ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

REGULATIONS - 2019

CHOICE BASED CREDIT SYSTEM

B.E. MECHANICAL ENGINEERING

THE VISION OF THE DEPARTMENT OF MECHANICAL ENGINEERING

Department of Mechanical Engineering strives to be recognized globally for excelling in Engineering education and research leading to innovative, entrepreneurial and competent Graduates in Mechanical Engineering and allied disciplines.

THE MISSION OF THE DEPARTMENT OF MECHANICAL ENGINEERING

1. To provide a world-class education through the conduct of pioneering and cutting-edge research that inculcate professional, technical, critical-thinking, and communication skills necessary for students and faculty to make impactful contributions to society.
2. To create future leaders in the science and art of mechanical and allied engineering streams.
3. To expand the frontiers of engineering science and to encourage technological innovation while fostering academic excellence and scholarly learning in a collegial environment.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The PEOs of the Mechanical Engineering Programme are to make our students

1. To achieve success in careers that deal with the design, simulation and analysis of engineering systems, experimentation and testing, manufacturing, technical services, and research.
2. To communicate effectively with peers, and updating and adapting their core knowledge and abilities to ethically compete in the ever-changing multicultural global enterprise.
3. To conduct multi-disciplinary research and development (via graduate study or industry) resulting in tangible applications that advance technology and foster innovation in order to compete successfully in the global economy.
4. To exchange and apply knowledge to create new opportunities that advance our society and proactively address through team efforts to solve a variety of technical, environmental and societal problems.
5. To actively embrace impactful leadership roles in the practice of Mechanical Engineering in industry and government organizations (including both traditional and emerging technical areas) as well as in public service organizations.

PROGRAMME OUTCOMES (POs):

On successful completion of the Mechanical Engineering Degree programme, the Graduates shall exhibit the following:

PO	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply knowledge of mathematics, basic science and engineering science.

2	Problem analysis	Identify, formulate and solve engineering problems.
3	Design/development of solutions	Design a system or process to improve its performance, satisfying its constraints.
4	Conduct investigations of complex problems	Conduct experiments & collect, analyze and interpret the data.
5	Modern tool usage	Apply various tools and techniques to improve the efficiency of the system.
6	The Engineer and society	Conduct themselves to uphold the professional and social obligations.
7	Environment and sustainability	Design the system with environment consciousness and sustainable development.
8	Ethics	Interacting industry, business and society in a professional and ethical manner.
9	Individual and team work	Function in a multidisciplinary team.
10	Communication	Proficiency in oral and written Communication.
11	Project management and finance	Implement cost effective and improved system.
12	Life-long learning	Continue professional development and learning as a life-long activity.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

On successful completion of the Mechanical Engineering Degree programme, the Graduates shall exhibit the following:

1. Understand, analyze, apply, design and develop engineering systems adopting thermal, design and manufacturing concepts.
2. Utilize computational and design tools for efficient product development.
3. Apply the acquired knowledge for innovative solutions to cater societal needs and industrial problems.

PEO / PO Mapping:

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
I	✓	✓	✓	✓	✓			✓				
II								✓	✓	✓	✓	✓
III								✓	✓	✓	✓	✓
IV	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

MAPPING OF COURSE OUTCOME AND POs and PSOs

COURSE NAME	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
YEAR-1/SEM-1															
Technical English						3				3					
Engineering Mathematics - I	3	2	2	2	1	1	0	1	1	1	0	2	3	1	1
Engineering Physics	3	2	3	2	2	1	1	1	0	0	0	2	3	1	1
Engineering Chemistry	3	2	1	1	2	0	0	0	1	1	0	0	3	1	1
Engineering Graphics	3	0	1	0	2.4	0	0	0	0	2	0	2	2	2.2	0.4
Basic Sciences Laboratory	3	2	3	2	3	0	0	0	2	0	0	0	3	1	1
Workshop Practices Laboratory	3	2	0	0	1	0	0.6	0	0	0	0	3	2.6	2.6	1
YEAR-1/SEM-2															
Engineering Mathematics - II	3	3	3	3	1	1		1	1	1		2	3	1	1
Manufacturing Processes	3	3	2	0	0	0	0	0	0	0	0	1	3	0	0
Problem Solving and Python Programming	2	3	2	1	3	2	2	1	2	1	2	3	3	1	1
Basics of Electrical and Electronics Engineering	2.8	2.75	2.8	2.8	2.8						3	3			
Engineering Mechanics	3	2	2.6	1	2.6	0	0	0	0	0	0	2	3	1	2.6
Fluid Mechanics and Machinery	3	3	2.8	2.6	1	1.4	1	2	1	2	1	2.4	3	2.2	2.6
Problem Solving and Python Programming Laboratory	3	2	2	1	3	2	2	1	2	1	2	2	2	2	2
Electrical and Electronics Engineering Laboratory	2.67	2.67	2.67	2.67								3			
YEAR-2/SEM-3															
Transform Techniques and Partial Differential Equations	3	2.6	1.6	1.6	1	1		1	1	1		1.6	1	2	1
Mechanics of Materials	3	3	2	1	0	0	0	0	0	0	0	0	3	2	0
Engineering Thermodynamics	3	3	2	1	0.2	0.4	0.6	0	0	0	0	1	2	1.4	0.2
Computer Aided Design	2	1	3	1	3	0	0	1	0	3	1	3	2	1	2
Engineering Materials and Metallurgy	3	1.4	2	0.4	0	0.6	0.2	0	0	0	0	2	2	2	1
Strength of Materials and Fluid Machinery Laboratory	2.8	2.6	1.6	3	1	2.6	1	2	1	2	1	2	2.8	1.6	1
Computer Aided Machine Drawing	3	3	3	0	3	0	0	1	1	2	1	3	2	0	2
YEAR-2/SEM-4															
Hydraulics and Pneumatics	3	2.6	2.2	2	1.8	1.6	2.2	1.2	1.6	1.8	1	2.2	3	1.8	1.6
Theory of Machines	3	2	2	1	2	0	0	1	0	0	0	1	3	0	1
Metal Cutting and Machine Tools	3	3	2.8	1	1	1	3	0	0	3	0	2	3	2.2	2.2
Applied Thermodynamics	2.8	2	1.4	0.8	0	0	0.6	0	0	0	0	1	2	1.8	0

Manufacturing Technology Laboratory	3	2.4	3	0	0	2	2	1	3	3	0	1	3	3	2
Computer Aided Manufacturing Laboratory	2.2	1.8	2.4	2.2	1.8	1	0.4	0	0.8	0	0.8	0.2	1	2.4	2.6
YEAR-3/SEM-5															
Total Quality Management		1.2	0.6		1.2	1.8	1.2	1.2	0.6			1.8			
Design of Machine elements	2	2	3	2	1	0	0	1	0	0	0	2	3	0	2
Metrology and Measurements	1.4	1.4	1	2.4	1	0.6	1	0.4	0.8	0.4	1.8	0.2	3	2.8	2.6
Thermal Engineering	3	2	1.6	1.4	0	0	0.4	0	0	0	0	1	1.8	1.4	0
Metrology and Dynamics Laboratory	1.2	2	2	2.6	0.8	1.2	1.6	0.4	0.8	1.2	1.2	0.4	2	1.2	2
Thermal Engineering Laboratory	3	2	2	0	0	0	1	0	0	1	0	1	3	2	1
IndustrialTraining/Internship*	2	2	2	2	2	1	1	2	3	3	3	2	3	2	2
YEAR-3/SEM-6															
Design of Transmission Systems	2	2	3	2	1	0	0	1	0	0	0	2	3	0	2
Environmental Sciences	2.2	1.8	1.5		1.5	2	2.8	2		2					
Heat and Mass transfer	3	3	2.2	2	0.8	0	0	0	0	0	0	1	3	2	0.4
Heat Transfer and Refrigeration and Air-conditioning Laboratory	3	2	2	1	0.4	0.2	0	0	0	0	0	1	2	2	0.4
Geometric Modeling and Simulation Laboratory	2	3	3	1.8	3	0	0	1	1	1	0	1	3	0	3
YEAR-4/SEM-7															
Energy Conversion Techniques	3	0.8	0.8	0.4	0	0	0.8	0	0	0	0	1	2.1	0.8	0
Finite Element Analysis	3	3	2	2	2	0	0	1	0	0	2	2	3	0	1
Computer Integrated Manufacturing	3	3	2.6	1.8	0	0	0	0	0	0	0	1	2	1	0
Mechatronics	3	1.8	1.8	1.6	1.8	0	0	0	1	0	0	0.4	2.8	1.6	2.2
Mechatronics Laboratory	3	1	2	2	2.4	0	1	0	3	0	2	2	2.4	2.4	2.4
Project I (Design and Fabrication)	3	3	3	2	2	1	1	2	3	3	3	2	3	2	2
YEAR-4/SEM-8															
Project II	3	3	3	2	2	1	1	2	3	3	3	2	3	2	2

ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

B.E. MECHANICAL ENGINEERING

REGULATIONS - 2019

CHOICE BASED CREDIT SYSTEM

CURRICULA AND SYLLABI FOR I TO VIII SEMESTERS

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	HS5151	Technical English	HSMC	4	0	0	4	4
2.	MA5158	Engineering Mathematics - I	BSC	3	1	0	4	4
3.	PH5151	Engineering Physics	BSC	3	0	0	3	3
4.	CY5151	Engineering Chemistry	BSC	3	0	0	3	3
5.	GE5151	Engineering Graphics	ESC	1	0	4	5	3
PRACTICALS								
6.	BS5161	Basic Sciences Laboratory	BSC	0	0	4	4	2
7.	GE5162	Workshop Practices Laboratory	ESC	0	0	4	4	2
			TOTAL	**14**	**1**	**12**	**27**	**21**

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA5252	Engineering Mathematics - II	BSC	3	1	0	4	4
2.	ME5251	Manufacturing Processes	BSC	3	0	0	3	3
3.	GE5153	Problem Solving and Python Programming	ESC	3	0	0	3	3
4.	EE5251	Basics of Electrical and Electronics Engineering	ESC	3	0	0	3	3
5.	GE5152	Engineering Mechanics	ESC	3	1	0	4	4
6.	CE5251	Fluid Mechanics and Machinery	PCC	3	0	0	3	3
PRACTICALS								
7.	GE5161	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
8.	EE5261	Electrical and Electronics Engineering Laboratory	ESC	0	0	4	4	2
			TOTAL	**18**	**2**	**8**	**28**	**24**

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Elective – Humanities I	HSMC	3	0	0	3	3
2.	MA5355	Transform Techniques and Partial Differential Equations	BSC	3	1	0	4	4
3.	ML5352	Mechanics of Materials	ESC	3	0	0	3	3
4.	ME5301	Engineering Thermodynamics	PCC	3	0	0	3	3
5.	ME5351	Computer Aided Design	PCC	3	0	0	3	3
6.	ML5351	Engineering Materials and Metallurgy	PCC	3	0	0	3	3
PRACTICALS								
7.	CE5361	Strength of Materials and Fluid Machinery Laboratory	ESC	0	0	4	4	2
8.	ME5361	Computer Aided Machine Drawing	PCC	0	0	4	4	2
			TOTAL	**18**	**1**	**8**	**27**	**23**

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Elective – Humanities II	HSMC	3	0	0	3	3
2.	ME5451	Hydraulics and Pneumatics	PCC	3	0	0	3	3
3.	ME5401	Theory of Machines	PCC	3	1	0	4	4
4.	ME5402	Metal Cutting and Machine Tools	PCC	3	0	0	3	3
5.	ME5403	Applied Thermodynamics	PCC	3	0	0	3	3
PRACTICALS								
6.	ME5461	Manufacturing Technology Laboratory	PCC	0	0	4	4	2
7.	ME5411	Computer Aided Manufacturing Laboratory	PCC	0	0	4	4	2
			TOTAL	**15**	**1**	**8**	**24**	**20**

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	GE5451	Total Quality Management	HSMC	3	0	0	3	3

2.	ME5551	Design of Machine elements	PCC	3	0	0	3	3
3.	ME5552	Metrology and Measurements	PCC	3	0	0	3	3
4.	ME5501	Thermal Engineering	PCC	3	0	0	3	3
5.		Professional Elective - I	PEC	3	0	0	3	3
6.		Audit Course – I*	AC	3	0	0	3	0
PRACTICALS								
7.	ME5511	Metrology and Dynamics Laboratory	PCC	0	0	4	4	2
8.	ME5512	Thermal Engineering Laboratory	PCC	0	0	4	4	2
9.	ME5513	IndustrialTraining/Internship*	EEC	0	0	4	4	2
			TOTAL	**18**	**0**	**12**	**30**	**21**

*****Audit Course is optional.

* The students will undergo industrial training / Internship during previous vacation

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	ME5601	Design of Transmission Systems	PCC	3	0	0	3	3
2.	GE5251	Environmental Sciences	BSC	3	0	0	3	3
3.	ME5651	Heat and Mass transfer	PCC	3	0	0	3	3
4.		Professional Elective – II	PEC	3	0	0	3	3
5.		Professional Elective - III	PEC	3	0	0	3	3
6.		Open Elective - I	OEC	3	0	0	3	3
7.		Audit Course – II*	AC	3	0	0	3	0
PRACTICALS								
8.	ME5611	Heat Transfer and Refrigeration and Air-conditioning Laboratory	PCC	0	0	4	4	2
9.	ME5612	Geometric Modeling and Simulation Laboratory	PCC	0	0	4	4	2
			TOTAL	**21**	**0**	**8**	**29**	**22**

*****Audit Course is optional.

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	ME5701	Energy Conversion Techniques	PCC	3	0	0	3	3
2.	ME5751	Finite Element Analysis	PCC	3	0	0	3	3
3.	ME5702	Computer Integrated Manufacturing	PCC	3	0	0	3	3
4.	ME5752	Mechatronics	PCC	3	0	0	3	3

5.		Professional Elective – IV	PEC	3	0	0	3	3
6.		Open Elective - II	OEC	3	0	0	3	3
PRACTICALS								
7.	ME5761	Mechatronics Laboratory	PCC	0	0	4	4	2
8.	ME5711	Project I (Design and Fabrication)	EEC	0	0	6	6	3
			TOTAL	**18**	**0**	**10**	**28**	**23**

SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Professional Elective - V	PEC	3	0	0	3	3
2.		Professional Elective - VI	PEC	3	0	0	3	3
PRACTICALS								
3.	ME5811	Project II	EEC	0	0	16	16	8
			TOTAL	**6**	**0**	**16**	**22**	**14**

TOTAL : 168 CREDITS

HUMANITIES AND SOCIAL SCIENCES (HSMC) – MANAGEMENT AND OTHERS

Sl. No.	Course Code	Course Title	Category	Periods per week			Credits	Semester
				L	T	P		
1.	HS5151	Technical English	HSMC	4	0	0	4	1
2.	GE5451	Total Quality Management	HSMC	3	0	0	3	5

HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

Sl. No	Course Code	Course Title	Periods per week			Credits
			Lecture	Tutorial	Practical	
1.	HU5171	Language and Communication	3	0	0	3
2.	HU5172	Values and Ethics	3	0	0	3
3.	HU5173	Human Relations at Work	3	0	0	3
4.	HU5174	Psychological Processes	3	0	0	3

5.	HU5175	Education, Technology and Society	3	0	0	3
6.	HU5176	Philosophy	3	0	0	3
7.	HU5177	Applications of Psychology in Everyday Life	3	0	0	3

HSMC– ELECTIVES – HUMANITIES II (EVEN SEMESTER)

Sl. No	Course Code	Course Title	Periods per week			Credits
			Lecture	Tutorial	Practical	
1.	HU5271	Gender Culture and Development	3	0	0	3
2.	HU5272	Ethics and Holistic Life	3	0	0	3
3.	HU5273	Law and Engineering	3	0	0	3
4.	HU5274	Film Appreciation	3	0	0	3
5.	HU5275	Fundamentals of Language and Linguistics	3	0	0	3
6.	HU5276	Understanding Society and Culture through Literature	3	0	0	3

BASIC SCIENCE COURSE (BSC)

Sl. No.	Course Code	Course Title	Category	Periods per week			Credits	Semester
				L	T	P		
1.	MA5158	Engineering Mathematics - I	BSC	3	1	0	4	1
2.	PH5151	Engineering Physics	BSC	3	0	0	3	1
3.	CY5151	Engineering Chemistry	BSC	3	0	0	3	1
4.	BS5161	Basic Sciences Laboratory	BSC	0	0	4	2	1
5.	MA5252	Engineering Mathematics - II	BSC	3	1	0	4	2
6.	ME5251	Manufacturing Processes	BSC	3	0	0	3	2
7.	MA5355	Transform Techniques and Partial Differential Equations	BSC	3	1	0	4	3
8.	GE5251	Environmental Sciences	BSC	3	0	0	3	6

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Sl. No.	Course Code	Course Title	Category	Periods per week			Credits	Semester
				L	T	P		
1.	ME5513	Industrial Training/ Internship	EEC	0	0	0	2	5
2.	ME5712	Project I (Design and Fabrication)	EEC	0	0	6	3	7
3.	IE5811	Project II	EEC	0	0	16	8	8

ENGINEERING SCIENCE COURSE (ESC)

Sl. No.	Course Code	Course Title	Category	Periods per week			Credits	Semester
				L	T	P		
1.	GE5151	Engineering Graphics	ESC	1	0	4	3	1
2.	GE5162	Workshop Practices Laboratory	ESC	0	0	4	2	1
3.	GE5153	Problem Solving and Python Programming	ESC	3	0	0	3	2
4.	EE5251	Basics of Electrical and Electronics Engineering	ESC	3	0	0	3	2
5.	GE5152	Engineering Mechanics	ESC	3	1	0	4	2
6.	GE5161	Problem Solving and Python Programming Laboratory	ESC	0	0	4	2	2
7.	EE5261	Electrical and Electronics Engineering Laboratory	ESC	0	0	4	2	2
8.	ML5352	Mechanics of Materials	ESC	3	0	0	3	3
9.	CE5361	Strength of Materials and Fluid Machinery Laboratory	ESC	0	0	4	2	3
10.	CE5251	Fluid Mechanics and Machinery	PCC	3	0	0	3	2

AUDIT COURSES (AC)

Registration for any of these courses is optional to students

Sl. No	Course	Course Title	Periods per week			Total Contact Periods	Credits
			L	T	P		
1.	AD5091	Constitution of India	3	0	0	3	0
2.	AD5092	Value Education	3	0	0	3	0
3.	AD5093	Pedagogy Studies	3	0	0	3	0
4.	AD5094	Stress Management by Yoga	3	0	0	3	0
5.	AD5095	Personality Development Through Life Enlightenment Skills	3	0	0	3	0
6.	AD5096	Unnat Bharat Abhiyan	3	0	0	3	0
7.	AD5097	Essence of Indian Knowledge Tradition	3	0	0	3	0
8.	AD5098	Sanga Tamil Literature Appreciation	3	0	0	3	0

PROFESSIONAL CORE COURSES (PCC)

Sl. No	Code No.	Course Title	Category	Periods per week			Credits	Semester
				L	T	P		
1.	ME5301	Engineering Thermodynamics	PCC	3	0	0	3	3
2.	ME5351	Computer Aided Design	PCC	3	0	0	3	3
3.	ML5351	Engineering Materials and Metallurgy	PCC	3	0	0	3	3

4.	ME5361	Computer Aided Machine Drawing	PCC	0	0	4	2	3
5.	ME5451	Hydraulics and Pneumatics	PCC	3	0	0	3	4
6.	ME5401	Theory of Machines	PCC	3	1	0	4	4
7.	ME5402	Metal Cutting and Machine Tools	PCC	3	0	0	3	4
8.	ME5403	Applied Thermodynamics	PCC	3	0	0	3	4
9.	ME5461	Manufacturing Technology Laboratory	PCC	0	0	4	2	4
10.	ME5411	Computer Aided Manufacturing Laboratory	PCC	0	0	4	2	4
11.	ME5551	Design of Machine elements	PCC	3	0	0	3	5
12.	ME5553	Metrology and Measurements	PCC	3	0	0	3	5
13.	ME5501	Thermal Engineering	PCC	3	0	0	3	5
14.	ME5511	Metrology and Dynamics Laboratory	PCC	0	0	4	2	5
15.	ME5512	Thermal Engineering Laboratory	PCC	0	0	4	2	5
16.	ME5601	Design of Transmission Systems	PCC	3	0	0	3	6
17.	ME5651	Heat and Mass transfer	PCC	3	0	0	3	6
18.	ME5611	Heat Transfer and Refrigeration and Air-conditioning Laboratory	PCC	0	0	4	2	6
19.	ME5612	Geometric Modeling & Simulation Laboratory	PCC	0	0	4	2	6
20.	ME5701	Energy Conversion Techniques	PCC	3	0	0	3	7
21.	ME5751	Finite Element Analysis	PCC	3	0	0	3	7
22.	ME5702	Computer Integrated Manufacturing	PCC	3	0	0	3	7
23.	ME5752	Mechatronics	PCC	3	0	0	3	7
24.	ME5761	Mechatronics Laboratory	PCC	0	0	4	2	7

PROFESSIONAL ELECTIVE COURSES

SEMESTER V, ELECTIVE I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	ME5071	Automobile Engineering	PEC	3	0	0	3	3
2.	ME5077	Measurements and Controls	PEC	3	0	0	3	3
3.	ME5001	Design Concepts in Engineering	PEC	3	0	0	3	3
4.	ME5002	Composite Materials and Mechanics	PEC	3	0	0	3	3
5.	MA5353	Numerical Methods	PEC	3	0	0	3	3
6.	ML5751	Non-destructive Evaluation of Materials	PEC	3	0	0	3	3
7.	ME5075	Entrepreneurship Development	PEC	3	0	0	3	3

SEMESTER – VI, ELECTIVE – II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	ME5003	Refrigeration and Air Conditioning	PEC	3	0	0	3	3
2.	ME5004	Turbo Machinery	PEC	3	0	0	3	3
3.	MF5652	Additive Manufacturing	PEC	3	0	0	3	3
4.	MF5651	Non-traditional Machining Processes	PEC	3	0	0	3	3
5.	ME5073	Design for Manufacturing	PEC	3	0	0	3	3
6.	ME5082	Product Design and Development	PEC	3	0	0	3	3
7.	ME5005	Industrial safety	PEC	3	0	0	3	3
8.	GE5552	Engineering Management	PEC	3	0	0	3	3

SEMESTER – VI, ELECTIVE – III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	ME5079	New and Renewable Sources of Energy	PEC	3	0	0	3	3
2.	ME5006	Advanced Internal Combustion Engineering	PEC	3	0	0	3	3
3.	ME5007	Casting and Welding Processes	PEC	3	0	0	3	3
4.	ME5081	Process Planning and Cost Estimation	PEC	3	0	0	3	3
5.	ME5083	Product life Cycle Management	PEC	3	0	0	3	3
6.	ME5084	Surface Engineering Tribology	PEC	3	0	0	3	3
7.	GE5072	Human Rights	PEC	3	0	0	3	3

SEMESTER – VII, ELECTIVE – IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	ME5008	Design of Heat Exchangers	PEC	3	0	0	3	3
2.	ME5072	Computational Techniques for Fluid Dynamics	PEC	3	0	0	3	3
3.	ME5085	Quality and Reliability Engineering	PEC	3	0	0	3	3
4.	IE5652	Production and Operations Management	PEC	3	0	0	3	3
5.	ME5074	Design of Jigs, Fixtures and Press Tools	PEC	3	0	0	3	3
6.	ME5009	Mechanical Vibrations and Noise Control	PEC	3	0	0	3	3
7.	GE5071	Disaster Management	PEC	3	0	0	3	3
8.	GE5075	Engineering Ethics	PEC	3	0	0	3	3

SEMESTER – VIII, ELECTIVE – V

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	ME5010	Energy Conservation in Industries	PEC	3	0	0	3	3
2.	ME5011	Energy Efficient Buildings Design	PEC	3	0	0	3	3
3.	IE5073	Lean Six Sigma	PEC	3	0	0	3	3
4.	ME5012	Industrial Robotics Technology	PEC	3	0	0	3	3
5.	ME5013	Applied Finite Element Analysis	PEC	3	0	0	3	3
6.	ME5014	Metal Forming Technology	PEC	3	0	0	3	3
7.	ME5076	Marketing Management	PEC	3	0	0	3	3

SEMESTER – VIII, ELECTIVE – VI

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	ME5015	Gas Dynamics and Space Propulsion	PEC	3	0	0	3	3
2.	ME5016	Solar Energy Technology	PEC	3	0	0	3	3
3.	ME5080	Precision Manufacturing	PEC	3	0	0	3	3
4.	ME5078	MEMS and Microsystems	PEC	3	0	0	3	3
5.	ME5017	Machine Vision	PEC	3	0	0	3	3
6.	ME5018	Applied Operations Research	PEC	3	0	0	3	3
7.	IE5077	Systems Engineering	PEC	3	0	0	3	3

SUMMARY

Name of the Programme : B.E. Mechanical Engineering										
S.No	**Category**	**Credits per Semester**								**Total Credits**
		I	II	III	IV	V	VI	VII	VIII	
1	**HSMC**	4	0	3	3	3	0	0	0	**13**
2	**BSC**	12	7	4	0	0	3	0	0	**26**
3	**ESC**	5	14	5	0	0	0	0	0	**24**
4	**PCC**	0	3	11	17	13	10	14	0	**68**
5	**PEC**	0	0	0	0	3	6	3	6	**18**
6	**OEC**	0	0	0	0	0	3	3	0	**6**
7	**EEC**	0	0	0	0	2	0	3	8	**13**
8	**AC (Non-Credit)**	0	0	0	0	0	0	0	0	**0**
	Total Credits	**21**	**24**	**23**	**20**	**21**	**22**	**23**	**14**	**168**

HS5151 TECHNICAL ENGLISH L T P C
4 0 0 4

COURSE OBJECTIVES:

The first semester English course entitled 'Technical English' aims to,

- Familiarise first year students of engineering and technology with the fundamental aspects of technical English.
- Develop all the four language skills by giving sufficient practice in the use of the skills in real life contexts.
- Enhance the linguistic and communicative competence of first year engineering and technology students.

UNIT I INTRODUCING ONESELF 12

Listening: Listening and filling a form, listening to speeches by specialists from various branches of engineering and completing activities such as answering questions, identifying the main ideas of the listening text, style of the speaker (tone and tenor) – **Speaking**: Introducing oneself –introducing friend/ family - **Reading:** Descriptive passages (from newspapers / magazines)- **Writing**: Writing a paragraph (native place, school life)- **Grammar:** Simple present, present continuous – **Vocabulary Development**: One word substitution

UNIT II DIALOGUE WRITING 12

Listening: Listening to conversations (asking for and giving directions) –**Speaking:** making conversation using (asking for directions, making an enquiry), Role plays-dialogues- **Reading:** Reading a print interview and answering comprehension questions-**Writing**: Writing a checklist, Dialogue writing- **Grammar**: Simple past – question formation (Wh- questions, Yes or No questions, Tag questions)- **VocabularyDevelopment**: Stress shift, lexical items related to the theme of the given unit.

