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)

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	2	0	1	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	2	0	1	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 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 AU,CE,CS,EE,IT , ME & SF)	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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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	S2	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 Resources 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	Enterprises 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	S3	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

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OPEN ELECTIVE COURSES OFFERED BY MECH TO OTHER DEPARTMENTS

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

LIST OF VALUE ADDED COURSES

Sl. No	Course Name	Number of Hours	Offered by Internal/ External*
1.	Drafting Software (any one)	15	Internal/External
2.	Modeling Software (any one)	15	Internal/External
3.	Simulation Software (any one)	15	Internal/External
4.	Optimization Techniques (any one)	15	Internal/External
5.	Analysis Software (any one)	30	Internal/External
6.	Energy Audit in Industry	30	Internal/External
7.	TOEFL / IELTS	30	Internal/External
8.	GRE / GATE	30	Internal/External
9.	Condition Monitoring	30	Internal/External
10.	Design for Manufacture and Assembly	30	Internal/External
11.	Design of Experiments	30	Internal/External
12.	Piping Design	30	Internal/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**

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

SEMESTER - I

20EN151	**TECHNICAL ENGLISH – I** (common to all branches)	L	T	P	C
		2	0	1	3

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

Course Objectives : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Comprehend and apply Grammar in context for professional communication*	*Understand*
CO2:	*Infer the gist and specific information.*	*Apply*
CO3:	*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.

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

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

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
		2	0	1	3

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

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

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

UNIT - I **[09]**

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

UNIT - II **[09]**

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

UNIT - III **[09]**

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

UNIT - IV **[09]**

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

UNIT - V **[09]**

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

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

Text Books :

1 Dr.S.Sumant,Technical English II, Tata McGraw Hill, New Delhi, 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

20MA241	**ENGINEERING MATHEMATICS – II** (COMMON TO AU, CE, ME & SF)	L	T	P	C
		3	1	0	4

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes : On Completion of this course, the student will be able to		**Cognitive Level**
CO1	*Apply the concepts of analytic functions, conformal mapping and bilinear transformations.*	*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.

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

Prerequisite: *Basic knowledge of C programming.*

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

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

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

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

SEMESTER – II

20EE041	**BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING** (Common To AU,CE,CS,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**	L	T	P	C
	(Common to All Branches)	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

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

20CS227	**PYTHON PROGRAMMING LABORATORY**	L	T	P	C
	(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	-	-	-	-	-	-		3	1
CO2:	*Write functions to solve mathematical problems.*	3	3	3	2	2	-	-	-	-	-	-		3	1
CO3:	*Demonstrate the use of files in python.*	3	3	3	2	2	-	-	-	-	-	-		3	1
CO4:	*Develop simple applications using python.*	3	3	3	1	3	-	-	-	-	-	-		3	1
CO5:	*Construct GUI applications using python programming.*	3	3	3	1	3	-	-	-	-	-	-		3	1
	Average	**3**	**3**	**3**	**2**	**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
20PH028	**PHYSICS LABORATORY** (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

		L	T	P	C
20ME314	**MANUFACTURING TECHNOLOGY - I**	3	0	0	3

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

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*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

20ME315	**BASIC MECHANICS**	L	T	P	C
		3	1	0	4

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

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Acquire knowledge 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.

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

20HR351	**CAREER DEVELOPMENT SKILLS - I**	L	T	P	C
		2	0	0	0

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*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

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

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

20MA434	**OPERATIONS RESEARCH**	L	T	P	C
	(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.

4 http://nptel.ac.in/courses/113106032/

5 http://www.vssut.ac.in/lecture_notes/lecture1424355321.pdf

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.
4 http://nptel.ac.in.

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)

.

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

SEMESTER - IV

20ME422	**MANUFACTURING TECHNOLOGY LABORATORY**	L	T	P	C
		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.

