L	T	P	C
20AU901	**BASICS OF AUTOMOBILE ENGINEERING** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Provide basic platform knowledge of automobile engineering*	*Understand*
CO2:	*Explain the working principal of petrol and diesel engines*	*Understand*
CO3:	*Interpret the method of power transmission unit*	*Understand*
CO4:	*Built knowledge of steering and brake*	*Understand*
CO5:	*Illustrate the knowledge of automotive electrical systems and functioning*	*Understand*

UNIT - I INTRODUCTION [09]

Automobile - Components of an automobile - Classification of automobiles - Layout of chassis - Types of drives front wheel- rear wheel - four wheel.

UNIT - II IC ENGINES [09]

Classification - ignition system - firing order - Otto/ Diesel cycles - Two stroke and four stroke engines – scavenging - Cooling and Lubrication systems - Fuel Supply system – air fuel ratio - Carburetor – types.

UNIT - III TRANSMISSION SYSTEM [09]

Clutch - Function - single plate - multi plate - friction clutches - Centrifugal and semi centrifugal clutch - Gear Box -slide mesh - constant mesh and synchromesh gear box - Torque convertor – overdrive - Propeller shaft and rear axle- Universal joint – Differential - Rear axle drives - Wheels and Tyres.

UNIT - IV STEERING AND BRAKE [09]

Steering system - function and principle - Ackerman and Davis steering principles - wheel alignment –steering gear boxes. Brakes - Mechanical - hydraulic and vacuum brake - master cylinder - wheel cylinder -Bleeding of brakes.

UNIT - V ELECTRICAL SYSTEMS [09]

Battery – types - Dynamo and Alternator – Cut-out relay - Diagram of Wiring system - Lighting System and Accessories - Headlight - switches - Windscreen Wipers – Horn – Speedometer – Heater and Air conditioning.

Total = 45 Periods

Text Books :

1 Kirpal Singh, Automobile Engineering, Vol. I & II, Standard Publishers, New Delhi, Fourteenth Edition, 2018.

2 Gupta,S. K., A Textbook of Automobile Engineering, S.Chand Publishing, New Delhi, Second Edition, 2020.

Reference Books :

1 Rajput, R K, A Textbook of Automobile Engineering, Laxmi Publications (P) Ltd, New Delhi, Second Edition, 2017.

2 Ganesan. V, Internal Combustion Engines, Tata McGraw-Hill Publishing Co., New Delhi, Fourth Edition, 2012.

3 Mathur M.L. and Sharma R.P, A Course in Internal Combustion Engines, Dhanpat Rai and sons, New Delhi, Second Edition, 2016.

4 Ramalingam K.K, Automobile Engineering, Scitech Publications (India) Pvt. Ltd, Chennai, Second Edition, 2011.

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

Regulation: R 2020

Course Code: 20AU901 **Course Name: Basics of Automobile Engineering**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Provide basic platform knowledge of automobile engineering*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	*Explain the working principal of petrol and diesel engines*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	*Interpret the method of power transmission unit*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	*Built knowledge of steering and brake*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	*Illustrate the knowledge of automotive electrical systems and functioning*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

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

		L	T	P	C
20AU902	**AUTOMOTIVE ENGINE TECHNOLOGY** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Illustrate the fundamental concepts and functions of an automotive engine and working cycles*	*Understand*
CO2:	*Explain the combustion phenomena in SI engines*	*Understand*
CO3:	*Identify the CI engines injection, ignition and combustion phenomena*	*Understand*
CO4:	*Outline the emission control techniques.*	*Understand*
CO5:	*Demonstrate the measurement techniques and emission standards.*	*Understand*

UNIT – I CONSTRUCTION AND OPERATION [09]

Constructional details of spark ignition (SI) and compression ignition (CI) engines. Working principles. Two stroke SI and CI engines. Comparison of SI and CI engines and four stroke and two stroke engines. Engine classification, firing order. Otto, diesel and dual cycles. Introduction to Lean burn engine technologies.

UNIT – II SI ENGINES [09]

Air fuel ratio requirements - Carburetion - Throttle body injection, Multi point injection. Function of Components, Spark plug, Ignition System - battery coil, magneto coil, Electronic. Combustion in SI Engines - Combustion Chambers, Stages of Combustion - factors affecting flame propagation, Knock in SI engines, variables affecting knocking. Pollution from SI engines.

UNIT – III CI ENGINES [09]

Diesel fuel injection system, Function of Components, Jerk type pump, Distributor pump, Mechanical and pneumatic Governor, Fuel Injector, Types of nozzles, importance of Swirl, Squish, Turbulence air motion, Combustion in CI Engines - Combustion Chambers, Stages of Combustion, Factors affecting Ignition Delay, Knock in CI engines. Pollution from CI engines.

UNIT - IV EMISSION CONTROL TECHNIQUES [09]

Design of engine, optimum selection of operating variables for control of emissions, EGR, charge stratification, SCR, DPF, Lean NOX catalyst technology. Thermal reactors, secondary air injection, catalytic converters, catalysts, fuel modifications, fuel cells, Two stroke engine pollution and control.

UNIT - V MEASUREMENT TECHNIQUES, EMISSION STANDARDS AND TEST PROCEDURES [09]

NDIR, FID, Chemiluminescent analyzers, Gas Chromatograph, smoke meters, emission standards, driving cycles - USA, Japan, Euro and India. Test procedures - ECE, FTP Tests. SHED Test - Chassis dynamometers, dilution tunnels.

Total = 45 Periods

Text Books :

1 Ganesan. V, Internal Combustion Engines, Tata McGraw-Hill Publishing Co., New Delhi, Fourth Edition, 2012.

2 Mathur M.L. and Sharma R.P, A Course in Internal Combustion Engines, Dhanpat Rai and sons, New Delhi, Second Edition, 2016.

Reference Books :

1 Ramalingam K.K, Automobile Engineering, Scitech Publications (India) Pvt. Ltd, Chennai, Second Edition, 2011.

2 John B. Heywood, Internal Combustion Engine Fundamentals, Tata McGraw Hill Education, New Delhi, Second Edition, 2018.

3 Gupta H.N, Fundamentals of Internal Combustion Engines, PHI Learning Private Ltd., New Delhi, Second Edition, 2013.

4 Obert, E.F., Internal Combustion Engineering and Air Pollution, Intext Education Publishers, New York, Third Edition, 1988.

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

Regulation: R 2020

Course Code: 20AU902 **Course Name: Automotive Engine Technology**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Illustrate the fundamental concepts and functions of an automotive engine and working cycles*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	*Explain the combustion phenomena in SI engines.*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	*Identify the CI engines injection, ignition and combustion phenomena*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	*Outline the emission control techniques.*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	*Demonstrate the measurement techniques and emission standards.*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

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

		L	T	P	C
20AU903	**AUTOMOTIVE VEHICLE TECHNOLOGY** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify 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.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL 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, operating safety- passive safety: exterior safety, interior safety, safety sandwich construction – NCAP.

UNIT - II SAFETY CONCEPTS [09]

Design of the body for safety -Energy equation - engine location - deceleration of vehicle inside passenger compartment - deceleration on impact with stationary and movable obstacle.

UNIT - III SAFETY EQUIPMENTS [09]

Seat belt - regulations, automatic seat belt tightener system - collapsible steering column - tiltable steering wheel - air bags - electronic system for activating air bags - bumper design for safety - Collision warning system - Central Locking system - Child safety.

UNIT - IV CRASH AND IMPACT MECHANICS [09]

Design of crash crumple zones - Behavior of specific body structures in crash testing - Roll over crash tests - Regulatory requirements for crash testing & testing procedure - vehicle impacts- Side and Frontal Pole Impact.

UNIT - V COMFORT AND CONVENIENCE SYSTEM [09]

Steering and mirror adjustment - central locking system - Garage door opening system - tyre pressure control system - rain sensor system - environment information system.

Total = 45 Periods

Text Books :

1 Ljubo Vlacic, Michel Parent and Fumio Harashima, Intelligent Vehicle Technologies, Butterworth-Heinemann publications, Oxford, First Edition, 2001.

2 Robert Bosch GmbH, Safety, Comfort and Convenience Systems, John Wiley& Sons, New Delhi, Third edition, 2007

Reference Books :

1 Bosch, Automotive Hand Book, SAE International, New York, Eighth Edition, 2011.

2 Vivek D. Bhise, Ergonomics in the automotive design process. CRC Press, New York, 2012.

3 Ronald K Jurgen, Automotive Electronics Handbook, Tata McGraw-Hill Inc., New York, Second Edition, 1999.

4 William B Ribbens, Understanding Automotive Electronics, Butterworth-Heinemann, Woburn, Eighth edition, 2017.

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

Regulation: R 2020

Course Code: 20AU904 **Course Name: Automotive Safety**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explain the automotive safety and its importance.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO2	*Analyze the safety concepts.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3	*Illustrate the various safety equipment functions and importance*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4	*Identify the various crash test and impact test mechanics.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5	*Examine the function of warning and avoidance systems.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**3**	-	-	-	-	-	**-**	**-**	**-**	**3**	**-**	**-**

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

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

		L	T	P	C
20AU905	**HYBRID VEHICLES** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the electric and hybrid vehicle operation and architectures.*	*Understand*
CO2:	*Explain the different subsystems of hybrid and electric vehicle*	*Understand*
CO3:	*Demonstrate the energy requirement for vehicles*	*Understand*
CO4:	*Model and simulate the vehicle characteristics, operating modes, and performance parameters of the vehicle*	*Understand*
CO5:	*Design and develop the systems of hybrid and electric vehicles*	*Understand*

UNIT - I NEED FOR ALTERNATIVE SYSTEM [09]

Need for hybrid and electric vehicles – main components and working principles of a hybrid and electric vehicles, Different configurations of hybrid and electric vehicles. Comparative study of diesel, petrol, hybrid and electric Vehicles. Advantages and Limitations of hybrid and electric Vehicles.

UNIT - II SUBSYSTEMS OF HYBRID AND ELECTRIC VEHICLES [09]

Basics – Types, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Battery pack Design, Properties of Batteries.

UNIT - III ENERGY SOURCES [09]

Battery Parameters- - Different types of batteries – Lead Acid- Nickel Metal Hydride – Lithium ion- Sodium based- Metal Air. Battery Modeling- Equivalent circuits, Battery charging- Quick Charging devices. Fuel Cell- Fuel cell Characteristics- Fuel cell types-Half reactions of fuel cell. Ultra capacitors. Battery Management System.

UNIT - IV MOTORS AND CONTROLLERS [09]

Types of Motors, Characteristic of DC motors, AC single phase and 3-phase motor, PM motors, Switched reluctance motors, Motor Drives and speed controllers, Torque Vectoring, Regenerative Braking. Rectifiers, Inverters, DC/DC converters.

UNIT - V DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES [09]

Design requirement for electric vehicles- Range, maximum velocity, acceleration, power requirement, mass of the vehicle. Various Resistance- Transmission efficiency- Electric vehicle chassis and Body Design, Electric Vehicle Recharging and Refueling Systems, performance of electrical vehicles.

Total = 45 Periods

Text Books :

1 Iqbal Husain, Electric and Hybrid Vehicles-Design Fundamentals, CRC Press, New York, Second Edition, 2010.

2 Mehrdad Ehsani, Modern Electric, Hybrid Electric and Fuel Cell Vehicles, CRC Press, New York, Second Edition, 2009.

Reference Books :

1 James Larminie and John Lowry, Electric Vehicle Technology Explained, John Wiley & Sons, New York, Second Edition, 2012.

2 Lino Guzzella, Vehicle Propulsion Systems, Springer-Verlag Berlin, Heidelberg, Third Edition, 2013

3 Ron Hod Kinson, Light Weight Electric/ Hybrid Vehicle Design, Butterworth Heinemann Publication, London, 2001

4 Ronald K Jurgen, Electric and Hybrid – Electric Vehicles, SAE International, New York, First Edition, 2011.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL 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**

		L	T	P	C
20AU906	**OFF HIGHWAY VEHICLES** (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 construction and requirement of off road vehicles.*	*Understand*
CO2:	*Explain the different types of earth moving machines and explain the different sub systems.*	*Understand*
CO3:	*Describe the specifications, functions, merits and demerits of different types and subsystems of scrappers, graders and ditchers.*	*Understand*
CO4:	*Discuss the construction and working principle of farm equipment, military and combat vehicles.*	*Understand*
CO5:	*Explain the vehicle systems and features.*	*Understand*

UNIT - I CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES [09]

Construction layout, capacity and applications. Power Plants, Chassis and Transmission, Multi-axle vehicles.

UNIT - II EARTH MOVING MACHINES [09]

Earthmovers like dumpers, loaders - single bucket, Multi bucket and rotary types - bulldozers, excavators, backhoe loaders, scrappers, drag and self powered types, Bush cutters, stumpers, tree dozer, rippers etc. – Power and capacity of earth moving machines.

UNIT - III SCRAPPERS ,GRADERS, SHOVELS AND DITCHERS [09]

Scrappers, elevating graders, motor graders, self powered scrappers and graders, Power shovel, revolving and stripper shovels – drag lines – ditchers – capacity of shovels.

UNIT - IV FARM EQUIPMENT, MILITARY AND COMBAT VEHICLES [09]

Power take off, special implements. Special features and constructional details of tankers, guncarriers and transport vehicles.

UNIT - V VEHICLE SYSTEMS AND FEATURES [09]

Brake system and actuation – OCDB and dry disc caliper brakes. Body hoist and bucket operational hydraulics. Hydro-pneumatic suspension cylinders. Power steering system. Kinematics for loader and bulldozer operational linkages. Safety features, safe warning system for dumper.

Total = 45 Periods

Text Books :

1 Robert L. Peurifoy, Clifford J. Schexnayder, Construction, planning, equipment and methods, Tata McGraw HillPublishing company Ltd, New Delhi, Ninth Edition, 2018.

2 Nakra C.P., Farm machines and equipment, Dhanparai Publishing company, New Delhi, First Edition, 2003.

Reference Books :

1 Wong.J.Y., Theory of Ground Vehicles, John Wiley & Sons, New York, Fifth Edition, 2022.

2 Ageikin S., Off the road wheeled and combined traction devices – Ashgate Publishing Co. Ltd., New Delhi, First Edition,1988

3 Heinz Heisler, Vehicle and Engine Technology, , SAE International, New York, Second Edition, 1999

4 Sean Bennet and Ian Andrew Norman, Heavy Duty Truck systems, Delmar Cengage learning, New York, Fifth Edition, 2011.

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

Regulation: R 2020

Course Code: 20AU906 **Course Name: Off Highway Vehicles**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Describe the construction and requirement of off road vehicles.*	3	3	2	-	-	-	3	3	-	-	-	-	-	-
CO2	*Explain the different types of earth moving machines and explain the different sub systems.*	3	3	2	-	-	-	3	-	-	-	-	-	-	-
CO3	*Describe the specifications, functions, merits and demerits of different types and subsystems of scrappers, graders and ditchers.*	3	3	3	-	-	-	3	3	-	-	-	-	-	-
CO4	*Discuss the construction and working principle of farm equipment, military and combat vehicles.*	3	3	2	-	-	-	3	3	-	-	-	-	-	-
CO5	*Explain the vehicle systems and features.*	3	2	2	-	-	-	3	-	-	-	-	-	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**

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

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

		L	T	P	C
20AU907	**MODERN AND INTELLIGENT VEHICLE SYSTEM** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify the various systems involved in driver support systems and their working principle.*	*Understand*
CO2:	*Familiarize with global positioning systems, geographical information systems and navigation systems.*	*Understand*
CO3:	*Comprehend the constructional and working features of safety systems and security systems.*	*Understand*
CO4:	*Recognize about the various comfort systems.*	*Understand*
CO5:	*Explain the various adaptive control systems.*	*Understand*

UNIT - I DRIVER ASSISTANCE SYSYTEMS [09]

Introduction, driver support systems – driver information, driver perception, driver convenience, driver monitoring. Vehicle support systems – general vehicle control, vehicle status monitoring and automated highway systems.

UNIT - II TELEMATICS [09]

Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition and application of Internet of Things (IoT) in automotive industry.

UNIT - III SAFETY SYSTEMS AND SECURITY SYSTEMS [09]

Airbags, seat belt tightening system, collision avoidance and warning systems, child lock, antilock braking systems, Anti-theft technologies, smart card system and number plate coding.

UNIT - IV COMFORT SYSTEMS [09]

Active suspension systems, requirement and characteristics, different types, power steering, collapsible and tiltable steering column and power windows.

UNIT - V ADAPTIVE CONTROL SYSTEMS [09]

Adaptive cruise control, adaptive noise control, anti spin regulation, traction control systems and cylinder cut off technology and autonomous driving.

Total = 45 Periods

Text Books :

1 Ljubo Vlacic, Michel Parent and Fumio Harashima, Intelligent Vehicle Technologies, Butterworth-Heinemann publications, Oxford, First Edition, 2001.

2 Ronald K Jurgen, Navigation and Intelligent Transportation Systems – Progress in Technology, Automotive Electronics Series, SAE, New York, First Edition, 1998.

Reference Books :

1 Richard Bishop, Intelligent Vehicle Technology and Trends, Artech House, London, First Edition, 2005.

2 William B Ribbens, Understanding Automotive Electronics, Butterworth-Heinemann, Woburn, Eighth edition, 2017.

3 Robert Bosch, Automotive Handbook, Bently Publishers, Cambridge, Tenth Edition, 2018.

4 Robert Bosch, Bosch Automotive Electrics and Automotive Electronics, Springer Vieweg Wiesbaden, Switzerland, Fifth Edition, 2013.

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DEPARTMENT OF MECHANICAL 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 wheel alignment and balancing, gauges for engine tune up and pollution measurement, spark plug cleaner, cylinder re-boring machine, fuel injection calibration machine. Importance of maintenance. Schedule and unscheduled maintenance. Scope of maintenance. Equipment downtime. Vehicle inspection. Reports. Log books. Trip sheet. Lay out and requirements of maintenance shop.

UNIT - II ENGINE REPAIR AND OVERHAULING [09]

Dismantling of engine and its components. Cleaning methods. Inspection and checking. Repair and reconditioning methods for all engine components. Maintenance of ignition system, fuel injection system, cooling system – lubrication system. Engine trouble shooting chart.

UNIT - III MAINTENANCE, REPAIR AND OVERHAULING OF THE CHASSIS [09]

Maintenance, servicing and repair of clutch, fluid coupling, gearbox, torque converter, propeller shaft. Maintenance of front axle, rear axle, brakes, steering systems.

UNIT - IV MAINTENANCE AND REPAIR OF VEHICLE BODY [09]

Body panel tools for repairing. Tinkering and painting. Use of soldering, metalloid paste. Tyre maintenance, metallic, plastics

UNIT - V MAINTENANCE AND REPAIR OF ELECTRICAL SYSTEMS [09]

Care, maintenance, testing and troubleshooting of battery, starter motor, dynamo, alternator and regulator. Transistorized regulator problems.

Total = 45 Periods

Text Books :

1 John E. Dolce, Analytical Fleet Maintenance Management, SAE International, New York, Third Edition, 2009.

2 James D. Halderman, Advanced Engine Performance Diagnosis, Pearson Education, New Delhi, Seventh Edition, 2019.

Reference Books :

1 Bosch Automotive Handbook, SAE International, New York, Tenth Edition,2018

2 Willam H. Crouse and Donald L. Anglin, Automotive Mechanics, Tata McGraw Hill Publishing Company, New Delhi, Tenth Edition, 2007.

3 Service Manuals from different vehicle manufacturers.

4 Judge. A.N, Motor vehicle engine servicing, Pitman Paper pack, London, Third Edition, 1969.

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DEPARTMENT OF MECHANICAL 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**

		L	T	P	C
20CE901	**ARCHITECTURAL HERITAGE OF INDIA** (Open Elective)	3	0	0	3

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

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Illustrate various materials used and construction style of Indus Valley Civilization*	*Understand*
CO2:	*Demonstrate the materials used and construction style of Chera, Chola and Pandya architecture*	*Understand*
CO3:	*Describe the materials used and construction style of Mughal architecture*	*Understand*
CO4:	*Explain the various materials and construction style of British* architecture	*Understand*
CO5:	*Describe various materials and construction style of Portuguese, Dutch, French and Danish*	*Understand*

UNIT - I INDUS VALLEY CIVILIZATION [09]

Indus valley civilization – Chronological introduction – Construction style – Materials used – The cities Harappa, lothal and Mohenjo-Daro, The great bath – The granary at Harappa – The assembly hall – Ajanta-Ellora Cave temples – Mahabodhi temple complex

UNIT - II SOUTH INDIAN ARCHITECTURE [09]

Chera-Chola-Pandya architecture – Chronological introduction – Construction style – Materials used – Brihadeeswarar Temple – Meenakshi Temple – Kalinga – Chalukya – Pallava architecture – Mahabalipuram stone temples – Khajuraho – Muskin Bhanvi – Konark Sun Temple – Hoysala – Vijayanagara architecture – twin temples Mosale – Virupaksha temple Raya Gopura at Hampi

UNIT - III MUGHAL ARCHITECTURE [09]

Mughal architecture – Chronological introduction – Construction style – Materials used – Qutub Minar – Taj Mahal – Humayun's Tomb – Redfort – Fatehpur Sikri – Agra fort – Jama Masjid – Rajput civil architecture – Chronological introduction – Construction style – Materials used – All hill forts of Rajasthan

UNIT - IV BRITISH ARCHITECTURE [09]

British colonial architecture – Chronological introduction – Construction style – Materials used – Buildings in Chennai, Mumbai, Shimla – Churches – Mountain railways of India-bridges.

UNIT - V COLONIAL ARCHITECTURE [09]

Other colonial architecture – Portuguese-Dutch-French-Danish – Chronological introduction – Construction style – Materials used – Churches – Churches and Convents of Goa and Cochi – French town of Puducherry – Tranquebar fort – Bungalow on the beach

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

Text Books :

1 Bindia Thapar, Surat Kumar Manto, and Suparna Bhalla., Introduction to Indian Architecture: Arts of Asia, Periplus Editions (HK) ltd, Hong Kong, First Edition, 2005

2 Sandhya Ketkar., The History of Indian Art, Jyotsna Prakashan Publisher, Maharashtra, E – Edition, 2020

Reference Books :

1 Christopher Tadgell., The History of Architecture in India, Phaidon Press Ltd, New York, First Edition, 1990

2 Mark M. Jarzombek, Vikramaditya Prakash, Francis D. K. Ching., A Global History of Architecture, John Wiley & Sons, Hoboken, Second Edition, 2010

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DEPARTMENT OF MECHANICAL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE901 **Course Name: Architectural Heritage of India**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Illustrate various materials used and construction style of Indus Valley Civilization*	3	3	-	2	-	2	2	-	-	-	-	3	-	-
CO2	*Demonstrate the materials used and construction style of Chera, Chola and Pandya architecture*	3	3	-	2	-	2	2	-	-	-	-	3	-	-
CO3	*Describe the materials used and construction style of Mughal architecture*	3	3	-	1	-	2	2	-	-	-	-	3	-	-
CO4	*Explain the various materials and construction style of British* architecture	3	3	-	2	-	2	2	-	-	-	-	3	-	-
CO5	*Describe various materials and construction style of* Portuguese, Dutch, French and Danish	3	3	-	1	-	2	2	-	-	-	-	3	-	-
	Average	**3**	**3**	**-**	**2**	**-**	**2**	**2**	**-**	**-**	**-**	-	**3**	-	-

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

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

		L	T	P	C
20CE902	**BUILDING PLANNING AND CONSTRUCTION** (Open Elective)	3	0	0	3

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

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline the factors to be considered in planning and construction of buildings*	*Understand*
CO2:	*Infer the different components and Foundations of building in their construction practices.*	*Understand*
CO3:	*Interpret masonry and* alternative *materials of wood, aluminum and glass.*	*Understand*
CO4:	*Discuss different types of floors, roofs and the materials which are commonly used for construction.*	*Understand*
CO5:	*Explain about dampness and fire resistance in buildings*	*Understand*

UNIT - I FUNCTIONAL PLANNING OF BUILDINGS [09]

Types of Buildings, Aspects and Principles of Building Planning, Building By - laws and Regulations, Site Selection criteria, Orientation of Building and its relation to surrounding environment, Sustainability and Green Buildings - Building Bye - laws and Building code of India 2016.

UNIT - II BUILDING COMPONENTS AND FOUNDATIONS [09]

Lintels, arches, different types of floors-concrete, mosaic, terrazzo floors, pitched, flat and curved roofs, lean-to roof, coupled roofs, trussed roofs, king and queen post trusses; RCC roofs, madras terrace/shell roofs. Foundations: Shallow foundations, spread, combined, strap and mat footings.

UNIT - III ALTERNATIVE MATERIALS AND MASONRY [09]

Structure, properties, seasoning of timber; Classification of various types of woods used in buildings, defects in timber; Alternative materials for wood, galvanized iron, fibre-reinforced plastics, steel, aluminium and glass; Types of masonry, English and Flemish bonds, rubble and ashlars masonry, cavity and partition walls - Light weight concrete blocks – merits and demerits.

UNIT - IV FLOORS,ROOFS AND STAIRCASES [09]

Components of a floor, materials used for floor construction, Different types of flooring, Ground floor and upper floors, Types of roofs, Basic roofing elements and Roof coverings. Functional requirements of a good stair, type of stairs, planning a stair case.

UNIT - V DAMP PROOFING AND FIRE PROTECTION [09]

Damp proofing and Fire protection: Causes and effect of dampness on buildings, Materials and methods used for damp proofing, Fire hazards, Grading of buildings according to fire resistance, Fire resisting properties of common building materials, Fire resistant construction.

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

Text Books :

1 Varghese P. C., Building construction, PHI Learning Pvt. Ltd, New Delhi ,Second Edition, 2016.

2 B. C. Punmia , Ashok Kumar Jain, Arun Kumar Jain, Building Construction, Laxmi Publications, New Delhi ,Eleventh Edition,2019.

Reference Books :

1 S. K. Duggal, Building Materials II, New Age International (P) Limited, New Delhi ,Fourth Edition, 2016,

2 Bulding Bye-laws 2019

3 National Building Code of India, 2016.

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DEPARTMENT OF MECHANICAL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE902 **Course Name: Building Planning and Construction**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Outline the factors to be considered in planning and construction of buildings*	3	2	1	1	-	3	2	-	-	-	-	2	-	-
CO2	*Infer the different components and Foundations of building in their construction practices.*	3	2	-	2	-	2	3	-	-	-	-	2	-	-
CO3	*Interpret masonry and* alternative *materials of wood, aluminum and glass.*	2	-	-	2	-	3	2	-	-	-	-	2	-	-
CO4	*Discuss different types of floors, roofs and the materials which are commonly used for construction.*	3	2	-	2	-	3	2	-	-	-	-	2	-	-
CO5	*Explain about dampness and fire resistance in buildings*	3	2	-	2	-	3	3	-	-	-	-	2	-	-
	Average	**3**	**2**	**1**	**2**	**1**	**3**	**3**	**-**	-	-	**-**	**2**	-	-

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

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

20CE903 **ELEMENTARY CIVIL ENGINEERING** (Open Elective)

L	T	P	C
3	0	0	3

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

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Provide an overview of civil engineering*	*Understand*
CO2:	*Explain the basics of surveying , modern tools of surveying and mapping*	*Understand*
CO3:	*Summarize the fundamentals of building materials in civil engineering*	*Understand*
CO4:	*Explain the components of building structures.*	*Understand*
CO5:	*Interpret various infrastructures of civil engineering in construction*	*Understand*

UNIT - I OVERVIEW OF CIVIL ENGINEERING **[09]**

History of Civil Engineering - Role and Functions of Civil Engineer - Fields of Civil Engineering - Importance of Civil Engineering

UNIT - II BASICS OF SURVEYING **[09]**

Introduction - Basic Definitions (Surveying, leveling, Plans, Maps, Scales) - Introduction to divisions of surveying - Classification of surveying - Fundamental principles of surveying - Measurement in Surveying - Phases of Surveying

MODERN TOOLS OF SURVEYING AND MAPPING:

Introduction to Global Positioning System - Remote Sensing and Geographic Information System

UNIT - III FUNDAMENTALS OF BUILDING MATERIALS **[09]**

Bricks – stones – sand – M-sand - cement – fly ash - silica fume - mortar- concrete – steel – glass - wood –plastics – ceramics

UNIT - IV COMPONENTS OF BUILDING **[09]**

Foundations – stone masonry – brick masonry – beams – columns – lintels – roofing – flooring – plastering- damp proofing weathering course

UNIT - V STRUCTURES **[09]**

Introduction to dams, weirs, barrages and check dams - Role of transportation in national development - Modes of transportation - Introduction to road traffic and traffic control - Introduction to mass transportation system

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

Text Books :

1 Anurag Kandya, Elements of Civil Engineering, Charotar Publishing House Pvt. Ltd, Gujarat, Third Edition, 2017.

2 Palanichamy M.S., Basic Civil Engineering, Tata McGraw-Hill, New Delhi, Fourth Edition, 2011.

Reference Books :

1 Poonam Sharma & Swati Rajput, Sustainable Smart Cities in India – Challenges and Future Perspectives, Springer, First Edition, 2017.

2 Dr.B.C.Punamia, Surveying, Laxmi Publication, New Delhi, Seventh Edition, 2016.

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DEPARTMENT OF MECHANICAL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE903 **Course Name: Elementary Civil Engineering**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Provide an overview of civil engineering*	1	-	-	-	-	1	-	-	-	-	-	1	-	-
CO2	*Explain the basics of surveying and modern tools of surveying and mapping*	2	1	-	-	-	2	-	-	-	-	-	1	-	-
CO3	*Summarize the fundamentals of building materials in civil engineering*	2	1	-	-	-	2	2	-	-	-	-	1	-	-
CO4	*Explain the components of building structures.*	2	1	-	-	-	2	-	-	-	-	-	1	-	-
CO5	*Interpret various infrastructures of civil engineering in construction*	3	2	1	-	-	3	2	-	-	-	-	1	-	-
	Average	**3**	**2**	**1**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	-

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

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

		L	T	P	C
20CE904	**ENERGY AND ENVIRONMENT** (Open Elective)	3	0	0	3

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

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline the earth's energy, environment and the processes leading to climate change.*	*Understand*
CO2:	*Infer the atmospheric issues related to the chemistry, green house gases*	*Understand*
CO3:	*Summarize the role of the terrestrial energy-environment-climate system*	*Understand*
CO4:	*Interpret the Possible effects of Global Warming and climate change.*	*Understand*
CO5:	*Outline the Natural and Anthropogenic and Green House Gas theory*	*Understand*

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

Overview on the Earth's energy requirements-Climate Change-Origins of the terrestrial atmosphere-Earth's early atmosphere- Introduction to Climate-Layers of the atmosphere.

UNIT - II **GLOBAL ATMOSPHERIC ISSUES** **[09]**

Composition of the present day atmosphere-Introduction to Atmospheric chemistry-Green House Gases, and the O3 - depletion problem-Post Industrial Revolution Scenario

UNIT - III **ENERGY BALANCE** **[09]**

Earth Atmosphere System- Solar and Terrestrial Radiation- Absorption of Radiation by gases.-Energy balance- Solar variability and the Earth's Energy Balance.

UNIT - IV **ATMOSPHERIC CHEMISTRY AND CLIMATE** **[09]**

The Global Temperature Record.-Possible effects of Global Warming. – Indian Context. Atmospheric Chemistry and Climate Change- Atmospheric Aerosol and Cloud Effects on Climate.

