MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC, NBA & Affiliated to Anna University)
Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

Curriculum/Syllabus

Programme Code : ME

Programme Name : B.E-Mechanical Engineering

Regulation : R-2021

MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, Accredited by NAAC & NBA, Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dt, Tamil Nadu.

Ph. No.: 04287-220837

Email: principal@mec.edu.in.

MUTHAYAMMAL ENGINEERING COLLEGE
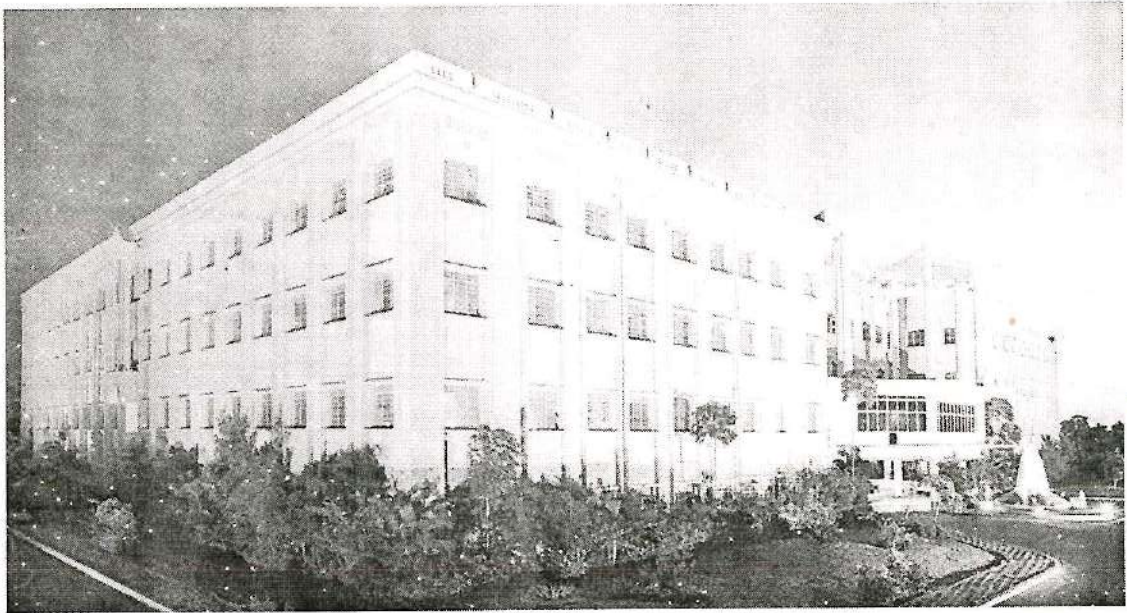
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Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

Curriculum/Syllabus

Programme Code   : ME

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MUTHAYAMMAL ENGINEERING COLLEGE
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AGENDA FOR THE 6th BOARD OF STUDIES MEETING
Department of Mechanical Engineering
Dt. 14.05.2021

Venue: CAD/CAM Lab

1) Passing of the following details:

a) List of courses in the Basket of Professional Core (PC), Professional Elective (PE), Employability Enhancement Courses (EEC) for R2021 under Choice Based Credit System (CBCS), for the batch of students admitted in 2020-2021 in B.E – Mechanical Engineering Programme.

b) Scheme and Syllabi for Professional Core (PC), Professional Elective (PE), Employability Enhancement Courses (EEC) for R2021 under Choice Based Credit System (CBCS), for the batch of students admitted in 2020-2021 in B.E – Mechanical Engineering Programme.

2) Panel of Expert for question paper setting and evaluation.

3) Any other matter with permission of the chair.

Institution Vision and Mission:

Vision

- To be a Centre of Excellence in Engineering, Technology and Management on par with International Standards

Mission

- To Prepare the Students with High Professional Skills and Ethical Values
- To Impart Knowledge through Best Practices
- To Instill Spirit of Innovation through Training, Research and Development
- To Undertake Continuous Assessment and Remedial Measures
- To Achieve Academic Excellence through Intellectual, Emotional and Social Stimulation

Department Vision and Mission:

Vision:

To prepare competent Mechanical Engineers with state of art technologies to cater industry demands

Mission:

M1: To create technically proficient students to meet global challenges

M2: To enable the opportunities for students and faculty members to apply the knowledge

M3: To prepare students to excel as successful professionals and entrepreneur's in their careers

Program Educational Objectives (PEO):

PEO1: Graduates should be able to Comprehend, analyze and synthesize data in order to design and develop mechanical systems

PEO2: Graduates should be able to pursue higher education and research for career development

PEO3: Graduates should be able to demonstrate leadership skills and ethical value for sustainable economical development towards the improvement of quality of life

Program Outcomes (PO):

PO 1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2. 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.

PO 3. 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.

PO 4. 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.

PO 5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6. 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.

PO 7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10.   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.

PO 11.   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.

PO 12.   Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO):

PSO1: To apply the knowledge of design, development and analysis of Mechanical Systems

PSO2: To demonstrate collaborative learning for making more sustainable products

PSO3: To work as a professional entrepreneur by applying Mechanical and Management practices

MUTHAYAMMAL ENGINEERING COLLEGE, RASIPURAM
(An Autonomous Institution)
DEPARTMENT OF SCIENCE AND HUMANITIES
GROUPING OF COURSES

1. Humanities and Social Sciences Courses (HS)

S.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	21HSS01	Business English	HS	2	2	0	0	2
2	21HSS02	English Communicative Skills Laboratory	HS	3	0	0	3	1
3	21HSS03	Life Skills and Workplace Psychology	HS	2	2	0	0	2
4	21HSS04	Technical English For Engineers	HS	2	2	0	0	2
5	21HSS05	Communicative English for Engineers	HS	2	2	0	0	2
6	21HSS06	Basics of Japanese Language	HS	2	2	0	0	2
7	21HSS07	Basics of French Language	HS	2	2	0	0	2

2. Basic Science Courses (BS)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1.	21BSS01	Engineering Physics	BS	3	3	0	0	3
2.	21BSS02	Physics and Chemistry Laboratory	BS	2	0	0	2	1
3.	21BSS03	Bio and Nanomaterials Sciences	BS	3	3	0	0	3
4.	21BSS04	Material Sciences	BS	3	3	0	0	3
5.	21BSS05	Physics for Mechanical Engineers	BS	3	3	0	0	3
6.	21BSS11	Engineering Chemistry	BS	3	3	0	0	3
7.	21BSS12	Environmental Science and Engineering	BS	3	3	0	0	3
8.	21BSS13	Organic Chemistry	BS	3	3	0	0	3
9.	21BSS14	Physical Chemistry	BS	3	3	0	0	3
10.	21BSS15	Applied Chemistry	BS	3	3	0	0	3
11.	21BSS16	Organic Chemistry Laboratory	BS	3	0	0	3	1
12.	21BSS17	Physical Chemistry Laboratory	BS	3	0	0	3	1
13.	21BSS21	Algebra and Calculus	BS	4	3	1	0	4
14.	21BSS22	Differential Equations and Vector Analysis	BS	4	3	1	0	4
15.	21BSS23	Transform and Partial Differential Equations	BS	4	3	1	0	4
16.	21BSS24	Discrete Mathematics	BS	4	3	1	0	4
17.	21BSS25	Statistical and Queuing Model	BS	4	3	1	0	4
18.	21BSS26	Numerical Methods	BS	4	3	1	0	4
19.	21BSS27	Probability and Random Processes	BS	4	3	1	0	4
20.	21BSS28	Statistic and Numerical Methods	BS	4	3	1	0	4

3. General Engineering Science Courses (GES)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			
					L	T	P	C
1.	21GES01	Programming for Problem Solving Using C	GES	3	3	0	0	3
2.	21GES02	Programming for Problem Solving Technique	GES	3	3	0	0	3
3.	21GES03	Programming in C Laboratory	GES	3	0	0	3	1
4.	21GES04	Programming in C and Python Laboratory	GES	3	0	0	3	1
5.	21GES05	Electrical and Electronic Sciences	GES	3	3	0	0	3
6.	21GES06	Mechanical and Building Sciences	GES	3	3	0	0	3
7.	21GES07	Computer Aided Drafting Laboratory	GES	3	0	0	3	1
8.	21GES08	Python Programming	GES	3	3	0	0	3
9.	21GES09	Programming in Python Laboratory	GES	3	0	0	3	1
10.	21GES10	Soft Skills Laboratory	GES	3	0	0	3	1
11.	21GES11	Electronic Devices	GES	3	3	0	0	3
12.	21GES12	Electronic Simulation Laboratory	GES	3	0	0	3	1
13.	21GES13	Electric Circuits	GES	3	2	1	0	3
14.	21GES14	Electric Circuits Laboratory	GES	3	0	0	3	1
15.	21GES15	Manufacturing Process	GES	3	3	0	0	3
16.	21GES16	Manufacturing Process Laboratory	GES	3	0	0	3	1
17.	21GES17	Mechanical and Building Sciences Laboratory	GES	3	0	0	3	1
18.	21GES18	Construction Materials	GES	3	3	0	0	3
19.	21GES19	Concepts in Product Design	GES	3	3	0	0	3
20.	21GES20	Renewable Energy Sources	GES	3	3	0	0	3
21.	21GES21	Electrical Drives and Control	GES	3	3	0	0	3
22.	21GES22	Electrical Drives and Control Laboratory	GES	3	0	0	3	1
23.	21GES23	Analog and digital communication	GES	3	3	0	0	3
24.	21GES24	Digital Principles and System Design	GES	3	3	0	0	3
25.	21GES25	Digital Principles and System Design Laboratory	GES	3	0	0	3	1
26.	21GES26	Engineering Drawing	GES	4	1	0	3	3
27.	21GES27	Engineering Geology	GES	3	3	0	0	3
28.	21GES28	Engineering Mechanics	GES	4	3	1	0	4
29.	21GES29	Wireless Communication	GES	4	3	1	0	4
30.	21GES30	Electronics and Microprocessors	GES	3	3	0	0	3
31.	21GES31	Microprocessor Laboratory	GES	3	0	0	3	1
32.	21GES32	Data Structures using Python	GES	3	3	0	0	3
33.	21GES33	Electronic Devices and Circuits	GES	3	3	0	0	3
34.	21GES34	Electronic Devices and Circuits Lab	GES	3	0	0	3	1

4. Professional Core (PC)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1.	19MEC01	Engineering Materials and Metallurgy	PC	3	3	0	0	3
2.	21MEC02	Engineering Thermodynamics	PC	3	3	0	0	3
3.	21MEC03	Fluid Mechanics and Machinery	PC	3	3	0	0	3
4.	21MEC04	Strength of Materials	PC	3	3	0	0	3
5.	21MEC05	Kinematics of Machines	PC	3	3	0	0	3
6.	21MEC06	Manufacturing Technology	PC	3	3	0	0	3
7.	21MEC07	Thermal Engineering	PC	3	3	0	0	3
8.	21MEC08	Automobile Engineering	PC	3	3	0	0	3
9.	21MEC09	Heat and Mass Transfer	PC	3	3	0	0	3
10.	21MEC10	Design of Machine Elements	PC	3	3	0	0	3
11.	21MEC11	Dynamics of Machines	PC	3	3	0	0	3
12.	21MEC12	Computer Aided Design and Manufacturing	PC	3	3	0	0	3
13.	21MEC13	Metrology and Measurements	PC	3	3	0	0	3
14.	21MEC14	Applied Hydraulics and Pneumatics	PC	3	3	0	0	3
15.	21MEC15	Gas Dynamics and Jet Propulsion	PC	3	3	0	0	3
16.	21MEC16	Finite Element Analysis	PC	3	3	0	0	3
17.	21MEC17	Fluid Mechanics and Machinery Laboratory	PC	3	0	0	3	1
18.	21MEC18	Manufacturing Technology Laboratory	PC	3	0	0	3	1
19.	21MEC19	Strength of Materials Laboratory	PC	3	0	0	3	1
20.	21MEC20	Measurements Laboratory	PC	3	0	0	3	1
21.	21MEC21	Heat and Mass Transfer Laboratory	PC	3	0	0	3	1
22.	21MEC22	Assembly Drawing and Modeling Laboratory	PC	3	0	0	3	1
23.	21MEC23	Thermal Engineering Laboratory	PC	3	0	0	3	1
24.	21MEC24	Dynamics of Machines Laboratory	PC	3	0	0	3	1
25.	21MEC25	Design of Transmission Systems	PC	3	3	0	0	3
26.	21MEC26	Total Quality Management	PC	3	3	0	0	3

5. Professional Electives (PE)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1.	21MEE01	Advanced Machining Processes	PE	3	3	0	0	3
2.	21MEE02	Principles of Management	PE	3	3	0	0	3
3.	21MEE03	Mechatronics	PE	3	3	0	0	3
4.	21MEE04	Automotive Electronics	PE	3	3	0	0	3
5.	21MEE05	Design of Pressure Vessel and Piping	PE	3	3	0	0	3
6.	21MEE06	Advanced IC Engines	PE	3	3	0	0	3
7.	21MEE07	Industrial Automation & Robotics	PE	3	3	0	0	3
8.	21MEE08	Vibration and Noise Control	PE	3	3	0	0	3
9.	21MEE09	Refrigeration and Air conditioning	PE	3	3	0	0	3
10.	21MEE10	Composite Materials	PE	3	3	0	0	3
11.	21MEE11	Computational Fluid Dynamics	PE	3	3	0	0	3
12.	21MEE12	Energy Conservation in Industry	PE	3	3	0	0	3
13.	21MEE13	Additive Manufacturing Techniques	PE	3	3	0	0	3
14.	21MEE14	Design of jigs, fixtures and Press Tools	PE	3	3	0	0	3
15.	21MEE15	Cryogenic Engineering	PE	3	3	0	0	3
16.	21MEE16	Lean Manufacturing	PE	3	3	0	0	3
17.	21MEE17	Advanced Metrology	PE	3	3	0	0	3
18.	21MEE18	Power Plant Engineering	PE	3	3	0	0	3
19.	21MEE19	Artificial Intelligence	PE	3	3	0	0	3
20.	21MEE20	MEMS	PE	3	3	0	0	3
21.	21MEE21	Welding Technology	PE	3	3	0	0	3

6. Employability Enhancement Courses (EEC)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1.	21MES01	Project work Phase –I	EEC	6	0	0	6	3
2.	21MES02	Project work Phase -II	EEC	20	0	0	20	10
3.	21MES03	Value Added Course /Internship	EEC	2	0	0	2	1
4.	21MES04	Inter Disciplinary Project	EEC	3	0	0	3	1
5.	21MES05	Constitution of India and professional Ethics	EEC	3	3	0	0	0
6.	21MES06	Essence of Indian Traditional Knowledge	EEC	3	3	0	0	0

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Department	Mechanical Engg.
Programme	B.E

SEMESTER - I

Sl. No.	Course Code	Course Name	Hours/ Week			Credit C	Contact Hours
			L	T	P		
THEORY							
1.	21HSS01	Business English	2	0	0	2	2
2.	21BSS21	Algebra & Calculus	3	1	0	4	4
3.	21BSS01	Engineering Physics	3	0	0	3	3
4.	21BSS11	Engineering Chemistry	3	0	0	3	3
5.	21GES02	Programming for Problem Solving Techniques	3	0	0	3	3
6.	21GES05	Electrical and Electronics Sciences	3	0	0	3	3
PRACTICAL							
7	21GES07	Computer Aided Drafting Laboratory	0	0	3	1	3
8	21GES04	Programming in C & Python Laboratory	0	0	3	1	3
9	21HSS02	English Communicative Skills Laboratory	0	0	3	1	3
		Total Credits				**21**	

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Department	Mechanical Engg.
Programme	B.E

SEMESTER - II

Sl. No.	Course Code	Course Name	Hours/ Week			Credit C	Contact Hours
			L	T	P		
THEORY							
1	21HSS03	Life Skill Psychology and Ethics	2	0	0	2	2
2	21BSS22	Differential Equations and Vector Analysis	3	2	0	4	5
3	21BSS03	Bio and Nano Material Sciences	3	0	0	3	3
4	21BSS12	Environmental Science and Engineering	3	0	0	3	3
5	21GES19	Concepts in Product Design	3	0	0	3	3
6	21GES15	Manufacturing Processes	3	0	0	3	3
PRACTICAL							
7	21BSS02	Physics and Chemistry Laboratory	0	0	2	1	2
8	21GES16	Manufacturing Processes Laboratory	0	0	3	1	3
		Total Credits				**20**	

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UG
R – 2021 |

| Department | Mechanical Engg. |
| Programme | B.E |

SEMESTER – III

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	21BSS23	Transform and Partial Differential Equations	3	1	0	4	4
2.	21MEC02	Engineering Thermodynamics	3	0	0	3	3
3.	21GES28	Engineering Mechanics	3	1	0	4	4
4.	21MEC03	Fluid Mechanics and Machinery	3	0	0	3	3
5.	21MEC06	Manufacturing Technology	3	0	0	3	3
6.	21GES21	Electrical Drives and Controls	3	0	0	3	3
PRACTICAL							
7	21MEC17	Fluid Mechanics and Machinery Laboratory	0	0	3	1	3
8	21MEC18	Manufacturing Technology Laboratory	0	0	3	1	3
9	21GES22	Electrical Drives and Controls laboratory	0	0	3	1	3
		Total Credits				23	

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| Department | Mechanical Engg. |
| Programme | B.E |

SEMESTER - IV

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1	21BSS28	Statistics and Numerical Methods	3	1	0	4	4
2	21MEC01	Engineering Materials and Metallurgy	3	0	0	3	3
3	21MEC04	Strength of Materials	3	0	0	3	3
4	21MEC07	Thermal Engineering	3	0	0	3	3
5	21MEC14	Applied Hydraulics and Pneumatics	3	0	0	3	3
6	21GES30	Electronics and Microprocessors	3	0	0	3	3
PRACTICAL							
7	21MEC19	Strength of Materials Laboratory	0	0	3	1	3
8	21GES31	Microprocessor Laboratory	0	0	3	1	3
9	21MEC23	Thermal Engineering Laboratory	0	0	3	1	3
		Total Credits				22	

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Programme	B.E

SEMESTER - V

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	21MEC05	Kinematics of Machines	3	0	0	3	3
2.	21MEC08	Automobile Engineering	3	0	0	3	3
3.	21MEC10	Design of Machine Elements	3	0	0	3	3
4.	21MEC12	Computer Aided Design and Manufacturing	3	0	0	3	3
5.	21MEC13	Metrology and Measurements	3	0	0	3	3
6.	21*****	OPEN ELECTIVE-I	3	0	0	3	3
PRACTICAL							
7.	21MEC20	Measurements Laboratory	0	0	3	1	3
8.	21MEC22	Assembly Drawing and Modeling Laboratory	0	0	3	1	3
		Total Credits				20	

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Department	Mechanical Engg.
Programme	B.E

SEMESTER - VI

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1	21MEC09	Heat and Mass Transfer	3	0	0	3	3
2	21MEC11	Dynamics of Machines	3	0	0	3	3
3	21MEC25	Design of Transmission Systems	3	0	0	3	3
4	21MEE**	Professional Elective -I	3	0	0	3	3
5	21*****	Open Elective-II	3	0	0	3	3
6	21*****	Open Elective-III	3	0	0	3	3

		PRACTICAL					
7	21MEC21	Heat and Mass Transfer Laboratory	0	0	3	1	3
8	21MEC24	Dynamics of Machines Laboratory	0	0	3	1	3
9	21MES04	Interdisciplinary Project	0	0	3	1	3
					Total Credits	21	

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Department	Mechanical Engg.
Programme	B.E

SEMESTER - VII

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	21MES06	Essence of Indian Traditional Knowledge	3	0	0	0	3
2.	21MEC26	Total Quality Management	3	0	0	3	3
3.	21MEE**	Professional Elective -II	3	0	0	3	3
4.	21MEE**	Professional Elective -III	3	0	0	3	3
5.	21MEE**	Professional Elective -IV	3	0	0	3	3
6	21*****	Open Elective-IV	3	0	0	3	3
PRACTICAL							
7	21MES01	Project work Phase –I	0	0	6	3	6
		Total Credits				18	

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Department	Mechanical Engg.
Programme	B.E

SEMESTER - VIII

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1	21MES05	Constitution of India and Professional Ethics	3	0	0	0	3
2	21MEE**	PROFESSIONAL ELECTIVE -V	3	0	0	3	3
3	21MEE**	PROFESSIONAL ELECTIVE -VI	3	0	0	3	3
4	21*****	OPEN ELECTIVE-V	3	0	0	3	3
PRACTICAL							
5	21MES02	Project work Phase -II	0	0	20	10	20
		Total Credits				19	

CREDITS

Subject Area	Credits per Semester								Total	Percentage %
	I	II	III	IV	V	VI	VII	VIII		
HS	3	2	-	-	-	-	-	-	5	3
BS	10	11	4	4	-	-	-	-	29	18
ES	8	7	8	4	-	-	-	-	27	17
PC	-	-	11	14	17	11	3		56	34
PE	-	-	-	-	-	3	9	6	18	11
OE	-	-	-	-	3	6	3	3	15	9
EEC	-	-	-	-	-	1	3	10	14	8
MC	-	-	-	-	-	-	-	-	-	0
Total	21	20	23	22	20	21	18	19	164	100

HUMANITIES AND SOCIAL SCIENCES

(HS)

For

Mechanical Engineering

21HSS01	BUSINESS ENGLISH	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To make effective communication in business situations.
- To use English accurately, appropriately and fluently in different situations (academic, social and professional) and familiarize themselves with all speech sounds in English
- To inculcate the effective email writing skills for better business communication.
- To ensure that learners to understand the fundamentals of Business writing and interviews.
- To prepare for and participate in presentations on business topics.

COURSE OUTCOMES

21HSS01.CO1   Employ strategies to be a successful employee or employer in the workplace.

21HSS01.CO2   Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.

21HSS01.CO3   Able to use electronic technology in business communication

21HSS01.CO4   Understanding of lectures, talks and interviews on business topics delivered by authentic business specialists

21HSS01.CO5   Use the phrases and sentences clearly in their written communication

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21HSS01.CO1	-	-	-	-	-	-	-	-	-	X	X	X	-	-	-
21HSS01.CO2	-	-	-	-	-	-	-	-	X	X	-	X	-	-	-
21HSS01.CO3	-	-	-	-	-	-	-	X	X	X	-	X	-	X	-
21HSS01.CO4	-	-	-	-	-	-	-	-	-	X	-	X	-	-	-
21HSS01.CO5	-	-	-	-	-	-	-	-	-	X	-	X	-	-	-

UNIT I   COMMUNICATION AND BUSINESS ENGLISH   6

Communication meaning – Objectives – Importance – Process of Communication – Barriers to communication – Effective Communication - Make up sentences- the text about business- Business Operations- conversation - giving sentences unity-arranging sentences for clarity- Accent on positive Language - Coherence- Transitional words

UNIT II   GRAMMAR & VOCABULARY   6

Phrases & Clauses- Kinds of Sentences - Types of sentences and sentence patterns – GRE Vocabulary – Prefix & Suffix - Synonyms - Antonyms - Word Formation- Error Spotting- Sentence Correction- Word Analogy- Idioms and Phrases- Direct and Indirect Speech- 'If' Conditionals

UNIT III   WRITING CV AND LETTER OF APPLICATION   6

Writing for communicative purposes [Letters – official and personal , Messages / Notices, Reports , Emails, Advertisements , Structure of the Sales Letter- Letter of Authorization- Letter of Recommendation.-Application for a job (covering letter and CV) - Creative Writing (Stories, Poems, Dialogues)

UNIT IV   JOB INTERVIEWS AND RECRUITMENT   6

Job Interviewing- appearance and body language - Attending interviews -Public Speaking and Oral Reporting- Overcome Nervousness- Making Formal Speech-Use of Voice- Using Telephone -Use of Visual Aids- Interviewing People-Recruitment - Asking for Information- Asking for Action- Orders-Inquiries about people-claims –Refusing Request- Adjustment Refusals- Credit Refusal- Text Types - Academic Writing [Paragraphs , Essays]

UNIT V   PRESENTATION AND GRAMMAR USAGE   6

Presentation – Types and Importance of Presentation – Standards of Punctuation – Apostrophe, Brackets, Colon, Comma etc…Standards for Grammar- Adjective-Adverb Confusion, Subject-Verb Agreement, Dangling Modifier, Parallelism.

TOTAL HOURS:30 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Lesikar, Bamford	Basic Business Communication"	1ˢᵗ Canadian Edition (IRWIN DORSEY), Von Hoffmann Press,	1993
2.	Simon Sweeney	English For Business	Cambridge University Press	2008

REFERENCE BOOKS:

SL.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Mindscapes	English For Technologists and Engineers	Department of English, Anna University, Chennai.	2012
2.	Rutherford, Andrea.	J Basic Communication Skills for Technology.	Pearson New Delhi.	2001
3.	Viswamohan, Aysha.	English for Technical Communication	Tata McGraw-Hill, New Delhi.	2008
4.	Aspinall Tricia, Bethell George.	Test your Business Vocabulary in Use.	Cambridge University Press	2003
5.	Cambridge ESOL.	BEC 1, 3.	Cambridge University Press,	2001

21HSS02	ENGLISH COMMUNICATIVE SKILLS LABORATORY	L T P C
		0 0 3 1

COURSE OBJECTIVES

- To instill the basic communication concepts to enhance students' communication skills through various lab sessions.
- To understand the importance of listening and speaking in language acquisition process
- To speak English accurately, appropriately and fluently in different situations (academic, social and professional) and familiarize themselves with all speech sounds in English
- To help students develop the ability to communicate effectively in spoken English and develop their soft skills and interpersonal skills.
- To increase employability by developing students' communication skills in English.

COURSE OUTCOMES

21HSS02.CO1 Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.

21HSS02.CO2 Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.

21HSS02.CO3 Read different genres of texts adopting various reading strategies.

21HSS02.CO4 Listen/view and comprehend different spoken discourses/excerpts in different accents

21HSS02.CO5 Communicate with others confidently

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21HSS02.CO1	-	-	-	-	-	-	-	-	X	X	X	X	-	-	-
21HSS02.CO2	-	-	-	-	-	-	-	X	-	X	X	X	-	X	-
21HSS02.CO3	-	-	-	-	-	-	-	X	X	X	X	X	-	X	-
21HSS02.CO4	-	-	-	-	-	-	-	-	-	X	-	X	-	-	-
21HSS02.CO5	-	-	-	-	-	-	-	-	-	X	-	X	-	-	-

UNIT I FORMAL & INFORMAL CONVERSATION PRACTICE

Role Play conversations - with family members, neighbours, friends, relatives etc. Simple expressions - agreeing / disagreeing, persuading, wishing, consoling, advising, arguing, expressing opinions etc.- Professional dialogues with superiors - Conversation with different professionals in government and corporate Offices, Official Meetings, educational Institutions, (At the railway junction, malls, post office, bank) etc- every day usage of English

UNIT II ORAL REVIEW, RADIO SHOW & NARRATIVE TECHNIQUES

Oral review of books - Presentation of various radio programs like news, announcements. advertisements, entertainment programs etc. as a team activity. Understanding the basic narrative techniques - Narrating short stories. Narrating real life experiences, Oral interpretation of charts, tables, graphs.

UNIT III RESUME / LETTER WRITING

Preparation of resume - structure – Types of resume – writing the vision statement – Objectives – Types of Letter – Job Application – accepting / declining a Job offer.

UNIT IV PRESENTATION SKILLS & GROUP DISCUSSION

Elements of effective presentation – Structure of a presentation – Speech acts - effective use to presentation tools - Audience analysis – Preparing the PPT slides - Video samples- Importance of GD – in the selection process - Structure of a GD – Moderator – led and other GDs - Strategies in GD – Team work - Body Language - Mock GD -Video samples

UNIT V INTERVIEW SKILLS

Kinds of interviews – one to one, group interview, telephone interview, online interview, stress interview - Required Skills – Corporate culture – Mock interviews-Video samples.

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Sobana.S, Manivannan.R and Immanuel. G,	Communication and Soft Skills	VK Publications, Sivakasi.	2016

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Anderson, P.V.	Technical Communication	Thomson Edition, New Delhi	2007
2.	Rizvi, Ashraf. M	Effective Technical Communication	Tata McGraw-Hill, New Delhi	2005
3.	Dutt, Kiranmai P and Geetha Rajeevan	Basic Communication Skills .	Foundation Books, New Delhi.	2007

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| 21HSS03 | LIFE SKILLS AND WORKPLACE PSYCHOLOGY | L T P C |
| | | 2 0 0 2 |

COURSE OBJECTIVES:

- To inculcate critical thinking process and to prepare them on problem solving skills.
- To enable learners to perform in a team.
- To learn leadership qualities and practice them.
- To make the learners to use grammar error free sentences.
- To introduce the essentials of psychology at workplace and gain insights about work place behavior

COURSE OUTCOMES:

21HSS03.CO1	Able to think critically on a particular problem.
21HSS03.CO2	Able to do good performance in a team.
21HSS03.CO3	Able to become an effective leader.
21HSS03.CO4	Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
21HSS03.CO5	Students will be able to classify and utilize their knowledge In Psychology in the process of employment

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21HSS03.CO1	-	-	-	-	-	-	-	-	-	X	X	X	-	-	-
21HSS03.CO2	-	-	-	-	-	-	-	-	X	X	-	X	-	-	-
21HSS03.CO3	-	-	-	-	-	-	-	X	X	X	-	X	-	X	-
21HSS03.CO4	-	-	-	-	-	-	-	-	-	X	-	X	-	-	-
21HSS03.CO5	-	-	-	-	-	-	-	-	-	X	-	X	-	-	-

UNIT I   CRITICAL THINKING & PROBLEM SOLVING   6
Creativity, Lateral thinking, Critical thinking, Multiple Intelligence, Problem Solving, Six thinking hats Mind Mapping & Analytical Thinking.

UNIT II   TEAMWORK   6
Groups, Teams, Group Vs Teams, Team formation process, Stages of Group, Group Dynamics, Managing Team Performance & Team Conflicts.

UNIT III   LEADERSHIP SKILLS   6
Leadership, Levels of Leadership, Making of a leader, Types of leadership, Professional Etiquette – Prevention of Sexual Violence and Misconduct on Campus.

UNIT IV   GRAMMAR & VOCABULARY   6
Single Word substitutes – verb patterns- use of dialogue writing - tenses – voices – use of conditionals – comparative Adjectives (affirmative and negative) – expanding–   nominal compounds – articles – use of prepositions - phrasal verbs – British and American vocabulary – error detection – abbreviations and acronyms - Instruction - Recommendation.

UNIT V   WORKPLACE PSYCHOLOGY   6
Nature and Development of Industrial/Work Psychology - Employee Selection Techniques, Fair Employment Practices Recruitment- Biographical Information, Interviews, References & Letters of Recommendation Job Analysis- Types, Newer Developments.

TOTAL HOURS: 30 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Matthewman, L., Rose, A. & Hetherington, A	Work Psychology	Oxford University Press, India.	2009
2.	Dr.K.Ravikanth Roa , Dr. P. Dhinakar	Life skills Education	Neel Kamal	2016

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Larry James	The First Book of Life Skills	First Edition; Embassy Books	2016
2.	Shalini Verma	Development of Life Skills and Professional Practice	First Edition; Sultan Chand (G/L) & Company	2014
3.	Viswamohan, Aysha.	English for Technical Communication.	Tata McGraw-Hill, New Delhi.	2008
4.	Landy, F. J. & Conte, J. M	Work in the 21st Century: An Introduction to Industrial and Organizational Psychology.	Wiley India: New Delhi: 2nd Edition.	2010
5.	Schultz, D. & Schultz, S. E.	Psychology and Work Today	Pearson Education : New Delhi.	2002

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21HSS04	TECHNICAL ENGLISH FOR ENGINEERS	L T P C
		2 0 0 2

COURSE OBJECTIVES
- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.
- To make the learners to use the phrase and clauses error free.

COURSE OUTCOMES
21HSS04.CO1	Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
21HSS04.CO2	Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
21HSS04.CO3	Read different genres of texts adopting various reading strategies.
21HSS04.CO4	listen/view and comprehend different spoken discourses/excerpts in different accents
21HSS04.CO5	use the phrases and sentences clearly in their written communication

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21HSS04.CO1	-	-	-	-	-	-	-	-	-	X	X	X	-	-	-
21HSS04.CO2	-	-	-	-	-	-	-	-	X	X	-	X	-	-	-
21HSS04.CO3	-	-	-	-	-	-	-	X	X	X	-	X	-	X	-
21HSS04.CO4	-	-	-	-	-	-	-	-	-	X	-	X	-	-	-
21HSS04.CO5	-	-	-	-	-	-	-	-	-	X	-	X	-	-	-

UNIT I   GRAMMAR & VOCABULARY   6
Word formation with prefixes and suffixes – synonyms and antonyms – verb patterns – tenses – voices – use of conditionals – comparative adjectives (affirmative and negative) – expanding– nominal compounds – articles – use of prepositions - phrasal verbs – British and American vocabulary.

UNIT II   LISTENING   6
Extensive listening – listening for general content – listening to fill up gapped texts – intensive listening – listening for specific information: retrieval of factual information – listening to identify topic, context, function, speaker's opinion, attitude, etc. – global understanding skills and ability to infer, extract gist and understand main ideas

UNIT III   SPEAKING   6
Verbal and non verbal communication – speech sounds – syllables – word stress (structures and content words) – sentences stress – intonation – pronunciation drills, tongue twisters –developing confidence – introducing oneself – asking for or eliciting objects — giving instructions

UNIT IV   READING   6
Exposure to different reading techniques – reading for gist and global meaning – predicting the content – text – identifying the topic sentence and its role in each paragraph – scanning – inferring / identifying lexical and contextual meanings – transfer of information / guided note-making – understanding discourse coherence – sequencing of sentences – cloze reading.

UNIT V   WRITING   6
Introductions to the characteristics of technical style – writing definitions and descriptions –paragraph writing (topic sentence and its role, unity, coherence and use of cohesive expressions) – process description (use of sequencing connectives) – comparison and contrast – formal letter writing (letter to the editor, letter for seeking practical training, and letter for undertaking project works in industries)

TOTAL HOURS: 30 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Raman, Meenakshi & Sangeetha Sharma.	Technical Communication: Principles and Practice. Oxford University Press,	Oxford University Press, New Delhi.	2011
2	Rizvi, Ashraf. M.	Effective Technical Communication.	Tata McGraw-Hill, New Delhi.	2005

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Regional Institute of English	English for Engineers.	Cambridge University Press, New Delhi.	2006
2	Mindscapes	English For Technologists and Engineers	Department of English, Anna University, Chennai,	2012
3	Rutherford, Andrea.	J Basic Communication Skills for Technology	Pearson, New Delhi.	2001
4	Viswamohan, Aysha.	English for Technical Communication.	Tata McGraw-Hill, New Delhi.	2008
5	Raman, Meenakshi & Sangeetha Sharma.	Technical Communication: Principles and Practice. Oxford University	Press, New Delhi.	2011

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21HSS05	COMMUNICATIVE ENGLISH FOR ENGINEERS	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To understand the importance of listening and speaking in language acquisition process
- To engage in conversation intelligibly
- To use English accurately, appropriately and fluently in different situations (academic, social and professional) and familiarize themselves with all speech sounds in English
- To write academic, communicative and creative pieces of writing
- To devise different tasks / methods to enhance their learners' communication skills

COURSE OUTCOMES

21HSS05.CO1 Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.

21HSS05.CO2 Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.

21HSS05.CO3 Read different genres of texts adopting various reading strategies.

21HSS05.CO4 listen/view and comprehend different spoken discourses/excerpts in different accents

21HSS05.CO5 Communicate with others confidently

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21HSS05.CO1	-	-	-	-	-	-	-	-	X	X	X	X	-	-	-
21HSS05.CO2	-	-	-	-	-	-	-	X	-	X	X	X	-	X	-
21HSS05.CO3	-	-	-	-	-	-	-	X	X	X	X	X	-	X	-
21HSS05.CO4	-	-	-	-	-	-	-	-	-	X	-	X	-	-	-
21HSS05.CO5	-	-	-	-	-	-	-	-	-	X	-	X	-	-	-

UNIT I GRAMMAR & VOCABULARY   6

Phrases & Clauses- Kinds of Sentences - Types of sentences and sentence patterns – GRE Vocabulary - Word Formation- Error Spotting- Sentence Correction- Word Analogy- Idioms and Phrases- Direct and Indirect Speech- 'If' Conditionals

UNIT II LISTENING   6

Listening processes: top-down and bottom-up skills - Listening strategies - Sounds of English: Consonants, vowels and diphthongs - Phonemic transcription, tongue twisters, words often mispronounced - Word stress and sentence stress: content words, structural words, strong forms, weak forms - Intonation patterns - Language functions : [Inviting-accepting/declining invitation - Offering /accepting/ refusing help - Thanking/ responding to thanks - Congratulating , Complimenting - Apologizing/ accepting an apology

UNIT III SPEAKING   6

Greeting - Introducing Oneself -Invitation - Making Request - Expressing Gratitude - Complimenting and Congratulating - Expressing Sympathy - Apologizing - Asking for Information - Seeking Permission - Complaining and Expressing Regret - Using English in Real Life Situation [At the Bank/ post office/ College office - At the Green Grocer - At the Temple - At the College Canteen or Restaurant - At the Police station - At the Railway Station/ Bus Station - At the Medical Shop - At the Library

UNIT IV READING   6

Importance of Reading - Why develop reading habits among students and How - Reading techniques [Skimming , Scanning , Intensive reading , Extensive] Reading different text types [Menu ,Email , Letters , Cartoons , Advertisements, Recipe , Articles , Literary texts – stories, plays, poems, Biographies] – identifying lexical and Contextual meaning- Understanding Discourse Coherence – sequencing of sentences

UNIT V WRITING   6

Developing Proficiency in Writing - Writing for communicative purposes [Letters – official and personal , Messages / Notices, Reports , Emails , Advertisements ,Application for a job (covering letter and CV) - Creative Writing (Stories, Poems , Dialogues)

TOTAL HOURS: 30

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Raman, Meenakshi & Sangeetha Sharma.	Technical Communication: Principles and Practice.	Oxford University Press. New Delhi.	2011
2	Rizvi, Ashraf. M	Effective Technical Communication.	Tata McGraw-Hill New Delhi.	2005

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Regional Institute of English	English for Engineers. Cambridge University Press	New Delhi.	2006.
2	Dr.Gunasekaran, Vishu "	Technical English Work Book.	Vishnu "Print Media, Krishna Publications	2011
3	Rutherford, Andrea.	J Basic Communication Skills for Technology.	Pearson, New Delhi.	2001
4	Viswamohan, Aysha.	English for Technical Communication.	Tata McGraw-Hill, New Delhi.	2008
5	Raman, Meenakshi & Sangeetha Sharma.	Technical Communication: Principles and Practice.	Oxford University Press. New Delhi	2011

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21HSS06	BASICS OF JAPANESE LANGUAGE	L T P C
		2 0 0 2

COURSE OBJECTIVES:

- To develop the reading skill of the students and to familiarize them with Japanese language.
- To instill the communication concepts and enhance the students' conversational skill through various practice sessions.
- To familiarize them with a variety of words and pronunciation.
- To develop the receptive skills such as listening, writing, reading and to make the students well-versed in speaking.
- To assist them in improving their vocabulary in Japanese.

COURSE OUTCOMES:

21HSS06.CO1	Learn and write Japanese alphabet.
21HSS06.CO2	Develop their pronunciation skill in Japanese language.
21HSS06.CO3	Enrich the vocabulary in Japanese language.
21HSS06.CO4	Speak in Japanese at various occasions.
21HSS06.CO5	Understand and communicate by constructing sentences.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21HSS06.CO1	-	-	-	-	-	-	-	-	-	X	X	X	-	-	-
21HSS06.CO2	-	-	-	-	-	-	-	-	X	X	-	X	-	-	-
21HSS06.CO3	-	-	-	-	-	-	X	X	X	-	X	-	X	-
21HSS06.CO4	-	-	-	-	-	-	-	-	-	X	-	X	-	-	-
21HSS06.CO5	-	-	-	-	-	-	-	-	-	X	-	X	-	-	-

UNIT I   INTRODUCTION OF JAPANESE LANGUAGE   6

Introduction about Japan - Japanese people - Language and their culture - Importance of Japanese Language Learning - Japanese writing system – Hiragana - Basic Hiragana syllables - Hiragana with Diacritical Marks - Hiragana words and pronunciation – Katakana - Basic Katakana syllables - Katakana with Diacritical Marks – Katakana words and pronunciation.

UNIT II   BASIC WORDS   6

Japanese Greetings and daily expressions - Culture and Behavior of Japanese People and body language – bowing - Time of the day; calendar; counting using Japanese numerical classifiers.

UNIT III   PHRASES & CLAUSES   6

Grammar - Sentence patterns and examples - Making Sentences – Present, Past and Future, Progressive & Perfect Tense - Time- Asking question for numbers and time - Telephone number practice - Translate English into Japanese practice - Describe each person using given cues – Self-Introduction about students -Time and Age making comparisons; talking of daily activities; giving and receiving; shopping; making requests.

UNIT IV   BASIC TENSES   6

Grammar - Making Sentences – Present, Past and Future, Progressive & Perfect Tenses-verb and its forms-particles - pattern and examples -Adverbs - using frequency adverbs -Sentence making using time and verb with direct object - Translate English sentence to Japanese sentence - Making question sentence and answers.

UNIT - V   KEY BELIEFS AND VALUES OF JAPANESE SOCIETY   6

Japanese social interaction – Harmony – Order – Self-development – the three of the most important values. Basic ideas about self and the nature of human society- several religious and philosophical traditions.