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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.*	3	-	-	-	-	3	-	3	-	-	-	-	3	3
CO2	*Distinguish between the self and the body, implement the meaning of harmony in the Co– existence of Self and the Body.*	3	-	-	-	-	3	-	3	-	-	-	-	3	3
CO3	*Explain the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human–human relationships.*	3	-	-	-	-	3	-	3	-	-	-	-	3	3
CO4	*Describe the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.*	3	-	-	-	-	3	-	3	-	-	-	-	3	3
CO5	*Explain the ethical and unethical practices in work environment.*	3	-	-	-	-	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 - 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** (Use of standard Gas Table is permitted)	L	T	P	C
		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

		L	T	P	C
20ME622	**HEAT AND MASS TRANSFER LABORATORY**	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 – 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

		L	T	P	C
20ME563	**MEMS AND NEMS**				
	(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

20HS001	**PRINCIPLES OF MANAGEMENT** (Common to All Branches) **(PROFESSIONAL ELECTIVE – II)**	L	T	P	C
		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 .*	3	-	-	-	-	2	-	3	-	2	-	-	3	3
CO2:	*Discuss the various concepts of planning, MBO and Strategy to help solving managerial problems*	3	-	-	-	-	2	-	3	-	2	-	-	3	3
CO3:	*Explain the concepts of organizing, Delegation and Decision making.*	3	-	-	-	-	2	-	3	-	2	-	-	3	3
CO4:	*Describe the management concepts and styles in Leading.*	3	-	-	-	-	2	-	3	-	2	-	-	3	3
CO5:	*Illustrate the various controlling and emerging concepts in management thought and philosophy*	3	-	-	-	-	2	-	3	-	2	-	-	3	3
	Average	**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 - V

20ME662	**PRODUCT DESIGN AND DEVELOPMENT (PROFESSIONAL ELECTIVE – II)**	L	T	P	C
		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-machinesll, 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

20ME664	**INTERNAL COMBUSTION ENGINES (PROFESSIONAL ELECTIVE – II)**	L	T	P	C
		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.

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

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

4 Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

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**

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

Semester : **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

Semester : **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

Semester : **Regulation : R2020**

Course Code : 20ME903 **Course Name : PRODUCTION TECHNOLOGY OF AGRICULTURAL MACHINERY**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Acquire various engineering materials, classifications, compositions and properties	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO2:	Explore the concept and basic mechanics of metal cutting, working of standard machine tools and allied machines.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO3:	Apply the manufacturing process in welding for component production.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO4:	Demonstrate various advanced manufacturing process in engineering field.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO5:	Describe the basic concepts of Computer Numerical Control (CNC) machine tool and CNC programming.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	2	-	-	-	-	-	**-**	**-**	

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

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

OPEN ELECTIVE

20ME904	**SELECTION OF MATERIALS**	L	T	P	C
		3	0	0	3

Prerequisite:

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

CO1:	Explore the classification and properties of engineering materials	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

Semester : **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

Semester : **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 TRANSDUCER**	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.

E-Resources :

1 https://nptel.ac.in/courses/108/108/108108147/

2 https://www.youtube.com/watch?v=1uPTyjxZzyo

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : **Regulation : R2020**

Course Code : 20ME906 **Course Name : SENSORS AND TRANSDUCER**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Explore the basic concepts of various sensors and transducers.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO2:	Develop knowledge in mechanical and electromechanical sensor.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO3:	Differentiate the types of thermal sensor which are used in various applications.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO4:	Identify various types of magnetic sensors and working principles	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO5:	Acquire suitable sensors and its applications.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	1	-	-	-	-	-	**-**	**-**	**-**

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

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

OPEN ELECTIVE

20ME907	**ENERGY AUDITING**	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Describe the energy crisis & environmental concerns associated with the energy management and the importance of energy auditing.	Understand
CO2:	Identify the tools, techniques, management practices for the audit and management of electrical energy.	Understand
CO3:	Recognize the techniques of energy analysis and the associated energy efficient technologies for the routinely used thermal energy systems.	Apply
CO4:	State about the typical electrical energy powered utilities, services of industrial facilities & organizations and be able to identify the opportunities and options for the conservation & management of electrical energy.	Understand
CO5:	Interpret the basic economic concepts of underlay energy production and end use.	Evaluate

UNIT - I INTRODUCTION [09]

Energy – Power – Past & Present scenario of world; National energy consumption data – Environmental aspects associated with energy utilization – Energy Auditing: Need, Types, Methodology and Barriers. Role of energy managers. Instruments for energy auditing.

UNIT - II ELECTRICAL SYSTEMS [09]

Components of EB billing – HT and LT supply, Transformers, Cable sizing, Concept of capacitors, Power factor improvement, Harmonics, Electric motors – Motors efficiency computation, Energy efficient motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED lighting and scope of economics in illumination – Auditing in electrical systems.