UNIT III FORMAL LETTER WRITING 12

Listening: Listening to speeches by famous people and identifying the central message of the speech – answering multiple-choice questions)-**Speaking:** Giving short talks on a given topic-**Reading:** Reading motivational essays on famous engineers and technologists (answering open-ended and closed questions)- **Writing:** Writing formal letters/ emails (Complaint letters)-**Grammar**: Future Tense forms of verbs, subject and verb agreement-**Vocabulary Development**: Collocations – Fixed expressions

UNIT IV WRITING COMPLAINT LETTERS 12

Listening: Listening to short talks (5 minutes duration and fill a table, gap-filling exercise) note taking/note making- **Speaking:** Small group discussion, giving recommendations-**Reading:** Reading problem – solution articles/essays drawn from various sources- **Writing:** Making recommendations – Writing a letter/ sending an email to the Editor- note making- **Grammar:** Modals – Phrasal verbs – cause and effect sentences- **Vocabulary Development**: Connectives, use of cohesive devices in writing, technical vocabulary.

UNIT V WRITING DEFINITIONS AND PRODUCT DESCRIPTION 12

Listening: Listening to a product description (labeling and gap filling) exercises- **Speaking:** Describing a product and comparing and contrasting it with other products- **Reading**: Reading graphical material for comparison (advertisements)-**Writing:** Writing Definitions (short and long) – compare and contrast paragraphs- **Grammar:** Adjectives – Degrees of comparison - compound nouns- **Vocabulary Development**: Use of discourse markers – suffixes (adjectival endings).

TOTAL: 60PERIODS

LEARNING OUTCOMES

At the end of the course the students will have gained,

- Exposure to basic aspects of technical English.
- The confidence to communicate effectively I various academic situations.
- Learnt the use of basic features of Technical English.

TEXT BOOK:

1. Revised Edition of 'English for Engineers and Technologists' Volume 1 published by Orient Black Swan Limited 2019.

ASSESSMENT PATTERN

- Assessments will assess all the four skills through both pen and paper and computer based tests.
- Assessments can be pen and paper based, quizzes.

MA5158	ENGINEERING MATHEMATICS – I (Common to all branches of B.E. / B.Tech. Programmes in I Semester)	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT I MATRICES 12

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II DIFFERENTIAL CALCULUS 12

Limit of function – One sided limit – Limit Laws – Continuity – left and right continuity – types of discontinuities – Intermediate Value Theorem – Derivatives of a function - Differentiation rules – Chain rule – Implicit differentiation – logarithmic differentiation – Maxima and minima – Mean value theorem – (Optional: Polar coordinate system – Differentiation in polar coordinates).

UNIT III FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Errors and approximations – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT IV INTEGRAL CALCULUS 12

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT V MULTIPLE INTEGRALS 12

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

TOTAL :60 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

- Use the matrix algebra methods for solving practical problems.

- Apply differential calculus tools in solving various application problems.
- Able to use differential calculus ideas on several variable functions.
- Apply different methods of integration in solving practical problems.
- Apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXTBOOKS:

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, 44thEdition, New Delhi, 2017.
2. James Stewart, "Calculus with Early Transcendental Functions", Cengage Learning, 6thEdition, New Delhi,2013.
3. Joel Hass, Christopher Heil and Maurice D.Weir, "Thomas' Calculus", Pearson, 14th Edition, New Delhi, 2018.
4. Narayanan S. and Manicavachagom Pillai T. K., “Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.

REFERENCES:

1. Bali N., Goyal M. and Watkins C., “Advanced Engineering Mathematics”, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7thEdition, New Delhi, 2009.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2015.
3. Greenberg M.D., “Advanced Engineering Mathematics”, Pearson Education2nd Edition, 5th Reprint, Delhi, 2009.
4. Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”,Narosa Publications, 5th Edition, New Delhi, 2017.
5. Peter V.O’Neil, “Advanced Engineering Mathematics”, Cengage Learning India Pvt., Ltd, 7th Edition, New Delhi , 2012.
6. Ramana B.V., “Higher Engineering Mathematics”, Tata McGraw Hill Co. Ltd., 11th Reprint, New Delhi, 2010.

PH5151 ENGINEERING PHYSICS L T P C

(Common to all branches of B.E / B.Tech programmes) **3 0 0 3**

COURSEOBJECTIVES:

- To make the students in understanding the importance of mechanics.
- To equip the students on the knowledge of electromagnetic waves.
- To introduce the basics of oscillations, optics and lasers.
- To enable the students in understanding the importance of quantum physics.
- To elucidate the application of quantum mechanics towards the formation of energy bands in crystalline materials.

UNIT I MECHANICS 9

Moment of inertia (M.I) - Radius of gyration - Theorems of M .I - M.I of circular disc, solid cylinder , hollow cylinder , solid sphere and hollow sphere - K.E of a rotating body – M.I of a diatomic molecule – Rotational energy state of a rigid diatomic molecule - centre of mass – conservation of linear momentum – Relation between Torque and angular momentum - Torsional pendulum.

UNIT II ELECTROMAGNETIC WAVES 9

Gauss’s law – Faraday’s law - Ampere’s law - The Maxwell’s equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

UNIT III OSCILLATIONS, OPTICS AND LASERS 9

Simple harmonic motion - resonance - waves on a string - standing waves - traveling waves - Energy transfer of a wave - sound waves - Doppler effect - reflection and refraction of light waves - total internal reflection - interference - interferometers - air wedge experiment. Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO_2 laser, semiconductor laser - applications.

UNIT IV BASIC QUANTUM MECHANICS 9

Photons and light waves - Electrons and matter waves - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization - Particle in a infinite potential well - Normalization, probabilities and the correspondence principle.

UNIT V APPLIED QUANTUM MECHANICS 9

The harmonic oscillator - Barrier penetration and quantum tunneling - Tunneling microscope - Resonant diode - Finite potential wells - particle in a three dimensional box - Bloch's theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands.

TOTAL: 45 PERIODS

COURSEOUTCOMES:

After completion of this course, the students should able to

- Understanding the importance of mechanics.
- Express the knowledge of electromagnetic waves.
- Know the basics of oscillations, optics and lasers.
- Understanding the importance of quantum physics.
- Apply quantum mechanical principles towards the formation of energy bands in crystalline materials.

TEXT BOOKS

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education, 2017.
2. D.Halliday, R.Resnick and J.Walker. Principles of Physics. John Wiley & Sons, 2015.
3. N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. Springer-Verlag, 2012.

REFERENCES

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson, 2016.
2. D.J.Griffiths. Introduction to Electrodynamics. Pearson Education, 2015
3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications. Springer, 2012.

CY5151ENGINEERING CHEMISTRY L T P C
(COMMON TO ALL BRANCHES) 3 0 0 3

COURSEOBJECTIVES:

- To introduce the basic concepts of polymers, their properties and some of the important applications.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To facilitate the understanding of the laws of photochemistry, photoprocesses and instrumentation & applications of spectroscopic techniques.
- To familiarize the operating principles and applications of energy conversion, its processes and storage devices.
- To inculcate sound understanding of water quality parameters and water treatment techniques.

UNIT I POLYMER CHEMISTRY 9

Introduction: Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermosetting. Types and mechanism of polymerization: addition (free radical, cationic, anionic and living); condensation and copolymerization. Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of

polymerization: Bulk, emulsion, solution and suspension. Structure, Properties and uses of: PE, PVC, PC, PTFE, PP, Nylon 6, Nylon 66, Bakelite, Epoxy; Conducting polymers – polyaniline and polypyrrole.

UNIT II NANOCHEMISTRY 9

Basics-distinction between molecules, nanomaterials and bulk materials; size-dependent properties. Types –nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Characterization - Scanning Electron Microscope and Transmission Electron Microscope - Principle and instrumentation (block diagram). Properties (optical, electrical, mechanical and magnetic) and Applications of nanomaterials - medicine, agriculture, electronics and catalysis.

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY 9

Photochemistry: Laws of photochemistry - Grotthuss-Draper law, Stark-Einstein law and Lambert-Beer Law (derivation and problems). Photo physical processes – Jablonski diagram. Chemiluminescence, photo-sensitization and photoquenching – mechanism and examples. Spectroscopy: Electromagnetic spectrum - absorption of radiation - electronic, vibrational and rotational transitions. Width and intensities of spectral lines. Atomic absorption spectroscopy, UV-Vis and IR spectroscopy- principles, instrumentation (Block diagram) and applications.

UNIT IV ENERGY CONVERSIONS AND STORAGE 9

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant – fast breeder reactor. Solar energy conversion - solar cells. Wind energy. Batteries - types of batteries – primary battery (dry cell), secondary battery (lead acid, nickel-cadmium and lithium-ion-battery). Fuel cells – H_2-O_2 and microbial fuel cell. Explosives – classification, examples: TNT, RDX, Dynamite; Rocket fuels and propellants – definition and uses.

UNIT V WATER TECHNOLOGY 9

Water – sources and impurities – water quality parameters: colour, odour, pH, hardness, alkalinity, TDS, COD and BOD. Boiler feed water – requirement – troubles (scale & sludge, caustic embrittlement, boiler corrosion and priming & foaming. Internal conditioning – phosphate, calgon and carbonate treatment. External conditioning - zeolite (permutit) and ion exchange demineralization. Municipal water treatment process – primary (screening, sedimentation and coagulation), secondary (activated sludge process and trickling filter process) and tertiary (ozonolysis, UV treatment, chlorination, reverse osmosis).

TOTAL: 45 PERIODS

COURSEOUTCOMES:

- To recognize and apply basic knowledge on different types of polymeric materials, their general preparation methods and applications to futuristic material fabrication needs.
- To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
- To identify and apply suitable spectroscopic technique for material analysis and study different forms of photochemical reactions.
- To recognize different forms of energy resources and apply them for suitable applications in energy sectors.
- To demonstrate the knowledge of water and their quality in using at different industries.

TEXT BOOKS:

1. Jain P. C. & Monica Jain., “Engineering Chemistry”, 16th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015.
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.
3. S.S.Dara, “A text book of Engineering Chemistry”, Chand Publications, 2014.

REFERENCES:
1. Schdeva M V, “Basics of Nano Chemistry”, Anmol Publications Pvt Ltd
2. B.Sivasankar, “Instrumental Methods of Analysis”, Oxford University Press. 2012.
3. Friedrich Emich, “Engineering Chemistry”, Scientific International Ltd.
4. V RGowariker, N V Viswanathan and Jayadev Sreedhar, “Polymer Science” New AGE International Publishers, 2009.

GE5151 ENGINEERING GRAPHICS **L T P C**
1 0 4 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Drawing free hand sketches of basic geometrical shapes and multiple views of objects.
2. Drawing orthographic projections of lines and planes.
3. Drawing orthographic projections of solids.
4. Drawing development of the surfaces of objects.
5. Drawing isometric and perspective views of simple solids.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION) 1
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNITI PLANE CURVES AND FREE HANDSKETCHING 14
Basic Geometrical constructions, Curves used in engineering practices-Conics – Construction of ellipse, parabola and hyperbola by different methods – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three-Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNITII PROJECTION OF POINTS, LINES AND PLANE SURFACES 15
Orthographic projection- principles-Principle planes-First angle projection-Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes-Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNITIII PROJECTION OF SOLIDS 15
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to both the principal planes by rotating object method and auxiliary plane method.

UNITIV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES15
Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

UNITV ISOMETRIC AND PERSPECTIVE PROJECTIONS 12
Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms pyramids and cylinders by visual ray method and vanishing point method.

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY) 3
Introduction to drafting packages and demonstration of their use

TOTAL (L: 15 + P: 60) = 75 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Draw free hand sketching of basic geometrical shapes and multiple views of objects.
2. Draw orthographic projections of lines and planes
3. Draw orthographic projections of solids

4. Draw development of the surfaces of objects
5. Draw isometric and perspective views of simple solids.

TEXT BOOKS:

1. Bhatt,N.D.,Panchal V M and Pramod R. Ingle, "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2014.
2. Parthasarathy, N. S. and Vela Murali, "Engineering Drawing", Oxford University Press, 2015

REFERENCES:

1. Agrawal, B. and Agrawal C.M., "Engineering Drawing", Tata McGraw, N.Delhi, 2008.
2. Gopalakrishna, K. R., "Engineering Drawing",Subhas Stores, Bangalore, 2007.
3. Natarajan, K. V., "A text book of Engineering Graphics", 28thEd.,Dhanalakshmi Publishers, Chennai, 2015.
4. Shah, M. B., and Rana, B. C., "Engineering Drawing", Pearson, 2ndEd., 2009.
5. Venugopal, K. and Prabhu Raja, V., "Engineering Graphics", New Age,2008.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only.
4. The students will be permitted to use appropriate scale to fit solution within A3 size.
5. The examination will be conducted in appropriate sessions on the same day.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3				3					2		2	2	3	2
2	3									2		2	2	2	
3	3				3					2		2	2	2	
4	3		2		3					2		2	2	2	
5	3		3		3					2		2	2	2	

BS5161 **BASIC SCIENCES LABORATORY** **L T P C**
(Common to all branches of B.E. / B.TechProgrammes) **0 0 4 2**

PHYSICS LABORATORY: (Any Seven Experiments)

COURSE OBJECTIVES:

- To inculcate experimental skills to test basic understanding of physics of materials including properties of matter, thermal and optical properties.
- To induce the students to familiarize with experimental determination of velocity of ultrasonic waves and band gap determination.

LIST OF EXPERIMENTS:

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of Young's modulus
3. Uniform bending – Determination of Young's modulus
4. Lee's disc Determination of thermal conductivity of a bad conductor

5. Potentiometer-Determination of thermo e.m.f of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire
8. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
9. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
10. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Post office box -Determination of Band gap of a semiconductor.
12. Spectrometer- Determination of wavelength using gating.
13. Photoelectric effect
14. Michelson Interferometer.
15. Estimation of laser parameters.
16. Melde's string experiment

TOTAL: 30 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able

- To determine various moduli of elasticity and also various thermal and optical properties of materials.
- To determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids

CHEMISTRY LABORATORY: (Minimum of 8 experiments to be conducted)

COURSE OBJECTIVES:

- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and polymers by spectroscopy and viscometry methods.

LIST OF EXPERIMENTS:

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler‟s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of polyvinylalcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.
14. Phase change in a solid.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

- To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
- To determine the amount of metal ions through volumetric and spectroscopic techniques
- To determine the molecular weight of polymers by viscometric method.

- To quantitatively analyse the impurities in solution by electroanalytical techniques
- To design and analyse the kinetics of reactions and corrosion of metals

TEXT BOOKS:

1. Laboratory Manual- Department of Chemistry, CEGC, Anna University (2014).
2. Vogel's Textbook of Quantitative Chemical Analysis (8^{th} edition, 2014).

GE5162 WORKSHOP PRACTICES LABORATORY L T P C
(Common to all Branches of B.E. / B.Tech. Programmes) 0 0 4 2

COURSE OBJECTIVES:
The main learning objective of this course is to provide hands on training to the students in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work.
2. Sawing, planning, making joints in wood materials used in common household wood work.
3. Wiring various electrical joints in common household electrical wire work.
4. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical household equipments; Making a tray out of metal sheet using sheet metal work.
5. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES 15

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
b) Preparing plumbing line sketches.
c) Laying pipe connection to the suction side of a pump
d) Laying pipe connection to the delivery side of a pump.
e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:

a) Sawing,
b) Planing and
c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:

a) Studying joints in door panels and wooden furniture
b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES 15

WIRING WORK:

a) Wiring Switches, Fuse, Indicator and Lamp etc. such as in basic household,
b) Wiring Stair case light.
c) Wiring tube – light.
d) Preparing wiring diagrams for a given situation.

Wiring Study:

a) Studying an Iron-Box wiring.
b) Studying a Fan Regulator wiring.
c) Studying an Emergency Lamp wiring.

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES 15

WELDING WORK:

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
b) Practicing gas welding.

BASIC MACHINING WORK:

a) (simple)Turning.
b) (simple)Drilling.
c) (simple)Tapping.

ASSEMBLY WORK:

a) Assembling a centrifugal pump.
b) Assembling a household mixer.
c) Assemblinganairconditioner.

SHEET METAL WORK:

a) Making of a square tray

FOUNDRY WORK:

a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES 15

SOLDERING WORK:

a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

a) Studying a FM radio.
b) Studying an electronic telephone.

TOTAL = 60 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Understand the concept of plumbing work and fittings in common household applications.
2. Ability to saw, plan and join wood materials used in common household wood applications.
3. Become familiar with wiring various electrical joints in common household electrical applications.

4. Perform various weld joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical household equipments; Make a tray out of metal sheet using sheet metal work.
5. Become familiar with soldering and testing simple electronic circuits; Assemble and test simple electronic components on PCB.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2			1							3	3	3	1
2	3	2			1							3	3	3	1
3	3	2			1		1					3	2	2	1
4	3	2			1		1					3	3	3	1
5	3	2			1		1					3	2	2	1

MA5252 ENGINEERING MATHEMATICS – II (Common to all branches of B.E. / B.Tech. Programmes in II Semester) **L T P C 3 1 0 4**

COURSE OBJECTIVES:

- To acquaint the students with the concepts of vector calculus which naturally arises in many engineering problems.
- To develop an understanding of the standard techniques of complex variable theory in particular analytic function and its mapping property.
- To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- To acquaint the students with Differential Equations which are significantly used in Engineering problems.
- To make the students appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I VECTOR CALCULUS **12**

Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's theorem, Stoke's theorem and Gauss divergence theorem – Verification and application in evaluating line, surface and volume integrals.

UNIT II ANALYTIC FUNCTION **12**

Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions - Bilinear transformation $w = c + z,\ az,\ 1/z,\ z^2$.

UNIT III COMPLEX INTEGRATION **12**

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT IV DIFFERENTIAL EQUATIONS **12**

Method of variation of parameters – Method of undetermined coefficients – Homogenous equations of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

UNIT V LAPLACE TRANSFORMS **12**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives and integrals –

Initial and Final Value Theorems – Inverse Transforms – Convolution Theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

- Calculate grad, div and curl and use Gauss, Stokes and Greens theorems to simplify calculations of integrals.
- Construct analytic functions and use their conformal mapping property in application problems.
- Evaluate real and complex integrals using the Cauchy's integral formula and residue theorem.
- Apply various methods of solving differential equation which arise in many application problems.
- Apply Laplace transform methods for solving linear differential equations.

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2015.
2. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, New Delhi, 2017.

REFERENCES:

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7th Edition, New Delhi, 2009.
2. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 4th Edition, New Delhi, 2011.
3. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, 5th Edition, New Delhi, 2017.
4. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7th Edition, New Delhi, 2012.
5. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., 11th Reprint, New Delhi, 2010.

ME5251 MANUFACTURING PROCESSES **L T P C**
3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is:

1. To provide the knowledge on the working principles of various metal casting processes.
2. To explain the working principles of various metal joining processes.
3. To discuss the working principles of bulk deformation of metals.
4. To render the knowledge on the working principles of sheet metal forming process.
5. To get familiarize with the working principles of plastics molding.

UNITI METAL CASTING PROCESSES **9**

Sand Casting – Sand Mould – Type of patterns - Pattern Materials – Pattern allowances – Molding sand Properties and testing – Cores –Types and applications – Molding machines – Types and applications– Melting furnaces – Principle of special casting processes- Shell, investment – Ceramic mould – Pressure die casting – Centrifugal Casting - CO casting - Defects in Sand casting process – Stir casting - Defects in Sand casting.

UNITII METAL JOINING PROCESSES **9**

Fusion welding processes – Type of Gas welding – Flame characteristics – Filler and Flux materials – Arc welding, Electrodes, Coating and specifications – Principles and types of Resistance welding – Gas metal arc welding – Submerged arc welding – Electro slag welding – Gas Tungsten arc

welding – Principle and application of special welding processes – Plasma arc welding – Thermit Welding – Electron beam welding – Friction welding – Friction stir welding – Diffusion welding – Weld defects – Brazing and soldering – methods and process capabilities – Adhesive bonding, Types and application

UNITIII BULK DEFORMATION PROCESSES 9

Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – Characteristics of the processes – Typical forging operations – rolling of metals – Types of Rolling – Flat strip rolling – shape rolling operations – Defects in rolled parts – Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion.

UNITIV SHEET METAL PROCESSES 9

Sheet metal characteristics – Typical shearing, bending and drawing operations – Stretch forming operations – Formability of sheet metal – Test methods –special forming processes - Working principle and applications – Hydro forming – Rubber pad forming – Metal spinning – Introduction of Explosive forming, magnetic pulse forming, peen forming, Super plastic forming – Micro forming – Incremental forming.

UNITV MANUFACTURE OF PLASTIC COMPONENTS 9

Types and characteristics of plastics – Molding of thermoplastics – working principles and typical applications – injection molding – Plunger and screw machines – Compression molding, Transfer Molding – Typical industrial applications – introduction to blow molding – Rotational molding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics.

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Explain the working principles of various metal casting processes.
2. Categorise and select appropriate metal joining process.
3. Compare the working principles of bulk deformation of metals.
4. Analyze the principles of sheet metal forming process.
5. Illustrate the methods in the manufacture of plastics components.

TEXT BOOKS:

1. Kalpakjian. S, “Manufacturing Engineering and Technology”, Pearson Education India Edition, 2006.
2. Roy. A. Lindberg, Processes and materials of manufacture, PHI / Pearson education, 2006.

REFERENCES:

1. Gowri.S, P. Hariharan, A.SureshBabu, Manufacturing Technology I, Pearson Education, 2008.
2. HajraChouldhary S.K. and Hajra Choudhury. A. K., Elements of Workshop Technology, Volume I and II, Media Promoters and Publishers Private Limited, Mumbai, 1997.
3. Paul Degarma E., Black J.T. and Ronald A. Kosher, Materials and Processes, in Manufacturing, Eight Edition,Prentice Hall of India, 1997.
4. Rao. P. N., Manufacturing Technology Foundry, Forming and Welding, 2nd Ed.Tata McGraw Hill, 2003.
5. Sharma, P.C., A Textbook of Production Technology, S.Chand and Co. Ltd., 2004.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2									1	3		
2	3	3	2									1	3		
3	3	3	2									1	3		
4	3	3	2									1	3		
5	3	3	2									1	3		

GE5153 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
3 0 0 3

COURSEOBJECTIVES:

- To know the basics of algorithmic problem solving.
- To develop Python programs with conditionals and loops.
- To define Python functions and use function calls.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I INTRODUCTION TO COMPUTING AND PROBLEM SOLVING 9

Fundamentals of Computing – Computing Devices – Identification of Computational Problems – Pseudocodes and Flowcharts – Instructions – Algorithms – Building Blocks of Algorithms – Introduction to Python Programming – Python Interpreter and Interactive Mode – Variables and Identifiers – Arithmetic Operators– Values and Types – Statements.

SUGGESTED ACTIVITIES:

- Developing Pseudocodes and flowcharts for real life activities such as railway ticket booking using IRCTC, admission process to undergraduate course, academic schedules during a semester etc.
- Developing algorithms for basic mathematical expressions using arithmetic operations.
- Installing Python.
- Simpleprograms on print statements, arithmetic operations.

SUGGESTED EVALUATION METHODS:

- Assignments on pseudocodes and flowcharts.
- Tutorials on Pythonprograms.

UNIT II CONDITIONALS AND FUNCTIONS 9

Operators – Boolean Values – Operator Precedence – Expression – Conditionals: If-Else Constructs – Loop Structures/Iterative Statements – While Loop – For Loop – Break Statement – Function Call and Returning Values – Parameter Passing – Local and Global Scope – Recursive Functions.

SUGGESTED ACTIVITIES:

- Simple Python program implementationusing Operators, Conditionals, Iterative Constructs and Functions.
- Implementation of asimple calculator.
- Developing simple applications like calendar, phone directory, to-do lists etc.
- Flow charts for GCD, Exponent Functions, Fibonacci Series using conditionals and iterative statements.
- External learning - Recursion vs. Iteration.

SUGGESTED EVALUATION METHODS:

- Tutorials on the above activities.
- Group discussion on external learning.

UNIT III SIMPLE DATA STRUCTURES IN PYTHON 10

Introduction to Data Structures – List – Adding Items to a List – Finding and Updating an Item – Nested Lists – Cloning Lists – Looping Through a List – Sorting a List – List Concatenation – List Slices – List Methods – List Loop – Mutability – Aliasing – Tuples: Creation, Accessing, Updating, Deleting Elements in a Tuple, Tuple Assignment, Tuple as Return Value, Nested Tuples, Basic Tuple Operations – Sets.

SUGGESTED ACTIVITIES:

- Implementing python program using lists, tuples, sets for the following scenario:
  Simple sorting techniques

Student Examination Report
Billing Scheme during shopping.

- External learning - List vs. Tuple vs. Set – Implementing any application using all the three data structures.

SUGGESTED EVALUATION METHODS:

- Tutorials on the above activities.
- Group Discussion on external learning component.

UNIT IV STRINGS, DICTIONARIES, MODULES 10

Strings: Introduction, Indexing, Traversing, Concatenating, Appending, Multiplying, Formatting, Slicing, Comparing, Iterating – Basic Built-In String Functions – Dictionary: Creating, Accessing, Adding Items, Modifying, Deleting, Sorting, Looping, Nested Dictionaries Built-in Dictionary Function – Finding Key and Value in a Dictionary – Modules – Module Loading and Execution – Packages – Python Standard Libraries.

SUGGESTED ACTIVITIES:

- Implementing Python program by importing Time module, Math package etc.
- Creation of any package (student's choice) and importing into the application.

SUGGESTED EVALUATION METHODS:

- Tutorials on the above activities.

UNIT V FILE HANDLING AND EXCEPTION HANDLING 7

Introduction to Files – File Path – Opening and Closing Files – Reading and Writing Files – File Position – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions.

SUGGESTED ACTIVITIES:

- Developing modules using Python to handle files and apply various operations on files.
- Usage of exceptions, multiple except blocks - for applications that use delimiters like age, range of numerals etc.
- Implementing Python program to open a non-existent file using exceptions.

SUGGESTED EVALUATION METHODS:

- Tutorials on the above activities.
- Case Studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionariesetc.
CO6: Read and write data from/to files in Python programs.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									✓
CO2	✓		✓		✓							✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓	✓	✓							✓
CO5	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

TEXT BOOKS:

1. Reema Thareja, "Python Programming: Using Problem Solving Approach", Oxford University Press, 2017.

2. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, Second Edition, Shroff/O‘Reilly Publishers, 2016.
(http://greenteapress.com/wp/thinkpython/).