UNIT - V **ENVIRONMENTAL VARIABILITY** **[09]**

Natural (volcanoes, forest fires) and Anthropogenic (Antarctic Ozone Hole, Global Warming).-Green House Gas theory.- Effects of urbanization- Landscape changes-Influence of Irrigation-Desertification and Deforestation

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

Text Books :

1 Peter E Hodgson, Energy the Environment and Climate Change, Imperial College Press, London, First Edition, 2010
2. Ahluwalia V K, Energy and Environment, The Energy and Resources Institute, New Delhi, First Edition, 2019

Reference Books :

1 Richard Wolfson, Energy, Environment, and Climate, Publisher: W. W. Norton & Company, New York, Second Edition,2011
2 Saeed Moaveni ,Energy, Environment, and Sustainability with Mind Tap, Cengage India Private Limited ,New Delhi, First Edition,2017
3 Wilbanks, T., Bilello D, Schmalzer D, Scott, Climate Change and Energy Supply and Use: Technical Report for the U.S. Department of Energy in Support of the National Climate Assessment., Island Press,Washington,2013
4 Frank T. Princiotta, Global Climate Change - The Technology Challenge, Springer Publisher, New York, First Edition, 2011

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

Regulation: R 2020

Course Code: 20CE904 **Course Name: Energy and Environment**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Outline The Earth's Energy, Environment and the processes leading to climate change.*	3	3	-	-	-	2	2	-	-	-	-	2	-	-
CO2	*Infer the Atmospheric issues related to the chemistry, Green House Gases*	3	3	-	-	-	2	2	-	-	-	-	2	-	-
CO3	*Summarize the role of the Terrestrial Energy-Environment-Climate System*	3	3	-	-	-	2	2	-	-	-	-	2	-	-
CO4	*Interpret the* Possible effects of Global Warming and climate change.	3	3	-	-	-	2	2	-	-	-	-	2	-	-
CO5	*Outline the* Natural and Anthropogenic and Green House Gas theory	3	3	-	-	-	2	2	-	-	-	-	2	-	-
	Average	**3**	**3**	**-**	-	**-**	**2**	**2**	**-**	-	-	**-**	**2**	**-**	-

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

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

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 environmentprotection - Environment Protection Act as the framework legislation - strength and weaknesses of EIA - National Green tribunal the courts infrastructure projects

UNIT - IV **HAZARDOUS SUBSTANCES AND ACTIVITIES** **[09]**

Legal framework - EPA and rules made there under PLI Act, 199 - Principles of strict and absolute liability - Hazardous Wastes (Management, Handling and Transboundary) Rules, 2008 - Biomedical Waste (Management and Handling) Rules, 1998 - Municipal Solid Wastes (Management and Handling) Rules, 2000 - E - Waste (Management and Handling) Rules, 2011 - Batteries (Management & Handling) Rules, 2001

UNIT - V **INTERNATIONAL ENVIRONMENTAL LAW** **[09]**

Development of international environmental law, nature and scope of key international environmental law principles and rights (substantive and procedural), Establishment of Environmental Institutions like UNEP, Ozone Protection – Montreal Protocol for the Protection of Ozone Layer, 1987 as amended; U.N. Convention on Climate Change1992, Kyoto Protocol, 1997; Public Participation in Decision-making and Access to Justice in Environmental Matters, 1998 (Aarhus Convention); Johannesburg Conference, 2002.

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

Text Books :

1. Divan,S and Rosencranz, A., Environmental Law and Policy in India, Oxford India Paperbacks, New Delhi, Second edition, 2005.
2. Kanchan Chopra., Development and Environmental Policy in India: The Last Few Decades, Springer Publication, New Delhi, First edition, 2017.

Reference Books :

1. Birnie, P Boyle, and Red well's., International Law and the Environment ,Oxford University Press, United Kingdom, Fourth edition,2021.
2. Upadhyay S. and Upadhyay V., Hand Book on Environmental Law- Forest Laws, Wildlife Laws and the Environment; Vols. I, II and III, Lexis Nexis Butterworths, New Delhi, India, First Edition, 2001.
3. Leelakrishnan, P., Environmental Law Case Book, Lexis Nexis, India, Sixth Edition, 2021.
4. Sands, P., Principles of International Environmental Law, Cambridge University press, United Kingdom, Second Edition, 2002.

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

Regulation: R 2020

Course Code: 20CE905 **Course Name: Environmental Laws and Policies**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Summarize the basic concepts in Environmental laws and its judicial activism*	3	2	2	-	-	2	-	-	-	-	2	3	-	-
CO2	*Interpret different water acts and marine laws in India*	3	2	2	-	-	-	-	-	-	-	-	3	-	-
CO3	*Summarize Various Environment protection laws and acts in the framework of Mega projects*	3	2	3	-	-	2	-	-	-	-	2	3	-	-
CO4	*Explain the management and Handling of various hazardous waste management*	3	2	3	1	-	3	1	-	-	-	2	3	-	-
CO5	*Summarize the International Environmental laws framed at various conferences.*	3	2	3	2	-	3	-	-	-	-	2	3	-	-
	Average	**3**	**2**	**3**	**3**	**-**	**3**	**1**	**-**	**-**	**-**	**2**	**3**	-	-

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

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

		L	T	P	C
20CE906	**GLOBAL WARMING AND CLIMATE CHANGE** (Open Elective)	3	0	0	3

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

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline the concept of the causes and effects of global warming*	*Understand*
CO2:	*Summarize about physical and chemical characteristics of atmosphere*	*Understand*
CO3:	*Identify the causes and effects of climate change*	*Remember*
CO4:	*Infer the agreements took place among the countries regarding climate change*	*Understand*
CO5:	*Summarize about the concept of mitigation measures against climate change*	*Understand*

UNIT - I **EARTH'S CLIMATE SYSTEM** **[09]**

Role of ozone in environment – Ozone layer – Ozone depleting gases – Greenhouse gases and its sources - Green House Effect, Radiative Effects of Greenhouse Gases -The Hydrological Cycle – Green House Gases and Global Warming – Effects and causes of Global Warming, Carbon Cycle.

UNIT - II **ATMOSPHERE AND ITS COMPONENTS** **[09]**

Importance of Atmosphere – Physical Chemical Characteristics of Atmosphere - Vertical structure of the atmosphere - Composition of the atmosphere - Atmospheric stability -Temperature profile of the atmosphere - Lapse rates- Temperature inversion - effects of inversion on pollution dispersion.

UNIT - III **IMPACTS OF CLIMATE CHANGE** **[09]**

Causes of Climate change – Change of Temperature in the environment - Melting of ice Pole-sea level rise - Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

UNIT - IV **OBSERVED CHANGES AND ITS CAUSES** **[09]**

Climate change and Carbon credits – CDM- Initiatives in India - Kyoto Protocol - Intergovernmental Panel on Climate change - Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India .

UNIT - V **CLIMATE CHANGE AND MITIGATION MEASURES** **[09]**

Clean Development Mechanism – Carbon Trading – Examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding - Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS) - Waste(MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

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

Text Books :

1 Kandarp Tarkeshprasad Vaishnav., Climate Change Solutions, Global Warming Solutions & Innovative Ideas For Construction of World Development, Notion Press, Chennai, First Edition, 2018

2 Vivian Moritz., Climate Change and Global Warming, Syrawood Publishing House, New York, First Edition, 2017

Reference Books :

1 Marie Antonette and Chloe Marechal., Climate Change Past, Present & Future, Wiley-Blackwell, New Jersey, First Edition, 2015.

2 Empereur Raymond., Global Warming and Climate Change, Litfire Publishing, Atlanta, First Edition, 2017.

3 Agarwal S.K., Global Warming and Climate Change Past, Present & Future, Ashish Publishing House, New Delhi, First Edition, 2004.

4 https://onlinecourses.swayam2.ac.in/arp19_ap55/preview

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL 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**

		L	T	P	C
20CE907	**INTRODUTION TO DISASTER MANAGEMENT AND MITIGATION** (Open Elective)	3	0	0	3

Prerequisite: Nil

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the concepts of disaster and its effect in Indian scenario.*	*Understand*
CO2:	*Elaborate the difference between natural and manmade disasters.*	*Understand*
CO3:	*Outline the disaster management cycle and its operation.*	*Understand*
CO4:	*Outline the disaster management in India and its profile.*	*Understand*
CO5:	*Propose the application of geo-informatics for disaster management and mitigation.*	*Apply*

UNIT - I INTRODUCTION TO DISASTER [09]

Definition of Disaster, hazard, global and Indian scenario, general perspective, importance of study in human life, Direct and indirect effects of disasters, long term effects of disasters. Introduction to global warming and climate change.

UNIT - II NATURAL DISASTER AND MANMADE DISASTERS [09]

Natural Disaster: Meaning and nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion.

Manmade Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.

UNIT - III DISASTER MANAGEMENT CYCLE AND FRAMEWORK [09]

Disaster Management Cycle, Paradigm Shift in Disaster Management Pre-Disaster Risk Assessment and Analysis, Risk Mapping, zonation and Micro zonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development, Awareness During Disaster Evacuation, Disaster Communication, Search and Rescue, Emergency Operation Centre, Incident Command System, Relief and Rehabilitation, Damage and Needs Assessment, Restoration of Critical Infrastructure, Early Recovery, Reconstruction and Redevelopment, IDNDR, Yokohama Strategy, Hyogo Framework of Action.

UNIT - IV DISASTER MANAGEMENT IN INDIA DISASTER PROFILE OF INDIA [09]

Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005, Institutional and Financial Mechanism, National Policy on Disaster Management, National Guidelines and Plans on Disaster Management, Role of Government, Non-Government and Inter-Governmental Agencies.

UNIT - V APPLICATIONS OF SCIENCE AND TECHNOLOGY FOR DISASTER MANAGEMENT & MITIGATION [09]

Geo-informatics in Disaster Management, Disaster Communication System, Land Use Planning and Development Regulations, Structural and Non Structural Mitigation of Disasters, S&T Institutions for Disaster Management in India.

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

Text Books :

1. R B Singh., Disaster Management and Mitigation, World focus Publisher, New Delhi, First Edition, 2016.
2. Satish Modh, Introduction to disaster management, Macmillan publishers India ltd, New Delhi, Second Edition, 2019.

Reference Books :

1. R B Singh., Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi, Reprint Edition, 2006.
2. Pardeep Sahni, Disaster Risk Reduction in South Asia, PHI Learning, New Delhi, Fourth Edition, 2018.
3. M. Saravanakumar, Disaster Management, Himalaya Publishing House, Bangalore, First Edition, 2017
4. Singh, Disaster Management: Future Challenges, IK International, New Delhi, First Edition, 2017.

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

Regulation: **R 2020**

Course Code: **20CE907** **Course Name:** **Introduction to Disaster Management and Mitigation**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the concepts of disaster and its effect in Indian scenario.*	3	3	1	-	-	2	-	-	-	-	-	3	-	-
CO2:	*Elaborate the difference between natural and manmade disasters.*	3	3	1	-	-	3	-	-	-	-	-	3	-	-
CO3:	*Outline the disaster management cycle and its operation*	3	3		-	-	2	-	-	-	-	-	3	-	-
CO4:	*Outline the disaster management in India and its profile*	3	3	1	-	-	3	-	-	-	-	-	3	-	-
CO5:	*Propose the application of geo-informatics for disaster management and mitigation.*	3	3	3	-	2	3	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**1**	-	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	-

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

		L	T	P	C
20CE908	**INTRODUCTION TO EARTHQUAKE ENGINEERING** (Open Elective)	3	0	0	3

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

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Illustrate 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 MECHANICAL 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	*Illustrate the causes and effects of earthquake.*	3	2	2	-	-	-	2	-	-	-	-	3	-	-
CO2	*Explain the basic concepts in seismology and correlate to earthquake engineering.*	3	2	2	-	-	-	2	-	-	-	-	3	-	-
CO3	*Summarize the theory of vibrations.*	3	2	3	-	-	-	2	-	-	-		3	-	-
CO4	*Outline the design process for earthquake resisting structures*	3	2	3	2	-	-	2	-	-	-		3	-	-
CO5	*Predict the performance of building and structures under the earthquake.*	3	2	3	2	-	-	2	-	-	-	-	3	-	-
	Average	**3**	**2**	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**		**3**	-	-

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

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

		L	T	P	C
20CE909	**SOLID WASTE MANAGEMENT** (Open Elective)	3	0	0	3

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

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*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 Disposalǁ, McGraw-Hill, Inc., Second Edition, Noida, 1997.

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

Regulation: R 2020

Course Code: 20CE909 **Course Name: Solid Waste Management**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Overview the concept of Solid waste and management.*	3	3	3	-	-	-	-	-	2	-	-	-	-	-
CO2	*Summarize about on-site storage and processing of solid waste.*	3	3	3	-	-	-	-	-	2	-	-	-	-	-
CO3	*Summarize about Collection and transportation of waste.*	3	3	3	-	-	-	-	-	2	-	-	-	-	-
CO4	*Summarize about off-Site Processing of solid waste.*	3	3	3	-	-	-	-	-	2	-	-	-	-	-
CO5	*Interpret about safe disposal of solid waste.*	3	3	3	-	-	-	-	-	2	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**

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

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

20CE910	WATER AND AIR POLLUTION MANAGEMENT (Open Elective)	L	T	P	C
		3	0	0	3

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

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain water and air quality standards*	*Understand*
CO2:	*Discuss water treatment and fundamentals of air pollution*	*Understand*
CO3:	*Demonstrate the particulate of air pollution.*	*Understand*
CO4:	*Classify air pollution control technologies.*	*Understand*
CO5:	*Describe air pollution control equipment.*	*Understand*

UNIT - I INTRODUCTION [09]

Water effluent standards -water quality indices - physical- chemical and biological parameters of water- water quality requirement - potable water standards -Air pollutants – Sources – Classification of air pollutants – Particulates and gaseous pollutants – Effects of air pollutants on human health, vegetation and property – Global issues and air pollution – Global warming – Ozone layer depletion – Ambient air quality and emission standards – Air pollution indices – Air act.

UNIT - II WATER TREATMENT AND FUNDAMENDALS OF ATMOSPHERIC POLLUTANTS [09]

Water purification systems in natural systems- physical processes-chemical processes and biological processes primary, secondary and tertiary treatment-Unit operations-unit processes. Mixing, clarification - sedimentation; Types; aeration and gas transfer – coagulation and flocculation, coagulation processes - stability of colloids –Disinfection - Fundamentals of meteorology – Wind roses – Atmospheric stability – Atmospheric diffusion of pollutants – Transport, transformation and deposition of air contaminants – Plume behaviour – Atmospheric diffusion theories – Plume rise.

UNIT - III PARTICULATE AIR POLLUTION [09]

Control principles – Principles and equipment description of control technologies – Particulates control by Gravitation, centrifugal, filtration, scrubbing, electrostatic precipitation – Absorption, adsorption, condensation, incineration and bio filtration for control of gaseous air pollutants.

UNIT - IV AIR POLLUTION CONTROL TECHNOLOGIES [09]

Biological air pollution control technologies – Bioscrubbers, bio filters. Air pollutants in indoor environments – Levels of pollutants in indoor and outdoor air – Indoor air pollution from outdoor sources – Measurement methods – Control Technologies.

UNIT - V AIR POLLUTION CONTROL EQUIPMENT [09]

Introduction – Installation of Settling chambers, Inertial separators, Dust trap, Involute cyclone, Multiple cyclone, Filters, Electrostatic precipitators, Scrubbers, Separating devices – Efficiency of equipment.

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

Text Books :

1 Rao, C. S., Environmental Pollution Control Engineering, New Age International, New Delhi, First Edition, 2006.

2 Davis M. L. and Cornwell D. A., Introduction to Environmental Engineering, Tata McGraw Hill Education Pvt. Ltd,. New Delhi, First Edition, 2010.

Reference Books :

1 Rao, C. S., Environmental Pollution Control Engineering, New Age International, New Delhi, First Edition, 2006.

2 Anjaneyulu, D., Air Pollution and Control Technologies, Allied Publishers, Mumbai, First Edition 2002.

3 S.K. Garg, “Water Supply Engineering”, Khanna Publishers, New Delhi, Thirty three Edition, 2010.

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

Regulation: R 2020

Course Code: 20CE910 **Course Name: Water and Air Pollution Management**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explain water and air quality standards*	3	3	-	-	-	-	2	-	-	-	-	3	-	-
CO2	*Discuss water treatment and fundamentals of air pollution*	3	3	-	-	-	-	-	-	-	-	-	2	-	-
CO3	*Demonstrate the particulate of air pollution.*	3	2	-	-	-	-	2	-	-	-	-	3	-	-
CO4	*Classify air pollution control technologies*	3	3	-	-	-	-	2	-	-	-	-	3	-	-
CO5	*Describe air pollution control equipment.*	3	3	-	-	-	-	2	-	-	-	-	3	-	-
	Average	**3**	**3**	**-**	-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	-	-

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

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

		L	T	P	C
20CS901	**PROGRAMMING IN JAVA**				
	(Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Discover java programming fundamentals to solve real world problem.*	*Understand*
CO2:	*Implement the concept of class and constructor.*	*Apply*
CO3:	*Examine important features of java like inheritance and interfaces.*	*Understand*
CO4:	*Illustrate the features of package and exception handling.*	*Understand*
CO5:	*Apply the concepts of string manipulations.*	*Apply*

UNIT – I JAVA FUNDAMENTALS [09]

The Java Buzzwords – Data Types – Variables– Local Variable – Instant Variable – Static variable – Array-Single Dimensional Array-Multi Dimensional Array – Operators – Control Statements – if – if else – nested if– else if– for – for each – while – do while – Switch – Break– Continue.

UNIT – II CLASS FUNDAMENTALS AND CONSTRUCTORS [09]

Class Fundamentals –Declaring Objects – Methods – Instant Method– Static Method– Method Overloading– Recursion – this keyword – Garbage Collection – Constructors – Argument constructor– No-Argument Constructor – Constructor Overloading – Access Control.

UNIT – III INHERITANCE AND INTERFACES [09]

Inheritance – Single – Multilevel – Hierarchical – Super keyword – Method Overriding – Abstract class – Final variable– Final class – Interfaces – Default Interface Methods – Static Methods in Interface.

UNIT – IV PACKAGES AND EXCEPTION HANDLING [09]

Packages –User define Package – Predefine Package – Access Protection – Importing Packages – Array List– Wrapper Classes – Exception Handling Fundamentals – Exceptions Types –Try and Catch – Multiple Catch – Nested Try – Throw – Throws – Finally.

UNIT – V STRING AND STRING BUFFER [09]

The String Constructors – String Length – Character Extraction – String Comparison – Searching Strings – Modifying a String – Data Conversion using value Of method – Methods in String Buffer – append – delete – replace – insert – reverse – capacity.

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

Text Books :

1 Herbert Schildt, Java - The Complete Reference, Oracle Press, McGraw-Hill Education, New Delhi, Eleventh Edition, 2018.

2 Cay S. Horstmann, Core Java Volume 1 - Fundamentals, Prentice Hall, India, Tenth Edition, 2015.

Reference Books :

1 Herbert Schildt, Java - A Beginner Guide, Oracle Press, McGraw-Hill Education, New Delhi, Sixth Edition, 2014.

2 Joshua Bloch, Effective Java: A Programming Language Guide, Addison-Wesley Professional, USA, Third Edition, 2018.

3 Allen B. Downey and Chris Mayfield, Think Java: How to Think Like a Computer Scientist, O'Reilly, California, First Edition, 2016.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL 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**

		L	T	P	C
20CS902	**BASIC CONCEPTS OF DATA STRUCTURE** (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 Reema Thareja, Data Structures Using C, Oxford University Press, England, Second Edition, 2011

Reference Books :

1 R. F. Gilberg, B. A. Forouzan, Data Structures, Thomson, India, Second Edition, 2005.

2 A.K. Sharma, Data Structures using C, Pearson Education, India, First Edition, 2011.

3 Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Fundamentals of Data Structures in C++,University Press, United States, Second Edition, 2008

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DEPARTMENT OF MECHANICAL 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**

		L	T	P	C
20CS903	**FUNDAMENTALS OF DATABASE CONCEPTS** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline database architecture and the E-R Model for Database design.*	*Understand*
CO2:	*Apply Structured query language to create and manipulate a relational database.*	*Apply*
CO3:	*Build functions, triggers and recursive queries.*	*Apply*
CO4:	*Demonstrate the purpose of normalization.*	*Understand*
CO5:	*Discover about transaction and query processing concepts.*	*Understand*

UNIT – I BASIC CONCEPTS AND E-R MODEL [9]

Database System Applications – Purpose of Database Systems – Views of Data – Database Languages –Database and Application Architecture. Overview of the Design Process – The Entity-Relationship model – Complex Attributes – Mapping Cardinalities and Keys.

UNIT – II RELATIONAL MODEL AND SQL FUNDAMENTALS [9]

Introduction to Relational Model: Structure of Relational Databases – Database Schema –Keys – Schema Diagrams. Overview of the SQL Query Language – SQL Data Definition – Basic Structure of SQL Queries – Additional Basic Operations – Set operations – Null values – Aggregate functions – Modification of the Database.

UNIT - III INTERMEDIATE SQL AND ADVANCED SQL [09]

Join Expressions – Views – Transactions – Integrity Constraints – Authorization –Accessing SQL from Programming Language – Functions and Procedures – Triggers – Recursive Queries.

UNIT - IV NORMALIZATION [09]

Functional Dependencies – Non-loss Decomposition – First, Second and Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

UNIT - V TRANSACTIONS AND QUERY PROCESSING [09]

Transaction Concept – A Simple Transaction Model – Storage Structure – Transaction Atomicity and Durability – Transaction Isolation – Serializability – Concurrency Control – Lock-Based protocols – Query Processing overview

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

Text Books :

1 Abraham Silberschatz, Henry F. Korth and S. Sudharshan, Database System Concepts, Tata McGraw Hill, New Delhi, Seventh Edition, 2019.
2 Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, Pearson Education, New Delhi, Seventh Edition, 2016.

Reference Books :

1 Abraham Silberschatz, Henry F. Korth and S. Sudharshan, Database System Concepts, Tata McGraw Hill, New Delhi, Sixth Edition, 2015.
2 S.K.Singh, Database Systems Concepts, Design and Applications, Pearson Education, New Delhi, Second Edition, 2011.
3 C.J.Date, A.Kannan and S.Swamynathan, An Introduction to Database Systems, Pearson Education, New DelhiEighth Edition, 2006.
4 http://freevideolectures.com/course/2668/database-management-system#

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DEPARTMENT OF MECHANICAL ENGINEERING

CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CS903** **Course Name:** **FUNDAMENTALS OF DATABASE CONCEPTS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Outline database architecture and the E-R Model for Database design.*	3	3	3	-	2	2	-	-	-	-	-	2	-	-
CO2:	*Apply Structured query language to create and manipulate a relational database.*	3	3	3	-	2	2	-	-	-	-	-	2	-	-
CO3:	*Build functions, triggers and recursive queries.*	3	3	3	-	2	2	-	-	-	-	-	2	-	-
CO4:	*Demonstrate the purpose of normalization.*	3	3	3	-	2	2	-	-	-	-	-	2	-	-
CO5:	*Discover about transaction and query processing concepts.*	3	3	3	-	2	2	-	-	-	-	-	2	-	-
	Average	**3**	**3**	**3**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

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

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

20CS904	**INTERNET PROGRAMMING** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the technologies around the internet.*	*Understand*
CO2:	*Construct the idea of web designing at user interface.*	*Apply*
CO3:	*Discuss the concept of data processing on client and server side.*	*Understand*
CO4:	*Construct the web oriented response at server side in PHP and XML format*	*Apply*
CO5:	*Illustrate the web service architecture and to enable rich client presentation using AJAX.*	*Understand*

UNIT – I INTRODUCTION TO WEB [09]

Web Essentials: Clients, Servers, and Communications. The Internet – History – Basic Internet Protocols: TCP and IP – DNS – URL. The World Wide Web – HTTP: Request Message – Response Message – Web Clients – Web Servers – Case Study.

UNIT – II BASICS OF HTML AND CSS [09]

HTML. An Introduction to HTML History and Version - Structure of HTML Page – HTML tags for data formatting - Tables – Links – Images - List – Frames – Forms - HTML 5 Tags and Validation. Style Sheets: CSS Syntax and Structure – CSS Rules for Backgrounds, Colours, and Properties – Manipulating Texts, Fonts, borders and Boxes - Margin – Padding Lists – CSS Positioning.

UNIT– III CLIENT SIDE SCRIPTING [09]

JavaScript: Syntax and Execution – Internal, embedded and External JavaScript. JavaScript: Variables – Arrays – Functions – Conditions – Loops – Type Conversion – Objects and DOM – Inbuilt Functions – Validation and Regular Expressions – Event Handling.

UNIT – IV SERVER SIDE SCRIPTING [09]

PHP: Introduction – Using PHP – variables – Program Control. Built-in Functions: Connecting to Database – Using cookies – Regular Expression. XML: Basics – DTD – XML Scheme – DOM and Presenting XML – XML parsers and validation.

UNIT– V AJAX and WEB SERVICE [09]

AJAX: Introduction – Ajax Client Server Architecture, XML http Request Object – Call Back Methods. Introduction to Web Services – Java web services: Basics – SOAP – WSDL: Creating, Publishing and Describing a web service – Consuming a web service – Database Driven Web Service from an application.

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

Text Books :

1 Randy Connolly and Ricardo Hoar, Fundamentals of Web Development, Pearson Education New Delhi, First Edition, 2016.

2 Paul Deitel, Harvey Deitel and Abbey Deitel , Internet and World Wide Web – How to Program, Pearson Education, New Delhi, Fifth Edition, 2012.

Reference Books :

1 Chris Bates, Web Programming – Building Internet Applications, John Wiley & Sons Ltd, USA, Third Edition, 2007.

2 John Dean, Web Programming With HTML5, CSS and JavaScript, Jones and Bartlett Publishers, Inc, United States, Third Edition, 2008.

3 Jon Duckett, Beginning Web Programming With HTML, XHTML and CSS, Wiley Publishing Inc, India, Second Edition, 2008.

4 www.tutorialspoint.com

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DEPARTMENT OF MECHANICAL ENGINEERING

CO-PO MAPPING

Regulation: R 2020

Course Code: 20CS904 **Course Name: INTERNET PROGRAMMING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Summarize the technologies around the internet.*	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO2:	*Construct the idea of web designing at user interface.*	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO3:	*Discuss the concept of data processing on client and server side.*	3	3	3	-	3	1	-	-	-	-	-	2	-	-
CO4:	*Construct the web oriented response at server side in PHP and XML format*	3	3	3	-	3	1	-	-	-	-	-	2	-	-
CO5:	*Illustrate the web service architecture and to enable rich client presentation using AJAX.*	3	2	3	-	3	2	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**3**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

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

		L	T	P	C
20CS905	**FUNDAMENTALS OF MOBILE APPLICATION DEVELOPMENT** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify various concepts of mobile programming that make it unique from programming for other platforms.*	*Understand*
CO2:	*Critique mobile applications on their design pros and cons.*	*Understand*
CO3:	*Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.*	*Apply*
CO4:	*Program mobile applications for the Android operating system that use basic and advanced phone features.*	*Understand*
CO5:	*Deploy applications to the Android marketplace for distribution.*	*Apply*

UNIT – I OVERVIEW OF THE ANDROID PLATFORM [09]

Introducing Android – Setting Up Your Android Development Environment – Writing Your First Android Application – Mastering the Android Development Tools

UNIT – II ANDROID APPLICATION BASICS [09]

Understanding the Anatomy of an Android Application – Defining Your Application Using the Android Manifest File – Managing Application Resources

UNIT – III ANDROID USER INTERFACE DESIGN ESSENTIALS [09]

Exploring User Interface Screen Elements – Designing User Interfaces with Layouts – Working with Fragments – Working with Dialogs

UNIT – IV ANDROID APPLICATION DESIGN ESSENTIALS [09]

Android application design: Using Android Preferences – Working with Files and Directories – Using Content Providers – Designing Compatible Applications

UNIT– V PUBLISHING AND DISTRIBUTING ANDROID APPLICATIONS [09]

The Android Software Development Process – Designing and Developing Bulletproof Android Applications – Testing Android Applications – Publishing Your Android Application

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

Text Books :

1 Lauren Darcey, Shane Conder, Android Wireless Application Development, Pearson Education, India, Second Edition, 2011.

2 Ed Burnette, Hello Android: Introducing Google's Mobile Development Platform, The Pragmatic Publishers, North Carolina USA, Third Edition, 2010.

Reference Books :

1 Google Developer Training, Android Developer Fundamentals Course – Concept Reference, Google Developer Training Team, 2016.

2 Zigurd Mednieks, Laird Dornin, Blake Meike G, Masumi Nakamura, Programming Android: Java Programming for the New Generation of Mobile Devices, OReilly Media, USA, Second Edition, 2011.

3 2016Reto Meier, Professional Android 4 Application Development, Wrox Publications, John Wiley, New York, First Edition, 2012.

4 https://developer.android.com/training/basics/firstapp

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DEPARTMENT OF MECHANICAL ENGINEERING

CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CS905** **Course Name:** **FUNDAMENTALS OF MOBILE APPLICATION DEVELOPMENT**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Identify various concepts of mobile programming that make it unique from programming for other platforms.*	3	2	2	-	1	-	-	-	-	-	-	1	-	-
CO2:	*Critique mobile applications on their design pros and cons.*	3	2	3	-	2	-	-	-	-	-	-	2	-	-
CO3:	*Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.*	3	2	3	-	2	-	-	-	-	-	-	2	-	-
CO4:	*Program mobile applications for the Android operating system that use basic and advanced phone features.*	3	2	2	-	2	-	-	-	-	-	-	1	-	-
CO5:	*Deploy applications to the Android marketplace for distribution.*	3	2	3	-	2	-	-	-	-	-	-	2	-	-
	Average	**3**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

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

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

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, Cenage learning New Delhi, Second Edition, 2012.

2 Ankit Fadia, The Ethical Hacking Guide to Corporate Security, Macmillan Publishers, India, Second Edition, 2010.

3 James S. Tiller, The Ethical Hack: A Framework for Business value Penetration Testing, CRC Press, Florida, First Edition, 2005.

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DEPARTMENT OF MECHANICAL ENGINEERING

CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CS906** **Course Name:** **PRINCIPLES OF ETHICAL HACKING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Discuss the basics of hacking with its ethics*	3	3	3	-	3	3	-	3	-	-	-	2	-	-
CO2:	*Extend the possibilities and types of Attacks*	3	3	2	-	1	2	-	1	-	-	-	1	-	-
CO3:	*Summarize the testing process with programming Language.*	3	3	2	-	3	3	-	2	-	-	-	3	-	-
CO4:	*Infer about the impact of hacking wireless network*	3	3	2	-	3	2	-	1	-	-	-	2	-	-
CO5:	*Outline about the protection scheme.*	3	3	2	-	3	2	-	1	-	-	-	3	-	-
	Average	**3**	**3**	**2**	**-**	**3**	**2**	**-**	**1**	**-**	**-**	**-**	**2**	**-**	**-**

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

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

		L	T	P	C
20CS907	**GREEN TECHNOLOGY** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify Green IT with its different dimensions and Strategies.*	Understand
CO2:	*Describe Green data centres and storage along with its green software methodologies.*	Understand
CO3:	*Outline the concepts o to manage the green IT with necessary components.*	Understand
CO4:	*Recognize various green enterprise activities, functions and their role with IT.*	Understand
CO5:	*Categorize various laws, standards and protocols for regulating green IT.*	Understand

UNIT – I GREEN IT [09]

Environmental Concerns and Sustainable Development – Environmental Impacts of IT – Green IT – Holistic Approach to Greening IT – Greening IT – Applying IT for enhancing Environmental sustainability – Green IT Standards and Eco-Labelling of IT – Enterprise Green IT strategy – Life Cycle of a device or hardware – Reuse, Recycle and Dispose.

UNIT – II SUSTAINABLE SOFTWARE DEVELOPMENT AND GREEN DATA CENTRES [09]

Current Practices – Sustainable Software – Attributes – Metrics – Methodology – Defining Actions – Data Centres: Associated Energy Challenges – IT Infrastructure – Management – Green Data Centre Metrics – Green Data Storage – Storage Media Power Characteristics – Energy Management Techniques for Hard Disks.

UNIT – III ENTERPRISE GREEN IT STRATEGY [09]

Approaching Green IT Strategies – Business Drivers – Business Dimensions for Green IT Transformation – Organizational Considerations – Steps to Develop Green IT Strategy – Metrics and Measurements – Multilevel Sustainable Information – Sustainability Hierarchy Models.

UNIT – IV GREEN ENTERPRISE READINESS AND THE ROLE OF IT [09]

Readiness and Capability – Development and Measuring of an Organization's G-Readiness Framework – Organizational and Enterprise Greening – Information systems in Greening Enterprises – IT Usage and Hardware – Inter-Organizational Enterprise activities and Green Issues – Enablers and making the case for IT and Green Enterprise.

UNIT – V LAWS, STANDARDS AND PROTOCOLS [09]

The regulatory environment and IT manufacturers – Non regulatory government initiatives – Industry associations and standards bodies – Green building standards – Green data centres – Social movements and Greenpeace – Cloud Computing – Energy Usage Model.