UNIT - III THERMAL SYSTEMS [09]

Stoichiometry, Boilers, Furnaces and Thermal fluid heaters – Efficiency computation and economic measures. Steam: Distribution & usage, Steam traps, Condensate recovery, Flash steam utilization, Insulators & Refractories – Auditing in thermal systems.

UNIT - IV ENERGY CONSERVATION IN MAJOR UTILITIES [09]

Pumps, Fans, Blowers, Compressed air systems, Refrigeration and Air Conditioning systems – Cooling towers – D.G. sets - Auditing and energy conservation.

UNIT - V ECONOMICS [09]

Energy economics – Discount rate, Payback period, Internal rate of return, Net present value, Life cycle costing – ESCO concept – Auditing and Economics.

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

Text Books :

1. Energy manager training manual (4 Volumes) available at www.energymanagertraining.com, a website administered by Bureau of energy efficiency (BEE), a 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

Semester : **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.

E-RESOURCES

1 https://nptel.ac.in/courses/112/105/112105232/
2 https://nptel.ac.in/courses/112/107/112107142/

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : **Regulation : R2020**

Course Code : 20ME908 **Course Name : FIBRE REINFORCED PLASTICS**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Select various materials for designing composite structures.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO2:	Apply knowledge of fracture mechanics of composites during designing of composite structures.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO3:	Analyze critically damping capacity of composite materials.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO4:	Correlate various manufacturing / fabricating techniques for composite structures based on design.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO5:	Explore various composite applications.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	1	-	-	-	-	-	**-**	**-**	**-**

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

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

OPEN ELECTIVE

		L	T	P	C
20ME909	**LEAN MANUFACTURING**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Demonstrate the lean manufacturing principles to find and eliminate wastes.	Understand
CO2:	Identify the lean manufacturing tools and their potential applications.	Understand
CO3:	Summarize the usage of visual management, TPM and lean practices.	Apply
CO4:	Acquire the technology drivers of lean manufacturing.	Understand
CO5:	Describe technology drivers of lean manufacturing.	Analyze

UNIT - I LEAN MANUFACTURING PRINCIPLES [09]

Lean manufacturing paradigms - lean manufacturing - origin - Toyota Production System - types of wastes -tools and techniques to eliminate wastes - value stream mapping (VSM) - primary icons - secondary icons - developing the VSM.

UNIT - II LEAN MANUFACTURING TOOLS [09]

5S concepts - stages of 5S and waste elimination - Kaizen - steps of Kaizen - lean manufacturing through Kaizen – Single Minute Exchange of Die - theory of SMED - design for SMED - strategic SMED and waste elimination - pull production through Kanban - one piece flow production.

UNIT - III VISUAL MANAGEMENT, TPM AND LEAN IMPLEMENTATION [09]

Visual management - tools for eliminating wastes - overproduction, inventory, delay, transportation, processing, unnecessary motion, defective parts, underutilization of people - implementation - total productive maintenance - implementation of lean practices.

UNIT - IV MANAGEMENT AND TECHNOLOGY DRIVERS OF LEAN MANUFACTURING [09]

Lean manufacturing - twenty criteria model - management driver - organizational structure - devolution of authority - employee status and involvement - nature of management - business and technical processes - time management - agility through technology driver.

UNIT - V MANUFACTURING STRATEGY AND COMPETITIVE DRIVERS OF LEAN MANUFACTURING [09]

Quick manufacturing setups - quick response - product life cycle management - product service elimination - automation - competitive driver - status of quality and productivity - compatible cost accounting system.

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

Text Books :

1 Devadasan.S.R, Mohan Sivakumar.V, Murugesh.R and Shalij.P.R, Lean Manufacturing: Theoretical, Practical and Research Futurities, PHI Learning Private Limited, New Delhi, Second Edition, 2012.

2 Pascal Dennis, Lean Production Simplified, Productivity Press, New York, Third Edition, 2007.

Reference Books :

1 Bill Carreira, Lean Manufacturing That Works, PHI Learning Private Limited, New Delhi, Third Edition, 2016.

2 Dennis P. Hobbs, LEAN Manufacturing Implementation, Cengage Learning, New Delhi, Fifth Edition, 2015.

E-RESOURCES

1 https://nptel.ac.in/courses/112/104/112104188/ - (Lean Manufacturing System Technology)

2 https://freevideolectures.com/course/4162/nptel - (Toyota Production system)

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

DEPARTMENT OF MECHANICAL ENGINEERING

Semester : **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

Semester : **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)