TOTAL HOURS: 30

TEXT BOOKS:

SL. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	George Trombley , Yukari Takenaka	Japanese from Zero! 1: Proven Techniques to Learn Japanese for Students and Professionals	Volume 1) 6th Edition Bay Foreign Language Books Ltd,	2015
2	Living Language Japanese, Complete Edition	Japanese reading & writing guide, and free online learning Paperback	Unabridged	2012

REFERENCE BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Pimsleur	Japanese Level 1 CD: Learn to Speak and Understand Japanese with Pimsleur Language Programs Pimsleur;	3rd edition (Comprehensive)	2002
2	Pimsleur	Japanese Level 2 CD: Learn to Speak and Understand Japanese with Pimsleur Language Programs Pimsleur;	Pimsleur; 3 edition	October 1, 2002
3	Pimsleur	Japanese Level 3 CD: Learn to Speak and Understand Japanese with Pimsleur Language Programs Pimsleur	Pimsleur; 3 edition	October 1, 2002
4	Eriko Sato	Practice Makes Perfect Basic Japanese 1st Edition, McGraw-Hill Education	Pimsleur; 1 edition	April 1, 2014
5	Mr Tae K Kim,	A Guide to Japanese Grammar: A Japanese approach to learning Japanese grammar ,	Create Space Independent Publishing Platform	January23, 2014

21HSS07	BASICS OF FRENCH LANGAUGE	L T P C
		2 0 0 2

COURSE OBJECTIVES

- To develop the reading skill of the students and to familiarize them with French language.
- To instill the communication concepts and enhance the students' conversational skill through various practice sessions.
- To familiarize them with a variety of words and pronunciation.
- To develop the receptive skills such as listening, writing, reading and to make the students well-versed in speaking.
- To assist them in improving their vocabulary in French.

COURSE OUTCOMES

21HSS07.CO1	Learn and write French alphabet.
21HSS07.CO2	Develop their pronunciation skill in French language.
21HSS07.CO3	Enrich the vocabulary in French language.
21HSS07.CO4	Speak in French at various occasions.
21HSS07.CO5	Understand and communicate by constructing sentences.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21HSS07.CO1	-	-	-	-	-	-	-	-	-	X	X	X	-	-	-
21HSS07.CO2	-	-	-	-	-	-	-	-	X	X	-	X	-	-	-
21HSS07.CO3	-	-	-	-	-	-	-	X	X	X	-	X	-	X	-
21HSS07.CO4	-	-	-	-	-	-	-	-	-	X	-	X	-	-	-
21HSS07.CO5	-	-	-	-	-	-	-	-	-	X	-	X	-	-	-

UNIT I   BASIC GRAMMAR   6
Alphabets – Numbers 0-31 – Nouns – Definite articles – Indefinite articles – verbs – Greetings- adjectives – possessive adjectives – countries and nationality – months of the year

UNIT II   BASIC VOCABULARY   6
Personality- dresses – colours – interests – adjectives: masculine / feminine – singular / plural – negation – regular verbs

UNIT III   BASIC PHRASES   6
Time – days of the week – house – numbers 32-69 – irregular verbs : aller, faire, prendre – negation : ne.... jamais – questions – near future – pronominal verbs - pronoun : 'on'

UNIT IV   SPEAKING   6
Name of dishes – shopping – at the restaurant – recipe – numbers: 70 – 1000 – partitive articles: du, de la, de l', des - passé ompose and negation - irregular past participles- preposition à + definite article

UNIT V   CULTURE AND SOCIETY   6
Town – directions – public transport – preposition à/en + transport – irregular past participles – adverbs

TOTAL HOURS: 30 Hours

TEXTBOOK:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Régine Mérieux and Yves Loiseau.	Connexions 1	Didier	2004
2.	Rosemary Schell	French for Beginners	Maanu Graphics	2013

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	R.de Roussy de Sales	French Verbs Drills 5th Edition	McGraw-Hill Education	2017
2.	Annie Heminway	Complete French Grammar	McGraw-Hill Education	2016
3.	David M.Srillman and Ronni L.Gordon	French Vocabulary Drills	McGraw-Hill Education	2014
4.	Frederic Bibard	Fluent in French	Talk in French	2016
5.	Gaelle Graham	Complete French	Teach Yourself	2010

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RASIPURAM-637 408, NAMAKKAL Dist.

BASIC SCIENCES

(BS)

For

Mechanical Engineering

21BSS01	ENGINEERING PHYSICS	L T P C
		3 0 0 3

COURSE OBJECTIVES
- To acquire the knowledge in acoustical engineering and ultrasonic
- To enrich the principles involved in laser technology and its applications
- To understand the concept and significance in fiber optics
- To acquire the knowledge on classification and properties of different types of crystal structures
- To understand the concepts in elasticity and transfer of heat energy through materials

COURSE OUTCOMES
21BSS01.CO1	A knowledge of contemporary issues on ultrasonic studies
21BSS01.CO2	An ability to apply knowledge in laser technology for engineering practice
21BSS01.CO3	An ability to solve problems in fiber optics technology
21BSS01.CO4	An ability to analyze the crystal structures by applying crystallographic parameters
21BSS01.CO5	An ability to apply knowledge in elasticity and heat transfer

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21BSS01.CO1	X	X	X	-	X	-	-	-	-	-	-	X	-	-	-
21BSS01.CO2	X	X	-	-	X	-	-	-	-	-	-	X	X	-	-
21BSS01.CO3	X	X	X	-	X	-	-	-	-	-	-	X	-	-	X
21BSS01.CO4	X	X	X	-	-	-	-	-	-	-	-	X	-	-	X
21BSS01.CO5	X	X	X	-	-	-	-	-	-	-	-	X	-	-	-

UNIT I ACOUSTICS AND ULTRASONICS   9
Introduction of acoustics – Classification of sound-Weber-Fechner law- Reverberation – Reverberation time – Factors affecting acoustics of building and its remedy – Absorption coefficient – Measurement of Absorption coefficient. Introduction to ultrasonics– properties – Detection of ultrasonic waves, Magnetostriction effect – Magnetostriction generator – piezoelectric effect – piezoelectric generator–Cavitations – SONAR – Non Destructive Testing – pulse echo system, through transmission and reflection modes.

UNIT II LASERS   9
Introduction – Principle of Spontaneous emission and stimulated emission. Population inversion - pumping methods. Einstein's A and B coefficients – derivation – Types of lasers – He-Ne, Nd-YAG, Semiconductor lasers (homojunction & heterojunction) – Industrial Applications – Lasers in welding, cutting, heat treatment – Medical applications – Holography (construction & reconstruction).

UNIT III FIBRE OPTICS AND ITS APPLICATIONS   9
Principle and propagation of light in optical fibers – Numerical aperture and Acceptance angle – Classification based on materials, refractive index profile – Double crucible technique of fiber drawing – Splicing – Loss in optical fiber – attenuation, dispersion, bending – Fibre optical communication system (Block diagram) – Fiber optic Light sources – Detectors - Endoscope.

UNIT IV CRYSTAL PHYSICS   9
Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius –Coordination number – Packing factor for SC, BCC, FCC and HCP structures –Crystal defects – point, line and surface defects- Burger vector.

UNIT V PROPERTIES OF MATTER AND THERMAL PHYSICS   9
Elasticity – Hook's law – Relationship between three modulii of elasticity (Qualitative) – stress and strain diagram – Poisson's ratio – factors affecting elasticity – bending moment – depression of a cantilever – young's modulus by uniform bending – I shaped girders. Modes of heat transfer – thermal conductivity – Newton's law of cooling – linear heat flow – lee's disc method – radial heat flow – rubber tube method – conduction through compound media (series and parallel method)

TOTAL: 45 Hours

TEXT BOOKS:

Sl.No	Author	Title of the Book	Publisher	Year of Publication
1.	B.N.Sankar & S.O.Pillai,	Engineering Physics I	New Age International Publishers	2015
2	Rajagopal K	Engineering Physics	PHI, New Delhi	2011

REFERENCE BOOKS:

Sl.No	Author	Title of the Book	Publisher	Year of Publication
1.	Tamilarasan.K &Prabhu.K	Engineering Physics-I	Mc Graw Hill Education	2015
2	Palanisamy P.K	Engineering Physics	SCITECH Publications	2011
3	Senthilkumar G	Engineering Physics I	VRB Publishers	2011
4	Gaur R.K. and Gupta S.L.	Engineering Physics	Dhanpat Rai publishers	2009
5	D.K.Bhattacharya & Poonam Tandon	Engineering Physics	Oxford university Press	2017

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RASIPURAM-637 408, NAMAKKAL Dist.

21BSS02	PHYSICS AND CHEMISTRY LABORATORY	L T P C
		0 0 2 1

COURSE OBJECTIVES

- The students will understand the ultrasonic sounds in liquid medium.
- The students can demonstrate laser and its propagation through optics.
- To understand thermal conductivity of bad conductors.
- The students familiar with characteristics of water and able to estimate hardness and alkalinity of water sample.
- The students will understand the basic concepts condunctometric and pH metric titrations.

COURSE OUTCOMES

21BSS02.CO1	Ability to determine the velocity of ultrasonic sound in any liquid.
21BSS02.CO2	Capable of understanding the concept of laser and its propagation through Optical fiber.
21BSS02.CO3	Ability to determine the thermal conductivity of the bad conductor and determine the modulus of elasticity.
21BSS02.CO4	Able to analyze hardness and alkalinity of water sample.
21BSS02.CO5	Able to estimate the amount of acid by conductometric, potentiometric and pH metric titrations.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21BSS02.CO1	X	X	X	-	X	-	-	-	-	-	-	X	-	-	-
21BSS02.CO2	X	X	-	-	X	-	-	-	-	-	-	X	X	-	-
21BSS02.CO3	X	X	X	-	X	-	-	-	-	-	-	X	-	-	X
21BSS02.CO4	X	X	X	-	-	-	-	-	-	-	-	X	-	-	X
21BSS02.CO5	X	X	X	-	-	-	-	-	-	-	-	X	-	-	-

LIST OF EXPERIMENTS IN PHYSICS

1. (a) Determination of Wavelength and particle size using Laser, (b) Determination of acceptance angle in an optical fiber.
2. Determination of Velocity of sound and Compressibility of liquid – Ultrasonic Interferometer
3. Determination of Thermal Conductivity of a bad conductor – Lee's Disc method.
4. Determination of Young's Modulus by uniform bending method
5. Determination of Moment of Inertia by rigidity modulus

LIST OF EXPERIMENTS IN CHEMISTRY

1. Determination of hardness of water by EDTA Method
2. Determination of alkalinity in water sample
3. Conductometric titration of HCl vs NaOH
4. Estimation of hydrochloric acid by pH meter
5. Determination of molecular weight of polymer using Oswald Viscometer

REFERENCE BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dr.G.Senthilkumar	Physics Laboratory Manual	VRB Publishers	2017
2.	Dr.P.Mani	Engineering Physics Practical	Dhanam Publications	2017
3.	R.Veeraswamy, V.Venkateswaran	Basic Principles of Practical Chemistry	Sultan Chand & Sons	2013
4.	P.Meena Sundari	Engineering Chemistry Laboratory Manual	KKS Publishers	2015

21BSS03	BIO AND NANOMATERIALS SCIENCE	L T P C
		3 0 0 3

COURSE OBJECTIVES
- To understand the classification and properties of materials
- To acquire the knowledge in basics of biomaterials
- To enrich the principles involved in nanotechnology
- To understand the synthesis techniques of nanomaterials
- To educate the basic concepts of carbon nanotubes

COURSE OUTCOMES

21BSS03.CO1	A knowledge on basics of materials
21BSS03.CO2	A knowledge of contemporary issues on bio materials
21BSS03.CO3	An ability to apply knowledge in nanomaterials and its applications
21BSS03.CO4	An ability to solve problems in nanotechnology
21BSS03.CO5	An ability to apply knowledge in carbon nanotubes

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21BSS03.CO1	X	X	X	-	-	X	X	X	-	X	-	X	X	-	-
21BSS03.CO2	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
21BSS03.CO3	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
21BSS03.CO4	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
21BSS03.CO5	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-

Unit- I Introduction to Materials   9
Postulates of Rutherford and Bhor atom model-Bhor Theory of Hydrogen atom- -Classification of atomic bonds-primary and secondary bonds – Classification of Materials: metals-ceramics-composites-types and its general properties-Significance of Phase diagram.

Unit- II Basics of Biomaterials   9
Definition of biomaterials and biocompatibility- classification of biomaterials- shape memory alloys-properties and applications-properties of NiTinol –properties and application of alumina-polymers in biomedical use-schematic diagram and working of heart lung machine-contact lenses.

Unit- III Introduction to Nanotechnology   9
Definition of Nanoscale system –Theory of Nanotechnology –surface to volume ratio- Classification of nano structures based on dimension: 0D, 1D, 2D, 3D materials – Applications of Nanotechnology

Unit- IV Synthesis Of Nanomaterials   9
Bottom up and top down process, difference between bottom up and top down process, Electro deposition method – Plasma arcing method –Ball milling-Chemical vapour deposition-Pulsed laser deposition method- Lithography-Electron beam lithography –properties of nanomaterials-Applications.

Unit V Carbon Nano Materials   9
Bonding in carbon structures–Carbon nanotube types – Single walled and multi walled carbon nanotubes-structure and properties – Synthesis of carbon nanotube: arc discharge- chemical vapour deposition method –applications.

Total : 45

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RASIPURAM-637 408, NAMAKKAL Dist.

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Pillai S.O.	Solid State Physics	New Age International(P) Ltd	2009
2	Sujata V. Bhatt	Biomaterials	Second Edition Narosa Publishing House	2005
3	T.Pradeep	TheEssentials:Understanding Nanoscience and Nanotecnology	TataMcGraw-Hill PublishingCompany Limited,NewDelhi,	2008

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	James F. Shackelford, Madanapalli K. Muralidhara	Introduction to Materials Science for Engineers	Sixth Edition, Pearson Education Inc.	2007
2	C.M.Agrawal, J.L.Ong, M.R.Appleford ,Gopinath Mani	Introduction to Biomaterials basic theory with Engineering Applications	Cambridge University Press New York	2014
3	B.D. Ratner, A.S. Hoffman F.J. Schoen, J.E. Lemons	Biomaterials Science an Introduction to Materials in Medicine	2nd Edition Elsevier Academic Press, California, USA	2004
4	C.P. Poole and F.J. Owens.	Introduction to Nanotechnology	Wiley, New Delhi	2007
5	M. Meyyappan	Carbon Nanotubes Science & Applications	CRC Pres, Boca Ranton, London, New York, Washington D.C	2005

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RASIPURAM-637 408, NAMAKKAL Dist.

21BSS04	MATERIAL SCIENCES	L T P C
		3 0 0 3

COURSE OBJECTIVES
- To understand the types of atomic structures in crystalline materials
- To understand the basic concepts in magnetism and superconductivity
- To impart knowledge on conducting and semiconducting materials
- To educate the concept of dielectric materials
- To understand the basic concepts in modern engineering materials

COURSE OUTCOMES
21BSS04.CO1	An ability to identify the types of crystalline structure
21BSS04.CO2	An ability to apply properties on magnetism and superconducting materials
21BSS04.CO3	An ability to apply knowledge on superconducting materials and its applications
21BSS04.CO4	An ability to apply knowledge on dielectric materials
21BSS04.CO5	An ability to use the synthesis techniques in modern materials

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21BSS04.CO1	X	X	-	X	-	-	-	-	-	-	-	X	-	-	-
21BSS04.CO2	X	-	X	-	-	-	-	-	-	-	-	X	-	-	-
21BSS04.CO3	X	X	X	-	-	-	-	-	-	-	-	X	-	-	-
21BSS04.CO4	X	X	-	-	-	-	-	-	-	-	-	X	-	-	-
21BSS04.CO5	X	-	-	X	-	-	-	-	-	-	-	X	X	-	X

UNIT I CRYSTAL PHYSICS   9
Lattice – Unit cell – Bravais lattice – Lattice planes – Milier indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius –Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and Graphite structures (Qualitative) – Crystal growth techniques – Bridgeman technique and Czochralski method.

UNIT II CONDUCTORS AND SEMICONDUCTORS   9
Classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann-Franz law – Quantum theory - Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.Properties of semiconductors - classification – Elemental and Compound semiconductors – Intrinsic and Extrinsic semiconductors - carrier concentration derivation in intrinsic semiconductors - band gap determination - Hall effect – Determination of Hall coefficient –Experimental method - Applications of Hall Effect.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS   9
Origin of magnetic moment – Types – Dia, para, Ferro, anti ferromagnetic materials – Domain theory – Hysteresis – Soft and hard magnetic materials – Ferrites – preparation, properties and applications.Properties of superconducting materials - BCS theory of superconductivity (Qualitative) - Types of super conductors – High T_c superconductors – Applications of superconductors – SQUID, Cryotron, Magnetic levitation.

UNIT IV DIELECTRIC MATERIALS   9
Basic definitions - Electrical susceptibility – dielectric constant – Types of polarization - electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius –Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials(capacitor and transformer) – ferroelectricity and applications

UNIT V ADVANCED ENGINEERING MATERIALS   9
Metallic glasses: Preparation, properties and applications – metallic glasses as transformer cores.Shape memory alloys (SMA): Types and Characteristics - properties of NiTi alloy- advantages and disadvantages of SMA - applications. Nanomaterials: Synthesis– Eleectro deposition, Plasma arcing - properties of nanoparticles and applications. Carbon nanotubes: Types - Single walled and multi walled nanotubes – Synthesis of carbon nanotube - pulsed laser deposition, chemical vapour deposition – Properties and applications

TOTAL: 45 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Palanisamy P K	Materials Science	Scitech Publishers	2007
2	V Rajendran	Materials Science	Tata McGraw Hill publications	2008

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Arumugam,	Materials Science	Anuradha Publications	2010
2	William Smith	Materials science	Tata McGraw Hill publications	2015
3	Raghavan V	Materials science	Prentice Hall India Ltd.	2007
4	O.P.Kanna	Material Science and Metallurgy	Dhanpat Rai Publications	2012
5	G.Sudarmozhi	Material Science	Bharathi Publishers	2015

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21BSS05	PHYSICS FOR MECHANICAL ENGINEERS	L T P C
		3 0 0 3

COURSE OBJECTIVES

- Define the various moduli of elasticity and explain streamline and turbulent flow of liquid and apply Poiseuille's formula to determine the coefficient of viscosity of a liquid.
- Describe experimental methods to determine thermal conductivity and state the laws of thermodynamics and their applications in the field of Engineering.
- Define and explain electrical and thermal conductivity of conducting materials.
- Explain the theory of semi-conducting materials and its applications.
- Recognize the novel properties of new engineering materials

COURSE OUTCOMES

21BSS05.CO1	An ability to identify the types crystalline structure
21BSS05.CO2	An ability to apply properties on magnetism and superconducting materials
21BSS05.CO3	An ability to apply knowledge on superconducting materials and its applications
21BSS05.CO4	An ability to apply knowledge on dielectric materials
21BSS05.CO5	An ability to use the synthesis techniques in modern materials

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21BSS05.CO1	X	X	X	-	X	-	-	-	-	-	-	X	-	-	-
21BSS05.CO2	X	X	-	-	X	-	-	-	-	-	-	X	X	-	-
21BSS05.CO3	X	X	X	-	X	-	-	-	-	-	-	X	-	-	X
21BSS05.CO4	X	X	X	-	-	-	-	-	-	-	-	X	-	-	X
21BSS05.CO5	X	X	X	-	-	-	-	-	-	-	-	X	-	-	-

UNIT I PROPERTIES OF MATTER AND HYDRODYNAMICS   9

Elasticity - Poisson's ratio and relation between moduli (qualitative) - Stress-strain diagram- Factors affecting elasticity - Bending of beams - Cantilever - expression for bending moment – Measurement of Young's modulus by uniform and non-uniform bending - I shaped girders - Stream line flow - Turbulent flow- Poiseuille's formula for flow of liquid through a capillary tube – Determination of coefficient of viscosity of a liquid

UNIT II HEAT AND THERMODYNAMICS   9

Thermal conductivity - Forbe's and Lee's disc methods- Radial and cylindrical flow of heat -Thermal conductivity of rubber and glass - Thermal insulation of buildings - Thermal insulating materials - Thermal equilibrium - Zeroth law of thermodynamics - Internal Energy - First law of thermodynamics - Indicator diagram - Isothermal process - Work done in an isothermal expansion - Adiabatic process - Work done in an adiabatic expansion – Reversible and irreversible processes - Second law of thermodynamics - Carnot engine - Efficiency of Canot's cycle - Carnot's cycle as heat engine and refrigerator - Carnot's theorem - Comparative study of Ideal Otto and diesel engines and their efficiency (no derivation) - Entropy - temperature diagram of Carnot's cycle.

UNIT III CONDUCTING MATERIALS   9

Conductors - classical free electron theory of metals - Electrical and thermal conductivity - Wiedemann-Franz law - Lorentz number - Drawbacks of classical theory - Quantum theory -band theory of solids(qualitative treatment only) - Fermi distribution function - Effect of temperature on Fermi Function - Density of energy states - Carrier concentration in metals - application of conducting materials in induction furnace

UNIT IV SEMICONDUCTING MATERIALS   9

Intrinsic semiconductors – Energy band diagram – direct and indirect band gap semiconductors -Carrier concentration in intrinsic semiconductors - Fermi level – Variation of Fermi level with temperature – Electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentration in N-type and P-type semiconductors (Qualitative Treatment only) – Variation of Fermi level with temperature and impurity concentration – Compound semiconductors – Hall effect – Determination of Hall coefficient – Hall effect applications - application of semiconductors in strain measurements

UNIT V NEW ENGINEERING MATERIALS 9

Metallic glasses: Preparation - properties – applications. Shape memory alloys: Characterisitics - properties of Ni-Ti alloy – application- advantages and disadvantages of SMA. Advanced Ceramics: Introduction – characteristics – structural ceramics. Nanoscience and Nanotechnology – significance of the nanoscale - different types of nanostructures (Confinement Dimensions 0-D, 1-D, 2-D and 3-D) - Categories of nanomaterials - Fabrication of nonomaterials - Ball milling method and Chemical vapour deposition technique - Carbon nanotubes - Types of carbon nanotubes - CNT structure – properties and applications. Biomaterials (metals and alloys, ceramics) - classification and applications.

TOTAL: 45Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B.N.Sankar& S.O.Pillai	Engineering Physics 1	New Age International Publishers	2015
2	M. Arumugam,	Materials Science	Anuradha Publications	2006

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B. K. Pandey and S. Chaturvedi	Engineering Physics	Cengage Learning India Pvt. Ltd., Delhi,	2012
2	Rajendran, V, and Marikani A	Materials science	TMH Publications	2004
3	Jayakumar. S.	Materials science	R K. Publishers, Coimbatore	2008
4	Palanisamy P.K	Materials science	Scitech Publications (India) Pvt. Ltd	2007
5	Sudarmozhi.G.	Engineering Physics II.	Bharathi Publishers,	2015

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RASIPURAM-637 408, NAMAKKAL Dist.

21BSS11	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- The students familiar with characteristics of water and know the specification of boiler feed water. To understand the softening of hard water by using various purification techniques.
- To understand the principles involved in corrosion. The students able to apply these principles towards the prevention of corrosion.
- The students will understand the basic concepts of polymers chemistry and its applications. The students have sound knowledge of plastics and rubbers.
- The students understand the reaction of nuclear fission and fusion and promote the knowledge about process of nuclear reactors and understand various chemical reactions involved in the batteries.
- The students will have knowledge on industrial important abrasives and refractories.

COURSE OUTCOMES

21BSS11.CO1	Acquire knowledge conversant with principles of water characterization and treatment of portable water for industrial purpose.
21BSS11.CO2	An ability to apply principles of electrochemistry and corrosion towards the control of corrosion.
21BSS11.CO3	Ability to familiarize different polymers, plastics, rubbers and its applications.
21BSS11.CO4	Ability to apply basic knowledge on nuclear reactors and its use in electrical power generation and working of energy storage devices
21BSS11.CO5	Acquire knowledge on abrasives, refractories in industrial application.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21BSS11.CO1	X	X	-	-	X	X	-	X	-	-	-	-	-	-	-
21BSS11.CO2	X	-	X	-	X	-	X	-	-	-	-	-	-	-	-
21BSS11.CO3	X	-	X	-	-	-	X	-	-	-	-	-	-	X	-
21BSS11.CO4	X	-	X	-	X	X	-	-	-	-	-	-	-	X	-
21BSS11.CO5	X	-	X	-	X	-	X	-	-	-	-	-	-	-	-

UNIT I   WATER TECHNOLOGY   9

Characteristics of water – hardness of water – types of hardness – estimation of hardness by EDTA method – alkalinity – types of alkalinity – estimation of alkalinity – Boiler feed water – requirements – disadvantages of using hard water in boilers – boiler troubles – scale and sludge – priming and foaming – caustic embrittlement – boiler corrosion – internal conditioning (phosphate, calgon, colloidal and carbonate conditioning methods) – external conditioning – zeolite and demineralization process – desalination and reverse osmosis.

UNIT II   CORROSION AND CORROSION CONTROL   9

Corrosion – chemical corrosion – electrochemical corrosion – mechanism of dry and wet corrosion – types of corrosion – galvanic corrosion – differential aeration corrosion – factors influencing rate of corrosion – corrosion control methods – sacrificial anodic method and impressed current cathodic protection method – corrosion inhibitors – types of inhibitors – protective coatings – paints – requirements of paints – constituents and functions of paints – failures of paints – electroplating of gold on copper – electroless plating of nickel.

UNIT III   POLYMERS   9

Polymers – definition – polymerization – types of polymerization (addition, condensation and copolymerization only) – mechanism of addition polymerization (free radical mechanism only) – properties of polymers – molecular weights, stereo specific polymers and polydispersive index –Plastics and its classification – thermo plastics and thermosetting plastics – preparation, properties and uses of polyvinyl chloride (PVC), Teflon, polyamides (nylon – 11, nylon – 6 and nylon – 6,6) and polyethylene terephthalate (PET) – Rubber – vulcanization of rubber – preparation, properties, uses of butyl rubber and SBR .

UNIT IV   NON CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES   9

Nuclear energy – fission and fusion reactions – nuclear chain reactions – characteristics of nuclear chain reaction – light water nuclear reactor for power generation – breeder reactor – solar energy conversion – solar cells – wind energy – Fuel cells – working of hydrogen and oxygen fuel cell – batteries – types of batteries – construction and working of batteries – alkaline battery – lead acid battery, nickel – cadmium battery and lithium battery.

UNIT V   ENGINEERING MATERIALS   9

Refractories – classification – acidic, basics and neutral refractories – properties – manufacture of alumina, magnesite and zirconia bricks – Abrasives – natural and synthetic abrasives – hardness of abrasives – Mohs scale – manufacture, properties and uses of silicon carbide and boron carbide – application of abrasives.

TOTAL: 45 Hours

TEXT BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B P.C.Jain and Monica Jain	Engineering Chemistry	Dhanpat Rai Pub, Co., New Delhi	2013
2.	Dr.A.Ravikrishnan	Engineering Chemistry I & II	Sri Krishna Hitech Publishing Company Pvt. Ltd	2016

REFERENCE BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dr.P.Santhi & S.Elavarasan	Engineering Chemistry	Sri Kandhan Publications	Aug 2016
2.	S.S. Dara	A text book of engineering chemistry	S.Chand & Co.Ltd., New Delhi	2013
3.	Shradha Sinha	Advanced Engineering Chemistry	Krishna Prakasan Media (P) Ltd., Meerut	2015
4.	B.Sivasankar	Engineering Chemistry	Tata McGraw-Hill Publishing Company, Ltd., New Delhi	2008
5.	V.R.Gowariker N.V.Viswanathan and Jayadev Sreedhar	Polymer Science	New Age International Pvt. Ltd., Chennai	2006

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RASIPURAM-637 408, NAMAKKAL Dist.

21BSS12	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES
- To give a comprehensive insight into ecosystem, biodiversity and natural recourses.
- To create an awareness on the various environmental pollution aspects and issues.
- To educate the ways and means to protect the environment from various types of pollution.
- To import some fundamental knowledge on human welfare measures and understands the role of government and non-government organization in environment managements.
- Discuss the impact of human population on the environment

COURSE OUTCOMES
21BSS12.CO1	Able to define and explain scope and importance of environment, ecosystem and biodiversity.
21BSS12.CO2	Acquire knowledge about various natural resources and equitable use of resources for sustainable life style.
21BSS12.CO3	Acquire knowledge on various environmental pollution and able to protect.
21BSS12.CO4	Acquire fundamental knowledge on human welfare and Familiarizes about the roles of various government and non-government organization in environment managements.
21BSS12.CO5	Acquire knowledge on impacts of human population over the environment.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21BSS12.CO1	X	-	-	-	-	X	X	-	-	-	-	X	-	-	-
21BSS12.CO2	X	X	X	-	-	X	X	-	-	-	-	X	-	-	-
21BSS12.CO3	X	-	X	-	X	-	X	X	-	-	-	X	-	-	-
21BSS12.CO4	X	-	-	-	-	X	-	X	-	-	-	X	-	-	-
21BSS12.CO5	X	X	-	-	-	X	X	-	-	-	-	X	-	-	-

UNIT I   ECOSYSTEMS AND BIODIVERSITY   9
Definition, scope and importance of environment – need for public awareness – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction to biodiversity definition – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – hot – spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man – wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and exsitu conservation of biodiversity.

UNIT II   NATURAL RESOURCES   9
Forest resources: Use and over – exploitation, deforestation, cause – effect – control measures – Water resources: Use and over – utilization of surface and ground water, floods, drought, conflicts over water, dams – benefits and problems –Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer – pesticide problems, water logging, salinity – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

UNIT III   ENVIRONMENTAL POLLUTION   9
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution(c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – disaster management: floods, earthquake, cyclone and landslides.

UNIT IV   SOCIAL ISSUES AND THE ENVIRONMENT   9
From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people – environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, – environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Forest conservation act – role of nongovernmental organization – Public awareness.

UNIT V   HUMAN POPULATION AND THE ENVIRONMENT   9

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV/AIDS – women and child welfare – role of information technology in environment and human health.

TOTAL: 45 Hours

TEXT BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dr.A.Ravikrishnan	Environmental Science and Engineering	Sri Krishna Hitech Publishing Company Pvt. Ltd	June 2016
2.	Gilbert M. Masters	Introduction to Environmental Engineering and Science	Pearson Education Pvt., Ltd., Second Edition. ISBN 81-297-0277-0	2004

REFERENCE BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dharmendra S. Sengar	Environmental Law	Prentice hall of India PVT LTD, New Delhi	2007
2.	R.K.Trivedi	Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol-I and II	BS Publications	2010
3.	R.Rajagopalan	Environmental Studies	From Crisis to Cure, Oxford University Press	2015
4.	Benny Joseph	Environmental Science and Engineering	Tata McGraw-Hill, New Delhi	2006
5.	T.G.Miller	Environmental Science	Wadsworth Publishing Co.	2007

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| 21BSS13 | ORGANIC CHEMISTRY | L T P C |
| | | 3 0 0 3 |

COURSE OBJECTIVES
- The students familiar with different types of organic compounds and its characteristics reactions.
- The students will understand the preparation of heterocyclic compounds and organic dyes.
- To understand the mechanism for the preparation of organic compounds with help of reagents.
- The students understand the chemistry of carbohydrates and proteins.
- The students will have knowledge on identification of organic compounds with spectroscopy tools.

COURSE OUTCOMES
21BSS13.CO1	Acquire knowledge on various functional groups of organic compounds.
21BSS13.CO1	An ability to prepare heterocyclic compounds and dyes.
21BSS13.CO1	Ability to explain mechanism of various organic reactions.
21BSS13.CO1	Acquire knowledge on types, functions and reactions of carbohydrates and proteins.
21BSS13.CO1	Acquire knowledge on identification of organic compounds by spectroscopy.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21BSS13.CO1	X	X	-	-	X	X	-	X	-	-	-	-	-	-	-
21BSS13.CO2	X	-	X	-	X	-	X	-	-	-	-	-	-	-	-
21BSS13.CO3	X	-	X	-	-	-	X	-	-	-	-	-	-	X	-
21BSS13.CO4	X	-	X	-	X	X	-	-	-	-	-	-	-	X	-
21BSS13.CO5	X	-	X	-	X	-	X	-	-	-	-	-	-	-	-

UNIT - I   INTRODUCTION TO ORGANIC CHEMISTRY   9
Introduction – types of organic compounds (aliphatic and aromatic) – various types of functional groups – types of organic reactions (substitution and elimination only) – Aliphatic nucleophilic substitution – mechanism of SN1, SN2 and SNi reactions – Aliphatic elimination reactions – mechanisms of E1 and E2 reactions.

UNIT - II   CHEMISTRY OF HETEROCYCLIC COMPOUNDS AND DYES   9
Introduction – heterocyclic compounds having not more than one heteroatoms such as oxygen, nitrogen and sulphur – synthesis and properties of furan, pyrrole and thiophene. Dyes – color and constitution – chromophore – auxochrome – classification according to application and structure – preparation and uses of methyl orange, fluorescein and malachite green dyes.

UNIT - III   ORGANIC NAMING REACTIONS AND REAGENTS   9
Perkin reaction – Reimer Tiemann reaction – Kolbe Schmitt reaction – Ullmann reaction – Diels Alder reaction – Important reagents and their synthetic applications in organic chemistry – $LiAlH_4$, $NaBH_4$, Ag_2O, Lead tetra acetate and Osmium tetroxide.

UNIT - IV   CHEMISTRY OF CARBOHYDRATES AND PROTEINS   9
Carbohydrate – classification – mono saccharides, structure elucidation of mono saccharides (glucose and fructose only), interconversion (aldose to ketose and ketose to aldose only). Amino acids – Zwitter ion – isoeletric point – preparation of amino acids. Peptides – Peptide linkages – proteins – classification of proteins – Structure of proteins.

UNIT - V   ORGANIC SPECTROSCOPY   9
UV-Visible spectroscopy – types of electronic transitions – Instrumentation – bathochromic shift and hypsochromic shift – IR spectroscopy – number and types of fundamental vibrations – Instrumentation – position of IR absorption frequencies for functional groups like aldehyde, ketone, alcohol, acid, amine and amide.

Total: 45

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Arun Bahl and B.S.Bahl	A Text Book of Organic Chemistry	S.Chand & Company Ltd	2012
2	V.K.Ahluwalia and R.K.Parashar	Organic Reaction Mechanism	Narosa Publishing House	2017

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Tantillo Dean J	Applied Theoretical Organic Chemistry	World Scientific	2018
2.	Tom Sorrell	Organic Chemistry	University Science Books,	2016
3.	Mehta Bhupinder & Mehta Manju	Organic Chemistry -II Edition	PHI Learning Pvt. Ltd.	2015
4.	R.T. Morrison and R.N. Boyd	Organic Chemistry	VI Edition Prentice Hall Inc.	1996
5.	K.S. Tiwari, N.K. Vishnoi and S.N. Malhotra	A text book of Organic Chemistry	Second Edition, Vikas Publishing House Pvt. Ltd, Delhi	1998

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| 21BSS14 | PHYSICAL CHEMISTRY | L T P C |
| | | 3 0 0 3 |

COURSE OBJECTIVES:
- To acquire knowledge on electric components and their behavior.
- To demonstrate the kinetics involved in chemical reaction.
- To determine the physical properties of photochemistry.
- To verify various laws involved in physical chemistry.
- To familiarize with different types of alloys.

COURSE OUTCOMES
21BSS14.CO1	Understand the fundamentals of electrochemistry.
21BSS14.CO2	Illustrate the kinetics and theories involved in chemical reactions
21BSS14.CO3	Demonstrate various quantum theories and reactions of photochemistry.
21BSS14.CO4	Summarize the properties of colloids
21BSS14.CO5	Interpret the characteristics of alloys and phase rule.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21BSS14.CO1	X	X	-	-	X	X	-	X	-	-	-	-	-	-	-
21BSS14.CO2	X	-	X	-	X	-	X	-	-	-	-	-	-	-	-
21BSS14.CO3	X	-	X	-	-	-	X	-	-	-	-	-	-	X	-
21BSS14.CO4	X	-	X	-	X	X	-	-	-	-	-	-	-	X	-
21BSS14.CO5	X	-	X	-	X	-	X	-	-	-	-	-	-	-	-

UNIT I   ELECTROCHEMISTRY   9
Electrical Resistance – Specific Resistance – Electrical conductance – Specific conductance – Equivalent conductance – Ceil constant – Determination of cell constant – variation of conductance with dilution – Kohlrausch's law – Single electrode potential – Nernst equation – Applications of Nernst equation –Electrochemical series.

UNIT II   CHEMICAL KINETICS   9
Rate of a reaction – Order of a reaction – Examples and rate equations for Zero order, First order, Second order and Third order reactions – Molecularity of a reaction – Unimolecular and Bimolecular reactions – Half life period – Activation energy – Arrhenius equation – Collision theory of reaction rates.

UNIT III   PHOTOCHEMISTRY   9
Laws of Photochemistry, Beer–Lambert's law- Grothus & Drapper's law- Stark Einstein's law-Quantum efficiency– Reason for difference in quantum efficiency – Method of determination of quantum yield. Jabulanski diagram - Photochemical reactions, Kinetics and mechanism of Hydrogen – Chlorine reaction – Photosensitization - Photo inhibitor - Chemiluminescence.

UNIT IV   COLLOIDS   9
Introduction to colloids – properties of colloids – coagulation of solutions – Origin of charge on colloidal particles – Determination of size of colloidal particles – Donnan Membrane equilibrium – Emulsions – Gels – Applications of colloids – Nanoparticles (Au, Ag, Pt) – Preparation – Characterization – Properties and Application.

UNIT V   PHASE EQUILLIBRIA   9
Phase - Components – Degrees of freedom - The Gibbs Phase rule – Derivation of the Phase rule – One Component system – The water System – Two Component system – Simple Eutectic System – Lead-Silver System - Desilverisation of Lead – Congruent and Incongruent Melting points.

TOTAL: 45 Hours

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	B.R.Puri, L.R.Sharma	Principals of Physical Chemistry	Vishal Publishing Co	2017
2	A. S. Negi	A Textbook of Physical Chemistry	New Age International	2007

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David W. Ball	Physical Chemistry	Cengage Learning	2014
2.	Arthur Adamson	A Textbook of Physical Chemistry	Elsevier	2012
3.	V.D. Athawale	Experimental Physical Chemistry	New Age International	2007
4.	Peter Atkins & Julio de Paula	Atkins' Physical Chemistry	Oxford university press	2002
5.	Kund and Jain	Physical Chemistry	S.Chand and Company	1996

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RASIPURAM-637 408, NAMAKKAL Dist.

21BSS15	APPLIED CHEMISTRY	L T P C
		3 0 0 3

COURSE OBJECTIVES
- The students familiar with characteristics of water and know the specification of boiler feed water. To understand the softening of hard water by using various purification techniques.
- To understand the concept and importance of thermodynamics.
- The students will understand the basic concepts of electrochemistry and its applications.
- The students understand about the fuels and its type and understand the combustion of fuels.
- The students will have knowledge on industrial important abrasives, cement, cement and glass.

COURSE OUTCOMES
21BSS15.CO1   Acquire knowledge conversant with principles of water characterization and treatment of portable water for industrial purpose.
21BSS15.CO2   An ability to apply principles of thermodynamics.
21BSS15.CO3   Ability to familiarize basic concepts of electrochemistry and its applications.
21BSS15.CO4   Ability to apply basic knowledge on the fuels and its uses and acquire knowledge on the combustion of fuels.
21BSS15.CO5   Acquire knowledge on industrial important abrasives, cement and glass.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21BSS15.CO1	X	X	-	-	X	X	-	X	-	-	-	-	-	-	-
21BSS15.CO2	X	-	X	-	X	-	X	-	-	-	-	-	-	-	-
21BSS15.CO3	X	-	X	-	-	-	X	-	-	-	-	-	-	X	-
21BSS15.CO4	X	-	X	-	X	X	-	-	-	-	-	-	-	X	-
21BSS15.CO5	X	-	X	-	X	-	X	-	-	-	-	-	-	-	-

UNIT I   PHASE RULE AND ALLOYS   9
Statement and explanation of terms involved – one component system – water system – condensed phase rule – construction of phase diagram by thermal analysis – simple eutectic systems (lead-silver system only) – alloys – importance, ferrous alloys – nichrome and stainless steel – heat treatment of steel, non-ferrous alloys – brass and bronze.

UNIT II   CHEMICAL THERMODYNAMICS   9
Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions: Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation, Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore.

UNIT IIII   ELECTROCHEMISTRY   9
Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes – Standard Hydrogen electrode - Calomel electrode – Ion selective electrode – glass electrode and measurement of pH – electrochemical series – significance – potentiometer titrations (redox - Fe^{2+} versus dichromate) and conduct metric titrations (acid-base – HCl vs, NaOH) titrations.

UNIT IV   FUELS AND COMBUSTION   9
Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- coalanalysis of coal (proximate and ultimate)- carbonization- Otto Hoffmann method - petroleum- manufacture of synthetic petrol (Bergius process)- knocking, octane number - diesel oil- cetane number - natural gas- compressed natural gas(CNG)-liquefied petroleum gases(LPG) - Combustion of fuels: introduction- theoretical calculation of calorific value- ignition temperature- flue gas analysis (ORSAT Method).

UNIT V   ENGINEERING MATERIALS   9
Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Portland cement- manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement–properties and uses. Glass - manufacture, types, properties and uses.

TOTAL: 45 Hours

TEXT BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B P.C. Jain and Monica Jain	Engineering Chemistry	Dhanpat Rai Pub, Co., New Delhi	2013
2.	Dr.A.Ravikrishnan	Engineering Chemistry I & II	Sri Krishna Hitech Publishing Company Pvt. Ltd	2016

REFERENCE BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dr.P.Santhi & S.Elavarasan	Engineering Chemistry	Sri Kandhan Publications	Aug 2016
2.	S.S. Dara	A text book of engineering chemistry	S.Chand & Co.Ltd., New Delhi	2013
3.	Shradha Sinha	Advanced Engineering Chemistry	Krishna Prakasan Media (P) Ltd., Meerut	2015
4.	B.Sivasankar	Engineering Chemistry	Tata McGraw-Hill Publishing Company, Ltd., New Delhi	2008
5.	V.R.Gowariker N.V.Viswanathan and Jayadev Sreedhar	Polymer Science	New Age International Pvt. Ltd., Chennai	2006

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21BSS16	ORGANIC CHEMISTRY LABORATORY	L	T	P	C
		0	0	3	1

COURSE OBJECTIVES

- The students familiar with different types of organic compounds and its characteristics reactions.
- The students will understand the preparation of organic compounds.
- To understand the mechanism for the preparation of organic compounds.
- The students will have skill on preparation of simple organic compounds.
- The students will understand various methods of organic preparations.