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

Text Books :ENERGY MANAGEMENT

1 San Murugesan, G.R. Gangadharan, Harnessing Green IT - Principles and Practices, Wiley Publication, India, First Edition, 2012.

2 Bhuvan Unhelkar, Green IT Strategies and Applications - Using Environmental Intelligence, CRC Press, Florida, First Edition, 2016.

Reference Books :

1 Woody Leonhard, Katherrine Murray, Green Home computing for dummies, Wiley Publication, India, First Edition, 2009.

2 Bud E. Smith, Green Computing: Tools and Techniques for Saving Energy, Money and Resources, CRC Press, Florida, Second Edition, 2014.

3 Jason Harris, Green Computing and Green IT - Best Practices on regulations and industry, Lulu.com, First edition, 2008.

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

DEPARTMENT OF MECHANICAL ENGINEERING

CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CS907** **Course Name:** **GREEN TECHNOLOGY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Identify Green IT with its different dimensions and Strategies.*	3	3	3	-	3	-	-	-	-	-	-	2	-	-
CO2:	*Describe Green data centres and storage along with its green software methodologies.*	3	2	2	-	3	-	-	-	-	-	-	1	-	-
CO3:	*Outline the concepts o to manage the green IT with necessary components.*	3	3	2	-	3	-	-	-	-	-	-	2	-	-
CO4:	*Recognize various green enterprise activities, functions and their role with IT.*	3	3	3	-	3	-	-	-	-	-	-	1	-	-
CO5:	*Categorize various laws, standards and protocols for regulating green IT.*	3	3	3	-	3	-	-	-	-	-	-	2	-	-
	Average	3	3	3	-	3	-	-	-	-	-	-	2	-	-

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

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

		L	T	P	C
20CS908	**ARTIFICIAL INTELLIGENCE AND ROBOTICS** (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 – Prepositional 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.

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

DEPARTMENT OF MECHANICAL ENGINEERING

CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CS908**

Course Name: **ARTIFICIAL INTELLIGENCE AND ROBOTICS**

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

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

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

		L	T	P	C
20CS909	**BIG DATA AND ANALYTICS** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Discover the insights of big data analytics*	*Understand*
CO2:	*Identify the file systems and to know the map reduce technique*	*Understand*
CO3:	*Summarize data by utilizing various statistical and data mining approaches*	*Understand*
CO4:	*Deploy and Perform analytics on real-time streaming data*	*Understand*
CO5:	*Comprehend the various NoSql alternative database models*	*Understand*

UNIT – I INTRODUCTION TO BIG DATA [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 Ambiga Dhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley, United States, First Edition, 2013.
3. P. J. Sadalage and M. Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison-Wesley Professional, United States, Third Edition, 2013.
4. Richard Cotton, Learning R – A Step-by-step Function Guide to Data Analysis, O_Reilly Media, California, Third Edition, 2018.

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

DEPARTMENT OF MECHANICAL ENGINEERING

CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CS909** **Course Name:** **BIG DATA AND ANALYTICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Discover the insights of big data analytics*	3	3	2	-	3	2	-	-	-	-	-	1	-	-
CO2:	*Identify the file systems and to know the map reduce technique*	3	2	1	-	3	3	-	-	-	-	-	1	-	-
CO3:	*Summarize data by utilizing various statistical and data mining approaches*	3	3	2	-	3	2	-	-	-	-	-	1	-	-
CO4:	*Deploy and Perform analytics on real-time streaming data*	3	3	2	-	3	2	-	-	-	-	-	1	-	-
CO5:	*Comprehend the various NoSql alternative database models*	3	3	1	-	3	2	-	-	-	-	-	1	-	-
	Average	**3**	**3**	**2**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**

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

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

		L	T	P	C
20CS910	**HARDWARE AND TROUBLE SHOOTING** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify with the Basic functional units of a computer system.*	*Understand*
CO2:	*Discover the working Concepts of I/O devices in computer.*	*Understand*
CO3:	*Examine the interfaces and controllers connected to PC.*	*Understand*
CO4:	*Outline the system configuration, Installation and maintenance of PC.*	*Understand*
CO5:	*Summarize about faults, diagnostics and troubleshooting in PC.*	*Understand*

UNIT – I INTRODUCTION [9]

Introduction - Computer Organization – Number Systems and Codes – Memory – ALU – CU – Instruction prefetch – Interrupts – I/O Techniques – Device Controllers – Error Detection Techniques – Microprocessor – Personal Computer Concepts – Advanced System Concepts – Microcomputer Concepts – OS – Multitasking and Multiprogramming – Virtual Memory – Cache Memory – Modern PC and User.

UNIT – II PERIPHERAL DEVICES [9]

Introduction – Keyboard – CRT Display Monitor – Printer – Magnetic Storage Devices –FDD – HDD – Special Types of Disk Drives – Mouse and Trackball – Modem – Fax Modem – CD ROM Drive – Scanner – Digital Camera – DVD – Special Peripherals.

UNIT – III PC HARDWARE OVERVIEW [9]

Introduction – Hardware BIOS DOS Interaction – The PC family – PC hardware – Inside the System Box – Motherboard Logic – Memory Space – Peripheral Interfaces and Controllers – Keyboard Interface – CRT Display interface – FDC – HDC – Microprocessors in PC.

UNIT – IV INSTALLATION AND PREVENTIVE MAINTENANCE [9]

Introduction – system configuration – pre installation planning – Installation practice – routine checks – PC Assembling and integration – BIOS setup – Engineering versions and compatibility – preventive maintenance – DOS – Virus – Data Recovery.

UNIT – V TROUBLESHOOTING [9]

Introduction – computer faults – Nature of faults – Types of faults – Diagnostic programs and tools – Microprocessor and Firmware – Programmable LSI's – Bus Faults – Faults Elimination process – Systematic Troubleshooting – Symptoms observation and analysis – fault diagnosis – fault rectification – Troubleshooting levels – FDD, HDD, CD ROM Problems.

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

Text Books :

1 B. Govindarajalu, IBM PC Clones Hardware, Troubleshooting and Maintenance, McGraw-Hill, New Delhi, Second Edition, 2003.

2 K.L. James, Computer Hardware Installation, Interfacing, Troubleshooting and maintenance, PHI Learning Private Limited, India, First Edition, 2013.

Reference Books :

1 Craig Zacker and John Rourke, PC Hardware: The Complete Reference, McGraw-Hill, New Delhi, Fifth Edition, 2001.

2 Jean Andrews, Guide to Hardware Managing, Maintaining and Troubleshooting, Cengage Learning (Course Technology), Boston, Fifth Edition, 2010

3 Cheryl A. Schmidt, Complete A+ guide to IT Hardware and Software, Pearson Education, India, Eighth Edition, 2020.

4 Scott M. Mueller, Upgrading and Repairing PCs, Pearson Education, India, Twenty Second Edition, 2012.

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

DEPARTMENT OF MECHANICAL ENGINEERING

CO-PO MAPPING

Regulation: R 2020

Course Code: 20CS910 **Course Name: HARDWARE AND TROUBLE SHOOTING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Identify with the Basic functional units of a computer system.*	3	2	-	-	2	-	-	-	-	-	-	2	-	-
CO2:	*Discover the working Concepts of I/O devices in computer.*	3	2	-	-	2	-	-	-	-	-	-	2	-	-
CO3:	*Examine the interfaces and controllers connected to PC.*	3	2	-	-	2	-	-	-	-	-	-	2	-	-
CO4:	*Outline the system configuration, Installation and maintenance of PC.*	3	2	-	-	2	-	-	-	-	-	-	2	-	-
CO5:	*Summarize about faults, diagnostics and troubleshooting in PC.*	3	2	-	-	2	-	-	-	-	-	-	2	-	-
	Average	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

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

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

		L	T	P	C
20EC901	**BASICS OF MEDICAL ELECTRONICS** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On the successful completion of the course, students will be able to		***Cognitive Level***
CO1	*Describe the recording methods of various bio-potentials.*	*Understand*
CO2	*Illustrate the working of various equipment that deal with bio-chemical and non-electrical parameter measurement.*	*Understand*
CO3	*Discuss the different types of therapeutic equipment.*	*Understand*
CO4	*Interpret the principles of various medical imaging modalities.*	*Understand*
CO5	*Outline the recent trends in medical instrumentation.*	*Understand*

UNIT – I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING [09]

The origin of bio-potentials - Bio-potential electrodes - Carrier, chopper and isolation amplifiers -Transducers for biomedical applications: Strain gauge, piezoelectric transducer, thermocouple, thermistor, biosensors - ECG, EEG, EMG, PCG, ERG and EOG: Lead systems, recording methods.

UNIT - II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT [09]

Blood gas analyzers - Electrophoresis - Colorimeter & Photometer - Auto analyzer - Blood flow meter - Cardiac output - Respiratory measurement - Blood pressure measurement - Temperature measurement - Pulse measurement -Blood cell counters: Coulter counters.

UNIT - III THERAPEUTIC EQUIPMENTS [09]

Cardiac pacemakers - DC defibrillator - Dialyzers - Surgical diathermy - Physiotherapy and electrotherapy equipment - Oxygenators - Heart lung machine.

UNIT - IV MEDICAL IMAGING [09]

X-Ray - Computer Axial Tomography - Positron Emission Tomography - MRI and NMR - Ultrasonic Imaging systems.

UNIT - V RECENT TRENDS IN MEDICAL INSTRUMENTATION - [09]

Thermograph - Endoscopy unit - LASER in medicine - Biomedical telemetry - Radio-pill - Cardiac catheterization laboratory - Electrical safety of medical equipment.

Total (L: 45) = 45 Periods

Text Books :

1 R.S.Khandpur, Handbook of Biomedical Instrumentation, Tata McGraw Hill, New Delhi, Third Edition, 2014

2 Leslie Cromwel, Fred J.Weibel, Erich A. Pfeiffer, Biomedical Instrumentation and Measurements, Pearson/Prentice Hall India, New Delhi, Second Edition, 2011.

Reference Books :

1 John G.Webster, Medical Instrumentation Application and Design, John Wiley & Sons Inc, New Jersy, Fourth Edition, 2009.

2 Joseph J.Carr and John M.Brown, Introduction to Biomedical Equipment Technology, John Wiley &Sons, New Jersy, Fourth Edition, 2008.

3 M. Arumugam, Biomedical Instrumentation, Anuradha Publications, Chennai, Second Edition, Reprint 2009.

4 R.L. Reka & C. Ravikumar, Biomedical Instrumentation/ Medical Electronics, Lakshmi Publications, Chennai, Second Edition, Reprint 2010.

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

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

20EC902	**NANO TECHNOLOGY**	L	T	P	C
	(Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes: On completion of this course, the student will be able to		***Cognitive Level***
CO1	*Describe the evolution and associated techniques of Nano science.*	*Understand*
CO2	*Interpret the diversities in Nano systems.*	*Understand*
CO3	*Classify different Nano particles, shells and their Characterization.*	*Understand*
CO4	*Illustrate the importance of nanotechnology in biotechnology.*	*Understand*
CO5	*Outline the applications of nanotechnology in industry and society.*	*Understand*

UNIT – I INTRODUCTION [09]

Nano science - Evolution - Electron microscopes - Scanning probe microscopes - Optical microscopes for nanotechnology - X ray diffraction - Associated techniques.

UNIT – II DIVERSITY IN NANO SYSTEMS [09]

Fullerenes - Synthesis and purification - Mass spectrometry and ion/molecule reactions - Chemistry of fullerenes - Endo-hedral chemistry - Conductivity and super conductivity in doped fullerenes - Carbon nanotubes - Synthesis and purification - Electronic structure - Transport - Mechanical - Physical properties applications - Semiconductor quantumdots - Synthesis and applications.

UNIT – III METAL NANO PARTICLES AND NANO SHELLS [09]

Method of preparation - Characterization - Functions and applications - Core shell nanoparticles: Types of system - Characterization - Functions and applications - Nano shells: Types, characterization, properties and applications.

UNIT – IV EVOLVING INTERFACES IN NANO [09]

Nano biology - Interaction between bio molecules and nano particle surfaces - Applications of nano in biology -Microprobes for medical diagnosis and biotechnology - Current status - Nano sensors - Order from chaos - Applications - Smart dust sensors - Nano medicines various kinds - Future directions.

UNIT – V IMPACT OF NANO TECHNOLOGY ON SOCIETY [09]

Introduction - Industrial revolution to Nano revolution - Implications of Nano sciences and Nano technology on society - Issues - Nano policies and institutions - Nanotech and war - Nano arms race - Harnessing nano technology for economic and social development.

Total = 45 Periods

Text Books :

1 PradeepT, Nano: The Essentials, Understanding Nano Science and Nano technology, TMH, New Delhi, First Edition, 2007.

2 Mick Wilson, Kamali Kannargare., Geoff Smith, Nano technology: Basic Science and Emerging technologies, Overseas Press, New Delhi, First Edition, 2005.

Reference Books :

1 Nalwa H S, Encyclopedia of Nanoscience and Nanotechnology, Vol 1-10, American Scientific Publishers, California, First Edition 2004.

2 Rao C N R and Govindaraj A, Nanotubes and Nanowires, Royal Society of Chemistry, London, Third Edition, 2005.

3 Richard A L Jones, Soft Machines: Nanotechnology and Life, Oxford University Press, Oxford, FirstEdition,2007

4 Charles P. Poole, Frank J. Owens, Introduction to Nanotechnology, Wiley Inter science, New Jersey, First Edition, 2003.

5 Mark A. Ratner, Daniel Ratner, Nanotechnology: A gentle introduction to the next Big Idea, Pearson Education, London, 2003.

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF MECHANICAL 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**

		L	T	P	C
20EC903	**ELECTRONICS AND MICROPROCESSOR** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes: On the successful completion of the course, students will be able to		***Cognitive Level***
CO1	*Interpret the fundamental concepts of semiconductor device.*	*Understand*
CO2	*Explain the various characteristics of amplifiers.*	*Understand*
CO3	*Outline the fundamental concepts of Digital Electronics*	*Understand*
CO4	*Describe about 8085 microprocessors*	*Understand*
CO5	*Explain the applications using microprocessor*	*Understand*

UNIT – I SEMICONDUCTORS AND RECTIFIERS [09]

Classification of solids based on energy band theory - Intrinsic semiconductors - Extrinsic semiconductors - PN junction diode: Characteristics - Half wave and full wave rectifiers - Zener diode: Characteristics - Voltage regulator.

UNIT – II TRANSISTORS AND AMPLIFIERS [09]

Bipolar junction transistor: Construction and characteristics - CE configuration and characteristics - Transistor biasing: Fixed and voltage divider biasing - Construction and characteristics: FET, SCR and UJT - Concept of feedback: Negative feedback – Application in temperature and motor speed control - Common Emitter Amplifier (Qualitative treatment only).

UNIT – III DIGITAL ELECTRONICS [09]

Number system: Binary, Octal, Hexadecimal - Boolean algebra - Logic gates - Half adder and full adder - Flip flops - Shift Registers: SISO, SIPO, PISO, PIPO - Counters: 3-bit Synchronous up & down, 3-bit Asynchronous up & down - A/D conversion: Single slope, Successive approximation - D/A conversion: Binary weighted resistor type.

UNIT – IV 8085 MICROPROCESSOR [09]

Block diagram of Microcomputer – 8085: Architecture, Pin configuration, Addressing modes, Instruction set and Simple programs using arithmetic and logical operations.

UNIT – V INTERFACING AND APPLICATIONS OF MICROPROCESSOR [09]

Basic interfacing concepts - Interfacing of Input and Output devices - Applications of microprocessor: Temperature control, Stepper motor control, Traffic light control - Case study: Mining problem, Turbine monitor using 8085.

Total (L: 45) = 45 Periods

Text Books :

1. Jacob Millman and Christos C. Halkias, Integrated Electronics, Tata McGraw-Hill publishers, US, Second Edition, 2011.
2. Ramesh Gaonkar, Microprocessor Architecture II, Programming and Applications with 8085, Penram International Publishing, USA, Sixth Edition, 2013.

Reference Books :

1. Malvino Leach and Saha, Digital Principles and Applications, Tata McGraw-Hill Education, New Delhi, Eighth Edition, 2014.
2. Mehta V.K, Principles of Electronics, S. Chand and Company Ltd., New Delhi, Seventh Edition, 2014.
3. Salivahanan S, Suresh Kumar N, Vallavaraj A, Electronic Devices and Circuits, Tata McGraw-Hill Education, New Delhi, Third Edition, 2012.
4. Krishna Kant, Microprocessors and Microcontrollers, PHI Learning Private Ltd., New Delhi, Second Edition, 2013.

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING
CO PO MAPPING

Regulation: R 2020

Course Code: 20EC903 **Course Name: Electronics and Microprocessor**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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** (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 analog communication techniques*	*Understand*
CO2	*Describe Digital communication techniques*	*Understand*
CO3	*Use data and pulse communication techniques*	*Understand*
CO4	*Explain Source and Error control coding*	*Understand*
CO5	*Utilize multi-user radio communication*	*Understand*

UNIT – I ANALOG COMMUNICATION [09]

Noise: Source of Noise – External Noise- Internal Noise- Noise Calculation. Introduction to Communication Systems: Modulation – Types – Need for Modulation. Theory of Amplitude Modulation – Evolution and Description of SSB Techniques – Theory of Frequency and Phase Modulation – Comparison of various Analog Communication System (AM – FM – PM).

UNIT – II DIGITAL COMMUNICATION [09]

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) Minimum Shift Keying (MSK) –Phase Shift Keying (PSK) – BPSK – QPSK – 8 PSK – 16 PSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).

UNIT – III DATA AND PULSE COMMUNICATION [09]

Data Communication: History of Data Communication – Standards Organizations for Data Communication- Data Communication Circuits – Data Communication Codes – Error Detection and Correction Techniques – Data communication Hardware – serial and parallel interfaces. Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) – Comparison of various Pulse Communication System (PAM – PTM – PCM).

UNIT – IV SOURCE AND ERROR CONTROL CODING [09]

Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, mutual information, channel capacity, channel coding theorem, Error Control Coding, linear block codes, cyclic codes, convolution codes, viterbi decoding algorithm.

UNIT – V MULTI-USER RADIO COMMUNICATION [09]

Advanced Mobile Phone System (AMPS) – Global System for Mobile Communications (GSM) – Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse – Channel Assignment and Hand – Overview of Multiple Access Schemes – Satellite Communication – Bluetooth.

Total (L: 45) = 45 Periods

Text Books :

1 Wayne Tomasi, Advanced Electronic Communication Systems, Pearson Education, London, Sixth Edition 2009.

2 Simon Haykin, Communication Systems, John Wiley & Sons, New Jersy, Fourth Edition, 2004.

Reference Books :

1 H.Taub, D L Schilling and G Saha, Principles of Communication, McGraw Hill Education, New York, Fourth Edition, 2017.

2 B. P.Lathi, Modern Analog and Digital Communication Systems, Oxford University Press, Oxford, Third Edition, 2007.

3 Rappaport T.S, Wireless Communications: Principles and Practice, Pearson Education, London, Third Edition 2007.

4 Blake, Electronic Communication Systems, Thomson Delmar Publications, USA, Second Edition, 2001.

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

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

		L	T	P	C
20EC905	**PRINCIPLES OF COMMUNICATION** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes: On the successful completion of the course, students will be able to		***Cognitive Level***
CO1	Determine the performance of analog modulation schemes in time and frequency domains.	*Understand*
CO2	Determine the performance of systems for generation and detection of modulated analog signals.	*Understand*
CO3	Characterize analog signals in time domain as random processes and in frequency domain using Fourier transforms	*Understand*
CO4	Determine the performance of analog communication systems in the presence of Noise	*Understand*
CO5	Interpret the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems.	*Understand*

UNIT – I AMPLITUDE MODULATION [09]

Introduction, Amplitude Modulation: Time & Frequency – Domain description, Switching modulator, Envelop detector. Time and Frequency – Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing. SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television.

UNIT – II ANGLE MODULATION [09]

Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase–Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Superheterodyne Receiver

UNIT - III RANDOM VARIABLES & PROCESS [09]

Introduction, Probability, Conditional Probability, Random variables, Several Random Variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross–correlation functions

UNIT – IV NOISE IN ANALOG MODULATION [09]

Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth (refer Chapter 5 of Text), Noise Figure. Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM.

UNIT – V DIGITAL REPRESENTATION OF ANALOG SIGNALS [09]

Introduction, Why Digitize Analog Sources?, The Sampling process, Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, The Quantization Process, Quantization Noise, Pulse–Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing.

Total (L: 45) = 45 Periods

Text Books :

1 Wayne Tomasi, Advanced Electronic Communication Systems, Pearson Education, London, Sixth Edition, 2009.

2 Simon Haykin, Communication Systems, John Wiley & Sons, New Jersy, Fourth Edition2004.

Reference Books :

1 H.Taub & D.L.Schilling, Principles of Communication Systems**,** TMH, New Delhi, First Edition, 2011.

2 H.Taub, D L Schilling and G Saha, Principles of Communication, Pearson Education, London, Fourth Edition, 2017.

3 B. P.Lathi, Modern Analog and Digital Communication Systems, Oxford University Press, Oxford, Third Edition 2007.

4 Blake, Electronic Communication Systems, Thomson Delmar Publications, USA, First Edition, 2002.

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF MECHANICAL 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**

		L	T	P	C
20EC906	**FUNDAMENTALS OF ROBOTICS** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes: On completion of this course, the students will be able to		***Cognitive Level***
CO1	*Describe the basis of Robotics*	*Understand*
CO2	*Describe the technologies applicable for Robotics in computer based vision*	*Understand*
CO3	*Interpret the different sensing elements of robot*	*Understand*
CO4	*Develop the algorithms applicable for robotics*	*Apply*
CO5	*Develop 4-axis and 6-axis robot*	*Apply*

UNIT – I INTRODUCTION TO ROBOTICS [09]

Motion - Potential function - Road maps - Cell decomposition sensor and sensor planning - Kinematics - Forward and inverse kinematics - Transformation matrix and DH transformation - Geometric methods and algebraic methods.

UNIT – II COMPUTER VISION [09]

Projection - Optics, projection on the Image plane and radiometry - Image processing - Connectivity - Images - Gray Scale and binary images - Blob filling - Histogram - Convolution - Digital convolution and filtering and Masking techniques - Edge detection - Face detection.

UNIT - III SENSORS AND SENSING DEVICES [09]

Introduction to various types of sensor - Resistive sensors - Range sensors – Radar and Infra-red - Introduction to sensing - Light sensing - Heat sensing - Touch sensing and position sensing.

UNIT – IV ARTIFICIAL INTELLIGENCE [09]

Uniform Search strategies - Breadth first, Depth first, Depth limited - Iterative and deepening depth first search and bidirectional search - The A* algorithm - Planning - State-space planning - Plan - space planning - Graph plan/Sat plan and their comparison - Multi-agent planning 1 and Multi-agent planning 2 - Probabilistic reasoning

UNIT – V INTEGARATION TO ROBOT [09]

Building of 4 axis or 6 axis robot - Vision system for pattern detection - Sensors for obstacle detection - AI algorithms for path finding - Decision making.

Total (L: 45) = 45 Periods

Text Books :

1 Duda, Hart and Stork, Pattern Recognition, Wiley-Inter science, New Jersy, First Edition, 2000.

2 Mallot, Computational Vision: Information Processing in Perception and Visual Behavior, MIT Press, USA, First Edition, 2000.

Reference Books :

1 Stuart Russell and Peter Norvig, Artificial Intelligence-A Modern Approach, Pearson Education Series in Artificial Intelligence, USA, First Edition, 2004.

2 Robert Schilling and Craig., Fundamentals of Robotics, Analysis and control, PHI, New Delhi, First Edition 2003.

3 Forsyth and Ponce, Computer Vision, A modern Approach, Pearson Education, USA, First Edition 2003.

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF MECHANICAL 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**

		L	T	P	C
20EC907	**INTERNET OF THINGS SENSING AND ACTUATOR DEVICES** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes: On completion of this course, the student will be able to		***Cognitive Level***
CO1	*Describe what IoT is and how it works today.*	*Understand*
CO2	Design and program IoT devices.	*Understand*
CO3	*Describe the functions and characteristics of IoT sensors.*	*Understand*
CO4	*Illustrate the wireless, energy, power, RF and sensing modules.*	*Understand*
CO5	*Describe the applications and technological challenges faced by IoT devices.*	*Understand*

UNIT – I BASICS OF IOT [09]

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT – IoT Information Security.

UNIT – II IOT PROTOCOLS [09]

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BAC Net Protocol – Modbus – KNX – Zigbee Architecture – Network layer – APS layer – Security

UNIT – III IOT SENSORS [09]

Industrial sensors – Description & Characteristics–First Generation – Description &Characteristics– Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics – Polytronics Systems – Description &Characteristics–Sensors' Swarm – Description & Characteristics – Printed Electronics – Description & Characteristics – IoT Generation Roadmap.

UNIT– IV TECHNOLOGICAL ANALYSIS [09]

Wireless Sensor Structure–Energy Storage Module–Power Management Module – RF Module– Sensing Module.

UNIT – V APPLICATIONS [09]

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronization and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging.

Total = 45 Periods

Text Books:

1 David Easley and Jon Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, London, First Edition, 2010.

2 Guillaume Girardin, Antoine Bonnabel, Dr. Eric Mounier, Technologies & Sensors for the Internet of Things Businesses & Market Trends, First Edition, 2014.

Reference Books:

1 Honbo Zhou, Dieter Uckelmann; Mark Harrison, The Internet of Things in the Cloud: A Middleware Perspective - CRC Press, USA, First Edition, 2012.

2 Florian Michahelles, Architecting the Internet of Things –– Springer, Berlin, First Edition, 2011.

3 Ida N, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.

4 Olivier Hersent, Omar Elloumi and David Boswarthick, The Internet of Things: Applications to the Smart Grid and Building Automation, Wiley, New Jersy, First Edition, 2012.

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING
CO PO MAPPING

Regulation: **R 2020**

Course Code: 20EC907 **Course Name:** **Internet of Things Sensing and Actuator Devices**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Describe what IoT is and how it works today.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	Design and program IoT devices.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	*Describe the functions and characteristics of IoT sensors.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	*Illustrate the wireless, energy, power, RF and sensing modules.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	*Describe the applications and technological challenges faced by IoT devices.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

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

		L	T	P	C
20EC908	**CONSUMER ELECTRONICS** (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 fundamentals of consumer electronics*	*Understand*
CO2	*Discuss various entertainment electronics appliances*	*Understand*
CO3	*Demonstrate various smart home systems*	*Understand*
CO4	*Outline various home appliances*	*Understand*
CO5	*Illustrate various communication equipment's used In day to day life*	*Understand*

UNIT – I CONSUMER ELECTRONICS FUNDAMENTALS [09]

History of Electronic Devices- Vacuum Tubes, Transistors, Integrated Circuits- Moore's Law, Semiconductor Devices, Diodes, Rectifiers, Transistors, Logic Gates, Combinational Circuits, ADC, DAC and Microprocessors, Microprocessor Vs Microcontrollers, Microcontrollers in consumer electronics, Energy management, Intelligent Building Perspective.

UNIT – II ENTERTAINMENT ELECTRONICS [09]

Audio systems: Construction and working principle of: Microphone, Loud speaker, AM and FM receiver, stereo, 2.1 home theatres, 5.1 home theatres, Display systems: CRT, LCD, LED and Graphics display Video Players: DVD and Blue RAY. Recording Systems: Digital Cameras and Camcorders.

UNIT – III SMART HOME [09]

Technology involved in Smart home, Home Virtual Assistants- Alexa and Google Home. Home Security Systems - Intruder Detection, Automated blinds, Motion Sensors, Thermal Sensors and Image Sensors, PIR, IR and Water Level Sensors.

UNIT– IV HOME APPLIANCES [09]

Home Enablement Systems: RFID Home, Lighting control, Automatic Cleaning Robots, Washing Machines, Kitchen Electronics- Microwave, Dishwasher, Induction Stoves, Smart Refrigerators, Smart alarms, Smart toilet, Smart floor, Smart locks.

UNIT – V COMMUNICATION SYSTEMS [09]

Cordless Telephones, Fax Machines, PDAs - Tablets, Smart Phones and Smart Watches, Introduction to Smart OS - Android and iOS. Video Conferencing Systems - Web/IP Camera, Video security, Internet Enabled Systems, Wi-Fi, IoT, Li-Fi, GPS and Tracking Systems.

Total = 45 Periods

Text Books:

1 Dennis C Brewer, Home Automation, Que Publishing, London, First Edition, 2013.

2 Jordan Frith, Smartphones as Locative Media, Wiley, New Jersy, First Edition, 2014.

Reference Books:

1 Lyla B Das, Embedded Systems-An Integrated Approach, Pearson, London, First Edition, 2013

2 Marilyn Wolf, Computers as Components - Principles of Embedded Computing System Design, Third Edition Morgan Kaufmann Publisher (An imprint from Elsevier), 2012

3 Peckol, Embedded system Design, John Wiley & Sons, USA, First Edition, 2010

4 Thomas M. Coughlin, Digital Storage in Consumer Electronics, Elsevier and Newness, Amsterdam, Netherlands First Edition, 2012.

5 Philip Hoff, Consumer Electronics for Engineers, Cambridge University Press. London, First Edition, 1998.

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING
CO PO MAPPING

Regulation: **R 2020**

Course Code: 20EC908 **Course Name:** **Consumer Electronics**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Describe the evolution and fundamentals of consumer electronics*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	*Discuss various entertainment electronics appliances*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	*Demonstrate various smart home systems*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	*Outline various home appliances*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	*Illustrate various communication equipment's used In day to day life*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

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

		L	T	P	C
20EE901	**ELECTRICAL DRIVES AND CONTROL** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Categorize and explain the operation of electrical drives*	*Understand*
CO2:	*Explain the characteristics of various electrical drives*	*Understand*
CO3:	*Interpret the operation of starting and braking methods of AC and DC machines*	*Understand*
CO4:	*Choose the appropriate speed control techniques for DC motor drives*	*Understand*
CO5:	*Choose the appropriate speed control techniques for AC motor drives*	*Understand*

UNIT - I INTRODUCTION [09]

Electrical drives – Need – Advantage of electrical drives – Basic elements of electrical drives – Factors influencing the choice of electrical drives – Four quadrant operation of a motor driving a hoist load – Load torques – Selection of motors with regard to thermal overloading – Classes of motor duty.

UNIT - II CHARACTERISTICS OF ELECTRIC DRIVES [09]

DC Motors: DC shunt, DC series, DC compound and Permanent Magnet DC motors – AC Motors: Single phase and three phase Induction motors – Speed–Torque characteristics of various types of loads and drive motors.

UNIT - III MOTOR STARTING AND BRAKING METHODS [09]

Types of Starters: Two Point Starter, Three Point Starter, Four Point Starter, DOL Starter, Y-Δ Starter. Braking of Electrical Motors: Shunt Motor, Series Motor, Single Phase Induction Motor.

UNIT - IV DC DRIVES [09]

Speed control of DC series and shunt motors — Armature and field control – Ward-Leonard control system – Controlled Rectifiers Fed DC motor Drive – Chopper fed DC motor Drive: Buck, Boost and Buck-Boost – Applications.

UNIT - V AC DRIVES [09]

Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Inverter and AC Voltage Controller Based Induction Drives – Applications.

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

Text Books :

1 Dubey G.K, Fundamentals of Electrical Drives, Narosa Publishing House, New Delhi, Second Edition, 2019.

2 Vedam Subramaniam, Electric Drives: Concepts and Applications, Tata McGraw Hill Publishing Company, New Delhi, Second Edition, 2010.

Reference Books :

1 Krishnan. R, Electric Motor Drives: Modeling, Analysis and Control, Prentice Hall Pvt. Ltd, New Delhi, Second Edition, 2003.

2 Pillai.S.K, A First Course on Electric Drives, Wiley Eastern Limited, New Delhi, Fourth Edition, 2012.

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

4 M.D. Singh and K.B. Khanchandani, Power Electronics, Tata McGraw Hill Publishing Co Ltd., New Delhi, Second Edition, 2013.