REFERENCES:

1. Guido van Rossum, Fred L. Drake Jr., “An Introduction to Python – Revised and Updated for Python 3.2”, Network Theory Ltd., 2011.
2. John V Guttag, “Introduction to Computation and Programming Using Python”, Revised and Expanded Edition, MIT Press , 2013
3. Charles Dierbach, “Introduction to Computer Science using Python”, Wiley India Edition, 2016.
4. Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd., 2015.
5. Kenneth A. Lambert, “Fundamentals of Python: First Programs”, Cengage Learning, 2012.

EE5251 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
3 0 0 3

COURSEOBJECTIVES:

- To understand the basic concepts of electric circuits, magnetic circuits and wiring.
- To understand the operation of AC and DC machines.
- To understand the working principle of electronic devices and circuits.

UNIT I BASIC CIRCUITS AND DOMESTIC WIRING 9

Electrical circuit elements (R, L and C)-Dependent and independent sources – Ohm’s Law-Kirchhoff’s laws - mesh current and node voltage methods (Analysis with only independent source) - Phasors – RMS-Average values-sinusoidal steady state response of simple RLC circuits. Types of wiring- Domestic wiring - Specification of Wires-Earthing-Methods-Protective devices.

UNIT II THREE PHASE CIRCUITS AND MAGNETIC CIRCUITS 9

Three phase supply – Star connection – Delta connection –Balanced and Unbalanced Loads-Power in three-phase systems – Comparison of star and delta connections – Advantages-Magnetic circuits-Definitions-MMF, Flux, Reluctance, Magnetic field intensity, Flux density, Fringing, self and mutual inductances-simple problems.

UNIT III ELECTRICAL MACHINES 9

Working principle of DC generator, motor-EMF and Torque equation-Types –Shunt, Series and Compound-Applications. Working principle of transformer-EMF equation-Operating principles of three phase and single phase induction motor-Applications. Working principles of alternator-EMF equation-Operating principles of Synchronous motor, stepper motor-Applications.

UNIT IV BASICS OF ELECTRONICS 9

Intrinsic semiconductors, Extrinsic semiconductors – P-type and N-type, P-N junction, VI Characteristics of PN junction diode, Zener effect, Zener diode, Zener diode Characteristics-Rectifier circuits-Wave shaping.

UNIT V CURRENT CONTROLLED AND VOLTAGE CONTROLLED DEVICES 9

Working principle and characteristics - BJT, SCR, JFET, MOSFET.

TOTAL: 45 PERIODS

COURSEOUTCOMES:

CO1 To be able to understand the concepts related with electrical circuits and wiring.
CO2 To be able to study the different three phase connections and the concepts of magnetic circuits.
CO3 Capable of understanding the operating principle of AC and DC machines.
CO4 To be able to understand the working principle of electronic devices such as diode and zener diode.
CO5 To be able to understand the characteristics and working of current controlled and

voltage controlled devices.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓							
CO2	✓	✓	✓	✓	✓						✓	
CO3	✓	✓	✓	✓	✓						✓	✓
CO4	✓	✓	✓	✓	✓						✓	✓
CO5	✓		✓	✓	✓						✓	✓

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", McGraw Hill Education, 2014
2. Del Toro, "Electrical Engineering Fundamentals", Second edition, Pearson Education, New Delhi, 1989.
3. John Bird, "Electrical Circuit theory and technology", Routledge, 5th edition, 2013

REFERENCES:

1. Thomas L. Floyd, 'Electronic Devices', 10th Edition, Pearson Education, 2018.
2. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017
3 Kothari DP and I.J Nagrath, "Basic Electrical Engineering", McGraw Hill, 2010.
4 Muhammad H.Rashid, "Spice for Circuits and electronics", 4th ed.,Cengage India,2019.

GE5152 ENGINEERING MECHANICS L T P C
3 1 0 4

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Applying the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.
2. Applying the concept of reaction forces (non-concurrent coplanar and noncoplanar forces) and moment of various support systems with rigid bodies in 2D and 3D in equilibrium. Reducing the force, moment, and couple to an equivalent force - couple system acting on rigid bodies in 2D and 3D.
3. Applying the concepts of locating centroids/center of gravity of various sections / volumes and to find out area moments of inertia for the sections and mass moment of inertia of solids.
4. Applying the concepts of frictional forces at the contact surfaces of various engineering systems.
5. Applying the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

UNIT I STATICS OF PARTICLES (9+3)

Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles -Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle- Newton's First Law of Motion, Space and Free-Body Diagrams, Forces in Space, Equilibrium of a Particle in Space.

UNITII EQUILIBRIUM OF RIGID BODIES (9+3)

Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point,Varignon's Theorem, Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a Force about an Axis, Couple - Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force -Couple system, Further Reduction of a System of Forces, Equilibrium in Two and Three Dimensions - Reactions at Supports and Connections.

UNITIII DISTRIBUTED FORCES (9+3)

Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration , Theorems of Pappus-Guldinus, Distributed Loads on Beams, Centre of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies , Determination of Centroids of Volumes by Integration.

Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration , Polar Moment of Inertia , Radius of Gyration of an Area , Parallel-Axis Theorem , Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates , Determination of the Moment of Inertia of a Three-Dimensional Body by Integration

UNIT IV FRICTION (9+3)

The Laws of Dry Friction. Coefficients of Friction, Angles of Friction, Wedges, Wheel Friction. Rolling Resistance, Ladder friction.

UNITV DYNAMICS OF PARTICLES (9+3)

Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion -Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods - Work of a Force , Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact, Method of Virtual Work - Work of a Force, Potential Energy, Potential Energy and Equilibrium.

TOTAL (L: 45 + T: 15)=60 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Apply the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.
2. Apply the concept of reaction forces (non-concurrent coplanar and noncoplanar forces) and moment of various support systems with rigid bodies in 2D and 3D in equilibrium. Reducing the force, moment, and couple to an equivalent force - couple system acting on rigid bodies in 2D and 3D.
3. Apply the concepts of locating centroids / center of gravity of various sections / volumes and to find out area moments of inertia for the sections and mass moment of inertia of solids.
4. Apply the concepts of frictional forces at the contact surfaces of various engineering systems.
5. Apply the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

TEXT BOOKS:

1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, SanjeevSanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education., 11thEdition, 2017.
2. Vela Murali, "Engineering Mechanics-Statics and Dynamics", Oxford University Press, 2018.

REFERENCES:

1. Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.
2. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.
3. Irving H. Shames, Krishna Mohana Rao G, Engineering Mechanics – Statics and Dynamics, 4thEdition, Pearson Education Asia Pvt. Ltd., 2005.
4. Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013.
5. Timoshenko S, Young D H, Rao J V and SukumarPati, Engineering Mechanics, 5thEdition, McGraw Hill Higher Education, 2013.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	1	2							2	3	1	2
2	3	2	2	1	2							2	3	1	2
3	3	2	3	1	3							2	3	1	3
4	3	2	3	1	3							2	3	1	3
5	3	2	3	1	3							2	3	1	3

CE5251 FLUID MECHANICS AND MACHINERY L TP C
3 0 0 3

COURSEOBJECTIVE:

Tointroducethestudents about propertiesof thefluids,behaviourof fluids understatic conditions and to impart basic knowledge of the dynamicsoffluids and to exposetothe applications oftheconservationlawstoa)flow measurements b)flow through pipes(bothlaminarandturbulent)andc)forcesonpipebends with an exposure tothe significanceof boundarylayertheoryandits thicknesses with expose to basic principles of working of hydraulic machineries and to design Pelton wheel, Francis and Kaplan turbine, centrifugal and reciprocating pumps..

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 10

Properties of fluids- Pressure Measurements-Buoyancy and floatation-Flow characteristics- Eulerian and Lagrangian Principle of fluid flow– concept of control volume and system – Reynold's transportation theorem- continuity equation, energy equation and momentum equation-Applications.

UNIT II FLOW THROUGH PIPES AND BOUNDARY LAYER 9

Reynold's Experiment- Laminar flow through circular conduits- Darcy Weisbach equation – friction factor- Moody diagram- minor losses- Hydraulic and energy gradient – Pipes in series and parallel- Boundary layer concepts – types of boundary layer thickness.

UNIT III DIMENSIONAL ANALYSIS AND MODEL STUDIES 7

Fundamentaldimensions-Dimensionalhomogeneity-Rayleigh's method andBuckingham Pi theorem-Dimensionlessparameters-Similitudeandmodelstudies-Distortedandundistorted models.

UNIT IV TURBINES 10

Impact of jets - Velocity triangles - Theory of roto-dynamic machines - Classification of turbines – Pelton wheel, Francis turbine (inward and outward) and Kaplan turbine- Working principles - Work done by water on the runner - Efficiencies – Draft tube - Specific speed - Performance curves for turbines – Governing of turbines.

UNIT V PUMPS 9

Classification of pumps- Centrifugal pumps– working principle - Heads and efficiencies– Velocity triangles- Work done by the impeller - performance curves - Reciprocating pump working principle – indicator diagram and it's variations – work saved by fitting air vessels.

TOTAL: 45 PERIODS

COURSEOUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Understand the difference between solid and fluid, its properties and behaviour in static conditions.

CO2 Understand the conservation laws applicable to fluids and its application through fluid kinematics and dynamics.

CO3 Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performances of prototype by model studies.

CO4 Estimate losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel.

CO5 Understand the concept of boundary layer and its application to find the drag force excreted by the fluid on the flat solid surface.

TEXT BOOKS:

1. Modi P.N. and Seth, S.M. Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, (2017)
2. JainA. K. FluidMechanics including Hydraulic Machines,Khanna Publishers, New Delhi, 2014.

REFERENCES:

1. Narayana Pillai N. Principles of Fluid Mechanics and Fluid Machines, (3rd Ed.), University Press (India) Pvt. Ltd. 2009.
2. S K Som; Gautam Biswas and S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill Education Pvt. Ltd., 2012
3. Subramanya, K. Fluid Mechanics and Hydraulic Machines, Tata McGraw- Hill Pub. Co., New Delhi, 2011
4. Yunus A. Cengel ; John M. Cimbala, FluidMechanics,McGrawHill EducationPvt.Ltd.,2014
5. Streeter, V. L. and Wylie E. B., Fluid Mechanics, McGraw Hill Publishing Co.(2010)

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	H	H	H	H	H	H
PO2	Problemanalysis	H	H	H	H	H	H
PO3	Design / development of solutions	M	H	H	H	H	H
PO4	Investigation	M	M	H	H	H	H
PO5	Modern Tool Usage	L	L	L	L	L	L
PO6	Individual and Team work	L	L	L	M	M	H
PO7	Communication	L	L	L	L	L	L
PO8	Engineer and Society	M	M	M	M	M	M
PO9	Ethics	L	L	L	L	L	L
PO10	Environment and Sustainability	M	M	M	M	M	M
PO11	Project Management and Finance	L	L	L	L	L	L
PO12	Life Long Learning	M	M	M	H	H	H
PSO1	Knowledge of Civil Engineering discipline	H	H	H	H	H	H
PSO2	Critical analysis of Civil Engineering problems and innovation	M	M	H	M	M	M
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	H	H	H	M	M	H

L - Low, M - Medium, H - High

GE5161 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY L T P C
0 0 4 2

COURSEOBJECTIVES:

- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To articulate where computing strategies support in providing Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.
2. Python programming using simple statements and expressions.
3. Scientific problems using Conditionals and Iterative loops.
4. Implementing real-time/technical applications using Lists, Tuples.
5. Implementing real-time/technical applications using Sets, Dictionaries.
6. Implementing programs using Functions.
7. Implementing programs using Strings.
8. Implementing programs using written modules and Python Standard Libraries.
9. Implementing real-time/technical applications using File handling.
10. Implementing real-time/technical applications using Exception handling.
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Develop algorithmic solutions to simple computational problems
CO2: Develop and execute simple Python programs.
CO3: Structure simple Python programs for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python data structures.
CO6: Apply Python features in developing software applications.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									✓
CO2	✓		✓		✓							✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓	✓	✓							✓
CO5	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

EE5261ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

COURSEOBJECTIVES

1. To impart hands on experience in verification of circuit laws and measurement of circuit parameters
2. To train the students in performing various tests on electrical motors.
3. It also gives practical exposure to the usage of CRO, power sources & function generators

LIST OF EXPERIMENTS

1. Verification of Kirchhoff's Law.
2. Steady state response of AC and DC circuits (Mesh, Node Analysis)
3. Frequency response of RLC circuits.
4. Measurement power in three phase circuits by two-watt meter method.
5. Regulation of single phase transformer.
6. Performance characteristics of DC shunt generator.
7. Performance characteristics of single phase induction motor.
8. Characteristics of PN diode and Zener diode
9. Characteristics of Zener diode
10. Half wave and full wave Rectifiers
11. Application of Zener diode as shunt regulator.
12. Characteristics of BJT and JFET

TOTAL: 60 PERIODS

COURSEOUTCOMES:

1. To become familiar with the basic circuit components and know how to connect them to make a real electrical circuit;
2. Ability to perform speed characteristic of different electrical machines
3. Ability to use logic gates and Flip flops

MA5355 TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes;
- To introduce Fourier series analysis which is central to many applications in engineering :
- To develop the analytic solutions for partial differential equations used in engineering by Fourier series;
- To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic;
- To develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems.

UNIT IPARTIAL DIFFERENTIAL EQUATIONS **12**

Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Lagrange's Linear equation – Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

UNIT II FOURIER SERIES **12**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and cosine series – Complex form of Fourier series – Parseval's identity – Harmonic Analysis.

UNIT IIIAPPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION **12**

Classification of partial differential equations- Method of separation of variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in cartesian coordinates.

UNIT IV FOURIER TRANSFORM **12**

Fourier integral theorem – Fourier transform pair - Sine and cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

UNIT VZ – TRANSFORM AND DIFFERENCE EQUATIONS **12**

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and final value theorems – Formation of difference equation – Solution of difference equation using Z - transform.

TOTAL : 60 PERIODS

COURSE OUTCOMES :

At the end of the course, students will be able to

- Solve partial differential equations which arise in application problems.
- Analyze the functions as an infinite series involving sine and cosine functions.
- Obtain the solutions of the partial differential equations using Fourier series.
- Obtain Fourier transforms for the functions which are needed for solving application problems.
- Manipulate discrete data sequences using Z transform techniques.

TEXTBOOKS:

1. Erwin kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 10th Edition, New Delhi, 2015.
2. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, New Delhi, 2017.

REFERENCES:

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7th Edition, New Delhi, 2009.
2. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 4th Edition, New Delhi, 2011.
3. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7th Edition, New Delhi, 2012.
4. Ramana, B.V. "Higher Engineering Mathematics", Tata McGraw Hill, 11th Reprint, New Delhi, 2010.

ML5352 MECHANICS OF MATERIALS **L T P C**
3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare students for:

1. To develop the understanding of the principle concepts behind stress, strain and deformation of solids for various engineering applications.
2. Analyzing the transverse loading on beams and stresses in beam for various engineering applications.
3. Analyzing the torsion principles on shafts and springs for various engineering applications.
4. Analyzing the deflection of beams for various engineering applications.
5. Analyzing the thin and thick shells and principal stresses in beam for various engineering applications

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 – Volumertric strains

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 – Flitched beams – 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

Double Integration method – Macaulay's method – Area moment Theorems for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell's reciprocal theorems.

UNIT V THICK & THIN SHELLS & PRINCIPAL STRESSES 9

Stresses in thin cylindrical shell due to internal pressure, circumferential and longitudinal stresses and deformation in thin cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lame's theory – Application of theories of failure – Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress.

TOTAL: 45 PERIODS

COURSEOUTCOMES:

Upon completion of this course, the students will be able to:

1. Quote the stress and strain relationship and also distinguish the determinate and indeterminate structures.
2. Determine the shear force and bending moment diagrams for s beams for various engineering applications.
3. Estimate the torsional load and stresses on shafts and springs for various engineering applications.
4. Analyze the deflection of beams for various engineering applications.
5. Illustrate principle stresses, knowledge of calculating deformation in thin cylindrical and spherical shells.

TEXT BOOKS:

1. Bansal, R.K., Strength of Materials, Laxmi Publications (P) Ltd., 2007
2. Jindal U.C., Strength of Materials, Asian Books Pvt. Ltd., New Delhi, 2007

REFERENCES:

1. Egor. P.Popov " Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2001
2. Ferdinand P. Beer, Russell Johnson, J.r. and John J. Dewole Mechanics of Materials, Tata McGraw Hill publishing 'co. Ltd., New Delhi.
3. Hibbeler, R.C., Mechanics of Materials, Pearson Education, Low Price Edition, 2007.
4. Subramanian R., Strength of Materials, oxford University Press, Oxford Higher Education Series, 2007.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
C01	3	3	2	1									3	2	
C02	3	3	2	1									3	2	
C03	3	3	2	1									3	2	
CO4	3	3	2	1									3	2	
CO5	3	3	2	1									3	2	

ME5301 ENGINEERING THERMODYNAMICS **L T P C**
3 0 0 3

COURSE OBJECTIVES: The main learning objective of this course is to prepare students for:

1. Understanding the basics and application of zeroth and first law of thermodynamics.
2. Analysing the second law of thermodynamics for performance of thermal systems.
3. Impartingthe knowledge on availability and applications of second law of thermodynamics
4. Interpreting the various properties of steam.
5. Estimating the macroscopic properties of gas mixtures.

UNIT I BASICS, ZEROTH AND FIRST LAW 9

Review of Basics – Thermodynamic systems, Properties and processes Thermodynamic Equilibrium - Displacement work - P-V diagram. Thermal equilibrium - Zeroth law – Concept of temperature and Temperature Scales. First law – application to closed and open systems – steady and unsteady flow processes.

UNIT II SECOND LAW AND ENTROPY 9

Heat Engine – Refrigerator - Heat pump. Statements of second law and their equivalence & corollaries. Carnot cycle - Reversed Carnot cycle - Performance - Clausius inequality. Concept of entropy - T-s diagram - Tds Equations - Entropy change for a pure substance.

UNIT III AVAILABILITY AND APPLICATIONS OF II LAW 9

Ideal gases undergoing different processes - principle of increase in entropy. Applications of II Law. High and low grade energy. Availability and Irreversibility for open and closed system processes - I and II law Efficiency

UNIT IV PROPERTIES OF PURE SUBSTANCES 9

Steam - formation and its thermodynamic properties - p-v, p-T, T-v, T-s, h-s diagrams. PVT surface. Determination of dryness fraction. Calculation of work done and heat transfer in non-flow and flow processes using Steam Table and Mollier Chart.

UNIT V GAS MIXTURES AND THERMODYNAMIC RELATIONS 9

Properties of Ideal gas, real gas - comparison. Equations of state for ideal and real gases. vander Waal's relation - Reduced properties - Compressibility factor - Principle of Corresponding states - Generalized Compressibility Chart. Maxwell relations - Tds Equations - heat capacities relations - Energy equation, Joule-Thomson experiment - Clausius-Clapeyron equation.

TOTAL =45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Apply zeroth and first lawsto thermodynamic systems.
2. Relate the second law of thermodynamics towards analyzing the performance of thermal systems.
3. Adopt the concept of entropy and availability in thermal systems
4. Evaluate the various properties of steam using thermodynamic relations
5. Compute the macroscopic properties of gas mixtures.

TEXT BOOKS:

1. Nag.P.K., “Engineering Thermodynamics”, 6th Edition, Tata McGraw Hill (2017), New Delhi
2. Natarajan, E., “Engineering Thermodynamics: Fundamentals and Applications”, 2nd Edition (2014), Anuragam Publications, Chennai

REFERENCES:

1. Cengel, Y and M. Boles, Thermodynamics - An Engineering Approach, Tata McGraw Hill,8th Edition, 2015.
2. Chattopadhyay, P, “Engineering Thermodynamics”, 2nd Edition Oxford University Press, 2016.
3. Rathakrishnan, E., “Fundamentals of Engineering Thermodynamics”, 2nd Edition, Prentice Hall of India Pvt. Ltd, 2006.
4. Claus Borgnakke and Richard E. Sonntag, “Fundamentals of Thermodynamics”, 7th Edition, Wiley Eastern, 2009.
5. Venkatesh. A, “Basic Engineering Thermodynamics”, Universities Press (India) Limited, 2007.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	1			1					1	2	1	
2	3	3	2	1			1					1	2	1	
3	3	3	2	1	1		1					1	2	2	1
4	3	3	2	1		1						1	2	2	
5	3	3	2	1		1						1	2	1	

ME5351 COMPUTER AIDED DESIGN **L T P C**
3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Applying the fundamental concepts of computer graphics and its tools in a generic framework.
2. Creating and manipulating geometric models using curves, surfaces and solids.
3. Applying concept of CAD systems for 3D modeling and visual realism.
4. Creating and adding geometric tolerances in assembly modeling.
5. Applying CAD standard practices in engineering design.

UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS 9

Product cycle- Design process - Computer Aided Design – Computer graphics – co-ordinate systems- 2D and 3D transformations- homogeneous coordinates - graphic primitives (point, line, circle drawing algorithms) - Clipping- viewing transformation.

UNIT II GEOMETRIC MODELING 9

Representation of curves - Hermite cubic spline curve, Bezier curve, B-spline curves, Surface Modeling – Surface Entities, Representation of Surface, Bezier Surface, B-Spline Surface and Coons Surface. Solid Modeling - Solid Entities, Solid Representation, Boundary Representation (B-Rep), Sweeps Representation, Constructive Solid Geometry (CSG).

UNIT III VISUAL REALISM 9

Need for hidden surface removal, The Depth - Buffer Algorithm, Properties that help in reducing efforts, Scan Line coherence algorithm, Span - Coherence algorithm, Area-Coherence Algorithms, Warnock’s Algorithm, Priority Algorithms– shading – coloring – computer animation.

UNIT IV PART ASSEMBLY 9

Mass properties - Assembly modeling – Inference of position and orientation –Geometric Dimensioning and Tolerancing – Functional importance of various types of fits, Geometrical dimensioning and Tolerancing, Tolerance stacking – types and remedies.

UNIT V CAD STANDARDS 9

Standards for computer graphics- Graphical Kernel System (GKS) - Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, ACIS and DXF - communication standards.

TOTAL =45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Employ the fundamental concepts of computer graphics and its tools in a genericframework.
2. Create and manipulatethe geometric models using curves, surfaces andsolids
3. Develop3D model and visualrealism in CAD systems.
4. Apply geometricaldimensioning and tolerancing in assemblymodeling.
5. Adapt the standard CAD practices in engineeringdesign.

TEXT BOOKS:

1. Ibrahim Zeid "Mastering CAD CAM" Tata McGraw-Hill Publishing Co.2007.
2. P. N. Rao, CAD/CAM: Principles and Applications, Tata McGraw Hill, 2006.

REFERENCES:

1. Groover, M. P., CAD/CAM: Computer-Aided Design and Manufacturing, Pearson Education, 2008.
2. Chris McMahon and Jimmie Browne "CAD/CAM Principles, practice and manufacturing management "Pearson education Asia, 2001.
3. Donald Hearn and M. Pauline Baker "Computer Graphics"'. Prentice Hall, Inc, 1992.
4. Foley, Wan Dam, Feiner and Hughes – "Computer graphics principles & practice", Pearson Education - 2003.
5. William M Neumann and Robert F.Sproul "Principles of Computer Graphics", McGraw Hill Book Co. Singapore, 1989.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	3	1	3			1		3	1	3	2	1	2
2	2	1	3	1	3			1		3	1	3	2	1	2
3	2	1	3	1	3			1		3	1	3	2	1	2
4	2	1	3	1	3			1		3	1	3	2	1	2
5	2	1	3	1	3			1		3	1	3	2	1	2

ML5351 ENGINEERING MATERIALS AND METALLURGY L T P C
3 0 0 3

COURSE OBJECTIVES: The main learning objective of this course is to prepare the students to

1. Construct the phase diagrams and understand the iron-iron carbide phase diagram.
2. Select and applyproper heat treatment processbased on the application requirements.
3. Identify and use suitable ferrous and non-ferrous alloys for engineering applications.
4. Understand the applications ofpolymer, ceramics and composites.
5. explain different testing procedures and failure mechanisms

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron – Iron carbide equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application.

UNITII HEAT TREATMENT 9

Definition – Full annealing, stress relief, recrystallisation and spheroidising –normalizing, hardening and Tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram – continuous cooling Transformation (CCT) diagram – Austempering, Martempering – Hardenability, Jominy end quench test -case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening – Thermo-mechanical treatments- elementary ideas on sintering.

UNITIII FERROUS AND NON-FERROUS METALS 9

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti& W) – stainless and tool steels – HSLA - Maraging steels – Grey, white, malleable, spheroidal – alloy cast irons, Copper and its alloys – Brass, Bronze and Cupronickel – Aluminium and its alloys; Al-Cu – precipitation strengthening treatment – Titanium alloys, Mg-alloys, Ni-based super alloys – shape memory alloys- Properties and Applications

UNITIV NON-METALLIC MATERIALS 9

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS,PAI, PPO, PPS, PEEK, PTFE, Thermo set polymers – Urea and Phenol formaldehydes - Engineering Ceramics – Properties and applications of Al2O3, SiC, Si3N4, PSZ and SIALON – intermetallics- Composites- Matrix and reinforcement Materials- applications of Composites - Nano composites.

UNITV MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS 9

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

TOTAL =45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Construct the iron-iron carbide phase diagram and estimate the phases present in the microstructure.
2. Select a suitable heat treatment process for ferrous alloys based on the requirements.
3. Choose suitable ferrous and non-ferrous alloys for specific engineering applications
4. use different polymer, ceramics and composites for a specific engineering applications
5. Describe testing procedures and failure mechanisms

TEXT BOOKS:

1. Kenneth G.Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 4th Indian Reprint 2002.
2. Sydney H.Avner, "Introduction to Physical Metallurgy", McGraw Hill Book Company, 1994

REFERENCES:

1. A. Alavudeen, N. Venkateshwaran, and J. T.WinowlinJappes, A Textbook of Engineering Materials and Metallurgy, Laxmi Publications, 2006.
2. Amandeep Singh Wadhwa, andHarvinder Singh Dhaliwal, A Textbook of Engineering Material and Metallurgy, University Sciences Press, 2008.
3. G.S. Upadhyay and Anish Upadhyay, "Materials Science and Engineering", Viva Books Pvt.Ltd, New Delhi, 2006.
4. Raghavan.V, "Materials Science and Engineering", Prentice Hall of India Pvt.Ltd. 1999.
5. Williams D Callister, "Material Science and Engineering" Wiley India Pvt Ltd, Revised Indian edition 2007.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	1		1	1					1	2	2	1
2	3	2	2									2	2	2	1
3	3		2			1						2	2	2	1
4	3		2			1						3	2	2	1
5	3	3	2	1								2	2	2	1

CE5361 STRENGTH OF MATERIALS AND FLUID MACHINERY LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

1. To study the mechanical properties of materials when subjected to different types of loading.
2. To verify the principles studied in Fluid Mechanics theory by performing experiments in lab.