COURSE OUTCOMES

21BSS16.CO1	Acquire knowledge on various functional groups of organic compounds.
21BSS16.CO2	Acquire knowledge on identification of organic compounds by simple color reactions.
21BSS16.CO3	An ability to identify special elements present in organic compounds.
21BSS16.CO4	Ability to identify functional groups in organic compounds.
21BSS16.CO5	Acquire knowledge on basics in organic compound preparation.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21BSS16.CO1	X	X	-	-	X	X	-	X	-	-	-	-	-	-	-
21BSS16.CO2	X	-	X	-	X	-	X	-	-	-	-	-	-	-	-
21BSS16.CO3	X	-	X	-	-	-	X	-	-	-	-	-	-	X	-
21BSS16.CO4	X	-	X	-	X	X	-	-	-	-	-	-	-	X	-
21BSS16.CO5	X	-	X	-	X	-	X	-	-	-	-	-	-	-	-

LIST OF EXPERIMENTS

1. Organic Qualitative Analysis
a) Detection of elements- nitrogen, sulphur and halogens.
b) Detection of aliphatic or aromatic.
c) Detection of whether saturated or unsatured compounds.
d) Preliminary tests and detection of functional groups, phenols, aromatic amines, aromatic acids, Urea, benzamide & carbohydrate (monosaccharides only).

2. Introduction to Organic Synthetic Procedures
a) Acetylation – Preparation of acetanilide from aniline.
b) Hydrolysis – Preparation of salycilic acid from methyl salyciliate.
c) Substitution – Conversion of acetone to iodoform.
d) Nitration – Preparation of m-dinitrobenzene from nitrobenzene.
e) Oxidation – Preparation of benzoic acid from benzaldehyde/ benzyl alcohol

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	V.Venkateswaran, R.Veerasamy	Basic Principles of Practical Chemistry	Sultan Chand & Sons	2013
2	Arun Bahl and B.S.Bahl	A Text Book of Organic Chemistry	S.Chand & Company Ltd	2012

21BSS17	PHYSICAL CHEMISTRY LABORATORY	L T P C
		0 0 3 1

COURSE OBJECTIVES:

- To acquire knowledge on conductance measurements.
- To determine the rate of a chemical reaction.
- To determine the physical properties of photochemistry.
- To verify phase rule in physical chemistry.
- To familiarize with different types absorption.

COURSE OUTCOMES

21BSS17.CO1	An ability to measure the conductance of a solution.
21BSS17.CO2	Demonstrate phase diagram of simple system.
21BSS17.CO3	Able to determine the rate of reaction of simple reaction.
21BSS17.CO4	Able to estimate the amount of weak acid by conductometric measurements.
21BSS17.CO5	An ability to calculate partition coefficient of two immiscible liquids.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21BSS17.CO1	X	X	-	-	X	X	-	X	-	-	-	-	-	-	-
21BSS17.CO2	X	-	X	-	X	-	X	-	-	-	-	-	-	-	-
21BSS17.CO3	X	-	X	-	-	-	X	-	-	-	-	-	-	X	-
21BSS17.CO4	X	-	X	-	X	X	-	-	-	-	-	-	-	X	-
21BSS17.CO5	X	-	X	-	X	-	X	-	-	-	-	-	-	-	-

LIST OF EXPERIMENTS

1. Determination of molecular weight of a polymer by viscosity method.
2. Determination of partition co-efficient of iodine between two immiscible solvents
3. Determination of Ka of the weak acid
4. Conductometric experiments - Verification of Oswald's Dilution Law
5. Titration of Weak Acid Vs Weak Base
6. Determination of Rate Constant (K)
7. To study the adsorption of Acetic acid on charcoal and construct the isotherm.
8. Determination of pH metric titration of Strong Acid Vs Strong Base
9. Enzyme catalytic reaction by varying pH.
10. Application of Phase Rule to Phenol-Water system
11. To study the inversion of cane sugar by polarimeter.

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	V.Venkateswaran, R.Veerasamy	Basic Principles of Practical Chemistry	Sultan Chand & Sons	2013
2	B.R.Puri, L.R.Sharma	Principals of Physical Chemistry	Vishal Publishing Co	2017

21BSS21	ALGEBRA AND CALCULUS	L T P C
		3 1 0 4

COURSE OBJECTIVES
- To realize the use of matrix algebra techniques in engineering applications and to develop for future applications.
- To familiarize the student with differential calculus concepts. This is needed in almost all branches of engineering.
- To impart knowledge on the functions with several variables which finds applications in many engineering branches
- To familiarize the students with integral calculus concepts.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

COURSE OUTCOMES
21BSS21.CO1	This course equips students to have basic knowledge in matrix algebra techniques with its engineering applications.
21BSS21.CO2	This course helps students in understanding the concepts of differential calculus.
21BSS21.CO3	The students will have knowledge on functions with several variables.
21BSS21.CO4	The students will gain understanding of the basic techniques of integration.
21BSS21.CO5	The students will have the ability to solve the real time engineering problems, with multiple integrals and their usage

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21BSS21.CO1	X	X	X	-	-	-	-	-	-	-	-	X	-	X	-
21BSS21.CO2	X	X	-	-	-	-	-	-	-	-	-	X	-	X	-
21BSS21.CO3	X	X	X	-	-	-	-	-	-	-	-	X	-	X	-
21BSS21.CO4	X	X	X	-	-	-	-	-	-	-	-	X	-	X	-
21BSS21.CO5	X	X	X	-	-	-	-	-	-	-	-	X	-	X	-

UNIT - I   MATRICES   9+3
Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Cayley-Hamilton Theorem (Without Proof) – Orthogonal transformation of a symmetric matrix to Diagonal form – Reduction of a quadratic form to canonical form by orthogonal transformation

UNIT – II   DIFFERENTIAL CALCULUS   9+3
Representation of Functions, Limits, Continuity, Derivatives, Differentiability Rules-Maxima and Minima of functions of one variable- Mean Value Theorem.

UNIT – III   FUNCTIONS OF SEVERAL VARÌABLES   9+3
Functions of two variables – Taylor series - Partial derivatives – Maxima and minima – Constrained maxima and minima – Lagrange's multipliers method – Jacobians

UNIT – IV   INTEGRALCALCULUS   9+3
Definite and Indefinite Integrals-Substitution Rule-Integration by parts-Trigonometric Integrals, Integration of rational functions by partial fractions -Improper Integrals.

UNIT – V   MULTIPLE INTEGRALS   9+3
Double integrals in Cartesian coordinates – Change of order of integration – Area between two curves – Area of double integral - Triple integration in Cartesian coordinates – Volume as triple integrals

                                                                    TOTAL: 45 + 15

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	James Stewart	Calculus with Early Transcendental Functions	Cengage Learning, New Delhi	2008
2.	Grewal. B.S	Higher Engineering Mathematics, 43rd Edition	Khanna Publications, Delhi	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Veerarajan. T	Engineering Mathematics for first year	Tata McGraw-Hill Publishing Company Ltd., New Delhi	2015
2.	Erwin Kreyszig	Advanced Engineering Mathematics, 9th Edition	John Wiley and Sons, New Delhi	2018
3.	Jain R.K., Iyengar S.R.K.	Advanced Engineering Mathematics, 4th edition	Alpha Science International Ltd	2014
4.	Bali N. P Manish Goyal	A Text book of Engineering Mathematics, 9th edition	Laxmi Publications Pvt Ltd.	2016
5.	Dass, H.K., Er. RajnishVerma	Higher Engineering Mathematics, 3rd Revised Edition	S. Chand Private Ltd	2014

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21BSS22	DIFFERENTIAL EQUATIONS AND VECTOR ANALYSIS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering.
- To construct relatively simple quantitative models of change, and to deduce their consequences.
- To develop an understanding of the standard techniques of analytic theory.
- To enable the student to apply complex integration theory with confidence, in application areas of engineering fields.
- To have a sound knowledge of Laplace transform and learn the inverse Laplace transformations for solving real time Engineering problems.

COURSE OUTCOMES

21BSS22.CO1	The knowledge gained on ordinary differential equations will provide a strong platform to solve the research problems in model engineering.
21BSS22.CO2	The knowledge gained on vector calculus provides a framework for modeling systems. Use Gauss, Stokes and Greens theorems to simplify calculations of integrals and prove simple results.
21BSS22.CO3	Using analytical functions for real world problems, engineer makes models of projects and then simulates its models in real world conditions.
21BSS22.CO4	To enable the student to apply complex integration efficiently solving the problems that occur in various branches of engineering disciplines.
21BSS22.CO5	This course equips students to have basic knowledge in inverse Laplace transforms with its engineering applications

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21BSS22.CO1	X	X	X	-	-	-	-	-	-	-	-	X	-	X	-
21BSS22.CO2	X	X	-	-	-	-	-	-	-	-	-	X	-	X	-
21BSS22.CO3	X	X	-	-	-	-	-	-	-	-	-	X	-	X	-
21BSS22.CO4	X	X	X	-	-	-	-	-	-	-	-	X	-	X	-
21BSS22.CO5	X	X	X	-	-	-	-	-	-	-	-	X	-	X	-

UNIT - I ORDINARY DIFFERENTIAL EQUATIONS 9+3

Linear differential equations of second and higher order with constant coefficient when the R.H.S is e^{ax}, sin ax, cos ax, e^{ax}sinbx, e^{ax}cosbx – Cauchy's Euler's equations and Legendre's linear equations – simultaneous first order linear equations with constant co-efficients – Method of variation of parameter when the R.H.S is sec ax, cosec ax, tan ax, cot ax.

UNIT - II VECTOR CALCULUS 9+3

Gradient, divergence and curl – Line, surface and volume integrals – Green's, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Verification of the above theorems and evaluation of integrals using them

UNIT – III ANALYTIC FUNCTIONS 9+3

Functions of a complex variable – Analytic function: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w =az, 1/z and bilinear transformation.

UNIT – IV COMPLEX INTEGRATION 9+3

Cauchy's integral theorem (excluding proof) and Cauchy's integral formula(excluding proof) – Taylor's and Laurent's series expansions(excluding proof) – Singular points – Classifications – Cauchy's residue theorem – Contour integration- circle and semi-circle Contour (excluding poles on the real axis).

UNIT – V LAPLACE TRANSFORMS AND INVERSE LAPLACE TRANSFORMS 9+3

Laplace transforms – Basic properties – Initial and final value theorems - Problems - Transform of periodic functions. Inverse Laplace transforms – statement of convolution theorem - Problems – Partial fraction method – Problems – Solution of linear ODE of second order with constant coefficients.

UNIT - V   ORDINARY DIFFERENTIAL EQUATIONS   9+3

Linear differential equations of second and higher order with constant coefficient when the R.H.S is e^{ax}, sin ax, cos ax. e^{ax}sinbx, e^{ax}cosbx – Cauchy's Euler's equations and Legendre's linear equations – simultaneous first order linear equations with constant co-efficients – Method of variation of parameter when the R.H.S is sec ax, cosec ax, tan ax, cot ax.

TOTAL: 45 + 15 = 60 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Glyn James	Advanced Modern Engineering Mathematics, 4th Edition	Pearson Education	2016
2.	Grewal. B.S	Higher Engineering Mathematics, 43rd Edition	Khanna Publications, Delhi	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bali N. P Manish Goyal	A Text book of Engineering Mathematics, 9th edition	Laxmi Publications Pvt Ltd.	2016
2.	Erwin Kreyszig	Advanced Engineering Mathematics, 9th Edition	John Wiley and Sons, New Delhi	2014
3.	Tony Croft, Anthony Croft, Robert Davison, Martin Hargreaves, James Flint	Engineering Mathematics: A Foundation for Electronic, Electrical, Communications and Systems Engineers, 4th Revised Edition	Pearson Education	2012
4.	Peter V. O.Neil	Advanced Engineering Mathematics, 7th Edition	Cengage learning	2012
5.	Dass, H.K. , Er. RajnishVerma	Higher Engineering Mathematics, 3rd Revised Edition	S. Chand Private Ltd	2014

21BSS23	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To develop Z transform techniques for discrete time systems
- To introduce Fourier series analysis which is central to many applications in engineering
- To develop the basic knowledge in solving the boundary value problems
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes

COURSE OUTCOMES

21BSS23.CO1	This course enables the students to apply Fourier transform techniques to many engineering problems.
21BSS23.CO2	Using this course, a student develops Z transform techniques for discrete time systems for real world problems.
21BSS23.CO3	Provides the students to have sound knowledge Fourier series analysis.
21BSS23.CO4	The students will have the ability to solve boundary value problems.
21BSS23.CO5	It equips students to find the solutions of partial differential equations that model real time processes

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21BSS23.CO1	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-
21BSS23.CO2	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-
21BSS23.CO3	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-
21BSS23.CO4	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-
21BSS23.CO5	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-

UNIT – I   FOURIER TRANSFORMS   9+3

Statement of Fourier integral theorem - Fourier transforms pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity–Problems .

UNIT – Ii   Z - TRANSFORMS AND DIFFERENCE EQUATIONS   9+3

Z- transforms - Elementary properties – Initial and final value theorem – Inverse Z - transforms – Partial fraction method – Residue method – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transforms

UNIT - III   FOURIER SERIES   9+3

Dirichlet''s conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval''s identity – Harmonic analysis

UNIT – IV   BOUNDARY VALUE PROBLEMS   9+3

Classification of PDE - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Fourier series solution in Cartesian coordinates – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges) on finite square plates (excluding circular plates).

UNIT – V   PARTIAL DIFFERENTIAL EQUATIONS   9+3

Formation of partial differential equations – Singular integrals – Solutions of standard types of first order partial differential equations - Lagrange''s linear equation - Linear partial differential equations of second and higher order with constant coefficients of homogeneous when the R.H.S is e^{ax+by}, $x^m y^n$ m,n>0, sin (ax+by), cos (ax+by)

TOTAL: 45 + 15=60 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Erwin Kreyszig	Advanced Engineering Mathematics, 9th Edition	John Wiley and Sons, New Delhi	2014
2.	Grewal. B.S	Higher Engineering Mathematics, 43rd Edition	Khanna Publications, Delhi	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Glyn James	Advanced Modern Engineering Mathematics, 4th Edition	Pearson Education	2016
2.	Bali N. P Manish Goyal	A Text book of Engineering Mathematics, 9th edition	Laxmi Publications Pvt Ltd.	2016
3.	Datta.K.B.	Mathematical Methods of Science and Engineering	Cengage Learning India Pvt Ltd, Delhi	2013
4.	Ray Wylie. C, Barrett.L.C	Advanced Engineering Mathematics, 6th Edition	Tata Mc Graw Hill Education Pvt Ltd, New Delhi	2012
5.	Ramana.B.V.	Higher Engineering Mathematics	Tata Mc Graw Hill Publishing Company, New Delhi	2008

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RASIPURAM-637 408, NAMAKKAL Dist.

21BSS24	DISCRETE MATHEMATICS		L	T	P	C
			3	1	0	4

COURSE OBJECTIVES
- To extend student's Logical and Mathematical maturity.
- To deal with abstraction and the counting principles.
- To identify the basic properties of graphs and model simple applications.
- To study the concepts and properties of algebraic structures.
- To learn discrete objects and their properties.

COURSE OUTCOMES
21BSS24.CO1	Have knowledge of the concepts needed to test the logic of a program.
21BSS24.CO2	Ability to distinguish between the notion of discrete and continuous mathematical structures
21BSS24.CO3	Have an understanding in identifying structures on many levels.
21BSS24.CO4	Be aware of the counting principles.
21BSS24.CO5	Be exposed to concepts and properties of algebraic structures such as groups, rings and fields.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21BSS24.CO1	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
21BSS24.CO2	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
21BSS24.CO3	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
21BSS24.CO4	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
21BSS24.CO5	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-

UNIT - I   LOGIC AND PROOFS   9+3

Propositional Logic – Propositional equivalences-Predicates and quantifiers- Rules of inference-introduction to Proofs-Proof Methods and strategy.

UNIT – II   COMBINATORICS   9+3

Mathematical inductions-Strong induction and well ordering-.The basics of counting-The pigeonhole principle –Permutations and combinations-Recurrence relations-Solving Linear recurrence relations-generating functions-inclusion and exclusion and applications.

UNIT – III   GRAPHS   9+3

Graphs and graph models-Graph terminology and special types of graphs-Representing graphs and graph isomorphism - connectivity-Euler and Hamilton paths.

UNIT – IV   ALGEBRAIC STRUCTURES   9+3

Algebraic systems-Semi groups and monoids-Groups-Subgroups and homomorphisms- Cosets and Lagrange's Theorem - Ring & Fields (Definitions and examples)

UNIT – V   LATTICES AND BOOLEAN ALGEBRA   9+3

Partial ordering-Posets-Lattices as Posets- Properties of lattices-Lattices as Algebraic systems –Sub lattices –direct product and Homomorphism-Some Special lattices- Boolean Algebra

TOTAL: 45 + 15

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Narsingh Deo	Graph Theory with Applications to Engineering and Computer Science, Reprint edition	Dover Publications Inc.	2016
2.	Tremblay J.P, Manohar R	Discrete Mathematical Structures with application to computer science,30th Reprint	Tata Mc Graw Hill Pub.Co.Ltd,New Delhi,	2011

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bernard Kolman , Robert C.Busby, Sharan Culter Ross	Discrete Mathematical Structures, 6th Edition	Pearson Education Pvt Ltd. ,New Delhi	2015
2.	Richard Johnsonbaugh	Discrete Mathematics , 7th Edition	Pearson Education Asia, New Delhi	2014
3.	Seymour Lipschutz, Mark Lipson, Varsha H. Patil	Discrete Mathematics Schaum's Outlines , Revised 3rd Edition	Mc Graw Hil Pub.Co.Ltd.,New Delhi	2013
4.	Ralph. P.Grimaldi	Discrete and combinatorial Mathematics : An Applied Introduction, 5th Edition	Pearson Education Asia,Delhi	2012
5.	Kenneth H. Rosen	Discrete Mathematics and its Applications, 7th Edition	Tata Mc Graw Hill Pub . co.Ltd.,New Delhi,Special Indian Edition	2011

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RASIPURAM-637 408, NAMAKKAL Dist.

21BSS25	STATISTICAL AND QUEUING MODEL	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES
- To understand concepts of testing of hypothesis
- To develop design of experiments model for research problems
- To understand the basic concepts of Control charts for measurements.
- Identify the concept of queueing models and apply in engineering.
- To understand the significance of advanced queueing models.

COURSE OUTCOMES
21BSS25.CO1	Provides knowledge to apply testing of hypothesis to real life problems.
21BSS25.CO2	This course enhances the students in design of experiments model for research problems
21BSS25.CO3	Apply the concept of Statistical Quality Control in engineering disciplines.
21BSS25.CO4	Acquire skills in analyzing queueing models.
21BSS25.CO5	Understand and characterize phenomenon which evolve with respect to time in a probabilistic manner

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21BSS25.CO1	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
21BSS25.CO2	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
21BSS25.CO3	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
21BSS25.CO4	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
21BSS25.CO5	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-

UNIT I TESTING OF HYPOTHESIS   9 + 3
Sampling distributions - Estimation of parameters - Statistical hypothesis -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT II DESIGN OF EXPERIMENTS   9 + 3
One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design.

UNIT III STATISTICAL QUALITY CONTROL   9 + 3
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

UNIT IV QUEUEING MODELS   9 + 3
Markovian queues – Birth and death processes – Single and multiple server queueing models – Little's formula – Queues with finite waiting rooms – Queues with impatient customers : Balking and reneging.

UNIT V ADVANCED QUEUEING MODELS   9 + 3
Finite source models – M/G/1 queue – Pollaczek Khinchin formula – M/D/1 and M/EK/1 as special cases – Series queues – Open Jackson networks.

TOTAL: 45 + 15=60 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Devore. J.L.,	"Probability and Statistics for Engineering and the Sciences	Cengage Learning, New Delhi	2014
2.	John F. Shortle, James M.Thompson, Carl M. Harris Donald Gross	Fundamentals of Queueing Theory, 4th Edition	Wiley	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Douglas C. Montgomery, George C. Runger	Applied Statistics and Probability for Engineers (International Student Version)", 6th Edition	John Wiley & Sons, Inc.	2016
2.	Spiegel. M.R., Schiller. J., Srinivasan.R.A.	Schaum's Outlines on Probability and Statistics, 4th Edition	Tata McGraw Hill Education	2013
3.	Johnson. R.A., and Gupta. C.B.	Miller,Freund's Probability and Statistics for Engineers,11th Edition	Pearson Education, Asia	2011
4.	Yates, R.D. and Goodman. D. J	"Probability and Stochastic Processes"	Wiley India Pvt. Ltd., Bangalore	2012
5.	Trivedi.K.S.,	Probability and Statistics with Reliability, Queueing and Computer Science Applications, 2nd Edition	John Wiley and Sons	2008

21BSS26	NUMERICAL METHODS	L T P C
		3 1 0 4

COURSE OBJECTIVES

- To solve a set of algebraic equations representing steady state models formed in engineering problems
- To deal with interpolation and approximation for the application of finite element analysis
- To find the trend information from discrete data set through numerical differentiation and summary information through numerical integration
- To predict the system dynamic behaviour through solution of ODEs modeling the system
- To solve PDE models representing spatial and temporal variations in physical systems through numerical methods

COURSE OUTCOMES

21BSS26.CO1	The students will have a clear perception of the power of numerical techniques
21BSS26.CO2	The students will have the ability to solve a set of algebraic equations representing steady state models formed in engineering problems
21BSS26.CO3	The students can deal with interpolation and approximation for the application of finite element analysis
21BSS26.CO4	It equips the knowledge in numerical differentiation and numerical integration
21BSS26.CO5	This course makes students easy in solving initial and boundary value problems

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21BSS26.CO1	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
21BSS26.CO2	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
21BSS26.CO3	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
21BSS26.CO4	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
21BSS26.CO5	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-

UNIT - I   SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS   9+3

Solution of algebraic and transcendental equations - Newton Raphson method – Solution of linear system of a equations - Gauss elimination method –Gauss Jordon method - Iterative methods of Gauss Jacobi and Gauss-Seidel -Eigen value of a matrix by power method

UNIT – II   INTERPOLATION AND APPROXIMATION   9+3

Interpolation with unequal intervals – Lagrange's interpolation – Newton's divided difference interpolation – Interpolation with equal intervals – Newton's forward and backward difference formulae.

UNIT – III   NUMERICAL DIFFERENTIATION AND INTEGRATION   9+3

Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal, Simpson's 1/3 rule – Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by trapezoidal and Simpsons's 1/3 rules.

UNIT – IV   INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL
EQUATIONS   9+3

Single step methods – Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations – Multi step methods – Milne's and Adams-Bash forth predictor corrector methods for solving first order equations.

UNIT – V   BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL
DIFFERENTIAL EQUATIONS   9+3

Finite difference methods for solving two-point linear boundary value problems – Finite difference techniques for the solution of two Laplace's and Poisson's equations on rectangular domain – one dimensional heat equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL: 45 + 15 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S. K. Gupta	Numerical Methods for Engineers , 3rd Edition	New Age International Pvt Ltd Publishers	2015
2.	Chapra. S.C., Canale.R.P.	Numerical Methods for Engineers, 6th Edition	Tata McGraw Hill, , New Delhi	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Grewal. B.S.	Numerical Methods in Engineering & Science: with Programs in C and C++, 10th Edition	Khanna Publishers, New Delhi	2010
2.	M.K. Jain	Numerical Methods for Scientific & Engineering Computation, 6th Edition	New Age International Publishers	2010
3.	Sankara Rao. K.	Numerical methods for Scientists and Engineers, 3rd Edition	Prentice Hall of India Private, New Delhi	2007
4.	Brian Bradie	A friendly introduction to Numerical analysis	Pearson Education, Asia, New Delhi	2007
5.	Gerald. C. F. Wheatley. P. O.	Applied Numerical Analysis,6th Edition	Pearson Education, Asia, New Delhi	2006

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RASIPURAM-637 408, NAMAKKAL Dist.

21BSS27	PROBABILITY & RANDOM PROCESSES	L T P C
		3 1 0 4

COURSE OBJECTIVES
- Analyze random or unpredictable experiments and investigate important features of random experiments.
- Construct probabilistic models for observed phenomena through distributions which play an important role in many engineering applications.
- To acquire the knowledge the concept of convergence of random sequence and the study of random signals
- To be familiar with application of auto correlation and cross correlation functions.
- To learn the concept of spectral density

COURSE OUTCOMES
21BSS27.CO1	The students will have a fundamental knowledge of the probability concepts.
21BSS27.CO2	It helps to use standard distributions to the real life problems.
21BSS27.CO3	Associate random variables by designing joint distributions and correlate the random variables.
21BSS27.CO4	It also helps to understand and characterize phenomenon which evolve with respect to time in a 0probabilistic manner.
21BSS27.CO5	Gained knowledge in correlation and spectral densities

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21BSS27.CO1	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
21BSS27.CO2	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
21BSS27.CO3	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
21BSS27.CO4	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
21BSS27.CO5	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-

UNIT - I   PROBABILITY AND RANDOM VARIABLES   9+3

Axioms of probability–conditional probability– Baye's theorem. random variables– Discrete and continuous random variables – MGF

UNIT – II   STANDARD DISTRIBUTIONS   9+3

Discrete distributions : Binomial, Poisson, Geometric. Negative Binomial and their properties – Continuous distributions : Uniform, Exponential, Gamma, Normal distributions and their properties

UNIT – III   TWO - DIMENSIONAL RANDOM VARIABLES   9+3

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and regression – Transformation of random variables

UNIT – IV   RANDOM PROCESSES   9+3

Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations

UNIT – V   CORRELATION AND SPECTRAL DENSITIES   9+3

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

TOTAL: 45 + 15=60 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Oliver. C Ibe.	Fundamentals of Applied Probability and Random Processes, 2nd Edition	Academic Press	2014
2.	Stark. H., Woods. J.W.	Probability and Random Processes with Applications to Signal Processing, 4th Edition	Pearson Education. Asia	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	HweiP.Hsu	Schaum"s Outline of Theory and Problems of Probability, Random Variables and Random Processes	Mc Graw Hill Publishing Company. New Delhi	2014
2.	Henry Stark , John W. Woods	Probability, Statistics, and Random Processes for Engineers" , 2nd Edition	Pearson Education	2014
3.	Miller. S.L., Childers. D.G.	Probability and Random Processes with Applications to Signal Processing and Communications , 2nd Edition	Academic Press (Elsevier)	2012
4.	Yates. R.D., Goodman. D.J.	Probability and Stochastic Processes, 2nd Edition	Wiley India Pvt. Ltd., Bangalore	2012
5.	Peyton Peebles	Problems and Solutions in Probability, Random Variables and Random Signal Principles (SIE), 1st Edition	Mc Graw Hill Publishing Company, New Delhi	2012

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21BSS28	STATISTICS AND NUMERICAL METHODS	L T P C
		3 1 0 4

COURSE OBJECTIVES
- To understand concepts of testing of hypothesis
- To develop design of experiments model for research problems
- To find the trend information from discrete data set through numerical differentiation and summary information through numerical integration
- To predict the system dynamic behaviour through solution of ODEs modeling the system
- To introduce numerical tools for the solutions of ordinary differential equations that model several physical processes

COURSE OUTCOMES
21BSS28.CO1	Provides knowledge to apply testing of hypothesis to real life problems.
21BSS28.CO2	This course enhances the students in design of experiments model for research problems
21BSS28.CO3	The students will have a clear perception of the power of numerical techniques
21BSS28.CO4	It equips the knowledge in numerical differentiation and numerical integration
21BSS28.CO5	This course makes students easy in solving ordinary differential equations

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21BSS28.CO1	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
21BSS28.CO2	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
21BSS28.CO3	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
21BSS28.CO4	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
21BSS28.CO5	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-

UNIT - I   TESTING OF HYPOTHESIS   9+3
Sampling distributions - Tests for single mean, Difference of means (large and small samples) – Tests for single variance and equality of variances – chi-square test for goodness of fit – Independence of attributes.

UNIT – II   DESIGN OF EXPERIMENTS   9+3
Completely randomized design – Randomized block design – Latin square design – One way- Two way Classification.

UNIT – III   SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS   9+3
Newton-Raphson method- Gauss Elimination method – Gauss-Jordan   methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Horner's Method – Eigen values of a matrix by Power method .

UNIT – IV   INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION   9+3
Lagrange's and Newton's divided difference interpolation –Newton's forward and backward difference interpolation - Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal and Simpson's 1/3 rules

UNIT – V   NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS   9+3
Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations – Adam's and Milne's predictor corrector methods for solving first order equations

TOTAL: 45 + 15

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S. K. Gupta	Numerical Methods for Engineers , 3rd Edition	New Age International Pvt Ltd Publishers	2015
2.	Walpole. R.E., Myers. R.H., Myers. S.L., Ye. K.	Probability and Statistics for Engineers and Scientists, 8th Edition	Pearson Education, Asia	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Douglas C. Montgomery, George C. Runger	Applied Statistics and Probability for Engineers (International Student Version)", 6th Edition	John Wiley & Sons, Inc.	2016
2.	Spiegel. M.R., Schiller. J., Srinivasan.R.A.	Schaum's Outlines on Probability and Statistics, 4th Edition	Tata McGraw Hill Education	2013
3.	Chapra. S.C., Canale.R.P.	Numerical Methods for Engineers, 6th Edition	Tata McGraw Hill, , New Delhi	2012
4.	Johnson. R.A., and Gupta. C.B.	Miller,Freund's Probability and Statistics for Engineers,11th Edition	Pearson Education, Asia	2011
5.	Grewal. B.S.	Numerical Methods in Engineering & Science: with Programs in C and C++, 10th Edition	Khanna Publishers, New Delhi	2010

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MUTHAYAMMAL ENGINEERING COLLEGE
(AUTONOMOUS)
RASIPURAM-637 408, NAMAKKAL Dist.

GENERAL ENGINEERING SCIENCES

(GES)

For

Mechanical Engineering

21GES01	PROGRAMMING FOR PROBLEM SOLVING USING C	L T P C
		3 0 0 3

COURSE OBJECTIVES
- To understand basic programming concepts
- To provide knowledge for problem solving through
- To provide hands-on experience with the concepts programming

COURSE OUTCOMES

21GES01.CO1	Understand the fundamentals of C programming
21GES01.CO2	Choose the loops and decision making statements to solve the problem
21GES01.CO3	Implement different Operations on arrays and Use functions to solve the given problem
21GES01.CO4	Understand String and structures
21GES01.CO5	Understand pointers and Implement file Operations in C programming for a given application

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES01.CO1	X	X	X	-	X	X	-	-	-	-	X		X	-	-
21GES01.CO2	X	X	X	-	-	-	-	-	-	-	X	X	X	-	-
21GES01.CO3	X	X	X	-	X	X	-	-	X	-	-	-	-	X	-
21GES01.CO4	X	X	X	X	X	-	-	-	-	-	X	-	-	-	X
21GES01.CO5	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-

UNIT I   INTRODUCTION TO C PROGRAMMING   9 HOURS

Introduction to computer software, Program Design Tools: Algorithms, Flowcharts, Pseudo codes, Structure of a C program, Writing the first C program. Keywords, Identifiers, Basic Data Types in C, Variables, Constants, Input / Output Statements in C, Operators in CArithmetic, Relational, Logical, Conditional, Type conversion an Typecasting.

UNIT II   CONDITIONAL AND LOOPING STATEMENTS   9 HOURS

Conditional branching statements, if, if-else, if-else-if and switch statements, Iterative statements, while, do-while and for loop statements, Nested loops, the break and continue statements.

UNIT III   FUNCTIONS AND ARRAYS   9 HOURS

Functions: Function Declaration/Function Prototype, Function definition, Function call, passing parameters to functions. Arrays: Declaration of arrays, accessing the elements of an array, storing values in arrays, operations on 1-d arrays – Inserting an Element of an array, Deleting an Element from an Array, searching for a Value in an Array, two-dimensional arrays, operations on twodimensional arrays – Sum, Difference.

UNIT IV   STRINGS AND STRUCTURES   9 HOURS

Strings: Introduction, Operations on Strings – finding the length of a String, converting characters of a string into upper case, Converting characters of a string into lower case. Structures: Introduction to Structures, Copying and comparing structures, Nested structures.

UNIT V   POINTERS AND FILE PROCESSING   9 HOURS

Pointers: Introduction to Pointers, Declaring pointer variables, Passing arguments to function using pointers. File Processing: Introduction to Files, Read Data from Files, Writing data to Files.

Total Periods:45 hours

TEXT BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Reema Thareja	Computer Fundamentals and Programming in C	Oxford University Press	Second Edition.
2.	Reema Thareja	Programming in C	Oxford University Press	Second Edition.

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Reema Thareja	Programming in C	Oxford University Press	Second Edition.
2.	B S Gottfried: Schaums	Programming with C	Outline Series	2003

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21GES02	PROGRAMMING FOR PROBLEM SOLVING TECHNIQUES	L	T	P	C
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COURSE OBJECTIVES

- To understand basic programming concepts
- To provide knowledge for problem solving through programming
- To provide hands-on experience with the concepts

COURSE OUTCOMES

21GES02.CO1	Understand the fundamentals of C programming
21GES02.CO2	Choose the loops and decision making statements to solve the problem
21GES02.CO3	Implement different Operations on arrays and Use functions to solve the given problem
21GES02.CO4	Develop Simple Python Programs using Appropriate Syntax, Control Structure and Expression
21GES02.CO5	Explain the Concept of Tuples and Files in Python Programming Language

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES02.CO1	X	X	X	X	-	-	-	-	-	-	-	-	-	X	-
21GES02.CO2	X	X	X	X	-	-	-	-	-	-	-	-	X	X	-
21GES02.CO3	X	X	X	-	-	-	-	-	-	-	-	-	-	X	-
21GES02.CO4	X	X	X	-	-	-	-	-	-	-	-	-	X	X	X
21GES02.CO5	X	X	X	-	-	-	-	-	-	-	-	X	X	-	-

UNIT I   INTRODUCTION TO C PROGRAMMING   9 HOURS

Introduction to computer software, Program Design Tools: Algorithms, Flowcharts, Pseudo codes, Structure of a C program, Writing the first C program. Keywords, Identifiers, Basic Data Types in C, Variables, Constants, Input / Output Statements in C, Operators in CArithmetic, Relational, Logical, Conditional, Type conversion and Typecasting.

UNIT II   CONDITIONAL AND LOOPING STATEMENTS   9 HOURS

Conditional branching statements, if, if-else, if-else-if and switch statements, Iterative statements, while, do-while and for loop statements, Nested loops, the break and continue statements.

UNIT III   FUNCTIONS AND ARRAYS   9 HOURS

Functions: Function Declaration/Function Prototype, Function definition, Function call, passing parameters to functions. Arrays: Declaration of arrays, accessing the elements of an array, storing values in arrays, operations on 1-d arrays – Inserting an Element of an array, Deleting an Element from an Array, searching for a Value in an Array, two-dimensional arrays, operations on twodimensional arrays – Sum, Difference

UNIT IV   INTRODUCTION TO PYTHON PROGRAMMING   9 HOURS

Introduction- Python interpreter and interactive mode- Creating and executing Python program- Data types: Numeric, Boolean, string, List, tuple and Dictionary-Comments- Expressions- Conditional statements: if, if-else and if-elif-else- Iterative statements: while, for, continue and pass- Functions- Fruitful functions- Recursive functions- Illustrative programs: Linear search and Binary search

UNIT V   STRINGS, LISTS, TUPLES AND DICTIONARIES   9 HOURS

Strings: Assignment- String slices and String methods- Lists: List operations and list methods-Tuples: Tuple assignment and Tuple operations- Dictionaries: Operations and methods. Illustrative Programs: Quick sort and Merge sort.

Total Periods: 45

TEXT BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Reema Thareja	Computer Fundamentals and Programming in C	Oxford University Press	Second Edition
2.	John V Guttag	Introduction to Computation and Programming Using Python	Revised and expanded Edition, MIT Press	2013

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Reema Thareja	Programming in C	Oxford University Press	Second Edition
2.	Robert Sedgewick, Kevin Wayne, Robert Dondero	Introduction to Programming in Python: An Inter-disciplinary Approach	Pearson India Education Services Pvt. Ltd.,	2016
3.	Timothy A. Budd	Exploring Python	Mc-Graw Hill Education (India) Private Ltd	2015
4.	Kenneth A. Lambert	Fundamentals of Python: First Programs	CENGAGE Learning	2012.

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21GES03	PROGRAMMING IN C LAB	L	T	P	C
		0	0	3	1

LIST OF EXPERIMENTS

1. Develop a program to find the largest of three numbers.
2. Develop an interactive program to calculate roots of quadratic equation by accepting the coefficients.
3. Develop a program to sum the series: $1/1! + 4/2! + 27/3! + \ldots$ using functions.
4. Develop a program to insert a number at a given location in an array.
5. Implement a program to perform a binary search on 1D sorted Array.
6. Develop a program to read a two dimensional array "marks" which stores marks of 5 students in three subjects. Display the highest marks in each subject
7. Develop a program to concatenate two strings and determine the length of the concatenated string
8. Develop a program to read and display the information about a student using structures.
9. Implement a program to enter a character and then determine whether it is a vowel or not using pointers.
10. Develop a program to read data from the keyboard, write it to a file called "Input", again read the same data from the "Input" file and display it on the screen.
11. Mini Projects

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21GES04	PROGRAMMING IN C AND PYTHON LAB	L	T	P	C
		0	0	3	1

LIST OF EXPERIMENTS

1. Develop a C program to find the largest of three numbers.
2. Develop an interactive C program to calculate roots of quadratic equation by accepting the coefficients.
3. Develop a C program to sum the series: $1/1! + 4/2! + 27/3! + \ldots$ using functions.
4. Develop a C program to insert a number at a given location in an array.
5. Implement a C program to perform a Fibonacci series.
6. Develop a C program to read a two dimensional array "marks" which stores marks of 5 students in three subjects. Display the highest marks in each subject.
7. Write a Python program to find GCD of two numbers.
8. Write a Python Program to find the square root of a number by Newton's Method.
9. Write a Python program to find the exponentiation of a number.
10. Write a Python Program to find the maximum from a list of numbers.
11. Write a Python Program to perform Linear Search.

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21GES05	ELECTRICAL AND ELECTRONICS SCIENCES	L T P C
		3 0 0 3

COURSE OBJECTIVES
- To impart knowledge on DC & AC circuits and its analysis
- To impart knowledge of measuring instruments.
- To study the operation of electrical machines.
- To impart the fundamentals of semiconductor.
- To understand the principles of micro computing.

COURSE OUTCOMES
21GES05.CO1	Able to analyze DC and AC circuits
21GES05.CO2	Able to explain the different type of measuring instruments
21GES05.CO3	Able to exhibit the operation of electrical machines
21GES05.CO4	Able to demonstrate the operation of rectifier and DAC/ADC
21GES05.CO5	Able to explain the principles of micro computing

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES05.CO1	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES05.CO2	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES05.CO3	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES05.CO4	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES05.CO5	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-

UNIT I   ELECTRICAL CIRCUITS   9
Ohm's law - Kirchhoff's laws - Resistors in series and parallel circuits (simple problem) - Introduction to ac circuits and its parameters - Three phase power supply – Star connection – Delta connection – Balanced and Unbalanced Loads.

UNIT II   MEASUREMENTS AND INSTRUMENTATION   9
Operating principles of Moving Coil and Moving Iron instruments - Principles of Electrical Instruments, Multimeters, Oscilloscopes - Static and Dynamic Characteristics of Measurement – Errors in Measurement – Transducers - Classification of Transducers

UNIT III   ELECTRICAL MACHINES   9
Construction, Principle of operation, Basics equation, of DC Motor and Generators - Single phase Induction motors, Construction, Types and speed control methods - Single Phase Transformer, voltage regulation and efficiency (Qualitative & Quantitative treatment only)

UNIT IV   SEMICONDUCTOR DEVICES AND DIGITAL ELECTRONICS   9
Operation and characteristics of PN Junction Diode - Half wave Rectifiers - Full wave Rectifiers - Bipolar Junction Transistor - Binary Number System - Logic Gates - Boolean algebra - Half and Full Adders - Registers and Counters - A/D and D/A Conversion.

UNIT V   INTRODUCTION TO MICROCOMPUTING   9
Architecture of 8051 – instruction set – addressing mode – serial port programming - interrupts – ADC/DAC

TOTAL: 45 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	D P Kothari and I.J Nagarath	Basic Electrical and Electronics Engineering	McGraw Hill Education(India) Private Limited	2016
2.	S.K.Bhattacharya	Basic Electrical and Electronics Engineering	Pearson India	2011

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Giorgio Rizzoni	Principles and Applications of Electrical Engineering	McGraw Hill Education(India) Private Limited	2010
2.	A.E.Fitzgerald, David E Higginbotham and Arvin Grabel,	Basic Electrical Engineering	McGraw Hill Education(India) Private Limited	2009
3.	Mittle N	Basic Electrical Engineering	Tata McGraw Hill Edition	2016
4.	Rajendra Prasad	Fundamentals of Electrical engineering	Prentice Hall of India	2006
5.	Del Toro	Electrical Engineering Fundamentals	Pearson Education, New Delhi	2015

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21GES06	MECHANICAL AND BUILDING SCIENCES	L T P C
		3 0 0 3

COURSE OBJECTIVES

- To get the knowledge on various type of power generation.
- To know about IC Engines and Boilers.
- To familiarize on Refrigeration and Air Conditioning.
- To posses knowledge about Surveying
- To know about the Civil Engineering materials and Building Elements

COURSE OUTCOMES

21GES06.CO1	Demonstrate the various power generation techniques.
21GES06.CO2	Outline the working principles of IC Engines and Boilers.
21GES06.CO3	Familiarize the Refrigeration and Air Conditioning systems.
21GES06.CO4	Understand the principles of field measurement in surveying.
21GES06.CO5	Gathered knowledge in civil engineering materials and Building Elements

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES06.CO1	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-
21GES06.CO2	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-
21GES06.CO3	X	X	-	-	X	X	-	X	-	-	-	X	X	-	-
21GES06.CO4	X	X	-	-	X	X	-	X	-	-	-	X	X	-	-
21GES06.CO5	X	X	-	-	X	X	-	X	-	-	-	X	X	X	X

A. MECHANICAL ENGINEERING

UNIT I: POWER PLANT ENGINEERING   8
Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps– working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT II: IC ENGINES   8
Internal combustion engines– Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler –fire tube-water tube-Bensen boiler.