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

Regulation: R 2020

Course Code: 20EE901 **Course Name: Electrical Drives and Control**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Categorize and explain the operation of electrical drives*	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO2:	*Explain the characteristics of various electrical drives*	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO3:	*Interpret the operation of starting and braking methods of AC and DC machines*	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO4:	*Choose the appropriate speed control techniques for DC motor drives*	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO5:	*Choose the appropriate speed control techniques for AC motor drives*	3	-	1	-	-	2	2	1	-	-	-	2	-	-
	Average	**3**	**-**	**1**	**-**	**-**	**2**	**2**	**1**	**-**	**-**	**-**	**2**	**-**	**-**

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

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

		L	T	P	C
20EE902	**POWER SEMICONDUCTOR DEVICES** (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 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 MECHANICAL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**
Course Code: **20EE902** **Course Name:** **Power Semiconductor Devices**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the power diode characteristics and applications for adjustable speed motor control*	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO2:	*Infer the static and dynamic characteristics of current controlled power semiconductor devices*	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO3:	*Realize the static and dynamic characteristics of voltage controlled power semiconductor devices*	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO4:	*Examine the gate drive requirements for power devices and isolation techniques between the gate and power circuits*	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO5:	*Discuss the electrical analog of thermal models and the methods for cooling power devices*	3	2	-	-	-	-	-	-	-	-	-	2	-	-
	Average	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	-	**-**

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

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

		L	T	P	C
20EE903	**ELECTRICAL POWER GENERATION SYSTEMS** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the layout and function of various parts inside the thermal power plant.*	*Remember*
CO2:	*Outline the layout, construction, working of the components inside the hydro power plant.*	*Understand*
CO3:	*Explain the principle of operation, layout and types of nuclear reactor in a nuclear power plant.*	*Understand*
CO4:	*Discuss about the types, performance and layout of gas and diesel power plants.*	*Understand*
CO5:	*Infer the basic concepts of different non-conventional energy sources.*	*Understand*

UNIT - I Thermal power plant [09]

Basic thermodynamic laws - various components of steam power plant – layout - pulverized coal burners - Fluidized bed combustion - coal handling and ash handling systems - Forced draft and induced draft fans – Boilers - feed pumps – superheater - regenerator – condenser – deaerators - cooling tower.

UNIT - II Hydro power plant [09]

Hydel power plant classifications- essential elements, selection of water turbines - selection of site for a hydel power plant - layout – dams – pumped storage power plants - micro hydel developments.

UNIT - III Nuclear power plant [09]

Principles of nuclear energy - nuclear fission - nuclear reactor, types – pressurized water reactor, boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor-nuclear power plants

UNIT - IV Gas and diesel power plant [09]

Fuels - gas turbine material, open and closed cycle gas turbine, work output & thermal efficiency, methods to improve performance - advantages and disadvantages- types of diesel engine power plant- components and layout.

UNIT - V Renewable energy [09]

Solar energy collectors – OTEC - wind power plants, tidal power plants and geothermal resources, fuel cell, MHD power generation principle.

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

Text Books :

1 Domkundwa, Arora Domkundwar, A Course in Power Plant Engineering, Dhanpat Rai and Co. Pvt. Ltd., New Delhi, Eighth edition, 2016.

2 P.K. Nag, Power Plant Engineering, Tata McGraw Hill Publishing Co Ltd., New Delhi, Third Edition, 2010.

Reference Books :

1 Philip Kiameh, Power Generation Handbook, Tata McGraw Hill Publishing Co Ltd., New Delhi, Third Edition, 2013.

2 P.C. Sharma, Power Plant Engineering, S.K. Kataria and Sons, New Delhi, First Edition, 2013.

3 Raja, A.K., Amit Prakash Manish Dwivedi, Power Plant Engineering, New Age International, New Delhi, First Edition, 2012.

4 Gupta, Manoj Kumar, Power Plant Engineering, PHI learning private limited, New Delhi, First Edition, 2012.

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

Regulation: **R 2020**

Course Code: **20EE903** **Course Name:** **Electrical Power Generation Systems**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Describe the layout and function of various parts inside the thermal power plant.*	3	1	-	-	-	2	3	2	-	-	-	1	-	-
CO2:	*Outline the layout, construction, working of the components inside the hydro power plant.*	3	2	-	-	-	2	3	1	-	-	-	1	-	-
CO3:	*Explain the principle of operation, layout and types of nuclear reactor in a nuclear power plant.*	3	2	-	-	-	3	3	2	-	-	-	1	-	-
CO4:	*Discuss about the types, performance and layout of gas and diesel power plants.*	3	2	-	-	-	2	3	1	-	-	-	1	-	-
CO5:	*Infer the basic concepts of different non-conventional energy sources.*	3	1	-	-	-	3	3	2	-	-	-	1	-	-
	Average	**3**	**2**	**-**	**-**	**-**	**2**	**3**	**2**	**-**	**-**	**-**	**1**	**-**	**-**

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

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

20EE904	**CONTROL ENGINEERING** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: Applied Mathematics

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Obtain the transfer function of electrical and mechanical systems.*	*Apply*
CO2:	*Determine the time-domain response of first and second order systems.*	*Apply*
CO3:	*Examine the stability of open loop system using bode / polar plot.*	*Apply*
CO4:	*Analyze the stability of the system by Root locus and Routh Hurwitz criterion.*	*Apply*
CO5:	*Design lag, lead, lag-lead compensator using bode plot.*	*Apply*

UNIT - I SYSTEM AND THEIR REPRESENTATION [09]

Basic elements in control system – Classification of control systems: Open and closed loop systems– Electrical, Mechanical translational and rotational system – Block diagram reduction techniques – Signal flow graphs.

UNIT - II TIME RESPONSE ANALYSIS [09]

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

UNIT - III FREQUENCY RESPONSE ANALYSIS [09]

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

UNIT - IV STABILITY OF CONTROL SYSTEM [09]

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

UNIT - V COMPENSATOR AND CONTROLLER [09]

Lag, lead and lag-lead networks – Lag, lead and lag-lead compensator using bode plots – P, PI, PID controllers.

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

Text Books :

1 Nagrath, J., and Gopal,V., Control Systems Engineering, New Age International (p) Limited, Publishers, New Delhi, Fourth Edition, 2007.

2 Benjamin C. Kuo, Automatic Control systems, PHI Learning, New Delhi, Seventh Edition, 2009.

Reference Books :

1 Ogata,K., Modern Control Engineering, PHI, New Delhi, Fifth Edition, 2009.

2 Norman S. Nise, Control Systems Engineering, John Wiley, New Delhi, Seventh Edition, 2014.

3 Smarajit Ghosh, Control systems, Pearson Education, New Delhi, Second Edition, 2009.

4 Roychoudhury,D., Modern control engineering, Prentice Hall of India, Second Edition, 2005.

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DEPARTMENT OF MECHANICAL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20EE904 **Course Name: Control Engineering**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Obtain the transfer function of electrical and mechanical systems.*	3	3	2	2	-	-	-	-	-	-	-	2	-	-
CO2:	*Determine the time-domain response of first and second order systems.*	3	3	2	2	-	-	-	-	-	-	-	2	-	-
CO3:	*Examine the stability of open loop system using bode / polar plot.*	3	3	3	2	-	-	2	-	-	-	-	2	-	-
CO4:	*Analyze the stability of the system by Root locus and Routh Hurwitz criterion.*	3	3	3	2	-	-	2	-	-	-	-	2	-	-
CO5:	*Design lag, lead, lag-lead compensator using bode plot.*	3	3	3	2	-	-	2	-	-	-	-	2	-	-
	Average	**3**	**3**	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

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

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

20EE905	**INDUSTRIAL AUTOMATION** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the major components of Programmable Logic Controller and its applications.*	*Understand*
CO2:	*Summarize the logical functions, timers and counters of PLC*	*Understand*
CO3:	*Discuss the various instructions and modes of operation related to PLC.*	*Understand*
CO4:	*Realize the architecture and various interfacing techniques of Distributed Control Systems*	*Understand*
CO5:	*Examine the different applications of PLC and Distributed Control Systems (DCS).*	*Understand*

UNIT - I INTRODUCTION TO PROGRAMMABLE LOGIC CONTROLLER (PLC) [09]

Introduction - PLC Evolution – PLC Vs Computers – Block Diagram of PLC – Parts of a PLC- Principles of Operation- Modifying the Operation**-** PLC Hardware Components: I/O modules, Power Supply, CPU – PLC size and Applications.

UNIT - II LOGIC FUNDAMENTALS, TIMER AND COUNTER [09]

Logic functions – Boolean instructions and functions – Hardwired logic Vs Programmed Logic - Developing circuits from Boolean instructions **–** PLC timer: classification and instructions – PLC counter: classification, instructions and applications

UNIT - III PLC PROGRAMMING [09]

PLC-memory map - Program scan – Relay type instructions – Instruction addressing - Branch instructions - Internal relay instructions - EXAMINE IF CLOSED and EXAMINE IF OPEN instructions - Modes of operation – Basic relay ladder logic and its control flow chart

UNIT - IV DISTRIBUTED CONTROL SYSTEM [09]

Distributed control system: Evolution – Architectures – Comparison – Local control unit – Process interfacing issues – Communication facilities – HMI Interface – Low and high level operator interfaces – Operator displays – Low and high level engineering interfaces – Introduction to SCADA.

UNIT - V APPLICATIONS OF PLC AND DCS [09]

PLC applications: Automatic Control of Ware House Door – Automatic Lubricating Oil Supplier – Conveyor Belt motor Control – Automatic Car Washing Machine – DCS applications: Pulp and paper environment, Petroleum and refining environment.

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

Text Books :

1 Frank D. and Petruzella, Programmable Logic controllers, Tata McGraw Hill Publishing Company Limited, New Delhi, Fifth Edition,2017

2 Lucas ,M.P., Distributed Control System, Van Nostrand and Reinhold Co., New york, First Edition, 1986.

Reference Books :

1 Gary Dunning, Introduction to Programmable Logic Controllers, Delmar Thomson Learning, New york, Third Edition, 2010

2 John W.Webb and Ronald A.Reis, Programmable Logic Controllers: Principles and Applications, PHI Private Ltd., New Delhi, Fifth Edition, 2003

3 Krishna Kant, Computer - Based Industrial Control, Prentice Hall, New Delhi, Second Edition(Revised), 2011

4 Madhuchhanda Mitra and Smarajit Sen Gupta, Programmable Logic Controllers and Industrial Automation, Penram International Publishing (India) Pvt. Ltd, Mumbai, Second Edition, 2009

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

Regulation: **R 2020**
Course Code: **20EE905** **Course Name:** **Industrial Automation**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the major components of Programmable Logic Controller and its applications.*	3	2	3	-	2	-	-	-	-	-	-	1	-	-
CO2:	*Summarize the logical functions, timers and counters of PLC*	3	2	3	-	2	-	-	-	-	-	-	1	-	-
CO3:	*Discuss the various instructions and modes of operation related to PLC.*	3	2	3	-	2	-	-	-	-	-	-	1	-	-
CO4:	*Realize the architecture and various interfacing techniques of Distributed Control Systems*	3	2	3	-	1	-	-	-	-	-	-	1	-	-
CO5:	*Examine the different applications of PLC and Distributed Control Systems (DCS)*	3	2	3	-	2	-	-	-	-	-	-	1	-	-
	Average	**3**	**2**	**3**	-	**2**	**–**	**-**	**-**	**-**	**-**	**-**	**1**	-	**-**

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

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

20EE906	**ELECTRICAL INSTRUMENTS AND MEASUREMENTS** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the construction and calibration of moving coil and Moving iron meters*	*Understand*
CO2:	*Discuss the operation and error correction method of wattmeter and Energy meter.*	*Understand*
CO3:	*Describe the various types of potentiometer and their limitations*	*Understand*
CO4:	*Determine the values of resistor, inductor, capacitor and frequency using bridges.*	*Understand*
CO5:	*Explain the concepts of storage and display devices.*	*Understand*

UNIT - I MEASUREMENT OF VOLTAGE AND CURRENT [9]

Galvanometers – Ballistic, D'Arsonval galvanometer – Principle, construction, operation and comparison of moving coil, moving iron meter – Extension of range and calibration of voltmeter and ammeter – Errors and compensation.

UNIT - II MEASUREMENT OF POWER AND ENERGY [9]

Wattmeters: Induction, Electro-dynamometer - Theory & its errors - Methods of correction – Calibration of wattmeter – Energy meter: Single Phase Energy Meter - Construction, Theory, Errors - Adjustment of Errors – Construction and principle of working of single phase dynamometer type power factor meter.

UNIT - III POTENTIOMETERS & INSTRUMENT TRANSFORMERS [9]

DC potentiometer – Basic circuit, standardization – Laboratory type (Crompton's) – AC potentiometer – Drysdale (polar type) type – Gall-Tinsley (coordinate) type – Limitations & applications – C.T and P.T construction, theory, operation, phasor diagram – Applications.

UNIT - IV BRIDGE MEASUREMENT [9]

Measurement of resistance: Wheatstone bridge, Kelvin double bridge, Megger – Measurement of Inductance: Maxwell Bridge, Anderson bridge – Measurement of Capacitance: Schering bridge, Desauty's Bridge – Determination of frequency using Wein Bridge.

UNIT - V STORAGE AND DISPLAY DEVICES [9]

Recorders: Strip Chart, X-Y Recorders – Digital Plotters – Digital Storage Oscilloscope – Digital multimeters – LED – DLP – Dot Matrix Display – Data Loggers

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

Text Books :

1 Golding, E.W and Widdis F.C, Electrical Measurements & Measuring Instruments, A.H.Wheeler & Co, Allahabad, India, Sixth Edition,2019.

2 Sawhney, A.K., A course in Electrical & Electronic Measurements and Instrumentation, Dhanpat Rai & Co (P) Ltd, Delhi, Nineteenth Edition, 2021.

Reference Books :

1 Gupta, J.B, Electrical Measurements and Measuring Instruments, S.K. Kataria & Sons, Delhi, Third edition, 2012.

2 Singh, S.K, Industrial Instrumentation and control, Tata McGraw Hill, New york, Second Edition, 2003.

3 Kalsi H.S, Electronic Instrumentation, Tata McGraw Hill, New york, Second Edition, 2004.

4 Martia U. Reissland, Electrical Measurement, New Age International (P) Ltd., New Delhi, Second Edition, 2001.

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DEPARTMENT OF MECHANICAL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20EE906** **Course Name:** **Electrical Instruments and Measurements**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the construction and calibration of moving coil and Moving iron meters*	3	3	2	-	-	1	1	-	-	-	-	3	2	3
CO2:	*Discuss the operation and error correction method of wattmeter and Energy meter.*	3	3	2	-	-	1	1	-	-	-	-	3	2	3
CO3:	*Describe the various types of potentiometer and their limitations*	3	3	2	-	-	1	1	-	-	-	-	3	2	3
CO4:	*Determine the values of resistor, inductor, capacitor and frequency using bridges.*	3	3	2	-	-	1	1	-	-	-	-	3	2	3
CO5:	*Explain the concepts of storage and display devices.*	3	3	2	-	-	1	1	-	-	-	-	3	2	3
	Average	**3**	**3**	**2**	**-**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**3**	**2**	**3**

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

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

20EE907	**ENERGY CONSERVATION AND MANAGEMENT** (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:	*Give the introduction about energy conservation principle and practices*	*Remember*
CO2:	*Describe the concept of energy efficiency in the building.*	*Understand*
CO3:	*Explain the concept of energy efficiency in the industry*	*Understand*
CO4:	*Illustrate the concept of energy efficiency in the power plant*	*Understand*
CO5:	*Describe the importance energy management and Demand Control Techniques*	*Understand*

UNIT - I ENERGY CONSERVATION PRINCIPLES AND PRACTICES [09]

Energy scenario – Principles and imperatives of energy conservation – Energy consumption pattern – Resource availability – Need for energy saving – Overview of energy consumption and its effects –Energy Monitoring, targetng and reporting - Role of Bureau of Energy Efficiency - Standards and labeling.

UNIT - II ENERGY EFFICIENCY IN BUILDINGS [09]

Introduction, definition and concepts – Energy and water as a resource – Electrical energy conservation: Opportunities and techniques for energy conservation in buildings – Green buildings, Intelligent buildings, Rating of buildings, Efficient use of buildings – Solar passive architecture – Eco-housing concepts.

UNIT - III ENERGY EFFICIENCY IN INDUSTRIES [09]

Potential areas for electrical energy conservation in various industries – Conservation methods – Energy management opportunities in electrical heating, cable selection – Energy efficient motors – Adjustable AC drives – Application and its use – Energy efficiency in lighting.

UNIT - IV ENERGY EFFICIENCY IN POWER PLANTS [09]

Captive power generation systems – Sequence operation of power plants – Gas Insulated Substation – Bus ducts – Types and working principle - Energy management opportunities in transformer – Power transformer – Types of switchgear (HT and LT switchgear) GCB and generator.

UNIT - V ENERGY MANAGEMENT AND AUDIT [09]

Energy Management: Definition, Objective, Importance of energy management, Load management: Demand control techniques - Utility monitoring control system. Energy Audit: definition, types of energy audit, Methodology, Need for energy Audit, Steps involved in energy auditing.

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

Text Books :ENERGY MANAGEMENT

1 Mehmet Kanoglu and Yunus A. Cengel Dr, Energy Efficiency and Management for Engineers, Tata Mcgrow Hill, New Delhi, First Edition, 2019

2 Craig B. Smith, Energy Management Principles, Pergamon Press, United Kingdom, Second Edition, 2015.

Reference Books :

1 Wayne C Turner, Energy Management Handbook, The Fairmount Press, Newyork, Eighth Edition, 2006.

2 Bureau of Energy Efficiency Study material for Energy Managers and Auditors Examination: Paper I to IV

3 G. G. Rajan, Optimizing Energy Efficiencies in Industry", Tata McGraw Hill, New Delhi , Fourth Edition, , 2004

4 Frank Kreith and Yogi Goswami D, Energy Management and Conservation Handbook, Taylor & Francis, New Delhi Second Edition, 2016.

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DEPARTMENT OF MECHANICAL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**
Course Code: **20EE907** **Course Name:** **Energy Conservation and Management**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Give the introduction about energy conservation principle and practices*	2	1	2	-	-	-	1	3	1	-	-	3	-	-
CO2:	*Describe the concept of energy efficiency in the building.*	2	2	2	-	-	-	1	3	1	-	-	3	-	-
CO3:	*Explain the concept of energy efficiency in the industry*	2	2	2	-	-	-	1	3	1	-	-	3	-	-
CO4:	*Illustrate the concept of energy efficiency in the power plant*	2	2	2	-	-	-	1	3	1	-	-	3	-	-
CO5:	*Describe the importance energy management and Demand Control Techniques*	2	2	2	-	-	-	1	3	-	-	-	3	-	-
	Average	**2**	**2**	**2**	**-**	**-**	**-**	**1**	**3**	**1**	**-**	**-**	**3**	**-**	**-**

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

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

		L	T	P	C
20EE908	**ELECTRICAL WIRING, ESTIMATION AND COSTING** (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 various wiring materials and protective devices.*	Understand
CO2:	*Discuss the internal wiring system and illumination.*	Understand
CO3:	*Outline the external wiring system and installations.*	Understand
CO4:	*Apply the knowledge to prepare electrical estimation for domestic installation.*	Apply
CO5:	*Apply the knowledge to prepare the electrical estimation details for industrial installation.*	Apply

UNIT - I INTRODUCTION TO WIRING AND PROTECTIVE DEVICES [09]

Wiring accessories – main switch – isolator and load break duty – classification of main switches – functional switches – one way, two way, intermediate switches – knife switches – specification of switches – function and specification of socket outlets, ceiling roses, fan regulators – Fuses, need, classification, Neutral link – Miniature circuit breaker, classification, function and specification – ELCB – RCCB.

UNIT - II INTERNAL WIRING SYSTEM [09]

Design and Drawing of Internal wiring system for various types of Residential, Commercial and Industrial buildings – Electrical layout – Clearance of line – Different types of circuits, Light circuit, Power circuit, Sub-main wiring, Main wiring, Single Line diagram – Different types of Lamps used in Residential, Commercial and Industrial buildings.

UNIT - III EXTERNAL WIRING SYSTEM AND EARTHING [09]

Different types of Under Ground (UG) Cables – Cable Laying – Electrical Control Panels – External Electrical Distribution System – Single Line Diagram – Load Calculations – General Specifications of Generating Set, Transformer – Street Lighting – Earthing, Different types of earthing system – Plate earthing, Pipe Earthing.

UNIT - IV ESTIMATION OF DOMESTIC INSTALLATION [09]

Selection of cables for internal wiring – Cable size calculation – Selection criteria for control switches – main switch – size of earth continuity conductor and earthing conductor – Preparation of schematic diagrams and wiring diagrams – Estimation problems regarding Electrification of domestic buildings – Relevant rules regarding electrification of high rise buildings.

UNIT - V ESTIMATION OF INDUSTRIAL INSTALLATIONS [09]

Installation of motor pump set – Estimation problem regarding domestic and irrigation pump sets – Estimation problems in small workshops below 50kW connected load – Service connection, definition, classification – use of weather proof cables – estimation problems for single phase and three phase overhead service connections.

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

Text Books :

1 Raina, K.B. and Bhattacharya, S.K., Electrical Design Estimating and Costing, New Age International, Bengaluru, Second Edition, 2017.

2 Gupta, J.B., A Course in Electrical Installation Estimating and Costing, S K Kataria & Sons,New Delhi, First Edition Reprint, 2013.

Reference Books :

1 Surjith Singh, Electrical estimating and costing, Dhanpat Rai Publishing Company, New Delhi, First Edition,2016.

2 Uppal, S.L., Electrical Wiring, Estimating and Costing, Khanna Publisher, New Delhi, Sixth Edition, 1987.

3 Soni, P.M. and Upadhyay, P.A.,Wiring, Estimating, Costing & Contracting, ATUL PRAKASHAN, Gujarat, First Edition, 2017.

4 Bureau of Indian Standards, I.E. rules for wiring, Electricity Supply Act-1948.

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DEPARTMENT OF MECHANICAL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20EE908** **Course Name:** **Electrical Wiring, Estimation and Costing**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Describe the various wiring materials and protective devices.	3	-	1	-	-	-	-	-	-	-	-	-	-	-
CO2:	Discuss the internal wiring system and illumination.	3	-	1	-	-	-	-	-	-	-	-	-	-	-
CO3:	Outline the external wiring system and installations.	3	-	1	-	-	-	-	-	-	-	-	-	-	-
CO4:	Explain the electrical estimation for domestic installation.	3	2	1	-	1	-	-	-	-	-	-	-	-	-
CO5:	Describe the electrical estimation details for industrial installation.	3	2	1	-	1	-	-	-	-	-	-	-	-	-
	Average	**3**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-	-

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

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

20EE909 **FUNDAMENTALS OF ELECTRICAL MACHINERY** (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 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 MECHANICAL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20EE909** **Course Name:** **Fundamentals of Electrical Machinery**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Discuss fundamentals in various electrical circuits.*	3	1	-	-	-		-	-	-	-	-	-	-	-
CO2:	*Explain the operation and characteristics of DC machines.*	3	1	-	-	-		2	-	-	-	-	-	-	-
CO3:	*Determine the efficiency and regulation of the transformer.*	3	1	-	-	-		2	-	-	-	-	-	-	-
CO4:	*Explain the operation and starting methods of Induction Motors.*	3	1	-	-	-		2	-	-	-	-	-	-	-
CO5:	*Describe the applications of Synchronous Machines.*	3	1	-	-	-		2	-	-	-	-	-	-	-
	Average	**3**	**1**	**-**	**-**	**-**		**2**	**-**	**-**	**-**	**-**	**-**	-	**-**

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

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

20EE910	**PRINCIPLES OF SOFT COMPUTING TECHNIQUES** (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 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 MECHANICAL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20EE910 **Course Name: Principles of Soft Computing Techniques**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Describe the concepts of artificial neural network*	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO2:	*Summarize the various types of neural network.*	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO3:	*Discuss the basic concepts of fuzzy logic system.*	3	2	-	-	3	-	-	-	-	-	-	1	-	-
CO4:	*Illustrate various methods used in fuzzy systems*	3	2	-	-	3	-	-	-	-	-	-	1	-	-
CO5:	*Outline the genetic algorithm and hybrid genetic algorithm concepts*	3	2	-	-	3	-	-	-	-	-	-	1	-	-
	Average	**3**	**2**	-	-	**3**	-	-	-	-	-	-	1	-	-

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

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

		L	T	P	C
20EE911	**EMBEDDED SYSTEM TECHNOLOGY** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Illustrate the fundamentals of embedded systems.*	*Understand*
CO2:	*Outline the various types of embedded communication protocols*	*Understand*
CO3:	*Explain the concept of software development process and tools*	*Understand*
CO4:	*Describe the functions of real time operating systems*	*Understand*
CO5:	*Discuss the applications of real time embedded systems*	*Understand*

UNIT – I INTRODUCTION TO EMBEDDED SYSTEMS [09]

Embedded System Vs General Computing System – Classification of embedded systems – Functional building blocks of embedded systems – Structural units in embedded processor – Selection of processor & memory devices – Processor interfacing with memory and I/O units – Embedded hardware unit.

UNIT - II EMBEDDED NETWORKS [09]

Introduction to I/O device ports & buses – Serial communication using I^2C,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 MECHANICAL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20EE911 **Course Name: Embedded System Technology**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Illustrate the fundamentals of embedded systems*	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO2:	*Outline the various types of embedded communication protocols*	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO3:	*Explain the concept of software development process and tools.*	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO4:	*Describe the functions of real time operating systems.*	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO5:	*Discuss the applications of real time embedded systems*	3	2	3	-	3	3	-	-	-	-	-	3	-	-
	Average	**3**	**2**	**3**	**-**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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

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

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 MECHANICAL 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 Dejey, Dr.Murugan, Cyber Forensics, Oxford University Press, India, First Edition, 2018.

2 William Stallings and Lawrie Brown, Computer Security: Principles and Practice, Prentice Hall, United States, Third Edition, 2017.

Reference Books :

1 John W. Rittinghouse, William M. Hancock, Cyber Security Operations Handbook, Elsevier Publications , India ,First Edition,2008

2 Deborah G Johnson, Computer Ethics, Pearson Education Publication, India ,Fourth Edition , 2014

3 https://onlinecourses.swayam2.ac.in/cec20_cs15/preview

4 https://www.simplilearn.com/tutorials/cyber-security-tutorial/cyber-security-for-beginners

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL 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	PSO1	PSO2
CO1:	*Describe the basic concepts in cyber security and cybercrime.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO2:	*Explore about classification of cyber forensics.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO3:	*Summarize the latest trends in ethical hacking.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO4:	*Discuss the fundamentals of computer forensics and evidence collection.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO5:	*Describe the vulnerabilities in cyber security.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
	Average	3	3	3	-	2	-	-	-	-	-	-	3	-	-

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

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

		L	T	P	C
20IT903	**FUNDAMENTALS OF BUSINESS INTELLIGENCE** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the nuances of extracting information from the various sources of digital data*	*Understand*
CO2:	*Infer the techniques involved in Online Transaction Processing and Online Analytical processing systems.*	*Understand*
CO3:	*Discuss the concept of data integration.*	*Remember*
CO4:	*Summarize the various methods of data integration.*	*Understand*
CO5:	*Describe the various process involved in the Enterprise Reporting.*	*Understand*

UNIT – I DIGITAL DATA [09]

Digital Data: Sources and Characteristics –Structured– Unstructured– Semi-Structured – Business Intelligence (BI) : Definition – BI Component Framework – BI Users – BI Applications – BI Tools.

UNIT – II OLTP AND OLAP [09]

OLTP: Advantages – Challenges – OLAP: Types of Data – OLAP Architectures: MOLAP – ROLAP – HOLAP – OLAP and OLTP – Data models for OLTP – Data models for OLAP.

UNIT – III DATA INTEGRATION [09]

Data Integration : Approaches and Advantages – Technologies – Data Quality – Data Profiling – Data Warehouse : Goals and Sources – Data Mart –Operational Data Store – Ralph Kimball's Approach– Data Mapping –Staging.

UNIT – IV MULTIDIMENSIONAL DATA MODELING [09]

Data Modeling: Entity and Attribute – Cardinality of Relationship – Types of Data Model – Data Modeling Techniques – Fact Table – Dimension table – Dimensional Models –Dimensional Modeling Life Cycle.

UNIT – V ENTERPRISE REPORTING [09]

Enterprise Reporting: Reporting Perspectives– Report Standardization and Presentation Practices – Enterprise Reporting Characteristics in OLAP –Balanced Scorecards – Create Dashboards – Scorecards Vs Dashboards.

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

Text Books:

1 R. N. Prasad, Seema Acharya, Fundamentals of Business Analytics, Wiley Publication Hoboken, New Jersey, Second Edition, 2016.

2 Regi Mathew, Business Analytics for Decision Making, Pearson Education, India , First Edition,2020.

Reference Books :

1 David Stephenson, Big Data Demystified, FT Publishing International, United States, First Edition, 2018.

2 Wayne Winston, Microsoft Excel 2019 Data Analytics and Business Modeling, Microsoft Press, United States, Sixth Edition, 2019.

3 Soheil Bakhshi, Expert Data Modelling with Power BI,Packt Publishing , Mumbai, First Edition, 2021.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL 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 Ethereum blockchain for different use cases.*	*Understand*
CO5:	*Outline the end-to-end development of a decentralized application.*	*Understand*

UNIT – I BLOCKCHAIN ARCHITECTURE [9]

History –Blockchain –Centralized vs. Decentralized Systems–Layers of Blockchain–Versions of Blockchain: 3.0 and 4.0 – Blockchain Uses and Use Cases – Laying the Blockchain Foundation – Cryptography.

UNIT – II WORKING OF BLOCKCHAIN [9]

Game Theory –Prisoner's Dilemma –Byzantine Generals' Problem – The Blockchain – Merkle Trees – Properties of Blockchain Solutions – Blockchain Transactions – Distributed consensus mechanisms – Blockchain applications.

UNIT – III BITCOIN [9]

History of Money – Working with Bitcoins – Bitcoin Blockchain – The Bitcoin Network – Bitcoin Scripts – Full NodesvsSPVs – Bitcoin Wallets.

UNIT – IV ETHEREUM AND HYPERLEDGER [9]

Bitcoin to Ethereum – Ethereum Blockchain – Ethereum Smart Contracts – Ethereum Virtual Machine and Code Execution–Ethereum Ecosystem – Swarm – Whisper – DApp – Development components – Hyperledger: Iroha – Blockchain Explorer – Fabric Chain tool.

UNIT – V APPLICATIONS OF BLOCKCHAIN [9]

Decentralized Applications – Blockchain Application Development – Interacting with Bitcoin Blockchain – Sending Transactions–Creating a Smart Contract – Executing Smart Contract Functions – Public vs. Private Blockchains.

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

Text Books:

1 Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions, A Press, New York, First Edition, 2018.

2 Brenn Hill, Samanyu Chopra, Paul Valencourt, Blockchain Quick Reference: A guide to exploring decentralized blockchain application development, Packt Publishing, Mumbai, First Edition, 2018.

Reference Books :

1 Imran Bashir, Mastering Blockchain Distributed Ledgers, Decentralization and Smart Contracts Explained, Packt Publishing, Mumabi, First Edition, 2017.

2 Pethuru Raj, Chellammal Suria Narayanan, Kavita Saini, Blockchain Technology and Applications, CRC Press, United States, First Edition, 2021.

3 E. Golden Julie, J. Jesu VedhaNayahi, Noor Zaman Jhanjhi, Blockchain Technology Fundamentals, Applications, and Case Studies, CRC Press , United States, First Edition, 2021.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL 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	PSO1	PSO2
CO1:	*Infer the theoretical aspects of blockchain and apply in real case scenarios.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO2:	*Discuss the core components and working of blockchain.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3:	*Explain the technical concepts of bit coin.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO4:	*Interpret the Ethereum blockchain for different use cases.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO5:	*Outline the end-to-end development of a decentralized application.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
	Average	3	2	3	-	-	-	-	-		-	-	3	-	-

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

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

20IT905 **INTERNET OF THINGS AND APPLICATIONS** (Open Elective)

L	T	P	C
3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the physical and logical design of IoT.*	*Understand*
CO2:	*Summarize the various design methodologies of IoT.*	*Understand*
CO3:	*Outline the various packages in Python for IoT real world application.*	*Understand*
CO4:	*Discuss IoT applications using Raspberry PI and Python.*	*Remember*
CO5:	*Infer the knowledge on design of smart IoT applications.*	*Understand*

UNIT–I FUNCTIONAL BLOCKS OF IoT **[09]**

Definition and Characteristics of IoT – Physical Design: Layers and Protocols – Logical Design: IoT Functional Blocks – IoT Communication models and APIs – IoT Enabling Technologies –IoT Levels and Deployment Templates.