PART – I STRENGTH OF MATERIALS **30**

LIST OF EXPERIMENTS

1. Tension test on mild steel rod
2. Torsion test on mild steel rod
3. Hardness test on metal beam (Rockwell and Brinell Hardness Tests)
4. Compression test on helical spring
5. Deflection test on carriage spring

PART – II FLUID MECHANICS AND MACHINES LABORATORY **30**

LIST OF EXPERIMENTS

A. FLOW MEASUREMENT

1. Verification of Bernoulli's theorem
2. Flow through orifice/venturi meter
3. Friction factor for flow through pipes
4. Impact of jet on fixed plate

B. METACENTER

5. Determination of metacentric height

C. PUMPS

6. Characteristics of centrifugal pumps
7. Characteristics of gear pump
8. Characteristics of submersible pump
9. Characteristics of reciprocating pump

D. TURBINES

10. Characteristics of Pelton wheel turbine

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

1. Perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.
2. Use the measurement equipment's for flow measurement.
3. Perform test on different fluid machinery.
4. Verify and apply Bernoulli equation for flow measurement like orifice/venturi meter.
5. Measure friction factor in pipes and compare with Moody diagram and verify momentum conservation law.
6. Determine the performance characteristics of rotodynamic pumps.
7. Determine the performance characteristics of positive displacement pumps.
8. Determine the performance characteristics of turbine.

REFERENCES:

1. Hydraulic Laboratory Manual, Centre for Water Resources, Anna University, 2015.
2. Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics. Standard Book House. New Delhi, 2017.
3. Subramanya K, Fluid Mechanics and Hydraulic Machines, Tata McGraw Hill Edu. Pvt. Ltd.2011

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	M	H	H	H	H	H
PO2	Problemanalysis	M	M	H	H	H	H
PO3	Design / development of solutions	L	L	M	M	M	M
PO4	Investigation	H	H	H	H	H	H
PO5	Modern Tool Usage	L	L	L	L	L	L
PO6	Individual and Team work	M	M	H	H	H	H
PO7	Communication	L	L	L	L	L	L
PO8	Engineer and Society	M	M	M	M	M	M
PO9	Ethics	L	L	L	L	L	L
PO10	Environment and Sustainability	M	M	M	M	M	M
PO11	Project Management and Finance	L	L	L	L	L	L
PO12	Life Long Learning	M	M	M	M	M	M
PSO1	Knowledge of Civil Engineering discipline	M	H	H	H	H	H
PSO2	Critical analysis of Civil Engineering problems and innovation	L	L	M	M	M	M
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	L	L	L	L	L	L

L - Low, M - Medium, H - High

ME5361 COMPUTER AIDED MACHINE DRAWING **L T P C**
0 0 4 2

COURSE OBJECTIVES:
The main learning objective of this course is to provide hands on training to the students in:

1. Applying standard drawing practices using fits and tolerances.
2. Modeling orthogonal views of machine components.
3. Modeling orthogonalviews of assembled components.
4. Preparing standard drawing layout for modeled parts or assemblies with BoM.
5. Gaining practical experience in handling 2D drafting software systems.

PART I DRAWING STANDARDS & FITS AND TOLERANCES 4

Code of practice for Engineering Drawing, BIS specifications – Welding symbols, riveted joints, keys, fasteners – Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc. - Limits, Fits – Tolerancing of individual dimensions – Specification of Fits – Preparation of production drawings and reading of part and assembly drawings, basic principles of Geometric Dimensioning &Tolerancing.

PART II 2D DRAFTING 56

Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed Drawing.

1. Bearings – Bush Bearing
2. Valves – Safety and Non-return Valves.
3. Couplings – Flange, Oldham's, Muff, Gear couplings.
4. Joints – Universal, Knuckle, Gib& Cotter, Strap, Sleeve &Cotter joints.
5. Engine parts – Piston, Connecting Rod, Crosshead (vertical and horizontal), Stuffing box, Multi-plate clutch.
6. Machine Components – Screw Jack, Machine Vice,LatheTailStock, Lathe Chuck, Plummer Block,Vane and Gear pumps.

Total: 20% of classes for theory classes and 80% of classes for practice

Note: 25% of assembly drawings must be done manually and remaining 75% of assembly drawings must be done by using any CAD software. The above tasks can be performed manually and using standard commercial 2D CAD software.

TOTAL(L: 4 + P: 56) = 60 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Practice drawing standards using fits and tolerances.
2. Model orthogonal views of machine components.
3. Model orthogonalviews of assembled components.
4. Preparestandard drawing layout for modeled parts or assemblies with BoM.
5. Create standard drawing for modeled parts or assemblies using modeling software.

TEXT BOOK:

1. Gopalakrishna K.R., "Machine Drawing", 22 nd Edition, Subhas Stores Books Corner, Bangalore, 2013.

REFERENCES:

1. N. D. Bhatt and V.M. Panchal, "Machine Drawing", 48th Edition, Charotar Publishers,2013
2. Junnarkar, N.D., "Machine Drawing", 1st Edition, Pearson Education, 2004
3. N. Siddeshwar, P. Kanniah, V.V.S. Sastri, "Machine Drawing" , published by Tata Mc GrawHill,2006
4. S. Trymbaka Murthy, "A Text Book of Computer Aided Machine Drawing", CBS Publishers, New Delhi, 2007

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3		3			1	1	2	1	3	2		2
2	3	3	3		3			1	1	2	1	3	2		2
3	3	3	3		3			1	1	2	1	3	2		2
4	3	3	3		3			1	1	2	1	3	2		2
5	3	3	3		3			1	1	2	1	3	2		2

ME5451 HYDRAULICS AND PNEUMATICS L T P C
3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:

1. Applying the working principles of fluid power systems and hydraulic pumps.
2. Applyingthe working principles of hydraulic actuators and control components.
3. Designing and develop hydraulic circuits and systems.
4. Applying the working principles of pneumatic power system and its components.
5. Solving problems and troubles in fluid power systems.

UNITI FLUID POWER PRINICIPLES AND HYDRAULIC PUMPS 9
Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types of fluids - Properties of fluids and selection – Basics of Hydraulics – Pascal's Law – Principles of flow - Friction loss – Work, Power and Torque- Problems, Sources of Hydraulic power : Pumping Theory-– Pump Classification – Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criteria of pumps – Fixed and Variable displacement pumps – Problems

UNITII HYDRAULIC ACTUATORS AND CONTROL COMPONENTS 9
Hydraulic Actuators: Cylinders – Types and construction, Application, Hydraulic cushioning – Rotary actuators-Hydraulic motors - Control Components : Direction Control, Flow control and pressure control valves – Types, Construction and Operation – Accessories : Reservoirs, Pressure Switches – Filters –types and selection- Applications – Fluid Power ANSI Symbols – Problems

UNITIII HYDRAULIC CIRCUITS AND SYSTEMS 9
Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative, Pump Unloading, Double-Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Deceleration circuits ,Sizing of hydraulic systems, Hydrostatic transmission, Electro hydraulic circuits,–Servo and Proportional valves – Applications- Mechanical ,hydraulic servo systems.

UNITIV PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS 9
Properties of air –Air preparation and distribution – Filters, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit –classification-single cylinder and multi cylinder circuits-Cascade method –Integration of fringe circuits ,Electro Pneumatic System – Elements – Ladder diagram – timer circuits-Problems, Introduction to fluidics and pneumatic logic circuits

UNITV TROUBLE SHOOTING AND APPLICATIONS 9
Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems, Conditioning of hydraulic fluids Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for metal working, handling, clamping counter and timer circuits. – Low cost Automation – Hydraulic and Pneumatic power packs.

TOTAL = 45 PERIODS

Note: (Use of standard Design Data Book is permitted in the University examination)

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Apply the working principles of fluid power systems and hydraulic pumps.
2. Apply the working principles of hydraulic actuators and control components.
3. Design and develop hydraulic circuits and systems.
4. Apply the working principles of pneumatic power system and its components.
5. Solve problems and troubles in fluid power systems.

TEXT BOOKS:

1. Anthony Esposito, “Fluid Power with Applications”, Prentice Hall, 2009.
2. James A. Sullivan, “Fluid Power Theory and Applications”, Fourth Edition, Prentice Hall, 1997

REFERENCES:

1. Jagadeesha. T., “Pneumatics Concepts, Design and Applications “, Universities Press, 2015.
2. Joshi.P., Pneumatic Control”, Wiley India, 2008.
3. Majumdar, S.R., “Oil Hydraulics Systems – Principles and Maintenance”,TataMcGraw Hill, 2001.
4. Shanmugasundaram.K., “Hydraulic and Pneumatic Controls”. Chand & Co, 2006.
5. Srinivasan.R., “Hydraulic and Pneumatic Controls”, Vijay Nicole Imprints, 2008.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	1	1			2				1		3		
2	3	1	1	1			2				1	2	3	1	
3	3	3	3	3	3	3	3	2	3	3	1	3	3	3	3
4	3	3	3	3	3	3	3	2	3	3	1	3	3	3	3
5	3	3	3	2	3	2	2	2	2	3	1	3	3	2	2

ME5401 THEORY OF MACHINES **L T P C**
3104

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Applying the basic components of mechanisms, analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism and design cam mechanisms for specified output motions.
2. Applying the basic concepts of toothed gearing and kinematics of gear trains
3. Analyzing the effects of friction in machine elements
4. Analyzing the force-motion relationship in components subjected to external forces and analyzing of standard mechanisms.
5. Analyzing the undesirable effects of unbalances resulting from prescribed motions in mechanism and the effect of dynamics of undesirable vibrations.

UNITI KINEMATICS OF MECHANISMS **9+3**

Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain – kinematics analysis in simple mechanisms – velocity and acceleration polygons– Analytical methods – computer approach – cams – classifications – displacement diagrams - layout of plate cam profiles – derivatives of followers motion – circular arc and tangent cams.

UNITII GEARS AND GEAR TRAINS **9+3**

Spur gear – law of toothed gearing – involute gearing – Interchangeable gears – Gear tooth action interference and undercutting – nonstandard teeth – gear trains – parallel axis gears trains – epicyclic gear trains – automotive transmission gear trains.

UNITIII FRICTION IN MACHINE ELEMENTS **9+3**

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.

UNITIV FORCE ANALYSIS 9+3

Applied and Constrained Forces – Free body diagrams – static Equilibrium conditions – Two, Three and four members – Static Force analysis in simple machine members – Dynamic Force Analysis – Inertia Forces and Inertia Torque – D'Alembert's principle – superposition principle – dynamic Force Analysis in simple machine members

UNITV BALANCING AND VIBRATION 9+3

Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing machines – free vibrations – Equations of motion – natural Frequency – Damped Vibration – bending critical speed of simple shaft – Torsional vibration – Forced vibration – harmonic Forcing – Vibration isolation.

TOTAL(L: 45) =45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Apply the basic components of mechanisms, analyze the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism and design cam mechanisms for specified output motions.
2. Apply the basic concepts of toothed gearing and kinematics of gear trains
3. Analyze the effects of friction in machine elements
4. Examine the force-motion relationship in components subjected to external forces and in standard mechanisms.
5. Evaluate the undesirable effects of unbalances resulting from prescribed motions in mechanism and the effect of dynamics of undesirable vibrations.

TEXT BOOKS:

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", Oxford University Press, 2017.
2. Ramamurthi. V, "Mechanics of Machines", Narosa Publishing House, 2002.

REFERENCES:

1. AmitabhaGhosh and Asok Kumar Mallik, "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., 1988.
2. Rao.J.S. and Dukkipati.R.V. "Mechanism and Machine Theory", New Age International Pvt. Ltd., 2006.
3. Rattan, S.S, "Theory of Machines", McGraw-Hill Education Pvt. Ltd., 2014.
4. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGraw-Hill, 2009.
5. Wilson and Sadler, Kinematics and Dynamics of Machinery, Pearson, 2008.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	1	2			1				1	3		1
2	3	2	2	1	2			1				1	3		1
3	3	2	2	1	2			1				1	3		1
4	3	2	2	1	2			1				1	3		1
5	3	2	2	1	2			1				1	3		1

ME5402 METAL CUTTING AND MACHINE TOOLS L T P C

3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. To impart the knowledge, aspects and the significance of material removal processes.
2. To demonstrate the operations of turning and automatic machine tools.
3. To explain the principle of reciprocating, milling and gear cutting machines.
4. To illustrate the principles of abrasive and broaching processes.
5. To get familiarize with CNC machines and its programming.

UNITI THEORY OF METAL CUTTING 9

Mechanics of chip formation, , forces in machining, Types of chip, cutting tools – single point cutting tool nomenclature, orthogonal and oblique metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNITII 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 RECIPROCATING, MILLING AND GEAR CUTTING MACHINES 9

Reciprocating machine tools: shaper, planer, slotter: Types and operations- Hole making: Drilling, reaming, boring, tapping, type of milling operations-attachments- types of milling cutter– machining time calculations - Gear cutting, gear hobbing and gear shaping – gear finishing methods.

UNIT IV ABRASIVE PROCESSES AND BROACHING 9

Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding, internal grinding - micro finishing methods - Typical applications – concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines.

UNIT V COMPUTER NUMERICAL CONTROL MACHINE TOOLS 9

Numerical Control (NC) machine tools – CNC types, constructional details, special features, machining centre and part programming fundamentals – manual part programming and computer assisted part programming.

TOTAL =45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Apply the principles of material removal processes.
2. Determine the machining parameters of turning process and select appropriate automates.
3. Categorise the reciprocating, milling & hole making processes and calculate the gear cutting parameters.
4. Classify the abrasive and broaching processes
5. Construct the CNC part programming for machining and turning centres.

TEXT BOOKS:

1. Kalpakjian. S, “Manufacturing Engineering and Technology”, Pearson Education India Edition, 2009.
2. Roy. A. Lindberg, Processes and materials of manufacture, PHI / Pearson education, 2006.

REFERENCES:

1. GeofreyBoothroyd, “Fundamentals of Metal Machining and Machine Tools”, McGraw Hill, 1984.
2. Hajra Choudhury. “Elements of Workshop Technology – Vol.II”. Media Publishers &Promoters,India, 2010.
3. HMT – “Production Technology”, Tata McGraw Hill, 1998.
4. Richerd R Kibbe, John E. Neely, Roland O.Merges and Warren J.White “Machine Tool Practices”, Prentice Hall of India, 1998.
5. Rao. P.N “Manufacturing Technology,” Metal Cutting and Machine Tools, Tata McGraw- Hill, New Delhi, 2003.

CO	PO												PSO		
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1	3	3	3	1	1	1	3			3		2	3	3	2
2	3	3	3	1	1	1	3			3		2	3	2	2
3	3	3	3	1	1	1	3			3		2	3	2	2
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5	3	3	3	1	1	1	3			3		2	3	2	3

ME5403 APPLIED THERMODYNAMICS **L T P C**
3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Applying the concepts and laws of thermodynamics to predict the operation of thermodynamic cycles and performance of Internal Combustion(IC) engines and Gas Turbines.
2. Analyzing the performance of steam nozzle and computing critical pressure ratio
3. Evaluating the performance of steam turbines
4. Understanding the working of IC engines and its auxiliaries
5. Determining the performance parameters of IC engines

UNIT I THERMODYNAMIC CYCLES **9**

Air Standard Cycles – Carnot, Otto, Diesel, Dual, Brayton – Cycle Analysis, Performance and Comparison, Basic Rankine Cycle, modified, reheat and regenerative cycles.

UNIT II STEAM NOZZLES AND INJECTOR **9**

Types and Shapes of nozzles, Flow of steam through nozzles, Critical pressure ratio, Variation of mass flow rate with pressure ratio. Effect of friction. Metastable flow.

UNIT III STEAM AND GAS TURBINES **9**

Types, Impulse and reaction principles, Velocity diagrams, Work done and efficiency – optimal operating conditions. Multi-staging, compounding and governing. Gas turbine cycle analysis – open and closed cycle. Performance and its improvement - Regenerative, Intercooled, Reheated cycles and their combination.

UNIT IV INTERNAL COMBUSTION ENGINES – FEATURES AND COMBUSTION **9**

IC engine – Classification, working, components and their functions. Ideal and actual : Valve and port timing diagrams, p-v diagrams- two stroke & four stroke, and SI & CI engines – comparison. Geometric, operating, and performance comparison of SI and CI engines. Desirable properties and qualities of fuels. Air-fuel ratio calculation – lean and rich mixtures. Combustion in SI & CI Engines – Knocking – phenomena and control.

UNIT V INTERNAL COMBUSTION ENGINE PERFORMANCE AND AUXILIARY SYSTEMS **9**

Performance parameters and calculations. Morse and Heat Balance tests. Multipoint Fuel Injection system and Common Rail Direct Injection systems. Ignition systems – Magneto, Battery and Electronic. Lubrication and Cooling systems. Concepts of Supercharging and Turbocharging – Emission Norms

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Analyse the thermodynamic cycles under different operating conditions
2. Design a steam nozzle as per specific requirements.
3. Assess the performance of steam turbines
4. Explain the working of all IC engine components
5. Compute the performance of IC engines

TEXTBOOKS:

1. Mahesh. M. Rathore, “Thermal Engineering”, 1st Edition, Tata McGraw Hill, 2010.
2. Ganesan.V , " Internal Combustion Engines" 4th Edition, Tata McGraw Hill, 2012.

REFERENCES:

1. Ballaney. P, “Thermal Engineering”, 25th Edition, Khanna Publishers, 2017.
2. Domkundwar,Kothandaraman, &Domkundwar, “ A Course in Thermal Engineering”, 6th Edition, DhanpatRai& Sons, 2011.
3. Gupta H.N, “Fundamentals of Internal Combustion Engines”, 2nd Edition Prentice Hall of India, 2013.

4. Mathur M.L and Mehta F.S., “Thermal Science and Engineering”, 3rd Edition, Jain Brothers Pvt. Ltd, 2017.
5. Soman. K, “Thermal Engineering”, 2nd Edition, Prentice Hall of India, 2011.

CO	PO												PSO		
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5	3	2	1	1			2					1	2	2	

ME5461 MANUFACTURING TECHNOLOGY LABORATORY **L T P C**
0 0 4 2

COURSE OBJECTIVES:

The main learning objective of this course is to provide hands on training to the students in:

1. Select appropriate tools, equipments and machines to complete a given job.
2. Develop component using casting processes.
3. Perform various joints by Gas Metal Arc Welding (GMAW) processes.
4. Perform various manufacturing processes such as rolling, drawing, turning, shaping, drilling, milling.
5. Fabricate gears using gear making machines.

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LIST OF EXPERIMENTS

1. Fabricating simple structural shapes using Gas Metal Arc Welding machine.
2. Preparing green sand moulds with cast patterns.
3. Casting aluminum parts using stir casting machine.
4. Reducing thethickness of the plates using rolling machine.
5. Reducing the diameter of on circular parts using wire drawing process machine.
6. Taper Turning and Eccentric Turning on circular parts using lathe machine.
7. Knurling, external and internal thread cutting on circular parts using lathe machine.
8. Shaping – Square and Hexagonal Heads on circular parts using shaper machine.
9. Drilling and Reaming using vertical drilling machine.
10. Milling contours on plates using vertical milling machine.
11. Cutting spur and helical gear using milling machine.
12. Generating gearsusinggear hobbingmachine.
13. Generatinggearsusing gear shapingmachine.
14. Grinding components using cylindrical, surface and centerless grindingmachine.
15. Broaching components using broaching machine.

Total (P: 60) = 60 Periods

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Select appropriate tools, equipments and machines to complete a given job.
2. Create components using casting processes.
3. Perform various welding process using GMAW.
4. Perform various machining process such as rolling, drawing, turning, shaping, drilling, milling.
5. Fabricate the gears using various gear generation and forming processes.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	3			2	2	1	3	3		1	3	3	2
2	3	2	3			2	2	1	3	3		1	3	3	2
3	3	2	3			2	2	1	3	3		1	3	3	2
4	3	3	3			2	2	1	3	3		1	3	3	2
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ME5411 COMPUTER AIDED MANUFACTURING LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:
The main learning objective of this course is to provide hands on training to the students in:

1. Applying the fundamental working principle of CNC machine tool.
2. Programming G & M Code programming and simulate the CNC program.
3. Generating part programming data through CAM software.
4. Integrating CNC and unconventional machine tools.
5. Applying the principles of Additive Manufacturing process.

LIST OF EXPERIMENTS:

1. MANUAL PART PROGRAMMING: - CNC Machining Centre

i) Linear Cutting.
ii) Circular cutting.
iii) Cutter Radius Compensation.
iv) Canned Cycle Operations.

2. MANUAL PART PROGRAMMING: - CNC Turning Centre

i) Straight, Taper and Radial Turning.
ii) Thread Cutting.
iii) Rough and Finish Turning Cycle.
iv) Drilling and Tapping Cycle.

3. COMPUTER AIDED PART PROGRAMMING

Generate CL Data and Post process data using CAM packages for Machining and Turning Centre.

4. STUDY OF CNC EDM or CNC EDM WIRE-CUT

5. STUDY OF ADDITIVE MANUFACTURING PROCESS: FDM or SLA or SLS or LOM

TOTAL = 60 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:

1. Apply the fundamental working principle of CNC machine tool.
2. Program G & M Code programming and simulate the CNC program.
3. Generate part programming data through CAM software.
4. Integrate CNC and unconventional machine tools.
5. Apply the principles of Additive Manufacturing process

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	3	3		3		2		2		2	1	3	2	3
2	3	3	3	3	3	2							2	3	2
3	2	1	2	2										2	2
4	2	1	2	3										2	3
5	2	1	2	3	3	3			2		2			3	3

GE5451 TOTAL QUALITY MANAGEMENT **L T P C**
3 0 0 3

OBJECTIVES:

- Teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- Explain the TQM Principles for application.
- Define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
- Describe Taguchi's Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
- Illustrate and apply QMS and EMS in any organization.

UNIT I INTRODUCTION **9**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM –-Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES **9**

Leadership - Deming Philosophy, Quality Council, Quality statements and Strategic planning- Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal--Continuous process improvement –Juran Trilogy, PDSA cycle, 5S and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I **9**

The seven traditional tools of quality - New management tools - Six-sigma Process Capability- Bench marking - Reasons to benchmark, Benchmarking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Benchmarking - FMEA - Intent , Documentation, Stages: Design FMEA and Process FMEA.

UNIT IV TQM TOOLS & TECHNIQUES II **9**

Quality circles – Quality Function Deployment (QFD) - Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures- Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM **9**

Introduction-Benefits of ISO Registration-ISO 9000 Series of Standards-Sector-Specific Standards - AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements-Implementation-Documentation-Internal Audits-Registration-ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001-Benefits of EMS.

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Ability to apply TQM concepts in a selected enterprise.
CO2: Ability to apply TQM principles in a selected enterprise.
CO3: Ability to understand Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
CO4: Ability to understand Taguchi's Quality Loss Function, Performance Measures and apply QFD, TPM, COQ and BPR.
CO5: Ability to apply QMS and EMS in any organization.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓										✓
CO2						✓						✓
CO3					✓				✓			
CO4		✓			✓	✓	✓	✓				✓
CO5			✓			✓	✓	✓				

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Bester field,MaryB.Sacre,HemantUrdhwareshe and RashmiUrdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.

REFERENCES:

1. Joel.E. Ross, “Total Quality Management – Text and Cases”,Routledge.,2017.
2. Kiran.D.R, “Total Quality Management: Key concepts and case studies, Butterworth – Heinemann Ltd, 2016.
3. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
4. Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd., 2006 .

ME5551 DESIGN OF MACHINE ELEMENTS L T P C
3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Designing machine members subjected to static and variable loads.
2. Designing shafts and couplings for various applications.
3. Analyzing bolted and welded joints for various kinds of loads.
4. Designing helical, leaf springs and flywheels for various applications.
5. Designing and select sliding and rolling contact bearings.

UNIT I FUNDAMENTAL CONCEPTS IN DESIGN 9

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers- Direct, Bending and torsional loading- Modes of failure - Factor of safety – Combined loads – Principal stresses – Eccentric loading – curved beams – crane hook and ‘C’ frame- theories of failure – Design based on strength and stiffness – stress concentration – Fluctuating stresses – Endurance limit –Design for finite and infinite life under variable loading - Exposure to standards.

UNIT II SHAFTS AND COUPLINGS 9

Shafts and Axles - Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys and splines – Rigid and flexible couplings.

UNIT III TEMPORARY AND PERMANENT JOINTS 9

Threaded fasteners - Bolted joints – Simple and eccentrically loaded bolted joints- Welded joints – Butt, Fillet and parallel transverse fillet welds – welded joints subjected to bending, torsional and eccentric loads.

UNIT IV ENERGY STORING ELEMENTS 9

Types of springs, design of helical and concentric springs–surge in springs, Design of laminated springs - Flywheels considering stresses in rims and arms for engines and presses - Solid and Rimmed flywheels

UNIT V BEARINGS 9

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi & Boyd graphs, -- Selection of Rolling Contact bearings -Seals and Gaskets.

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Design machine members subjected to static and variable loads.
2. Design shafts and couplings for various applications.
3. Designbolted and welded joints for various kinds of loads.

4. Design helical, leaf springs and flywheels for various applications.
5. Design and select sliding and rolling contact bearings.

TEXT BOOKS:

1. Bhandari V B, “Design of Machine Elements”, 4th Edition , Tata McGraw-Hill Book Co, 2016
2. Joseph Shigley, Richard G. Budynas and J. Keith Nisbett “Mechanical Engineering Design”, 10th Edition, Tata McGraw-Hill , 2015.

REFERENCES:

1. Ansel C Ugural, “Mechanical Design – An Integral Approach”, 1st Edition, Tata McGraw-Hill Book Co, 2004.
2. Design Data Hand Book”, PSG College of Technology, Coimbatore, 2013.
3. Merhyle Franklin Spotts, Terry E. Shoup, and Lee EmreyHornberger, “Design of Machine Elements” 8th Edition, Printice Hall, 2004.
4. Robert C. Juvinall and Kurt M. Marshek, “Fundamentals of Machine component Design”,6th Edition, Wiley, 2017.
5. Sundararajamoorthy T. V. and Shanmugam .N, “Machine Design”, Anuradha Publications, Chennai, 2003.

CO	PO												PSO		
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1	2	2	3	2	1			1				2	3		2
2	2	2	3	2	1			1				2	3		2
3	2	2	3	2	1			1				2	3		2
4	2	2	3	2	1			1				2	3		2
5	2	2	3	2	1			1				2	3		2

ME5552 METROLOGY AND MEASUREMENTS L T P C
3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. To introduce the basic terminology of measurements and the procedure for estimating measurement uncertainty.
2. To give an overview of the various linear and angular measuring instruments used in industries.
3. To provide the necessary skills needed to perform tolerance analysis in manufacturing situations and to design gauges for limit measurement during manufacturing.
4. To give an understanding of the importance of surface metrology and the role of GD&T in manufacturing.
5. To expose the science behind the advanced measurements and their applications in manufacturing industries in quality control

UNIT I BASICS OF METROLOGY 9

Measurement – Need, Process, Role in quality control; Factors affecting measurement - SWIPE; Errors in Measurements – Types – Control – Measurement uncertainty – Types, Estimation, Problems on Estimation of Uncertainty, Statistical analysis of measurement data, Measurement system analysis, Calibration of measuring instruments, ISO standards.