UNIT III: REFRIGERATION AND AIR CONDITIONING SYSTEM   7
Terminology of Refrigeration and Air Conditioning. Principle of vapor compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

B. BUILDING SCIENCES

UNIT IV : FUNDAMENTALS OF SURVEYING   7
Surveying – objectives – divisions – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples.

UNIT V   : MATERIALS AND FOUNDATIONS   7
Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel sections – Foundations: Types, Bearing capacity – Requirement of good foundations.

UNIT VI : BUILDING ELEMENTS AND STRUCTURES   8
Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – basics of interior design – Bridges – Dams.

TOTAL: 45 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Shanmugam G and Palanichamy M S	Basic Civil and Mechanical Engineering	McGraw Hill Publishing Co., New Delhi	1996
2.	Ramamrutham S	Basic Civil Engineering	DhanpatRai Publishing Co. (P) Ltd.	2015

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Venugopal K. and Prahu Raja V	Basic Mechanical Engineering	Anuradha Publishers, Kumbakonam	2016
2.	Shantha Kumar S R J	Basic Mechanical Engineering	Hi-tech Publications, Mayiladuthurai	2014
3.	PrabhuT.J,Jai Ganesh. V and Jebaraj.S	Basic Mechanical Engineering	Scitech Publications, Chennai	2010
4.	Seetharaman S	Basic Civil Engineering	Anuradha Agencies	2015
5.	Satheesh Gopi	Basic Civil Engineering	Pearson Publishers	2009

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21GES07   COMPUTER AIDED DRAFTING LABORATORY

L T P C
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COURSE OBJECTIVES
- To construct various curves in engineering applications.
- To understand the principles of projection to project points, lines and planes.
- To draw the orthographic views of solids.
- To draw the projection of solids in simple position and with their axis inclined.
- .To be able to construct the development of surfaces.

COURSE OUTCOMES
21GES07.CO1	Understand the basics of drawing instruments and standards.
21GES07.CO2	Construct various curves used in engineering applications.
21GES07.CO3	Comprehend and draw orthographic vies of various solids
21GES07.CO4	Explain and draw the projection of points, lines and planes
21GES07.CO5	Draw the projection of solids and development of surfaces using CAD software.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES07.CO1	X	-	-	-	-	-	-	-	-	X	-	-	X	X	-
21GES07.CO2	X	-	-	-	-	-	-	-	-	X	-	-	X	X	-
21GES07.CO3	X	-	-	-	-	-	-	-	-	X	-	-	X	X	-
21GES07.CO4	X	-	-	-	-	-	-	-	-	X	-	-	X	X	-
21GES07.CO5	X	-	-	-	-	-	-	-	-	X	-	-	X	X	-

CONCEPTS AND CONVENTIONS   4
(Not for Examination) Importance of graphics in engineering applications, Use of drafting instrument, BIS conventions and specifications - Size, layout and folding of drawing sheets, Lettering and dimensioning.

COMPUTER AIDED DRAFTING (Not for Examination)   6
Importance 2d Drafting, sketching, modifying, transforming and dimensioning

UNIT I: PLANE CURVES   10
Curves used in engineering practices, Conics. Construction of ellipse, Parabola and hyperbola by eccentricity method, Construction of cycloid, construction of involutes of square and circle, Drawing of tangents and normal to the above curves.

UNIT II: PROJECTION OF POINTS, LINES AND PLANES   10
General Principles of Orthographic projection, Need for importance of multiple views and their placement, First angle projection, layout of views, Projection of points, Projection of straight lines located in the first quadrant, Projection of polygonal surface inclined to both reference planes.

UNIT III: ISOMETRIC TO ORTHOGRAPHIC VIEWS   10
Representation of three dimensional objects, Developing visualization skills through free hand sketching of multiple views from pictorial views of objects, Drawing orthographic views of various solids, Dimensioning.

UNIT IV: PROJECTION OF SOLIDS   10
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane.

UNIT V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES   10
Sectioning of simple solids like prisms, pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other, Development of lateral surfaces of simple and truncated solids, Prisms, pyramids, cylinders and cones.
**NOTE: Students have to give descriptive answers to the questions from first two units and need to draw the answer figures using CAD software for the questions from the last three units in end semester exam.

TOTAL: P: 60 = 60

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Natrajan K.V	A text book of Engineering Graphics	Dhanalakshmi Publishers, Chennai	2015
2.	Basant Agrawal and C.M. Agrawal	Engineering Drawing	McGraw Hill Education; Second edition	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gopalakrishnan K.R	Engineering Drawing (Vol. I&II combined)	Subhas Stores Bangalore	2007
2	Luzzader, Warren.J. and Duff,John M	Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production	Eastern Economy Edition, Prentice Hall of India Pvt. Ltd. New Delhi	2005
3	Shah M.B., and Rana B.C	Engineering Drawing	Pearson, 2nd Edition	2009
4	Venugopal K. and Prabhu Raja V	Engineering Graphics	New Age International (P) Limited	2008
5	Bhatt N.D. and Panchal V.M	Engineering Drawing	Charotar Publishing House, 50th Edition	2010

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21GES08	PYTHON PROGRAMMING	L T P C
		3 0 0 3

COURSE OBJECTIVES
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures -- lists, tuples, dictionaries.
- To do input/output with files in Python

COURSE OUTCOMES
21GES08.CO1 Read, write, execute by hand simple Python programs.
21GES08.CO2 Structure simple Python programs for solving problems.
21GES08.CO3 Decompose a Python program into functions.
21GES08.CO4 Represent compound data using Python lists, tuples, dictionaries.
21GES08.CO5 Read and write data from/to files in Python Programs.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES08.CO1	X	X	X	X	-	-	-	-	-	-	-	-	-	X	-
21GES08.CO2	X	X	X	X	-	-	-	-	-	-	-	-	X	X	-
21GES08.CO3	X	X	X	-	-	-	-	-	-	-	-	-	-	X	-
21GES08.CO4	X	X	X	-	-	-	-	-	-	-	-	-	X	X	X
21GES08.CO5	X	X	X	-	-	-	-	-	-	-	-	X	X	-	-

UNIT I   INTRODUCTION   9 HOURS
The way of programming-What is programming- debugging – formal and natural languages - Python: Features - Installing - Running – Python interpreter and interactive mode.

UNIT II   VARIABLES, EXPRESSIONS, CONDITIONALS   9 HOURS
Values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass;

UNIT III   FUNCTIONS, STRINGS   9 HOURS
Functions, function definition and use, flow of execution. Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays.

UNIT IV   LISTS, TUPLES, DICTIONARIES   9 HOURS
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension.

UNIT V   FILES, MODULES, PACKAGES   9 HOURS
Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages.

Total: 45 Hours

TEXT BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Allen B. Downey	Think Python: How to Think Like a Computer Scientist	O'Reilly Publishers	2016
2.	Guido van Rossum and Fred L. Drake Jr	An Introduction to Python	Network Theory Ltd	2011

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Charles Dierbach	Introduction to Computer Science using Python: A Computational Problem-Solving Focus	Wiley India Edition	2013
2.	John V Guttag	Introduction to Computation and Programming Using Python	MIT Press	2013
3.	Kenneth A. Lambert	Fundamentals of Python: First Programs	CENGAGE Learning	2012
4.	Paul Gries, Jennifer Campbell and Jason Montojo	Practical Programming: An Introduction to Computer Science using Python 3	Pragmatic Programmers,LLC	2013
5.	Timothy A. Budd	Exploring Python	Mc-Graw Hill Education (India) Private Ltd	2015

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21GES09	PROGRAMMING IN PYTHON LAB	L T P C
		0 0 3 1

LIST OF EXPERIMENTS

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED
Python 3 interpreter for Windows/Linux

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| 21GES10 | SOFT SKILLS LABORATORY | L T P C |
| | | 0 0 3 1 |

COURSE OBJECTIVES
- To Analyse the Strength and Weakness of an Individual
- To build an effective team in work place
- To develop effective Time Management Skills
- To describe the qualities of an Effective Presenter
- To improve Health and Social life

COURSE OUTCOMES
21GES10.CO1	Identifying the Career Path
21GES10.CO2	Developing the leadership Qualities for the betterment of the team
21GES10.CO3	Developing Effective Time Management Skill
21GES10.CO4	Understanding the importance of Effective Communication
21GES10.CO5	Handling Stress and Developing Problem Solving Skill

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES10.CO1	X	-	-	-	-	X	X	X	X	X	-	X	-	X	-
21GES10.CO2	X	-	-	-	-	X	X	X	X	X	-	X	-	X	-
21GES10.CO3	X	X	X	X	-	X	X	X	X	X	-	X	-	X	-
21GES10.CO4	X	X	X	X	-	X	X	X	X	X	-	X	-	X	-
21GES10.CO5	X	X	-	-	X	X	X	X	X	X	X	X	-	X	-

UNIT I Self Analysis
SWOT Analysis – Intra Personal Skill – Inter Personal Skill

UNIT II Team Work
Importance of a Team Player – Leadership Quality – Decision Making Skill

UNIT III Time management
Effective Planning – Goal Setting – Spending right time on right job

UNIT IV Presentation skill
Verbal Communiction – Non Verbal Communication

UNIT V Stress Management
Eustress – Distress – Emotional Intelligence – Fear Management (Crowd Fear, Exam Fear, Stage Fear)

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Department of Mechanical Engineering
MUTHAYAMMAL ENGINEERING COLLEGE
(AUTONOMOUS)
RASIPURAM-637 408, NAMAKKAL Dist.

21GES11	ELECTRONIC DEVICES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- To know about the basics of Semiconductor Diodes
- To know about the working principle and characteristics of BJT.
- To know about the operation and characteristics of FET.
- To know about the biasing techniques of BJT and FET.
- To understand the working function and applications of special diodes and optoelectronic devices.

COURSE OUTCOMES:
After the completion of the course, the students can able to

21GES11.CO1	Understand the theory, operation and characteristics of semiconductor diodes.
21GES11.CO2	Explain the basics and characteristics of BJT
21GES11.CO3	Describe the construction, working principle and characteristics of FET
21GES11.CO4	Discuss about the biasing of BJT and FET.
21GES11.CO5	Understand the working function and applications of special diodes and optoelectronics devices.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES11.CO1	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES11.CO2	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES11.CO3	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES11.CO4	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES11.CO5	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-

UNIT I: SEMICONDUCTOR DIODES 9
Review of Semiconductor Physics-Drift and diffusion currents-Continuity Equation-Theory of PN Junction Diode-Diode Current Equation-Current Voltage Characteristics-Effect of Temperature on PN Junction diodes-Diffusion Capacitance-Applications: Rectifiers, Clippers, Clampers-Avalanche Breakdown Mechanism-Zener Diode as a Voltage Regulator.

UNIT II: BIPOLAR JUNCTION TRANSISTORS 9
Bipolar Junction Transistor Operations-Configurations: CC, CB, CE-Transistor Current Components-Ebermoll's Model of Transistor-Small Signal Low Frequency Hybrid-High Frequency Effects-Transistor as an Amplifier and Switch.

UNIT III: FIELD EFFECT TRANSISTORS 9
Operation and Characteristics of JFET-Configurations of JFET-JFET as Amplifier, Switch, Voltage Variable Resistor-Metal Oxide Semiconductor Field Effect Transistor (MOSFET)-Enhancement and Depletion Mode MOSFET-Characteristics of n-MOS and p-MOS-Introduction to CMOS.

UNIT IV: BIASING OF BJT AND FET 9
DC operating point and Load line-Q point-Bias Stability-Transistor Biasing Methods: Fixed Bias-Collector to Base Bias-Self biasing, Thermal Runaway, Thermal Stability-FET biasing methods: Self bias-Source bias-Voltage divider bias-Biasing MOSFETs.

UNIT V: SPECIAL DIODES AND OPTO ELECTRONIC DEVICES 9
Theory and Characteristics of Schottky Diode-Tunnel Diode-Varactor Diode-SCR-TRIAC-LDR-UJT-Photoemissivity and Photoconductivity-Photoconductive Cell-Photo Voltaic Cell-Photodiode-Phototransistors-Construction and Characteristics of LCD and LED-LASER Diodes- Opto Couplers, FINFET.

TOTAL: 45

TEXT BOOKS

S l . N o	Author(s)	Title of the Book	Publisher	Year of Publication
1	Jacob Millman, Christos Halkias & Satyabrata Jit, Millman's	Electronic Devices and Circuits	McGraw Hill	2nd Edition, 2008.
2	Robert L.Boylestad, Louis Nashelsky	Electronic Devices and Circuit Theory	Pearson education	11th Edition,2012

REFERNCE BOOKS

S l . N o	Author(s)	Title of the Book	Publisher	Year of Publication
1	Allen Mottershead	Electronic Devices and Circuits	Prentice Hall of India	2008
2	Douglas.A.Pucknell, Kamran Eshraghian	Basic VLSI Design, Principles and Application	Prentice Hall of India	2009
3	S.Salivahanan, N.Sureshkumar and A.Vallavaraj	Electronic Devices and Circuits	Tata McGraw Hill	2nd Edition, , 2008
4	Donald A. Neamen	Semiconductor Physics and Devices	Tata McGraw Hill	Third Edition
5	S. M. Sze	Semiconductor Devices: Physics and Technology	Wiley	Second Edition

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MUTHAYAMMAL ENGINEERING COLLEGE
(AUTONOMOUS)
RASIPURAM-637 408, NAMAKKAL Dist.

21GES12	ELECTRONIC SIMULATION LABORATORY	L	T	P	C
		0	0	3	1

COURSE OBJECTIVES:

The objectives of this laboratory course are,
- To understand the operation of semiconductor devices using laboratory equipments and simulation software.
- To design and test the electronic circuits using laboratory devices, equipments and simulation software.

COURSE OUTCOMES:

After the completion of the course, the students can able to

21GES12.CO1	Measure and interpret the parameters of diodes and transistors
21GES12.CO2	Construct and analyze the amplifier using BJT.
21GES12.CO3	Construct and analyze the voltage regulator.
21GES12.CO4	Design and measure various wave shaping circuits using diodes.
21GES12.CO5	Measure and interpret the parameters of different special diodes.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES12.CO1	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES12.CO2	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES12.CO3	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES12.CO4	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES12.CO5	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-

LIST OF EXPERIMENTS:

1. Analyze the Device Behaviour of Semiconductor Diodes.
2. Analyze the Characteristics of Bipolar Junction Transistors.
3. Design and Analysis of BJT as an amplifier.
4. Analyze the Device Behaviour of FETs.
5. Design and Analysis of Voltage Regulators.
6. Design and Analysis of Rectifiers.
7. Design and Analysis of Clippers and Clampers.
8. Analyze the device Behaviour of UJT.
9. Analyze the device Behaviour of SCR.
10. Analyze the characteristics of LED, LDR and Photodiode.

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MUTHAYAMMAL ENGINEERING COLLEGE
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RASIPURAM-637 408, NAMAKKAL Dist.

21GES13	ELECTRIC CIRCUITS	L T P C
		2 1 0 3

COURSE OBJECTIVES
- To communicate the knowledge on DC circuits and its analysis.
- To impart knowledge on AC circuits and its analysis.
- To impart knowledge on solving circuits equations using network theorems.
- To introduce the concept of resonance circuits and transient response in circuits.
- To impart knowledge on balanced and unbalanced in three phase circuits.

COURSE OUTCOMES
21GES13.CO1	Able to analyze DC circuits
21GES13.CO2	Able to give details on the AC circuits and analyze.
21GES13.CO3	Able to solve the different type of network problems
21GES13.CO4	Able to implement the resonance condition in the power circuits.
21GES13.CO5	Able to analyze the different type of load in three phase circuits.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES13.CO1	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES13.CO2	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES13.CO3	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES13.CO4	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES13.CO5	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-

UNIT I   DC CIRCUITS   6+3
Basic circuit elements - Ohm's law - Resistors in series and parallel circuits - Voltage division and current division - Kirchhoff's laws - Source transformation - Star-Delta conversion - Mesh and nodal analysis.

UNIT II   AC CIRCUITS   6+3
Introduction to AC circuits- Form Factor - Phase and phase difference - Sinusoidal Voltage and Current - Single phase AC circuits - Series and parallel RL, RC and RLC circuits - Power - Power factor.

UNIT III   NETWORK THEOREMS FOR DC AND AC CIRCUITS   6+3
Superposition theorem - Thevenin's theorem - Norton's theorem - Maximum power transfer theorem - Reciprocity theorem- Compensation theorem

UNIT IV   RESONANCE CIRCUITS AND TRANSIENT RESPONSE   6+3
Series and parallel resonance - Quality factor and bandwidth - Transient response of RL, RC and RLC Circuits using Laplace transform for DC input.

UNIT V   THREE PHASE CIRCUITS   6+3
Three phase balanced / unbalanced voltage sources - Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced loads - Phasor diagram of voltages and currents - Power and Power factor measurements in three phase circuits.

                                                                                          TOTAL: 45 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Charles K. Alexander, Mathew N.O. Sadiku	Fundamentals of Electric Circuits	McGraw Hill	2013
2.	William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin	Engineering Circuits Analysis	McGraw Hill publishers New Delhi	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jegatheesan, R	Analysis of Electric Circuits	McGraw Hill	2015
2.	Mahadevan, K.., Chitra, C	Electric Circuits Analysis	Prentice-Hall of India Pvt Ltd., New Delhi	2015
3.	Sudhakar A and Shyam Mohan SP	Circuits and Network Analysis and Synthesis	McGraw Hill	2015
4.	M E Van Valkenburg	Network Analysis	Prentice-Hall of India Pvt Ltd, New Delhi	2015
5.	Chakrabarti A	Circuits Theory (Analysis and synthesis)	Dhanpath Rai & Sons, New Delhi	2011

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| 21GES14 | ELECTRIC CIRCUITS LABORATORY | L T P C |
| | | 0 0 3 1 |

COURSE OBJECTIVES

- To simulate various electric circuits using Matlab
- To gain practical experience on electric circuits and verification of theorems

COURSE OUTCOMES

| 21GES14.CO1 | Able to simulate the electrical circuits |
| 21GES14.CO2 | Able to design the circuit and implement in hardware |

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES14.CO1	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES14.CO2	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-

LIST OF EXPERIMENTS:

1. Verification of ohm's law
2. Verification of Kirchhoff's voltage and current laws.
3. Verification of Thevenin's theorem
4. Verification of Norton 's theorem
5. Verification of Superposition theorem
6. Verification of Maximum Power Transfer Theorem.
7. Study of CRO and measurement of sinusoidal voltage and frequency.
8. Determination of time constant of series R-C electric circuits.
9. Determination of frequency response of series & parallel RLC circuits.
10. Calibration of single phase energy meter.
11. Determination of power in three phase circuits by two-watt meter method.

TOTAL: 45 Hours

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RASIPURAM-637 408, NAMAKKAL Dist.

21GES15	MANUFACTURING PROCESSES	L T P C
		3 0 0 3

COURSE OBJECTIVES
- To introduce the students to the concept of some basic production processes and fabrication techniques.
- Understand the Concept of metal castingprocesses.
- To understand metal joining processes.
- Understanding metal forming Processes.
- To study the Plastic and composite materialmouldingprocesses

COURSE OUTCOMES
21GES15.CO1	Understand the concepts of casting processes..
21GES15.CO2	Study about fabrication processes to join the different metals.
21GES15.CO3	Understand the concept of bulk deformation process.
21GES15.CO4	Study about the metal forming processes.
21GES15.CO5	Understand the process of composite materials.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES15.CO1	X	X	X	·	·	X	·	-	-	-	·	-	X	·	-
21GES15.CO2	X	X	X	-	·	X	X	X	-	X	·	-	X	-	·
21GES15.CO3	X	X	·	X	X	X	X	X	-	X	-	·	X	-	-
21GES15.CO4	X	X	X	X	X	X	-	-	·	·	·	-	X	-	-
21GES15.CO5	X	X	-	·	X	X	X	X	·	X	-	X	X	X	X

UNIT I CASTING PROCESSES   9
Introduction–Patterns, Requirements of a good pattern, pattern materials, types of patterns, pattern allowances–Mould making, types of moulds, moulding processes, types of sand moulding–Coremaking,typesofcores,coreprints,corebox-MouldingSand Properties of mouldings and, types of moulding sand–Melting equipment, cupola furnace, crucible furnace, electric furnace–Gating system–Casting processes, Sand casting. Shell-mould casting, Investment casting, Die casting, centrifugal casting –Defects, Cleaning and Inspection of casting.

UNIT II FABRICATION PROCESSES   9
Introduction–Classification of welding processes–Resistance welding, spot, seam, projection, butt welding–Gaswelding,oxy-acetylenewelding,equipments–Arcwelding,shielded arc welding, TIG, MIG, submerged arc welding, electro-slag welding, ultrasonic welding, plasma arc welding, laser beam welding, friction welding–Soldering and Brazing–Testing and Inspection of welded joints, Defects in welds.

UNIT III BULK DEFORMATION PROCESSES   9
Introduction–Cold and hot working processes Rolling, classification of rolling, principle, rolling stand arrangement, defects in rolling–Forging, classification of forging, methods of forging, defects in forging–Extrusion, Classification of extrusion, Hot and cold extrusion processes, extrusion defects and equipments–Drawing, Drawing of rods. wire and tubes.

UNIT IV METAL FORMING PROCESSES   9
Introduction-Metal stamping and forming, bending, deep drawing, stretch forming, metals pinning, blanking, piercing, embossing and coining, notching, punching, roll forming, rubber press forming, hydro-mechanical forming--Comparison of metal forming processes–Defects in sheet metal formed parts.

UNIT V PLASTIC AND COMPOSITE MATERIAL PROCESSES   9
Processing of plastics, compression moulding, transfer moulding, injection moulding, blow moulding, thermo forming and calendaring-advantages of plastic materials–Introduction to composite material–Classification of composite materials–advantages of composite materials.

TOTAL: 45 Hours

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	RajputR.K	ATextBookofManufacturingTechnology	Laxmipublications(P)Ltd,NewDelhi.	2008
2.	SharmaP.C	ATextBookofProductionTechnology	S.ChandandCompany IVEdition,	2004

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	RaoP.N.	ManufacturingTechnologyVol.1	TataMcGrawHillpublishingcompanylimited, NewDelhi,3rdedition,	2009
2.	HajraChoudhury	ElementsofWorkshopTechnologyVol.1&2.	MediapromotersPvtLtd. .Mumbai	2007.
3.	SeropeKalpajianand Steven R.Schmid	Manufacturing Engineering and Technology	PearsonEducationInc., SecondIndianReprint	2002
4.	JainR.K	Production Technology	KhannaPublications	2001
5.	LuqmanMidhat	Production Processes	CBS; 1ST edition	2010

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21GES16	MANUFACTURING PROCESSES LAB	L T P C
		0 0 3 1

COURSE OBJECTIVES

- To introduce the students to the concept of some basic production processes and fabrication techniques.
- Understand the Concept of metal casting proceses,
- To understand metaljoining processes.
- Understanding metal forming Processes.
- To study the Plastic and composite material moulding processes

COURSE OUTCOMES

21GES16.CO1	Understand the concepts of casting processes..
21GES16.CO2	Study about fabrication processes to join the different metals.
21GES16.CO3	Understand the concept of bulk deformation process.
21GES16.CO4	Study about the metal forming processes.
21GES16.CO5	Understand the process of composite materials.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES16.CO1	X	X	X	-	-	X	-	-	-	-	-	-	X	-	-
21GES16.CO2	X	X	X	-	-	X	X	X	-	X	-	-	X	-	-
21GES16.CO3	X	X	-	X	X	X	X	X	-	X	-	-	X	-	-
21GES16.CO4	X	X	X	X	X	X	-	-	-	-	-	-	X	-	-
21GES16.CO5	X	X	-	-	X	X	X	X	-	X	-	X	X	X	X

List of Experiments

1. Fitting work   :preparation of l joint, v-joint
2. Carpentry work :Preparation of T-Joint, Lap joint, Dovetail Joint
3. Plumbing Work : Basic pipe connections (PVC) involving the fittings like Valves, Taps, and

         Bends., Mixed pipe (PVC and G.I) connections involving the fitting like Valves, Taps, and Bends

4. Sheet metal Work: Construction of Tray, Funnel and cone
5. Foundry   : Solid pattern Moulding, Split pattern Moulding , Core making
6. Welding   : Vertical Welding and Horizontal Welding
7. Lathe Work   : Plain Turning, Step Turning, Taper Turning, and Knurling operation.

TOTAL: 30 Hours

Chairman-Board of Studies
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(AUTONOMOUS)
RASIPURAM-637 408, NAMAKKAL Dist.

21GES17	MECHANICAL AND BUILDING SCIENCES LAB	L T P C
		0 0 3 1

COURSE OBJECTIVES:
- At the end of course the student will plan the pipe connections in PVC, G.I pipes.
- Analyze to separate the woods with tools and made of several pieces with proper types of joints using tools and machines.
- Demonstrate and remove materials from metal components and assemble the components.
- Join two metals by melting their edges by electric arc welding.
- Demonstrate Residential house wiring and Fluorescent lamp wiring.

COURSE OUTCOMES
21GES17.CO1	The students are able to make different pipe connections using PVC, G.I pipes.
21GES17.CO2	The students demonstrate different types of joints using carpentry and power tools.
21GES17.CO3	They categories various sheet metal working tools and fitting tools.
21GES17.CO4	They are able to use welding equipments to join structures.
21GES17.CO5	Students organize household wirings.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES17.CO1	-	·	·	-	-	X	·	-	-	X	-	-	·	·	·
21GES17.CO2	·	-	-	·	-	X	-	-	·	X	-	-	-	-	-
21GES17.CO3	X	X	-	-	X	X	-	X	-	-	·	X	X	-	-
21GES17.CO4	X	X	-	·	X	X	-	X	-	-	-	X	X	-	-
21GES17.CO5	X	X	-	-	X	X	-	X	·	-	-	X	X	X	X

UNIT I: CIVIL ENGINEERING PRACTICE   25
1. PLUMBING WORK
1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, Elbows and household fittings.
2. Basic pipe connections (PVC) involving the fittings like Valves, Taps, and Bends.
3. Mixed pipe (PVC and G.I) connections involving the fitting like Valves, Taps, and Bends

2. CARPENTRY WORK
1. Study of Carpentry Tools
2. Preparation of T-joint
3. Preparation of Lap joint
4. Preparation of Dovetail Joint

UNIT II   MECHANICAL ENGINEERING PRACTICE   25
FITTING WORK
1. Study of Sheet Metal Work.
2. Preparation of L joint
3. Preparation of V-joint
WELDING
1. Study of Welding Equipments and Tools
2. Preparation of Butt joint
3. Preparation of Lap joint
4. Preparation of Tee joint
5.
MACHINE ASSEMBLY PRACTICE
1. Assembly and Dismantling for gear box.
2. Assembly and Dismantling for the two wheeler wheel.

UNIT III   ELECTRICAL ENGINEERING PRACTICE   10
1. Residential house wiring
2. Fluorescent lamp wiring.
3. Stair-case Wiring and Door bell wiring

Chairman-Board of Studies
Department of Mechanical Engineering
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(AUTONOMOUS)
RASIPURAM-637 408, NAMAKKAL Dist.

21GES18	CONSTRUCTION MATERIALS	L T P C
		3 0 0 3

COURSE OBJECTIVES
- To introduce students to various materials commonly used in civil engineering construction and their properties.
- To study about the concrete design mix.
- To know about the procedures in concreting.
- To understand special concrete and their use.
- To know about the manufacture of cement.

COURSE OUTCOMES
At the end of the course the student will be able to

21GES18.CO1	Demonstrate knowledge of construction materials and their usages in building projects.
21GES18.CO2	Learning to further research in advancement of civil engineering materials field.
21GES18.CO3	Identify the materials including their sources and production and properties.
21GES18.CO4	Understood characteristics of conventional building materials like stone, brick, wood etc.
21GES18.CO5	Learned about new and composite materials and their value adding characteristic of being lightweight, energy efficient, speedy construction among others.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES18.CO1	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-
21GES18.CO2	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-
21GES18.CO3	X	X	-	-	X	X	-	X	-	-	-	X	X	-	-
21GES18.CO4	X	X	-	-	X	X	-	X	-	-	-	X	X	-	-
21GES18.CO5	X	X	-	-	X	X	-	X	-	-	-	X	X	X	X

UNIT I: STONES – BRICKS – CONCRETE BLOCKS   9
Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – brick earth – composition and harmful constituents – Efflorescence – Bricks for special use –Refractory bricks – Cement, Concrete blocks – Light weight concrete blocks.

UNIT II   : CEMENT – AGGREGATES – MORTAR   9
Cement – Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Hydration – Tests on cement– Industrial byproducts – Fly ash Aggregates – Natural stone aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – abrasion Resistance – Grading – Sand Bulking.

UNIT III : CONCRETE   9
Concrete – Ingredients – Manufacturing Process – RMC – Tests on fresh and hardened concrete – Modulus of rupture – Mix specification – Mix proportioning – BIS method –Admixtures and their functions – High Strength Concrete and HPC – Other types of Concrete – Durability of Concrete – Corrosion – Causes and effects – remedial measures – Thermal properties of concrete – Micro cracking of concrete – Quality of Water for mixing and curing – use of sea water for mixing concrete.

UNIT IV : TIMBER AND OTHER MATERIALS   9
Timber – Market forms – Industrial timber– Plywood – Veneer – Thermacole – Panels of laminates .
Ferrous metals: Iron and steel, basic metallurgy, composition and grades, market forms and heat treatment 0 Steel as reinforcement – Corrosion of metals and protection.
Non –ferrous metals: Aluminum, copper, brass and glass products – properties – applications.

UNIT V : MODERN MATERIALS   9
Glass – Ceramics – Sealants for joints – Fiber glass reinforced plastic – Clay products – Refractory's – Composite materials – Types – Applications of laminar composites – Fiber textile – Geo membranes and Geotextiles for earth reinforcement – polymers and plastics: walls, pipes and sanitary ware, glues and mastics – acid and chemical resistant products.

TOTAL : 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Duggal.S.K	Building Materials	4th Edition, New Age International	2016
2	Edward Allen and Joseph Iano	Fundamentals of Building Construction: Materials and Methods	Wiley, 6th Edition	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Varghese. P.C	Building construction	Prentice Hall of India Pvt. Ltd, New Delhi	2012
2	Shetty.M.S	Concrete Technology (Theory and Practice)	S. Chand and Company Ltd	2014
3	Arora S.P. and .Bindra S.P	The Text Book of Building Construction	Dhanpat Rai and Sons	1999
4	G.S.Birdie, T.D.Ahuja	Building Construction and construction materials	Dhanpat Rai publishing company, New Delhi.	2007
5	Gambhir.M.L	Concrete Technology	3rd Edition, Tata McGraw Hill Education	2009

21GES19	CONCEPTS IN PRODUCT DESIGN	L T P C
		3 0 0 3

COURSE OBJECTIVES
- To apply different ideas to manage innovation and development
- To analyze the product specification
- To know the concepts of CAD ,CAM ,CAE
- To develop product geometry, fundamental and conceptualization management
- To estimate and also to analyse the manufacturing components and assembly cost

COURSE OUTCOMES

21GES19.CO1	Apply different ideas enabling people to manage to work with innovation and development in organization.
21GES19.CO2	Examine the product specification select concept, product performance and manufacturing
21GES19.CO3	Develop product geometry. layout, fundamental and incidental interaction
21GES19.CO4	Design the integrated process robust design, conceptualization and management of industrial design.
21GES19.CO5	Estimate and Analyze the manufacturing components and assembly cost, planning for prototypes.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES19.CO1	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-
21GES19.CO2	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-
21GES19.CO3	X	X	-	-	X	X	-	X	-	-	-	X	X	-	-
21GES19.CO4	X	X	-	-	X	X	-	X	-	-	-	X	X	-	-
21GES19.CO5	X	X	-	-	X	X	-	X	-	-	-	X	X	X	X

UNIT I: INTRODUCTION   9
Strategic importance of Product development - integration of customer, designer. material supplier and process planner, Competitor and customer - behavior analysis. Understanding customer-promoting customer understanding-involve customer in development and managing requirements

UNIT II   : CONCEPT GENERATION, SELECTION AND TESTING   9
Plan and establish product specifications. Task - Structured approaches - clarification – search externally and internally- reflect on the solutions and processes -concept selection - methodology - benefits. Implications - product performance – manufacturability.

UNIT III: PRODUCT ARCHITECTURE   9
Product development management - creation - clustering -geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems -architecture of the chunks - creating detailed interface specifications-Portfolio Architecture.

UNIT IV: INDUSTRIAL DESIGN   9
Integrate process design - Managing costs - Robust design - Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically - Need for industrial design-impact – design process - investigation of customer needs – conceptualization- refinement - management of the industrial design process.

UNIT V: DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT   9
Definition - Estimation of Manufacturing cost-reducing the component costs and assembly costs – Minimize system complexity - Prototype basics - Principles of prototyping – Planning for prototypes - Economic Analysis.

TOTAL: L: 45 Hours

TEXT BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Ulrich K.T. and Eppinger S.D	Product Design and Development	McGraw –Hill International Editions	1999
2	Kevin Otto	Product Design	Pearson Education,	2004

REFERENCE BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Rosenthal S	Business One Orwin Homewood	Business One Orwin, Homewood	1992
2	Rosenthal S	Effective Product Design and Development	Business One Orwin, Homewood	1992
3	Pugh S	Total Design – Integrated Methods for successful Product Engineering	Addison Wesley Publishing	1991
4	Clive L.Dym	Engineering Design: A Project-based Introduction	John Wiley & Sons	2009
5	Yousef Haik	Engineering Design Process	Cengage Learning	2010

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21GES20	RENEWABLE ENERGY SOURCES	L T P C
		3 0 0 3

COURSE OBJECTIVES
- At the end of the course, the students are expected to identify the new methodologies/ technologies for effective utilization of renewable energy sources.
- To understand reverse of energy recourses.
- Understand solar energy production and applications.
- To understand wind energy systems.
- Other energy recourses are studied and learned.

COURSE OUTCOMES
21GES20.CO1	Understand the fundamentals of energy scenario.
21GES20.CO2	Illustrate the techniques used in utilization and measurement of solar energy
21GES20.CO3	Demonstrate the types and performance of wind energy systems
21GES20.CO4	Comprehend and identify the bio-mass energy sources and applications.
21GES20.CO5	Outline the utilization techniques of tidal, wave, Hydro, geothermal, fuel cell systems and hybrid system energy sources.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES20.CO1	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-
21GES20.CO2	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-
21GES20.CO3	X	X	-	-	X	X	-	X	-	-	-	X	X	-	-
21GES20.CO4	X	X	-	-	X	X	-	X	-	-	-	X	X	-	-
21GES20.CO5	X	X	-	-	X	X	-	X	-	-	-	X	X	X	X

UNIT I: INTRODUCTION   9
World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilisation – Renewable Energy Scenario in Tamilnadu, India and around the World - Potentials - Achievements / Applications – Economics of renewable energy systems.

UNIT II: SOLAR ENERGY   9
Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

UNIT III: WIND ENERGY   9
Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance - Site Selection – Details of Wind Turbine Generator – Safety and Environmental Aspects.

UNIT IV: BIO - ENERGY   9
Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Bio diesel – Cogeneration - Biomass Applications.

UNIT V: OTHER RENEWABLE ENERGY SOURCES   9
Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro-Geothermal Energy Hydrogen and Storage - Fuel Cell Systems – Hybrid Systems.

TOTAL: L: 45 Hours

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	G.D. Rai	Non Conventional Energy Sources,	Khanna Publishers, New Delhi,	2011.
2.	Twidell, J.W. & Weir	A., Renewable Energy Sources	EFN Spon Ltd., UK.	2006

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David M. Mousdale	Introduction to Biofuels,	CRC Press Taylor & Francis Group, USA	2010
2.	Chetan Singh Solanki	Solar Photovoltaic, Fundamentals. Technologies and Applications,	PHI Learning Private Limited, New Delhi	2009
3.	S.P. Sukhatme	Solar Energy	Tata McGraw Hill Publishing Company Ltd., New Delhi,	1997.
4.	Sinduja S	Renewable Energy Sources	Anuradha Publications	2012
5.	Tasneem abbasi and T.A Abbasi	Renewable Energy Sources: Their Impact on Global Warming and Pollution	Prentice Hall India Learning Private Limited	2010

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21GES21	ELECTRICAL DRIVES AND CONTROLS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES
- To understand the basics of electrical drives.
- To study the drive motor characteristics,
- To study the different methods of starting D.C motors and Induction Motors.
- To study the Conventional and Solid-State DC Drives.
- To study the Speed Control of AC Drives.

COURSE OUTCOMES
21GES21.CO1	Able to explain the basics of electrical drives.
21GES21.CO1	Able to describe drive motor characteristics
21GES21.CO1	Able to demonstrate the methods of starting D.C motors and Induction Motors.
21GES21.CO1	Able to describe speed control of DC drives.
21GES21.CO1	Able to explain the conventional and solid state speed control of AC drives.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES21.CO1	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES21.CO2	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES21.CO3	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES21.CO4	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES21.CO5	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-

UNIT I   INTRODUCTION   9
Basic Elements - Types of Electric Drives - Factors are influencing the choice of Electrical Drives -Heating and Cooling Curves - Loading conditions and classes of duty - Selection of power rating for drive motors with regard to thermal overloading and Load variation factors.

UNIT II   DRIVE MOTOR CHARACTERISTICS   9
Dynamics of Motor load system – Multiquadrant operation – DC Motor (Types, Torque Equation, Characteristics and Applications) - Single phase induction motor (Types and Applications) - Three phase induction motors(Types, Characteristics) - Braking of Electric motors.

UNIT III   STARTING METHODS   9
Necessity of a starters – Types of DC Motor Starters – Types of 3 phase squirrel cage and slip ring Induction Motor Starters.

UNIT IV   CONVENTIONAL AND SOLID STATE SPEED CONTROL OF DC DRIVES   9
Speed control of DC series and shunt motors - Armature and field control - Ward-Leonard control system using controlled rectifiers and DC choppers.

UNIT V   CONVENTIONAL AND SOLID STATE SPEED CONTROL OF AC DRIVES   9
Speed control of three phase induction motor - Voltage control, voltage / frequency control and slip power recovery scheme using inverters and AC voltage regulators.

TOTAL: 45 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	G. K. Dubey	Fundamentals of Electrical Drives	CRC press	2002
2.	Vedam Subrahmaniam	Electric Drives (Concepts and Applications)	Tata McGraw-Hill	2010

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gnanavadivel J Karthikeyan J Chitra Selvi S	Electrical Drives and Controls	Anuradha Publishers	2004
2.	Thiyagarajan V	Electrical Drives and Controls	A.R. Publications	2015
3.	Pillai SK	A First Course on Electric Drives	New age international publishers	2013
4.	Jagadeesh Babu V	Electrical Drives and Controls	Scitech Publications	2015
5.	Austin Hughes and Bill Drury	Electric Motors and Drives	Newness Heinemann Publishers	2018

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21GES22	ELECTRICAL DRIVES AND CONTROLS LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To study the conventional and solid-state drives
- To study the different methods of starting D.C motors and induction motors.
- To understand the basic concepts of different types of electrical machines and their performance.

LIST OF EXPERIMENTS:

1. Load test on DC Shunt & DC Series motor.
2. O.C.C & Load characteristics of DC Shunt and DC Series generator.
3. Speed control of DC shunt motor (Armature, Field control).
4. Load test on single phase transformer.
5. O.C & S.C Test on a single phase transformer.
6. V curves and inverted V curves of synchronous Motor.
7. Load test on three phase squirrel cage Induction motor.
8. Speed control of three phase slip ring Induction Motor.
9. Load test on single phase Induction Motor.
10. Study of DC & AC Starters.

TOTAL: 45 Hours

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21GES23	ANALOG AND DIGITAL COMMUNICATION	L T P C
		3 0 0 3

COURSE OBJECTIVES

1. To Understand basic elements of a communication system
2. To Conduct analysis of baseband signals in time domain and in frequency domain
3. To Demonstrate understanding of various analog and digital modulation and demodulation techniques technique
4. To Analyses the performance of modulation and demodulation techniques in various transmission environments
5. To appreciate the importance of synchronization in communication systems

COURSE OUTCOMES

21GES23.CO1	Explain and apply various types of modulation and demodulation in analog and digital Communication.
21GES23.CO2	Describe the concept of digital communicationtechniques.
21GES23.CO3	Describe the concept of various digital transmission techniques.
21GES23.CO4	Comprehend the Cellular communicationtechniques.
21GES23.CO5	Explain the concepts of Satellite communication and Optical communication

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES23.CO1	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES23.CO2	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES23.CO3	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES23.CO4	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES23.CO5	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-

UNIT I   FUNDAMENTALS OF ANALOG COMMUNICATION   9

Principles of amplitude modulation - AM envelope - frequency spectrum and bandwidth - modulation index andpercent modulation - AM Voltage distribution - AM power distribution - Angle modulation - FM and PM waveforms - phase deviation and modulation index - frequency deviation and percent modulation - Frequency analysis of angle modulated waves - Bandwidth requirements for Angle modulated waves.