UNIT–II IoT DESIGN METHODOLOGY **[09]**

M2M – M2M Vs IoT – Software Defined Networks – Network function Virtualization – IoT Platform Design Methodologies – Domain Specific IoT.

UNIT – III PYTHON PACKAGES FOR IOT AND RASPBERRY PI **[09]**

JSON – XML – HTTPLib and URLLib – SMTPLib. Raspberry Pi : Pin Configurations – Interfaces : Serial, SPI, 12C Programming – Python program with Raspberry Pi –Controlling Output – Reading input from pins.

UNIT –IV IoT APPLICATIONS USING RASPBERRY PI **[09]**

LED Controlling – Traffic Light controller – Integrating Sensors – Developing web application to control IoT device – Uploading the sensor values onto the cloud for analysis – Sending SMS – Sending images and video via mail.

UNIT–V IoT USE CASES **[09]**

Smart and Connected Cities – An IoT Strategy for Smarter Cities – Architecture – Use Cases: Street Lighting – Smart Parking – Smart Traffic – Smart Home Automation – Smart Agriculture– Weather Monitoring.

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

Text Books:

1 Arshdeep Bahga and Vijay Madisetti, Internet of Things –A Hands-on Approach, Orient Blackswan Private Limited, New Delhi, First Edition, 2015.

2 David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Pearson Education, First Edition, 2017.

Reference Books :

1 Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Apress Publications, New York, First Edition, 2013.

2 Rajkamal, Internet of Things: Architecture, Design Principles And Applications, McGraw Hill Education, New York, First Edition, 2017.

3 Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things – Key Applications and Protocols, Wiley, New York, 2015.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL 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	PSO1	PSO2
CO1:	*Explain the physical and logical design of IoT.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO2:	*Summarize the various design methodologies of IoT.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3:	*Outline the various packages in Python for IoT real world application.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO4:	*Discuss IoT applications using Raspberry PI and Python.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO5:	*Infer the knowledge on design of smart IoT applications.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
	Average	3	2	3	-	-	-	-	-	-	-	-	3	-	-

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

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

20IT906	**PRINCIPLES OF SOFTWARE TESTING** (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 Glenford J.Myess**,** The Art of Testing, Wiley, India, Third Edition, 2003.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL 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 ALGORTHMIC 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 PROBLMES [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 MECHANICAL 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**

		L	T	P	C
20IT908	**PRINCIPLES OF CLOUD COMPUTING** (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 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 IaaSand benefits– Cloud Service Providers – Challenges and risks in cloud adoption –Types of Cloud.

UNIT – IV **CLOUD SIMULATORS** **[9]**

CloudSim Simulator –Architecture– User code–CloudSim– GridSim– SimJava – Working platform for CloudSim– GreenCloud.

UNIT-V **VMWARE SIMULATOR** **[9]**

VMWare– Advantages of VMWare virtualization–VMWare workstation–Virtual Machines – Create a new virtual machine on local host – Cloning virtual machine – Recent Trends.

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

Text Book:

1 Anthony T.Velte , Toby J. Velte Robert Elsenpeter, Cloud computing : A Practical Approach, Tata McGraw- Hill , New Delhi ,Second Edition, 2017.

2 Dan C Marinescu, Cloud Computing: Theory and Practice, MK Elsevier, Second Edition, United States,2017.

Reference Books :

1 Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, Cloud computing for Dummies, Wiley, India, Second Edition,2020.

2 Rajkumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing: Principles and Paradigms, Wiley, India, First Edition, 2011.

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DEPARTMENT OF MECHANICAL 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** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline the need and importance of Linux Open Source Software.*	*Understand*
CO2:	*Discuss the manipulations on Array and String using PHP.*	*Remember*
CO3:	*Summarize various functions in String and Date object*	*Understand*
CO4:	*Describe simple code segment using list and tuple in Python.*	*Understand*
CO5:	*Outline the usage of decision and looping statements in PERL.*	*Remember*

UNIT – I LINUX **[09]**

Open Sources: Need, Advantages and Applications – Open Source Operating Systems: LINUX – Kernel Mode and – Process – Scheduling – Personalities – Cloning and Signals.

UNIT – II PHP **[09]**

PHP: Syntax of PHP –Common PHP Script Elements –Variables and Constants – Data types – Operators and Statements –Arrays and Functions –String Manipulations– Regular Expression.

UNIT – III MySQL **[09]**

Setting up an account – Starting, Terminating and writing your own MySQL Programs – Record Selection Technology – Strings – Date and Time – Sorting Query Results module – DDL – DDL –DCL –TDL.

UNIT – IV PYTHON **[09]**

Syntax and Style – Python Objects – Numbers – Sequences – Strings – Lists and Tuples – Dictionaries – Decision and Loops – Files – Input and Output Statements – Errors and Exceptions – Functions.

UNIT – V PERL **[09]**

Perl : Perl Parsing Rules – Variables and Data – Statements and Control Structures – Subroutines – Packages and Modules – Files and Data Manipulation.

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

Text Book:

1 Martin C.Brown, Python: The Complete Reference, McGraw Hill Education, India, Fourth Edition, 2018.

2 Richard Petersen, The Complete Reference Linux, TataMcGraw Hill, New Delhi, Sixth Edition, 2017.

Reference Books :

1 Frank M. Kromann, Beginning PHP and MySQL, Apress, New York, Fifth Edition, 2018.

2 Martin C. Brown, Perl: The Complete Reference, Tata McGraw-Hill, New Delhi, Fifth, 2017.

3 Steven Holzner, PHP: The Complete Reference, Tata McGraw-Hill, New Delhi, Sixth Edition, 2017.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL 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	PSO1	PSO2
CO1:	*Outline the need and importance of Linux Open Source Software.*	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO2:	*Discuss the manipulations on Array and String using PHP.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3:	*Summarize various functions in String and Date object*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4:	*Describe simple code segment using list and tuple in Python.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5:	*Outline the usage of decision and looping statements in PERL.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
	Average	3	3	3	-	-	-	-	-	-	-	-	3	-	-

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

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 Lan Sommerville, Software Engineering, Pearson Education, India, Tenth Edition, 2017.

2 Roger Pressman, Software Engineering: A Practitioner's Approach, McGraw Publications , India , Seventh Edition ,2017

Reference Books :

1 Jalote P,An Integrated Approach to Software Engineering, Narosa Publishers, New Delhi, Third Edition, 2015.

2 Mark Richards and Neal Ford, Fundamentals of Software Architecture: An Engineering Approach, O'Relly, First Edition, 2020.

3 Rajib Mall, Fundamentals of Software Engineering, PHI Learning, India ,Fifth Edition,2018.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL 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**

		L	T	P	C
20SF901	**OCCUPATIONAL HEALTH AND HYGIENE (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1	*Compare the concept and spectrum of health functional units and activities of occupational health service.*	*Understand*
CO2	*Identify physical chemical and biological hazards in the work environment and its control measures.*	*Apply*
CO3	*Explain the principles of ventilation and its requirements.*	*Understand*
CO4	*Demonstrate about the lighting and its requirements.*	*Understand*
CO5	*Reduce the gas poisoning and its effects.*	*Apply*

UNIT - I **OCCUPATIONAL HEALTH** **[09]**

Concept and spectrum of health - functional units and activities of occupational health services - occupational and work-related disease - Levels of prevention of diseases - notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, siderosis, anthracosis, aluminosis and anthrax.

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

Recognition, evaluation and control of physical hazards. Vibration - Description and measurement of vibration. Vibration control methods. Effects of whole-body vibration on human body and control measures - Noise - noise measurement, evaluation, noise control methods - hearing loss - causes - Biological effects of noise exposure.

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

Ventilation systems - Purpose of ventilation - General principles ventilation requirements. Physiological and comfort level. Natural ventilation - Dilution ventilation - Mechanical ventilation - Local exhaust ventilation - Ventilation measuring instruments. Fundamentals of hood and duct designs. Standards on ventilation.

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

Purpose of lighting - Advantages of good illumination - Lighting and the work - Sources and kinds of artificial lighting principles of good illumination. Design of Lighting installation - Maintenance - Lighting and Color Standards on lighting and illuminations.

UNIT - V **GAS POISONING** **[09]**

Lead - Nickel, Chromium and Manganese toxicity - Gas poisoning (such as CO, ammonia, coal and dust) their effects and prevention - Local and systemic and chronic effects - Carcinogens, Mutagens, Teratogens. Personal monitoring devices - Medical support.

Total = 45 Periods

Text Books:

1. Jeanne Mager Stellman(ed) Encyclopedia of Occupational Health and Safety, International Labour Office, Geneva, Fourth Edition, 1998.
2. The Industrial Environment -Its Evaluation and Control, DHHS (NIOSH), 1973.

Reference Books:

1. Barbara Cohrssen, Patty´sIndustrial Hygiene and Toxicology, Wiley, Inderscience, New York. Seventh Edition, 2021.
2. Yudenich, V.V., Accident First Aid, Mir Publishers, Moscow, 1986.
3. Cantlie, James, First aid to the injured. St John Ambulance Association, 1932.
4. S.K. Halder, Industrial and Occupational Health, Kindle Edition, 2017.

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

CO PO MAPPING

Regulation: R2020

Course Code: 20SF901 **Course Name: Occupational Health and Hygiene**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Compare the concept and spectrum of health functional units and activities of occupational health service.*	3	2	2	-	-	3	2	2	-	-	-	2	-	-
CO2	*Identify physical chemical and biological hazards in the work environment and its control measures.*	3	2	2	-	-	3	2	2	-	-	-	2	-	-
CO3	*Explain the principles of ventilation and its requirements.*	3	2	2	-	-	3	2	2	-	-	-	2	-	-
CO4	*Demonstrate about the lighting and its requirements.*	3	2	2	-	-	3	2	2	-	-	-	2	-	-
CO5	*Reduce the gas poisoning and its effects.*	3	2	2	-	-	3	2	2	-	-	-	2	-	-
	Average	**3**	**2**	**2**	**-**	**-**	**3**	**2**	**2**	**-**	**-**	**-**	**2**	**-**	**-**

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

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

		L	T	P	C
20SF902	**CONSTRUCTION SAFETY (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1	*List out Hazards from various Construction equipment and activities.*	*Remember*
CO2	*Mention various Control measures adopted in each Construction activity to avoid Incidents.*	*Apply*
CO3	*Demonstrate the safe use of various types of ladders, Hand held power tools, Hydraulic tools used in Construction industry.*	*Understand*
CO4	*Compare various components of cranes, safety features and its function.*	*Understand*
CO5	*Choose the minimum requirements of BOCW act to the Construction site when they work.*	*Apply*

UNIT - I INTRODUCTION [09]

Safety aspects of construction planning- Human factors in construction safety management. Roles of various groups in ensuring safety in construction industry.

UNIT - II SAFETY IN VARIOUS CONSTRUCTION OPERATIONS [09]

Excavation- underwater works- Ladders & Scaffolds - Tunneling- Blasting- Demolition- Pneumatic caissons- Confined Space- Temporary Structures. Indian Standards on construction safety- National Building Code Provisions on construction safety.

UNIT - III SAFETY IN MATERIAL HANDLING EQUIPMENTS [09]

Storage & stacking of construction materials, Safety in the use of construction equipment's - Vehicles, Cranes, Tower Cranes, Lifting gears, Hoists & Lifts, Wire Ropes, Pulley blocks, Temporary power supply, Mixers, Conveyors, Pneumatic and hydraulic tools in construction.

UNIT - IV CONTRACT CONDITIONS ON SAFETY [09]

Health, Welfare, Social Security and Insurance. Application of ergonomics for construction safety.

UNIT - V CONTRACT LABOUR ACT AND CENTRAL RULES [09]

Buildings and other Construction Workers (RE & CS) Act and Central Rules. Provisions regarding Licensing, safety, health, welfare and social security aspects only.

Total = 45 Periods

Text Books:

1. National Building Code of India, Bureau of Indian Standards, New Delhi, 2005.
2. Building & Other Construction Workers (RE &CS) Actand Central Rules, 1966.

Reference Books:

1. V.J. Davies & K. Tomasin, Construction Safety Handbook, Thomas Telford Publishing, London. 1990.
2. K.N. Vaid (Ed.), Construction Safety Management, National Institute of Construction Management and Research, Bombay,1988.
3. James B. Full man, Construction Safety, Security & Loss Prevention, John Wiley & Sons. 1984.
4. R.T. Ratay, Handbook of Temporary Structures in Construction, Mc Graw-Hill, 1984.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF902 **Course Name: Construction Safety**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*List out Hazards from various Construction equipment and activities.*	3	2	3	-	2	-	3	-	1	-	-	2	-	-
CO2	*Mention various Control measures adopted in each Construction activity to avoid Incidents.*	3	2	3	-	2	-	3	-	1	-	-	2	-	-
CO3	*Demonstrate the safe use of various types of ladders, Hand held power tools, Hydraulic tools used in Construction industry.*	3	2	3	-	2	-	3	-	1	-	-	2	-	-
CO4	*Compare various components of cranes, safety features and its function.*	3	2	3	-	2	-	3	-	1	-	-	2	-	-
CO5	*Choose the minimum requirements of BOCW act to the Construction site when they work.*	3	2	3	-	2	-	3	-	1	-	-	2	-	-
	Average	**3**	**2**	**3**	**-**	**2**	**-**	**3**	**-**	**1**	**-**	**-**	**2**	**-**	**-**

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

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

		L	T	P	C
20SF903	**BUILDING FIRE SAFETY (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1	*Explain the human behaviour under emergency movement and the concept of planning and design of seating arrangements in assembly buildings, evacuation routes and exits.*	*Understand*
CO2	*Outline the general life safety requirements applicable to all buildings and to plan, design and locate exits in buildings.*	*Understand*
CO3	*Illustrate the fire and life safety requirements for buildings of specific occupancy.*	*Understand*
CO4	*Choose and distribute portable and fixed fire fighting systems in buildings of different occupancies as per BIS.*	*Apply*
CO5	*Develop the method of carrying out fire investigation, arson identification, fire training, fire safety audit and fire risk assessment.*	*Apply*

UNIT - I BASIC BUILDING PLANNING AND DESIGN [09]

Process of emergency evacuation - special features of personnel movement. Parameter characteristics of the movement of people; Stages of evacuation; Planning and design of evacuation routes and exits; planning of seating arrangements in large assembly buildings.

UNIT - II NBC CODES FOR BUILDINGS [09]

Classification of buildings based on occupancy and type of construction according to fire resistance as per NBC; Fire zone; General fire safety requirements applicable to all individual occupancies. General exit requirements as per NBC; Internal staircases; horizontal exits; fire tower; ramps; fire lifts; external fire escape ladders; Planning of location and calculation of capacity, number and width of exit as per NBC for different occupancy classification.

UNIT - III FIRE PREVENTION AND BIS STANDARD [09]

Fire and life safety requirements in different groups of buildings-Hotel, Schools & Colleges, Hospitals, Theatres, shopping malls, etc., Fire protection and prevention in high rise buildings - Fire protection in underground structures and in buildings under construction. Sitting of detectors as per relevant Indian standard specifications; Selection and planning of alarm system as per relevant standards (BIS).

UNIT - IV FIRE PREVENTION AND BIS STANDARD [09]

Selection and distribution of portable extinguishers (for class A and B fires) and other fire protection equipment and systems for different occupancy classification as per NBC; Planning of fixed fire fighting installation for different occupancy classification-sprinkler system; total flooding system; CO2 system; foam system; Fire Investigation; Detection of arson; Fire training and education - fire drill, fire order; Fire safety audits; Fire risk assessment.

UNIT - V FIRE SAFETY AND CODES [09]

Causes of fire in buildings. Stages of fire and how it spreads. Fire drill. Heat / fire / smoke detection. Alarm and extinguisher systems. Fire safety standards. General guidelines for egress design for multi-storey buildings. Understanding all the above through product literature/ field visits. Exercise on design of fire safety systems for different building types through choice, calculations, layout and drawings.

Total = 45 Periods

Text Books:

1. Butcher, E.G. and Parnell, A.C., Designing of fire safety. John Wiley and Sons Ltd., New York, U.S.A, 1983.
2. Roytman, M. Ya., Principles of Fire Safety Standards for Building Construction, Amerind Publishing Co. Pvt. Ltd., New Delhi, 1975.

Reference Books:

1. Barendra Mohan Sen, Fire Protection and Prevention the Essential Handbook, UBS Publishers and Dist., New Delhi, 2013.
2. Jain, V.K., Fire Safety in Buildings, New Age International (P) Ltd., New Delhi, Second Edition, 2010.
3. Huang, Kai, Population and Building Factors That Impact Residential Fire Rates in Large U.S. Cities, Applied Research Project, Texas State University.
4. Life Safety Code Handbook, National Fire Protection Association, Lathrop, James K.Ed. NFPA, 1991.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL 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 fire fighting systems in buildings of different occupancies as per BIS.*	3	3	3	-	-	-	2	-	-	1	-	2	-	-
CO5	*Develop the method of carrying out fire investigation, arson identification, fire training, fire safety audit and fire risk assessment.*	3	3	3	-	-	-	2	-	-	1	-	2	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**1**	**-**	**2**	**-**	**-**

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

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

		L	T	P	C
20SF904	**SAFETY IN ELECTRICAL ENGINEERING (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1	*Explain the working principles and applications of various kinds of Electrical Machines and/or systems.*	*Understand*
CO2	*Choose & brief the hazards associated with electricity at work place.*	*Apply*
CO3	*Recall human safety aspects over electric and magnetic fields.*	*Remember*
CO4	*Compare various protective equipment and enumerate their working and application.*	*Understand*
CO5	*Identify hazardous areas/locations in a given industrial site for selection, installation, operation and maintenance of electrical equipment.*	*Apply*

UNIT - I **INTRODUCTIONTO ELECTRICAL EQUIPMENTS** **[09]**

Transformers, DC Machines, Alternators, Induction Machines- Characteristics, application Protection Relays: Requirements of relay- types of protection, Classification: Distance Relay, Differential Relay, Static Relay- Definitions and types.

UNIT - II **CIRCUIT BREAKERS** **[09]**

Function switch gear, Arc Phenomenon- Initialization of an Arc, Arc interruption, Recovery voltage, and Restriking voltage classification and working, Working of MCB and ELCB. Faults in Power System: Causes and types, Fuses: Definition, types of fuses, selection of fuses, advantages and disadvantages.

UNIT - III **EFFECT OF ELECTRIC FIELD AND MAGNETIC FIELD** **[09]**

Human Safety Aspects, Effect of Current and Voltage on Human being- distance from the source, Typical V-I characteristics of skin - Nervous System, Electrical Shocks and their prevention, Insulation: Classes of Insulation, FRLS insulation, Continuity test.

UNIT - IV **SAFETY DURING INSTALLATION OF PLANT AND EQUIPMENT** **[09]**

Safe sequences in installation -Risk during installation, Safety during testing and commissioning- steps, Test on relays- Protection and interlock system on safety.

UNIT - V **HAZARDOUS ZONES** **[09]**

Classification of hazardous zones. Intrinsically safe and explosion proof electrical apparatus, Selection of equipment in hazardous area. Electrical Fires: Hazards of static electricity, Safety procedures in electrical maintenance, Statutory requirements from Electrical Inspectorate. Introduction to Indian Electricity Act and Rules.

Total = 45 Periods

Text Books:

1. S. Rao, Electrical Safety, Fire Safety Engineering and Safety Management, Khanna Publishers, New Delhi, Third Edition, 2019.
2. John Cadick, Electrical Safety Hand book, John Cadick, TMH Publishers, Sixth Edition, 2019.

Reference Books:

1. Charles A Gross, Fundamentals of Electrical Engineering, Taylor and Francis Group, 2012.
2. H. Wayne Beaty, Handbook for Electrical Engineers, Mc GrawHill, Fifteenth Edition, 2007.
3. Donald G Fink, Standard Handbook for Electrical Engineers, Mc GrawHill, Twelth Edition, 1987.
4. Donald G Fink, Electrical Engineering, Mc Graw Hill, Fifteenth Edition, 1907.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL 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**

		L	T	P	C
20SF905	**LEGAL ASPECTS OF SAFETY (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1	*Describe about the factories act and rules.*	*Understand*
CO2	*Illustrate the legal obligations regarding any injury by gaining knowledge of Workmen's Compensation Act. ESI Act & Rules.*	*Understand*
CO3	*Outline about the legal aspects granting of license for storage, transportation and usage of explosive substance as applicable as per Petroleum Act and Explosive Act.*	*Understand*
CO4	*Explain the Environment (Protection) act and Rules.*	*Understand*
CO5	*Choose the concept, powers and functions of Central, State and Joint Boards, provisions regarding prevention and control of Water & Air pollution, Penalties, Central & State Laboratories.*	*Apply*

UNIT - I FACTORIES ACT [09]

Factories Act- Definitions, Preliminary, inspecting staff, Health, Safety, Provisions relating to hazardous processes, Welfare, Working hours of adults, Employment of young persons, Special provisions - Definitions, Powers of inspectors, Power of Govt. to direct inquiry. Duties of Safety Officers, Reporting of accidents, Emergency Action Plan, Safety Committee.

UNIT - II WORKMEN'S COMPENSATION ACT [09]

Workmen's Compensation Act: Definitions, Employer´s liability for compensation, Calculation of amount of compensation. ESI Act and Rules: Applicability, Definitions and Benefits. Public Liability Insurance Act and Rules- Definitions, Calculation of amount of relief, Environmental Relief Fund, Advisory Committee, Powers of District Collector, Extent of Liability, Contribution to Relief Fund.

UNIT - III EXPLOSIVES ACT [09]

Explosives Act: Definitions, Categories of Explosives, General Safety Provisions, and Use of Explosives, Grant of license, Notice of Accidents, Inquiry into ordinary and more serious accidents. Extension of definition to other explosive substances. Explosives Rules, SMPV Rules and Gas Cylinder Rules (in brief). Petroleum Act with important rules - definitions, safety in the import, transport, storage, license, exemption, notice of accidents.

UNIT - IV ENVIRONMENT (PROTECTION) ACT [09]

Water Act and Air Act: Definitions, powers and functions of Boards, prevention and control of pollution, consent administration. Environment (Protection) Act and Rules-Definitions, powers of central government, power of giving directions, authorities. MSIHC Rules- Definitions, Duties of Authorities, Notification of major accidents, Safety Reports, Safety Audit, On- site & Off-site emergency plans.

UNIT - V POWER TO MAKE RULES [09]

Powers and Functions of Central, State and Joint Boards, Provisions regarding prevention and control of water pollution, Penalties, Central & State Water Laboratories, Power to make rules, Power of supersession and overriding effect. Rules on Consent for Establishment.

Total = 45 Periods

Text Books:

1. S.K.T. Narayanan, Safety, Health and Environment Handbook Hardcover, McGraw Hill Education (India) Private limited, First Edition, 2017.
2. Gayle Wood Side and Dianna Koeurek, Environmental Safety and Health Engineering, John Wiley & Sons,1997.

Reference Books:

1. Ganguly & Changeriya, Health Safety and Environment, 2016.
2. Explosives Act and Related Rules & The Gas Cylinder Rules, Professional Book Publishers, 2004.
3. James B. Well, Environmental Management Handbook for Hydrocarbon Processing Industries, Factories Act, 1948.
4. Petroleum Act and Rules & The Petroleum Act, Universal Law Publishing, 1934.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF905 **Course Name: Legal Aspects of Safety**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Describe about the factories act and rules.*	3	-	3	-	-	3	3	2	-	-	-	2	-	-
CO2	*Illustrate the legal obligations regarding any injury by gaining knowledge of Workmen's Compensation Act. ESI Act & Rules.*	3	-	3	-	-	3	3	2	-	-	-	2	-	-
CO3	*Outline about the legal aspects granting of license for storage, transportation and usage of explosive substance as applicable as per Petroleum Act and Explosive Act.*	3	-	3	-	-	3	3	2	-	-	-	2	-	-
CO4	*Explain the Environment (Protection) act and Rules.*	3	-	3	-	-	3	3	2	-	-	-	2	-	-
CO5	*Choose the concept, powers and functions of Central, State and Joint Boards, provisions regarding prevention and control of Water & Air pollution, Penalties, Central & State Laboratories.*	3	-	3	-	-	3	3	2	-	-	-	2	-	-
	Average	**3**	**-**	**3**	**-**	**-**	**3**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**-**

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

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

		L	T	P	C
20SF906	**SAFETY IN INDUSTRIES (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1	*Explain the General safety rules, principles, maintenance, Inspections in Foundry Operations.*	*Understand*
CO2	*Apply the concepts of safety in design of building fire safety.*	*Apply*
CO3	*Develop the safety in industrial operations.*	*Apply*
CO4	*Recall about welding, common hazards in welding, personal protective equipment and safety precautions in welding.*	*Remember*
CO5	*Illustrate on safety in finishing, inspection and testing of machines.*	*Understand*

UNIT - I FOUNDRY OPERATIONS SAFETY [09]

Foundry Operations - Furnace - health hazard - safe methods of operation. Forging operations heat radiation - maintenance of machines - final checking of tools, guards, lubrication, shop equipment and hand tools - safe work practice. Operations in hot and cold rolling mills. Shearing -bending - rolling - drawing - turning - boring - milling - planning - grinding. Selection and care of tools - health hazards and prevention.

UNIT - II BUILDING FIRE SAFETY [09]

Building Fire Safety Objectives of fire safe building design, Fire load, fire resistant material and fire testing - structural fire protection - structural integrity - concept of exit design -exists width calculations -fire certificates - fire safety requirements for high rise buildings - snookers.

UNIT - III PERSONNEL RISK IN INDUSTRIAL OPERATIONS [09]

Storages and Transportation General consideration, petroleum product storages, storage tanks and vessel-storages layout segregation, separating distance, secondary containment - venting and relief, atmospheric vent, pressure, vacuum valves, flame arrestors, fire relief - fire prevention and protection - LPG storages -underground storages-loading and unloading facilities-drum and cylinder storage ware house, storage hazard assessment of LPG and LNG Hazards during transportation – pipeline transport.

UNIT - IV WORKSHOP PROCESS SAFETY [09]

Workshop Safety Hand tools and Power tools - Safety while using Grinding stone - Welding and gas cutting safety - Identification of Dangerous points - Lubrication Safety-Safety in Cold Forming and Hot Working of Metals.

UNIT - V SAFETY INSPECTION AND AUDIT [09]

Safety Inspections Safety Audit- Safety Survey - Plant safety inspection - Safety tour – Safety samplings - What is safety budget - Direct cost - indirect cost- Safety Equipment's & their budget preparation.

Total = 45 Periods

Text Books:

1. Elahi Naseer, Industrial Safety Management, Kalpaz Publication, 2006.
2. Dr. Shailednrakumar U Kale,Dr. Umesh Gramopadhye, Industrial Safety Management.

Reference Books:

1. Guidelines for Hazard Evaluation Procedures, Centre for Chemical Process Safety, Third Edition, AICHE 2008.
2. Guidelines for Chemical Process Quantitative Risk Analysis, Centre for Chemical Process Safety, Second Edition, AICHE, 2000.
3. Methodologies for Risk and Safety Assessment in Chemical Process Industries, Common Wealth Science Council, UK.
4. Trevor A Klett, Hazop and Hazon, Institute of Chemical Engineering.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL 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**

		L	T	P	C
20SF907	**FOOD SAFETY (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1	*Apply the knowledge on food quality in food industry.*	*Apply*
CO2	*Identify the food additives and food contaminants and their chemical and toxicological properties.*	*Apply*
CO3	*Summarize the effects of pests on food and the various methods for controlling them.*	*Understand*
CO4	*Explain about the national and international regulations for biosafety.*	*Understand*
CO5	*Demonstrate an ability to recognize the environmental, social and ethical implications of biotech applications.*	*Understand*

UNIT - I **FOOD QUALITY** **[09]**

Objective and importance of quality control, classification of quality attributes and its role in food quality, quality assessment of food materials (fruits, cereals, milk and meat), types of quality characteristics of food, methods used for determination of the quality in food industry, factors influencing the quality of food, sample and sampling methods of quality evaluation.

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

Factors contributing to physical, chemical and biological contamination in food chain, prevention and control of food borne hazards, definition and regulation of food sanitation, sources of contamination, personal hygiene-food handlers, cleaning compounds, sanitation methods and pest control, sanitation and safety in foodservices.

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

Principles of food safety and quality, quality assurance, Good Agricultural Practices (GAP), Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP), Good Veterinary Practice (GVP), Applications of HACCP in food safety, Current challenges to food safety.

UNIT - IV **FOOD LAWS AND REGULATIONS** **[09]**

Basic concepts of food standards, Role of national regulatory agencies: Food safety and Standards Act: salient provision and prospects, FSSAI, PFA, certification- AGMARK, ISI (BIS). Role of international regulatory agencies: USDA, FDA, BRC, WHO, FAO, Codex Alimentarius commission, WTO agreements: SPS and TBT agreements, ISO and its standards for food quality and safety.

UNIT - V **FOOD SAFETY AUDITING** **[09]**

Food surveillance: International and national practices, procedure and protocols, food alerts, traceability and food product recall. Export and import of food in India: introduction, import and export policies, FDA import policy, export-import policy, export control systems. Import intelligence and alert systems, packaging and labelling, specifications and certifications.

Total = 45 Periods

Text Books:

1. Fleming & Hunt, Biological Safety, Principles and Practices, ASM Press, Fourth Edition, 2006.
2. Fawatt, H.H. and Wood, W.S., Safety and Accident Prevention in Chemical Operation, Wiley Interscience, 1965.

Reference Books:

1. N.G. Marriott, G.W. Schilling and B. Robert, Principles of Food Sanitation, Springer, Fifth Edition 2018.
2. I. Alli, Food Quality Assurance - Principles & Practices, CRC Press, India, 2018.
3. Cynthia A. Robert, The Food Safety Information Hand Book, 2009.
4. Early, Guide to Quality Management Systems for the Food Industry, Springer, First Edition, 2005.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL 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**

		L	T	P	C
20SF908	**SAFETY MANAGEMENT AND ITS PRINCIPLES (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1	*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 MECHANICAL ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF908 **Course Name: Safety Management and its Principles**

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

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

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

		L	T	P	C
20SF909	**SAFETY IN AUTOMOBILE ENGINEERING (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1	*Explain about automobile engines, fuel systems and CMV rules for proto type testing and emission standards.*	*Understand*
CO2	*Demonstrate the electrical systems-ignition, lighting, horn, wipers, HVAC and concerned CMV rules*	*Understand*
CO3	*Classify the transmission systems - clutch, gearbox, steering, and differential. Chassis - springs, axles and brakes and corresponding CMV rules.*	*Understand*
CO4	*Outline the lubricating systems, cooling systems and miscellaneous systems. CMV rules for safety devices.*	*Understand*
CO5	*Choose passive and active safety.*	*Apply*

UNIT - I INTRODUCTION AND EMISSION [09]

Types of automobiles. Limiting Dimensions as per Central Motor Vehicles Rules. Engines - Classification, Construction, Materials of engine components. Prototype Testing as per Central Motor Vehicles Rules. Fuel System - Fuel tank, Fuel filter, Types of Fuel system. Carburettor – Simple and Modern, Fuel injection System. Emission Standards as per CMV Rules.

UNIT - II ELECTRICITY STORAGE AND ITS UTILLIZATION [09]

Electrical System - Storage Battery Operations and Maintenance. Ignition System - Coil and Magneto Ignition System. Starting System, Lighting System, Horn System-Wind Shield Wiper Motors, Fans, Heaters, Trafficators. Automobile air conditioning. Central Motor Vehicles Rules regarding Lighting, Windshields, Wipers.

UNIT - III TRANSMISSION SYSTEM AND BRAKING SYSTEM [09]

Transmission System - Clutches - operation and fault finding of clutches, Fluid Flywheel, Gear Box types, Steering Systems, Chassis Springs, and Suspension. Differential, Dead and Live axles, Rims, Tyre etc. Brakes - Types, construction and fault finding. CMV Rules-Brakes, Steering & Tyre.