UNIT II MEASUREMENT OF LINEAR, ANGULAR DIMENSIONS AND ASSEMBLY AND TRANSMISSION ELEMENTS 9

Linear Measuring Instruments – Vernier caliper, Micrometer, Vernier height gauge, Depth Micrometer, Bore gauge, Telescoping gauge; Gauge blocks – Use and precautions, Comparators – Working and advantages; Opto-mechanical measurements using measuring microscope and Profile projector - Angular measuring instruments – Bevel protractor, Clinometer, Angle gauges, Precision level, Sine bar, Autocollimator, Angle dekkor, Alignment telescope.

Measurement of Screw threads - Single element measurements – Pitch Diameter, Lead, Pitch. Measurement of Gears – purpose – Analytical measurement – Runout, Pitch variation, Tooth profile, Tooth thickness, Lead – Functional checking – Rolling gear test.

UNIT III TOLERANCE ANALYSIS 9

Tolerancing – Interchangeability, Selective assembly, Tolerance representation, Terminology, Limits and Fits, Problems (using tables); Design of Limit gauges, Problems. Tolerance analysis in manufacturing, Process capability, tolerance stackup, tolerance charting.

UNIT IV METROLOGY OF SURFACES 9

Fundamentals of GD & T- Conventional vs Geometric tolerance, Datums, Inspection of geometric deviations like straightness, flatness, roundness deviations, etc. Simple problems – Measurement of Surface finish – Functionality of surfaces, Parameters, Comparative, Stylus based and Optical Measurement techniques, Filters, Introduction to 3D surface metrology- Parameters.

UNIT V ADVANCES IN METROLOGY 9

Lasers in metrology - Advantages of lasers – Laser scan micrometers; Laser interferometers – Applications – Straightness, Alignment; Ball bar tests, Computer Aided Metrology - Basic concept of CMM – Types of CMM – Constructional features – Probes – Accessories – Software – Applications – Multisensor CMMs.

Machine Vision - Basic concepts of Machine Vision System – Elements – Applications - On-line and in-process monitoring in production - Computed tomography – White light Scanners.

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Describe the importance of measurements in engineering and the factors affecting measurements and to estimate measurement uncertainty.
2. Describe the working principle and applications of various linear and angular measuring instruments and basic concepts of measurement of assembly and transmission elements and select a measuring instrument for the given application.
3. Interpret the various tolerance symbols given in engineering drawings to choose the appropriate manufacturing process.
4. Describe the principles and methods of form and surface metrology and interpret surface metrology related information in Engineering drawings.
5. Describe the advances in measurements for quality control in manufacturing Industries.

TEXTBOOKS:

1. Dotson Connie, “Dimensional Metrology”, Cengage Learning, First edition, 2012.
2. Mark Curtis, Francis T. Farago, “Handbook of Dimensional Measurement”, Industrial Press, Fifth edition, 2013.

REFERENCES:

1. AmmarGrous, J “Applied Metrology for Manufacturing Engineering”, Wiley-ISTE, 2011.
2. Galyer, J.F.W. Charles Reginald Shotbolt, “Metrology for Engineers”, Cengage Learning EMEA; 5th revised edition, 1990.
3. National Physical LaboratoryGuideNo. 40, No. 41, No. 42, No. 43, No. 80, No. 118, No. 130, No. 131. http://www.npl.co.uk. (relevant to syllabus).
4. Raghavendra N.V. and Krishnamurthy. L., Engineering Metrology and Measurements, Oxford University Press, 2013.
5. Venkateshan, S. P., “Mechanical Measurements”, Second edition, John Wiley &Sons, 2015.

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ME5501 THERMAL ENGINEERING LTPC
3003

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Evaluating the fuel properties and arrive at proximate and ultimate analysis of fuels.
2. Understanding the different types of boilers and compute their performance.
3. Assessing the performance of an air compressor.
4. Comprehending the working principle of various refrigeration systems
5. Determining the different psychrometric properties and heat load

UNIT I FUELS AND COMBUSTION 9

Fuels - Types and Characteristics of Fuels - Determination of Properties of Fuels – Fuels Analysis - Proximate and Ultimate Analysis - Moisture Determination - Calorific Value -Gross & Net Calorific Values

UNIT II BOILERS 9

Types and comparison, Mountings and Accessories. Performance calculations, Boiler trial.

UNIT III AIR COMPRESSORS 9

Classification and comparison, working principle, work of compression - with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency. Multistage air compressor with Intercooling. Working principle and comparison of Rotary compressors with reciprocating air compressors

UNIT IV REFRIGERATION SYSTEMS 9

Vapour compression refrigeration cycle, Effect of Superheat and Sub-cooling, Performance calculations, Working principle of air cycle, vapour absorption system, and Thermoelectric refrigeration.

UNIT V PSYCHROMETRY AND AIR-CONDITIONING 9

Psychrometric properties – Property calculations using Psychrometric chart and expressions. Psychrometric processes – adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing Air conditioning systems, concept of RSHF, GSHF and ESHF, Cooling load calculations. Cooling towers – concept and types.

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Determine the fuel properties adopting proximate and ultimate analysis.
2. Analyze the performance of different boilers.
3. Assess the performance of air compressors under different operating conditions
4. Explain the working principles of various refrigeration systems and estimate COP.
5. Compute psychrometricproperties and design suitable air conditioning systems.

TEXTBOOKS:

1. Mahesh. M. Rathore, “Thermal Engineering”, 1st Edition, Tata McGraw Hill, 2010.
2. Ballaney. P, “ Thermal Engineering”, 25th Edition, Khanna Publishers, 2017

REFERENCES:

1. Ananthanarayanan P.N, " Basic Refrigeration and Air-Conditioning", 4th Edition, Tata McGraw Hill, 2013.
2. Arora, " Refrigeration and Air-Conditioning", 2nd Edition, Prentice Hall of India, 2010.
3. Mathur M.L and Mehta F.S., "Thermal Science and Engineering", 3rd Edition, Jain Brothers Pvt. Ltd, 2017.
4. Nag P.K, " Basic and Applied Thermodynamics", 2nd Edition, Tata McGraw Hill, 2010
5. Soman. K, "Thermal Engineering", 2nd Edition, Prentice Hall of India, 2011

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ME5511 METROLOGY AND DYNAMICS LABORATORY LTPC

0042

COURSE OBJECTIVES:

The main learning objectives of this course are to:

1. Demonstrate the calibration of simple linear measuring instruments and use of linear, angular measuring instruments, comparators, contact, and optical measurements used in manufacturing industries.
2. Demonstrate the measurement of GD&T parameters like straightness, perpendicularity, roundness, etc.
3. Demonstrate the measurement of surface finish using contact methods.
4. Demonstrate the working principles of kinematics involved in various mechanisms.
5. Demonstrate the working principles of Dynamics involved in various Experiments

PART I METROLOGY LABORATORY 30

List of Experiments:

1. Calibration and use of linear measuring instruments – Vernier caliper, micrometer, Vernier height gauge, depth micrometer, bore gauge, telescopic gauge, Comparators.
2. Measurement of angles using bevel protractor, sine bar, autocollimator, precision level.
3. Measurement of assembly and transmission elements - screw thread parameters – Screw thread Micrometers, Three wire method, Toolmaker's microscope.
4. Measurement of gear parameters – Micrometers, Vernier caliper, Gear tester.
5. Measurement of features in a prismatic component using Coordinate Measuring Machine (CMM), Programming of CNC Coordinate Measuring Machines for repeated measurements of identical components.
6. Non-contact (Optical) measurement using Measuring microscope / Profile projector and Video measurement system.
7. Surface metrology - Measurement of form parameters – Straightness, Flatness, Roundness, Cylindricity, Perpendicularity, Runout, Concentricity – in the given component using Roundness tester.
8. Measurement of Surface finish in components manufactured using various processes (turning, milling, grinding, etc.,) using stylus based instruments.

PART II DYNAMICS LABORATORY 30

List of Experiments:

1. Study of gear parameter.
2. Epicycle gear Train.
3. Determination of moment of inertia of flywheel and axle system.

4. Determination of mass moment of inertia of a body about its axis of symmetry.
5. Undamped free vibration of a single motor shaft system.
6. Torsional Vibration (Undamped) of single motor shaft system.
7. Dynamic analysis of cam mechanism.
8. Watts Governor.
9. Porter Governor.
10. Experiment of Proell Governor.
11. Experiment of motorized gyroscope.
12. Determination of critical speed of shaft.

TOTAL = 60 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Select a suitable measuring instrument for measurement of linear and angular dimensions, and comparators and measure the dimensions of a given component.
2. Calibrate simple linear measuring instruments like Vernier caliper, micrometer, Vernier height gauge, etc. using gauge blocks.
3. Use advanced measuring equipment coordinate measuring machine, roundness tester, measuring microscope, surface finish measuring equipment to carryout measurements.
4. Measure the various kinematic parameters.
   Evaluate the vibration parameters of different mechanical systems.

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ME5512 THERMAL ENGINEERING LABORATORY L TPC

0 0 4 2

COURSE OBJECTIVES:

The main learning objective of this course is to provide hands on training to the students in:

1. Identifying the performance influencing parameters of various engines
2. Determining the valve and port timing for IC engines
3. Methodology to be adopted for performance evaluation of boiler and steam turbine
4. Quantifying the various performance parameters of air compressors
5. Estimating the fuel properties

PART I IC ENGINE LABORATORY 45

List of Experiments

1. Valve Timing and Port Timing diagrams.
2. Actual p-v diagrams of IC engines.
3. Performance Test on four – stroke Diesel Engine.
4. Heat Balance Test on 4 – stroke Diesel Engine.
5. Morse Test on Multi-Cylinder Petrol Engine.
6. Retardation Test on a Diesel Engine.
7. Determination of p-θ diagram and heat release characteristics of an IC engine.
8. Determination of Flash Point and Fire Point of various fuels / lubricants
9. Performance test on a two stage Reciprocating Air compressor

PARTII STEAM LABORATORY 15

List of Experiments:

1. Study of Steam Generators and Turbines.
2. Performance and Energy Balance Test on a Steam Generator.
3. Performance and Energy Balance Test on Steam Turbine.

TOTAL = 60 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Examine the performance of IC engines
2. Determine the valve overlap and scavenging periods
3. Evaluate the performance of boilers and steam turbines
4. Performance prediction of air compressors
5. Quantify the flash and fire point of any given fuel/lubricant

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ME5601 DESIGN OF TRANSMISSION SYSTEMS LTPC
3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:

1. Designing flexible elements like belt, ropes and chain drives for engineering applications.
2. Designing spur and helical gear drives for power transmission.
3. Designing bevel and worm drives for power transmission.
4. Designing multi speed gear box for machine tool and automotive applications.
5. Designing clutch and brake systems for engineering applications.

UNIT I DESIGN OF FLEXIBLE ELEMENTS 9

Motor power capacity for various applications - Design of Flat belts and pulleys - Selection of V belts and sheaves – Selection of wire ropes and pulleys – Design of Transmission Chains and Sprocket.

UNIT II SPUR AND HELICAL GEARS 9

Gear materials - Design of straight tooth spur & helical gears based on speed ratios, number of teeth, Fatigue strength, Factor of safety, strength and wear considerations. Force analysis –Tooth stresses - Dynamic effects - Helical gears – Module - normal and transverse, Equivalent number of teeth – forces.

UNIT III BEVEL AND WORM GEARS 9

Straight bevel gear: Gear materials - Tooth terminology, tooth forces and stresses, equivalent number of teeth, estimation of dimensions of straight bevel gears. Worm Gear: Gear materials - Tooth terminology, Thermal capacity, forces and stresses, efficiency, estimation of dimensions of worm gear pair.

UNIT IV GEAR BOXES 9

Need - Design of sliding and constant mesh gear boxes: Speed selection - Geometric progression - Standard step ratio - Ray diagram, kinematic layout – Determination of number of teeth. Design of

multi speed gear box for machine tool applications, Variable speed gear box, Fluid Couplings, Torque Converters for automotive applications - Continuous variable transmission system.

UNIT V CLUTCHES AND BRAKES 9

Design of single and multi-plate clutches, cone clutches, internal expanding rim clutches and Electromagnetic clutches. Design of brakes: External shoe brakes - Single and Double Shoe, Internal expanding shoe brakes and Band brakes.

TOTAL = 45 PERIODS

Note: (Use of standard Design Data Book is permitted in the University examination)

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Design flexible elements like belt, ropes and chain drives for engineering applications.
2. Design spur and helical gear drives for power transmission.
3. Design bevel and worm drives for power transmission.
4. Design multi speed gear box for machine tool and automotive applications.
5. Design clutch and brake systems for engineering applications.

TEXT BOOKS:

1. Shigley. J., Mischke. C., Budynas, R., and Nisbett. K., "Mechanical Engineering Design", 10th Edition, Tata McGraw-Hill, 2014.
2. Sundararajamoorthy. T. V. and Shanmugam. N., "Machine Design", 9th Edition, Anuradha Publications, Chennai, 2003
3. Sen and Bhattacharya, "Principles of Machine Tools", New Central Book Agencies, 1975.

REFERENCES:

1. Bernard Hamrock, Steven Schmid, Bo Jacobson, "Fundamentals of Machine Elements",2nd Edition, Tata McGraw Hill, 2006
2. Bhandari V, "Design of Machine Elements", 15th Reprint, Tata McGraw-Hill Book Co, 2014
3. C.S.Sharma, KamleshPurohit, "Design of Machine Elements", Prentice Hall of India,Pvt. Ltd., 2003
4. Design Data Hand Book, PSG College of Technology, 2013- Coimbatore
5. GitinMaitra,L. Prasad "Handbook of Mechanical Design", 2nd Edition, Tata McGraw-Hill,2001
6. Md. Jalaludeen , Machine Design, Volume II, Design of Transmission Systems, 4th edition, Anuradha Publications, 2014
7. Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2003
8. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine component Design",5th Edition, Wiley, 2011.

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GE5251 ENVIRONMENTAL SCIENCES L T P C

3 0 0 3

COURSE OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.

- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and non-renewable resources, causes of their degradation and measures to preserve them.
- To familiarize the influence of societal use of resources on the environment and introduce the legal provisions, National and International laws and conventions for environmental protection.
- To inculcate the effect of population dynamics on human and environmental health and inform about human right, value education and role of technology in monitoring human and environmental issues.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

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, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – bio geographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – 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 ex-situ conservation of biodiversity. Field study of common plants, insects, birds Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

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 – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land 47 degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization-environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

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 – Case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
- To identify the causes, effects and environmental pollution and natural disasters and contribute to the preventive measures in the immediate society.
- To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
- To recognize different forms of energy and apply them for suitable applications in for technological advancement and societal development.
- To demonstrate the knowledge of societal activity on the long and short term environmental issues and abide by the legal provisions, National and International laws and conventions in professional and personal activities and to identify and analyseeffect of population dynamics on human value education, consumerism and role of technology in environmental issues.

TEXT BOOKS:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers (2018).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2016).
3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).

REFERENCES:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005).
5. ErachBharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. (2013).

ME5651 HEAT AND MASS TRANSFER LTPC
3003

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Understanding the steady and transient heat conduction.
2. Comprehending the principles of convective heat transfer.
3. Outlining the facets of heat transfer for designing a heat exchanger
4. Inferring the fundamental concepts of radiation heat transfer.
5. Analyzing the relation between heat and mass transfer

UNIT I CONDUCTION 9

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

UNIT II CONVECTION 9

Conservation Equations, Boundary Layer Concept – Forced Convection: External Flow – Flow over Plates, Cylinders Spheres and Bank of tubes. Internal Flow – Entrance effects. Free Convection – Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Cylinders and Spheres.

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS 9

Nusselt's theory of condensation- Regimes of Pool boiling and Flow boiling, correlations in boiling and condensation. Heat Exchanger Types - Overall Heat Transfer Coefficient – Fouling Factors. LMTD and NTU methods. Introduction to TEMA Standards.

UNIT IV RADIATION 9

Radiation laws, Black Body and Gray body Radiation. Shape Factor. Electrical Analogy. Radiation Shields.

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 = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Summarizethe mechanism of heat conduction under steady and transient conditions.
2. Elucidate the principles of convective heat transfer.
3. Design a heat exchanger for any specific application
4. Adopt the concept of radiation heat transfer in real time systems
5. Develop solutions to problems involving combined heat and mass transfer

TEXT BOOKS:

1. R.C. Sachdeva, "Fundamentals of Engineering Heat & Mass transfer", New Age International Publishers, 2009
2. Yunus A. Cengel, "Heat Transfer A Practical Approach" – Tata McGraw Hill, 5thEdition – 2013

REFERENCES:

1. Frank P. Incropera and David P. Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley & Sons, 7th Edition, 2014.
2. Holman, J.P., "Heat and Mass Transfer", Tata McGraw Hill, 2010
3. Kothandaraman, C.P., "Fundamentals of Heat and Mass Transfer", New Age International, New Delhi, 2012
4. Ozisik, M.N., "Heat Transfer", McGraw Hill Book Co., 1994.
5. S.P. Venkateshan, "Heat Transfer", Ane Books, New Delhi, 2014

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ME5611HEAT TRANSFER AND REFRIGERATION AND AIR-CONDITIONING LABORATORY

LTPC
0042

COURSE OBJECTIVES:

The main learning objective of this course is to provide hands on training to the students in:

1. Predicting the thermal conductivity of solids and liquids.
2. Estimating the convective heat transfer coefficient under different conditions
3. Determining the range, approach, effectiveness and CoC of a typical cooling tower.
4. Assessing the performance of various heat exchangers.
5. Evaluating the CoP of refrigeration and air-conditioning systems.

LIST OF EXPERIMENTS:

1. Thermal conductivity measurement of pipe insulation using lagged pipe apparatus.
2. Determination of thermal conductivity of a composite wall, insulating powder, oils and water.
3. Determination of heat transfer coefficient of air under natural convection and forced convection.
4. Heat transfer from pin-fin under natural and forced convection.
5. Determination of heat flux under pool boiling and flow boiling in various regimes.
6. Determination of heat transfer coefficient in film-wise and drop-wise condensation.
7. Determination of friction factor, heat transfer coefficient of cold/hot fluid and effectiveness of a tube-in-tube heat exchanger.
8. Determination of Stefan – Boltzmann constant.
9. Determination of emissivity of a grey surface.
10. Calibration of thermocouples / RTDs at standard reference temperatures.
11. Determination of Coefficient of Performance of a vapour compression refrigeration system and Air-Conditioning system.
12. Determination of effectiveness of a cooling tower.

LIST OF EQUIPMENTS:

1. Lagged pipe apparatus.
2. Composite wall, insulating powder apparatus and liquid thermal conductivity measuring apparatus.
3. Natural convection and forced convection test setup.
4. Pin-fin under natural and forced convection test setup.
5. Pool boiling and flow boiling apparatus.
6. Film-wise and drop-wise condensation apparatus.
7. Tube-in-tube heat exchanger test setup.
8. Stefan – Boltzmann constant apparatus.
9. Emissivity measuring apparatus.
10. Calibration of thermocouples / RTDs test setup.
11. Vapour compression refrigeration system and Air-Conditioning system test setup
12. Cooling tower test setup.

TOTAL = 60 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Determine the thermal conductivity of solids and liquids.
2. Compute the convective heat transfer coefficient under natural/forced mode
3. Evaluate the thermal performance of cooling towerat different flow conditions
4. Assess the performance of heat exchangers
5. Arrive at EER of refrigeration and air-conditioning systems.

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ME5612 GEOMETRIC MODELING AND SIMULATION LABORATORY LTPC 0042

COURSE OBJECTIVES: The main learning objective of this course is to provide hands on training to the students in:

1. Designing 3 Dimensional geometric model of parts, sub-assemblies, assemblies and exporting it to drawing.
2. Analyzing the force, stress, deflection in mechanical components.
3. Analyzing thermal stress and heat transfer in mechanical components.
4. Analyzing the vibration of mechanical components.
5. Analyzing the modal, harmonic, transient and spectrum concepts in mechanical components.

LIST OF EXPERIMENTS

1. 3D GEOMETRIC MODELLING 30

1. CAD Introduction – Sketcher
2. Solid modeling: Extrude, Revolve, Sweep,Variational sweep and Loft.
3. Surface modeling: Extrude, Sweep, Trim,Mesh of curves and Free form.
4. Feature manipulation: Copy, Edit, Pattern, Suppress, History operations.
5. Assembly: Constraints, Exploded Views, Interference check
6. Drafting: Layouts, Standard & Sectional Views, Detailing & Plotting.
7. Exercises in Modeling and drafting of Mechanical Components
8. Assembly using Parametric and Feature based Packages

2. SIMULATION AND ANALYSIS 30

1. Force and Stress analysis using link elements in Trusses.
2. Stress and deflection analysis in beams with different support conditions.
3. Stress analysis of flat plates.
4. Stress analysis of axis–symmetric components.
5. Thermal stress and heat transfer analysis of plates.
6. Thermal stress analysis of cylindrical shells.
7. Vibration analysis of spring-mass systems.
8. Modal analysis of Beams.
9. Harmonic, transient and spectrum analysis of simple systems.

TOTAL = 60 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Design 3 Dimensional geometric model of parts, sub-assemblies, assemblies and export it to drawing.
2. Analyze the force, stress, deflection in mechanical components.
3. Analyze thermal stress and heat transfer in mechanical components.
4. Analyze the vibration of mechanical components.
5. Analyze the modal, harmonic, transient and spectrum concepts in mechanical components.

CO	PO												PSO		
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1	2	3	3		3			1	1	1		1	3		3
2	2	3	3	2	3			1	1	1		1	3		3
3	2	3	3	2	3			1	1	1		1	3		3
4	2	3	3	2	3			1	1	1		1	3		3
5	2	3	3	2	3			1	1	1		1	3		3

ME5701 ENERGY CONVERSION TECHNIQUES LTPC
3003

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:

1. Analyzing the thermodynamic cycles used in power generation
2. Evaluating the merits of direct thermal energy conversion systems
3. Assessing the performance of fuel cells
4. Selecting the best energy storage mechanism for any given application
5. Developing a mechanism for total energy recovery from a system adopting CHCP concept

UNIT I ENERGY CONVERSION CYCLES 9
Bell Coleman, Scuderi, Stirling, Ericsson, Lenoir, Atkinson, Stoddard and Kalina cycle – Comparison with Rankine and Brayton cycles

UNIT II DIRECT CONVERSION OF THERMAL TO ELECTRICAL ENERGY 9
MHD - Thermoelectric Converters – Thermoelectric refrigerator – Thermoelectric Generator – Thermionic converters – Ferro electric converter – Nernst Effect Generator – Thermo Magnetic Converter.

UNIT III DIRECT CONVERSION OF CHEMICAL TO ELECTRICAL ENERGY 9
Fuel Cell : Basics – working advantages and drawbacks – types – comparative analysis – thermodynamics and kinetics of fuel cell process – performance of fuel cell – applications

UNIT IV ENERGY STORAGE SYSTEMS 9
Batteries – types – working – performance governing parameters – hydrogen energy – solar cells. Energy storage devices for Mechanical Energy, Electrical Energy, Chemical Energy, Thermal Energy.

UNIT V COMBINED HEAT, COOLING AND POWER PRODUCTION (CHCP) 9
Cogeneration - types - Configuration and thermodynamic performance of steam turbine cogeneration systems – gas turbine cogeneration systems – reciprocating IC engines cogeneration systems – concept of Polygeneration

TOTAL = 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:

1. Analyze the thermodynamic cycles used in power generation
2. Evaluate the merits of direct thermal energy conversion systems
3. Assess the performance of fuel cells
4. Identify a suitable energy storage mechanism for specific application
5. Design an effective energy recovery system adopting CHCP concept

TEXT BOOKS:

1. Archie.W.Culp, Principles of Energy Conversion, 2nd Edition, McGraw-Hill Inc., 1991, New York.
2. Chapter on Cogeneration in Guide book for National Certification Examination for "Energy Managers and Energy Auditors", available at http://www.em-ea.org/Guide%20Books/book-2/2.7%20Cogeneration%20.pdf (this website is administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India).
3. Kordesch Karl, and Günter R. Simader, Fuel Cell and Their Applications, Wiley 2006

REFERENCES:

1. Bent Sorensen, Renewable Energy Conversion, Transmission, and Storage Technology & Engineering, Academic Press, 2007.
2. Charles R. Russell, Elements of Energy Conversion, Permagon Press, 1967.
3. Hart A.B. and Womack, G.J., Fuel Cells: Theory and Application, Prentice Hall, 1989.
4. Kettari, M.A., Direct Energy Conversion, Addison-Wesley, 1997.
5. Yogi Goswami, D. and Frank Kreith, Energy Conversion, Second Edition, Science, 2017.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
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2	3						1					1	2	1	
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4	3		2				1					1	2	1	
5	3	2	2	1			1					1	3	1	

ME5751 FINITE ELEMENT ANALYSIS LTPC
3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:

1. Developing mathematical models for Boundary Value Problems and their numerical solution.
2. Applying concepts of Finite Element Analysis to solve one dimensional problem.
3. Determining field variables for two dimensional scalar variable problems.
4. Determining field variables for two dimensional vector variable problems.
5. Applying the need for Isoparametric transformation and the use of numerical integration.

UNIT I INTRODUCTION 9
Historical Background – Mathematical Modeling of field problems in Engineering –Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

UNIT II ONE-DIMENSIONAL PROBLEMS 9
One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors-Assembly of Matrices - Solution of problems from solid mechanics including thermal stresses-heat transfer. Natural frequencies of longitudinal vibration and mode shapes. Fourth Order Beam Equation – Transverse deflections and Transverse Natural frequencies of beams.

UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS 9
Second Order 2D Equations involving Scalar Variable Functions – Variational formulation –Finite Element formulation – Triangular elements and Quadrilateral elements- Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems – Torsion of Non circular shafts.

UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS 9
Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Constitutive matrices and Strain displacement matrices – Stiffness matrix – Stress calculations - Plate and shell elements.

UNITV ISOPARAMETRIC FORMULATION AND ADVANCED TOPICS 9
Natural co-ordinate systems – Isoparametric elements – Shape functions for isoparametric elements – One and two dimensions – Serendipity elements – Numerical integration - Matrix solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis Software- Introduction to Non Linearity.

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Develop mathematical models for Boundary Value Problems and their numerical solution
2. Formulate the Finite Element methodology to solve the one dimensional problem(s).
3. Estimate field variables for two dimensional scalar variable problems

4. Determine field variables for two-dimensional vector variable problems
5. Apply the Isoparametric transformationand the use of numerical integration to engineering problems.