UNIT II   DIGITAL COMMUNICATION   9

Shannon limit for information capacity - Digital amplitude modulation - Frequency Shift Keying - FSK bit rateand baud - FSK transmitter - BW consideration of FSK - FSK receiver - Phase Shift Keying – BPSK, QPSK8- PSK - Quadrature Amplitude modulation – 8-QAM - bandwidth efficiency - Carrier recovery – squaring loop. Costas loop - DPSK.

UNIT III   DIGITAL TRANSMISSION   9

Pulse modulation - PCM – PCM sampling - Sampling rate - Signal to Quantization noise rate - Commanding-analog and digital - Delta modulation PCM - Adaptive Delta modulation PCM - Differential PCM – Inter symbol interference - Eye patterns.

UNIT IV   CELLULAR COMMUNICATION   9

Fundamental concept of Cellular telephone - Frequency reuse, Interference - Co-channel Interference, Adjacent channel Interference - Cell splitting - Cell sectoring - Segmentation and Dualization - Roaming and Handoff.

UNIT V   SATELLITE AND OPTICAL COMMUNICATION   9

Kepler's Law - Satellite Orbits - Geo synchronous satellites - satellite system link models -Optical Fiber Communication system - Optical Fiber configurations - Optical Fiber classification Losses in Optical fiber cables - Optical sources - LED , Injection laser diode - Light detector - PIN diodes, Avalanche photo diode.

Total:45

TEXT BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Wayne Tomasi,	Electronic Communication Systems Fundamentals through Advanced	Pearson Education	2008
2.	H.Taub,D L Schilling,G Saha	Principles of Communication	Pearson Education	2008

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	B.P.Lathi	Modern Analog and Digital Communication systems	Oxford University Press	2008
2.	Blake	Electronic Communication Systems	Thomson Delmar Publications	2002
3.	Martin S.Roden	Analog and Digital Communication System	PHI	2002
4.	B.Sklar	Digital Communication Fundamentals and Applications	Pearson Education	2007
5.	Simon Haykin	Communication Systems	John Wiley & Sons	2010.

21GES24	DIGITAL PRINCIPLES AND SYSTEM DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- To know about the basics of Boolean Algebra and Logic Gates.
- To Design and Implement Combinational Logic.
- To Design and Implement Synchronous Sequential Logic.
- To Design and Implement of Asynchronous Sequential Logic.
- Be familiar with the theory, construction, and operation of Basic Memory And Programmable Logic.

COURSE OUTCOMES:

21GES24.CO1	To Learn about the basics of Boolean Algebra and Logic Gates.
21GES24.CO2	To Learn about the basics Combinational Logic.
21GES24.CO3	To Learn about the basics Synchronous Sequential Logic.
21GES24.CO4	To Learn about the basics of Asynchronous Sequential Logic.
21GES24.CO5	Be familiar with the theory, construction, and operation of Basic Memory and Programmable Logic.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES24.CO1	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES24.CO2	X	X	X	-	-	-	-	-	-	X	•	X	X	-	-
21GES24.CO3	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
21GES24.CO4	X	X	X	-	-	-	-	•	-	X	-	X	X	-	-
21GES24.CO5	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-

UNIT I: BOOLEAN ALGEBRA AND LOGIC GATES   9

Review of Number Systems --Arithmetic Operations -Binary Codes–Boolean Algebra and Theorems –Boolean Functions–Simplification of Boolean Functions using Karnaugh Map and \Tabulation Methods –Logic Gates–NAND and NOR Implementations.

UNIT II   :COMBINATIONAL LOGIC   9

Combinational Circuits –Analysis and Design Procedures–Circuits for Arithmetic Operations. Code Conversion –Decoders and Encoders –Multiplexers and Demultiplexers –Introduction to HDL –HDL Models of Combinational circuits.

UNIT III:SYNCHRONOUS SEQUENTIAL LOGIC   9

Sequential Circuits –Latches and Flip Flops –Analysis and Design Procedures –State Reduction and State Assignment –Shift Registers–Counters –HDL for Sequential Logic Circuits.

UNIT IV:ASYNCHRONOUS SEQUENTIAL LOGIC   9

Analysis and Design of Asynchronous Sequential Circuits–Reduction of State and Flow Tables –Race-free State Assignment–Hazards.

UNIT V:MEMORY AND PROGRAMMABLE LOGIC   9

RAM and ROM –Memory Decoding –Error Detection and Correction –Programmable Logic Array –Programmable Array Logic –Sequential Programmable Devices –Application Specific Integrated Circuits.

TOTAL: 45 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Morris Mano M. and Michael D. Ciletti	Digital Design	Pearson Education	IV Edition, 2008.
2.	John F. Wakerly,	Digital Design Principles and Practices	Pearson Education	IV Edition, 2007

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Charles H. Roth Jr.	Fundamentals of Logic Design	Jaico Publishing House	Fifth Edition–, Mumbai, 2003
2.	Donald D. Givone	Digital Principles and Design	Tata Mcgraw Hill	2003
3.	Kharate G. K	Digital Electronics	Oxford University Press	2010
4.	Thomas L. Floyd	Digital Fundamentals	Pearson Education Inc	10th Edition, 2011
5.	Donald D.Givone	Digital Principles and Design	TMH	2003

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RASIPURAM-637 408, NAMAKKAL Dist.

21GES25   DIGITAL PRINCIPLES AND SYSTEM DESIGN LABORATORY

L	T	P	C
0	0	3	1

LIST OF EXPERIMENTS

1. Verification of Boolean theorems using digital logic gates
2. Design and implementation of combinational circuits using basic gates
3. Design and implementation of 4-bit binary adder / subtractor using basic gates and MSI devices.
4. Design and implementation of parity generator / checker using basic gates and MSI devices
5. Design and implementation of magnitude comparator.
6. Design and implementation of application using multiplexers/ Demultiplexers.
7. Design and implementation of Shift registers
8. Design and implementation of Synchronous and Asynchronous counters
9. Design and implementation of Coding combinational / sequential circuits using HDL

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RASIPURAM-637 408, NAMAKKAL Dist.

21GES26	ENGINEERING DRAWING	L	T	P	C
		1	0	3	3

COURSE OBJECTIVES

- To construct various curves in engineering applications.
- To draw the projection of three dimensional objects representing machine structure.
- To analyze the principles of projection of various planes by different angle to project points, lines and planes.
- To draw the projection of simple solid when axis is inclined to one reference plane by change of position method.
- To identify the interior components of machinery (or) buildings by sectioning the solid, and to study the development of simple solids for fabrication of sheet metals.

COURSE OUTCOMES

21GES26.CO1	Construct various curves in engineering applications.
21GES26.CO2	Draw the projection of three dimensional objects representing machine structure.
21GES26.CO3	Analyze the principles of projection of various planes by different angle to project points, lines and planes.
21GES26.CO4	Draw the projection of simple solid when axis is inclined to one reference plane by change of position method.
21GES26.CO5	Identify the interior components of machinery (or) buildings by sectioning the solid, and to study the development of simple solids for fabrication of sheet metals.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES26.CO1	X	-	-	-	-	-	-	-	-	X	-	-	X	X	-
21GES26.CO2	X	-	-	-	-	-	-	-	-	X	-	-	X	X	-
21GES26.CO3	X	-	-	-	-	-	-	-	-	X	-	-	X	X	-
21GES26.CO4	X	-	-	-	-	-	-	-	-	X	-	-	X	X	-
21GES26.CO5	X	-	-	-	-	-	-	-	-	X	-	-	X	X	-

CONCEPTS AND CONVENTIONS (Not for Examination)   4

Importance of graphics in engineering applications, Use of drafting instrument, BIS conventions and specifications - Size, layout and folding of drawing sheets, Lettering and dimensioning.

COMPUTER AIDED DRAFTING (Not for Examination)   6

Importance 2d Drafting, sketching, modifying, transforming and dimensioning.

UNIT I: PLANE CURVES   13

Curves used in engineering practices, Conics, Construction of ellipse, Parabola and hyperbola by eccentricity method, Construction of cycloid, construction of involutes of square and circle, Drawing of tangents and normal to the above curves.

UNIT II: ISOMETRIC TO ORTHOGRAPHIC VIEWS   13

Representation of three dimensional objects, General Principles of Orthographic projection, Need for importance of multiple views and their placement, First angle projection, layout of views, Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT III: PROJECTION OF POINTS, LINES AND PLANE   13

(Free hand sketching) Projection of points, Projection of straight lines located in the first quadrant, Determination of true lengths and true inclinations, Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT IV: PROJECTION OF SOLIDS   13

(Free hand sketching) 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 V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES   **13**

(Free hand sketching) Sectioning of simple solids like prisms. pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other. (Obtaining true shape of section is not required). Development of lateral surfaces of simple and truncated solids, Prisms, pyramids, cylinders and cones.

TOTAL: L: 15 + P: 60 = 75

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Natrajan K.V	A text book of Engineering Graphics	Dhanalakshmi Publishers, Chennai	2015
2.	Basant Agrawal and C.M. Agrawal	Engineering Drawing	McGraw Hill Education; Second edition	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gopalakrishnan K.R	Engineering Drawing (Vol. I&II combined)	Subhas Stores Bangalore	2007
2	Luzzader, Warren.J. and Duff,John M	Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production	Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi	2005
3	Shah M.B., and Rana B.C	Engineering Drawing	Pearson, 2nd Edition	2009
4	Venugopal K. and Prabhu Raja V	Engineering Graphics	New Age International (P) Limited	2008
5	Bhatt N.D. and Panchal V.M	Engineering Drawing	Charotar Publishing House. 50th Edition	2010

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21GES27	ENGINEERING GEOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To impart the concepts of geological agents and their processes.
- To provide knowledge on various properties of minerals and their engineering significance.
- To give knowledge on various classifications of rocks.
- To understand the importance of geological investigations and mapping.
- To understand the applications of geological surveys in civil engineering structures.

COURSE OUTCOMES

21GES27.CO1   Understand the application of geology knowledge to Civil Engineering construction.
21GES27.CO2   Understand the concepts of various geological materials.
21GES27.CO3   Understand the properties, behaviour and engineering significance of different type of rocks and minerals.
21GES27.CO4   Learned the interpretation skills of geological maps having different type of geological features.
21GES27.CO5   Learned consideration and importance of geological aspects in civil engineering related infrastructure projects.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES27.CO1	X	-	-	-	-	-	-	-	-	X	-	-	X	X	-
21GES27.CO2	X	-	-	-	-	-	-	-	-	X	-	-	X	X	-
21GES27.CO3	X	-	-	-	-	-	-	-	-	X	-	-	X	X	-
21GES27.CO4	X	-	-	-	-	-	-	-	-	X	-	-	X	X	-
21GES27.CO5	X	-	-	-	-	-	-	-	-	X	-	-	X	X	-

UNIT I: PHYSICAL GEOLOGY   9

Role of Geology in civil engineering – Branches of geology – Earth structures and composition – Elementary knowledge on continental drift and plate tectonics – Earth processes – weathering – soils – Geological work of river, wind and sea – Engineering importance -- Earthquake belts in India – Ground water – Mode of occurrence –Prospecting .

UNIT   II   :   MINEROLOGY   9

Elementary knowledge on symmetry elements of important crystallographic systems – Physical properties of minerals – Study of the rock forming minerals – Quartz family – Feldspar family – Mica – Pyroxene family minerals – Fundamentals of process of formation of ore minerals – Properties, behaviour and engineering significance of clay minerals – Coal and petroleum – Their origin and occurrence in India.

UNIT III : PETROLOGY   9

Classification of rocks – Distinction between igneous, sedimentary and metamorphic rocks – Occurrence, Engineering properties and distribution – Igneous rocks – Granite, syenite, diorite, gabbro, pegmatite, dolerite and basalt – sedimentary rocks – Sandstone, limestone, shale, conglomerate and breccias – Metamorphic rocks –Quartzite, marble, slate, phyllite, gneiss and schist.

UNIT IV : STRUCTURAL GEOLOGY AND MAP   9

Attitude of beds – Outcrops – Contours – Introduction to geological maps – Folds – Faults and joints – Their bearing on engineering construction – Seismic and electrical methods for civil engineering investigations. Study of structures.

UNIT V : GEOLOGICAL INVESTIGATION   9

Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings. Causes and preventions – Sea erosion and Coastal protection.

TOTAL: (L:45):45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Parbin Singh.	A Text book of Engineering and General Geology	Katson publishing house, Ludhiana.	2010
2	Varghese, P.C	Engineering Geology for Civil Engineering	PHI Learning Private Limited, New Delhi	2012

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Muthiayya, V.D	A Text of Geology	Oxford IBH Publications, Calcutta.	2010
2	Blyth F.G.H. and De Freitas M.H	Geology for Engineers	Edward Arnold, London	2010
3	F.G.Bell.	Fundamentals of Engineering Geology	B.S. Publications, Hyderabad	2011
4	Dobrin. M.B	An introduction to geophysical prospecting	McGraw0Hill, New Delhi	2010
5	KVGK Gokhale	Principles of Engineering Geology	BS Publications, Hyderabad	2011

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21GES28	ENGINEERING MECHANICS	L T P C
		3 1 0 4

COURSE OBJECTIVES
- To generalize the scalar and vector representation of forces and moments.
- To explore truss, beam, frame and cable problems and respond to the distributed force systems.
- To predict Centroid and Moment of Inertia.
- To realize the Laws of Motion, Principle of Work and Energy, Kinematics & Kinetics of Motion and the interrelationship.
- To comprehend the effect of friction on equilibrium.

COURSE OUTCOMES
21GES28.CO1	Generalize the scalar and vector representation of forces and moments.
21GES28.CO2	Explore truss, beam, frame and cable problems and respond to the distributed force systems.
21GES28.CO3	Predict Centroid and Moment of Inertia.
21GES28.CO4	Realize the Laws of Motion, Principle of Work and Energy, Kinematics & Kinetics of Motion and the interrelationship.
21GES28.CO5	Comprehend the effect of friction on equilibrium.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21GES28.CO1	X	X	X	X	-	X	-	-	-	-	-	X	X	-	-
21GES28.CO2	X	X	X	X	-	X	-	-	-	-	-	X	X	-	-
21GES28.CO3	X	X	X	X	-	X	-	-	-	-	-	X	X	-	-
21GES28.CO4	X	X	X	X	-	X	-	-	-	-	-	X	X	-	-
21GES28.CO5	X	X	X	X	-	X	-	-	-	-	-	X	X	-	-

UNIT I: BASICS AND STATICS OF PARTICLES   15
Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Vector operations of forces – additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

UNIT II: EQUILIBRIUM OF RIGID BODIES   15
Free body diagram – Types of supports – Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III: PROPERTIES OF SURFACES AND SOLIDS   15
Centroids and centre of mass – Centroids of lines and areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Theorems of Pappus – Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia

UNIT IV: DYNAMICS OF PARTICLES   15
Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's laws of motion – Work Energy Equation – Impulse and Momentum – Impact of elastic bodies.

UNIT V: FRICTION   15
Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction – Rolling – resistance.

TOTAL:L : 45 + T :30 = 75

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Beer, F.P and Johnston. E.R.,	Vector Mechanics for Engineers: Statics and Dynamics	Tata McGraw-Hill Publishing company, New Delhi	2013
2.	S. Timoshenko, D.H. Young, J.V. Rao and Sukumar Pati	Engineering Mechanics	McGraw Hill Education; 5 edition	2013

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Hibbeller, R.C and Ashok Gupta	Engineering Mechanics: Statics and Dynamics	Pearson Education	2010
2	Irving H. Shames and Krishna Mohana Rao. G	Engineering Mechanics – Statics and Dynamics	Pearson Education	2006
3	Meriam J.L. and Kraige L.G	Engineering Mechanics	John Wiley & Sons	2013
4	Rajasekaran S and Sankarasubramanian G	Engineering Mechanics	Vikas Publishing House Pvt. Ltd	2005
5	Bhavikatti. S.S	Engineering Mechanics	New Age International (P) Limited Publishers	2015

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PROFESSIONAL CORE

(PC)

For

Mechanical Engineering

21MEC01   ENGINEERING MATERIALS AND METALLURGY   L T P C
                                                     3 0 0 3

COURSE OBJECTIVES
- To learn about the micro-structure of materials, phase diagrams for different binary Alloys.
- To impart knowledge on different types of phase diagrams of alloys and types of heat treatments.
- To identify the various mechanical properties of materials through different types of tests and their significance.
- To know about different types of alloy steels with their applications, non-ferrous alloys with particular reference to copper, aluminum, magnesium, zinc, nickel, titanium, lead and tin alloys.
- To gain knowledge on the types, structure, properties and applications of polymers, ceramics and composites.

COURSE OUTCOMES
21MEC01.CO1	Gain knowledge on micro-structure of materials, iron-carbon and other phase diagrams.
21MEC01.CO2	Acquire knowledge on isothermal transformation diagram and various types of heat treatments.
21MEC01.CO3	Understand different types of ferrous and non ferrous alloy steels and their engineering applications.
21MEC01.CO4	Comprehend the types of non metallic materials and their properties
21MEC01.CO5	Know the concepts of plastic deformation, strengthening mechanisms and fracture of metals, various mechanical testing methods for properties and their engineering importance.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC01.CO1	X	X	X	X	-	-	X	X	-	-	-	X	X	X	X
21MEC01.CO2	X	X	X	X	-	-	X	X	-	-	-	X	X	X	X
21MEC01.CO3	X	X	X	X	-	-	X	X	-	-	-	X	X	X	X
21MEC01.CO4	X	X	X	X	-	-	X	X	-	-	-	X	X	X	X
21MEC01.CO5	X	X	X	X	-	-	X	X	-	-	-	X	X	X	X

UNIT I: ALLOYS AND PHASE DIAGRAMS   9
Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron – carbon equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application.

UNIT II: HEAT TREATMENT   9
Definition – Full annealing, stress relief, recrystallization and spheroid sing – normalizing, hardening and tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T.diagram CCR – Hardenability, Jominy end quench test - Austempering, martempering – case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening.

UNIT III: FERROUS AND NON-FERROUS METALS   9
Effect of alloying additions on steel- α and β stabilisers– stainless and tool steels – HSLA, Maraging steels – Cast Iron - Grey, white, malleable, spheroidal – alloy cast irons, Copper and copper alloys – Brass, Bronze and Cupronickel – Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys, Mg-alloys, Ni-based super alloys and Titanium alloys.

UNIT IV: NON-METALLIC MATERIALS   9
Polymers – types of polymer, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET,PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes)- Engineering Ceramics –Properties and applications of Al_2O_3, SiC, Si_3N_4, PSZ and SIALON –Composites-Classifications- Metal Matrix and FRP - Applications of Composites.

UNIT V: MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS   9

Mechanisms of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), hardness tests, Impact test Izod and charpy, fatigue and creep failure mechanisms.

TOTAL L: 45=45

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Avner, S.H	Introduction to Physical Metallurgy	McGraw Hill Book Company	2017
2.	Williams D Callister	Material Science and Engineering	Wiley India Pvt. Ltd.	2012

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Raghavan.V	Materials Science and Engineering	Prentice Hall of India Pvt. Ltd	2004
2	Kenneth G.Budinski and Michael K. Budinski	Engineering Materials	Prentice Hall of India Private Limited, 4th Indian Reprint	2010
3	Upadhyay. G.S. and AnishUpadhyay	Materials Science and Engineering	Viva Books Pvt. Ltd., New Delhi	2007
4.	U.C.Jindal	Material Science and Metallurgy. "EngineeringMaterials and Metallurgy	First Edition, Dorling Kindersley	2012
5.	P. Khanna	Text Book of Material Science and Metallurgy	DhanpatRai Publication (P) Ltd., New Delhi	2007

21MEC02 ENGINEERING THERMODYNAMICS

L T P C
3 0 0 3

(Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychometric Chart permitted)

COURSE OBJECTIVES:
- To familiarize the students to understand the fundamentals of thermodynamics
- To understand about second law of thermodynamics and applications
- To know the working of steam turbines
- To understand about gas cycles
- To know the psychometric process

COURSE OUTCOMES

21MEC02.CO1	Familiarize the concepts of thermodynamics laws and solving problems in nozzle, turbine and compressor
21MEC02.CO2	Understand second law of thermodynamics and solving problems related to it
21MEC02.CO3	Know the working of steam turbines and calculations
21MEC02.CO4	Understanding gas tables, compressibility chart and its and applying this to gases.
21MEC02.CO5	Knowing the Psychometric process and applying in air conditioning and gas cycles

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC02.CO1	X	X	X	X	X	X	-	-	-	-	-	-	X	X	-
21MEC02.CO2	X	X	-	-	-	-	-	-	-	-	-	-	X	-	-
21MEC02.CO3	X	X	-	-	-	-	-	-	-	-	-	-	X	-	-
21MEC02.CO4	X	X	-	-	-	-	-	-	-	-	-	-	X	-	-
21MEC02.CO5	X	X	-	-	-	-	-	-	-	-	-	-	X	-	-

UNIT I: BASIC CONCEPTS AND FIRST LAW   9
Basic concepts - concept of continuum, comparison of microscopic and macroscopic approach. Path and point functions. Intensive and extensive, total and specific quantities. System and their types. Thermodynamic Equilibrium State, path and process. Quasi-static, reversible and irreversible processes. Heat and work transfer, definition and comparison, sign convention. Displacement work and other modes of work .P-V diagram. Zeroth law of thermodynamics – concept of temperature and thermal equilibrium– relationship between temperature scales –new temperature scales. First law of thermodynamics –application to closed and open systems – steady and unsteady flow processes.

UNIT II: SECOND LAW AVAILABILITY ANALYSIS   9
Heat reservoir, source and sink, Heat Engine, Refrigerator, Heat pump, Statements of second law and its corollaries, Carnot cycle Reversed Carnot cycle, Performance, Clausius inequality, Concept of entropy, T-s diagram, Tds Equations, entropy change for - pure substance, ideal gases – different processes, principle of increase in entropy. Applications of II Law, High and low grade energy. Available and non-available energy of a source and finite body, Energy and irreversibility, Expressions for the energy of a closed system and open systems, Energy balance and entropy generation, Irreversibility, I and II law Efficiency.

UNIT III: PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE   9
Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface, Use of Steam Table and Mollier Chart. Determination of dryness fraction. Application of I and II law for pure substances. Ideal and actual Rankine cycles, Cycle Improvement Methods - Reheat and Regenerative cycles, Economiser, preheater, Binary and Combined cycles.

UNIT IV: IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS   9
Properties of Ideal gas- Ideal and real gas comparison- Equations of state for ideal and real gases-Reduced properties-.Compressibility factor-.Principle of Corresponding states. –Generalised Compressibility Chart and its use-. Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Energy equation, Joule-Thomson Coefficient, ClausiusClapeyron equation, Phase Change Processes. Simple Calculations

UNIT V: GAS MIXTURES AND PSYCHROMETRY

Mole and Mass fraction, Dalton's andAmagat's Law. Properties of gas mixture – Molar mass, gasconstant, density, change in internal energy, enthalpy, entropy and Gibbs function. Psychometric properties. Psychometric charts. Property calculations of air vapour mixtures by using chart and expressions. Psychometric process – adiabatic saturation, sensible heating and cooling,humidification, dehumidification, evaporative cooling and adiabatic mixing. Simple Applications

TOTAL: L +T=45= 45

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Nag.P.K	Engineering Thermodynamics	4thEdition, Tata McGraw-Hill	2017
2.	Natarajan E	Engineering Thermodynamics	Anuragam Publications	2012

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Cengel. Y and M.Boles	Thermodynamics - An Engineering Approach	7th EditionTata McGraw Hill	2010.
2	Holman.J.P	Thermodynamics	3rd Edition, McGraw-Hill	1995
3	Arora C.P	Thermodynamics	Tata McGraw-Hill	2003
4.	Chattopadhyay,P	Engineering Thermodynamics	Oxford University Press	2010
5.	Prasanna Kumar	Engineering Thermodynamics	Pearson Education	2013

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21MEC03 FLUID MECHANICS AND MACHINERY

L T P C
3 0 0 3

COURSE OBJECTIVES

- To understand the applications of fluid in various engineering requirements
- To explain the various losses in pipes
- To understand the importance of dimensional analysis
- To interpret the various types pumps and its principles
- To comprehend the types of flow in turbine

COURSE OUTCOMES

21MEC03.CO1	Understand and recall the definitions and fundamental concepts of fluid properties
21MEC03.CO2	Illustrate the concepts of flow through circular conduits and solve losses in pipes
21MEC03.CO3	Make use of dimensional analysis and dimensionless parameters
21MEC03.CO4	Demonstrate the working of different types of pumps
21MEC03.CO5	Demonstrate the working of different types of turbines

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC03.CO1	X	X	X	-	-	X	X	X	-	X	-	X	X	-	-
21MEC03.CO2	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
21MEC03.CO3	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
21MEC03.CO4	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
21MEC03.CO5	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-

UNIT I: FLUID PROPERTIES AND FLOW CHARACTERISTICS   9
Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics concept of control volume - application of continuity equation, energy equation and momentum equation

UNIT II: FLOW THROUGH CIRCULAR CONDUITS   9
Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

UNIT III: DIMENSIONAL ANALYSIS   9
Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV: PUMPS   9
Impact of jets - Euler"s equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle -work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps classification.

UNIT V: TURBINES   9
Classification of turbines – heads and efficiencies – velocity triangles, axial, radial and mixed flow turbines, Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities - performance curves for turbines – governing of turbines.

TOTAL: L: 45: = 45

MECHANICAL ENGINEERING

TEXT BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dr. P.N. Modi& Dr. S.M. Seth	Hydraulics and Fluid Mechanics Including Hydraulics Machines	Rajsons Publications Pvt. Ltd. 20th edition	2015
2.	Dr. R. K. Bansal	A Textbook of Fluid Mechanics and Hydraulic Machines	Laxmi Publications, Ninth edition	2017

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Streeter, V. L. and Wylie E. B.	Fluid Mechanics	McGraw Hill Publishing Co.	2010
2	Kumar K. L.	Engineering Fluid Mechanics	Eurasia Publishing House(p) Ltd., New Delhi	2004
3	Robert W.Fox, Alan T. McDonald, Philip J.Pritchard,	Fluid Mechanics	Wiley, 9th Edition	2015
4	Graebel. W.P,	Engineering Fluid Mechanics	Taylor & Francis, Indian Reprint	2011
5	R.K.Rajput	A text book of Fluid Mechanics	S.Chand& co, New Delhi	2007

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21MEC04   STRENGTH OF MATERIALS

L T P C
3 0 0 3

COURSEOBJECTIVES

- To develop the theoretical basis and to derive the theories of the strength of materials with sound mathematical principles
- To enable to systematically solve engineering problems regardless of difficulty.
- To establish an understanding of the fundamental concepts of mechanics of deformable solids; including static equilibrium, geometry of deformation, and material constitutive behavior.
- To provide students with exposure to the systematic methods for solving engineering problems in solid mechanics.
- To discuss the basic mechanical principles underlying modern approaches for design of various types of structural members subjected to axial load, torsion, bending, transverse shear, and combined loading.

COURSE OUTCOMES

21MEC04.CO1	Demonstrate the basic concepts of stress, strain and fundamentals of elasticity.
21MEC04.CO2	Compute stresses on inclined plane and principal planes by graphical and analytical method
21MEC04.CO3	Construct Shear force Diagram, Bending Moment Diagram for different beam and load configurations
21MEC04.CO4	Determine the slope and deflection of different beams.
21MEC04.CO5	Determine pure Torsion of shafts and deformation of helical springs and apply it in different situations.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC04.CO1	X	X	X	X	-	-	-	-	-	-	-	X	X	X	X
21MEC04.CO2	X	X	X	X	-	-	-	-	-	-	-	X	X	-	-
21MEC04.CO3	X	X	X	X	-	-	-	-	-	-	-	X	X	X	X
21MEC04.CO4	X	X	X	X	-	-	-	-	-	-	-	X	X	X	X
21MEC04.CO5	X	X	X	X	-	-	-	-	-	-	-	X	X	-	-

UNIT I: STRESS, STRAIN AND DEFORMATION OF SOLIDS   9

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains –Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress.

UNIT II: TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM   9

Beams – types transverse loading on beams – Shear force and bending moment in beams –Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending–bending stress distribution – Load carrying capacity – Proportioning of sections–Shear stress distribution.

UNIT III: TORSION   9

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts–Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs

UNIT IV: DEFLECTION OF BEAMS   9

Slope and deflection of simply supported beams and cantilevers- Double integration- Macaulay's Method- moment area method- conjugate beam method.

UNIT V: THIN CYLINDERS, SPHERES AND THICK CYLINDERS   9

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure –Deformation in spherical shells – Lame's theorem.

MECHANICAL ENGINEERING

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bansal, R.K	Strength of Materials	Laxmi Publications (P) Ltd.,	2017
2.	Egor. P.Popov	Engineering Mechanics of Solids	Prentice Hall of India, New Delhi	2015

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jindal U.C	Strength of Materials	Asian Books Pvt. Ltd., New Delhi	2007
2.	Subramanian R	Strength of Materials	Oxford University Press, Oxford Higher Education Series	2007
3.	Ferdinand P. Been, Russell Johnson, J.r. and John J. Dewole	Mechanics of Materials	TataMcGraw Hill Publishingco. Ltd., New Delhi	2005
4.	D. K. Singh	Mechanics of Solids	Pearson Education New Delhi	2006
5.	B. K. Sarkar	Strength of Materials	Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi	2006

21MEC05   KINEMATICS OF MACHINERY

L T P C
3 0 0 3

COURSEOBJECTIVES

- To calculate mobility (number of degrees-of-freedom) and enumerate rigid links and types of joints within mechanisms.
- To identify the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the kinematics of cam and its follower.
- To understand the basics of gear mechanism and gear trains.
- To classify the effects of friction in motion transmission and in machine components.

COURSE OUTCOMES

21MEC05.CO1	Calculate mobility (number of degrees-of-freedom) and enumerate rigid links and types of joints within mechanisms.
21MEC05.CO2	Identify the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
21MEC05.CO3	Understand the kinematics of cam and its follower.
21MEC05.CO4	Understand the basics of gear mechanism and gear trains.
21MEC05.CO5	Classify the effects of friction in motion transmission and in machine components.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC05.CO1	X	X	X	X	-	X	-	-	-	-	-	-	X	-	-
21MEC05.CO2	X	X	X	X	-	X	-	-	-	-	-	-	X	-	-
21MEC05.CO3	X	X	X	X	-	X	-	-	-	-	-	-	X	-	-
21MEC05.CO4	X	X	X	X	-	X	-	-	-	-	-	-	X	-	-
21MEC05.CO5	X	X	X	X	-	X	-	-	-	-	-	-	X	-	-

UNIT I: BASICS OF MECHANISMS   9
Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler's criterion – Grashof's Law – Kinematic inversions of four-bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission Angle – Description of some common mechanisms

UNIT II: KINEMATICS OF LINKAGE MECHANISMS   9
Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration polygons – Velocity analysis using instantaneous centres – kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration – Introduction to linkage synthesis problem.

UNIT III: KINEMATICS OF CAM MECHANISMS   9
Classification of cams and followers – Terminology and definitions – Displacement diagrams – Uniform velocity, parabolic, simple harmonic, cycloidal and polynomial motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams.

UNIT IV: GEARS AND GEAR TRAINS   9
Law of toothed gearing – Involutes and cycloidal tooth profiles –Spur Gear terminology and definitions –Gear tooth action – contact ratio – Interference and undercutting – Non-standard gear teeth – Helical, Bevel, Worm, Rack and Pinion gears [Basics only] – Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains – Differentials – Automobile gear box.

UNIT V: INTRODUCTION AND OVERVIEW OF EXPERIMENTAL DESIGN   9

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction aspects in brakes – Friction in vehicle propulsion and braking.

TOTAL: L: 45=45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Rattan, S.S,	Theory of Machines	Tata McGraw-Hill	2012
2	Khurmi, R.S	Theory of Machines	S Chand Publications	2015

REFERENCE BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Norton. R. L.	Design of Machinery	McGraw Hill,	2010
2	J. J. Uicker, G. R. Pennock, and J. E. Shigley	Theory of Machines and Mechanism	Oxford Press	2009
3	Thomas Bevan,	Theory of Machines	CBS Publishers and Distributors	2005
4	Syad and R. L. Singal	Kinematics of Machinery	Tech Mac Publishers,Chennai	2007
5	Sadhu Singh	Theory of Machines	Pearson Education, New Delhi	2007

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21MEC06   MANUFACTURING TECHNOLOGY   **L T P C**
                                              3 0 0 3

COURSEOBJECTIVES

- To impart knowledge on the concepts and basic mechanism of metal cutting.
- To understand the constructional features and working principle of centre lathe, and special purpose lathes.
- To familiarize the working principle of various machining operations such as milling, shaping, planning, slotting, drilling and broaching.
- To understand the various abrasive processes.
- To understand the concepts of computer numerical control (CNC) machine tool and CNC programming

COURSE OUTCOMES

21MEC06.CO1	Explain the concepts and basic mechanism of metal cutting in different working conditions.
21MEC06.CO2	Compare the constructional features and working principle of centre lathe, and special purpose lathes.
21MEC06.CO3	Distinguish between the working principle of various machining operations such as milling, shaping, planning, slotting, drilling and broaching.
21MEC06.CO4	Comprehend and illustrate the abrasive and broaching processes
21MEC06.CO5	Demonstrate the concepts of computer numerical control (CNC) machine tool and CNC programming

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC06.CO1	X	X	X	-	-	X	-	-	-	-	-	X	-	-	X
21MEC06.CO2	X	X	-	X	X	X	-	-	-	-	-	X	-	-	X
21MEC06.CO3	X	-	X	X	X	-	-	-	-	-	-	X	-	-	X
21MEC06.CO4	X	X	-	-	-	-	-	-	-	-	-	X	-	-	X
21MEC06.CO5	X	X	-	-	-	-	-	-	-	-	-	X	-	-	X

UNIT I: THEORY OF METAL CUTTING   9
Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools–nomenclature. orthogonal metal cutting, thermal aspects, cutting tool materials, tool wear, tool life. surface finish, cutting fluids and Machinability.

UNIT II: TURNING MACHINES   9
Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes- tool layout – automatic lathes: semi-automatic – single spindle: Swiss type, automatic screw type – multi spindle

UNITIII: SHAPER, MILLING AND GEAR CUTTING MACHINES   9
Shaper - Types of operations. Drilling, reaming, boring, Tapping. Milling operations-types of milling cutter. Gear cutting – forming and generation principle and construction of gear milling, hobbling and gear shaping processes –finishing of gears.

UNIT IV: ABRASIVE PROCESS AND BROACHING   9
Abrasive processes: grinding wheel – specifications and selection, types of grinding process–cylindrical grinding, surface grinding, centerless grinding and internal grinding- Typical applications – concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines

UNIT V: CNC MACHINING   9
Numerical Control (NC) machine tools – CNC types, constructional details, special features, machining centre, part programming fundamentals CNC – manual part programming – micromachining – wafer machining

TOTAL: L: 45: = 45

MECHANICAL ENGINEERING

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	HajraChoudhury	Elements of Workshop Technology	Media Promoters	2008
2	Rao. P.N	Manufacturing Technology - Metal Cutting and Machine Tools	Tata McGraw-Hill	2013

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Richerd R Kibbe, John E. Neely, Roland O. Merges and Warren J.White	Machine Tool Practices	Prentice Hall of India	2010
2	Jain.R.K	Production Technology : Manufacturing Processes, Technology and Automation	Khanna Publishers	2011
3	GeofreyBoothroyd	Fundamentals of Metal Machining and Machine Tools	McGraw Hill	2007
4	Roy. A.Lindberg	Manufacturing Technology - Metal Cutting and Machine Tools	PHI/Pearson Education	2006
5	Dr. B. Kumar	Manufacturing Technology	Khanna Publishers	2009

21MEC07   THERMAL ENGINEERING

L T P C
3 0 0 3

(Use of standard refrigerant property data book, Steam Tables, Mollier diagram and Psychometric chart permitted)

COURSE OBJECTIVES
- To know about gas power cycles.
- To familiarize the working of IC engines.
- To learn the thermodynamic concepts in steam nozzles and turbine.
- To apply the concept in steam turbine and in air compressors
- To understand the concept of Refrigeration and air conditioning system

COURSE OUTCOMES

21MEC07.CO1	Understand gas laws and gas cycles and apply it to problems.
21MEC07.CO2	Familiarize working of IC engine and heat balance calculations.
21MEC07.CO3	Applying the thermodynamic concept in steam nozzles and turbine.
21MEC07.CO4	Knowing the concept in steam turbine and nozzle calculations.
21MEC07.CO5	Understanding the concept and applications in air compressors, Refrigeration and air conditioning system

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC07.CO1	X	X	X	X	-	X	X	-	X	-	-	X	X	-	-
21MEC07.CO2	X	X	X	X	X	X	X	-	X	-	-	X	X	X	-
21MEC07.CO3	X	X	X	X	-	-	X	-	X	X	-	X	X	X	X
21MEC07.CO4	X	X	X	X	X	X	X	-	X	-	-	X	X	-	X
21MEC07.CO5	X	X	X	X	X	X	X	-	X	-	X	X	X	-	X

UNIT I: GAS POWER CYCLES   9
Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure, and air standard efficiency-Comparison of cycles.

UNIT II: INTERNAL COMBUSTION ENGINES   9
Classification - Components and their function. Valve timing diagram and port timing diagram – actual and theoretical p-V diagram of four stroke and two stroke engines. Simple and complete Carburetor. MPFI, Diesel pump and injector system. Battery and Magneto Ignition System - Principles of Combustion and knocking in SI and CI Engines. Lubrication and Cooling systems. Performance calculation.

UNIT III: STEAM NOZZLES AND TURBINES   9
Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow. Impulse and Reaction principles, compounding, velocity diagram for simple and multi-stage turbines, speed regulations –Governors.

UNIT IV: AIR COMPRESSOR   9
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 and inter cooling –work of multistage air compressor

UNIT V: REFRIGERATION AND AIR CONDITIONING   9
Refrigerants - Vapour compression refrigeration cycle- super heat, sub cooling – Performancecalculations - working principle of vapour absorption system, Ammonia –Water, Lithium bromide –water systems (Description only). Air conditioning system - Processes, Types and WorkingPrinciples. - Concept of RSHF, GSHF, ESHF- Cooling Load calculations

TOTAL: L: 45 = 45

MECHANICAL ENGINEERING

TEXT BOOKS

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Rajput. R. K.,	Thermal Engineering	S.Chand publishers	2013
2	Kothandaraman.C.P	A course in Thermal Engineering	Fifth Edition, Dhanpat Rai & sons	2004

REFERENCE BOOKS

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Sarkar, B.K	Thermal Engineering	Tata McGraw-Hill Publishers	2007
2	Arora.C.P	Refrigeration and Air Conditioning	Tata McGraw-Hill Publishers	1994
3	Ganesan V	Internal Combustion Engines	Tata Mcgraw-Hill	2007
4	Rudramoorthy, R	Thermal Engineering	Tata McGraw-Hill	2003
5	Ramalingam. K.k	Thermal Engineering	SCITECH Publications	2009

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21MEC08   AUTOMOBILE ENGINEERING   L T P C

3 0 0 3

COURSEOBJECTIVES
- To identify the different structures in automobile engineering.
- To realize the engine auxiliary systems such as fuel injection system, electrical system and ignition system.
- To understand the working principles of transmission systems.
- To scrutinize the working principle of different types of steering and brake systems.
- To Familiarize about alternative fuels and hybrid vehicles.

COURSE OUTCOMES
21MEC08.CO1 Describe the vehicle construction and function of different parts.

21MEC08.CO2 Realize the engine auxiliary systems such as fuel injection system, electrical system and ignition system.

21MEC08.CO3 Identify the working principle of different types of transmission system.

21MEC08.CO4 Scrutinize the working principle of different types of steering and brake systems.

21MEC08.CO5 Familiarize alternative fuels.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC08.CO1	X	X	X	X	-	-	X	-	-	X	-	X	-	-	-
21MEC08.CO2	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
21MEC08.CO3	X	X	X	X	-	-	X	--	-	X	-	X	X	-	-
21MEC08.CO4	X	X	X	X	-	-	X	-	-	X	-	X	X	-	-
21MEC08.CO5	X	X	X	X	-	X	X	-	-	X	-	X	-	-	-

UNIT I: VEHICLE STRUCTURE AND ENGINES   9
Types of automobiles, vehicle construction and different layouts, chassis, frame and, body, Vehicle aerodynamics (various resistances and moments involved), IC engines –components functions and materials, variable valve timing (VVT).

UNIT II: ENGINE AUXILIARY SYSTEMS   9
Electronically controlled gasoline injection system for SI engines, electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system). Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system). Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

UNIT III: TRANSMISSION SYSTEMS   9
Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints, Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

UNIT IV: STEERING, BRAKES AND SUSPENSION SYSTEMS   9
Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control.

UNIT V: ALTERNATIVE ENERGY SOURCES   9
Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell
Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

TOTAL: L: 45 = 45

MECHANICAL ENGINEERING

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Kirpal Singh	Automobile Engineering Vol 1 & 2, 13th Edition	Standard Publishers, New Delhi	2012
2	Jain K.K. and Asthana .R.B	Automobile Engineering	Tata McGraw Hill Publishers, New Delhi	2002

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Newton .Steeds and Garet	Motor Vehicles	Butterworth Publishers	2010
2	Joseph Heitner	Automotive Mechanics, Second Edition	Second Edition, East-West Press	2004
3	Martin W, Stockel and Martin T Stockle	Automotive Mechanics Fundamentals	The Good heart Will Cox Company Inc, USA	2014
4	Heinz Heisler	Advanced Engine Technology	SAE International Publications USA	2016
5	Ganesan V	Internal Combustion Engines, Third Edition	Tata McGraw-Hill.	2007

21MEC09 HEAT AND MASS TRANSFER

L T P C
3 0 0 3

COURSE OBJECTIVES
- To understand, the basic concepts of conduction, convection and radiation and its applications.
- To differentiate free and forced convection and solve problems for each applications.
- To analyze the phase change heat transfer and sizing of heat exchangers.
- To acquire knowledge on radiation, the various laws of radiation, shape factor.
- To study convective mass transfer, its types and applications.