UNIT - IV LUBRICATION AND COOLING SYSTEM [09]

Lubrication Systems-Types, Components, Lubricating oil, Cooling system- Details of components, Study of Systems, Types. Miscellaneous - Special gadgets and accessories for fire fighting vehicles. Automobile accidents. CMV Rules regarding Safety devices for drivers, passengers.

UNIT - V PASSIVE AND ACTIVE SAFETY [09]

Design of body for safety, deceleration of vehicle, passenger. Concept of crumble zone, Safety Cage. Optimum crash pulse. Barrier test - Crash tests - Antilock braking system, Stability Control. Adaptive cruise control, Lane Keep Assist System, Collision warning, avoidance system, Blind Spot Detection system, Driver alertness detection System. ADAS, DAT.

Total = 45 Periods

Text Books:

1. Robert Bosch GmbH, Safety, Comfort and Convenience Systems, Wiley, Third Edition, 2007.
2. Ljubo Vlacic, Michel Parent, Fumio Harashima, Intelligent Vehicle Technologies Theory and Applications, Butterworth Heinemann, 2001.

Reference Books:

1. GBS Narang, Automobile Engineering, Khanna Publishers, Delhi, 2014.
2. Kirpal Singh, Automobile Engineering, Vol.I &II. Standard publishes, Delhi, Thirteenth Edition, 2012.
3. Joseph Heitner, Automotive Mechanics-Principles & Practices, CBS Publisher-Delhi, Second Edition, 2006.
4. P. L. Kohli, Automotive Electrical Equipment's, McGraw Hill, New Delhi, 1993.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL 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**

		L	T	P	C
20SF910	**SAFETY IN TRANSPORTATION (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1	*Explain the Working of railways and safety aspects in railway operation*	*Understand*
CO2	*Apply the Basic geometric design features of roads*	*Apply*
CO3	*Summarize about traffic studies and traffic safety*	*Understand*
CO4	*Outline the basic layout and facilities of docks and harbour*	*Understand*
CO5	*Choose the Working of airways and safety aspects in airway operation*	*Remember*

UNIT - I RAILWAY ENGINEERING [09]

Introduction of Railway Engineering: Permanent way. Curves, super-elevation, negative super elevation, transition curve, grade compensation on curves. Railway operation and control - points and crossings turn-out. Signalling and interlocking. Centralized traffic control. Railway accidents & safety. Rapid transit railways - types, merits & demerits.

UNIT - II HIGHWAY ENGINEERING [09]

Introduction of Highway Engineering: Classification of highways and urban road patterns. Typical cross section of roads. Factors controlling the alignment of roads. Basic geometric design - stopping and overtaking sight distances.

UNIT - III TRAFFFIC ENGINEERING [09]

Introduction of Traffic Engineering: Traffic characteristics. Various traffic studies and their applications. Traffic signals. Carriage-way markings. Traffic islands. Highway intersections. Principles of highway lighting. Road Accidents prevention, investigation and reduction.

UNIT - IV HARBOUR AND DOCK ENGINEERING [09]

Introduction of Harbour & Dock Engineering: Water transportation, classification of harbours, accessibility and size, ports, Indian ports. Layout of ports, breakwater, facilities (in brief) for docking, repair, approach, loading and unloading, storing and guiding.

UNIT - V AIR TRANSPORTATIONENGINEERING [09]

Classification of air transportation, Types of air craft engines - Propellants-feeding systems – Ignition and combustion - Theory of rocket propulsion - Performance study - Staging - Terminal and characteristic velocity-Applications – spaceflights. Air way accidents & safety.

Text Books:

1. B.S. Dhillon, Transportation Systems, Reliability and Safety, CRC Press, 2011.
2. John Khisty C, Kent Lall B, Transportation Engineering - An Introduction, Prentice Hall of India, New Delhi, Third Edition 2002.

Reference Books:

1. Srinivasan, R., Harbour, Dock and Tunnel Engineering, Charotar Publishing House Pvt. Ltd, Anand, 2013.
2. Chandra, S. & Agarwal, M. M. Railway Engineering, Oxford University Press, New Delhi, 2007.
3. Kadiyali, L. R., Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, 2004.
4. Khanna, S. K. and Justo, C.E.G., Highway Engineering, Nem Chand & Brothers, New Delhi, Ninth Edition,2001.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF910 **Course Name: Safety in Transportation**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explain the Working of railways and safety aspects in railway operation*	3	3	3	-	-	2	-	2	-	-	-	3	-	-
CO2	*Apply the Basic geometric design features of roads*	3	3	3	-	-	2	-	2	-	-	-	3	-	-
CO3	*Summarize about traffic studies and traffic safety*	3	3	3	-	-	2	-	2	-	-	-	3	-	-
CO4	*Outline the basic layout and facilities of docks and harbour*	3	3	3	-	-	2	-	2	-	-	-	3	-	-
CO5	*Choose the Working of airways and safety aspects in airway operation*	3	3	3	-	-	2	-	2	-	-	-	3	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**2**	**-**	**2**	**-**	**-**	**-**	**3**	**-**	**-**

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

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

		L	T	P	C
20SH901	**APPLICATIONS OF STATISTICS** (Open Elective)	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes : On Completion of this course, the student will be able to		**Cognitive Level**
CO1	*Analyze the measures of central tendency and dispersion.*	*Analyze*
CO2	*Applying the concepts of Correlation and Regression analysis*	*Apply*
CO3	*Testing the samples using method of hypothesis to obtain inferences.*	*Remember*
CO4	*Develop their skills in Design of Experiments.*	*Remember*
CO5	*Solving Non Parametric data to obtain inferences.*	*Understand*

UNIT– I DESCRIPTIVE STATISTICS [09]

Introduction to Statistics, Measures of Central Tendency - Mean, Median, Mode, Weighted Mean, Geometric Mean, Harmonic Mean, Measures of Variability- Range, Inter-Quartile Range, Variance, Standard Deviation, Coefficient of Variation.

UNIT – II CORRELATION AND REGRESSION ANLYSIS [09]

Types of Correlation-Karl Pearson's Coefficient of Correlation- Spearman's Rank Correlation-Regression Analysis-Uses-Regression equations-X on Y and Y on X Estimation.

UNIT – III TESTING OF HYPOTHESIS [09]

Large sample test based on Normal distribution for single mean and difference of means - Tests based on t - F distributions for testing means and variances-Chi-Square Test.

UNIT – IV DESIGN OF EXPERIMENTS [09]

Analysis of variance - One-way and two-way classifications - Completely randomized design - Randomized block design - Latin square design.

UNIT – V NON PARAMETRIC TESTS [09]

The Sign Test- Rank Sum Test- Mann-Whitney U Test, One Sample run Test-Spearman's Rank Correlation and Kruskal-Wallis Test (H-test).

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

Text Books :

1 Gupta. S.P., Statistical Methods , Sultan Chand & Sons Educational Publishers, New Delhi, Thirty first Edition, 2002.

2 Ross, S.M., Introduction to Probability and Statistics for Engineers and Scientists, Elsevier, Third Edition, 2004.

Reference Books :

1 Srivatsava TN and Shailaja Rego, Statistics for Management, Tata McGraw Hill, Fifth Edition, 2008.

2 Walpole. R.E., Myers. R.H., and Ye. K., Probability and Statistics for Engineers and Scientists, Pearson Education, Asia, Eighth Edition, 2007.

3 Richard I. Levin, David S. Rubin, Statistics for Management, Pearson Education, Seventh Edition, 2011.

4 Pillai R.S.N and Bagavathi.V , Statistics ,S.Chand Publishers ,New Delhi, Seventeenth Reprint Edition 2008.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL 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**

		L	T	P	C
20SH902	**COMBINATORICS AND GRAPH THEORY** (Open Elective)	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes : On Completion of this course, the student will be able to		**Cognitive Level**
CO1	*Interpret the concept of combinatorics Principles in Computer applications.*	*Understand*
CO2	*Acquire knowledge in Recurrences and Generating Functions.*	*Evaluate*
CO3	*Applying the concepts of graph theory*	*Apply*
CO4	*Constructing algorithm using Trees..*	*Remember*
CO5	*Developing Skills in Colouring and Directed Graphs.*	*Analyze*

UNIT– I COMBINATORICS [09]

The pigeon-hole principle - Basic counting problems- The binomial coefficients (the binomial theorem, algebraic vs. combinatorial proof, Pascal's identity, Pascal's triangle, Catalan numbers) - the principle of inclusion and exclusion.

UNIT – II RECURRENCES [09]

Fibonacci numbers - The substitution method- Linear recurrences (mostly homogenous recurrences, the characteristic polyr Generating functions.

UNIT – III INTRODUCTION TO GRAPH THEORY [09]

. Definition - examples – subgraphs – complements and graph isomorphism – Euler trail and circuits – planar graphs – Hamilton paths and cycles.

UNIT – IV TREES [09]

Definition – rooted trees – trees and sorting – weighted trees and prefix codes – bi connected components and Articulation points.

UNIT – V MATRICES, COLOURING AND DIRECTED GRAPH [09]

Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four color problem – Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness – Euler graphs.

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

Text Books :

1. Grimaldi, R.P. Discrete and Combinatorial Mathematics: An Applied Introduction, Fourth Edition, Pearson Education Asia, Delhi, 2007.
2. Narsingh Deo, Graph Theory With Application to Engineering and Computer Science, Prentice Hall of India, Second Edition, 2003.

Reference Books :

1. Douglas B. West, Introduction to Graph Theory, Prentice-Hall of India, Second Edition, 2012.
2. John Clark, Derek Allan Holton, A first look at Graph Theory, World Scientific Publishing Company Ilustrated 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 MECHANICAL 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**

		L	T	P	C
20SH903	**OPTIMIZATION TECHNIQUES** (Open Elective)	3	0	0	3

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

Course Outcomes : On successful completion of the course , the student will be able to		**Cognitive Level**
CO1	*Enable to develop the decision making during the uncertain situations by linear programming approach.*	*Apply*
CO2	*Identify to minimize the Transportation and Assignment cost and maximize the profit in Industries.*	*Analyze*
CO3	*Developing the network techniques in project scheduling.*	*Apply*
CO4	*Study the importance of stock controlling to maximize the profit.*	*Remember*
CO5	*Understand and apply the Replacement and sequencing methods in manufacturing engineering.*	*Understand*

UNIT - I LINEAR PROGRAMMING PROBLEM [09]

Introduction - scope and role of OR - phases of OR - limitations of OR - linear programming problem - formulation of linear programming problem - optimum solution by graphical method - simplex method (using slack variables only).

UNIT - II TRANSPORTATION AND ASSIGNMENT PROBLEM [09]

Transportation Models (Minimizing and Maximizing Cases) - Balanced and unbalanced cases - Initial Basic feasible solution by North West Corner Rule, Least cost and Vogel's approximation methods. Check for optimality by Modified method.

Assignment Models (Minimizing and Maximizing Cases) - Balanced and Unbalanced Cases - Solution by Hungarian method.

UNIT - III NETWORK MODELS [09]

Network - Fulkerson's rule - construction of a network - critical path method (CPM) - optimistic, pessimistic and most likely time estimates - project scheduling by PERT analysis.

UNIT - IV INVENTORY MODEL [09]

Types of Inventory - Deterministic inventory models - EOQ and EBQ models with and without shortages - Quantity discount model - Price breaks - probabilistic inventory model.

UNIT - V REPLACEMENT MODELS AND SEQUENCING [09]

Replacement of items that deteriorate with time - value of money changing with time - not changing with time - optimum replacement policy - individual and group replacement. Sequencing problem - assumptions - processing of 'n' jobs in 2 machines, 'n' jobs with 'm' machines.

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

Text Books :

1 P.K. Gupta and Man Mohan, Problems in Operations Research, S. Chand and Co, New Delhi ,Fourteenth Edition, 2016.

2 Wayne. L. Winston, Operations Research applications and algorithms, Thomson learning, New Delhi, Tenth Edition, 2016.

Reference Books :

1 Hira and Gupta, Problems in Operations Research, S. Chand and Co, New Delhi, Eighth Edition, 2015.

2 Taha H.A, Operation Research, Pearson Education, New Delhi, Sixth Edition, 2016.

3 J k Sharma , Operation Research, Macmillan India Pvt. Ltd., New Delhi, Seventh Edition,2007

4 R.Panneerselvam Operations Research, PHI Learning, Second Edition, 2011.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL 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- Param Vir Chakra- Career in the Defense forces- Service tests and interviews-Field craft and Battle craft-Basics of Map reading including practical.

Total = 45 Periods

Text Books :

1 National Cadet Corps- A Concise handbook of NCC Cadets by Ramesh Publishing House, New Delhi, 2014.

Reference Books :

1 *Cadets Handbook – Common Subjects SD/SW published by DG NCC, New Delhi.*

2 *Cadets Handbook- Specialized Subjects SD/SW published by DG NCC, New Delhi*

3 *NCC OTA Precise published by DG NCC, New Delhi.*

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

Regulation : R 2020

Course Code: 20SH904 **Course Name: BASIC MILITARY EDUCATION AND TRAINING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Display sense of patriotism, secular values and shall be transformed into motivated youth who will contribute towards nation building through national unity and social cohesion.	3	1	1	1	3	3	3	3	3	3	-	-	-	-
CO2	Demonstrate Health Exercises, the sense of discipline, improve bearing, smartness, turnout, develop the quality of immediate and implicit obedience of orders	3	1	1	1	3	3	3	3	3	3	-	-	-	-
CO3	Basic knowledge of weapons and their use and handling.	3	2	1	1	3	3	3	3	3	3	-	-	-	-
CO4	Understanding about social evils and shall inculcate sense of whistle blowing against such evils and ways to eradicate such evils	3	2	1	1	3	3	3	3	3	3	-	-	-	-
CO5	Acquaint, expose & provide knowledge about Army/Navy/ Air force and to acquire information about expansion of Armed Forces, service subjects and important battles.	3	2	1	1	3	3	3	3	3	3	-	-	-	-
	Average	3	2	1	1	3	3	3	3	3	3	-	-	-	-

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

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

		L	T	P	C
20SH905	**PROFESSIONAL COMMUNICATION (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, Mc GrawHill, New Delhi, 28th Reprint, 2015.

4 Department of English, English for Technologies and Engineers, Orient Black Swan, Hyderabad, First Edition, 2016.

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

Regulation : R 2020

Course Code: 20SH905 **Course Name : PROFESSIONAL COMMUNICATION**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Organize and compose resume' and SWOT analysis.	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO2	Prioritize the skills for interviews and job hunt.	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO3	Interpret by Listening and reading a text and comprehend it.	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO4	Identify the purpose of writing short messages and presentation.	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO5	Optimize the speaking skills to do well in Group Discussion.	-	-	-	-	-	-	-	-	3	3	-	2	-	-
	Average	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**-**	**-**

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

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: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery, Bioimaging – Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nano sensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sun barrier products – In Photostat, printing, solar cell, battery.

Total = 45 Periods

Text Books :

1 John Dinardo. N, Nanoscale characterization of surfaces & Interfaces. Second edition, Weinheim Cambridge, Wiley-VCH, 2000

2 Introduction to Nanoscience and Nanotechnology by Chattopadhyay K.K 1 January 2013

Reference Books :

1 Timp .G, Nanotechnology, AIP press/Springer, 1999.

2 AkhleshLakhtakia (Editor), The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

3 NANO: The Essentials: Understanding Nanoscience and Nanotechnology by T. Pradeep

4 An Introduction To Nanomaterials And Nanoscience (Pb 2020) by DAS A

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF MECHANICAL 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**

OPEN ELECTIVE

		L	T	P	C
20ME901	**BASIC MECHANICAL ENGINEERING**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explore the fundamental knowledge on basics of mechanical engineering*	*Understand*
CO2:	*Demonstrate the concepts of manufacturing technology.*	*Understand*
CO3:	*Describe the knowledge of power plants and pumps.*	*Understand*
CO4:	*Interpret the basic concepts of IC Engines.*	*Understand*
CO5:	*Analyze the Refrigeration and air conditioning systems*	*Analyze*

UNIT - I FUNDAMENTALS [09]

Introduction to mechanical engineering, concepts of thermal engineering, mechanical machine design, industrial engineering, and manufacturing technology.

UNIT - II MANUFACTURING TECHNOLOGY [09]

Manufacturing, classification, lathe, drilling machines, milling machines, metal joining, metal forming, casting, forging, and introduction to powder metallurgy.

UNIT - III POWER PLANT ENGINEERING [09]

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT - IV I C ENGINES [09]

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines.

UNIT - V REFRIGERATION AND AIR CONDITIONING SYSTEM [09]

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system–Layout of typical domestic refrigerator–Window and Split type room Air condition.

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

Text Books :

1 Shantha Kumar S R J., Basic Mechanical Engineering, Hi-tech Publications, Mayiladuthurai, Second Edition, 2000.

2 Venugopal K and Prahu Raja V, Basic Mechanical Engineering, Anuradha Publishers, Kumbakonam , Fourth Edition 2000.

Reference Books :

1 Lecture notes prepared by Department of Mechanical Engineering, NITT, 2020.

2. R. K. Rajput,Manufacturing Processes, University Science Press, New Delhi, Fourth Edition, 2020.

3 Hajra Choudry, S. K., Elements of Work Shop Technology – Vol. I, Media Promoters, New Delhi, Fourth Edition, 2010.

4 Ramesh Babu, Basic civil and Mechanical Engineering, VRB Publishers, Chennai, Fourth Edition, 2017.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME901 **Course Name : BASIC MECHANICAL ENGINEERING**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Explore the fundamental knowledge on basics of mechanical engineering	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO2:	Demonstrate the concepts of manufacturing technology	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO3:	Describe the knowledge of power plants and pumps.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO4:	Interpret the basic concepts of IC Engines.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO5:	Analyze the Refrigeration and air conditioning systems	3	3	3	-	-	2	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

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

OPEN ELECTIVE

20ME902	**SOLAR ENERGY UTILIZATION**	L	T	P	C
		3	0	0	3

Prerequisite:

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

CO1:	Explore the measurement of solar radiation and their application to various systems.	Understand
CO2:	Illustrate the principles of non-concentrating collectors and apply the principles in various real time applications.	Apply
CO3:	Describe the concept of concentrating collectors and their application to a wide range of systems.	Apply
CO4:	Analyze the various material characteristics of solar cell and determine maximum efficiency of solar cells.	Analyze
CO5:	Demonstrate the solar storage equipment and evaluate the economic analysis of various solar equipment.	Understand

UNIT - I INTRODUCTION TO SOLAR ENERGY [09]

Introduction - Sun-Earth relationships- solar constant- solar radiation at the earth surface- depletion of solar radiation- measurement of solar radiation- solar radiation data- solar time- solar radiation geometry- solar radiation on tilted surfaces-Sun as the source of energy sun angles - overview of applications.

UNIT - II NON CONCENTRATING COLLECTORS [09]

Types and classification of solar collectors - terminology related to flat plate collectors - evacuated collectors-Heat transfer processes and efficiency of a solar collector -solar drying- solar desalination- solar mechanical cooling- solar desiccant cooling- detailed study on heat pump – it needed.

UNIT - III CONCENTRATING COLLECTORS [09]

Tracking systems - compound parabolic concentrators - parabolic trough concentrators - concentrators with point focus - Heliostats- comparison of various designs - central receiver systems - parabolic trough systems - solar performance analysis - solar power plant - solar furnace.

UNIT - IV SOLAR PHOTOVOLTAIC [09]

Fundamentals of solar cells- - types of solar cell- P-N junction photodiode- description and principle of working of a solar cell- cell structure- solar module and panel- I-V characteristics of a PV module- maximum power point- cell efficiency- fill factor- Manufacturing of solar cell.

UNIT - V SOLAR ENERGY STORAGE AND ECONOMIC ANALYSIS [09]

Storage of solar energy - thermal storage-sensible and latent heat storage-Economic Analysis: Initial and annual costs-definition of economic terms for a solar system- present worth calculation-repayment of loan in equal annual installments- annual savings- cumulative savings and life cycle savings- payback period- clean development mechanism -solar vehicle -BIPV(Building Integrated photo voltaic) - house hold appliances.

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

Text Books :

1 Garg H P and Prakash J, Solar Energy: Fundamentals & Applications, McGraw Hill, New Delhi, First Revised Edition 2014 .
2 Duffie.J.A and Beckman W.A, Solar Engineering of Thermal processes, John Wiley And Sons, New York, Fourth Edition,2013 .

Reference Books :

1 Sukhatme. K and Sukhatme S.P., Solar Energy principles of thermal collection and storage, Tata McGraw Hill education, New Delhi, Third Edition,2008.
2 Rai G.D., Solar energy Utilization, Khanna Publishers, New Delhi, Fifth Edition, 2020.
3 Bhattachariya.T , Terrestrial Solar Photovoltaic, Narosa Publishers, New Delhi, Fourth Edition,2008.
4 Sukhatme S.P., Solar Energy, Tata McGraw Hills P Co., Third Edition, 2008.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME902 **Course Name : SOLAR ENERGY UTILIZATION**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Evaluate the measurement of solar radiation and their application to various systems.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO2:	Illustrate the principles of non-concentrating collectors and apply the principles in various real time applications.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO3:	Describe the concept of concentrating collectors and their application to a wide range of systems.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO4:	Analyze the various material characteristics of solar cell and determine maximum efficiency of solar cells.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO5:	Demonstrate the solar storage equipment and evaluate the economic analysis of various solar equipment.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**2**	-	-	-	-	-	**-**	**-**	**-**

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

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

OPEN ELECTIVE

		L	T	P	C
20ME903	**PRODUCTION TECHNOLOGY OF AGRICULTURAL MACHINERY**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Acquire various engineering materials, classifications, compositions and properties	Understand
CO2:	Explore the concept and basic mechanics of metal cutting, working of standard machine tools and allied machines.	Understand
CO3:	Apply the manufacturing process in welding for component production.	Apply
CO4:	Demonstrate various advanced manufacturing process in engineering field.	Understand
CO5:	Describe the basic concepts of Computer Numerical Control (CNC) machine tool and CNC programming.	Understand

UNIT – I ENGINEERING MATERIALS [09]

Engineering materials - their classification - Mechanical properties of materials, strength, elasticity, plasticity, stiffness, malleability, ductility, brittleness, toughness, hardness, resilience, machinability, formability, weldability. Steels and cast irons: Carbon steels, their classification based on percentage of carbon as low, mild, medium & high carbon steel, their properties & applications. Wrought iron, cast iron. Alloy steels: Stainless steel, tool steel.

UNIT - II MACHINING [09]

Basic principles of lathe - machine and operations performed on it. Basic description of machines and operations of Shaper-Planner, Drilling, Milling & Grinding.

UNIT - III WELDING [09]

Introduction, classification of welding processes. Gas welding, types of flames and their applications. Electric Arc welding. Resistance welding, Soldering & Brazing processes and their uses.

UNIT - IV ADVANCED MANUFACTURING PROCESS [09]

Abrasive flow machining - abrasive jet machining - water jet machining - Electro Discharge Machining (EDM) - Wire cut EDM - Electro Chemical Machining (ECM) - Ultrasonic Machining / Drilling (USM / USD) - Electron Beam Machining (EBM) - Laser Beam Machining (LBM).

UNIT - V CNC MACHINE [09]

Numerical control (NC) machine tools - CNC: types, constitutional details, special features – design considerations of CNC machines for improving machining accuracy - structural members – slide ways - linear bearings - ball screws - spindle drives and feed drives. Part programming fundamentals - manual programming.

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

Text Books :

1 Kalpakjian and Schmid ,Manufacturing Engineering and Technology, Pearson, New Delhi, Eighth Edition, 2016.

2 Hajra Choudry, Elements of workshop technology - Vol II, Media promoters, New Delhi ,Fourth Edition,2018

Reference Books :

1 Gupta. K.N., and Kaushik, J.P., Workshop Technology Vol I and II, New Heights, Daryaganj, New Delhi, Second Edition, 1998,.

2 Arthur. D., et. al., General Engineering Workshop Practice, Asia Publishing House, Bombay,Third Edition,2001.

3 Chapman W.A.J., Workshop Technology, Part I, II, III, E.L.B.S. and Edward Amold Publishers Ltd, London, First Edition,1992.

4 Dr. P. Kamaraj, Dr. V. R. Ramachandran, Production Technology of Agricultural Machinery,Kerela,First Edition,2020.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME903 Course Name : PRODUCTION TECHNOLOGY OF AGRICULTURAL MACHINERY

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Acquire various engineering materials, classifications, compositions and properties	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO2:	Explore the concept and basic mechanics of metal cutting, working of standard machine tools and allied machines.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO3:	Apply the manufacturing process in welding for component production.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO4:	Demonstrate various advanced manufacturing process in engineering field.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO5:	Describe the basic concepts of Computer Numerical Control (CNC) machine tool and CNC programming.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	2	-	-	-	-	-	**-**	**-**	

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

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

OPEN ELECTIVE

		L	T	P	C
20ME904	**SELECTION OF MATERIALS**	3	0	0	3

Prerequisite:

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

CO1:	Explore the classification and properties of engineering materials	Understand
CO2:	Acquire the knowledge on mechanical properties of various metal alloys.	Understand
CO3:	Identify different types of availability materials.	Analyze
CO4:	Examine required materials for engineering applications.	Analyze
CO5:	Select suitable material for various applications	Evaluate

UNIT - I ENGINEERING MATERIALS [09]

Introduction – classification of engineering materials – selection of materials for engineering purposes –selection of materials and shape –classification metal and alloys, polymers, ceramics and glasses, composites, natural materials,- non metallic materials- smart materials - physical, metrical properties of metals.

UNIT - II MATERIAL PROPERTIES [09]

Mechanical properties – fatigue strength – fracture Toughness - Thermal Properties - Magnetic Properties - Fabrication Properties –electrical , optical properties - Environmental Properties , Corrosion properties –shape and size - Material Cost and Availability– failure analysis.

UNIT - III MANUFACTURING PROCESSING AND ECONOMIC ANALYSIS [09]

Interaction of Materials Selection, Design, and Manufacturing Processes - Production Processes and Equipment for Metals - Metal Forming, Shaping, and Casting - Plastic Parts Processing - Composites Fabrication Processes - Advanced Ceramics Processing – surface treatment - Resource -The Price and Availability of Materials.

UNIT - IV MATERIALS SELECTION CHARTS AND TESTING [09]

Ashby material selection charts-Testing of Metallic Materials - Plastics Testing - Characterization and Identification of Plastics - Professional and Testing Organizations - Ceramics Testing - Nondestructive Inspection.

UNIT - V APPLICATIONS AND USES [09]

Selection of Materials for Biomedical Applications - Medical Products - Materials in Electronic Packaging - Advanced Materials in Sports Equipment - Materials Selection for Wear Resistance - Advanced Materials in Telecommunications - Using Composites - Manufacture and Assembly with Plastics, fiber and Diamond Films.

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

Text Books :

1 Ashby, M. F. , Materials selection in mechanical design, Elsevier,New Delhi, Third Edition, 2005.

2 Ashby, M. F. and Johnson, K. Materials and design – the art and science of material selection in product design. Elsevier, New Delhi, First Edition, 2002.

Reference Books :

1 Charles, J. A., Crane, F. A. A. and Furness, J. A. G. ,Selection and use of engineering materials, Butterworth-Heinemann, New Delhi, Third Edition, 1997.

2 Handbook of Materials Selection. Edited by Myer Kutz John Wiley & Sons, Inc., New York, Second Edition, 2002.

3 Fisher P.E., Selection of Engineering Materials and Adhesives ,CRC Press, US, First Edition,2020

4 Joseph Datsko ,Materials Selection for Design and Manufacturing theory and practice, CRC Press, US, First edition,2020.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME904 **Course Name : SELECTION OF MATERIALS**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Explore the classification and properties of engineering materials	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO2:	Acquire knowledge on mechanical properties of various metal alloys.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO3:	Identify different types of availability materials.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO4:	Examine required materials for engineering applications.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO5:	Select suitable material for various applications	3	3	3	-	-	1	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	1	-	-	-	-	-	**-**	**-**	**-**

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

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

OPEN ELECTIVE

		L	T	P	C
20ME905	**MARINE VEHICLES**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Explore the various types of marine vehicles and its applications	Understand
CO2:	Acquire marine vehicle Safety, Operations and controls of bunkering.	Understand
CO3:	Demonstrate remotely operable vehicle design, construction and its components.	Apply
CO4:	Analyze submersible and autonomous under water vehicles.	Analyze
CO5:	Design and operational consideration of manned and un manned submersible.	Create

UNIT - I MARINE VEHICLES [09]

Types – general – by function – commercial marine vehicles- passenger ship, cargo ships, oil and chemical tankers , cattle carriers, harbor crafts, off shore platform, container ships.

UNIT - II REEFERS AND GAS CARRIERS [09]

.Introduction – Types , design considerations, safety – operation and controls, precaution during bunkering.

UNIT - III REMOTELY OPERABLE VEHICLE (ROV), UMS SHIPS [09]

Remotely Operable Vehicles (ROV) – The ROV business – Design theory and standards – control and simulation – design and stability – components of ROV – applications, UMS operation, and controls.

UNIT - IV SUBMERSIBLES AND AUTONOMOUS UNDERWATER VEHICLE (AUV) [09]

submersibles types – applications, AUV – Design and construction considerations – components – sensors – Navigation -control strategies – applications.

UNIT - V MANNED AND UN MANNED SUBMERSIBLE [09]

Introduction – Design and operational consideration – pressure hull exo-structure – ballasting and trim – maneuvering and control – Life support and habitability – emergency devices and equipment's – certification and classification, towed vehicles – gliders – crawler – Design and construction.

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

Text Books :

1 Jonathan M. Ross, human factors for naval marine vehicle design and operation, CRC Press, US, Second Edition, 2001.
2 Sabiha A. Wadoo, Pushkin Kachroo, Autonomous underwater vehicles, modeling, control design and Simulation, CRC press,US,Second Edition, 2011.

Reference Books :

1 Ferial L hawry, The ocean engineering handbook, CRC press, US,First Edition, 2000.
2 Richard A Geyer, Submersibles and their use in oceanography and ocean engineering, Elsevier, New Delhi, First Edition, 1997.
3 Robert D. Christ,Robert L. Wernli, Sr., The ROV Manual A User Guide for Remotely Operated Vehicles, Elsevier, New Delhi, second edition, 2014.
4 Frank Busby. R, Manned Submersibles, Office of the oceanographer of the Navy, United states, First Edition, 1976.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME905 **Course Name : MARINE VEHICLES**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Explore the various types of marine vehicles and its applications	3	3	3	-	-	2	-	-	1	-	-	-	-	-
CO2:	Acquire Safety, Operations and controls of bunkering.	3	3	3	-	-	2	-	-	1	-	-	-	-	-
CO3:	Demonstrate remotely operable vehicle design, construction and its components.	3	3	3	-	-	2	-	-	1	-	-	-	-	-
CO4:	Analyze submersible and autonomous under water vehicles.	3	3	3	-	-	2	-	-	1	-	-	-	-	-
CO5:	Design and operational consideration of manned and un manned submersible.	3	3	3	-	-	2	-	-	1	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	2	-	-	1	-	-	**-**	**-**	**-**

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

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

OPEN ELECTIVE

		L	T	P	C
20ME906	**SENSORS AND TRANSDUCERS**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Explore the basic concepts of various sensors and transducers.	Understand
CO2:	Develop knowledge in mechanical and electromechanical sensor.	Apply
CO3:	Differentiate the types of thermal sensor which are used in various applications.	Apply
CO4:	Identify various types of magnetic sensors and working principles	Analyze
CO5:	Acquire suitable sensors and its applications.	Understand

UNIT - I INTRODUCTION [09]

Definition, classification, static and dynamic parameters, Characterization - Electrical, mechanical, thermal and chemical. Classification of errors - Error analysis, Static and dynamic characteristics of transducers.

UNIT - II MECHANICAL AND ELECTROMECHANICAL SENSORS [09]

Resistive Potentiometer - strain gauge - Inductive sensors and transducer - capacitive sensors – ultrasonic sensors.

UNIT - III THERMAL SENSOR [09]

Gas thermometric sensors - acoustic temperature sensors - magnetic thermometer, resistance change -type thermometric sensors.