TEXT BOOKS:

1. Rao, S.S., "The Finite Element Method in Engineering", 6th Edition, Butterworth-Heinemann,2018.
2. Reddy,J.N. "Introduction to the Finite Element Method", 4th Edition, Tata McGrawHill,2018.

REFERENCES:

1. David Hutton, "Fundamentals of Finite Element Analysis", Tata McGrawHill, 2005
2. Dhanaraj. R and Prabhakaran Nair. K, "Finite Element Analysis", Oxford Publications, 2015.
3. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th Edition, Wiley Student Edition, 2004.
4. Seshu.P, "Text Book of Finite Element Analysis", PHI Learning Pvt. Ltd., NewDelhi, 2012.
5. TirupathiR.Chandrupatla and Ashok D.Belegundu, "Introduction to Finite Elements in Engineering", International Edition, Pearson Education Limited, 2014.

CO	PO												PSO		
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1	3	3	2	2	2			1			2	2	3		1
2	3	3	2	2	2			1			2	2	3		1
3	3	3	2	2	2			1			2	2	3		1
4	3	3	2	2	2			1			2	2	3		1
5	3	3	2	2	2			1			2	2	3		1

ME5702 COMPUTER INTEGRATED MANUFACTURING L T P C
3 0 0 3

COURSE OBJECTIVES:

The main objectives of this course are:

1. To throw light on the implementation of CIM and Automation in Manufacturing Industries.
2. To develop competence in overcoming the predicaments related to Production Planning and Control.
3. To offer an insight into Cellular Manufacturing.
4. To provide competence in developing FMS.
5. To render knowledge in the application of Industrial Robots.

UNIT I INTRODUCTION 9

Various phases in Product Design and CAD, CAM, Concepts of CAD/CAM – CIM concepts and elements – Types of production – Manufacturing Metrics and Economics – Production Performance Metrics –Manufacturing Cost - Simple problems – Basic Elements of an Automated system – Advanced Automation Functions - Levels of Automation – Lean Production and Just-In-Time Production.

UNIT II PRODUCTION PLANNING & CONTROL SYSTEM AND COMPUTER AIDED PROCESS PLANNING 9

Production planning and Control System - Aggregate Production Planning and Master Production Schedule – Material Requirement Planning (MRP I) – Simple Problems –Capacity Planning – Shop Floor Control – Inventory Control – EOQ, WIP costs & Inventory Holding Costs - Simple Problems – Introduction to Manufacturing Resource Planning (MRP II) & Enterprise Resource Planning (ERP) - Process planning – Manual Process Planning and case studies Computer Aided Process Planning (CAPP)

UNIT III GROUP TECNOLOGY AND CELLULAR MANUFACTURING 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 – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing –Rank Order Clustering Method - Arranging Machines in a GT cell – Hollier Method – Simple Problems Performance Metrics in Cell Operation – Simple Problems.

UNIT IV FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS) 9

Types of FMS & Flexibility – FMS Components – FMS Application & Benefits – FMS Planning and Implementation Issues – Quantitative analysis of Bottleneck Model on simple problems in FMS - Alternative Approach in Flexible Manufacturing - Automated Guided Vehicle System (AGVS) – Types of AGVS - Applications – Vehicle Guidance technologies –Vehicle Management & Safety.

UNIT V INDUSTRIAL ROBOTICS 9

Robot Anatomy and Related Attributes – Classification - Control systems – End Effectors –Sensors – Applications – Basics of Robot Part Programming – Robot Accuracy and Repeatability – Simple Problems.

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Apply the concept of CIM & Automation in Manufacturing Systems.
2. Discriminate the problems in Production Planning and Control.
3. Design Cellular Manufacturing Processes.
4. Implement FMS in conventional batch production.
5. Select and apply Robots for Industrial applications

TEXT BOOKS:

1. Mikell .P. Groover “Automation, Production Systems and Computer Integrated Manufacturing”, PEARSON, 2018.
2. Kant Vajpayee S., “Principles of Computer Integrated Manufacturing”, Prentice Hall India, 2003.

REFERENCES:

1. Gideon Halevi and Roland Weill, “Principles of Process Planning – A Logical Approach” Chapman & Hall, London, 1995.
2. GrooverMikell P. & ZIMMERS E., “CAD/CAM – Computer Aided Design and Manufacturing”, PEARSON, 2018.
3. Peter Scallan, “ Process Planning: The design/manufacture interface,” Elsevier Science & Technology Books
4. Radhakrishnan P., Subramanyan S. and Raju V., “CAD/CAM/CIM”, 2nd Edition, New Age International (P) Ltd, New Delhi, 2000.
5. Rao. P. N., Tewari. N. and Kundra. T.K., “Computer Aided Manufacturing”, Tata McGraw Hill Publishing Company, 2000.

CO	PO												PSO		
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1	3	3	2	1								1	2	1	
2	3	3	3	2								1	2	1	
3	3	3	3	3								1	2	1	
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5	3	3	2	1								1	2	1	

ME5752 MECHATRONICS **L T P C**
3 0 0 3

COURSE OBJECTIVES: The main objectives of this course are

1. To offer an overview of mechatronics and make students get acquainted with the sensors and transducers.
2. To impart knowledge about the fundamentals of microprocessor
3. To give insight into the method of interfacing
4. To provide competence on PLC and its programming
5. To render exposure in the design and development of mechatronics systems

UNIT I INTRODUCTION AND SENSORS 9

Introduction to Mechatronics – Systems – 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 – Pin Configuration - Architecture of 8085 – 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 – Architecture – Input / Output Processing – Programming with Timers, Counters and Internal relays – Data Handling – Selection of PLC.

UNIT V ACTUATORS AND MECHATRONICS SYSTEM DESIGN 9

Types of Stepper and Servo motors – Construction – Working Principle – Characteristics, Stages of Mechatronics Design Process – Comparison of Traditional and Mechatronics Design Concepts with Examples – Case studies of Mechatronics Systems – Pick and Place Robot – Engine Management system – Automatic Car Park Barrier.

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Identify suitable sensors to develop mechatronics systems
2. Explain the architecture and timing diagram of microprocessor, and also interpret and develop programs.
3. Devise appropriate interfacing circuits to connect I/O devices with microprocessor
4. Implement PLC as a controller in a mechatronics system
5. Design an apt mechatronics system for a real time application

TEXT BOOKS:

1. Bolton W., “Mechatronics”, Pearson Education, 6th Edition, 2015.
2. Ramesh S Gaonkar, “Microprocessor Architecture, Programming, and Applications with the 8085”, Penram International Publishing Private Limited, 6th Edition, 2013.

REFERENCES:

1. Bradley D.A., Dawson D., Buru N.C. and Loader A.J., “Mechatronics”, Chapman and Hall, 1993.
2. Davis G.Alciatore and Michael B.Histand, “Introduction to Mechatronics and Measurement systems”, McGraw Hill Education, 2011.
3. Devadas Shetty and Richard A. Kolk, “Mechatronics Systems Design”, Cengage Learning, 2010.
4. NitaigourPremchandMahalik, “Mechatronics Principles, Concepts and Applications”, McGraw Hill Education, 2015.

5. Smaili.A and Mrad.F, “Mechatronics Integrated Technologies for Intelligent Machines”, Oxford University Press, 2007.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1											3		
2	3	1	1	3	3								2	2	2
3	3	1	2		3								3	2	3
4	3	3	3	2	3				2				3	3	3
5	3	3	3	2					3			2	3	3	3

ME5761 MECHATRONICS LABORATORY **LT P C**
0 0 4 2

COURSE OBJECTIVES:

The main objectives of this course are

1. To provide experimental insight into the applications of different sensors, signal conditioning circuits and measurement techniques.
2. To render practical experience in the design and development of Hydraulic, Pneumatic and Electric actuator circuits that is required to develop Mechatronics Systems
3. To make students comprehend and appreciate the real-time applications of PLC and Microcontroller
4. To offer hands on-training in the simulation and control of Robot.
5. To make students conversant with the application of Image Processing

LIST OF EXPERIMENTS:

1. Design of Signal Conditioning Circuits and Analog Controller: V to I Converter –I to V Converter – Integrator – Differentiator – Instrumentation Amplifier – PID.
2. Experiments on the application of Sensors – LDR, Optocoupler, Ultrasonic, Infrared, Hall effect and MEMS Accelerometer.
3. Measurement of Displacement, Force and Temperature using Transducers and Data Acquisition System (DAQ).
4. Modeling and Analysis of basic Hydraulic, Pneumatic, Electro-Pneumatic, Electrical and Electronic Circuits by using simulation software.
5. Actuation of double acting cylinder by using Hydraulic, Pneumatic and Electro-Pneumatic circuits.
6. Automating the cylinder sequence A+B+B-A- by using Microcontroller.
7. PLC Automation with Timers and Counters – Cylinder Sequencing – Sorting of Objects on Conveyor Belt.
8. DC Drives – Speed and Direction Control by using Microcontroller.
9. AC Drives – Speed and Direction Control by using Microcontroller.
10. Stepper Motor – Position, Speed and Direction Control.
11. Servo Motor – Position, Speed and Direction Control.
12. Automatic Temperature Control System – Interfacing of temperature sensor, cooling system (Fan), LCD Display with Microcontroller.
13. Modeling and Analysis of Robot by using Simulation Software.
14. Experiments on Six-Axis Articulated Robot – Material Handling Application.
15. Actuation and control of Robot by using Internet of Things (IoT).
16. Experiments on the application of Image Processing – Machine Vision System – Robot Vision System.

TOTAL = 60 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Demonstrate the measurement of physical quantity such as displacement, force and temperature, and also the operation of signal conditioning circuits.

2. Devise appropriate circuits to automate and control the Hydraulic, Pneumatic, and Electric actuators.
3. Implement PLC, PID and microcontroller as a control unit in the Mechatronics System.
4. Develop a model of robot by using simulation software, and also execute real-time control over a Robot by IoT.
5. Implement image processing techniques to develop Machine/Robot vision systems.

CO	PO												PSO		
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2	3	1	2	2	2		1		3		2	2	2	2	2
3	3	1	2	2	3		1		3		2	2	3	3	3
4	3	1	2	2	3		1		3		2	2	3	3	3
5	3	1	2	2	3		1		3		2	2	3	3	3

ME5711 **PROJECT I (DESIGN AND FABRICATION)** **L T P C 0 0 6 3**

COURSE OBJECTIVES:

The main learning objective of this course is to provide hands on training to the students in:

1. Dicovering potential research areas in the field of Mechanical Engineering.
2. Comparing and contrast the several existing solutions for the problem identified.
3. Formulating and propose a plan for creating a solution for the research plan identified.
4. Conducting the experiments as a team and interpret the results.
5. Reporting and presenting the findings of the work conducted.

A project topic must be selected by the students in consultation with their guides. The ultimate aim of the project work is to deepen comprehension of mechanical principles by applying them to a new problem which may be the design and facbrication of a device for a specific application.

TOTAL : 90 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Discover potential research areas in the field of Mechanical Engineering.
2. Compare and contrast the several existing solutions for the problems identified.
3. Formulate and propose a plan for creating a solution for the research plan identified.
4. Conduct the experiments as a team and interpret the results.
5. Report and present the findings of the work conducted.

CO	PO												PSO		
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1	3	3	3	2	2	1	1	2	3	3	3	2	3	2	2
2	3	3	3	2	2	1	1	2	3	3	3	2	3	2	2
3	3	3	3	2	2	1	1	2	3	3	3	2	3	2	2
4	3	3	3	2	2	1	1	2	3	3	3	2	3	2	2
5	3	3	3	2	2	1	1	2	3	3	3	2	3	2	2

ME5811 **PROJECT II** **L T P C 0 0 16 8**

COURSE OBJECTIVES:

The main learning objective of this course is to provide hands on training to the students in:

1. Dicovering potential research areas in the field of Mechanical Engineering.
2. Comparing and contrast the several existing solutions for the problem identified.

3. Formulating and propose a plan for creating a solution for the research plan identified.
4. Conducting the experiments as a team and interpret the results.
5. Reporting and presenting the findings of the work conducted.

A project topic must be selected by the students in consultation with their guides. The ultimate aim of the project work is to deepen comprehension of mechanical principles by applying them to a new problem which may be the simulation, analysis, design and fabrication of mechanical systems for a specific application.

TOTAL : 240 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Discover potential research areas in the field of Mechanical Engineering.
2. Compare and contrast the several existing solutions for the problems identified.
3. Formulate and propose a plan for creating a solution for the research plan identified.
4. Conduct the experiments as a team and interpret the results.
5. Report and present the findings of the work conducted.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	2	2	1	1	2	3	3	3	2	3	2	2
2	3	3	3	2	2	1	1	2	3	3	3	2	3	2	2
3	3	3	3	2	2	1	1	2	3	3	3	2	3	2	2
4	3	3	3	2	2	1	1	2	3	3	3	2	3	2	2
5	3	3	3	2	2	1	1	2	3	3	3	2	3	2	2

ME5071 AUTOMOBILE ENGINEERING LTPC
3003

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Classifying the types of chassis and identify different class of automobiles
2. Outline the engine systems and their emission control.
3. Illustrating the functions of various transmission systems.
4. Imparting the working of different braking and steering systems.
5. Understanding the working of electrical and electronic components.

UNIT I INTRODUCTON TO AUTOMOBILE AND TYPES 9

An overview of different types of automobiles and their power sources. Specifications, Performance Parameters, Types of power delivery, Safety standards, Trends in automobile design. Two and Types, Regulations, Car body construction. Bus Body Details, General consideration relating to chassis layout. Introduction to MV Act, Pollution Norms,

UNIT II POWERTRAIN AND FUEL MANAGEMENT SYSTEMS 9

Reciprocating Engine systems, Hybrid systems. Pollutant emissions and their control; Catalytic converter systems, Electronic Engine Management systems for SI and CI engines. Liquid and gaseous alternate fuels - Alcohol, LPG, CNG, and Hydrogen

UNIT III CLUTCH AND TRANSMISSION SYSTEMS 9

Clutch system and types, Gear box and types - manual, automatic, and AMT, propeller shafting, Differential, Axles - function, and types, Wheels, Tyres - types, construction and specification, suspension system - types and functioning,

UNIT IV BRAKING AND SUSPENSION SYSTEMS 9

Braking system - requirements and types, Steering system - working, types and steering geometry parameters. Wheel balancing & Alignment Wind Tunnel testing, Servicing of Vehicles,

UNIT V ELECTRICAL AND ELECTRONIC SYSTEMS 9

Introduction to Battery, Alternator, and Starter Motor systems, working principle, and circuitry, Safety systems - seat belts, air-bag, ABS, Modern electronic features in vehicles like tyre pressure monitoring, ESP, EBD, Automatic headlamp ON, Rain sensing wipers, speed sensing auto locking, OBD. HVAC system

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Distinguish the different types of automobiles and chassis.
2. Interpret the various types of engines and their emission control.
3. Select the appropriate transmission systems.
4. Compare the braking and steering systems.
5. Infer the functions of different electrical and electronic components.

TEXTBOOKS:

1. Jack Erjavek, "Automotive Technology – A Systems Approach", Thomson Learning, 3rdEdition, 1999.
2. William H. Crouse and Donald L. Anglin, "Automotive Mechanics", Tata McGraw Hill, 10thEdition, 2004.

REFERENCES:

1. Gill P.S., "A Textbook of Automobile Engineering – Vol. I , II and III", S.K.Kataria and Sons, 2ndEdition, 2012.
2. Giri, N.K., "Automotive Technology", Khanna Publishers, 2ndEdition, 2002.
3. Kirpal Singh, Automobile Engineering Volume I and II, Standard Publishers &Distributors, 14th Edition, 2017.
4. Kumar D.S., "Automobile Engineering", S.K.Kataria and Sons, 2ndEdition, 2017.
5. Robert Bosch GmbH, "Automotive Handbook", Robert Bosch, 2004.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2					2	2					1	1	1	
2	2				1	2	2					1	1	2	
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5	2				1	2	1					1	1	1	

ME5077 MEASUREMENTS AND CONTROL L T P C
3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is to:

1. Identify measurement parameters and analyze errors of measurements.
2. Select and apply suitable transducer for a particular measurement.
3. Identify measurement parameters and select the appropriate sensor for it.
4. Explain the working of various types of control systems to apply for specific applications.
5. Apply the principle of automatic control systems to control various parameter(s).

UNIT I MEASUREMENTS AND ERROR ANALYSIS 9

General concepts – Units and standards – Measuring instruments –sensitivity, readability, range, accuracy, precision – static and dynamic response – repeatability hysteresis – systematic and random errors –Statistical analysis of experimental data – Regression analysis – Curve fitting - calibration and Uncertainty.

UNIT II INSTRUMENTS 9

Transducer, Modifying (intermediate) and Terminal stages – Mechanical and electrical transducers, preamplifiers – charge amplifiers – filters – attenuators – D' Arsonval – CRO – Oscillographs – recorders – microprocessor based data logging, processing and output

UNIT III PARAMETERS FOR MEASUREMENT 9

Dimension, displacement, velocity, acceleration, Impact – Force, torque, power- Pressure, Temperature, Heat Flux, Heat Transfer Coefficients, Humidity – Flow – Velocity - Time, frequency and phase angle – noise and sound level.

UNIT IV CONTROL SYSTEMS 9

Basic elements – feedback principle, implication of measurements – Error detectors – final actuating elements – Two position, multi-position, floating, proportional controls – relays – servo amplifiers – servo motors – Electrical, magnetic, electronic control systems

UNIT V APPLICATION OF CONTROL SYSTEMS 9

Governing of speed, kinetic and process control – pressure, temperature, fluid level, flow-thrust and flight control – photo electric controls – designing of measurement and control systems for different applications

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Identify measurement parameters and analyze errors of measurements.
2. Select and apply suitable transducer for a particular measurement.
3. Identify measurement parameters and select the appropriate sensor for it.
4. Explain the working of various types of control systems to apply for specific applications.
5. Apply the principle of automatic control systems to control various parameter(s).

TEXT BOOKS:

1. Venkateshan S P, Mechanical Measurements, 2nd Edition, John Wiley & Sons, Ltd, 2015.
2. William Bolton, Instrumentation and Control Systems, 2nd Edition, Newnes, 2015.

REFERENCES:

1. Beckwith, Marangoni and Lienhard, Mechanical Measurements, Pearson, 2013.
2. Ernest Doebelin and DhaneshManik, Measurement Systems, McGraw Hill InternationalEdition, 2017.
3. Holman J P, "Experimental Methods for Engineers", McGraw Hill Int. Edition, 7th Ed., 2017.
4. Nagrath I J, "Control Systems Engineering", New Age International Publishers, 2018.
5. NakraB.C , and Chaudhry K.K, Instrumentation, Measurement, and Analysis, Tata McGraw Hill, 4th Edition, 2016.

CO	PO												PSO		
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5	2	2	2	2								1	2	1	

ME5001 DESIGN CONCEPTS IN ENGINEERING LTPC
3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:

1. Analyzing the various design requirements and get acquainted with the processes involved in product development.
2. Applying the design processes to develop a successful product.
3. Applying scientific approaches to provide design solutions.
4. Designing solution through relate the human needs and provide a solution.
5. Applying the principles of material selection, costing and manufacturing in design.

UNITI DESIGN TERMINOLOGY 9

Definition-various methods and forms of design-importance of product design-static and dynamic products-various design projects-morphology of design-requirements of a good design-concurrent engineering-computer aided engineering-codes and standards-product and process cycles-bench marking.

UNITII INTRODUCTION TO DESIGN PROCESSES 9

Basic modules in design process-scientific method and design method-Need identification, importance of problem definition-structured problem, real life problem- information gathering - customer requirements- Quality Function Deployment (QFD)- product design specifications-generation of alternative solutions- Analysis and selection-Detail design and drawings-Prototype, modeling, simulation, testing and evaluation

UNITIII CREATIVITY IN DESIGN 9

Creativity and problem solving-vertical and lateral thinking-invention-psychological view, mental blocks-Creativity methods-brainstorming, synectics, force fitting methods, mind map, concept map-Theory of innovative problem solving (TRIZ) - conceptual decomposition creating design concepts.

UNITIV HUMAN AND SOCIETAL ASPECTS IN PRODUCT DEVELOPMENT 9

Human factors in design, ergonomics, user friendly design-Aesthetics and visual aspects environmental aspects-marketing aspects-team aspects-legal aspects-presentation aspects

UNITV MATERIAL AND PROCESSES IN DESIGN 9

Material selection for performance characteristics of materials-selection for new design substitution for existing design-economics of materials-selection methods-recycling and material selection-types of manufacturing process, process systems- Design for Manufacturability (DFM) - Design for Assembly (DFA).

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Articulate the various design requirements and get acquainted with the processes involved in product development.
2. Design the processes to develop a successful product.
3. Implement the scientific approaches to provide design solutions.
4. Integrate human and societal aspects in design.
5. Select materials and manufacturing processes in design.

TEXT BOOKS:

1. Dieter. G. N., Linda C. Schmidt, “Engineering Design”, McGraw Hill, 2013.
2. Horenstein, M. N., Design Concepts for Engineers, Prentice Hall, 2010.

REFERENCES:

1. Dhillon, B. S., Advanced Design Concepts for Engineers, Technomic Publishing Co., 1998.
2. Edward B. Magrab, Satyandra K. Gupta, F. Patrick McCluskey and Peter A. Sandborn, “Integrated Product and Process Design and Development”, CRC Press, 2009.
3. James Garratt, “Design and Technology”, Cambridge University Press, 1996.
4. Joseph E. Shigley, Charles R.Mische, and Richard G. Budynas, “Mechanical Engineering Design”, McGraw Hill Professional, 2003.
5. Sumesh Krishnan and MukulSukla, Concepts in Engineering Design, Notion Press, 2016.

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ME5002 COMPOSITE MATERIALS AND MECHANICS L T P C
3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:

1. Analyzing mechanical strength of the composite material
2. Developing the FRP and other composites by different manufacturing methods
3. Analyzing fiber reinforced Laminates for different combinations of plies with different orientations of the fiber.
4. Evaluating the stresses in the lamina of the laminate using different failure theories
5. Analyzing thermo-mechanical behavior and evaluate residual stresses in different types of laminates using the Classical Laminate Theory.

UNIT I INTRODUCTION TO COMPOSITE MATERIALS 9

Definition-Matrix materials-polymers-metals-ceramics - Reinforcements: Particles, whiskers, inorganic fibers, metal filaments- ceramic fibers- fiber fabrication- natural composite wood, Jute - Advantages and drawbacks of composites over monolithic materials. Mechanical properties and applications of composites, Particulate-Reinforced composite Materials, Dispersion-Strengthened composite, Fiber-reinforced composites Rule of mixtures-Characteristics of fiber-Reinforced composites, Manufacturing fiber and composites.

UNIT II MANUFACTURING OF COMPOSITES 9

Manufacturing of Polymer Matrix Composites (PMCs)-handlay-up, spray technique, filament winding, Pultrusion, Resin Transfer Moulding (RTM)-, bag moulding, injection moulding, Sandwich Mould Composites (SMC) - Manufacturing of Metal Matrix Composites (MMCs) - Solid state, liquidstate,vapour state processing, Manufacturing of Ceramic Matrix Composites (CMCs) –hot pressing-reaction bonding process-infiltration technique, direct oxidation- interfaces

UNIT III INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS 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. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

UNIT IV LAMINA STRENGTH ANALYSIS AND ANALYSIS OF LAMINATED FLAT PLATES 9

Introduction - Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies

UNIT V THERMO-STRUCURAL ANALYSIS 9

Fabrication stresses/Residual stresses in FRP laminated composites- Co-efficient of Thermal Expansion (C.T.E.) - Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E's -Stress and Moment Resultants due cooling of the laminates during fabrication-Calculations for thermo-mechanical stresses in FRP laminates. Case studies: Implementation of CLT for evaluating residual stresses in the components made with different isotropic layers such as electronic packages etc.

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Analyze mechanical strength of the composite material
2. Develop the FRP and other composites by different manufacturing methods
3. Analyze fiber reinforced Laminates for different combinations of plies with different orientations of the fiber.
4. Evaluate the stresses in the lamina of the laminate using different failure theories
5. Analyze thermo-mechanical behavior and evaluate residual stresses in different types of laminates using the Classical Laminate Theory.

TEXT BOOKS:

1. Gibson R F, Principles of Composite Material Mechanics, McGraw-Hill, 1994, CRC press, 4th Edition, 2015.
2. Mallick PK, Fiber – Reinforced Composites: Materials, Manufacturing and Design, CRC Press, 3rdEdition, 2007.

REFERENCES:

1. Agarwal, B. D. and Broutman, L. J., "Analysis and Performance of Fiber Composites", John Wiley and Sons, New York, 1990.
2. Halpin, J. C., "Primer on Composite Materials, Analysis", Technomic Publishing Co., 1984.
3. Hyer M. W., and Scott R White, "Stress Analysis of Fiber – Reinforced Composite Materials", McGraw-Hill, 1998
4. Issac M Daniel and Orilshai, "Engineering Mechanics of Composite Materials", Oxford University Press, 2007.
5. MadhujitMukhopadhyay, "Mechanics of Composite Materials and Structures", University Press, 2004.

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MA5353 NUMERICAL METHODS L T P C

3 1 0 4

COURSE OBJECTIVES:

1. To provide the mathematical foundations of numerical techniques for solving Eigen value problems and linear system of equations.
2. To apply the techniques of interpolation for equal and unequal intervals for the given data.
3. To understand and to apply the techniques of numerical integration and differentiation for solving and ODE in applying day today life.
4. To familiar in solving initial value problems and ODE for given initial and boundary conditions.
5. To demonstrate the utility of Numerical techniques for solving Partial Differential Equations in Heat and Fluid problems.

UNIT ISOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton-Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method – Eigen values of a matrix by Power method and by Jacobi's method.

UNIT IIINTERPOLATION AND APPROXIMATION 12

Interpolation with unequal intervals - Lagrange interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae – Least square method - Linear curve fitting.

UNIT IIINUMERICAL DIFFERENTATION AND INTEGRATION 12

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

UNIT IVINITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12

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

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 12

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

TOTAL:60 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to the algebraic and transcendental equations.
- Apply numerical methods to obtain approximate solutions to mathematical problems using interpolation.
- Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
- Analyse and evaluate the accuracy of common numerical methods in solving ODE of First and Second order equations.
- Understand various numerical techniques for solving PDE, for given conditions in Heat flow and Wave problems.

TEXT BOOKS:

1. Grewal, B.S. and Grewal,J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2014.
2. Sankara Rao . K, "Numerical Methods for Scientists and Engineers", PHI Learning Pvt Ltd., New Delhi, 2007.

ML5751 NON-DESTRUCTIVE EVALUATION OF MATERIALS L T P C

3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is

1. To understand the importance of NDT in quality assurance.
2. To imbibe the basic principles of various NDT techniques, its applications, limitations,

codes and standards.