COURSE OUTCOMES

21MEC09.CO1	Applying steady state heat conduction problems for composite systems and fins.
21MEC09.CO2	Solving problems in natural and forced convection for internal and external flows.
21MEC09.CO3	Calculating the effectiveness of heat exchanger using LMTD and NTU methods.
21MEC09.CO4	Illustrating radiation shape factors for various geometries.
21MEC09.CO5	Applying convective and diffusion mass transfer to gas flow through tubes.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC09.CO1	X	X	-	X	X	-	-	-	-	X	-	-	X	-	X
21MEC09.CO2	X	X	-	-	X	-	-	-	-	X	X	X	X	-	X
21MEC09.CO3	X	X	X	X	X		-	-	-	X	-	X	X	X	X
21MEC09.CO4	X	X	X	X	-	-	-	-	-	-	-	-	X	X	-
21MEC09.CO5	X	X	X	X	-	-	-	-	-	X	-	X	X	-	-

UNIT I: CONDUCTION   9
Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – Fourier Law of Conduction - General Differential Conduction equation in Cartesian and Cylindrical Coordinate systems – One Dimensional Steady State Heat Conduction through Plane Wall, Cylindrical and Spherical systems – Composite Systems – Critical thickness of insulation - Conduction with Internal Heat Generation – Extended Surfaces – Numerical Methods of One dimensional Heat conduction- Unsteady Heat Conduction – Lumped Analysis, Infinite and semi Infinite solids using Heislers Chart.

UNIT II: CONVECTION   9
Basic Concepts – Convective Heat Transfer Coefficients – Boundary Layer Concept – Types of Convection – Forced Convection – Dimensional Analysis – External Flow – Flow over Plates, Cylinders and Spheres – Internal Flow – Laminar, Turbulent and Combined flows – Flow over Bank of tubes – Free Convection – Dimensional Analysis – Flow over Vertical, Horizontal and Inclined Plates, Cylinders and Spheres.

UNIT III: PHASE CHANGE AND HEAT EXCHANGERS   9
Nusselts theory of condensation - Regimes in boiling - Correlations in condensation and boiling - Types of Heat Exchangers- compact heat exchanger – Overall Heat Transfer Coefficient – Fouling Factors - LMTD and Effectiveness – NTU methods of Heat Exchanger Analysis

UNIT IV: RADIATION   9
Basic Concepts, Laws of Radiation – Black Body Radiation – Grey body radiation –radiation shield - Shape Factor Algebra (Plates, parallel, perpendicular, parallel circular disc) – Gas radiations (qualitative study).

UNIT V: MASS TRANSFER   9
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 = 45

TEXT BOOKS:

MECHANICAL ENGINEERING

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Frank P Incropera and David P DeWitt	Fundamentals of Heat and Mass Transfer	John Wiley and Sons, New York	2011
2	YunusCengel and AfshinGhajar	Heat and Mass Transfer (SI Unit)	McGraw Hill, New York	2011

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Sachdeva R C	Fundamentals of Engineering Heat and Mass Transfer	New Age International	2010
2	YunusCengal	Heat and Mass Transfer	Tata McGraw Hill	2014
3	Holman J.P	Heat Transfer	Tata Mc Graw Hill	2009
4	Nag P.K	Heat Transfer	Tata McGraw-Hill, New Delhi	2011
5	Kothandaraman.C.P	Fundamentals of Heat and Mass Transfer	New Age International, New Delhi	2006

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21MEC10   DESIGN OF MACHINE ELEMENTS   L T P C
                                                     3 0 0 3

(Use of approved Design Data book is permitted)

COURSE OBJECTIVES

- To select the materials based on mechanical properties, different types of loading, simple, steady and variable stresses.
- To know the design procedure for various types of shafts, keys and couplings.
- To design the threaded fasteners, bolted joints including eccentric loading and welded joints for pressure vessels and structures.
- To design the various types of springs like helical, leaf, disc and torsional springs.
- To state the design procedure for various types of bearings and flywheel

COURSE OUTCOMES

21MEC10.CO1	Select the materials based on mechanical properties, different types of loading and introduction about simple, steady and variable stresses.
21MEC10.CO2	Know the design procedure for various types of shafts, keys and couplings.
21MEC10.CO3	Design the threaded fasteners, bolted joints including eccentric loading and welded joints for pressure vessels and structures.
21MEC10.CO4	Design the various types of springs like helical, leaf, disc and torsional springs.
21MEC10.CO5	Design various types of bearings like sliding contact, rolling contact bearing and flywheels.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC10.CO1	X	X	-	-	-	X	-	-	-	-	-	-	X	-	-
21MEC10.CO2	X	X	X	-	-	X	-	-	-	-	-	-	X	-	-
21MEC10.CO3	X	-	X	-	-	X	-	-	-	-	-	-	X	-	-
21MEC10.CO4	X	X	X	-	-	X	-	-	-	-	-	-	X	-	-
21MEC10.CO5	X	-	X	-	-	X	-	-	-	-	-	-	X	-	-

UNIT I: STEADY AND VARIABLE STRESSES   9

Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties, preferred numbers – direct, bending and torsional stress equations – calculation of principle stresses for various load combinations, 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.

UNIT II: DESIGN OF SHAFTS AND COUPLINGS   9

Design of Solid And Hollow Shafts Based on Strength And Rigidity – Design Of Keys - Design Of Rigid And Flexible Couplings.

UNIT III: DESIGN OF FASTNERS AND WELDED JOINTS   9

Threaded fasteners - design of bolted joints including eccentric loading – design of welded joints for structures.

UNIT IV: DESIGN OF SPRINGS   9

Design of helical, leaf and torsional springs under constant loads and varying loads – concentric torsion springs - belleville springs introduction to modern spring like wave spring, constant force spring (theory only).

UNIT V: DESIGN OF BEARINGS AND FLYWHEELS   9

Design of bearings – sliding contact and rolling contact types. – cubic mean load – design of journal bearings – mckees equation – lubrication in journal bearings – calculation of bearing dimensions – design of flywheels involving stresses in rim and arm.

                                                     TOTAL: L: 45 =45

TEXT BOOKS

Sl. No.	Author(s)	Title of the Book	Publisher	Year of

MECHANICAL ENGINEERING

				Publication
1	Richard G Budynas J.KeithNisbett	Shigley's Mechanical Engineering Design	Mc Graw Hill	2011
2	Khurmi R.S, Gupta J.K	Machine Design	Eurasia publishing house	2005

REFERENCE BOOKS

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Norton R.L	Design of Machinery	Tata McGraw-hill book co	2002
2	Orthwein W	Machine Component Design	Jaico Publishing co	2003
3	Ugural A.C	Mechanical Design – An Integral Approach	Mcgraw-hill book co	2004
4	Spotts M.F., Shoup T.E	Design and Machine Elements	Pearson Education	2004
5	V B Bhandari	Design of Machine Elements	Tata Mcgraw-hill.	2007

21MEC11   DYNAMICS OF MACHINES

L T P C
3 0 0 3

COURSE OBJECTIVES

- To learn about the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
- To impart knowledge on static and dynamic balancing.
- To understand the concept of single degree of freedom of vibrations and its damping mechanism.
- To gain knowledge on the basic vibrations on the constrained body and its critical position of vibrations.
- To understand principles in mechanisms used for governing of machines.

COURSE OUTCOMES

21MEC11.CO1	Gain knowledge on forces like static, dynamic forces and Inertia force and inertia torque on the reciprocating engines
21MEC11.CO2	Acquire knowledge on turning moment diagrams of flywheels and follower mechanisms.
21MEC11.CO3	Know the concepts of balancing mechanisms of different types of engines and machines.
21MEC11.CO4	Understand different types of vibration occurring in the moving system.
21MEC11.CO5	understand the effect of Dynamics of undesirable vibrations

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC11.CO1	X	X	X	X	-	X	-	-	-	X	-	-	X	-	-
21MEC11.CO2	X	X	-	X	-	X	-	-	-	X	-	X	X	-	-
21MEC11.CO3	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
21MEC11.CO4	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
21MEC11.CO5	X	X	-	X	-	X	-	-	X	X	-	X	X	-	X

UNIT I: FORCE ANALYSIS
9

Applied and constraint forces – Free body diagrams – Static equilibrium conditions – Static force analysis of simple mechanisms – Dynamic force analysis – Inertia force and Inertia torque – D Alembert's* principle –Dynamic Analysis in reciprocating engines – Gas forces – Inertia effect of connecting rod– Bearing loads – Crank shaft torque – Turning moment diagrams – Fly Wheels – Flywheels of punching presses- Dynamics of Cam-follower mechanism.

UNIT II: BALANCING
9

Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder engine – Balancing Multi-cylinder engines – Partial balancing in locomotive engines – Balancing of linkages – Balancing machines.

UNIT III: SINGLE DEGREE FREE VIBRATION
9

Basic features of vibratory systems – Degrees of freedom – single degree of freedom – Free vibration – Equations of motion – Natural frequency – Types of Damping – Damped vibration – Torsional vibration of shaft – Critical speeds of shafts – Torsional vibration – Two and three rotor torsional systems.

UNIT IV: FORCED VIBRATION
9

Response of one degree freedom systems to periodic forcing – Harmonic disturbances –
Disturbance caused by unbalance – Support motion –transmissibility – Vibration isolation vibration measurement.

UNIT V: MECHANISM FOR CONTROL   9

Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling force. Gyroscopes- Gyroscopic forces and torques – Gyroscopic stabilization – Gyroscopic effects in Automobiles, ships and airplanes

TOTAL: L: 45 = 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Shigley	Theory of Machines and Mechanisms	Oxford University Press	2016
2.	Sadhu Singh	Theory of Machines	Pearson Education	2005

REFERENCES:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rattan. S.S	Theory of Machines	Tata McGraw-Hill	2009
2.	Thomas Bevan	Theory of Machines	CBS Publishers and Distributors	2005
3.	Cleghorn. W. L,	Mechanisms of Machines	Oxford University Press	2005
4	Benson H. Tongue	Principles of Vibrations	Oxford University Press	2007
5	Ballaney.P.L	Theory of Machines	Khanna Publishers	2001

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21MEC12   COMPUTER AIDED DESIGN AND MANUFACTURING   L T P C
                                                      3 0 0 3

COURSEOBJECTIVES
- To provide an overview of how computers are being used in mechanical component design.
- To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

COURSE OUTCOMES
21MEC12.CO1   Explain the 2D and 3D transformations, clipping algorithm, Manufacturing models and Metrics

21MEC12.CO2   Explain the fundamentals of parametric curves, surfaces and Solids

21MEC12.CO3   Summarize the different types of Standard systems used in CAD

21MEC12.CO4   Apply NC & CNC programming concepts to develop part programme for Lathe & Milling Machines

21MEC12.CO5   Summarize the different types of techniques used in Cellular Manufacturing and FMS

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC12.CO1	X	-	X	-	X	-	-	-	-	-	-	-	X	-	-
21MEC12.CO2	X	-	X	-	X	-	-	-	-	-	-	-	X	-	-
21MEC12.CO3	X	-	X	-	X	-	-	-	-	-	-	-	X	-	-
21MEC12.CO4	X	-	X	-	X	-	-	-	-	-	-	-	X	-	-
21MEC12.CO5	X	-	X	-	X	-	-	-	-	-	-	-	-	X	-

UNIT I: INTRODUCTION   9
Introduction to CAD/CAM –CAD/CAM concept - Computer aided design – CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations– Manufacturing Planning, Manufacturing control- s —Types of production.

UNIT II: GEOMETRIC MODELING   9
Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves-Techniques for surface modeling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG andB-rep.

UNIT III: CAD STANDARDS   9
Standards for computer graphics- Graphical Kernel System (GKS) - standards for exchangeimages- Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, CALS etc. - communication standards.

UNIT IV: FUNDAMENTAL OF CNC AND PART PROGRAMING   9
Introduction to NC systems and CNC – Machine axis and Co-ordinate system- CNC machine tools- Principle of operation CNC- Construction features including structure- Drives and CNC controllers- 2D and 3D machining on CNC- Introduction of Part Programming, types – Detailed Manual part programming on Lathe & Milling machines using G codes and M codes- Cutting Cycles, Loops, Sub program and Macros- Introduction of CAM package.

UNIT V: CELLULAR MANUFACTURING AND FLEXIBLE MANUFACTURING SYSTEM 9
Group Technology (GT),Part Families–Parts Classification and coding–Simple Problems in Opitz Part Coding system–Production flow Analysis–Cellular Manufacturing–Composite part concept–Types of Flexibility – FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control–Quantitative analysis in FMS ME8691 Computer Aided Design and Manufacturing

                                                        TOTAL: L:45 =45

MECHANICAL ENGINEERING

TEXT BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ibrahim Zeid	CAD CAM	Tata McGraw-Hill	2007
2	RadhakrishnanP, SubramanyanS.andRaju V.	CAD/CAM/CIM	New Age International (P) Ltd, New Delhi	2007

REFERENCE BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Chris McMahon and Jimmie Browne	CAD/CAM Principles, Practice and Manufacturing management	Pearson Education	1999
2	Donald Hearn and M. Pauline Baker	Computer Graphics	Prentice Hall, Inc.	2010
3	Foley, Wan Dam, Feiner and Hughes	Computer graphics principles & practice	Pearson Education	2003

21MEC13   **METROLOGY AND MEASUREMENTS**   **L T P C**
                                                   3 0 0 3

COURSEOBJECTIVES

- Toprovideknowledgeonvari,ousMetrological equipmentsavailable to measure thedimension ofthe components.
- Toprovideknowledgeonthecorrectproceduretobeadoptedtomeasurethedimensionof thecomponents.
- To educate students on different measurement systems and on common types of errors
- To introduce measuring equipments used for linear and angular measurements
- To familiarize students with surface roughness measurements on machine components
- To give knowledge about thermocouples, thermometers and flow meters used for measurements

COURSE OUTCOMES

21MEC13.CO1	Demonstrate different measurement technologies and use of them in Industrial Components
21MEC13.CO2	Work in Quality control and quality assurances divisions in industries
21MEC13.CO3	Students will be able to design measuring equipments for the measurement of temperature and flow.
21MEC13.CO4	Design tolerances and fits for selected product quality
21MEC13.CO5	Understand the standards of length, angles: they can understand the evaluation of surface finish and measure the parts with various comparators.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC13.CO1	X	X	X	X	-	X	-	-	-	-	-	X	X	-	X
21MEC13.CO2	X	X	X	X	-	X	-	-	-	-	-	X	-	-	-
21MEC13.CO3	X	X	X	X	-	X	-	-	-	-	-	X	X	X	-
21MEC13.CO4	X	X	X	X	-	X	-	-	-	-	-	X	-	X	X
21MEC13.CO5	X	X	X	X	-	X	-	-	-	-	-	X	X	X	X

UNIT I: BASICS OF METROLOGY   5
IntroductiontoMetrology   –Need–Elements–Workpiece.Instruments–Persons–Environment– theireffectonPrecisionandAccuracy–Errors–ErrorsinMeasurements–Types–Control–Types ofstandards.

UNIT II: LINEAR AND ANGULAR MEASUREMENTS   .   10
LinearMeasuringInstruments–Evolution –Types–Classification–Limit gauges–gaugedesign– terminology – procedure – concepts of interchange ability and selective assembly – Angular measuringinstruments– Types–Bevelprotractorclinometersangle   gauges,spiritlevelssinebar–   Anglealignment telescope–Autocollimator –Applications.

UNIT III: ADVANCES IN METROLOGY   12
Basicconceptoflasers   Advantagesoflasers–   laserInterferometers–types–DCandACLasers interferometer–Applications–Straightness–Alignment.   BasicconceptofCMM–TypesofCMM   – Constructionalfeatures–Probes–Accessories – Software – Applications – Basic conceptsof MachineVisionSystem–Element –Applications.

UNIT IV: FORM MEASUREMENT   10
PrinciplesandMethodsofstraightness–Flatnessmeasurement– Threadmeasurement,gear measurement, surfacefinish measurement, Roundnessmeasurement–Applications.

UNIT V: MEASUREMENT OF POWER, FLOW AND TEMPERATURE   8
Force,torque,power- mechanical,Pneumatic, HydraulicandElectrical type. Flow measurement: Venturimeter, Orifice meter,rotameter,pitot tube– Temperature:bimetallicstrip, thermocouples, electrical resistancethermometer–ReliabilityandCalibration –ReadabilityandReliability.

                                                        TOTAL: L:45 =45

TEXT BOOKS:

MECHANICAL ENGINEERING

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	JainR.K	EngineeringMetrology	KhannaPublishers	2018
2	Gupta. I.C.,	EngineeringMetrology	DhanpatraiPublications	2018

REFERENCE BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Charles Reginald Shotbolt	Metrology for Engineers	Cengage Learning EMEA	1990
2	Backwith,Marangoni,Lienhard	Mechanical Measurements	PearsonEducation	2006
3	Jay.L.Bucher	The Metrology Handbook	Measurement Quality Division (ASQ)	2015
4	L.V. Ragavendra and L.Krishnamoorthy	Engineering Metrology and Measurements	Oxford Higher Education	2013
5	Anand K. Bewoor Vinay A .Kulgarni	Metrology and Measurements	McGraw Hill Companies	2016

21MEC14   APPLIED HYDRAULICS AND PNEUMATICS

L T P C
3 0 0 3

COURSE OBJECTIVES
- To know the applications of Fluid Power Engineering in Power transmission system.
- To familiarize hydraulic system and its components.
- To design hydraulic circuits for various application.
- To understand pneumatic systems, related components used in a system.
- To design the pneumatic system circuits.

COURSE OUTCOMES
21MEC14.CO1	Understand the fundamentals of fluid power systems
21MEC14.CO2	Comprehend and analyse the hydraulic systems and its components
21MEC14.CO3	Apply the design principles in developing hydraulic circuits.
21MEC14.CO4	Comprehend and analyse the pneumatic systems and its components
21MEC14.CO5	Apply the design principles in creating pneumatic circuits.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC14.CO1	X	X	X	X	-	X	X	-	-	X	-	X	X	-	-
21MEC14.CO2	X	X	X	-	-	X	X	-	-	X	-	X	X	-	-
21MEC14.CO3	X	X	X	-	-	-	X	-	X	X	-	-	X	-	-
21MEC14.CO4	X	X	X	-	-	X	X	-	-	X	-	-	X	-	-
21MEC14.CO5	X	X	X	-	-	-	X	-	X	X	-	-	X	-	-

UNIT I: FLUID POWER SYSTEMS AND FUNDAMENTALS   9
Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – General types of fluids –Fluid power symbols. Basics of Hydraulics-Applications of Pascal's Law- Laminar and Turbulent flow – Reynold's number – Darcy's equation – Losses in pipe, valves and fittings.

UNIT II: HYDRAULIC SYSTEM & COMPONENTS   9
Sources of Hydraulic Power: Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – pump performance – Variable displacement pumps. Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tanden, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators – Fluid motors, Gear, Vane and Piston motors.

UNIT III: DESIGN OF HYDRAULIC CIRCUITS   9
Construction of Control Components : Directional control valve – 3/2 way valve – 4/2 way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram. Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications of Intensifier – Intensifier circuit.

UNIT IV: PNEUMATIC SYSTEMS AND COMPONENTS   9
Pneumatic Components: Properties of air – Compressors – Filter, Regulator, and Lubricator Unit – Air control valves, Quick exhaust valves, and pneumatic actuators. Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Pneumohydraulic circuit, Sequential circuit design for simple applications using cascade method.

UNIT V: DESIGN OF PNEUMATIC CIRCUITS   9
Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics – Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

TOTAL: L: 45

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Anthony Esposito	Fluid Power with Applications	Pearson Education	2013
2	Majumdar S.R	Oil Hydraulics Systems- Principles and Maintenance	Tata McGraw-Hill	2001

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Srinivasan.R	Hydraulic and Pneumatic controls	Vijay Nicole	2006
2	Shanmugasundaram. K	Hydraulic and Pneumatic controls	Chand & Co.	2006
3	Majumdar S.R	Pneumatic systems– Principles and maintenance	Tata McGraw Hill	1995
4	Anthony Lal	Oil hydraulics in the service of industry	Allied publishers	1982
5	Harry L. Stevart D.B	Practical guide to fluid power	Taraoeala sons and Port Ltd.	1976

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21MEC15   GAS DYNAMICS AND JET PROPULSION

L T P C
3 0 0 3

COURSEOBJECTIVES
- To understand the basic concepts of isentropic flows.
- To analyze the heat transfer and friction of flow through ducts.
- To infer about Normal shock and oblique shock.
- To summarizes the theory behind jet propulsion.
- To predict the parameters for space propulsion.

COURSE OUTCOMES
21MEC15.CO1	Understand the basic concepts of isentropic flows.
21MEC15.CO2	Analyze the heat transfer and friction of flow through ducts.
21MEC15.CO3	Infer about Normal shock and oblique shock.
21MEC15.CO4	Summarizes the theory behind jet propulsion.
21MEC15.CO5	Predict the parameters for space propulsion.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC15.CO1	X	X	X	X	X	X	-	-	X	-	-	-	-	-	-
21MEC15.CO2	X	X	X	X	X	X	-	-	X	-	-	-	-	-	-
21MEC15.CO3	X	X	X	X	X	X	-	-	X	-	-	-	-	-	-
21MEC15.CO4	X	X	X	X	X	X	-	-	X	-	-	-	-	-	-
21MEC15.CO5	X	X	X	X	X	X	-	-	X	-	-	-	-	-	-

UNIT I: CONCEPTS AND ISENTROPIC FLOWS   9
Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts –Nozzle and Diffusers

UNIT II: FLOW THROUGH DUCTS   9
Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties

UNIT III: NORMAL AND OBLIQUE SHOCKS   9
Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl –Meyer relations – Applications.

UNIT IV: JET PROPULSION   9
Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operatingprinciple, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines.

UNIT V: SPACE PROPULSION   9
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: L: 45=45

MECHANICAL ENGINEERING

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Anderson, J.D	Modern Compressible flow	McGraw Hill	2012
2	Yahya, S.M	Fundamentals of Compressible Flow	New Age International (P) Limited	2014

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Ganesan. V	Gas Turbines	Tata McGraw Hill Publishing Co	2003
2	Cohen. H	Gas Turbine Theory	Longman Group Ltd	2010
3	Shapiro. A.H	Dynamics and Thermodynamics of Compressible fluid Flow	John wiley	2017
4	Sutton. G.P	Rocket Propulsion Elements	John wiley	2017
5	Zucrow. N.J	Aircraft and Missile Propulsion	John Wiley	2003

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21MEC16   FINITE ELEMENT ANALYSIS

L T P C
3 0 0 3

COURSEOBJECTIVES

- To obtain an understanding of the fundamental theory of the FEA method
- To understand the application and use of the FE method for heat transfer problems.
- To understand the use of the basic finite elements for structural applications using truss, beam, frame and plane elements.
- To understand the Overview of application packages such as ANSYS and DEFORM.
- To understand the basic step to involve the Solutions Techniques to Dynamic problems.

COURSE OUTCOMES

21MEC16.CO1	Compute mathematical model for solution of common engineering problems.
21MEC16.CO2	Apply mathematics, science and engineering to design and perform analysis of machine system.
21MEC16.CO3	Use professional-level finite element software to solve engineering problems in solid mechanics, fluid flow and heat transfer.
21MEC16.CO4	Derive the element matrix equation by different methods by applying basic laws in mechanics and integration by parts.
21MEC16.CO5	Apply the Natural co-ordinate systems and Solutions Techniques to Dynamic problems.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC16.CO1	X	X	X	X	-	X	-	-	-	X	-	X	X	-	X
21MEC16.CO2	X	X	X	X	-	X	-	-	-	X	-	X	-	-	-
21MEC16.CO3	X	X	X	X	-	X	-	-	-	-	-	X	X	X	-
21MEC16.CO4	X	X	X	X	-	X	-	-	-	-	-	X	-	X	X
21MEC16.CO5	X	X	X	X	-	X	-	-	-	X	-	X	X	X	X

UNIT I: INTRODUCTION   9
Basics of FEM – Initial value and boundary value problems – weighted residual Galerkin and Raleigh Ritz methods – Integration by parts – Basics of Variational formulation.

UNIT II: ONE DIMENSIONAL ANALYSIS   9
Steps in FEA – Discretization. function – derivation of element characteristics matrix, shape function, assembly and imposition of boundary conditions – solution and post processing – One dimensional analysis in solid mechanics and heat transfer.

UNIT III: TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS   9
Second Order 2D Equations involving Scalar Variable Functions-Variational Formulation-Finite Element Formulation-Triangular Elements-Shape function and Element Matrices and Vectors. Application to Field Problems-Thermal Problems-Higher Order Elements

UNIT IV: TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS   9
Equations of elasticity – Plane stress, plane strain and Axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.

UNIT V: ISOPARAMETRIC FORMULATION   9
Natural co-ordinate systems – Iso-parametric elements – Shape functions for iso-parametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems– Solutions Techniques to Dynamic problems.

TOTAL: L: 45= 45

MECHANICAL ENGINEERING

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Reddy, J.N.,	An Introduction to the Finite Element Method	Tata McGraw-Hill	2010
2.	Seshu, P	Text Book of Finite Element Analysis	Prentice-Hall of India Pvt. Ltd	2010

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bathe, K.J	Finite Element Procedures in Engineering Analysis	John Wiley & Sons	2003
2	Kobayashi S	Metal Forming and the Finite-Element Method	Oxford University Press, USA	2001
3	Lewis. R.W	The Finite Element Method in Heat Transfer Analysis	John Wiley & Sons	2010
4	Stanley Middleman Middleman	An Introduction to Fluid Dynamics 01 Edition	John Wiley & Sons	2015
5	Huang Usmani	Finite Element Analysis for Heat Transfer	Springer London	2012

21MEC17FLUID MECHANICS AND MACHINERY LABORATORY   L T P C
                                                      0 0 3 1

COURSE OBJECTIVES
- To understand the applications of fluid in various engineering requirements
- To explain the various losses in pipes
- To understand the importance of dimensional analysis
- To interpret the various types pumps and its principles
- To comprehend the types of flow in turbine

COURSE OUTCOMES
21MEC17.CO1	Understand and recall the definitions and fundamental concepts of fluid properties
21MEC17.CO2	Illustrate the concepts of flow through circular conduits and solve losses in pipes
21MEC17.CO3	Make use of dimensional analysis and dimensionless parameters
21MEC17.CO4	Demonstrate the working of different types of pumps
21MEC17.CO5	Demonstrate the working of different types of turbines

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC17.CO1	X	-	-	X	-	-	-	-	-	-	-	X	-	-	X
21MEC17.CO2	X	-	-	X	-	-	-	-	-	-	-	X	-	-	X
21MEC17.CO3	X	-	-	X	-	-	-	-	-	-	-	X	-	-	X
21MEC17.CO4	X	-	-	X	-	-	-	-	-	-	-	X	-	-	X
21MEC17.CO5	X	-	-	X	-	-	-	-	-	-	-	X	-	-	X

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. Conducting experiments and drawing the characteristic curves of centrifugal pump/submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL: P: 30 = 30

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21MEC18 MANUFACTURING TECHNOLOGY LABORATORY

L T P C
0 0 3 1

COURSEOBJECTIVES

- To impart knowledge on the concepts and basic mechanism of metal cutting.
- To understand the constructional features and working principle of centre lathe, and special purpose lathes.
- To familiarize the working principle of various machining operations such as milling, shaping, planning, slotting, drilling and broaching.
- To understand the variousabrasive processes.
- To understand the concepts of computer numerical control (CNC) machine tool and CNC programming

COURSE OUTCOMES

21MEC18.CO1	Explain the concepts and basic mechanism of metal cutting in different working conditions.
21MEC18.CO2	Compare the constructional features and working principle of centre lathe, and special purpose lathes.
21MEC18.CO3	Distinguish between the working principle of various machining operations such as milling, shaping, planning, slotting, drilling and broaching.
21MEC18.CO4	Comprehend and illustrate the abrasive and broaching processes
21MEC18.CO5	Demonstrate the concepts of computer numerical control (CNC) machine tool and CNC programming

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC18.CO1	-	-	-	X	-	-	-	-	-	-	-	X	-	-	X
21MEC18.CO2	-	-	-	X	-	-	-	-	-	-	-	X	-	-	X
21MEC18.CO3	-	-	-	X	-	-	-	-	-	-	-	X	-	-	X
21MEC18.CO4	-	-	-	X	-	-	-	-	-	-	-	X	-	-	X
21MEC18.CO5	-	-	-	X	-	-	-	-	-	-	-	X	-	-	X

TOTAL: P : 30= 30

LIST OF EXPERIMENTS

1. Eccentric Turning, Thread Cutting
2. Contour milling using vertical milling machine
3. Spur gear cutting in milling machine
4. Helical Gear Cutting in hobbing machine
5. Gear generation in hobbing machine
6. Gear generation in gear shaping machine
7. Plain Surface grinding
8. Cylindrical grinding
9. Tool angle grinding with tool and Cutter Grinder
10. Measurement of cutting forces in Milling / Turning Process
11. Centreless grinding

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21MEC19 STRENGTH OF MATERIALS LABORATORY

L T P C
0 0 3 1

COURSEOBJECTIVES

- To impart knowledge on the concepts and basic methods of material testing process.
- To understand the procedure of Tension test, Shear test, torsion test impact test of Steel material.
- To familiarize the testing procedure of hardness test of Rockwell and Brinell Hardness Testing Apparatus.
- To understand the various deflection tests on metal beam using given apparatus.
- To impart the knowledge of compression and deflection tests procedure of helical and carriage springs.

COURSE OUTCOMES

21MEC19.CO1	Explain the concepts and basic methods of material testing process.
21MEC19.CO2	Illustrate the various testing procedures and calculations of steel materials using Tension test, Shear test, torsion test impact test.
21MEC19.CO3	Demonstrate and calculate the hardness of various materials usingRockwell and BrinellHardnesstests.
21MEC19.CO4	Comprehend and calculate the deflection of Beams using given apparatus.
21MEC19.CO5	Demonstrate and calculate the various spring parameters using compression and deflection tests.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC19.CO1	X	X	X	X	-	-	-	-	-	-	-	X	X	X	X
21MEC19.CO2	X	X	X	X	-	-	-	-	-	-	-	X	X	-	-
21MEC19.CO3	X	X	X	X	-	-	-	-	-	-	-	X	X	X	X
21MEC19.CO4	X	X	X	X	-	-	-	-	-	-	-	X	X	X	X
21MEC19.CO5	X	X	X	X	-	-	-	-	-	-	-	X	X	-	-

LIST OF EXPERIMENTS

1. Tension test on mild steel rod
2. Double shear test on metal
3. Torsion test on mild steel rod
4. Impact test on metal specimen (Izod and Charpy)
5. Hardness test on metals (Rockwell and Brinell Hardness Tests)
6. Deflection test on metal beam
7. Compression test on helical spring
8. Deflection test on carriage spring

TOTAL: P:30 = 30

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21MEC20   MEASUREMENTS LABORATORY   L T P C
                                                                     0 0 3 1

COURSEOBJECTIVES

- ToprovideknowledgeonvariousVernier Caliper to measure the linear dimension ofthe components.
- To learn about operating procedure of various micrometers to measure the circular dimensions of the components.
- To educate students to measure the force and torque when the components attached to the load.
- To impart the knowledge on various gauges such as telescope gauges, sine bar, floating gauges.
- To familiarize operating procedure of Auto-collimator, Coordinate measuring machine and comparators.

COURSE OUTCOMES

21MEC20.CO1	Demonstrate various Vernier Caliper to measure the linear dimension of the components in Industries.
21MEC20.CO2	Use the various micrometers to measure the circular dimensions of the components.
21MEC20.CO3	Understand and operate the force and torque measuring equipment in industry.
21MEC20 CO4	Demonstrate the various gauges such as telescope gauges, sine bar, floating gauges
21MEC20.CO5	Recognize and understand the operating procedure of Auto-collimator, Coordinate measuring machine and comparators.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC20.CO1	X	X	X	X	-	X	-	-	-	-	-	X	X	-	X
21MEC20.CO2	X	X	X	X	-	X	-	-	-	-	-	X	-	-	-
21MEC20.CO3	X	X	X	X	-	X	-	-	-	-	-	X	X	X	-
21MEC20.CO4	X	X	X	X	-	X	-	-	-	-	-	X	-	X	X
21MEC20.CO5	X	X	X	X	-	X	-	-	-	-	-	X	X	X	X

LIST OF EXPERIMENTS

1. Tool Maker's Microscope
2. Comparator
3. Sine Bar
4. Gear Tooth Vernier Caliper
5. Floating gauge Micrometer
6. Co ordinate Measuring Machine
7. Surface Finish Measuring Equipment
8. Vernier Height Gauge
9. Bore diameter measurement using telescope gauge
10. Bore diameter measurement using micrometer
11. Force Measurement
12. Torque Measurement
13. Temperature measurement
14. Autocollimator

TOTAL: P:30 = 30

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Department of Mechanical Engineering
MUTHAYAMMAL ENGINEERING COLLEGE
(AUTONOMOUS)
RASIPURAM-637 408, NAMAKKAL Dist.

21MEC21   HEAT AND MASS TRANSFER LABORATORY

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COURSE OBJECTIVES

- To learn about working principles and calculation procedures of guarded plate method and lagged pipe apparatus.
- To familiarize the working principles and calculation procedures of natural convection and forced convection heat transfer apparatus.
- To impart the knowledge of Heat transfer testing procedure of Fin-Pin (natural & forced convection modes) and Parallel/counter flow heat exchanger apparatus.
- To learn about calculation procedure of Stefan-Boltzmann constant and emissivity of emissivity gray surface using given equipment.
- To understand the experimental and calculation procedures of given refrigeration, air conditioning and compressor system.

COURSE OUTCOMES

21MEC21.CO1	Recognize and calculate the Thermal conductivity using guarded plate method and lagged pipe apparatus.
21MEC21.CO2	Understand the working principles and calculate procedures of natural convection and forced convection heat transfer apparatus.
21MEC21.CO3	Conduct the testing on fin-pin and heat exchanger using Fin-Pin (natural & forced convection modes) and Parallel/counter flow heat exchanger apparatus.
21MEC21.CO4	Demonstrate and calculate the Stefan-Boltzmann constant and emissivity of emissivity gray surface using given equipment.
21MEC21.CO5	Illustrate the experimental and calculation procedures to determine the COP of refrigeration system and performance tests of Air-conditioning system and reciprocating compressors

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC21.CO1	X	X	-	X	X	-	-	-	-	X	-	-	X	-	X
21MEC21.CO2	X	X	-	-	X	-	-	-	-	X	X	X	X	-	X
21MEC21.CO3	X	X	X	X	X	-	-	-	-	X	-	X	X	X	X
21MEC21.CO4	X	X	X	X	-	-	-	-	-	-	-	X	X	X	-
21MEC21.CO5	X	X	X	X	-	-	-	-	-	X	-	X	X	-	-

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 transfer 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 gray surface.
8. 8. Effectiveness of Parallel/counter flow heat exchanger.

REFRIGERATION AND AIR CONDITIONING

9. Determination of COP of a refrigeration system.
10. Experiments on air-conditioning system.
11. Performance test on single/two stage reciprocating air compressor.

TOTAL: P:30 = 30

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RASIPURAM-637 408, NAMAKKAL Dist.

21MEC22   ASSEMBLY DRAWING AND MODELING LABORATORY   L T P C
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COURSE OBJECTIVES

- To develop skill to use software for creating 2 Dimensional models.
- To provide an overview of how computers are being used in mechanical component design.
- To make the students understand the computer graphics fundamentals.
- To familiarize orthographic views of simple solids.
- To build the students to identify with the various file types used in the CAD software.

COURSE OUTCOMES

21MEC22.CO1	Ability to use the software packers for drafting and modeling.
21MEC22.CO2	Demonstrate proficiency in CAD skills by creating complex 2D drawings from 3D solid modeling techniques.
21MEC22.CO3	Plan critically and use creativity in the design of mechanical components and systems.
21MEC22.CO4	Build, edit and parameterize properties of complex solid objects.
21MEC22.CO5	Ability to export / import CAD drawings for different applications.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC22.CO1	X	-	X	-	X	-	-	-	-	-	-	-	X	-	-
21MEC22.CO2	X	-	X	-	X	-	-	-	-	-	-	-	X	-	-
21MEC22.CO3	X	-	X	-	X	-	-	-	-	-	-	-	X	-	-
21MEC22.CO4	X	-	X	-	X	-	-	-	-	-	-	-	X	-	-
21MEC22.CO5	X	-	X	-	X	-	-	-	-	-	-	-	-	X	-

LIST OF EXERCISES USING SOFTWARE CAPABLE OF DRAFTING AND MODELING

Drawing of Parts and assembly drawings of following components using any CAD package.
1. Fasteners (Square and Hexagonal headed bolt and nut)
2. Flange coupling (Unprotected),
3. Footstep Journal Bearing
4. Screw Jack
5. Plummer block.
6. Gib and cotter joint
7. Cotter joint with sleeve.

Note: Plotting of drawings must be made for each exercise and attached to the records written by Students.

TOTAL P: 30=30

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21MEC23 THERMAL ENGINEERING LABORATORY

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(Use of standard refrigerant property data book, Steam Tables, Mollier diagram and Psychometric chart permitted)

COURSE OBJECTIVES
- To know about gas power cycles.
- To familiarize the working of IC engines.
- To learn the thermodynamic concepts in steam nozzles and turbine.
- To apply the concept in steam turbine and in air compressors
- To understand the concept of Refrigeration and air conditioning system

COURSE OUTCOMES
21MEC23.CO1	Understand gas laws and gas cycles and apply it to problems.
21MEC23.CO2	Familiarize working of IC engine and heat balance calculations.
21MEC23.CO3	Applying the thermodynamic concept in steam nozzles and turbine.
21MEC23.CO4	Knowing the concept in steam turbine and nozzle calculations.
21MEC23.CO5	Understanding the concept and applications in air compressors, Refrigeration and air conditioning system

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC23.CO1	X	X	X	X	-	X	X	-	X	-	-	X	X	-	-
21MEC23.CO2	X	X	X	X	X	X	X	-	X	-	-	X	X	X	-
21MEC23.CO3	X	X	X	X	-	-	X	-	X	X	-	X	X	X	X
21MEC23.CO4	X	X	X	X	X	X	X	-	X	-	-	X	X	-	X
21MEC23.CO5	X	X	X	X	X	X	X	-	X	-	X	X	X	-	X

LIST OF EXPERIMENTS
THERMAL ENGINEERING LAB
1. Valve Timing and Port Timing Diagrams.
2. Performance Test on 4stroke Diesel Engine.
3. Heat Balance Test on 4-stroke Diesel Engine.
4. Morse Test on Multicylinder Petrol Engine.
5. Retardation Test to find Frictional Power of a Diesel Engine.
6. Determination of Viscosity –Red Wood Viscometer.
7. Determination of Flash Point and Fire Point.

STEAM LAB

8. Study of Steam Generators and Turbines.
9. Performance and Energy Balance Test on a Steam Generator.
10. Performance and Energy Balance Test on Steam Turbine

TOTAL: P : 30 = 30

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RASIPURAM-637 408, NAMAKKAL Dist.

21MEC24   DYNAMICS OF MACHINES LABORATORY

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COURSE OBJECTIVES

- To learn about the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
- To impart knowledge on static and dynamic balancing.
- To understand the concept of single degree of freedom of vibrations and its damping mechanism.
- To gain knowledge on the basic vibrations on the constrained body and its critical position of vibrations.
- To understand principles in mechanisms used for governing of machines.

COURSE OUTCOMES

21MEC24.CO1	Gain knowledge on forces like static, dynamic forces and Inertia force and inertia torque on the reciprocating engines
21MEC24.CO2	Acquire knowledge on turning moment diagrams of flywheels and follower mechanisms.
21MEC24.CO3	Know the concepts of balancing mechanisms of different types of engines and machines.
21MEC24.CO4	Understand different types of vibration occurring in the moving system.
21MEC24.CO5	understand the effect of Dynamics of undesirable vibrations

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC24.CO1	X	X	X	X	-	X	-	-	-	X	-	-	X	-	-
21MEC24.CO2	X	X	-	X	-	X	-	-	-	X	-	X	X	-	-
21MEC24.CO3	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
21MEC24.CO4	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
21MEC24.CO5	X	X	-	X	-	X	-	-	X	X	-	X	X	-	X

LIST OF EXPERIMENTS

1. a) Study of gear parameters.
   b) Experimental study of velocity ratios of simple, compound, Epicyclic and differential gear trains.
2. a) Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinder Mechanisms.
   b) Kinematics of single and double universal joints.
3. a) Determination of Mass moment of inertia of Fly wheel and Axle system.
   b) Determination of Mass Moment of Inertia of axisymmetric bodies using Turn Table apparatus.
   c) Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum.
4. Motorized gyroscope – Study of gyroscopic effect and couple.
5. Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.
6. Cams – Cam profile drawing, Motion curves and study of jump phenomenon
7. a) Single degree of freedom Spring Mass System – Determination of natural frequency and verification
   of Laws of springs – Damping coefficient determination.
   b) Multi degree freedom suspension system – Determination of influence coefficient.
8. a) Determination of torsional natural frequency of single and Double Rotor systems. -Undamped and Damped Natural frequencies.
   b) Vibration Absorber – Tuned vibration absorber.
9. Vibration of Equivalent Spring mass system – undamped and damped vibration.
10. Whirling of shafts – Determination of critical speeds of shafts with concentrated loads.
11. a) Balancing of rotating masses.
    b) Balancing of reciprocating masses.
12. a) Transverse vibration of Free-Free beam – with and without concentrated masses.
    b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies.
    c) Determination of transmissibility ratio using vibrating table.