UNIT - IV MAGNETIC SENSOR [09]

Force and displacement measurement - Magneto resistive sensors - Hall Effect sensor, Inductance andeddy 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 medicaldiagnostic sensors - environmental monitoring.

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

Text Books :

1 Ernest O Doebelin, Measurement Systems – Applications and Design, Tata McGraw-Hill, New Delhi, Fourth edition, 2016.

2 Sawney A K and PuneetSawney, A Course in Mechanical Measurements and Instrumentation and Control, DhanpatRai and Co, New Delhi, Fourteenth edition, 2016.

Reference Books :

1 Patranabis D, Sensors and Transducers, PHI, New Delhi, Sixth Edition, 2015.

2 Richard Zurawski, Industrial Communication Technology Handbook, CRC Press, US,Second edition, 2015.

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

DEPARTMENT OF MECHANICAL 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	PSO1	PSO2
CO1:	Explore the basic concepts of various sensors and transducers.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO2:	Develop knowledge in mechanical and electromechanical sensor.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO3:	Differentiate the types of thermal sensor which are used in various applications.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO4:	Identify various types of magnetic sensors and working principles	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO5:	Acquire suitable sensors and its applications.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	1	-	-	-	-	-	**-**	**-**	**-**

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

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

OPEN ELECTIVE

		L	T	P	C
20ME907	**ENERGY AUDITING**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Describe the energy crisis & environmental concerns associated with the energy management and the importance of energy auditing.	Understand
CO2:	Identify the tools, techniques, management practices for the audit and management of electrical energy.	Understand
CO3:	Recognize the techniques of energy analysis and the associated energy efficient technologies for the routinely used thermal energy systems.	Apply
CO4:	State about the typical electrical energy powered utilities, services of industrial facilities & organizations and be able to identify the opportunities and options for the conservation & management of electrical energy.	Understand
CO5:	Interpret the basic economic concepts of underlay energy production and end use.	Evaluate

UNIT - I INTRODUCTION [09]

Energy – Power – Past & Present scenario of world; National energy consumption data – Environmental aspects associated with energy utilization – Energy Auditing: Need, Types, Methodology and Barriers. Role of energy managers. Instruments for energy auditing.

UNIT - II ELECTRICAL SYSTEMS [09]

Components of EB billing – HT and LT supply, Transformers, Cable sizing, Concept of capacitors, Power factor improvement, Harmonics, Electric motors – Motors efficiency computation, Energy efficient motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED lighting and scope of economics in illumination – Auditing in electrical systems.

UNIT - III THERMAL SYSTEMS [09]

Stoichiometry, Boilers, Furnaces and Thermal fluid heaters – Efficiency computation and economic measures. Steam: Distribution & usage, Steam traps, Condensate recovery, Flash steam utilization, Insulators & Refractories – Auditing in thermal systems.

UNIT - IV ENERGY CONSERVATION IN MAJOR UTILITIES [09]

Pumps, Fans, Blowers, Compressed air systems, Refrigeration and Air Conditioning systems – Cooling towers – D.G. sets - Auditing and energy conservation.

UNIT - V ECONOMICS [09]

Energy economics – Discount rate, Payback period, Internal rate of return, Net present value, Life cycle costing – ESCO concept – Auditing and Economics.

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

Text Books :

1. Energy manager training manual (4 Volumes) available at www.energymanagertraining.com, a website administered by Bureau of energy efficiency (BEE), a statuary body under ministry of power, Government Of India, 2004.
2. Abbi,Y.B , Energy Audit, Open University, The Energy and Resources Institute, Government Of India,2012 .

Reference Books :

1. Witte. L.C., P. S. Schmidt, D.R. Brown, Industrial Energy Management and Utilization, Hemisphere Pub, Washington, First Edition, 1988 .
2. Sonal Desai, Handbook of Energy Audit, Tata McGraw Hill, New Delhi, Second Edition, 2015.
3. Dryden. I.G.C., The Efficient Use Of Energy, Butterworth's, London, Fourth Edition, 2013.
4. Turner W.C., Energy Management Handbook, Wiley, New York, Eighth Edition, 2014.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME907 **Course Name : ENERGY AUDITING**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Describe the energy crisis & environmental concerns associated with the energy management and the importance of energy auditing.	3	3	3	-	2	2	-	-	1	-	-	-	-	-
CO2:	Identify the tools and techniques, and the management practices for the audit and management of electrical energy.	3	3	3	-	2	2	-	-	1	-	-	-	-	-
CO3:	Recognize the techniques of energy analysis and the associated energy efficient technologies for the routinely used thermal energy systems.	3	3	3	-	2	2	-	-	1	-	-	-	-	-
CO4:	State about the typical electrical energy powered utilities, services of industrial facilities & organizations and be able to identify the opportunities and options for the conservation & management of electrical energy.	3	3	3	-	2	2	-	-	1	-	-	-	-	-
CO5:	Interpret the basic economic concepts of underlay energy production and end use.	3	3	3	-	2	2	-	-	1	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**2**	2	-	-	1	-	-	**-**	**-**	**-**

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

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

OPEN ELECTIVE

20ME908	**FIBRE REINFORCED PLASTICS**	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Select various materials for designing composite structures.	Understand
CO2:	Apply knowledge of fracture mechanics of composites during designing of composite structures.	Apply
CO3:	Analyze critically damping capacity of composite materials.	Analyze
CO4:	Correlate various manufacturing/fabricating techniques for composite structures based on design.	Analyze
CO5:	Explore various composite applications.	Understand

UNIT - I INTRODUCTION [09]

Definition, Reason for composites, Classifications of composites, Thermosets - Epoxy; Unsaturated polyester resin; vinyl ester, polyimides etc.,-preparation, properties, and uses.

UNIT - II REINFORCEMENTS [09]

Types, Properties, chemistry and applications of fillers such as silica, titanium oxide, talc, mica etc., Manufacturing process, Properties, structure and uses of Glass fiber -.Carbon, Aramid, Boron, jute, sisal, cotton.

UNIT - III FABRICATIONS OF THERMOSET COMPOSITES [09]

Hand layup method, compression and transfer moulding, pressure and vacuum bag process, filament winding, protrusion, reinforced RIM, Injection moulding, of thermosets, SMC and DMC, Advantages and disadvantages of each method.

UNIT - IV TESTING OF COMPOSITES [09]

Destructive and non-destructive tests; Destructive-tensile, compression, flexural, impact strength, Hardness–Fatigue-toughness HDT ,basic concepts of fracture mechanisms.

UNIT - V APPLICATIONS OF COMPOSITES [09]

Aerospace, land transport, marine, structural, chemical plants and corrosion resistant products and energy applications sports, electrical, electronic and communication applications.

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

Text Books :

1 Chawla, K.K, Composite Material s, Springer Science in progress, USA, Sixth Edition, 2019.

2 Balasubramaniam, Composite Materials, John Wiley & Sons, Indian Ed., New York, Fourth Edition, 2016.

Reference Books :

1 Sharma S.C., Composite materials, Narosa Publications, NewDelhi, Third Edition, 2015.

2 Isaac M. Daniel and Ori Ishai, Engineering Mechanics of Composite Materials, Oxford University Press, UK, Second Edition, 2017.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME908 **Course Name : FIBRE REINFORCED PLASTICS**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Select various materials for designing composite structures.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO2:	Apply knowledge of fracture mechanics of composites during designing of composite structures.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO3:	Analyze critically damping capacity of composite materials.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO4:	Correlate various manufacturing / fabricating techniques for composite structures based on design.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO5:	Explore various composite applications.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	1	-	-	-	-	-	**-**	**-**	**-**

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

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

OPEN ELECTIVE

		L	T	P	C
20ME909	**LEAN MANUFACTURING**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Demonstrate the lean manufacturing principles to find and eliminate wastes.	Understand
CO2:	Identify the lean manufacturing tools and their potential applications.	Understand
CO3:	Summarize the usage of visual management, TPM and lean practices.	Apply
CO4:	Acquire the technology drivers of lean manufacturing.	Understand
CO5:	Describe technology drivers of lean manufacturing.	Analyze

UNIT - I LEAN MANUFACTURING PRINCIPLES [09]

Lean manufacturing paradigms - lean manufacturing - origin - Toyota Production System - types of wastes -tools and techniques to eliminate wastes - value stream mapping (VSM) - primary icons - secondary icons - developing the VSM.

UNIT - II LEAN MANUFACTURING TOOLS [09]

5S concepts - stages of 5S and waste elimination - Kaizen - steps of Kaizen - lean manufacturing through Kaizen – Single Minute Exchange of Die - theory of SMED - design for SMED - strategic SMED and waste elimination - pull production through Kanban - one piece flow production.

UNIT - III VISUAL MANAGEMENT, TPM AND LEAN IMPLEMENTATION [09]

Visual management - tools for eliminating wastes - overproduction, inventory, delay, transportation, processing, unnecessary motion, defective parts, underutilization of people - implementation - total productive maintenance - implementation of lean practices.

UNIT - IV MANAGEMENT AND TECHNOLOGY DRIVERS OF LEAN MANUFACTURING [09]

Lean manufacturing - twenty criteria model - management driver - organizational structure - devolution of authority - employee status and involvement - nature of management - business and technical processes - time management - agility through technology driver.

UNIT - V MANUFACTURING STRATEGY AND COMPETITIVE DRIVERS OF LEAN MANUFACTURING [09]

Quick manufacturing setups - quick response - product life cycle management - product service elimination - automation - competitive driver - status of quality and productivity - compatible cost accounting system.

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

Text Books :

1 Devadasan.S.R, Mohan Sivakumar.V, Murugesh.R and Shalij.P.R, Lean Manufacturing: Theoretical, Practical and Research Futurities, PHI Learning Private Limited, New Delhi, Second Edition, 2012.

2 Pascal Dennis, Lean Production Simplified, Productivity Press, New York, Third Edition, 2007.

Reference Books :

1 Bill Carreira, Lean Manufacturing That Works, PHI Learning Private Limited, New Delhi, Third Edition, 2016.

2 Dennis P. Hobbs, LEAN Manufacturing Implementation, Cengage Learning, New Delhi, Fifth Edition, 2015.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME909 **Course Name : LEAN MANUFACTURING**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Demonstrate the lean manufacturing principles to find and eliminate wastes .	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO2:	Identify the lean manufacturing tools and their potential applications.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO3:	Summarize the usage of visual management, TPM and lean practices.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO4:	Acquire the technology drivers of lean manufacturing.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO5:	Describe technology drivers of lean manufacturing.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	2	-	-	-	-	-	**-**	**-**	**-**

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

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

OPEN ELECTIVE

		L	T	P	C
20ME910	**SURFACE ENGINEERING**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Demonstrate the various factors influencing wear in materials	Understand
CO2:	Identify wear resistance techniques in engineering materials	Apply
CO3:	Acquire various surface treatment methods for alloy metals	Understand
CO4:	Describe various surface treatment techniques and its applications	Analyze
CO5:	*Explore the corrosion behaviour of engineering materials*	Understand

UNIT - I WEAR [09]

Introduction tribology, surface degradation, wear and corrosion, types of wear, roles of friction and lubrication- overview of different forms of corrosion, introduction to surface engineering, importance of substrate

UNIT - II COATING [09]

Chemical and electrochemical polishing, significance, specific examples, chemical conversion coatings, phosphating, chromating, chemical colouring, anodizing of aluminium alloys, thermochemical processes -industrial practices

UNIT - III SURFACE TREATMENT [09]

Surface pre-treatment, deposition of copper, zinc, nickel and chromium - principles and practices, alloy plating, electrocomposite plating, electroless plating of copper, nickel-phosphorous, nickel-boron; electroless composite plating; application areas, properties, test standards (ASTM) for assessment of quality deposits

UNIT - IV SURFACE TREATMENT TECHNIQUES [09]

Definitions and concepts, physical vapour deposition (PVD), evaporation, sputtering, ion plating, plasma nitriding, process capabilities, chemical vapour deposition (CVD), metal organic CVD, plasma assisted CVD, specific industrial applications

UNIT - V SPRAYING [09]

Thermal spraying, techniques, advanced spraying techniques - plasma surfacing, D-Gun and high velocity oxy-fuel processes, laser surface alloying and cladding, specific industrial applications, tests for assessment of wear and corrosion behaviour

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

Text Books :

1 Stachowiak, G.W &Batchelor A.W, Engineering Tribology, Butterworth-Heinemann, UK, First Edition, 2005.

2 Rabinowicz.E, Friction and Wear of materials, John Willey &Sona ,New York, Second Edition,1995.

Reference Books :

1 Sudarshan T S, Surface modification technologies - An Engineer's guide, Marcel Dekker, New york, First Edition,1989.

2 Varghese C.D, Electroplating and Other Surface Treatments - A Practical Guide, TMH, New Delhi, First Edition,1993.

3 Williama. J.A, Engineering Tribology, Oxboarduniv. Press, UK, Second Edition,1994.

4 Basu S.K,.Sengupta S.N &Ahuja B.P, Fundamentals of Tribology, Prentice-Hall of India Pvt. Ltd, New Delhi, Second Edition,2005.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME910 **Course Name : SURFACE ENGINEERING**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Demonstrate the lean manufacturing principles to find and eliminate wastes.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2:	Identify the lean manufacturing tools and their potential applications.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3:	Acquire various surface treatment methods for alloy metals	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4:	Describe various surface treatment techniques and its applications	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5:	Explore the corrosion behaviour of engineering materials	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	-	-	-	-	-	-	**-**	**-**	**-**

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

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

EMERGING AREA (SAFETY ENGINEERING)

20ME892 **PRINCIPLES OF SAFETY MANAGEMENT (HONOURS)**

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:	*Analyze the concepts and techniques of safety management functions.*	*.Analyze*
CO2:	*Recall about safety audit and to prepare a report for the audit.*	*Understand*
CO3:	*Acquire knowledge on the principles of accident and its control methods.*	*Understand*
CO4:	*Evaluate the accident cost using supervisors report and data.*	*Understand*
CO5:	*Recall the role of various agencies in safety education and training.*	*Understand*

UNIT – I CONCEPTS AND TECHNIQUES [09]

Content Evolution of modern safety concept - Safety Management functions - planning for safety for optimization of productivity -productivity, quality and safety - line and staff functions for safety - safety committee - budgeting for safety - safety policy - Statutory Provisions for safety management.

Incident Recall Technique (IRT), disaster control, job safety analysis, safety survey, safety inspection, safety sampling, evaluation of performance of supervisors on safety

UNIT – II SAFETY AUDIT - INTRODUCTION [09]

Components of safety audit, types of audit, audit methodology, non conformity reporting (NCR), audit checklist and report - review of inspection, remarks by government agencies, consultants, experts - perusal of accident and safety records, formats - implementation of audit indication - liaison with departments to ensure co-ordination - check list - identification of unsafe acts of workers and unsafe conditions in the shop floor

UNIT – III SAFETY AUDIT - INTRODUCTION [09]

Basic Principle of Accident & Prevention concept of an accident, reportable and non reportable accidents, reporting to statutory authorities - principles of accident prevention - accident investigation and reporting - Accident analysis - based on causes & injury - records for accidents, departmental accident reports, documentation of accidents - unsafe act and condition - Accident causation theories - domino sequence - supervisory role - role of safety committee - cost of accident

UNIT – IV SAFETY AUDIT - INTRODUCTION [09]

ANSI (Z16.1) Recommended practices for compiling and measuring work injury experience - permanent total disabilities, permanent partial disabilities, temporary total disabilities - Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety “t” score, safety activity rate - problems.

UNIT – V SAFETY EDUCATION AND TRAINING [09]

Importance of training - identification of training needs - training methods such as hands on training and tabletop exercise - Programme, seminars, conferences, competitions - method of promoting safe practice – motivation - communication -safety attitude and culture - role of government agencies and private consulting agencies in safety training - creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign - Domestic Safety and Training.

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

Text Books :

1 Heinrich, H.W., Industrial Accident Prevention, McGraw-Hill Company, New York, Fifth Edition, 2019.

2 Krishnan, N.V., Safety Management in Industry, Jaico Publishing House, Bombay, Second Edition, 2017.

Reference Books :

1 Relevant India Acts and Rules, Government of India.

2 Lees, F.P., Loss Prevention in Process Industries, Butterworth publications, London, Second edition, 2001.

3 John Ridley., Safety at Work, Butterworth and Co, London, Seventh Edition, 2003.

4 Blake, R.B., Industrial Safety, Prentice Hall Inc, Delhi, Third Edition, 2009.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME892 **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:	*Analyze the concepts and techniques of safety management functions.*	3	-	2	-	2	3	2	-	2	-	-	2	2	3
CO2:	*Recall about safety audit and to prepare a report for the audit.*	3	-	2	-	2	3	2	-	2	-	-	2	2	3
CO3:	*Acquire knowledge on the principles of accident and its control methods.*	3	-	2	-	2	3	2	-	2	-	-	2	2	3
CO4:	*Evaluate the accident cost using supervisors report and data.*	3	-	2	-	2	3	2	-	2	-	-	2	2	3
CO5:	*Recall the role of various agencies in safety education and training.*	3	-	2	-	2	3	2	-	2	-	-	2	2	3
	Average	**3**	**-**	**2**	**-**	**2**	3	2	-	2	-	-	**2**	**2**	**3**

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

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

EMERGING AREA (SAFETY ENGINEERING)

		L	T	P	C
20ME893	**ENVIRONMENTAL SAFETY (HONOURS)**	3	0	0	3

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

CO1:	*Gain about the air pollution effects and its control.*	*Remember*
CO2:	*Analyze about the water pollutants and its health hazards.*	*Analyze*
CO3:	*Apply the health and safety concepts with respect to hazardous waste management.*	*Apply*
CO4:	*Acquire knowledge on environmental measurement and its control.*	*Understand*
CO5:	*Demonstrate the health and safety practices in controlling risks for different engineering activities.*	*Understand*

UNIT – I AIR POLLUTION [09]

Classification and properties of air pollutants - Pollution sources - Effects of air pollutants on human beings, Animals, Plants and Materials - automobile pollution - hazards of air pollution - concept of clean coal combustion technology - ultra violet radiation, infrared radiation, radiation from sun - hazards due to depletion of ozone - deforestation - ozone holes -automobile exhausts - chemical factory stack emissions - CFC Statutory provisions related to air pollution.

UNIT – II WATER POLLUTION [09]

Classification of water pollutants - health hazards - sampling and analysis of water - water treatment - different industrial effluents and their treatment and disposal - advanced wastewater treatment - effluent quality standards and laws - chemical industries, tannery, textile effluents - common treatment - Statutory provisions related to water pollution.

UNIT – III HAZARDOUS WASTE MANAGEMENT [09]

Hazardous waste management in India - waste identification, characterization and classification technological options for collection, treatment and disposal of hazardous waste - selection charts for the treatment of different hazardous wastes - methods of collection and disposal of solid wastes - health hazards - toxic and radioactive wastes - incineration and vitrification - hazards due to bio-process - dilution standards and restrictions - recycling and reuse - statutory provisions related to hazardous waste management & handling.

UNIT – IV ENVIRONMENTAL MEASUREMENT AND CONTROL [09]

Sampling and analysis - dust monitor - gas analyzer, particle size analyzer - Lux meter - pH meter - gas chromatograph - atomic absorption spectrometer. Gravitational settling chambers - cyclone separators - scrubbers - electrostatic precipitator - bag filter - maintenance - control of gaseous emission by adsorption, absorption and combustion methods -Pollution Control Board - laws.

UNIT – V POLLUTION CONTROL IN PROCESS INDUSTRIES [09]

Pollution control in process industries like cement, paper and petroleum - petroleum products - textile - tanneries thermal power plants - dying and pigment industries - eco-friendly energy

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

Text Books :

1 Rao, C.S. ,Environmental Pollution Engineering, Wiley Eastern Limited, New Delhi, Third Edition, 2020.

2 Varma and Braner, Air Pollution Equipment, Springer Publishers, New Delhi, Second Edition, 2017.

Reference Books :

1 Mahajan, S.P., Pollution Control in Process Industries, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition, 2001.

2 Rao, C.S., Environmental Pollution Engineering, Wiley Eastern Limited, New Delhi, Third Edition, 2020.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME893 **Course Name : ENVIRONMENTAL SAFETY**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Gain about the air pollution effects and its control.*	2	-	2	-	2	3	3	-	2	-	-	2	2	3
CO2:	*Analyze about the water pollutants and its health hazards.*	2	-	2	-	2	3	3	-	2	-	-	2	2	3
CO3:	*Apply the health and safety concepts with respect to hazardous waste management.*	2	-	2	-	2	3	3	-	2	-	-	2	2	3
CO4:	*Acquire knowledge on environmental measurement and its control.*	2	-	2	-	2	3	3	-	2	-	-	2	2	3
CO5:	*Demonstrate the health and safety practices in controlling risks for different engineering activities.*	2	-	2	-	2	3	3	-	2	-	-	2	2	3
	Average	**2**	**-**	**2**	**-**	**2**	**3**	**3**	**-**	**2**	**-**	-	**2**	**2**	**3**

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

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

EMERGING AREA (SAFETY ENGINEERING)

		L	T	P	C
20ME894	**ELECTRICAL SAFETY (HONOURS)**	3	0	0	3

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

CO1:	*Familiarize the basic concepts in electrical circuit and hazards involved in it.*	*Remember*
CO2:	*Analyze the different types of electrical hazards in industries*	*. Analyze*
CO3:	*Acquire knowledge about the different types of protection systems.*	*Understand*
CO4:	*Apply the knowledge in the selection, installation, operation and maintenance of portable tools*	*. Apply*
CO5:	*Classify the different hazardous zones in Industries.*	*Understand*

UNIT – I CONCEPTS AND STATUTORY REQUIREMENTS [09]

Introduction - electrostatics, electro magnetism, stored energy, energy radiation and electromagnetic interference - Working principles of electrical equipment - Indian electricity act and rules - statutory requirements from electrical inspectorate - International standards on electrical safety - first aid - cardio pulmonary resuscitation(CPR).

UNIT – II ELECTRICAL HAZARDS [09]

Primary and secondary hazards - shocks, burns, scalds, falls - human safety in the use of electricity.
Energy leakage - clearances and insulation - classes of insulation - voltage classifications - excess energy - current surges - Safety in handling of war equipments - over current and short circuit current - heating effects of current - electromagnetic forces - corona effect - static electricity - definition, sources, hazardous conditions, control, electrical causes of fire and explosion - ionization, spark and arc-ignition energy - national electrical safety code ANSI.High voltage Hazards,
Lightning, hazards, lightning arrestor, installation - earthing, specifications, earth resistance, earth pit maintenance.

UNIT – III PROTECTION SYSTEMS [09]

Fuse, circuit breakers and overload relays - protection against over voltage and under voltage - safe limits of amperage – voltage - safe distance from lines - capacity and protection of conductor - joints and connections, overload and short circuit protection - no load protection - earth fault protection.
FRLS insulation - insulation and continuity test - system grounding - equipment grounding - earth leakage circuit breaker (ELCB) - cable wires - maintenance of ground - ground fault circuit interrupter - use of low voltage - electrical guards - Personal protective equipment - safety in handling hand held electrical appliances tools and medical equipments.

UNIT – IV SELECTION, INSTALLATION, OPERATION AND MAINTENANCE [09]

Role of environment in selection - safety aspects in application - protection and interlock - self diagnostic features and fail safe concepts - lock out and work permit system - discharge rod and earthing devices - safety in the use of portable tools - cabling and cable joints - preventive maintenance.

UNIT – V HAZARDOUS ZONES [09]

Classification of hazardous zone - Intrinsically safe and explosion proof electrical apparatus - increase safe equipment -their selection for different zones - temperature classification - grouping of gases - use of barriers and isolators -equipment certifying agencies.

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

Text Books :

1 Dr.Massim A.G. Mitolo., Electrical safety of Low voltage systems, Mc Graw Hill, Second Edition, 2009
2 Accident prevention manual for industrial operations, N.S.C., Chicago, Third edition, 2008.

Reference Books :

1 Fordham Cooper, W., Electrical Safety Engineering., Butterworth and Company, London, Third edition,2002
2 Indian Electricity Act and Rules, Government of India, 2003
3 Power Engineers – Handbook of TNEB, Chennai, 1989.
4 Martin Glove Electrostatic Hazards in powder handling, Research Studies Pvt Ltd., England, Second Edition,1988.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME894 **Course Name : ELECTRICAL SAFETY**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Familiarize the basic concepts in electrical circuit and hazards involved in it.*	3	-	-	-	2	3	2	-	2	-	2	2	2	3
CO2:	*Analyze the different types of electrical hazards in industries*	3	-	-	-	2	3	2	-	2	-	2	2	2	3
CO3:	*Acquire knowledge about the different types of protection systems.*	3	-	-	-	2	3	2	-	2	-	2	2	2	3
CO4:	*Apply the knowledge in the selection, installation, operation and maintenance of portable tools*	3	-	-	-	2	3	2	-	2	-	2	2	2	3
CO5:	*Classify the different hazardous zones in Industries.*	3	-	-	-	2	3	2	-	2	-	2	2	2	3
	Average	**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) **R 2020**

EMERGING AREA (SAFETY ENGINEERING)

20ME895 **SAFETY IN TEXTILE INDUSTRY (HONOURS)**

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 about the basic concepts of textile process and its safety*	*. Understand*
CO2:	*Acquire knowledge on hazards in sizing processes, looms and knitting machines.*	*Understand*
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 [9]

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 [9]

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 [9]

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

UNIT – IV HEALTH AND WELFARE [9]

Health hazards in textile industry related to dust fly and noise generation - 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 [9]

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

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

Text Books :

1 Safety in Textile Industry, Thane Belapur Industries Association, Mumbai,Fifth Edition, 2010.

2 Groover and Henry, D.S., Hand book of textile testing and quality control, New Delhi, Ninth Edition, 2013.

Reference Books :

1 100 Textile fibres - analysis, findings and recommendations LPA, 1989.

2 Quality tolerances for water for textile industry, BIS, Second Revision, 1982.

3 Shenai, V.A., A technology of textile processing, Vol. I, Textile Fibers, Third Edition, 1972.

4 Little, A.H., Water supplies and the treatment and disposal of effluent.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME895 **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:	*Familiarize about the basic concepts of textile process and its safety*	2	-	-	-	2	2	2	-	2	-	2	2	2	3
CO2:	*Acquire knowledge on hazards in sizing processes, looms and knitting machines.*	2	-	-	-	2	2	2	-	2	-	2	2	2	3
CO3:	*Demonstrate on various types of mechanical finishing operations.*	2	-	-	-	2	2	2	-	2	-	2	2	2	3
CO4:	*Analyze about the health and welfare measures in textile industry.*	2	-	-	-	2	2	2	-	2	-	2	2	2	3
CO5:	*Apply the relevant provisions of factories act and rules applicable to textile industry*	2	-	-	-	2	2	2	-	2	-	2	2	2	3
	Average	**2**	**-**	**-**	**-**	**2**	**2**	**2**	**-**	**2**	**-**	**2**	**2**	**2**	**3**

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

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

EMERGING AREA (SAFETY ENGINEERING)

		L	T	P	C
20ME896	**SAFETY IN CHEMICAL INDUSTRIES (HONOURS)**	3	0	0	3

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

CO1:	*Acquire knowledge on Chemical plant design, process, facilities and inherent safe design.*	*Understand*
CO2:	*Explore the commissioning phases and their documentation*	*.Understand*
CO3:	*Analyze the operating procedures and emergency procedures during plant operations.*	*Analyze*
CO4:	*Apply the concepts of plant maintenance, modification and emergency planning.*	*Apply*
CO5:	*Classify the different types of chemical storages and their safety measures.*	*Remember*

UNIT – I SAFETY IN PROCESS DESIGN AND PRESSURE SYSTEM [09]

Design process, conceptual design and detail design, assessment, inherently safer design - chemical reactor, types, batch reactors, reaction hazard evaluation, assessment, reactor safety, operating conditions, unit operations and equipments, utilities. Pressure system, pressure vessel design, standards and codes - pipe works and valves, heat exchangers - process machinery - over pressure protection, pressure relief devices and design, fire relief, vacuum and thermal relief, special situations and disposal - flare and vent systems - failures in pressure system.

UNIT – II PLANT COMMISSIONING AND INSPECTION [09]

Commissioning phases and organization, pre-commissioning documents, process commissioning, commissioning problems, post commissioning documentation Plant inspection, pressure vessel, pressure piping system, non destructive testing, pressure testing, leak testing and monitoring - plant monitoring, performance monitoring, condition, vibration, corrosion, acoustic emission - pipe line inspection.

UNIT – III PLANT OPERATIONS [09]

Operating discipline, operating procedure and inspection, format, emergency procedures - hand over and permit system - start up and shut down operation, refinery units - operation of fired heaters, driers, storage - operating activities and hazards - trip systems - exposure of personnel.

UNIT – IV PLANT MAINTENANCE, MODIFICATION AND EMERGENCY PLANNING [09]

Management of maintenance, hazards - preparation for maintenance, isolation, purging, cleaning, confined spaces, permit system - maintenance equipment - hot works - tank cleaning, repair and demolition - online repairs - maintenance of protective devices, modification of plant, problems - controls of modifications. Emergency planning, disaster planning, onsite emergency - offsite emergency, APELL.

UNIT – V STORAGES [09]

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, pressure storages, layout, instrumentation, vaporizer, refrigerated storages - LNG storages, hydrogen storages, toxic storages, chlorine storages, ammonia storages, other chemical storages - underground storages - loading and unloading facilities - drum and cylinder storage - ware house, storage hazard assessment of LPG and LNG.

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

Text Books :

1 Lees, F.P., Loss Prevention in Process Industries, Butterworths and Company, U.S., Fourth Edition, 2012.

2 Fawcett, H.H. and Wood, Safety and Accident Prevention in Chemical Operations, Wiley inters, U.S., Second Edition, 2008.

Reference Books :

1 Quantitative Risk Assessment in Chemical Process Industries, American Institute of Chemical Industries, Centre for Chemical Process safety, U.S., Second Edition,1999.

2 Accident Prevention Manual for Industrial Operations, NSC, Chicago, Third edition, 2008.

3 GREEN, A.E., High Risk Safety Technology, John Wiley and Sons, U.K., Second Edition, 2003.

4 Petroleum Act and Rules, Government of India.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME896 **Course Name : SAFETY IN CHEMICAL INDUSTRIES**

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 Chemical plant design, process, facilities and inherent safe design.*	2	-	-	-	2	3	2	-	-	-	2	2	2	3
CO2:	*Explore the commissioning phases and their documentation*	2	-	-	-	2	3	2	-	-	-	2	2	2	3
CO3:	*Analyze the operating procedures and emergency procedures during plant operations.*	2	-	-	-	2	3	2	-	-	-	2	2	2	3
CO4:	*Apply the concepts of plant maintenance, modification and emergency planning.*	2	-	-	-	2	3	2	-	-	-	2	2	2	3
CO5:	*Classify the different types of chemical storages and their safety measures.*	2	-	-	-	2	3	2	-	-	-	2	2	2	3
	Average	**2**	**-**	**-**	**-**	**2**	**3**	**2**	**-**	**-**	**-**	**2**	**2**	**2**	**3**

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

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

EMERGING AREA (SAFETY ENGINEERING)

		L	T	P	C
20ME897	**SAFETY IN ENGINEERING INDUSTRY (HONOURS)**	3	0	0	3

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

CO1:	*Determine 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:	*Recall 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 [10]

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, work area, material handling, inspection, standards and codes - saws, types, Hazards.

UNIT - II SAFETY IN DESIGN, USE & MAINTENANCE OF MACHINES [10]

Basic Principle of Machine guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS - guarding of hazards - point of operation protective devices, 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-authorized entry to hazardous installations - benefits of good guarding systems – introduction to sensors, instrumentation - types and measurement.

UNIT - III SAFETY IN WELDING AND GAS CUTTING [8]

Gas welding and oxygen cutting, resistances 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 - flashback arrestor - leak detection - pipe line safety - storage and handling of gas cylinders.

UNIT - IV SAFETY IN COLD FARMING AND HOT WORKING OF METALS [10]

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, foundry production cleaning and finishing foundry processes.

UNIT - V SAFETY IN FINISHING, INSPECTION AND TESTING [7]

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, engineering and administrative controls, Indian Boilers Regulation. Health and welfare measures in engineering industry - pollution control in engineering industry - industrial waste disposal.