3. To equip proper competencies to locate a flaw in various materials, products.
4. To apply the NDT techniques for in-situ applications.
5. To inculcate the knowledge of selectingsuitable NDT technique for a given application

UNIT I INTRODUCTION & VISUAL INSPECTION METHODS 9

NDT versus Mechanical testing, Need for NDT, Relative merits and limitations, various physical characteristics of materials and their applications in NDT.

Visual Inspection -Unaided, Aided- Borescopes -Videoscopes, Special features in Borescopes, Selection of borescopes, Optical sensors, Microscopes & replication Microscopy Technique and applications, Holography, Case study.

UNIT II LIQUID PENETRANT TESTING& MAGNETIC PARTICLE TESTING 9

LPT - Principle, types, Procedures, Penetrants and their characteristics, Emulsifiers, Solvent Cleaners / Removers, Developers- properties and their forms, Equipments, Advantages and limitations, Inspection and Interpretation, Applications and case study.

MPT-Principle, Theory of Magnetism, Magnetising current, Magnetisation methods, Magnetic particles, Procedure, Interpretation, Relevant and Non-relevant indications, Residual magnetism, Demagnetisation – need, methods, Advantages and Limitations, Applications, Magnetic Rubber Inspection, Magnetic Printing, Magnetic Painting, Case study.

UNIT III THERMOGRAPHY & EDDY CURRENT TESTING 9

Thermography – Introduction, Principle, Contact & Non-Contact inspection methods, Active & Passive methods, Liquid Crystal – Concept, example, advantages & limitations. Electromagnetic spectrum, infrared thermography- approaches, IR detectors, Instrumentation and methods and applications, Case study.

Eddy current Testing – Principle, properties of eddy currents, Eddy current sensing elements, probes, Instrumentation, Types of arrangement, Advantages & Limitations, Interpretation of Results& applications, Case study.

UNIT IV ULTRASONIC TESTING & ACOUSTIC EMISSION TESTING 9

Ultrasonic Testing-Principle, Basic Equipment, Transducers, couplants, Ultrasonic wave, Variables in UT, Transmission and Pulse-echo method, Straight beam and angle beam, A-Scan, B-Scan & C-Scan, Phased Array Ultrasound& Time of Flight Diffraction, Advantages & Limitations, Interpretation of Results& Applications, Case study

Acoustic Emission Technique – Introduction, Types of AE signal, AE wave propagation, Source location, Kaiser effect, AE transducers, Principle, AE parameters, AE instrumentation, Advantages & Limitations, Interpretation of Results, Applications, Case study.

UNIT V RADIOGRAPHY 9

Introduction, Principle, X-ray Production, Gamma ray sources, tubing materials, X-ray tubing characteristics, Interaction of X-ray with matter, Imaging, Film techniques, Filmless techniques, Types and uses of filters and screens, Real time radiography, geometric factors, inverse square law, characteristics of film, graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Digital Radiography – Film Digitisation, Direct Radiography &Computed Radiography, Computed Tomography, Gamma ray Radiography, Safety in X- ray and Gamma Ray radiography, Case study.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able

- To compare the various visual inspection techniques and apply them in inspection.
- To adapt the Penetrant testing procedures whileevaluating the surface defects.
- To interpret the images and the results obtained from the Thermographic technique and the Eddy current testing
- To analyze the results obtained in the Ultrasonic inspection and Acoustic Emission technique
- To explain the techniques involved in the Radiographic testing and the various advancements in Radiography.

TEXTBOOKS:

1. ASM Metals Handbook, “Non-Destructive Evaluation and Quality Control”, American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.
2. Paul E Mix, “Introduction to Non-destructive testing: a training guide”, Wiley, 2nd edition New Jersey, 2005

REFERENCES:

1. ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT Handbook,Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. 5, Electromagnetic Testing, Vol. 6, Acoustic Emission Testing, Vol. 7, Ultrasonic Testing.
2. Baldev Raj, T.Jayakumar, M.Thavasimuthu “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
3. Charles, J. Hellier,“ Handbook of Non-destructive evaluation”, McGraw Hill, New York 2001.
4. G. Gaussorgues, “Infrared Thermography”, Chapman & Hall, University Press, Cambridge, 1994.
5. Ravi Prakash, “Non-Destructive Testing Techniques”, New Age International Publishers, 1st revised edition, 2010.

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ME5075 ENTREPRENEURSHIP DEVELOPMENT L TP C
3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Understanding the types, characteristics of entrepreneurship and its role in economic development.
2. Appreciating of the theories of achievement motivation and the principles of entrepreneurship development program to enterprise.
3. Understanding the appropriate form of business ownership in setting up an enterprise.
4. Understanding the fundamental concepts of finance and accounting to enterprise.
5. Recognizing sickness in industry, selecting the appropriate corrective measures, and identifying the growth strategies in enterprise.

UNIT I ENTREPRENEURSHIP 9

Entrepreneur – Characteristics – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Role of Entrepreneurship in Economic Development – Factors Affecting Entrepreneurial Growth – Economic, Non Economic, Government Actions.

UNIT II MOTIVATION 9

Entrepreneurial Motivation: Theories and Factors, Achievement Motivation –Entrepreneurial Competencies – Entrepreneurship Development Programs – Need, Objectives – Business Game, Thematic Apperception Test, Self Rating, Stress management.

UNIT III BUSINESS 9

Small Enterprises – Definition, Characteristics, Project Identification and selection – Project Formulation: Significance, content, formulation of project report – Project Appraisal: Concept and method – Ownership Structures: Selection & Pattern.

UNIT IV FINANCING AND ACCOUNTING 9

Finance: Need, Sources, Capital Structure, Term Loans – Accounting: Need, Objectives, Process, Journal, Ledger, Trial Balance, Final Accounts – Working Capital Management: Significance, Assessment, Factors, Sources, Management.

UNIT V SUPPORT TO ENTREPRENEURS 9

Sickness in small Business: Concept, Signals, Symptoms, Magnitude, Causes and Consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in Small Scale Enterprise – Institutional Support to Entrepreneurs: Need and Support – Taxation Benefits to Small Scale Industry: Need, Depreciation, Rehabilitation, Investment.

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Explain the types, characteristics of entrepreneurship and its role in economic development.
2. Apply the theories of achievement motivation and the principles of entrepreneurship development program.
3. Select the appropriate form of business ownership in setting up an enterprise.
4. Apply the fundamental concepts of finance and accounting to enterprise.
5. Identify sickness in industry, select the appropriate corrective measures, and identify the growth strategies in enterprise.

TEXT BOOKS:

1. S.S.Khanka, “Entrepreneurial Development” S.Chand& Co. Ltd. Ram Nagar New Delhi,1999.
2. Kurahko&Hodgetts, “ Entrepreneurship – Theory, process and practices”, Thomson learning 6th edition.

REFERENCES:

1. Charantimath, P. M., Entrepreneurship Development and Small Business Enterprises, Pearson, 2006.
2. Hisrich R D and Peters M P, “Entrepreneurship” 5th Edition Tata McGraw-Hill, 2002.
3. Mathew J Manimala,” Entrepreneurship theory at cross roads: paradigms and praxis” Dream tech, 2nd edition 2006.
4. Rabindra N. Kanungo, “Entrepreneurship and innovation”, Sage Publications, New Delhi, 1998.
5. Singh, A. K., Entrepreneurship Development and Management, University Science Press, 2009.

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ME5003 REFRIGERATION AND AIR CONDITIONING LTPC 3003

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Understanding different types of refrigerant, their properties, and selecting appropriate refrigerant for a HVAC system.
2. Classifying different types of compressor and evaporator systems.
3. Determining the appropriate psychrometric processes and estimating the heat load
4. Describing types of air-conditioning system and air distribution configurations.
5. Understanding non-conventional refrigeration systems and instrumentation / control in HVAC systems.

UNIT I INTRODUCTION, REFRIGERANTS AND THEIR ENVIRONMENTAL ISSUES 9

Applications of air-conditioning and refrigeration, energy usage in air-conditioning/buildings Introduction of Refrigeration and Heat Pump: Carnot cycle, modification in reversed Carnot cycle, vapour compression cycle, actual vapour compression cycle.

Designation of refrigerants, Selection of refrigerants, Ozone Depletion Potential (ODP) and Global Warming (GW), Montreal and Kyoto protocols Total Equivalent Warming Index (TEWI), Azeotropic and zeotropic mixtures, alternative to existing CFC and HCFC refrigerants.

UNIT II BASIC REFRIGERATION, ADVANCED CYCLES AND THEIR COMPONENTS 9

Single and multi-compressor and multi- evaporator systems, System with flash chamber and intercooler, P-h and T-s diagrams, thermodynamic analysis, effect of inter cooling, sub-cooling and super heating, Cascade refrigeration.

Types of compressors, condensers, evaporators, expansion devices – Comparison between air-cooled and water-cooled condenser based air-conditioning plants

UNIT III AIR-CONDITIONING AND HEATING / COOLING LOAD ESTIMATION 9

Introduction to thermal comfort and parameters of indoor environment quality; Psychrometric properties, Psychrometric chart; Basic process in air-conditioning: Humidification and Dehumidification processes; Introduction to evaporative cooling and cooling towers-Thermodynamic analysis.

Heating and Cooling Load Estimation : Components of cooling/heat load, Room sensible heat factor (RSHF), Grand sensible Heat factor (GSHF), Heating and cooling load estimation of a typical office / domestic building, Concept of diversity.

UNIT IV AIR CONDITIONING SYSTEM TYPES AND AIR DISTRIBUTION 9

Major system types in air-conditioning: unitary, package, central chilled water based systems; components of chilled water system, concept of primary-secondary chilled water pumping; concept of variable flow systems, components of non-chilled water based system, types and role for energy efficiency, comparison of variable refrigerant flow and constant flow systems.

Fundamentals of duct design, pressure loss and AHU calculations, types of terminal units, advanced air distribution: VAV, UFAD systems; concept of heat recovery systems

UNIT V OTHER REFRIGERATION SYSTEMS, CONTROLS AND SAFETY IN RAC 9

Introduction to Vortex tube, steam jet and thermoelectric refrigeration systems, vapor absorption, vapor adsorption systems, reversed Brayton cycle - air based refrigeration.

Introduction to Building Management System, major components and use of BMS, instrumentation requirements, concept of Direct Digital Control. Installation, commissioning, noise, vibration, electrical connections and safety in RAC systems

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Understand different types of refrigerant, their properties, and select appropriate refrigerant for a HVAC system.
2. Classify different types of compressor and evaporator systems.
3. Adopt appropriate psychrometric processes and arrive at the heat load for a system.
4. Describe types of air-conditioning system and air distribution configurations.

5. Understandvarious non-conventional refrigeration systems, and adopt suitable instrumentation / control, safety in HVAC systems.

TEXT BOOKS:

1. Arora C P, Refrigeration and Air Conditioning, 3rd Edition, Tata McGraw-Hill, 2017.
2. Stoecker W.F and Jones J.W, Refrigeration and Air Conditioning, 2nd Edition, Tata McGraw-Hill, 1982.

REFERENCES:

1. Anantanarayanan P.N, Basic Refrigeration and Air Conditioning, 4th Edition, Tata McGraw-Hill, 2013.
2. Arora R.C, Refrigeration and Air Conditioning, Prentice Hall India, 2010.
3. ASHRAE Handbook Series: Fundamentals, Refrigeration, Systems and Equipmentsand HVAC Applications, 2014-18, ASHRAE Inc, Atlanta, USA.
4. Dossat Roy J., Principles of Refrigeration, 4th Edition, Pearson Education Asia, 2002
5. Kuehn T.H, Ramsey J W and Therelkeld J L, Thermal Environmental Engineering, Prentice Hall, 1998.

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ME5004 TURBO MACHINERY **L T P C**
3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Understanding various turbo machines and their energy transfer mechanism.
2. Constructing velocity triangle for a centrifugal fan / blower and evaluating the performance.
3. Examining the working and performance of centrifugal compressor.
4. Understanding the working of axial flow compressor and analysing the flow losses.
5. Examining the working and performance of axial and radial flow turbines.

UNIT I WORKING PRINCIPLES **9**

Classification of Turbomachines. Energy transfer between fluid and rotor - Euler equation and its interpretation. Velocity triangles. Efficiencies in Compressor and Turbine stages. Degree of reaction. Dimensionless parameters for Turbomachines.

UNIT II CENTRIFUGAL FANS AND BLOWERS **9**

Types – components – working. Flow analysis in impeller blades-volute and diffusers. Velocity triangles - h-s diagram. Stage parameters in fans and blowers. Performance characteristic curves – various losses. Fan – bearings, drives and noise.

UNIT III CENTRIFUGAL COMPRESSOR **9**

Components - blade types. Velocity triangles - h-s diagram, stage work. Slip factor and Degree of Reaction. Performance characteristics and various losses. Geometry and performance calculation.

UNIT IV AXIAL FLOW COMPRESSOR **9**

Construction details. Work done factor. Velocity triangles - h-s diagram, stage work. Work done factor. Performance characteristics, efficiency and stage losses – Stalling and Surging. Free and Forced vortex flow.

UNIT V AXIAL AND RADIAL FLOW TURBINES **9**

Axial flow turbines - Types – Elements - Stage velocity diagrams - h-s diagram, stage work - impulse and reaction stages. Compounding of turbines. Performance coefficients and losses.
Radial flow turbines: Types – Elements - Stage velocity diagrams - h-s diagram, stage work Performance coefficients and losses.

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Understand the basics of various turbo machines.
2. Analyse theperformance of a centrifugal fan / blower.
3. Evaluate the performance of centrifugal compressor.
4. Determine the performance parameters and flow losses in axial flow compressor.
5. Compute the performance of axial and radial flow turbines.

TEXT BOOKS:

1. Ganesan, V., “Gas Turbines”, 3rd Edition, Tata McGraw Hill, 2011.
2. Yahya, S.M., “Turbines, Compressor and Fans”, 4th Edition, Tata McGraw Hill, 2011.

REFERENCES:

1. Dixon, S.L., “Fluid Mechanics and Thermodynamics of Turbomachinery”, 7th Edition, Butterworth-Heinemann, 2014.
2. Gopalakrishnan .G and Prithvi Raj .D,” A Treatise on Turbomachines”, Scitech Publications (India) Pvt. Ltd., 2nd Edition, 2008.
3. Lewis, R.I., “Turbomachinery Performance Analysis” 1st Edition, Arnold Publisher, 1996.
4. Saravanamutto, Rogers, Cohen, Straznicky., “Gas Turbine Theory” 6th Edition, Pearson Education Ltd, 2009.
5. Venkanna, B.K., “Fundamentals of Turbomachinery”, PHI Learning Pvt. Ltd., 2009.

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MF5652 ADDITIVE MANUFACTURING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the development of Additive Manufacturing (AM), various business opportunities and applications
- To familiarize various software tools, processes and techniques to create physical objects that satisfy product development / prototyping requirements, using AM.
- To be acquainted with vat polymerization and material extrusion processes.
- To be familiar with powder bed fusion and direct energy deposition.
- To gain knowledge on applications of binder jetting, material jetting and laminated object manufacturing processes

UNIT I INTRODUCTION 9

Overview – Need - Development of Additive Manufacturing (AM) Technology: Rapid Prototyping- Rapid Tooling – Rapid Manufacturing – Additive Manufacturing. AM Process Chain- Classification – Benefits. Applications: Building Printing-Bio Printing- Food Printing-Printing Electronics. Business Opportunities and Future Directions - Intellectual Property.

UNIT II DESIGN FOR ADDITIVE MANUFACTURING (DFAM) 9

Concepts and Objectives- AM Unique Capabilities: Part Consolidation-Topology Optimization- Light weight Structure - DFAM for Part Quality Improvement. Data Processing - CAD Model Preparation -

Part Orientation and Support Structure Generation -Model Slicing - Tool Path Generation- Customized Design and Fabrication for Medical Applications- Case Studies.

UNIT III VAT POLYMERIZATION AND MATERIAL EXTRUSION 9

Photo polymerization: Stereolithography Apparatus (SLA)- Materials -Process -Advantages- Limitations- Applications. Digital Light Processing(DLP) - Materials – Process - Advantages - Applications.Extrusion Based System: Fused Deposition Modeling (FDM)- Process-Materials - Applications and Limitations.

UNIT IV POWDER BED FUSION AND DIRECT ENERGY DEPOSITION 9

Powder Bed Fusion: Selective Laser Sintering (SLS): Process – Powder Fusion Mechanism – Process Parameters – Typical Materials and Application. Selective Laser Melting (SLM) and Electron Beam Melting (EBM): Materials – Process - Advantages and Applications.

Beam Deposition Process: Laser Engineered Net Shaping (LENS)- Process -Material Delivery - Process Parameters -Materials -Benefits -Applications.

UNIT V OTHER ADDITIVE MANUFACTURING PROCESSES 9

Binder Jetting: Three Dimensional Printing - Materials -Process - Benefits and Limitations. Material Jetting: Multijet Modeling- Materials - Process - Benefits. Sheet Lamination Process: Laminated Object Manufacturing (LOM)- Basic Principle- Mechanism: Gluing or Adhesive Bonding – Thermal Bonding- Materials-Application and Limitation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course students shall be able to:

- CO1: Recognize the development of AM technology and how AM technology propagated into various businesses and developing opportunities.
- CO2: Acquire knowledge on process of transforming a concept into the final product in AM technology.
- CO3: Elaborate the vat polymerization and material extrusion processes and its applications.
- CO4: Acquire knowledge on process and applications of powder bed fusion and direct energy deposition.
- CO5: Evaluate the advantages, limitations, applications of binder jetting, material jetting and laminated object manufacturing processes.

TEXT BOOKS:

1. Andreas Gebhardt and Jan-Steffen Hötter “Additive Manufacturing: 3D Printing for Prototyping and Manufacturing”, Hanser publications, United States, 2015, ISBN: 978-1-56990-582-1.
2. Ian Gibson, David W. Rosen and Brent Stucker “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, 2nd edition,Springer., United States, 2015, ISBN-13: 978-1493921126.

REFERENCES:

1. Amit Bandyopadhyay and Susmita Bose, “Additive Manufacturing”, 1st Edition, CRC Press., United States, 2015, ISBN-13: 978-1482223590.
2. Andreas Gebhardt, “Understanding Additive Manufacturing: Rapid Prototyping, Rapid Manufacturing”, Hanser Gardner Publication, Cincinnati., Ohio, 2011, ISBN :9783446425521.
3. Kamrani A.K. and Nasr E.A., “Rapid Prototyping: Theory and practice”, Springer., United States ,2006, ISBN: 978-1-4614-9842-1.
4. Liou, L.W. and Liou, F.W., “Rapid Prototyping and Engineering applications: A tool box for prototype development”, CRC Press., United States, 2011, ISBN: 9780849334092.
5. Milan Brandt, “Laser Additive Manufacturing: Materials, Design, Technologies, and Applications”, Woodhead Publishing., United Kingdom, 2016, ISBN: 9780081004333.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3						1	3		2		3	1	1	1
2	3	2	1	1	2		3	2		2		3	1	3	2
3	3	1					2			2		3	2	2	1
4	3	1					2			2		3	2	2	1
5	3	1					2			2		3	2	2	1

MF5651 NON-TRADITIONAL MACHINING PROCESSES L T P C
3 0 0 3

COURSE OBJECTIVES:

- To classify non-traditional machining processes and describe mechanical energy based non-traditional machining processes.
- To differentiate chemical and electro chemical energy based processes.
- To describe thermo-electric energy based processes
- To explain nano finishing processes.
- To introduce hybrid non-traditional machining processes and differentiate hybrid non-traditional machining processes

UNIT I INTRODUCTION AND MECHANICAL ENERGY BASED PROCESSES 9

Introduction - Need for non-traditional machining processes - Classification of non-traditional machining processes - Applications, advantages and limitations of non-traditional machining processes - Abrasive jet machining, Abrasive water jet machining, Ultrasonic machining their principles, equipment, effect of process parameters, applications, advantages and limitations.

UNIT II CHEMICAL AND ELECTRO CHEMICAL ENERGY BASED PROCESSES 9

Principles, equipments, effect of process parameters, applications, advantages and limitations of Chemical machining, Electro-chemical machining, Electro-chemical honing, Electro-chemical grinding, Electro chemical deburring.

UNIT III THERMO-ELECTRIC ENERGY BASED PROCESSES 9

Principles, equipments, effect of process parameters, applications, advantages and limitations of Electric discharge machining, Wire electric discharge machining, Laser beam machining, Plasma arc machining, Electron beam machining, Ion beam machining.

UNIT IV NANO FINISHING PROCESSES 9

Principles, equipments, effect of process parameters, applications, advantages and limitations of Abrasive flow machining – Chemo mechanical polishing, Magnetic abrasive finishing, Magnetorheological finishing, Magneto rheological abrasive flow finishing.

UNIT V HYBRID NON-TRADITIONAL MACHINING PROCESSES 9

Introduction - Various hybrid non-traditional machining processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Selection and comparison of different non-traditional machining processes.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students shall be able to:

- CO1: Formulate different types of non-traditional machining processes and evaluate mechanical energy based non-traditional machining processes.
- CO2: Illustrate chemical and electro chemical energy based processes.
- CO3: Evaluate thermo-electric energy based processes.
- CO4: Interpret nano finishing processes.
- CO5: Analyse hybrid non-traditional machining processes and differentiate non-traditional machining processes.

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4	3		2		1		1			1		1	2	2	2
5	3		3	2	3		1			1		1	3	3	3

TEXT BOOKS:

1. Adithan. M., "Unconventional Machining Processes", Atlantic, New Delhi, India, 2009. ISBN 13: 9788126910458
2. Anand Pandey, "Modern Machining Processes", Ane Books Pvt. Ltd., New Delhi, India, 2019.

REFERENCES:

1. Benedict, G.F., "Non-traditional Manufacturing Processes", Marcel Dekker Inc., New York 1987. ISBN-13: 978-0824773526.
2. Carl Sommer, "Non-Traditional Machining Handbook", Advance Publishing., United States, 2000, ISBN-13: 978-1575373256.
3. Golam Kibria, Bhattacharyya B. and Paulo Davim J., "Non-traditional Micromachining Processes: Fundamentals and Applications", Springer International Publishing., Switzerland, 2017, ISBN:978-3-319-52008-7.
4. Jagadeesha T., "Non-Traditional Machining Processes", I.K. International Publishing House Pvt. Ltd., New Delhi, India, 2017, ISBN-13: 978-9385909122.
5. Kapil Gupta, Neelesh K. Jain and Laubscher R.F., "Hybrid Machining Processes: Perspectives on Machining and Finishing", 1st edition, Springer International Publishing., Switzerland, 2016, ISBN-13: 978-3319259208.

ME5073 DESIGN FOR MANUFACTURING LTPC
3003

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Applying economic process selection principles and general design principles for manufacturability in the development and design of products for various engineering applications. Also, apply design consideration principles of casting in the design of cast products.
2. Applying design consideration principles of forming in the design of extruded, stamped, and forged products.
3. Applying design consideration principles of machining in the design of turned, drilled, milled, planed, shaped, slotted, and ground products.
4. Applying design consideration principles of welding in the design of welded products.
5. Applying design consideration principles of assembly in the design of assembled products.

UNIT I INTRODUCTION AND DESIGN FOR CASTING 9

Introduction - Economics of process selection - General design principles for manufacturability; Design considerations for: Sand cast – Die cast – Permanent mold cast parts.

UNIT II DESIGN FOR FORMING 9

Design considerations for: Metal extruded parts – Impact/Cold extruded parts – Stamped parts – Forged parts.

UNIT III DESIGN FOR MACHINING 9

Design considerations for: Turned parts – Drilled parts – Milled, planed, shaped and slotted parts– Ground parts.

UNIT IV DESIGN FOR WELDING 9

Arc welding – Design considerations for: Cost reduction – Minimizing distortion – Weld strength – Weldment& heat treatment. Resistance welding – Design considerations for: Spot – Seam – Projection – Flash & Upset weldment.

UNIT V DESIGN FOR ASSEMBLY 9

Design for assembly – General assembly recommendations – Minimizing the no. of parts – Design considerations for: Rivets – Screw fasteners – Gasket & Seals – Press fits – Snap fits – Automatic assembly.

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Interpret the economics and design of cast components.
2. Design best manufacturing practices for forming of components
3. Develop design principles for machining.
4. Formulate design consideration in the design of welded products.
5. Apply design consideration principles of assembly in the design of assembled products**.**

TEXT BOOKS:

1. James G. Bralla, “Handbook of Product Design for Manufacture”, McGraw Hill, 1986.
2. O. Molloy, E.A. Warman, S. Tilley, Design for Manufacturing and Assembly: Concepts, Architectures and Implementation, Springer, 1998.

REFERENCES:

1. CorradoPoli, Design for Manufacturing: A Structured Approach, Elsevier, 2001.
2. David M. Anderson, Design for Manufacturability & Concurrent Engineering: How to Design for Low Cost, Design in High Quality, Design for Lean Manufacture, and Design Quickly for Fast Production, CIM Press, 2004.
3. Erik Tempelman, Hugh Shercliff, Bruno Ninaber van Eyben, Manufacturing and Design: Understanding the Principles of How Things Are Made, Elsevier, 2014.
4. Henry Peck, “Designing for Manufacture”, Sir Isaac Pitman & Sons Ltd., 1973.
5. Matousek, “Engineering Design”, Blackie & Sons, 1956.

CO	PO												PSO		
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1	3	3	2	1	2	1	1	1	1	2	2	2	3	2	2
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4	3	3	2	1	2	1	1	1	1	2	2	2	3	2	2
5	3	3	2	1	2	1	1	1	1	2	2	2	3	2	2

ME5082 PRODUCT DESIGN AND DEVELOPMENT LTPC

3003

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Applying the principles of generic development process; conducting customer need analysis; and setting product specification for new product design and development.
2. Generating, selecting, screening, and testing concepts for new product design and development.
3. Applying the principles of product architecture and industrial design to design and develop new products.
4. Applying theprinciples of DFM and Prototyping to design and develop new product.

5. Applying the concepts of economics principles; project management practices in the development of new product.

UNIT I INTRODUCTION TO PRODUCT DEVELOPMENT, CUSTOMER NEED ANALYSIS, PRODUCT SPECIFICATION 9

Introduction – A Generic Development Process – Adapting the Generic Product Development Process - Product Development Process Flows – Identifying Customer Needs - Product Specifications: Establishing Target Specifications; Setting the Final Specifications.

UNIT II CONCEPT GENERATION, SELECTION, AND TESTING 9

Concept Generation: The Activity of Concept Generation - Concept Selection: Concept Screening; Concept Scoring – Concept Testing.

UNIT III PRODUCT ARCHITECTURE AND INDUSTRIAL DESIGN 9

Product Architecture: Implications of the Architecture; Establishing the Architecture; Delayed Differentiation; Platform Planning; Related System-Level Design Issues – Industrial Design: Assessing the Need for Industrial Design; Impact of Industrial Design; The Industrial Design Process; Management of the Industrial Design Process; Assessing the Quality of Industrial Design.