21MEC25   DESIGN OF TRANSMISSION SYSTEMS

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(Use of approved Design Data book is permitted)

COURSE OBJECTIVES
- To learn the procedure of simple selection and design the flexible elements
- To impart knowledge on spur gear force analysis dynamic effects gear materials.
- To impart knowledge on the principles and procedure for the design of helical gears
- To know about the bevel and worm gear design.
- To impart knowledge on the stresses occurred in clutch and breaks.

COURSE OUTCOMES
21MEC25.CO1 Gain knowledge on Design the various transmission systems like belt, chain, rope.

21MEC25.CO2 Acquire knowledge on Design the spur gears and its related concepts and other gear designing terms related to parallel axis helical gears.

21MEC25.CO3 Acquire knowledge on Design the bevel, worm and cross helical gears based on the mechanisms chosen for building of various machines.

21MEC25.CO4 Acquire knowledge on Design the gear box for both constant speed and variable number of speeds in the transmission systems

21MEC25.CO5 Know the concepts of Design the clutches and Brakes and also able to utilize the same to solve practical problems.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC25.CO1	X	X	X	-	-	-	-	-	-	-	-	-	X	-	-
21MEC25.CO2	X	X	X	-	-	-	-	-	-	-	-	-	X	X	-
21MEC25.CO3	X	X	X	-	-	-	-	-	-	-	-	-	X	-	-
21MEC25.CO4	X	X	X	-	-	-	-	-	-	-	-	-	X	-	-
21MEC25.CO5	X	-	-	-	X	-	-	-	-	-	-	-	-	X	-

UNIT I:DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE LEMENTS   9
Design of flat belt, V - Belt and pulleys - Design of Wire Ropes and pulleys - Selection of flat belts and pulleys – V belts and pulleys – Selection of Wire ropes and pulleys - Introduction to modern transmission systems.

UNIT II: DESIGN OF SPUR GEARS AND PARALLEL AXIS HELICAL GEARS   9
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 transverseplane- Equivalent number of teeth-forces for helical gears.

UNIT III: DESIGN OF BEVEL AND WORM GEARS   9
Design of Straight bevel gears: Tooth terminology- Tooth forces and stresses – Equivalent number of teeth. Worm Gear: Terminology – Thermal capacity – materials - forces and stresses and Efficiency - Design of Worm gear – Estimating the size of the worm gear pair.

UNIT IV:DESIGN OF GEAR BOXES   9
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.

UNIT V: DESIGN OF CLUTCHES AND BRAKES   9
Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses. Design of plate clutches –axial clutches-cone clutches-internal expandingrim clutches-shoe and band brakes - external shoe brakes – Internal expanding shoe brake -Electromagnetic clutches

TOTAL:L: 45 = 45

MECHANICAL ENGINEERING

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bhandari V	Design of Machine Elements	Tata McGraw-Hill Book Co	2017
2.	Juvinall, R	Fundamentals of Machine Component Design	John Wiley and Sons	2005

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Orthwein W	Machine Component Design	Jaico Publishing Co	2003
2.	Prabhu. T.J	Design of Transmission Elements	Mani Offset	2000
3.	Hamrock B.J.,	Fundamentals of Machine Elements	McGraw - Hill Book Co	2009
4	Maitra, G.M. and L.V.Prasad	Hand book of Mechanical Design	Tata McGraw - Hill	2015
5	Joseph Shigley	Mechanical Engineering Design	Tata McGraw-Hill	2008

21MEC26   TOTAL QUALITY MANAGEMENT

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COURSEOBJECTIVES

- To understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management
- To understand the application of statistical approach for quality control
- To create an awareness about the ISO and QS certification process and its need for the industries
- To apply the quality concepts in product design, manufacturing etc in order to maximize customer Satisfaction
- Human involvement to improve quality and the development and transformation

COURSE OUTCOMES

21MEC26.CO1 Understand the concept of total quality management
21MEC26.CO2 Comprehend and illustrate the TQM principles
21MEC26.CO3 Solve quality related problems using statistical process control
21MEC26.CO4 Understand proven methodologies to enhance management processes
21MEC26.CO5 Illustrate the salient features of quality systems

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC26.CO1	X	-	-	-	-	X	X	X	X	X	-	X	-	X	-
21MEC26.CO2	X	-	-	-	-	X	X	X	X	X	-	X	-	X	-
21MEC26.CO3	X	X	X	X	-	X	X	X	X	X	-	X	-	X	-
21MEC26.CO4	X	X	X	X	-	X	X	X	X	X	-	X	-	X	-
21MEC26.CO5	X	X	-	-	X	X	X	X	X	X	X	X	-	X	-

UNIT I: INTRODUCTION   9

Definition of Quality – Dimensions of Quality – Quality Planning – Quality costs – Analysis Techniques for Quality Costs – Basic concepts of Total Quality Management – Historical Review – Quality Statements – Strategic Planning, Deming Philosophy – Crosby philosophy – Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen – Obstacles to TQM Implementation

UNIT II: TQM PRINCIPLES   9

Principles of TQM, Leadership – Concepts – Role of Senior Management – Quality Council, Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits– Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure

UNIT III: STATISTICAL PROCESS CONTROL (SPC)   9

The seven tools of quality – Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables X bar and R chart and attributes P, nP, C, and u charts. Industrial Examples, Process capability, Concept of six sigma – New seven Management tools

UNIT IV: TQM TOOLS   9

Benchmarking – Reasons to Benchmark – Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, and Benefits – Taguchi Quality Loss Function – Total Productive Maintenance (TPM) – Concept, Improvement Needs, and FMEA – Stages of FMEA- Case studies

UNIT V: QUALITY SYSTEMS   9

Need for ISO 9000 and Other Quality Systems – ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, ISO 9000:2005 (definitions), ISO 9001:2008 (requirements) and ISO 9004:2009 (continuous improvement), TS 16949, ISO 14000, AS9100 – Concept, Requirements and Benefits- Case studies

Total:L: 45 = 45

TEXT BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dale H. Besterfiled	Total Quality Management	Pearson Education Inc, New Delhi	2011
2.	James R. Evans and William M. Lidsay,	The Management and Control of Quality	South-Western	2010

REFERENCE BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	N. Gupta and B. Valarmathi,	Total Quality Management	Tata McGraw-Hill Publishing Company Pvt Ltd., New Delhi	2009
2	Dr S. Kumar	Total Quality Management,	Laxmi Publications Ltd., New Delhi	2006
3	P. N. Muherjee	Total Quality Management	Prentice Hall of India, New Delhi	2006
4	James R. Evans and William M. Lindsay	The Management and Control of Quality	8th Edition, First Indian Edition, Cengage Learning	2012
5	Suganthi.L and Anand Samuel	Total Quality Management	Prentice Hall (India) Pvt. Ltd	2006

PROFESSIONAL ELECTIVES

(PE)

For

Mechanical Engineering

21MEE01	ADVANCED MACHINING PROCESSES	L T P C
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COURSEOBJECTIVES
- To understand the surface treatment techniques.
- To understand the non-traditional machining
- To familiarize the laser beam machining and electron beam machining.
- To understand the manufacturing processes of ceramic composites.
- To understand the various Processing of Composites.

COURSE OUTCOMES
21MEE01.CO1 Understand the fundamentals of Surface treatment.
21MEE01.CO2 Illustrate the concepts of non-traditional machining processes
21MEE01.CO3 Explain the working principle of laser beam machining and electron beam machining
21MEE01.CO4 Summarize the fabrication techniques of microelectronic devices.
21MEE01.CO5 Comprehend the fabrication and processing of ceramic composites

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEE01.CO1	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-
21MEE01.CO2	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-
21MEE01.CO3	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-
21MEE01.CO4	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-
21MEE01.CO5	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-

UNIT I: SURFACE TREATMENT   9
Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating. Electro forming, Chemical vapour deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding.

UNIT II: NON-TRADITIONAL MACHINING   9
Introduction, need, AJM, Parametric Analysis, Process capabilities, USM –Mechanics of cutting, models, Parametric Analysis, WJM –principle, equipment, process characteristics , performance. EDM – principles, equipment, generators, analysis of R-C circuits, MRR , Surface finish, WEDM.

UNIT III: BEAM, ARC AND CHEMICAL MACHINING   9
Laser beam, electron beam, plasma arc & electro chemical machining-Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications.

UNIT IV: FABRICATION OF MICROELECTRONIC DEVICES   9
Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, computer aided design in microelectronics, surface mount technology, Integrated circuit economics. E-Manufacturing, nanotechnology

UNIT V: PROCESSING OF CERAMICS AND COMPOSITES   9
Applications, characteristics, classification. Processing of particulate ceramics, Powder preparations, consolidation, drying, sintering, Hot compaction, Area of application, finishing of ceramics. Composite Layers. Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

TOTAL: L: 45 = 45

MECHANICAL ENGINEERING

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	V. K. Jain	Advanced Machining Processes	Allied Publishers	2009
2	J. A. McGeough	Advanced Methods of Machining	Springer	2011

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kalpakijian	Manufacturing Engineering and Technology	Adisson Wesley	2010
2	R. A. Lindburg	Process and Materials of Manufacturing	PHI	2003
3	Chang Liu	Foundation of MEMS	Pearson	2012
4	Hassan El-Hofy,	Advanced Machining Processes: Nontraditional and Hybrid Machining Processes	McGraw-Hill	2005
5	V. K. Jain	Introduction to Micromachining	Alpha Science International Limited	2010

MECHANICAL ENGINEERING

21MEE02   PRINCIPLES OF MANAGEMENT

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COURSE OBJECTIVES
- To analyze the historic development of Management thoughts
- To learn the nature and purpose of planning, forecasting and decision making
- To expose the knowledge on concepts of organizing
- To analyze the concepts of delegation of authority and Organization culture.
- To familarise the students to the basic concepts of management in order to aid in understanding how an organization functions, and in understanding the complexity and wide variety of issues managers face in today's business firms.

COURSE OUTCOMES
21MEE02.CO1	Understand the evolution of management thought and role of managers
21MEE02.CO2	Discuss the phases of planning process and types of plans
21MEE02.CO3	Comprehend the different types of organization structure and illustrate the HR tasks
21MEE02.CO4	Describe the communication and directing process
21MEE02.CO5	Summarize the different controlling techniques in management

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEE02.CO1	X	-	-	-	-	X	X	X	X	X	-	X	-	X	-
21MEE02.CO2	X	-	-	-	-	X	X	X	X	X	-	X	-	X	-
21MEE02.CO3	X	X	X	X	-	X	X	X	X	X	-	X	-	X	-
21MEE02.CO4	X	X	X	X	-	X	X	X	X	X	-	X	-	X	-
21MEE02.CO5	X	X	-	-	X	X	X	X	X	X	X	X	-	X	-

UNIT I: INTRODUCTION TO MANAGEMENT   9
Organization- Management- Role of managers- Evolution of management thought- Organization and the environmental factors- Managing globally- Strategies for International business.

UNIT II: PLANNING   9
Nature and purpose of planning- Planning process- Types of plans- objectives- Managing by Objective (MBO) strategies- Types of strategies – Policies – Decision Making- Types of decision making process- Rational decision making process- Decision making under different conditions.

UNIT III: ORGANISING   9
Nature and purpose of organizing- Organization structure- Formal and informal groups/ organization- Line and staff authority- Departmentation- Span of control- Centralization and decentralization- Delegation of authority- Staffing- Selection and Recruitment- Orientation- Career development- Career stages- Training- Performance appraisal

UNIT IV: DIRECTING   9
Managing people- Communication- Hurdles to effective communication- Organization culture Elements and types of culture- Managing cultural diversity.

UNIT V: CONTROLLING   9
Process of controlling- Types of control- Budgetary and non-budgetary control techniques Managing productivity- Cost control- Purchase control- Maintenance control- Quality control Planning operations.

TOTAL: L: 45 = 45

MECHANICAL ENGINEERING

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Harold Koontz and Heinz Weihrich	Essentials of management: An International & Leadership Perspective	Tata McGraw-Hill Education	2015
2	Charles W.L Hill and Steven L McShane	Principles of Management	McGraw Hill Education	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Samuel C. Certo and TervisCerto	Modern management: concepts and skills	Pearson education	2014
2.	Heinz Weihrich, Mark V Cannice and Harold Koontz,	Management a global entrepreneurial perspective	Tata McGraw Hill	2013
3.	Stephen P. Robbins, David A.DeCenzo and Mary Coulter	Fundamentals of management	Prentice Hall of India	2012
4.	Don Hellriegel, Susan E. Jackson and John W. Slocum,	Management a competency based approach	Thompson South Western	2008
5.	Joseph L.Massie	Essentials of Management	Pearson Education	2003

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21MEC03   MECHATRONICS   L T P C
3 0 0 3

COURSE OBJECTIVES

- To understand the working principles of various sensors.
- To acquire in depth knowledge on the uses of microprocessor.
- To know how to interface computer with components.
- To develop skills about PLC
- To familiarize about actuators and able to design Mechatronics system.

COURSE OUTCOMES

21MEC03.CO1	Understand the working of different types of sensors.
21MEC03.CO2	Acquire in depth knowledge of 8085 microprocessor.
21MEC03.CO3	Interface computer with mechanical components for differen application.
21MEC03.CO4	Learn about PLC.
21MEC03.CO5	Familiarize about actuators and able to design Mechatronics system

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC03.CO1	X	X	X	X	X	-	-	-	X	X	-	X	-	X	-
21MEC03.CO2	X	X	X	X	X	-	-	-	X	X	-	X	-	X	-
21MEC03.CO3	X	X	X	X	X	-	-	-	X	X	-	X	-	X	-
21MEC93.CO4	X	X	X	X	X	-	-	-	X	X	-	X	-	X	-
21MEC03.CO5	X	X	X	X	X	-	-	-	X	X	-	X	-	X	-

UNIT I: INTRODUCTION   9

Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers: Static and dynamic characteristics of Sensor, Potentiometers –LVDT – Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor –Temperature sensors – Light sensors

UNIT II: 8085 MICROPROCESSOR   9

Introduction – Architecture of 8085 – Pin Configuration – Addressing Modes –Instruction set, Timing diagram of 8085.

UNIT III: PROGRAMMABLE PERIPHERAL INTERFACE   9

Introduction – Architecture of 8255, Keyboard interfacing, LED display –interfacing, ADC and DAC interface, Temperature Control – Stepper Motor Control – Traffic Control interface.

UNIT IV: PROGRAMMABLE LOGIC CONTROLLER   9

Introduction – Basic structure – Input and output processing – Programming – Mnemonics –Timers, counters and internal relays – Data handling – Selection of PLC.

UNIT V: ACTUATORS AND MECHATRONIC SYSTEM DESIGN   9

Types of Stepper and Servo motors – Construction – Working Principle – Advantages and Disadvantages. Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Engine Management system – Automatic car park barrier.

TOTAL: L : 45= 45

MECHANICAL ENGINEERING

TEXT BOOKS

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Bolton	Mechatronics	Printice Hall	2008
2	Ramesh S Gaonkar	Microprocessor Architecture, Programming, and Applications with the 8085	5th Edition, Prentice Hall	2008

REFERENCE BOOKS

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Michael B.Histand	Introduction to Mechatronics and Measurement systems	McGraw Hill International	2007
2	Smaili.A and Mrad.F	Mechatronics Integrated Technologies for Intelligent Machines	Oxford University Press	2007
3	Krishna Kant	Microprocessors & Microcontrollers	Prentice Hall of India	2007
4	Devadas Shetty and Richard A. Kolk	Mechatronics Systems Design	PWS publishing company	2007
5	Newton C. Braga	Mechatronics Source Book	Delmar Cengage Learning	2009

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21MEE04   AUTOMOTIVE ELECTRONICS

L T P C
3 0 0 3

COURSE OBJECTIVES
- The intention and purpose of this course is to study the basics of electronics, emission controls and its Importance in automobiles.
- To study the various sensors and actuators used in automobiles for improving fuel economy and emission control.
- To study the various blocks of control units used for control of fuel, ignition and exhaust systems.

COURSE OUTCOMES
21MEE04.CO1	Know the importance of emission standards in automobiles.
21MEE04.CO2	Understand the electronic fuel injection/ignition components and their function.
21MEE04.CO3	Choose and use sensors and equipment for measuring mechanical quantities, temperature and appropriate actuators.
21MEE04.CO4	Diagnose electronic engine control systems problems with appropriate diagnostic tools.
21MEE04.CO5	Analyses the chassis and vehicle safety system.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEE04.CO1	X	X	X	X	-	-	X	-	-	X	-	X	-	-	-
21MEE04.CO2	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
21MEE04.CO3	X	X	X	X	-	-	X	-	-	X	-	X	X	-	-
21MEE04.CO4	X	X	X	X	-	-	X	-	-	X	-	X	X	-	-
21MEE04.CO5	X	X	X	X	-	X	X	-	-	X	-	X	-	-	-

UNIT I: INTRODUCTION   8
Evolution of electronics in automobiles – emission laws – introduction to Euro I, Euro II, Euro III, Euro IV, Euro V standards – Equivalent Bharat Standards. Charging systems: Working and design of charging circuit diagram – Alternators – Requirements of starting system - Starter motors and starter circuits.

UNIT II: IGNITION AND INJECTION SYSTEMS   10
Ignition systems: Ignition fundamentals - Electronic ignition systems - Programmed Ignition – Distribution less ignition - Direct ignition – Spark Plugs. Electronic fuel Control: Basics of combustion – Engine fueling and exhaust emissions – Electronic control of carburetion – Petrol fuel injection – Diesel fuel injection.

UNIT III: SENSOR AND ACTUATORS IN AUTOMOTIVES   9
Working principle and characteristics of Airflow rate, Engine crankshaft angular position, Hall effect, Throttle angle, temperature, exhaust gas oxygen sensors – study of fuel injector, exhaust gas recirculation actuators, stepper motor actuator, vacuum operated actuator.

UNIT IV: ENGINE CONTROL SYSTEMS   9
Control modes for fuel control-engine control subsystems – ignition control methodologies – different ECU's used in the engine management – block diagram of the engine management system. In vehicle networks: CAN standard, format of CAN standard – diagnostics systems in modern automobiles.

UNIT V: CHASSIS AND SAFETY SYSTEMS   9
Traction control system – Cruise control system – electronic control of automatic transmission – antilock braking system – electronic suspension system – working of airbag and role of MEMS in airbag systems centralized door locking system – climate control of cars.

TOTAL: L: 45 = 45

MECHANICAL ENGINEERING

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ribbens	Understanding Automotive Electronics	Elsevier, Indian Reprint	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Barry Hollembeak	Automotive Electricity, Electronics & Computer Controls	Delmar Publishers	2001
2.	Richard K. Dupuy	Fuel System and Emission controls	Check Chart Publication	2000
3	Ronald. K. Jurgon	Automotive Electronics Handbook	McGraw-Hill	1999
4	Tom Denton	Automobile Electrical and Electronics Systems	Edward Arnold Publishers	2000

21MEE05   DESIGN OF PRESSURE VESSEL AND PIPING   L T P C
                                                              3 0 0 3

(Usage of Pressure Vessels, Design Hand Book is allowed for the students for examination)

COURSE OBJECTIVES

- To obtain an understanding of the fundamental methods and Terminology and its application.
- To understand the membrane stress analysis and industrial related problems in vessels.
- To design principles for pressure vessels and enhance the understanding of reinforcement.
- To obtain the buckling of pressure vessels and tubes, cylinders etc.
- To design procedure of pressure vessel and Design of piping layout.

COURSE OUTCOMES

21MEE05.CO1 Develop the stresses and terminology, efficiency and its applications.
21MEE05.CO2 Analysis the vessels shells components such as cylindrical, spherical, conical and Thermal.
21MEE05.CO3 Design the pressure vessels and ASME vessels codes.
21MEE05.CO4 Estimate the design procedure of pressure vessel and Design of piping layout.
21MEE05.CO5 Design and analysis the pipe stress.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEE05.CO1	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-
21MEE05.CO2	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-
21MEE05.CO3	X	-	-	-	X	X	-	-	-	--	-	X	-	X	-
21MEE05.CO4	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-
21MEE05.CO5	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-

UNIT I: INTRODUCTION   9
Methods for determining stresses – Terminology and Ligament Efficiency– Applications.

UNIT II: STRESS IN PRESSURE VESSELS   9
Introduction – Stresses in a circular ring, cylinder – Membrane stress Analysis of Vessel Shell components – Cylindrical shells, spherical Heads, conical heads – Thermal Stresses – Discontinuity stresses in pressure vessels.

UNIT III: DESIGN OF VESSELS   9
Design of Tall cylindrical self supporting process columns –Supports for short, vertical and horizontal vessels – stress concentration – at a variable Thickness transition section in a cylindrical vessel, about a circular Hole, elliptical openings. Theory of Reinforcement – pressure vessel Design. Introduction to ASME pressure vessel codes.

UNIT IV: BUCKLING OF VESSELS   9
Buckling phenomenon – Elastic Buckling of circular ring and cylinders under external pressure – collapse of thick walled cylinders or tubes under external pressure – Effect of supports on Elastic Buckling of Cylinders – Buckling under combined External pressure and axial loading.

UNIT V: PIPING   9
Introduction – Flow diagram – piping layout and piping stress Analysis

TOTAL: L: 45=45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John F. Harvey	Theory and Design of Pressure Vessels	CBS Publishers and Distributors	2001
2.	Donatello Annaratone	Pressure Vessel Design	Springer	2007

MECHANICAL ENGINEERING

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Henry H. Bedner	Pressure Vessels, Design Hand Book	CBS publishers and Distributors	2001
2	Stanley, M. Wales	Chemical process equipment, selection and Design	Buterworths series in Chemical Engineering	1988
3	John F. Harvey	Pressure Vessel Design: Nuclear and Chemical Applications	Priceton Inc.	1963
4	William. J., Bees	Approximate Methods in the Design and Analysis of Pressure Vessels and Piping	Pre ASME Pressure Vessels and Piping Conference	1997
5	Sam Kannapan	Introduction to Pipe Stress Analysis	John Wiley and Sons	1985

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21MEE06   ADVANCED IC ENGINES

L T P C
3 0 0 3

COURSE OBJECTIVES:
- To understand the underlying principles of operation of different Spark ignition Engines and components.
- To understand the underlying principles of operation of different CI Engines and components.
- To provide knowledge on pollutant formation & control.
- To realize the recent trends in automobiles
- To interpret the hybrid vehicle.

COURSE OUTCOMES
21MEE06.CO1	Understand the phenomenon of combustion in IC engines
21MEE06.CO2	Analyze the combustion phenomena in SI engines
21MEE06.CO3	Analyze the combustion phenomena in CI engines
21MEE06.CO4	Understand the emission standards for SI and CI engines.
21MEE06.CO5	Familiarize about alternative fuels.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEE06.CO1	X	X	X	X	-	-	X	-	-	X	-	X	-	-	-
21MEE06.CO2	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
21MEE06.CO3	X	X	X	X	-	-	X	-	-	X	-	X	X	-	-
21MEE06.CO4	X	X	X	X	-	-	X	-	-	X	-	X	X	-	-
21MEE06.CO5	X	X	X	X	-	X	X	-	-	X	-	X	-	-	-

UNIT I: SPARK IGNITION ENGINES   9
Mixture requirements – Fuel injection systems – Mono point, Multipoint & Direct injection - Stages of combustion – Normal and Abnormal combustion – Knock - Factors affecting knock – Combustion chambers.

UNIT II: COMPRESSION IGNITION ENGINES   9
Diesel Fuel Injection Systems - Stages of combustion – Knocking – Factors affecting knock – Direct and Indirect injection systems - Combustion chambers – Fuel Spray behaviour – Spray structure and spray penetration – Air motion - Introduction to Turbocharging.

UNIT III POLLUTANT FORMATION AND CONTROL   9
Pollutant – Sources – Formation of Carbon Monoxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters, Selective Catalytic Reduction and Particulate Traps – Methods of measurement – Emission norms and Driving cycles

UNIT IV ALTERNATIVE FUELS   9
Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits - Engine Modifications.

UNIT V RECENT TRENDS   9
Air assisted Combustion, Homogeneous charge compression ignition engines – Variable Geometry turbochargers – Common Rail Direct Injection Systems - Hybrid Electric Vehicles – NOx Adsorbers - Onboard Diagnostics.

TOTAL:L:45= 45

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John B. Heywood	Internal Combustion Engine Fundamentals	Tata McGraw Hill New Delhi	2002
2.	Ganesan.V	Internal Combustion Engines	Tata McGraw Hill	2003

MECHANICAL ENGINEERING

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Chris McMahon and Jimmie Browne	Internal Combustion Engines	Dhanpat Rai & Sons	2007
2.	Obert, E. F.,	Internal Combustion Engine and Air Pollution	International Text Book Publishers	2001
3.	Mathur, M. L, and Sharma. R. P	A course in Internal Combustion Engines	Dhanpat Rai-Publications New Delhi	2000
4.	Duffy Smith	Auto Fuel Systems	The Good Heart Willcox Company, Inc.,	1987
5.	Cohen, H, Rogers, G. E. C, and Saravanamuttoo. H. I. H.,	Gas Turbine Theory	Longman	2004

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| 21MEE07 | INDUSTRIAL AUTOMATION & ROBOTICS | L T P C |
| | | 3 0 0 3 |

COURSEOBJECTIVES
- To learn the levels of automation and production economics
- To impart the knowledge on Material handling and Identification Technologies.
- To know the Automated Assembly Systems.
- To impart clear knowledge about the techniques and applications of Automation and Robotics Programming in an industrial environment.
- To understand robotic systems and apply what they learned to a career in the Automation and Robotics field.

COURSE OUTCOMES
21MEE07.CO1	Understand levels of automation and production economics.
21MEE07.CO2	Understand the Material handling and Identification Technologies.
21MEE07.CO3	Explain the Automated Assembly Systems.
21MEE07.CO4	Understand the techniques and applications of Automation and Robotics Programming in an industrial environment.
21MEE07.CO5	Design and implement robotic systems and apply what they learned to a career in the Automation and Robotics field.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEE07.CO1	X	X	X	X	X	X	X	-	-	X	X	X	X	X	X
21MEE07.CO2	X	X	X	X	-	X	X	X	-	X	X	X	X	X	X
21MEE07.CO3	X	X	X	X	X	-	X	X	-	X	X	X	X	X	X
21MEE07.CO4	X	X	X	X	X	-	X	X	-	X	X	X	X	X	X
21MEE07.CO5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

UNIT I: INTRODUCTION   9
Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations. Production Economics: Methods of Evaluating Investment Alternatives, Costs in Manufacturing, Break Even Analysis, Unit cost of production, Cost of Manufacturing Lead time and Work-in-process.

UNIT II: MATERIAL HANDLING AND IDENTIFICATION TECHNOLOGIES   9
The material handling function, Types of Material Handling Equipment, Analysis for Material Handling Systems, Design of the System, Conveyor Systems, Automated Guided Vehicle Systems. Automated Storage Systems: Storage System Performance, Automated Storage/Retrieval Systems, Work-in-process Storage, Interfacing Handling and Storage with Manufacturing. Product identification system: Barcode, RFID etc.

UNIT III: AUTOMATED ASSEMBLY SYSTEMS   9
Design for Automated Assembly, Types of Automated Assembly Systems. Part Feeding Devices, Analysis of Multi-station Assembly Machines, Analysis of a Single Station Assembly Machine.

UNIT IV: FUNDAMENTALS OF ROBOT AND END EFFECTORS   9
Robot - Definition - Robot Anatomy - Co ordinate Systems, Work Envelope Types and Classification-Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications. End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT V: ROBOT KINEMATICS AND ROBOT PROGRAMMING   9
Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Velocity and Forces-Manipulator Dynamics, Trajectory Generator. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

TOTAL: L: 45 = 45

MECHANICAL ENGINEERING

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M.P.Grover	Automation, Production Systems and Computer Integrated Manufacturing	Pearson Education	2015
2	Krishna Kant	Computer Based Industrial Control	EEE-PHI	2017

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Tiess Chiu Chang & Richard A. Wysk	An Introduction to Automated Process Planning Systems	PHI	1985
2	Amber G.H & P.S. Amber	Anatomy of Automation	Prentice Hall	2009
3	S.R. Deb	Robotics Technology and flexible automation	Tata McGraw-Hill Education	2009

MECHANICAL ENGINEERING

21MEE08   VIBRATION AND NOISE CONTROL   **L T P C**
                                                                    3 0 0 3

COURSEOBJECTIVES
- To understand the basics of Vibration
- To understand the basics of Noise.
- To understand the Automotive Noise Sources.
- To impart clear knowledge about Control Techniques
- To understand the Source of Noise and control.

COURSE OUTCOMES
21MEE08.CO1	Understanding causes, source and types of vibration in machineries.
21MEE08.CO2	Gaining knowledge in sources and measurement standard of noise.
21MEE08.CO3	Ability to design and develop vibrations and Noise control systems.
21MEE08.CO4	Learn the applications IC Engines and Shock Absorbers.
21MEE08.CO5	Understand the Source of Noise and control methods.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEE08.CO1	X	-	-	-	-	X	X	-	-	-	-	X	-	-	-
16MEE06.CO2	X	X	X	-	-	X	X	-	-	-	-	X	-	-	-
21MEE08.CO3	X	-	X	-	X	-	X	X	-	-	-	X	-	-	-
21MEE08.CO4	X	-	-	-	-	X	-	X	-	-	-	X	-	-	-
21MEE08.CO5	X	X	-	-	-	X	X	-	-	-	-	X	-	-	-

UNIT I: Basics of Vibration   9
Introduction, classification of vibration: free and forced vibration, un-damped and damped vibration, linear and non linear vibration, response of damped and un-damped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies..

UNIT II: Basics of Noise   9
Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.

UNIT III: Automotive Noise Sources   9
Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.

UNIT IV: Control Techniques   9
Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments,application dynamic forces generated by IC engines, engine isolation. crank shaft damping, modal analysis of the mass elastic model shock absorbers.

UNIT V: Source of Noise and Control   9
Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles. sound in enclosures, sound energy absorption, sound transmission through barriers

TOTAL: L: 45 = 45

TEXT BOOKS:
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	SingiresuS.Rao	Mechanical Vibrations	Pearson Education,ISBM-81-297-0179-0	2004
2	KewalPujara	Vibrations and Noise for Engineers	Dhanpat Rai & Sons	2013

MECHANICAL ENGINEERING

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Bernard Challen and RodicaBaranescu	Diesel Engine Reference Book	SAE International- ISBN 0-7680-0403-9	1999
2	Julian Happian-Smith	An Introduction to ModernVehicle Design	Butterworth-Heinemann ISBN 0750-5044-3	2004
3	John Fenton	Handbook of Automotive body Construction and Design Analysis	Professional Engineering Publishing, ISBN 1-86058-073	1998
4	K. J. Bathe and F. I. Wilson	Numerical Methods in Finite Element Analysis	Prentice Hall of India, New Delhi	1978
5	J. P. Den Harto	Mechanical Vibrations	Crastrepres	2007

21MEE09   REFRIGERATION AND AIR CONDITIONING   **L T P C**
                                                           3 0 0 3

COURSEOBJECTIVES
- To understand the underlying principles of operations in different Refrigeration & Airconditioning systems and components.
- To provide knowledge on design aspects of Refrigeration & Air conditioning systems
- To know about different types of refrigeration system
- To make use of psychrometric chart.
- To know different load calculations in different type of air conditioning systems.

COURSEOUTCOMES
21MEE09.CO1	Upon completion of this course, the students can able to demonstrate the operations in refrigeration system
21MEE09.CO2	Understanding the concepts and implementing in different Refrigeration system
21MEE09.CO3	Applying different concepts to different refrigeration system and implementing to calculations
21MEE09.CO4	Solving problems in air conditioning systems
21MEE09.CO5	Load estimation and plant design in real time application of air conditioning system.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEE09.CO1	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-
21MEE09.CO2	X	X	X	-	-	-	-	-	-	-	-	-	X	-	-
21MEE09.CO3	X	X	X	-	-	-	-	-	-	-	-	-	X	-	-
21MEE09.CO4	X	X	X	-	-	-	-	-	-	-	-	-	X	-	-
21MEE09.CO5	-	-	-	-	X	-	-	-	-	-	-	-	-	X	-

UNIT I: INTRODUCTION   9
Introduction to Refrigeration - Unit of Refrigeration and C.O.P.- Ideal cycles- Refrigerants Desirable properties – Classification - Nomenclature - ODP & GWP.

UNIT II: VAPOUR COMPRESSION REFRIGERATION SYSTEM   9
Vapor compression cycle : p-h and T-s diagrams - deviations from theoretical cycle – sub cooling and heating- effects of condenser and evaporator pressure on COP- multi-pressure system – low temperature refrigeration - Cascade systems – problems. Equipments: Type of Compressors, Condensers, Expansion devices, Evaporators.

UNIT III: OTHER REFRIGERATION SYSTEMS   9
Working principles of Vapour absorption systems and adsorption cooling systems – Steam jet Refrigeration- Ejector refrigeration systems- Thermoelectric refrigeration- Air refrigeration - Magnetic - Vortex and Pulse tube refrigeration systems

UNIT IV: PSYCHROMETRIC PROPERTIES AND PROCESSES   9
Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree ofsaturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temperature Thermodynamic wet bulb temperature, Psychrometric chart; Psychrometric of air-conditioning processes, mixing of air streams.

UNIT V: AIR CONDITIONING SYSTEMS AND LOAD ESTIMATION   9
Air conditioning loads: Outside and inside design conditions; Heat transfer through structure, Solar radiation, Electrical appliances, Infiltration and ventilation, internal heat load; Apparatus selection;fresh air load, human comfort & IAQ principles, effective temperature & chart, calculation of summer &winter air conditioning load; Classifications, Layout of plants; Air distribution system; Filters; Air-conditioning Systems with Controls: Temperature, Pressure and Humidity sensors, Actuators &Safety controls.
TOTAL: L: 45=45

MECHANICAL ENGINEERING

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Arora, C.P	Refrigeration and Air Conditioning	McGraw Hill	2010.
2.	W.P. Jones	Air-Conditioning Engineering	Elsevier	2007

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Roy J. Dossat,	Principles of Refrigeration	Pearson Education	2009
2	Stoecker, W.F. and Jones J. W.,	Refrigeration and Air Conditioning	McGraw Hill	1986
3	Jones W.P	Air conditioning engineering	Elsevier	2001
4.	R.S.Khurmi	Textbook of Refrigeration and Air-conditioning	S.Chand	2006
5.	G F Hundy, A. R. Trott, T C Welch	Refrigeration and Air-Conditioning	Elsevier	2008

21MEE10   COMPOSITE MATERIALS

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COURSEOBJECTIVES
- To understand the fundamentals of composite material strength and its mechanical behavior
- To introduce the polymer matrix composites for different applications with different orientations
- To study Characteristics of metal matrix composites in manufacturing sectors
- To study the need of ceramic composites in society and industry.
- To understand the concepts of modern composite materials; and To study residual stresses in laminates during processing

COURSE OUTCOMES
21MEE10.CO1	Understand and explain the fundamentals of composite materials
21MEE10.CO2	Illustrate various orientation of polymer matrix composites and its properties
21MEE10.CO3	Demonstrate the need and production of metal matrix composites
21MEE10.CO4	Summarize the ceramic matrix composites productions
21MEE10.CO5	Comprehend the lamina construction and mechanics of composites

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEE10.CO1	X	-	X	-	X	-	-	-	-	-	-	X	-	-	-
21MEE10.CO2	X	-	-	-	X	-	-	-	-	-	-	X	X	-	-
21MEE10.CO3	X	-	X	-	X	-	-	-	-	-	-	X	-	-	X
21MEE10.CO4	X	-	X	-	-	-	-	-	-	-	-	X	-	-	X
21MEE10.CO5	X	-	X	-	-	-	-	-	-	-	-	X	-	-	-

UNIT I: INTRODUCTION TO COMPOSITE MATERIALS   9
Fundamentals of composites – need for composites – enhancement of properties – classification of composites – Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) – Reinforcement – particle reinforced composites, Fibre reinforced composites. Applications of various types of composites. Fiber production techniques for glass, carbon and ceramic fibers

UNIT II : POLYMER MATRIX COMPOSITES   9
Polymer resins – thermosetting resins, thermoplastic resins – reinforcement fibres – rovings – woven fabrics – non woven random mats – various types of fibres. PMC processes – hand layup processes – spray up processes – compression moulding – reinforced reaction injection moulding – resin transfer moulding – Pultrusion – Filament winding – Injection moulding. Fibre reinforced plastics (FRP), Glass Fibre Reinforced Plastics (GFRP). Applications of PMC in aerospace, automotive industries

UNIT III : METAL MATRIX COMPOSITES   9
Characteristics of MMC, various types of metal matrix composites alloy vs. MMC, advantages of MMC, limitations of MMC, Reinforcements – particles – fibres. Effect of reinforcement – volume fraction – rule of mixtures. Processing of MMC – powder metallurgy process – diffusion bonding – stir casting – squeeze casting, a spray process. Applications of MMC in aerospace, automotive industries.

UNIT IV CERAMIC MATRIX COMPOSITES   9
Engineering ceramic materials – properties – advantages – limitations – monolithic ceramics – need for CMC – ceramic matrix - various types of ceramic matrix composites- oxide ceramics – non oxide ceramics – aluminium oxide – silicon nitride – reinforcements – particles- fibres- whiskers. Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing). applications of CMC in aerospace, automotive industries

UNIT V: MECHANICS OF COMPOSITES   9

Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case. Orthotropic Stiffness matrix (Qij), Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Definitions-- Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates.

Total: L: 45= 45

TEXT BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Mathews F	Composite Materials: Engineering and Science	1st Edition, Chapman and Hall, London, England	1994
2	Chawla K. K	Composite materials	Second Edition, Springer – Verlag	1998

REFERENCE BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Clyne, T. W. and Withers, P. J	Introduction to Metal Matrix Composites	Cambridge University Press	1993
2	Mallick, P.K., Fiber,	Reinforced Composites: Materials, Manufacturing and Design	ManeelDekker Inc.	1993
3	Strong, A.B	Fundamentals of Composite Manufacturing	SME,Co.	1989
4	Sharma, S.C	Composite materials	Narosa Publications	2000
5	Mallick, P.K. and Newman, S.,	Composite Materials Technology: Processes and Properties	Hansen Publisher, Munish	1990

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21MEE11   COMPUTATIONAL FLUID DYNAMICS   L T P C
                                                            3 0 0 3

COURSE OBJECTIVES
- To introduce Governing Equations of viscous fluid flows
- To introduce numerical modeling and its role in the field of fluid flow and heat transfer
- To enable the students to understand the various discretization methods, solution proceduresand turbulence modeling.
- To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers
- To solve heat transfer problems

COURSE OUT COMES
21MEE11.CO1   Creating numerical modeling and its role in the field of fluid flow and heat transfer calculations
21MEE11.CO2   Using the various discretization methods, solution procedures and turbulence modeling, in one dimensional
21MEE11.CO3   Create discretization methods, numerical methods
21MEE11.CO4   Introducing numerical modeling and its role in the field of fluid flow and heat transfer
21MEE11.CO5   Creating confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers, and ANSYS analysis also.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEE11.CO1	X	X	X	-	-	X	X	X	-	X	-	X	X	-	-
21MEE11.CO2	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
21MEE11.CO3	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
21MEE11.CO4	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
21MEE11.CO5	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-

UNIT I: GOVERNING EQUATIONS AND BOUNDARY CONDITIONS   8
Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions –Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behaviour of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations

UNIT II: FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION   9
Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – Finite volume formulation for steady state One, Two and Three –dimensional diffusion problems –Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations – Use of Finite Difference and Finite Volume methods

UNIT III: FINITE VOLUME METHOD FOR CONVECTION DIFFUSION   10
Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties of discretization schemes – Conservativeness, Boundedness, Tran sportiveness, Hybrid, Power-law,QUICK Schemes

UNIT IV: FLOW FIELD ANALYSIS   9
Finite volume methods -Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants – PISO Algorithms.

UNIT V: TURBULENCE MODELS AND MESH GENERATION   9
Turbulence models, mixing length model, two equation (k-ϵ) models – High and low Reynoldsnumber models – Structured Grid generation – Unstructured Grid generation – Mesh refinement –Adaptive mesh – Software tools

TOTAL: L: 45=45

MECHANICAL ENGINEERING

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Versteeg, H.K	An Introduction to Computational Fluid Dynamics: The finite volume Method	Pearson Education Ltd.2nd Edition	2007
2.	Ghoshdastidar, P.S	Computer Simulation of flow and heat transfer	Tata McGraw Hill Publishing Company Ltd.	1998

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Muralidhar, K	Computational Fluid Flow and Heat Transfer	NarosaPublishing House, New Delhi,	1995
2	Patankar, S.V	Numerical Heat Transfer and Fluid Flow	Hemisphere Publishing Corporation,	2004.
3	Ghoshdastidar P.S	Heat Transfer	Oxford University Press	2005
4.	ProdipNiyogi	Introduction to Computational Fluid Dynamics	Pearson Education	2005
5.	Anil W. Date	Introduction to Computational Fluid Dynamics	Cambridge University Press.	2005.

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21MEE12	ENERGY CONSERVATION IN INDUSTRY	L T P C
		3 0 0 3

COURSE OBJECTIVES:
- To introduce fundamentals of energy conservation in industry.
- To learn various electrical system used in energy conservations.
- To enable the students to understand the various thermal systems used in energy conservations.
- To impart the knowledge on energy conservation in major utilities.
- To learn about energy economics and utilization calculations.