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

Text Books :

1 Accident Prevention Manual, NSC, Chicago, Third Edition, 2008.
2 Safety in the use of wood working machines, HSE, UK, Second Edition, 2005.

Reference Books :

1 Occupational Safety Manual, BHEL, Trichy, Second Edition, 1988.
2 Krishnan, N.V., Safety in Industry, Jaico Publishers House, London, Fourth Edition, 1996.
3 Health and Safety in Welding and Allied Processes, Welding Institute, UK, High Tech. Publishing Ltd., London, Fifth Edition, 1989

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME897 **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:	*Determine the General safety rules, principles, maintenance, Inspections of metal and wood working machinery*	2	-	-	-	2	3	2	-	2	-	2	2	2	3
CO2:	*Apply the concepts of safety in design, use and maintenance of machines.*	2	-	-	-	2	3	2	-	2	-	2	2	2	3
CO3:	*Recall about welding, common hazards in welding, personal protective equipment and safety precautions in welding.*	2	-	-	-	2	3	2	-	2	-	2	2	2	3
CO4:	*Analyze the safety in cold working and hot working of metals.*	2	-	-	-	2	3	2	-	2	-	2	2	2	3
CO5:	*Acquire knowledge on safety in finishing, inspection and testing of machines.*	2	-	-	-	2	3	2	-	2	-	2	2	2	3
	Average	**2**	**-**	**-**	**-**	**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**

EMERGING AREA (ADVANCED MANUFACTURING)

		L	T	P	C
20ME898	**ADVANCES IN MANUFACTURING PROCESSES (HONOURS)**	3	0	0	3

Prerequisite:

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

CO1:	Analyze the processes and evaluate the role of each process parameter during machining of various advanced materials	*Analyzing*
CO2:	Understand requirements to achieve maximum material removal rate and best quality of machined surface while machining various industrial engineering materials.	*Understanding*
CO3:	Analyze the different bulk metal forming process mechanics using different analysis	*Analyzing*
CO4:	Acquire the knowledge in mechanical micromachining processes.	*Remembering*
CO5:	Demonstrate the knowledge of Additive Manufacturing and Rapid Prototyping Technologies	*Understanding*

UNIT - I ENERGY ASSISTED MANUFACTURING PROCESSES [09]

Introduction – mechanism of materials removal and operating parameters of: Plasma Arc Machining – Laser Beam Machining – Electron Beam Machining – Electrical Discharge Machining – Ultrasonic Machining – Water Jet Machining – Abrasive water jet Machining – Abrasive jet Machining – Ion Beam Machining

UNIT - II PRECISION MACHINING [09]

. Electro chemical Machining- Ultra Precision turning and grinding- Chemical Mechanical Polishing (CMP) - ELID process – Partial ductile mode grinding-Ultra precision grinding- Binderless wheel – Free form optics. aspherical surface generation Grinding wheel- Design and selection of grinding wheel-High-speed grinding-High-speed milling- Diamond turning.

UNIT - III ADVANCES IN METAL FORMING [09]

Orbital forging, Isothermal forging, Warm forging, Overview of Powder Metal techniques –Hot and Cold isostatic pressing - high speed extrusion, rubber pad forming, Hydroforming, Superplastic forming, Peen forming-micro blanking –Powder rolling – Tooling and process parameters.

UNIT - IV MICRO MACHININING AND NANO FABRICATION [09]

Theory of micromachining – Micromachining Processes – Micro-milling – Micro-drilling – Micro-turning – Micro-grinding – Micro-polishing – Principle of Micro EDM – Micro wire EDM – Planetary Micro EDM – Reverse Micro EDM – Advantages, Challenges. Nano fabrication process - Nano machining techniques – Top / Bottom up Nano fabrication techniques - Sub micron lithographic technique, conventional film growth technique, Chemical etching, Quantum dot fabrication techniques – MOCVD – Epitaxy techniques.

UNIT - V RAPID PROTOTYPING AND SURFACE MODIFICATION TECHNIQUES [09]

Introduction – Classification – Principle advantages limitations and applications- Rapid Prototyping - Rapid Manufacturing - Rapid Tooling and Future Rapid Prototyping Processes -Stereolithography (SLA) – 3D Printing (3DP) – Selective Laser Sintering (SLS) – Laminated Object Manufacturing (LOM) – Fused Deposition Modelling (FDM) Introduction, Process descriptions, Materials, process variations, economic considerations, applications, design aspects and quality issues – CVD – PVD – Electroplating – Hot Dip Coating – Thermal Spraying.

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

Text Books :

1 Narayanaswamy, R., Theory of Metal Forming Plasticity, Narosa Publishers, 2020.

2 Benedict,G.F.,"Non Traditional manufacturing Processes",CRC press,2011

Reference Books :

1 Madou, M.J., Fundamentals of Micro fabrication: The Science of Miniaturization, Second Edition, CRC Press (ISBN: 0849308267),2006

2 McGeough,J.A.,"Advanced methods of Machining",Springer,2011

3 Pandey, P.S. and Shah.N., “Modern Manufacturing Processes”, Tata McGraw Hill, 2017.

4 Serope Kalpakjian., “Manufacturing Engineering and Technology” Pearson Education,2018

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME898 **Course Name : ADVANCES IN MANUFACTURING PROCESSES**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Analyze the processes and evaluate the role of each process parameter during machining of various advanced materials	2	-	2	-	3			-	2	-	2	2	3	2
CO2:	Understand requirements to achieve maximum material removal rate and best quality of machined surface while machining various industrial engineering materials.	2	-	2	-	3			-	2	-	2	2	3	2
CO3:	Analyze the different bulk metal forming process mechanics using different analysis	2	-	2	-	3			-	2	-	2	2	3	2
CO4:	Acquire the knowledge in mechanical micromachining processes.	2	-	2	-	3			-	2	-	2	2	3	2
CO5:	Demonstrate the knowledge of Additive Manufacturing and Rapid Prototyping Technologies	2	-	2	-	3			-	2	-	2	2	3	2
	Average	**2**		**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**

EMERGING AREA (ADVANCED MANUFACTURING)

		L	T	P	C
20ME899	**ADVANCED MATERIALS ENGINEERING (HONOURS)**	3	0	0	3

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

CO1:	*Comprehend the construction of composite materials*	*.Understand*
CO2:	*Develop the production process of polymer matrix composites.*	*Analyze*
CO3:	*Acquire to build the different manufacturing methods.*	*Understand*
CO4:	*Explore the shape memory alloys and applications.*	*Understand*
CO5:	Discover the nano materials and applications.	*Analyze*

UNIT – I INTRODUCTION [09]

INTRODUCTION TO COMPOSITE MATERIALS: Introduction, classification: polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon–carbon composites, fiber reinforced composites and nature-made composites, and applications.

REINFORCEMENTS: Fibres- glass, silica, kevlar, carbon, boron, silicon carbide, and born carbide fibres.

UNIT – II POLYMER MATRIX COMPOSITE [09]

Polymer composites, thermoplastics, thermosetting plastics, manufacturing of PMC, MMC & CCC and their applications.

UNIT – III MANUFACTURING METHODS [09]

Autoclave, tape production, moulding methods, filament winding, hand layup, pultrusion, RTM.

UNIT – IV SHAPE MEMORY ALLOYS [09]

FUNCTIONALLY GRADED MATERIALS: Types of functionally graded materials-classification different systems-preparation-properties and applications of functionally graded materials.

SHAPE MEMORY ALLOYS: Introduction-shape memory effect-classification of shape memory alloys composition-properties and applications of shape memory alloys.

UNIT – V NANO MATERIALS [09]

Introduction-properties at nano scales-advantages & disadvantages-applications in comparison with bulk materials (nano – structure, wires, tubes, composites). State of art nano advanced- topic delivered by student.

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

Text Books :

1 Mechanics of Composite Materials / R. M. Jones/ Mc Graw Hill Company, New York, 2015.

2 Analysis and performance of fibre Composites /B. D. Agarwal and L. J. Broutman /Wiley-Interscience, New York, 1980

Reference Books :

1 Analysis of Laminated Composite Structures / L. R. Calcote/Van Nostrand Rainfold,NY 1969

2 Mechanics of Composite Materials – Second Edition (Mechanical Engineering) /Autar K.Kaw / CRC Press

3 Nano material /A.K. Bandyopadyay, New age Publishers.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME899 **Course Name : ADVANCED MATERIALS ENGINEERING**

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 construction of composite materials*	2	-	2	-	3	-	-	-	2	-	2	-	3	2
CO2:	*Develop the production process of polymer matrix composites.*	2	-	2	-	3	-	-	-	2	-	2	-	3	2
CO3:	*Acquire to build the different manufacturing methods.*	2	-	2	-	3	-	-	-	2	-	2	-	3	2
CO4:	*Explore the shape memory alloys and applications.*	2	-	2	-	3	-	-	-	2	-	2	-	3	2
CO5:	Discover the nano materials and applications.	2	-	2	-	3	-	-	-	2	-	2	-	3	2
	Average	**2**		**2**	**-**	**3**	**-**	**-**	**-**	**2**	**-**	**2**	**-**	**3**	**2**

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

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

EMERGING AREA (ADVANCED MANUFACTURING)

20ME911 **MATERIALS TESTING AND CHARACTERIZATION TECHNIQUES (HONOURS)**

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:	Knowledgeable in microstructure evaluation & crystal structure analysis.	*Understand*
CO2:	Gain knowledge in electron microscopy.	*Understand*
CO3:	Discover the Chemical and Thermal Analysis,.	*Analyze*
CO4:	Examine the static mechanical testing methods.	*Analyze*
CO5:	Inspect the dynamic mechanical testing methods.	*Analyze*

UNIT – I MICRO AND CRYSTAL STRUCTURE ANALYSIS [09]

Principles of Optical Microscopy – Specimen Preparation Techniques – Polishing and Etching – Polarization Techniques – Quantitative Metallography – Estimation of grain size – ASTM grain size numbers – Microstructure of Engineering Materials - Elements of Crystallography – X- ray Diffraction – Bragg's law – Techniques of X-ray Crystallography – Debye – Scherer camera – Geiger Diffractometer – analysis of Diffraction patterns – Inter planer spacing – Identification of Crystal Structure, Elements of Electron Diffraction.

UNIT – II ELECTRON MICROSCOPY [09]

Interaction of Electron Beam with Materials – Transmission Electron Microscopy – Specimen Preparation – Imaging Techniques – BF & DF – SAD – Electron Probe Microanalysis – Scanning Electron Microscopy – Construction & working of SEM – various Imaging Techniques – Applications-Atomic Force Microscopy- Construction & working of AFM - Applications .

UNIT – III CHEMICAL AND THERMAL ANALYSIS [09]

Basic Principles, Practice and Applications of X-Ray Spectrometry, Wave Dispersive X-Ray Spectrometry, Auger Spectroscopy, Secondary Ion Mass Spectroscopy, Fourier Transform Infra Red Spectroscopy (FTIR)- Proton Induced X-Ray Emission Spectroscopy, Differential Thermal Analysis, Differential Scanning Calorimetry (DSC) And Thermo Gravitymetric Analysis (TGA).

UNIT – IV MECHANICAL TESTING – STATIC TESTS [09]

Hardness – Brinell, Vickers, Rockwell and Micro Hardness Test – Tensile Test – Stress – Strain plot – Proof Stress – Torsion Test - Ductility Measurement – Impact Test – Charpy & Izod – DWTT - Fracture Toughness Test, Codes and standards for testing metallic and composite materials.

UNIT – V MECHANICAL TESTING – DYNAMIC TESTS [09]

Fatigue – Low & High Cycle Fatigues – Rotating Beam & Plate Bending HCF tests – S-N curve – LCF tests – Crack Growth studies – Creep Tests – LM parameters – AE Tests-modal analysis - Applications of Dynamic Tests.

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

Text Books :

1. Davis J. R., Tensile Testing, ASM International,Second edition, 2004.
2. Dieter G.E., Mechanical Metallurgy, ISBN: 0070168938, McGraw Hill,Third edition, 1988.

Reference Books :

1 ASM Hand book-Materials characterization, Vol – 10, 2004.
2. Culity B.D., Stock S.R& Stock S., Elements of X ray Diffraction, Prentice Hall, Third Edition,2001.
3. Davis, H.E., Hauck G. & Troxell G.E., The Testing of engineering Materials, McGraw Hill, College Divn,Fourth Edition, 1982.
4. Grundy P.J. and Jones G.A., Electron Microscopy in the Study of Materials, Edward Arnold Limited, 1976.
5. Morita.S, Wiesendanger.R, and Meyer.E, "Non-contact Atomic Force Microscopy" Springer, 2002.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME911 Course Name : MATERIALS TESTING AND CHARACTERIZATION TECHNIQUES

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Knowledgeable in microstructure evaluation & crystal structure analysis.	2	2	2	-	3	-	-	-	2	-	3	-	3	2
CO2:	Gain knowledge in electron microscopy.	2	2	2	-	3	-	-	-	2	-	3	-	3	2
CO3:	Discover the Chemical and Thermal Analysis,.	2	2	2	-	3	-	-	-	2	-	3	-	3	2
CO4:	Examine the static mechanical testing methods.	2	2	2	-	3	-	-	-	2	-	3	-	3	2
CO5:	Inspect the dynamic mechanical testing methods.	2	2	2	-	3	-	-	-	2	-	3	-	3	2
	Average	**2**	**2**	**2**	**-**	**3**	**-**	**-**	**-**	**2**	**-**	**3**	**-**	**3**	**2**

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

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

EMERGING AREA (ADVANCED MANUFACTURING)

20ME912 **ADVANCED METROLOGY AND NON DESTRUCTIVE TESTING (HONOURS)**

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:	Demonstrate techniques used to quantify and comparison of products to required standards.	*Understand*
CO2:	Conversant with the newer technologies used in metrology.	*Understand*
CO3:	Design procedures which will incorporate quality in the product as per the customer's needs.	*Create*
CO4:	Demonstrate his or her knowledge in developing control mechanism to check variation in attributes and variables.	*Understand*
CO5:	Select suitable ND testing method for the contemporary issues.	*Remember*

UNIT – I INTRODUCTION [09]

Measuring Machines - Tool Maker's microscope - Co-ordinate measuring machines - Universal measuring machine - Laser viewers for production profile checks - Images shearing microscope- Use of computers- Machine vision technology - Microprocessors in metrology.

UNIT – II STATISTIAL QUALITY CONTROL [09]

Statistical Quality Control - Data presentation - Statistical measures and tools - Process capability - Confidence and tolerance limits - Control charts for variables and for fraction defectives - Theory of probability - Sampling - ABC standard - reliability and life testing.

UNIT – III BASIC NDT TESTS [09]

Liquid penetrants and magnetic particle tests - characteristics of liquid penetrants - different washable systems - Developers - applications - method of production of magnetic fields - Principles of operation of magnetic particle test - applications - Advantages and limitations.

UNIT – IV RADIOGRAPY [09]

Radiography - Sources of ray - x- ray production - properties of d and x rays - film characteristics – exposure charts- contrasts-operational characteristics of x ray equipment - applications.

UNIT – V ULTRASONIC TESTING METHODS [09]

Ultrasonic and acoustic emission techniques - Production of ultrasonic waves - different types of waves - general characteristics of waves - pulse echo method -A, B, C scans -Principles of acoustics emission technique - Advantage and limitations - Instrumentation – applications.

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

Text Books :

1 Jain,R.K."Engineering Metrology ", Khanna Publishers, 2019.

2 Barry Hull and Vernon John ," Non Destructive Testing ", Mac Millan, 2019

Reference Books :

1 American Society for Metals ,"Metals Hand Book ", Vol II ,1976.

2 Progress in Acoustics Emission, " Proceedings of 10th International Acoustics Emission Symposium ", Japanese Society for NDI,1990.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME912 **Course Name** : **ADVANCED METROLOGY AND NON DESTRUCTIVE TESTING**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Demonstrate techniques used to quantify and comparison of products to required standards.	2	2	3	3	3	-	-	-	2	-	3	-	3	2
CO2:	Conversant with the newer technologies used in metrology.	2	2	3	3	3	-	-	-	2	-	3	-	3	2
CO3:	Design procedures which will incorporate quality in the product as per the customer's needs.	2	2	3	3	3	-	-	-	2	-	3	-	3	2
CO4:	Demonstrate his or her knowledge in developing control mechanism to check variation in attributes and variables.	2	2	3	3	3	-	-	-	2	-	3	-	3	2
CO5:	Select suitable ND testing method for the contemporary issues.	2	2	3	3	3	-	-	-	2	-	3	-	3	2
	Average	**2**	**2**	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**3**	**-**	**3**	**2**

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

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

EMERGING AREA (ADVANCED MANUFACTURING)

20ME913 **OPTIMIZATION TECHNIQUES IN MANUFACTURING (HONOURS)**

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:	Introduce the various optimization techniques.	*Understand*
CO2:	*Develop the classic optimization techniques*	*Apply*
CO3:	*Apply the non linear programming methods in optimum design*	*Apply*
CO4:	*Construct the dynamic programming and network techniques.*	*Apply*
CO5:	Apply the algorithms and simulation.	*Apply*

UNIT – I INTRODUCTION [09]

Optimization – Historical Development – Engineering applications of optimization – Statement of an Optimization problem – classification of optimization problems.

UNIT – II CLASSIC OPTIMIZATION TECHNIQUES [09]

Linear programming - Graphical method – simplex method – dual simplex method – revised simplex method – duality in LP – Parametric Linear programming – Goal Programming.

UNIT – III NON-LINEAR PROGRAMMING [09]

Introduction – Lagrangeon Method – Kuhn-Tucker conditions – Quadratic programming – Separable programming – Stochastic programming – Geometric programming.

UNIT – IV INTEGER PROGRAMMING AND DYNAMIC PROGRAMMING AND NETWORK TECHNIQUES [09]

Integer programming - Cutting plane algorithm, Branch and bound technique, Zero-one implicit enumeration – Dynamic Programming – Formulation, Various applications using Dynamic Programming. Network Techniques – Shortest Path Model – Minimum Spanning Tree Problem – Maximal flow problem.

UNIT – V ADVANCES IN SIMULATION [09]

Genetic algorithms – simulated annealing – Neural Network and Fuzzy systems

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

Text Books :

1 R. Panneerselvam, “Operations Research”, Prentice Hall of India Private Limited, New Delhi 1, 2015

2 P.K. Guptha and Man-Mohan, Problems in Operations Research , Sultan chand & Sons, 1994

Reference Books :

1 Hamdy A. Taha, Operations Research – An Introduction, Prentice Hall of India, 1997

2 J.K.Sharma, Operations Research – Theory and Applications – Macmillan India Ltd., 1997

3 Ravindran, Philips and Solberg, Operations Research Principles and Practice, John Wiley & Sons, Singapore, 1992

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME913 **Course Name : OPTIMIZATION TECHNIQUES 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:	Introduce the various optimization techniques.	2	3	2	3	2	-	-	-	2	-	3	-	3	2
CO2:	*Develop the classic optimization techniques*	2	3	2	3	2	-	-	-	2	-	3	-	3	2
CO3:	*Apply the non linear programming methods in optimum design*	2	3	2	3	2	-	-	-	2	-	3	-	3	2
CO4:	*Construct the dynamic programming and network techniques.*	2	3	2	3	2	-	-	-	2	-	3	-	3	2
CO5:	Apply the algorithms and simulation.	2	3	2	3	2	-	-	-	2	-	3	-	3	2
	Average	**2**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**3**	**-**	**3**	**2**

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

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

EMERGING AREA (ADVANCED MANUFACTURING)

		L	T	P	C
20ME914	**SMART MANUFACTURING (HONOURS)**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Appreciate concepts and basic framework necessary for smart manufacturing	*Remembering*
CO2:	Illustrate current trends at system level in manufacturing organizations	*Understanding*
CO3:	Use of Sensors and Selection of sensors for various applications	*Remembering*
CO4:	Construct IoT based manufacturing systems	*Applying*
CO5:	Discover the importance of industry 4.0 concepts at manufacturing systems	*Analyzing*

UNIT - I SENSORS SMART MANUFACTURING [09]

Introduction – Role of sensors in manufacturing automation – operation principles of different sensors – electrical, optical, acoustic, pneumatic, magnetic, electro-optical and vision sensors. Condition monitoring of manufacturing systems – principles – sensors for monitoring force, vibration and noise, selection of sensors and monitoring techniques. Automatic identification techniques for shop floor control – optical character and machine vision sensors – smart / intelligent sensors – integrated sensors, Robot sensors, Micro sensors, Nano sensors.

UNIT - II DATA ANALYTICS [09]

Introduction to Data and Analytics in a Digital Context (Internet of Things), Product Data Management for Design and Manufacturing (PLM Tools), Typical data challenges (data quality, enrichment, integration of ERP & PLM data), Preparing data for analytics (techniques to improve data quality, integration - ETL)

Advances in data visualization & related tools-Statistical Techniques for Analytics, Descriptive Statistics Inferential statistics, Regression and ANOVA

UNIT - III CYBER PHYSICAL SYSTEMS [09]

Concept of Cyber Physical Systems (CPS) and Cyber Physical Production System (CPPS), System Architecture for implementation of CPPS, Components for CPPS, Communication for CPPS

UNIT - IV E- MANUFACTURING [09]

Introduction of Agent based manufacturing- agent based Manufacturing, Cloud Based Manufacturing Information technology-based Supply chain, Concept of agile manufacturing and E-manufacturing

UNIT - V INDUSTRY 4.0 [09]

Evaluation of industries, Introduction to Industry 4.0, Challenges in industry 4.0, Impact of Industry 4.0, Case studies on industry 4.0, Introduction to Internet of Things (IoT) and its applications, Smart supply chain and Case studies.

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

Text Books :

1 M. P. Grover “Automation, Production Systems and Computer-Integrated Manufacturing” Pearson Education, Fourth Edition, 2016, ISBN: 978-0133499612

2 S. K. Saha, Introduction to Robotics, Tata Mcgraw Hill Education Private Limited, Second Edition, ISBN: 978-9332902800

Reference Books :

1 Bahga and V. Madisetti, Internet of Things, A hands-on approach, Create Space Independent Publishing Platform, 1st edition, 2014, ISBN: 978-0996025515

2 S. Jeschke, C. Brecher, H. Song, and D. B. Rawat, Industrial Internet of Things: Cyber manufacturing Systems, Springer, 1st edition, 2017, ISBN: 978-3319425580

3 M. Skilton and F. Hovsepian, The 4th Industrial Revolution: Responding to the Impact of Artificial Intelligence on Business, Springer Nature, 2017, ISBN: 978-3-319-62479-2

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

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME914 **Course Name : SMART MANUFACTURING**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Appreciate concepts and basic framework necessary for smart manufacturing	2	-	2	-	3	-	-	-	2	-	3	2	3	2
CO2:	Illustrate current trends at system level in manufacturing organizations	2	-	2	-	3	-	-	-	2	-	3	2	3	2
CO3:	Use of Sensors and Selection of sensors for various applications	2	-	2	-	3	-	-	-	2	-	3	2	3	2
CO4:	Construct IoT based manufacturing systems	2	-	2	-	3	-	-	-	2	-	3	2	3	2
CO5:	Discover the importance of industry 4.0 concepts at manufacturing systems	2	-	2	-	3	-	-	-	2	-	3	2	3	2
	Average	**2**	**-**	**2**	**-**	**3**	**-**	**-**	**-**	**2**	**-**	**3**	**2**	**3**	**2**

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

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

VALUE ADDED COURSE

		L	T	P	C
20MEV01	**REVERSE ENGINEERING**	1	0	0	1

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

CO1: Outline the reverse engineering principles and how they apply to mechanical systems. *Understand*

CO2: function the design and materials of mechanical systems and reconstruct them using CAD software *Analyze*

Contents:

- Introduction to Reverse Engineering
- Basic Mechanical Systems
- Measurement and Documentation
- Disassembly and Inspection
- Reverse Engineering Software
- Tolerancing and Fit Analysis
- Design Intent and Function Analysis
- Project

Total = 15 Hours

Regulation : R2020

Course code : 20MEV01

Course Name : REVERSE ENGINEERING

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Outline the reverse engineering principles and how they apply to mechanical systems.	3	2	3	2	-	-	-	-	2	-	3	-	3	3
CO2	function the design and materials of mechanical systems and reconstruct them using CAD software	3	2	3	2	-	-	-	-	2	-	3	-	**3**	**3**
	Average	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**3**	**-**	**3**	**3**

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

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

VALUE ADDED COURSE

		L	T	P	C
20MEV02	**INTRODUCTION TO OIL AND GAS ENGINEERING**	1	0	0	1

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

CO1: Illustrate solid foundation in oil and gas engineering concepts *Understand*

CO2: Impart knowledge about the basics of drilling engineering ,production engineering, Oil and Gas Processing. *Understand*

Contents:

- Overview of the Oil and Gas Industry
- Exploration and Production
- Reservoir Engineering
- Drilling Engineering
- Production Engineering
- Oil and Gas Processing
- Health, Safety, and Environment (HSE) in Oil and Gas
- Project

Total = 15 Hours

Regulation : R2020

Course code : 20MEV02

Course Name : INTRODUCTION TO OIL AND GAS ENGINEERING

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Illustrate solid foundation in oil and gas engineering concepts	3	2	2	2	-	2	-	-	2	-	2	-	3	3
CO2	Impart knowledge about the basics of drilling engineering, production engineering, Oil and Gas Processing.	3	2	2	2	-	2	-	-	2	-	2	-	**3**	**3**
	Average	**3**	**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

		L	T	P	C
20MEV03	**GREEN MANUFACTURING: CONCEPTUAL DESIGN AND ITS PRACTICES**	1	0	0	1

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Foundational understanding of sustainable manufacturing principles and practices	*Understand*
CO2:	Equip knowledge and skills necessary to implement sustainable manufacturing practices in their future careers	*Understand*

Contents:

- Introduction to Green Manufacturing
- Sustainable Design Principles
- Green Materials and Processes
- Energy Efficiency in Manufacturing
- Waste Reduction and Resource Efficiency
- Green Supply Chain Management
- Sustainable Manufacturing Practices
- Project

Total = 15 Hours

Regulation : R2020

Course code : 20MEV03

Course Name : GREEN MANUFACTURING: CONCEPTUAL DESIGN AND ITS PRACTICES

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Foundational understanding of sustainable manufacturing principles and practices	3	-	2	-	-	2	3	-	-	-	2	-	2	2
CO2	Equip knowledge and skills necessary to implement sustainable manufacturing practices in their future careers	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**

VALUE ADDED COURSE

		L	T	P	C
20MEV04	**LOGISTICS AND SUPPLY CHAIN NETWORKS**	1	0	0	1

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Illustrate logistics and supply chain management concepts and practices	*Understand*
CO2:	Learn supply chain risk assessment techniques and strategies for mitigating supply chain risks.	*Understand*

Contents:

- Introduction to Logistics and Supply Chain Management
- Supply Chain Strategy
- Inventory Management
- Transportation Management
- Warehousing and Distribution
- Information Technology in Logistics
- Global Logistics and Trade
- Sustainability in Logistics
- Sustainability in Logistics
- Case Studies and Best Practices
- Project

Total = 15 Hours

Regulation : R2020

Course code : 20MEV04

Course Name : LOGISTICS AND SUPPLY CHAIN NETWORKS

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Illustrate logistics and supply chain management concepts and practices	2	-	-	-	2	-	-	-	2	-	2	-	2	2
CO2	Learn supply chain risk assessment techniques and strategies for mitigating supply chain risks.	2	-	-	-	2	-	-	-	2	-	2	-	2	2
	Average	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**-**	**2**	**-**	**2**	**2**

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

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

VALUE ADDED COURSE

		L	T	P	C
20MEV05	**INDUSTRIAL SAFETY ENGINEERING**	1	0	0	1

Course Outcomes : On successful completion of the course, the student will be able to	***Cognitive Level***
CO1: Explain the importance of industrial safety and its impact on organizations.	*Understand*
CO2: Develop and implement safety procedures in industrial settings.	*Apply*

Contents:

- Introduction to Industrial Safety
- Safety Management Systems
- Hazard Identification and Risk Assessment
- Safety Regulations and Standards
- Safety in Machine and Equipment Design
- Fire Safety Engineering
- Occupational Health and Safety
- Safety Training and Emergency Response
- Safety in Construction and Manufacturing
- Safety Audits and Inspections
- Case Studies and Best Practices
- Project

Total = 15 Hours

Regulation : R2020

Course code : 20MEV05

Course Name : INDUSTRIAL SAFETY 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 importance of industrial safety and its impact on organizations.	2	-	2	-	-	2	2	-	-	-	-	2	2	3
CO2	Develop and implement safety procedures in industrial settings.	2	-	2	-	-	2	2	-	-	-	-	2	**2**	**3**
	Average	**2**	**-**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**3**

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

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

VALUE ADDED COURSE

		L	T	P	C
20MEV06	**NANO TECHNOLOGY: MECHANICAL ENGINEERING'S NEW FRONTIER**	1	0	0	1

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

CO1: Illustrate the fundamentals of nanotechnology and its applications in mechanical engineering. *Understand*

CO2: Analyze the mechanical properties of nanomaterials and their behavior at the nanoscale *Analyze*

Contents:

- Introduction to Nanotechnology
- Nanomaterials
- Nanomechanics
- Nanosensors and Actuators
- Nanofabrication Techniques
- Nanotechnology in Energy Systems
- Nanotechnology in Manufacturing
- Nanotechnology in Biomedical Engineering
- Environmental Applications of Nanotechnology
- Safety and Ethical Considerations in Nanotechnology
- Case Studies and Current Research
- Project

Total = 15 Hours

Regulation : R2020

Course code : 20MEV06

Course Name : NANO TECHNOLOGY: MECHANICAL ENGINEERING'S NEW FRONTIER

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Illustrate the fundamentals of nanotechnology and its applications in mechanical engineering.	2	-	2	-	-	2	2	-	-	-	2	-	3	2
CO2	Analyze the mechanical properties of nanomaterials and their behavior at the nanoscale	2	-	2	-	-	2	2	-	-	-	2	-	**3**	**2**
	Average	**3**	**-**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**2**	**-**	**3**	**2**

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

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VALUE ADDED COURSE

		L	T	P	C
20MEV07	**RAPID PROTOTYPING**	1	0	0	1

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

CO1: Identify and select appropriate rapid prototyping technologies for different applications. *Apply*

CO2: Apply rapid prototyping techniques to create physical prototypes from digital models. *Apply*

Contents:

- Introduction to Rapid Prototyping
- Rapid Prototyping Processes
- 3D Printing Technologies
- Rapid Prototyping Materials
- Design for Rapid Prototyping
- Rapid Prototyping Software
- Post-Processing Techniques
- Rapid Prototyping Applications
- Rapid Prototyping in Product Development
- Rapid Prototyping Lab Session
- Project

Total = 15 Hours

Regulation : R2020

Course code : 20MEV07

Course Name : RAPID PROTOTYPING

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Identify and select appropriate rapid prototyping technologies for different applications.	2	-	2	-	3	-	-	-	-	-	2	2	3	2
CO2	Apply rapid prototyping techniques to create physical prototypes from digital models.	2	-	2	-	3	-	-	-	-	-	2	2	3	2
	Average	**2**	**-**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**3**	**2**

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

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

VALUE ADDED COURSE

		L	T	P	C
20MEV08	**NON-DESTRUCTIVE EVALUATION OF MATERIALS**	1	0	0	1

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Identify common NDE methods and their applications in various industries.	*Apply*
CO2:	Demonstrate proficiency in using NDE equipment and interpreting test results.	*Understand*

Contents:

- Introduction to Non-Destructive Evaluation
- Principles of NDE
- Visual Inspection and Optical Methods
- Radiographic Testing
- Ultrasonic Testing
- Eddy Current Testing
- Magnetic Particle Testing
- Liquid Penetrant Testing
- Acoustic Emission Testing
- Thermal Imaging
- Emerging NDE Techniques
- Project

Total = 15 Hours

Regulation : R2020

Course code : 20MEV08

Course Name : NON-DESTRUCTIVE EVALUATION 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	Identify common NDE methods and their applications in various industries.	2	2	2	3	3	-	-	-	2	-	2	-	3	2
CO2	Demonstrate proficiency in using NDE equipment and interpreting test results.	2	2	2	3	3	-	-	-	2	-	2	-	3	2
	Average	**3**	**2**	**2**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**2**	**-**	**3**	**2**

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