COURSE OUT COMES:

21MEE12.CO1	Understand the fundamentals of energy conservation in industry.
21MEE12.CO2	Explain and use the various electrical system used in energy conservations.
21MEE12.CO3	Understand the various thermal systems used in energy conservations.
21MEE12.CO4	Utilize the various energy conservations in major utilities.
21MEE12.CO5	Do the calculation in energy economics and utilization.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEE12.CO1	X	X	X	-	-	X	X	X	-	X	-	X	X	-	-
21MEE12.CO2	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
21MEE12.CO3	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
21MEE12.CO4	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
21MEE12.CO5	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-

UNIT I: INTRODUCTION
9

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
9

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in illumination.

UNIT III: THERMAL SYSTEMS
9

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and encon measures. Steam: Distribution &Usage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories

UNIT IV: ENERGY CONSERVATION IN MAJOR UTILITIES
9

Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets.

UNIT V: ECONOMICS
9

Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept

TOTAL: L: 45=45

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bureau of Energy Efficiency (BEE)	Energy Manager Training Manual (4 Volumes)	Ministry of Power, Government of India	2004

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REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Witte. L.C., P.S. Schmidt, D.R. Brown	Industrial Energy Management and Utilisation	Hemisphere Publication Washington	1988
2	Callaghn, P.W.	Design and Management for Energy Conservation	Pergamon Press, Oxford	1981
3	Dryden. I.G.C.	The Efficient Use of Energy	Butterworths, London	1982
4.	Turner. W.C.	Energy Management Hand book	Wiley, New York	1982
5.	Murphy. W.R. and G. Mc KAY	Energy Management	Butterworths, London	1987

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21MEE13   ADDITIVE MANUFACTURING TECHNIQUES   L T P C
                                                       3 0 0 3

COURSEOBJECTIVES

- To provide an exhaustive knowledge of various rapid prototyping techniques
- To educate the emerging trends and applications of Additive Manufacturing (AM) technology.
- To educate fundamental and advanced knowledge in the field of the associated aerospace, architecture, art, medical and industrial applications.
- To make familiar in reverse engineering and cad modeling
- To make familiar about materials and process parameters in prototype development.

COURSE OUTCOMES

21MEE13.CO1	Understand the basics of additive manufacturing processes
21MEE13.CO2	Describe various liquid based and solid based rapid prototyping systems
21MEE13.CO3	Illustrate various power based and special rapid prototyping systems
21MEE13.CO4	Describe reverse engineering in rapid prototyping.
21MEE13.CO5	Describe the properties of various materials used in prototyping

Course Outcomes	Program Outcomes												PSOs		
	PG1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEE13.CO1	X	X	X	-	-	X	-	-	-	-	-	X	-	-	X
21MEE13.CO2	X	X	-	X	X	X	-	-	-	-	-	X	-	-	X
21MEE13.CO3	X	-	X	X	X	-	-	-	-	-	-	X	-	-	X
21MEE13.CO4	X	X	-	-	-	-	-	-	-	-	-	X	-	-	X
21MEE13.CO5	X	X	-	-	-	-	-	-	-	-	-	X	-	-	X

UNIT I: INTRODUCTION   9
Need - Development of AM systems - AM process chain - Impact of AM on Product Development - Virtual Prototyping- Rapid Tooling - RP to AM -Classification of AM processes – Benefits- Applications.

UNIT II: LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS   9
Stereo lithography Apparatus SLA Principle, Part building processes, Photo polymerization of SL resins, Part quality, Recoating issues, Materials. Solid Ground Curing, Fused Deposition Modeling and Laminated Object Manufacturing Working Principle - Process parameters and Materials.

UNIT III: POWDER BASED AND OTHER RAPID PROTOTYPING SYSTEMS   9
Selective Laser Sintering Principle, Process Variables, Indirect and direct SLS - Powder structures, Materials, Post processing, Surface deviation and Accuracy - Three dimensional Printing Principle, Physics of 3DP, Types, Process capabilities, Solid, Liquid and Powder based 3DP systems.

UNIT IV: REVERSE ENGINEERING AND CAD MODELING   9
Basic concept - Digitization techniques - Model reconstruction - Data Processing for Rapid Prototyping - CAD model preparation, Data requirements - Geometric modeling techniques - Wire frame, surface and solid modeling - data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation-Software for AM- Case studies.

UNIT V: MATERIALS PROPERTIES   9
Role of materials - Viscous flow - Photo polymerization - Sintering - Infiltration - Materials for AM Processes - Mechanical Properties of AM Parts - Material properties, Colour, Dimensional accuracy, Stability, Surface finish, Machinability, Environmental resistance, Operational properties of products developed Direct Metal Deposition, Ballistic Particle Manufacturing, Electron Beam Melting and Laser Engineered Net Shaping Working Principle.

                                                TOTAL: L:45 = 45

MECHANICAL ENGINEERING

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ian Gibson, DavidW.Rosen	Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing	Springer	2015
2	Amit Bandyopadhyay, Susmita Bose	Additive Manufacturing	Taylor &Francis Group	2016

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Liou, L.W. and Liou, F.W	Rapid Prototyping and Engineering applications: A tool box for prototype development"	CRC Press	2011
2	Rafiq I. Noorani	Rapid Prototyping: Principles and Applications	John Wiley & Sons	2008
3	Ian Gibson, David Rosen & Brent Stucker	Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing	Springer	2016
4	Kamrani, A.K. and Nasr, E.A	Rapid Prototyping: Theory and practice	Springer	2006
5	Chua, C.K., Leong K.F. and Lim C.S	Rapid prototyping: Principles and applications	World Scientific Publishers	2010

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21MEE14   DESIGN OF JIGS, FIXTURES AND PRESS TOOLS   L T P C
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(Use of PSG Design Data Book is permitted in the University examination)

COURSE OBJECTIVES

- To understand about the tool design, functions of jigs and fixtures, principles of location and clamping, tolerances and materials used.
- To impart knowledge on different types of jigs such as post, turnover, channel, latch, box, pot, angular post jigs and fixtures.
- To understand the press working terminologies, and design of various elements of dies, design of simple blanking, piercing, compound and progressive dies.
- To impart knowledge on the structure various operations such as bulging, swaging, embossing, coining, curling, whole flanging, shaving and sizing.
- To gain proficiency in the development of required views of the final design.

COURSE OUTCOMES

21MEE14.CO1	Familiarize with various steps involved in the locating and clamping principle
21MEE14.CO2	List the types of jigs and fixtures and explain its functions.
21MEE14.CO3	Design and develop various types of jigs and fixtures for given components.
21MEE14.CO4	Illustrate the working of press tools and solve problems in strip layout.
21MEE14.CO5	Design and develop various types of press tool dies.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEE14.CO1	X	X	X	-	-	-	-	-	-	-	-	•	X	-	-
21MEE14.CO2	X	X	X	-	-	-	-	-	-	-	-	-	X	-	-
21MEE14.CO3	X	X	X	-	-	•	-	-	-	-	-	-	X	-	-
21MEE14.CO4	X	X	X	-	-	-	-	-	-	-	-	-	X	-	-
21MEE14.CO5	X	-	-	-	X	-	-	-	-	-	-	-	-	X	-

UNIT I: LOCATING AND CLAMPING PRINCIPLES   9

Objectives of tool design- Function and advantages of Jigs and fixtures – Basic elements -- principles of location – Locating methods and devices – Redundant Location – Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons – Tolerances and materials used.

UNIT II: JIGS AND FIXTURES   9

Design and development of jigs and 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 III: PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES   9

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 and preparation of four standard views of simple blanking, piercing, compound and progressive dies.

UNIT IV: BENDING AND DRAWING DIES   9

Difference between bending and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect – pressure pads – Ejectors – Variables affecting Metal flow in drawing operations – draw die inserts – draw beads ironing – Design and development of bending, forming, drawing, reverse redrawing and combination dies – Blank development for axisymmetric, rectangular and elliptic parts – Single and double action dies.

UNIT V: OTHER FORMING TECHNIQUES   9

Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction - tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke.

TOTAL:L: 45=45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Joshi P.H	Press tools - Design and Construction	wheels publishing	2010
2.	Joshi P.H	Jigs and Fixtures	Tata McGraw Hill.	2004

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Venkataraman. K	Design of Jigs Fixtures & Press Tools	McGraw Hill Book Company	1994
2.	Donaldson, Lecain and Goold	Tool Design	3rd Edition, Tata McGraw Hill	2000
3.	Hoffman	Jigs and Fixture Design	Thomson Delmar Learning, Singapore	2004
4.	David Spitler, Jeff Lantrip	Fundamentals of Tool Design	Society of Manufacturing Engineers	2003
5.	Hiram E Grant	Jigs and Fixture	Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi	2003

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21MEE15   CRYOGENIC ENGINEERING

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COURSEOBJECTIVES

- To learn about the cryogenic material properties and applications of cryogenics.
- To impart knowledge on Liquefaction cycles.
- To provide knowledge about gas separation and purification.
- To study the working of various cryo coolers.
- To learn about the construction of Dewar vessels and cryogenic instrumentation.

COURSE OUTCOMES

21MEE15.CO1	Explain the effect of material properties at cryogenic temperatures and applications of cryogens
21MEE15.CO2	Compute the figure of merit and yield of various liquefaction cycles
21MEE15.CO3	Assess the performance of rectification column for gas separation
21MEE15.CO4	Compare the Stirling, Gifford-McMahon and Pulse tube cry coolers based on power consumption, pressure ratio and Coefficient of Performance.
21MEE15.CO5	Explain the construction of Dewar vessels and cryogenic instrumentation

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEE15.CO1	X	X	X	-	-	X	-	-	-	-	-	X	-	-	X
21MEE15.CO2	X	X	-	X	X	X	-	-	-	-	-	X	-	-	X
21MEE15.CO3	X	-	X	X	X	-	-	-	-	-	-	X	-	-	X
21MEE15.CO4	X	X	-	-	-	-	-	-	-	-	-	X	-	-	X
21MEE15.CO5	X	X	-	-	-	-	-	-	-	-	-	X	-	-	X

UNIT I: INTRODUCTION TO CRYOGENICS   7

Insight on cryogenics - properties of cryogenic fluids - material properties at cryogenic temperatures - Applications of cryogenics in space programs, superconductivity, cryo metallurgy, biological and medical applications.

UNIT II: LIQUEFACTION CYCLES   9

Basics of Refrigeration - Methods of production of low temperatures - Joule Thompson expansion - inversion curve. Gas Liquefaction cycles - Carnot liquefaction cycle, Simple Linde Hampson cycle, Precooled Linde-Hampson cycle, Simple Claude cycle, Dual pressure Claude cycle - Figure of merit and yield of liquefaction cycle.

UNIT III: SEPARATION AND PURIFICATION SYSTEMS   9

Basics of Gas separation - Ideal separation of gases, characteristics of mixtures and the governing laws - T-C and H-C diagrams. Principle of Rectification - Rectification column - Theoretical plate calculations using McCabe-Thiele method, murphee efficiency. Gas purification.

UNIT IV: CRYOGENIC REFRIGERATORS   9

Cryocoolers - Fundamentals, classification, comparison and applications. Working of Stirling, Gifford-McMahon and Pulse tube cryocoolers.

UNIT V: STORAGE AND INSTRUMENTATION   9

Cryogenic Dewar vessels construction and design, cryogenic transfer Lines. Cryogenic insulation - vacuum, powder, multi layer, micro-sphere and foam-fibrous insulation - concept of vapour coated shields. Cryogenic instrumentation - temperature, flow and level measurements.

TOTAL: L:45 = 45

MECHANICAL ENGINEERING

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	MamataMukhopadhyay	Fundamental of Cryogenic Engineering	PHI learning Private Limited, New Delhi	2014
2	Thomas M. Flynn	Cryogenics Engineering	Marcel Dekker, New york	2005

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	G.G. Haselden	Cryogenics Fundamentals	Academic Press Inc., London	1999
2	K.D. Timmerhaus and T.M. Flynn	Cryogenics Process Engineering	Plenum Press, New York	1989
3	Randall F. Barron	Cryogenic System	Oxford University Press, New York	1985

21MEE16   LEAN MANUFACTURING

L T P C
3 0 0 3

COURSEOBJECTIVES

- Toacquirethegeneralknowledgetodeliverconsistentlyhighqualityandvalueaddedproduct sand services to the customer in a lean environment
- To understand the terminology relating to lean operations in both service and manufacturing organizations
- To understand various controlling and manufacturing techniques that effect lean manufacturing
- To comprehend the implementation process of lean manufacturing.
- To familiarize with the lean accounting system

COURSE OUTCOMES

21MEE16.CO1	Understand and apply the concept of lean thinking to the processes
21MEE16.CO2	Understand the work place organization process
21MEE16.CO3	Comprehend the various work flow and control techniques.
21MEE16.CO4	Illustrate various lean manufacturing techniques
21MEE16.CO5	Understand and analyze the manufacturing time and implementation of lean manufacturing

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEE16.CO1	X	X	X	-	-	X	-	-	-	-	-	X	-	-	X
21MEE16.CO2	X	X	-	X	X	X	-	-	-	-	-	X	-	-	X
21MEE16.CO3	X	-	X	X	X	-	-	-	-	-	-	X	-	-	X
21MEE16.CO4	X	X	-	-	-	-	-	-	-	-	-	X	-	-	X
21MEE16.CO5	X	X	-	-	-	-	-	-	-	-	-	X	-	-	X

UNIT I: INTRODUCTION   9
History–Evolution-Toyotaproductionsystem-Leanmanufacturingoverview.

UNIT II: ORGANIZATION OF WORK PLACE   9
Workplace organization- Visual controls-Pull production and cellular manufacturing- Value flow pull-Value and perfection lean

UNIT III: WORK FLOW AND CONTROL TECHNIQUES   9
Mapping the present–Mapping the future-Product and process development–Value stream analysis- Over production- Waiting- Work In Progress- Transportation- In appropriate processing-Excess motion or ergonomic problems-Defected products-Underutilization of employees.

UNIT IV: LEAN MANUFACTURING TECHNIQUES   9
Just In Time-Kanban tooling-Total Productive Maintenance–5S-SingleMinuteDieExchange-Lean six sigma.

UNIT V: IMPLEMENTATION OF LEAN MANUFACTURING   9
Flowcharting –Identifying and eliminating un necessary steps –Setup time- reduction approaches-Steps in implementing lean strategy–Lean accounting system.

TOTAL: L:45 = 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	DennisPHobbs	LeanManufacturingImplementation	J. RossPublications	2009
2	JayArthur	LeanSix-	TataMcGraw-	2009

MECHANICAL ENGINEERING

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	JeffreyKLiker	TheToyotaWay-14ManagementPrinciples	TataMcGraw-HillCompany,New Delhi	2015
2	PascalDennis	LeanProductionSimplified,	ProductivityPress, USA	2002
3	James PWomack, Daniel T. Jones	Lean Thinking: Banish waste and create wealth in your corporation	Simon&SchusterU K Limited,FreePress	2003
4	RichardJSchonb erger	WorldClassManufacturing	Sp FreePress	2003
5	Carreira B	Lean Manufacturing that Works	PHI	2007

21MEE17 ADVANCED METROLOGY

L T P C
3 0 0 3

COURSE OBJECTIVES
- Impart the knowledge on conceptualize fundamentals of metrology.
- Learn the advanced techniques used in metrology.
- Understand the various stage position metrology.
- Learn the working of sensors applied in inspection.
- Understand the various sensors using in instruments.

COURSE OUTCOMES
21MEE17.CO1	Understand the conceptualize fundamentals of metrology.
21MEE17.CO2	Explain the advanced techniques used in metrology.
21MEE17.CO3	Understand and demonstrate the stage position metrology.
21MEE17.CO4	Understand the working of sensors applied in inspection.
21MEE17.CO5	Describe the various sensors used in instruments.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEE17.CO1	X	X	X	X	-	X	-	-	-	-	-	X	X	-	X
21MEE17.CO2	X	X	X	X	-	X	-	-	-	-	-	X	-	-	-
21MEE17.CO3	X	X	X	X	-	X	-	-	-	-	-	X	X	X	-
21MEE17.CO4	X	X	X	X	-	X	-	-	-	-	-	X	-	X	X
21MEE17.CO5	X	X	X	X	-	X	-	-	-	-	-	X	X	X	X

UNIT I: INTRODUCTION 9
Laser Applications in Metrology: LASER light source, LASER interferometer, LASER alignment telescope, LASER micrometer, On-line and in-process measurements of diameter, Roundness and surface roughness using LASER, Micro holes and topography measurements, straightness and flatness measurement.

UNIT II: SPECIAL MEASURING INSTRUMENTS AND TECHNIQUES 9
Optoelectronic devices, contact and non-contact types, Applications in on-line and in-process monitoring systems, Tool wear measurement, Surface measurement, Machine vision, shape identification, Edge detection techniques, Normalisation, gray scale correlation, Template Techniques, Surface roughness using vision system, Interfacing robot and image processing system.

UNIT III: CO-ORDINATE MEASURING MACHINE 9
Types of CMM, Probes used, Applications, Non-contact CMM using electro optical sensors for dimensional metrology, Non-contact sensors for surface finish measurements, statistical evaluation of data using computer, Data integration of CMM and data logging in computers.

UNIT IV: STAGE POSITION METROLOGY 9
Introduction -Motorized linear and rotary stage-Drives for stage-Stage errors-Calibration of stages-Application and selection of micro/nano stages.

UNIT V: SENSORS IN INSPECTION 9
Manufacturing applications of photo detectors, deflection methods-beam detection, Reflex detection, & Proximity detection, Applications of Inductive and Capacitive proximity sensors, Understanding microwave sensing applications laser sensors and limit switches. Advanced sensor technology-Bar code systems, Principles and applications of Colour sensors, electro-magnetic identifier, Tactile sensors, Ultrasonic sensors, Odour sensors.

TOTAL: L:45 = 45

MECHANICAL ENGINEERING

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	T. Busch and R. Harlow Delmar	Fundamentals of dimensional Metrology	Delmar Publishers	2010
2	SabneSoloman	Sensors and Control systems in Manufacturing	McGraw Hill	2010

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	J. Watson Van Nostrand Rein	Optoelectronics	Hold (UK) Company	2015
2	Doebelin	Measurement systems: Applications & Design	International Student Edition	1975
3	Robert G. Seippel	Optoelectronics for Technology and Engineering	Prentice Hall India	1989
4	Ulrich-Rembold, Armbruster and Ulzmann Marcel	Interface Technology for Computer Controlled Manufacturing processes	Dekker Publications, NYC	1983
5	G. Thomas and G. Butter Worth	Engineering Metrology	Butterworth and Co., Ltd	-

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21MEE18   POWER PLANT ENGINEERING

L T P C
3 0 0 3

COURSE OBJECTIVES
- To provide an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.
- To understand about Thermal power plants and working
- To know about Diesel engine power plants and working
- To know the working of Nuclear power plants and other power plants
- To understand Environmental problems related to power plants

COURSE OUTCOMES
21MEE18.CO1	Comprehend the working principles of coal based thermal power plants
21MEE18.CO2	Illustrate the working principles of diesel, gas turbine and combined cycle power plants
21MEE18.CO3	Illustrate and explain the working principle and components of nuclear power plants
21MEE18.CO4	Explain the techniques to extract power from renewable energy sources
21MEE18.CO5	Understand the economic and environmental issues of power plants.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEE18.CO1	X	X	X	X	X	X	-	-	-	-	-	X	-	-	-
21MEE18.CO2	X	-	-	X	-	-	-	-	-	-	-	X	-	-	-
21MEE18.CO3	X	X	X	X	X	X	-	-	-	-	-	X	-	-	-
21MEE18.CO4	X	-	X	X	X	X	-	-	-	-	-	X	-	-	-
21MEE18.CO5	X	X	X	X	X	X	-	-	-	-	-	X	-	-	-

UNIT I: COAL BASED THERMAL POWER PLANTS   9
Rankine cycle - improvisations. Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

UNIT II: DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS   9
Otto, Diesel, Dual & Brayton Cycle - Analysis &Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT III: NUCLEAR POWER PLANTS   9
Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boiling Water Reactor(BWR), Pressurized Water Reactor(PWR), CANada Deuterium-Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measuresfor Nuclear Power plants.

UNIT IV: POWER FROM RENEWABLE ENERGY   9
Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar* Photo Voltaic (SPV), SolarThermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT V: ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS   9
Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria,relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

TOTAL : L: 45 =45

MECHANICAL ENGINEERING

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Nag. P.K.,	Power Plant Engineering	Tata McGraw – Hill	2010
2	C. Elanchezhian, L. Saravanakumar, B. VijayaRamnath	Power Plant Engineering	I.K.International Publishing house pvt ltd	2007

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	El-Wakil. M.M	Power Plant Technology	Tata McGraw – Hill Publishing Company Ltd.,	2010
2.	Thomas C. Elliott	Power Plant Engineering	Standard Handbook of McGraw – Hill	2003
3.	Godfrey Boyle	Renewable energy	Oxford University Press	2004
4	R.K.Rajput	Power Plant Engineering	LaxmiPublications	2016
5	S.C.AroraandS.Domkundwar	A COURSE in Power Plant Engineering	Dhanpatrai&Sons,	2008

21MEE19   ARTIFICIAL INTELLIGENCE   **L T P C**
                                                   3 0 0 3

COURSE OBJECTIVES
- To understand the various characteristics of intelligent agents.
- To learn about the different search strategies in AI.
- To learn to represent knowledge in solving AI problems.
- To understand the different ways of designing software agents.
- To know about the various applications of AI.

COURSE OUTCOMES
21MEE19.CO1   Use appropriate search algorithms for any AI problem.
21MEE19.CO2   Represent a problem using first order and predicate logic.
21MEE19.CO3   Provide the apt agent strategy to solve a given problem.
21MEE19.CO4   Design software agents to solve a problem.
21MEE19.CO5   Design applications for NLP that uses Artificial Intelligence.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEE19.CO1	X	X	X	-	-	X	X	-	-	X	-	X	-	X	-
21MEE19.CO2	X	-	X	-	-	X	X	-	-	X	-	-	-	X	-
21MEE19.CO3	X	X	X	-	-	X	X	-	-	X	-	X	-	X	-
21MEE19.CO4	-	-	X	-	-	X	X	-	-	X	-	-	-	X	-
21MEE19.CO5	X	X	X	-	-	X	X	-	-	X	-	X	-	X	-

UNIT I: INTRODUCTION   9
Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

UNIT II: PROBLEM SOLVING METHODS   9
Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing – Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games.

UNIT III: KNOWLEDGE REPRESENTATION   9
First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information.

UNIT IV: SOFTWARE AGENTS   9
Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

UNIT V: APPLICATIONS   9
AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving.

TOTAL: L: 45 = 45

MECHANICAL ENGINEERING

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S. Russell and P. Norvig.	Artificial Intelligence: A Modern Approach,	Prentice Hall, Third Edition,	2009.
2.	I. Bratko	Prolog: Programming for Artificial Intelligence	Addison-Wesley Educational Publishers Inc.,	2011

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M. Tim Jones	Artificial Intelligence: A Systems Approach	Jonesand Bartlett Publishers, Inc.	2008
2.	Nils J. Nilsson	The Quest for Artificial Intelligence	Cambridge University Press	2009
3	William F. Clocksin and Christopher S. Mellish	Programming in Prolog: Using the ISO Standard	Springer	2003
4	Gerhard Weiss	Multi Agent Systems	MIT Press	2013
5	David L. Poole and Alan K. Mackworth	Artificial Intelligence: Foundations of Computational Agents	Cambridge University Press	2010

21MEE20   MEMS   L T P C
                                                            3 0 0 3

COURSE OBJECTIVES

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices
- To educate on the rudiments of micro fabrication techniques
- To introduce various sensors and actuators
- To introduce different materials used for MEMS.
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

COURSE OUTCOMES

21MEE20.CO1	Describe new applications and directions of modern engineering
21MEE20.CO2	Ability to understand the sensors and actuators-I.
21MEE20.CO3	Ability to understand the sensors and actuators-II.
21MEE20.CO4	Critically analyze Microsystems and Micromachining technology for technical feasibility as well as practicality.
21MEE20.CO5	Ability to understand the Polymers and Optical MEMS

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEE20.CO1	X	X	X	X	X	-	-	-	X	X	-	X	-	X	-
21MEE20.CO2	X	X	X	X	X	-	-	-	X	X	-	X	-	X	-
21MEE20.CO3	X	X	X	X	X	-	-	-	X	X	-	X	-	X	-
21MEE20.CO4	X	X	X	X	X	-	-	-	X	X	-	X	-	X	-
21MEE20.CO5	X	X	X	X	X	-	-	-	X	X	-	X	-	X	-

UNIT I: INTRODUCTION TO PROCESS PLANNING   9
Intrinsic Characteristics of MEMS-Energy Domains and Transducers-Sensors and Actuators-Introduction to Micro fabrication-Silicon based MEMS processes-New Materials-Review of Electrical and Mechanical Concepts of MEMS-Semiconductor devices-Stress and Strain analysis-Flexural beam bending-Torsional deflection

UNIT II: SENSORS AND ACTUATORS-I   9
Electrostatic sensors-Parallel plate capacitors-Applications-Interdigitated Finger capacitor-Comb drive devices-Micro Grippers-Micro Motors-Thermal Sensing and actuation- Thermal expansion-Thermal couples-Thermal resistors-Thermal Bimorph-Applications-Magnetic Actuators-Micromagnetic components

UNIT III: SENSORS AND ACTUATORS-II   9
Piezoresistive sensors-Piezoresistive sensor materials-Stress analysis mechanical elements-Applications to inertia,Pressure,Tactile and Flow sensors-Piezoelectric sensors and actuators-piezoelectric effects-piezoelectric materials-Application to inertia,Acoustic,Tactile and Flow sensors

UNIT IV: MICROMACHINING   9
Silicon Anisotropic Etching-Anisotrophic Wet Etching-Dry Etching of Silicon-Plasma Etching-Deep Reaction Ion Etching(DRIE)-Isotropic Wet Etching-Gas Phase Etchants-Case studies-Basic surface micro machining processes-Structural and Sacrificial Materials-Acceleration of Sacrificial Etch-Assembly of 3D MEMS-Foundary process

UNIT V: POLYMER AND OPTICAL MEMS   9
Polymers in MEMS-Polimide-SU-8-Liquid Crystal Polymer(LCP)-PDMS-PMMA-Parylene-Fluorocation-Application to Acceleration, Pressure,Flow and Tactile sensors-Optical MEMS-Lenses and Mirrors-Actuators for Active Optical MEMS

TOTAL: L: 45 = 45

MECHANICAL ENGINEERING

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Chang Liu	Foundations of MEMS	Pearson Education	2006
2.	Stephen D Senturia	Microsystem Design	Springer Publication	2000

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	NadimMaluf	An Introduction to Micro Electro Mechanical System Design	Artech House	2000
2.	Mohamed Gad-el-Hal	The MEMS Handbook	CRC press Baco Raton	2000
3	Tai Ran Hsu	MEMS&Micro systems Design and Manufacture	Tata McGraw Hill	2002
4	E. H. Tay, Francis and W. O. Choong	Micrfluids and Bio MEMS applications	Springer	2002
5	Gardner, W. Julian, K. Varadan Vijay and O. Awadelkarim, Osama	Micro sensors MEMS and Smart Devices	Jhon Wiley & Sons Ltd	2001

21MEE21   WELDING TECHNOLOGY

L T P C
3 0 0 3

COURSE OBJECTIVES
- To provide knowledge of construction and working principles of gas and arc welding process.
- To educate various resistance welding processes.
- To introduce various construction and working principles of various solid-state welding processes.
- To introduce various special welding processes.
- To educate concepts on weld joint design, weldability and testing of weldments.

COURSE OUTCOMES
21MEE21.CO1	Understand the construction and working principles of gas and arc welding process.
21MEE21.CO2	Explain the construction and working principles of resistance welding process.
21MEE21.CO3	Illustrate the construction and working principles of various solid-state welding process.
21MEE21.CO4	Recognize the construction and working principles of various special welding processes.
21MEE21.CO5	Understand the concepts on weld joint design, weldability and testing of weldments.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEE21.CO1	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-
21MEE21.CO2	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-
21MEE21.CO3	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-
21MEE21.CO4	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-
21MEE21.CO5	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-

UNIT I: GAS AND ARC WELDING PROCESSES   9
Fundamental principles – Air Acetylene welding. Oxyacetylene welding, Carbon arc welding, Shielded metal arc welding, Submerged arc welding, TIG & MIG welding, Plasma arc welding and Electroslag welding processes - advantages. limitations and applications.

UNIT II: RESISTANCE WELDING PROCESSES   9
Cold welding. Diffusion bonding. Explosive welding, Ultrasonic welding, Friction welding, Forge welding, Roll welding and Hot pressure welding processes - advantages, limitations and applications.

UNIT III: SOLID STATE WELDING PROCESSES   9
Piezoresistive sensors-Piezoresistive sensor materials-Stress analysis mechanical elements-Applications to inertia,Pressure,Tactile and Flow sensors-Piezoelectric sensors and actuators-piezoelectric effects-piezoelectric materials-Application to inertia,Acoustic,Tactile and Flow sensors

UNIT IV: OTHER WELDING PROCESSES   9
Silicon Anisotropic Etching-Anisotrophic Wet Etching-Dry Etching of Silicon-Plasma Etching-Deep Reaction Ion Etching(DRIE)-Isotropic Wet Etching-Gas Phase Etchants-Case studies-Basic surface micro machining processes-Structural and Sacrificial Materials-Acceleration of Sacrificial Etch-Assembly of 3D MEMS-Foundary process

UNIT V: DESIGN OF WELD JOINTS, WELDABILITY AND TESTING OF WELDMENTS   9
Various weld joint designs – Welding defects – causes and remedies - Weldability of Aluminium, Copper, and Stainless steels. Destructive and non-destructive testing of weldments

TOTAL: L: 45 = 45

MECHANICAL ENGINEERING

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Little R.L.	Welding and welding Technology	McGraw Hill Publishing Co., Ltd., New Delhi	2008
2.	Parmer R.S.	Welding Engineering and Technology	Khanna Publishers, New Delhi.	2008

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Nadkarni S.V	Modern Arc Welding Technology	Oxford IBH Publishers	2005
2	AWS	Welding Hand Book Vol- 2 : Welding Process	AWS	-
3.	Christopher Davis	Laser Welding- Practical Guide	Jaico Publishing House	-
4	Davis A.C.	The Science and Practice of Welding	Cambridge University Press, Cambridge	-
5	Tylecote R.F.	The Solid Phase Welding of Metals	Edward Arnold Publishers Ltd. London	-

Employability Enhancement Courses (EEC)

For

Mechanical Engineering

21MES01 PROJECT WORK PHASE -I

L T P C
0 0 6 3

COURSEOBJECTIVES
* To achieve integrated mechanical design of a product through parts design, assembly and preparation of manufacturing drawings

COURSE OUTCOMES

21MES01.CO1	Choose an engineering problem in a current industrial scenario.
21MES01.CO2	Do related literature review
21MES01.CO3	Do intensive literature review
21MES01.CO4	Decide the working methodology of the project
21MES01.CO5	Make an analysis and produce a report over it

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MES01.CO1	X	.	X	X	X	-	-	-	X	X	X	X	X	X	X
21MES01.CO2	X	-	X	-	-	-	-	-	X	X	X	-	X	X	X
21MES01.CO3	X	-	-	X	X	X	-	-	X	X	X	.	X	X	X
21MES01.CO4	-	-	-	-	X	-	-	-	X	X	X	-	X	-	-
21MES01.CO5	X	-	-	-	-	-	-	-	X	X	X	-	X	-	-

Students are asked to form a team which consists of 4 members, maximum. Each team has to work under a project supervisor. Based on the current industrial scenario, any relevant problem should be selected for the project with the consultation of the supervisor. Literature review should be done related to the problem considered. The working methodology of the project work for the phase II should be decided. These activities should be registered in a report and submitted by the student which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report, jointly by external and internal examiners.

TOTAL: P:90 = 90

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21MES02 PROJECT WORK PHASE -II

L T P C
0 0 20 10

COURSE OBJECTIVES

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

COURSE OUTCOMES

21MES02.CO1	Apply knowledge and demonstrate to manage project in multi-disciplinary.
21MES02.CO2	Design and conduct experiments to interpret data pertaining to engineering problems
21MES02.CO3	Apply contextual knowledge to assess social, health and cultural issues and endue to professional engineering practice.
21MES02.CO4	Prepare documentation and presentation for engineering activities for society
21MES02.CO5	Perform effectively as leader in multi-disciplinary terms.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MES02.CO1	X	X	X	X	X	-	-	-	X	X	X	X	X	X	X
21MES02.CO2	-	X	X	-	-	X	-	-	X	X	X	-	X	X	X
21MES02.CO3	-	-	-	X	X	X	-	-	X	X	X	-	X	X	X
21MES02.CO4	-	-	-	-	X	-	-	-	X	X	X	-	X	-	-
21MES02.CO5	-	-	-	-	-	-	-	-	X	X	X	-	X	-	-

Based on the work methodology decided in the Phase I, the project is further developed. Necessary modeling and analysis is done using required software. The project is fabricated. The analytical results and the experimental results are validated. Three reviews will be conducted periodically by a committee constituted by the Head of the Department. A project report to be prepared by the students along with which the project has to be submitted for the final viva voce examination

TOTAL: P: 300 =300

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21MES03 VALUE ADDED COURSE /INTERNSHIP

L T P C
0 0 2 1

COURSE OBJECTIVES
- To provide students an understanding of the expectations of industry.
- To improve employability skills
- To bridge the skill gaps and make students industry ready.
- To provide an opportunity to develop inter-disciplinary skills.

COURSE OUTCOMES
21MES03.CO1	To understand the expectations of industry.
21MES03.CO2	To apply employability skills.
21MES03.CO3	To apply the skill industry ready.
21MES03.CO4	To use inter-disciplinary skills.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MES03.CO1	X	-	-	-	-	X	X	X	X	X	-	X	-	X	-
21MES03.CO2	X	-	-	-	-	X	X	X	X	X	-	X	-	X	-
21MES03.CO3	X	X	X	X	-	X	X	X	X	X	-	X	-	X	-
21MES03.CO4	X	X	X	X	-	X	X	X	X	X	-	X	-	X	-

Value Added Courses
- Fusion 360
- Modeling Software
- Analysis Software
- GRE/ GATE
- DFMA
- 3D Printing
- PLC
- Optimization

Internship Training
- Inplant Training in Industry.
- Training from Industry.
- Solve the Problems from Industry.
- Do the Project in Industry.

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21MES04	INTERDISCIPLINARYPROJECT	L T P C
		0 0 3 1

COURSEOBJECTIVES

- Todeveloptheabilitytosolveaspecificproblemrightfromitsidentificationandliterature reviewtillthesuccessfulsolutionofthesame.
- Totrainthestudentsinpreparingprojectreports and tofacereviewsandvivavoceexamination.

COURSE OUTCOMES

21MES04.CO1	Apply knowledge and demonstrate to manage project in inter-disciplinary.
21MES04.CO2	Design and conduct experiments to interpret data pertaining to engineering problems.
21MES04.CO3	Apply contextual knowledge to assess social, health and cultural issues and endue to professional engineering practice.
21MES04.CO4	Prepare documentation and presentation for engineering activities for society
21MES04.CO5	Perform effectively as leader in inter-disciplinary terms.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MES04.CO1	X	X	X	X	X	-	-	-	X	X	X	X	X	X	X
21MES04.CO2	-	X	X	-	-	X	-	-	X	X	X	-	X	X	X
21MES04.CO3	-	-	-	X	X	X	-	-	X	X	X	-	X	X	X
21MES04.CO4	-	-	-	-	X	-	-	-	X	X	X	-	X	-	-
21MES04.CO5	-	-	-	-	-	-	-	-	X	X	X	-	X	-	-

Based on the work methodology decided in the Phase I, the project is further developed. Necessary modeling and analysis is done using required software. The project is fabricated. The analytical results and the experimental results are validated. Three reviews will be conducted periodically by a committee constituted by the Head of the Department. A project report to be prepared by the students along with which the project has to be submitted for the final viva voce examination

TOTAL: T: 45 = 45

Chairman-Board of Studies
Department of Mechanical Engineering
MUTHAYAMMAL ENGINEERING COLLEGE
(AUTONOMOUS)
RASIPURAM-637 408, NAMAKKAL Dist.

21MES05   CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS L T P C
3 0 0 0

COURSEOBJECTIVES
- To create an awareness on Engineering Ethics and Human Values.
- To instill Moral and Social Values and Loyalty.
- To Create awareness among engineers about their social responsibilities
- To Appreciate the Ethical issues
- To Know the Human rights and concept of women empowerment
- To know features of our constitution.

COURSE OUTCOMES

21MES05.CO1	Practice the moral values that ought to guide the Engineering profession.
21MES05.CO2	Discover of the set of justified moral principles of obligation, ideals that ought to be endorsed by the engineers and apply them to concrete situations
21MES05.CO3	Know the definitions of risk and safety also discover different factors that affect the perception of risk
21MES05.CO4	Appreciate the Ethical issues and Know the code of ethics adopted in various professional body's and industries
21MES05.CO5	Justify the need for protection of human rights and to know about concept of women empowerment
21MES05.CO6	Know the successful functioning of democracy in India.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MES05.CO1	X	-	-	-	-	X	X	X	X	X	-	X	-	X	-
21MES05.CO2	X	-	-	-	-	X	X	X	X	X	-	X	-	X	-
21MES05.CO3	X	X	X	X	-	X	X	X	X	X	-	X	-	X	-
21MES05.CO4	X	X	X	X	-	X	X	X	X	X	-	X	-	X	-
21MES05.CO5	X	X	-	-	X	X	X	X	X	X	X	X	-	X	-

UNITI: HUMAN VALUES   9
Professional Ethics-Objectives of study of professional ethics-Human values- Definition of Morals and Ethics-Difference between Morality and Ethics-Values-Definition-Types of valuesDefinition of Integrity-Concept of Work Ethic- Service Learning- Definition Virtues-DefinitionCivic Virtue-Duties and Rights - Respect for Others – Attitude and values, opinions-changing attitude-beliefs-Reliability-Living Peacefully-Means to be adopted for leavingpeacefully-CaringSharing-Honesty-ValuingTime-Co-operation-Commitment-Empathy-Self-ConfidenceSpirituality.

UNTII: ENGINEERING ETHICS   8
Engineering ethics-Definition-Approach-Senses of Engineering Ethics-variety of moral issues–Inquiry-Types-Moral dilemmas-Steps to solve dilemma-Moral autonomy –Definition-consensus & controversy –Profession-Definition–Ethical theories-Theories about right action Personality–Self control- Self-interest –Self respect.

UNITIII: SAFETY, RESPONSIBILITIES OF ENGINEERS   6
Safety and risk-definition- - assessment of safety and risk - risk benefit analysis and reducing risk –Personal risk-Public risk-Reducing risk-Voluntary Risk-Collegiality and loyalty– Authority Types-collective bargaining -occupational crime –Responsibilityofengineers–Types – Socialresponsibility-Professional responsibility-confidentiality-conflicts of interest-liability.

UNIT IV: ETHICAL ISSUES IN ENGINEERING PRACTICE   6
Ethical issues–Industrial standards-Environmental ethics –Plastic waste disposal-E-Waste Disposal-Semi conductor waste Disposal-Industrial waste disposal-Human centred environmental ethics- computer ethics –Types of issues-Computer as the Instrument and Object of Unethical Acts -Engineers as managers-Codes of ethics-Sample code of Ethics like -Institution of Engineers(India)-Institute of Electrical & Electronics engineers- Institute of Electronics & Telecommunication Engineers - Indian Institute of Materials Management.

UNIT V: HUMAN RIGHTS   8

Human Rights-Definition-constitutional provisions-right to life and liberty-Human Rights of
Women-Discrimination against women- steps that are to be taken to eliminate discrimination
against women in Education, employment, health care, Economic and social life, Women in rural
areas- Status of Women in India - Constitutional Safeguards - Dowry Prohibition act 1961- Domestic
violence act 2005- Sexual harassment at work place bill 2006-Human Rights of
Children- Who is a child- list the Rights of the Child- Right to education--Protection of Children
from Sexual Offences Act(POCSO)-2012- National Human Rights Commission- Constitution Powers and
function of the Commission-Employee rights- Provisions made-Contractual-Non contractual employee
rights-Whistle blowing-definition-Aspects-Intellectual Property Rights (IPR)–Meaning-Need for
protection- Briefly description of concept of patents, Copy right, Trade mark.

UNIT VI: INDIAN CONSTITUTION   8

Introduction to constitution of India-Formation and Composition of the Constituent Assembly Salient
features of the Constitution-Preamble to the Indian Constitution Fundamental Rights Fundamental Duties-
Directive principles of state policy. Parliamentary system of governance- Structure of Parliament-
Lokhasabha and Rajyasabha -Functions of parliament- Legislative ,Executive, Financial Function, Powers
of Loksabha and Rajya Sabha- Procedure followed in parliament in making law-Structure of union
executive Power and position of President, Vice President, Prime minister and council of ministers.
Structure of the judiciary: Jurisdiction and functions of Supreme Court, high court, and subordinate courts
Federalism in the Indian constitution, Division of Powers- Union list, State list and concurrent list,
Structure of state legislation, Legislative assembly and Legislative council, Functions of state legislature,
Structure of state executive-Powers and positions of Governor, ,Speaker, Deputy Speaker, Chief Minister
and council of minister. Local self government- meaning-Threetiersystem-Villagepanchayath-
TalukpanchayathZillapanchayath-Local   bodies-Municipalities   and   Corporations,
BruhathmahanagaraPalike. Functions of Election commission, UPSC, KPSC.

TOTAL: T: 45 = 45

MECHANICAL ENGINEERING

21MES06   **ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE**   **L T P C**
                                                                3 0 0 0

COURSE OBJECTIVES

- The course aims at imparting basic principles of thought process, reasoning and inferencing.
- Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
- Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
- The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.

COURSE OUTCOMES

21MES06.CO1   To understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MES06.CO1	X	-	-	-	-	X	X	X	X	X	-	X	-	X	-

Basic Structure of Indian Knowledge System - Modern Science and Indian Knowledge System - Yoga and Holistic Health care - Case Studies.

TOTAL: T: 45 = 45