UNIT IV DFM AND PROTOTYPING 9

Design for Manufacturing: Estimate the Manufacturing Costs; Reduce the Costs of Components; Reduce the Costs of Assembly;Reduce the Costs of SupportingProduction; Consider the Impact ofDFMA– Prototyping: Type; Uses; Principles; Technologies; Planning for Prototypes.

UNIT V PRODUCT DEVELOPMENT ECONOMICS AND MANAGING PROJECTS 9

Product Development Economics: Elements of Economic Analysis; Economic Analysis Process - Managing Projects: Understanding and Representing Tasks; Baseline Project Planning; Accelerating Projects; Project Execution.

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Apply the principles of generic development process; conduct customer need analysis; and set product specification for new product design and development.
2. Generate, select, screen, and test concepts for new product design and development.
3. Apply the principles of product architecture and industrial design to design and develop new products.
4. Apply the principles of DFM and Prototyping to design and develop new product.
5. Apply the concepts of economics principles; project management practices in the development of new product.

TEXT BOOK:

1. Jamnia, A., Introduction to Product Design and Development for Engineers, CRC Press, 2018.
2. Karl, T. Ulrich and Steven, D. Eppinger, “Product Design and Development”, McGraw Hill, 2003.

REFERENCES:

1. Belz A., 36-Hour Course: “Product Development” McGraw-Hill, 2010.
2. Chitale, A. K. and Gupta, R. C., Product Design and Manufacturing, PHI Learning, 2013.
3. Pugh S., “Total Design – Integrated Methods for successful Product Engineering”, Addison Wesley Publishing, 1991.
4. Rosenthal S., “Effective Product Design and Development”, Business One, 1992.
5. Silva, A., Handbook of Research on Trends in Product Design and Development: Technological and Organizational Perspectives: Technological and Organizational Perspectives, IGI Global, 2010.

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ME5005 INDUSTRIAL SAFETY LTPC
3003

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:

1. Explaining the fundamental concept and principles of industrial safety
2. Applying the principles of maintenance engineering.
3. Analyzing the wear and its reduction.
4. Evaluating faults in various tools, equipments and machines.
5. Applying periodic maintenance procedures in preventive maintenance.

UNITI INDUSTRIAL SAFETY 9

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT II MAINTENANCE ENGINEERING 9

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNITIII WEAR AND CORROSION AND THEIR PREVENTION 9

Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNITIV FAULT TRACING 9

Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler,vi. Electrical motors, Types of faults in machine tools and their general causes.

UNITV PERIODIC AND PREVENTIVE MAINTENANCE 9

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, Advantages of preventive maintenance. Repair cycle concept and importance.

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Explain the fundamental concept and principles of industrial safety
2. Apply the principles of maintenance engineering.
3. Analyze the wear and its reduction.
4. Evaluate faults in various tools, equipments and machines.
5. Apply periodic maintenance procedures in preventive maintenance.

TEXTBOOKS:

1. L M Deshmukh, Industrial Safety Management, Tata McGraw-Hill Education, 2005.
2. Charles D. Reese, Occupational Health and Safety Management: A Practical Approach, CRC Press, 2003.

REFERENCES:

1. Edward Ghali, V. S. Sastri, M. Elboujdaini, Corrosion Prevention and Protection: Practical Solutions, John Wiley & Sons, 2007.
2. Garg, HP, Maintenance Engineering, S. Chand Publishing.
3. J Maiti, Pradip Kumar Ray, Industrial Safety Management: 21st Century Perspectives of Asia, Springer, 2017.
4. R. Keith Mobley, Maintenance Fundamentals, Elsevier, 2011.
5. W. E. Vesely, F. F. Goldberg, Fault Tree Handbook, Create space Independent Pub, 2014
6.

CO	PO												PSO		
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GE5552 ENGINEERING MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Explaining basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.
2. Applying various functions of management in professional organization.
3. Applying organizational theory in professional organization.
4. Applying the principles of productivity and operations management in professional organization.
5. Applying modern concepts and marketing in management in professional organization.

UNIT I INTRODUCTION TO MANAGEMENT 9

Definition and functions of Management - Approaches to the study of Management – Mintzberg's Ten Managerial Roles – Principles of Taylor; Fayol; Weber; Parker – Forms of Organization: Sole Proprietorship; Partnership; Company (Private and Public); Cooperative – Public Sector Vs Corporate Organization – Business Environment: Economic; Social; Political; Legal – Trade Union: Definition; Functions; Pros and cons.

UNIT II FUNCTIONS OF MANAGEMENT 9

Planning: Characteristics; Nature; Importance; Steps; Limitation – Organizing: Features; Process; Principles; Types – Departmentalization: Functional – Divisional (Product; Customer; Geographic) – Staffing: Systems Approach; Recruiting and Selection Process – Directing (Leading): Traits; Style; Managerial Grid (Blake-Mounton, Reddin) – Communication: Purpose; Model; Barriers –

Controlling: Types; Audit (External, Internal, Merits) – Decision Making: Elements; Characteristics; Process; Classification – Controlling techniques.

UNIT III ORGANIZATION THEORY 9

Human Resource Development (HRD): Goals – Organizational Conflict: Positive Aspects; Individual; Role; Interpersonal; Intra Group; Inter Group; Conflict Management – Need and Motivation Theories: Maslow's Hierarchy of Needs Theory; Herzberg's Motivation-Hygiene Theory; McClelland's Needs Theory of Motivation – Change Management: Concept of Change; Lewin's Process of Change Model; Sources of Resistance; Overcoming Resistance; Guidelines to managing Conflict.

UNIT IV PRODUCTIVITY AND OPERATIONS MANAGEMENT 9

Productivity: Concept; Measurements; Affecting Factors; Methods to Improve – Operations Management Tools: (Simple problems in) Transportation Model (Balanced); Assignment Model (Hungarian); Network Model (Shortest path); Critical Path Method; Decision Trees.

UNIT V MODERN CONCEPTS AND MARKETING MANAGEMENT 9

Concept, features, merits and demerits of: SWOT Analysis; Business Process Re-engineering (BPR); Supply Chain Management (SCM) – Marketing: Concept; Functions; Importance; Segmentation; Mix; Problems of Marketing in Small Enterprise; Competitive Analysis and Advantage – E-marketing.

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Explain basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.
2. Apply various functions of management in professional organization.
3. Apply organizational theory in professional organization.
4. Apply the principles of productivity and operations management in professional organization.
5. Apply modern concepts and marketing in management in professional organization.

TEXT BOOKS:

1. Koontz. H. and Weihrich. H., Essentials of Management: An International Perspective, 8th Edition, Tata McGrawhill, New Delhi, 2010.
2. M. Govindarajan and S. Natarajan, Principles of Management, Prentice Hall of India, New Delhi, 2009.

REFERENCES:

1. Joseph J, Massie, 'Essentials of Management' Prentice Hall of India Pvt. Ltd., 1985.
2. M. Govindarajan, Marketing Management, Prentice Hall of India, New Delhi, 2010.
3. R. Panneerselvam, Operations Research, Prentice Hall of India, New Delhi, 2013.
4. S.Chandran, Organizational Behaviours, Vikas Publishing House Pvt. Ltd., 1994.
5. Saxena, P.K., Principles of Management: A Modern Approach, Global India Publications, 2009.

CO	PO												PSO		
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1						0.6		0.6				0.3	0.3		
2						0.6		0.6				0.3	0.3		
3						0.6		0.6	0.9	0.9		0.3	0.3		
4	0.9	0.9	0.9	0.9		0.6		0.3			0.9	0.3	0.6		
5						0.6		0.6			0.3	0.3	0.6		

ME5079 NEW AND RENEWABLE SOURCES OF ENERGY **L T P C**
3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:

1. Analyzing the current energy scenario of India and World
2. Evaluating the solar energy at any given location and application of suitable technologies for harnessing them.
3. Quantification of wind energy and deployment of different devices for energy generation
4. Application of relevant concepts for recovering energy from biomass.
5. Employing appropriate engineering principlesfor tapping energy from ocean and geothermal resources.

UNIT I ENERGY SCENARIO **9**
Indian energy scenario in various sectors – domestic, industrial, commercial, agriculture, transportation and others – Present conventional energy status – Present renewable energy status-Potential of various renewable energy sources-Global energy status-Per capita energy consumption in various countries - Future energy plans

UNIT II SOLAR ENERGY **9**
Solar radiation – Measurements of solar radiation and sunshine – Solar thermal collectors – Flat plate and concentrating collectors – Solar thermal applications – Solar thermal energy storage – Fundamentals of solar photo voltaic conversion – Solar cells – Solar PV Systems – Solar PV applications.

UNIT III WIND ENERGY **9**
Wind data and energy estimation – Betz limit - Site selection for windfarms – characteristics Horizontal axis wind turbine – components - Vertical axis wind turbine – Wind turbine generators and its performance – Hybrid systems – Environmental issues - Applications.

UNIT IV BIO-ENERGY **9**
Bio resources – Biomass direct combustion – thermochemical conversion - biochemical conversion-mechanical conversion - Biomass gasifier - Types of biomass gasifiers - Cogeneration –- Carbonisation – Pyrolysis - Biogas plants – Digesters –Biodiesel production – Ethanol production - Applications.

UNIT V OCEAN AND GEOTHERMAL ENERGY **9**
Small hydro - Tidal energy – Wave energy – Open and closed OTEC Cycles – Limitations – Geothermal energy – Geothermal energy sources - Types of geothermal power plants – Applications - Environmental impact.

TOTAL = 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:

1. Describe the current energy scenario of India and World
2. Gauge the solar energy and apply suitable technologies for harnessing them.
3. Quantify wind energy and deploy appropriate devices for energy generation
4. Recover energy from biomass adopting proper concepts.
5. Employ appropriate engineering principles for tapping energy from ocean and geothermal resources.

TEXT BOOKS:

1. G.D. Rai, “Non-Conventional Energy Sources”, Standard Publishers Distributors, 1992.
2. John Twidell, Tony Weir, and Anthony D. Weir, Renewable Energy Resources, Taylor & Francis, 2006.

REFERENCES:

1. B.H. Khan, “Non-Conventional Energy Resources”, McGraw Hill, 2009.
2. G.N. Tiwari, “Solar Energy – Fundamentals Design, Modelling and applications”, Alpha Science, 2015.

3. Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, 2012.
4. N.K. Bansal, Non-Conventional Energy Resources, Vikas Publishing House, 2014.
5. S.P. Sukhatme, “Solar Energy: Principles of Thermal Collection and Storage”, Tata McGraw Hill, 2009.

CO	PO												PSO		
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5	2	2	2	1	1		3						2	3	2

ME5006 ADVANCED INTERNAL COMBUSTION ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Classifying thegasoline fuel injection systems and analyzing combustion knocking in SI engine combustion chambers.
2. Understanding Diesel fuel injection systems and CI engine combustion.
3. Explaining the mechanism of different pollutant formation and their control techniques.
4. Evaluating various alternative fuel options and utilization techniques.
5. Adopting advanced combustion modes and hybrid power train systems.

UNIT I SPARK IGNITION ENGINES 9
Mixture requirements – Fuel injection systems – Mono-point, Multipoint & Direct injection -Stages of combustion – Normal and Abnormal combustion, Spark Knock, Factors affecting knock, Combustion chambers.

UNIT II COMPRESSION IGNITION ENGINES 9
Diesel Fuel Injection Systems – Mechanical and Common Rail Direct Injection Systems - Stages of combustion – Knocking – Factors affecting knock –Direct and Indirect injection systems –Fuel Spray behaviour – Spray structure and spray penetration – Air motion - Combustion chambers – Turbo charging – Waste Gate, Variable Geometry turbochargers.

UNIT III EMISSION FORMATION AND CONTROL 9
Sources – Formation of Carbon Monoxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter – Methods of controlling emissions – In-cylinder treatments – After treatment systems – Three Way Catalytic converter, Selective Catalytic Reduction, De-NOx Catalyst, Diesel Oxidation Catalyst and Particulate Traps – Methods of emission measurement – Emission norms and Driving cycles.

UNIT IV ALTERNATIVE FUELS 9
Alcohol Fuels, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits – Utilisation Methods - Engine Modifications.

UNIT V ALTERNATE COMBUSTION AND POWER TRAIN SYSTEM 9
Low Temperature Combustion - Homogeneous charge compression ignition (HCCI) – Reactivity Controlled Compression Ignition (RCCI) – Gasoline Compression Ignition – Spark Assisted HCCI - Hybrid Electric and Electric Vehicles –- Fuel Cells.

TOTAL = 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Classifydifferent gasoline fuel injection systems and analyse SI engine combustion.

2. Understand Diesel fuel injection systems and CI engine combustion mechanism
3. Identify the sources of pollutants and adopt appropriate and control techniques.
4. Evaluatevarious alternative fuel optionsand its utilization techniques.
5. Adopt advanced combustion concepts and utilize hybrid power train systems.

TEXT BOOKS:

1. V. Ganesan, “Internal Combustion Engines”, V Edition, Tata McGraw Hill, 2012.
2. John B. Heywood, “Internal Combustion Engines Fundamentals”, McGraw-Hill, 1988.

REFERENCES:

1. B.P. Pundir, “IC Engines Combustion & Emission”, Narosa Publishing House, 2014.
2. Duffy Smith, “Auto Fuel Systems”, The Good Heart Wilcox Company, Inc., 2003.
3. EranSher, Handbook of Air Pollution from Internal Combustion Engines: Pollutant Formation and Control, Academic Press, 1998.
4. K.K. Ramalingam, “Internal Combustion Engine Fundamentals”, SciTech Publications, 2011.
5. R.B. Mathur and R.P. Sharma, “Internal Combustion Engines”, DhanpatRai& Sons, 2007.
6. Review articles on HCCI and RCCI – Progress in Energy and Combustion Science Journal – www.sciencedirect.com

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1				1	2	2					1	1	2	1
2	1					2	2					1	1	2	1
3	1					2	2					2	2	2	2
4	1		1		1	3	3					1	1	2	1
5	1	1	1		1	2	2					1	1	2	1

ME5007 CASTING AND WELDING PROCESSES L T P C
3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is :

1. To use the fundamental aspects of ferrous casting metallurgy in casting quality ferrous castings
2. To use the fundamental aspects of non ferrous casting metallurgy in casting quality non ferrous castings
3. To understand the concepts involved in ferrous welding metallurgy.
4. To understand the basics of non-ferrous welding metallurgy.
   To Know the causes and remedies of various welding defects ,weldability ,testing of weldments ,welding standards and codes.

UNIT I FERROUS CAST ALLOYS 9

Solidification of pure metals and alloys and eutectics -Nucleation - Growth Process, Critical nucleus size- Supercooling- Niyama Criterion -G/R ratio- Cell- Dendritic - Random dendritic structure- Segregation and Coring- Eutectics-Compositions and alloys in Cast Irons, FG-CGI- SG structures, Metallic Glass- Mold dilation, Mold metal reactions- Structure and Section sensitivity Cast irons- family & microstructures-Alloying effects- Malleable Iron, ADI, Charge calculations- Effect of normal elements and alloying elements in steels- Compositional aspects and properties of alloy steels- melting procedure and composition control for carbon steels- low alloy steels - stainless steels- composition control- slag-metal reactions-desulphurization-dephosphorisation, specifications for carbon steels- low alloy steels and stainless steels

UNIT II NON FERROUS CAST ALLOYS 9

Copper- Aluminium- Magnesium- zinc - Nickel base alloys- melting practices - Al alloys, Mg alloys, Nickel alloys, Zinc alloys and copper alloys-modification and grain refinement of Al alloys- problems in composition control- degassing techniques -Heat Treatment of Aluminium alloys – Basics of

Solution and Precipitation process. - Applications of Aluminium Alloy castings in various fields. Residual Stresses- defects in castings

UNIT III PHYSICAL METALLURGY OF WELDING 9

Welding of ferrous materials: Iron- Iron carbide diagram, TTT and CCT diagrams, effects of steel composition, formation of different microstructural zones in welded plain-carbon steels. Welding of C-Mn and low-alloy steels, phase transformations in weld and heat - affected zones, cold cracking, role of hydrogen and carbon equivalent, formation of acicular ferrite and effect on weld metal toughness.

UNIT IV WELDING OF ALLOY STEELS AND NON-FERROUS METALS 9

Welding of stainless steels, types of stainless steels, overview of joining ferritic and martensitic types, welding of austenitic stainless steels, Sensitisation, hot cracking, sigma phase and chromium carbide formation, ways of overcoming these difficulties, welding of cast iron. Welding of non-ferrous materials: Joining of aluminium, copper, nickel and titanium alloys, problems encountered and solutions

UNIT V DEFECTS, WELDABILITY AND STANDARDS 9

Defects in welded joints: Defects such as arc strike, porosity, undercut, slag entrapment and hot cracking, causes and remedies in each case. Joining of dissimilar materials, weldability and testing of weldments. Introduction to International Standards and Codes

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. produce quality ferrous castings .
2. produce quality non ferrous castings
3. Describe the metallurgical changes in the ferrous weldments.
4. Appreciate the metallurgical changes in the alloy steels and non- ferrous weldments.
5. Identify the welding defects and provide the remedy according to the standards.

TEXT BOOKS:

1. Heine R W, Loper C R and Rosenthal P C, "Principles of Metal Castings", Tata McGraw Hill, 2017.
2. A.K.Chakrabarthi, ‘Casting Technology and Cast Alloys,Prentice Hall, 2005.
3. R.S.Parmar, ‘Welding Engineering and Technology’, Khanna Publishers, 2010.

REFERENCES:

1. ASM International. Handbook Committee, ASM Handbook: Casting. Volume 15, ASM International, 2008.
2. Baldev Raj, Shankar V, Bhaduri A K, “Welding Technology for Engineers”, Narosa Publications, 2009.
3. Beeley P, “Foundry Technology" Butterworth-Heinemann, 2001.
4. John Brown,Foseco Ferrous Foundryman's Handbook, Butterworth-Heinemann, 2000.
5. John Campbell, “Casting", Butterworth-Heinemann, 2003.

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ME5081 PROCESS PLANNING AND COST ESTIMATION L T P C
3 0 0 3

COURSE OBJECTIVES:

The main learning objectives of this course are to:

1. Elucidate the steps involved in preparing a process plan for a given Product.
2. Provide an overview for costestimation of a given product.
3. Explain the allocation of overhead costs in manufacturing.
4. Elucidate the procedure to estimate the cost ofcastings and forging products.
5. Explain the costs involved in machining and estimate the machining cost.

UNIT I PROCESS PLANNING 9

Defining process planning –Drawing interpretation –Material selection process and methods – Selection of Production Processes from Tables – Selection of Process Parameters from Tables– Factors to be considered in selecting: Processes; Process Sequencing; Operation Sequencing; Equipment & Tool Selection; Tool Holding Devices; Measuring Instruments –Computer Aided Process Planning – Retrieval / Variance CAPP and Generative CAPP - Case Study in Process Planning.

UNIT II FUNDAMENTAL OF ESTIMATING AND ELEMENTS OF COST 9

Concept and Purpose of Estimating, Functions of Estimating Department, Concept of Costing, Costing versus Estimating, Types of Estimates, Importance of Estimates, Estimating Procedure, Cost Estimators and their Qualifications, Principal Constituents in a Cost Estimate – Elements of Cost – Introduction, Material Cost, Labour Cost, Expenses and Cost of Product (Ladder Cost).

UNIT III OVERHEADS AND DEPRECIATION 9

Overheads , Allocation or Distribution of Overhead Cost , Depreciation and Methods to Calculate it, Interest on Capital, Idleness Costs, Repair and Maintenance Cost

UNIT IV ESTIMATION OF CASTING, FORGING & WELDING COSTS 9

Estimation of cost for Casting processes, Welding processes and Forging processes.

UNIT V ESTIMATION OF MACHINING TIME AND COST 9

Estimation of Machining Time and Cost – Lathe operations, Drilling, Milling, Shaping Planing, and Grinding operations.

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Create a Process Plan for a given Product.
2. Identify Cost elements for a given Product.
3. Allocate Overhead to different departments in manufacturing a product.
4. Estimate cost for Casting and Forging products.
   Analyze the costs for machining a product

TEXT BOOKS:

1. Adithan, M, Process Planning and Cost Estimation, New Age International Publishers, 2007.
2. Peter Scallan, Process planning, The Design/Manufacture Interface, Butterworth-Heinemann, 2003.

REFERENCES:

1. Chitale A. K., and Gupta R. C., “Product Design and manufacturing”, Prentice Hall of India, New Delhi, 1997.
2. Gideon Halevi, “Process and operation planning”, Kluwer academic publishers (Printed ebook), 2003.
3. Narang G.B.S. & Kumar .V, “Production and Costing”, Khanna Publishers, 2000.
4. Phillip F. Ostwald & Jairo Munoz, “Manufacturing Processes And Systems”, 9th Edition, Wiley student edition, 2002.

5. Robert Creese, Adithan M. &Pabla B. S., “Estimating and Costing for the Metal Manufacturing Industries”, Marcel Dekker, 1992.

CO	PO												PSO		
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2	3	3	2	1		1	1	1	1		1	1	2	2	2
3	3	3	2	2		1	1	1			1	1	2	2	1
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ME5083 PRODUCT LIFECYCLE MANAGEMENT LTPC 3003

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Explaining the history, concepts and terminology of PLM.
2. Applying the functions and features of PLM/PDM.
3. Applying different modules offered in commercial PLM/PDM tools.
4. Implementing PLM/PDM approaches for industrial applications.
5. Integrating PLM/PDM with legacy data bases, CAx& ERP systems.

UNITI INTRODUCTION TO PLM 9

Introduction to PLM, Need for PLM, opportunities of PLM, Different views of PLM - Engineering Data Management (EDM), Product Data Management (PDM), Collaborative Product Definition Management (CPDM), Collaborative Product Commerce (CPC), Product Lifecycle Management (PLM). PLM/PDM Infrastructure – Network and Communications, Data Management, Heterogeneous data sources and applications.

UNITII PLM/PDM FUNCTIONS AND FEATURES 9

User Functions – Data Vault and Document Management, Workflow and Process Management, Product Structure Management, Product Classification and Programme Management. Utility Functions – Communication and Notification, data transport, data translation, image services, system administration and application integration

UNITIII DETAILS OF MODULES IN A PDM/PLM SOFTWARE 9

Case studies based on top few commercial PLM/PDM tools – Teamcenter, Windchill, ENOVIA, Aras PLM, SAP PLM, Arena, Oracle Agile PLM and Autodesk Vault.

UNIT IV ROLE OF PLM IN INDUSTRIES 9

Case studies on PLM selection and implementation (like auto, aero, electronic) - other possible sectors, PLM visioning, PLM strategy, PLM feasibility study, change management for PLM, financial justification of PLM, barriers to PLM implementation, ten step approach to PLM, benefits of PLM for–business, organization, users, product or service, process performance

UNIT V BASICS ON CUSTOMISATION/INTEGRATION OF PDM/PLM SOFTWARE 9

PLM Customization, use of EAI technology (Middleware), Integration with legacy data base, CAD, SLM and ERP

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Explain the history, concepts and terminology of PLM
2. Apply the functions and features of PLM/PDM
3. Apply different modules offered in commercial PLM/PDM tools.
4. Implement PLM/PDM approaches for industrial applications.
5. Integrate PLM/PDM with legacy data bases, CAx& ERP systems

TEXTBOOKS:

1. AnttiSaaksvuori and AnselmiImmonen, “Product Lifecycle Management”, Springer Publisher, 2008.
2. Michael Grieves, “Product Life Cycle Management”, Tata McGraw Hill, 2006.

REFERENCES:

1. ArieKarniel and Yoram Reich, Managing the Dynamics of New Product Development Processes: A New Product Lifecycle Management Paradigm, Springer, 2011.
2. IvicaCrnkovic, Ulf Asklund and AnnitaPerssonDahlqvist, “Implementing and Integrating Product Data Management and Software Configuration Management”, Artech House Publishers, 2003.
3. John Stark, “Global Product: Strategy, Product Lifecycle Management and the Billion Customer Question”, Springer Publisher, 2007.
4. John Stark, “Product Lifecycle Management: 21st Century Paradigm for Product Realisation”, Springer Publisher, 2011.
5. Kevin Roebuck, Product Lifecycle Management (PLM): High-impact Strategies - What You Need to Know: Definitions, Adoptions, Impact, Benefits, Maturity, Vendors, Emereo, 2011.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	1	1		3			1	2	2	2	1	2	1	2
2	2	2	1	1	3			1	2	2	2	1	2		2
3	2	2	1	1	3			1	2	2	2	1	2	1	2
4	2	2	1	1	3			1	2	2	2	1	2	1	2
5	2	2	1	1	3			1	2	2	2	1	2		2

ME5084 SURFACE ENGINEERING TRIBOLOGY LTPC
3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Describe the fundamentals of surface features and different types of friction associated with metals and non metals
2. Analyze the different types of wear mechanism and its standard measurement.
3. Analyze the different types of corrosion and its preventive measures
4. Analyze the different types of surface properties and surface modification techniques
5. Analyze the various types of materials used in the friction and wear applications

UNITI SURFACES AND FRICTION 9

Basics of surfaces features – Roughness parameters – surface measurement - Cause of friction- Laws of friction – Static friction – Rolling Friction – Stick-slip Phenomenon - Friction properties of metal and nonmetals – Friction in extreme conditions – Thermal considerations in sliding contact.

UNIT II WEAR 9

Laws of Wear - Types of Wear mechanism – wear debris analysis - Theoretical wear models - Wear of metals and nonmetals – International standards in friction and wear measurements

UNIT III CORROSION 9

Introduction – Types of corrosion – Factors influencing corrosion – Testing of corrosion – In-service monitoring, Simulated service, Laboratory testing – Prevention of Corrosion – Material selection, Alteration of environment, Design, Cathodic and Anodic Protection, Corrosion inhibitors

UNIT IV SURFACE TREATMENTS 9

Surface properties – Hydrophobic – Super hydrophobic – Hydrophilic - surface metallurgy –Surface coating Techniques – PVD – CVD – Physical CVD – Ion implantation – Surface welding – Thermal

spraying – Laser surface hardening and alloying - New trends in coating technology – DLC – CNC – Thick coatings – Nano-engineered coatings – Other coatings, Corrosion resistant coatings

UNITV ENGINEERING MATERIALS **9**

Introduction – High and low friction materials - Advanced alloys – Super alloys, Titanium alloys, Magnesium alloys, Aluminium alloys, and Nickel based alloys – Ceramics – Polymers – Biomaterials – Bio Tribology - Nano Tribology

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Describe the fundamentals of surface features and different types of friction associated with metals and non metals
2. Analyze the different types of wear mechanism and its standard measurement.
3. Analyze the different types of corrosion and its preventive measures
4. Analyze the different types of surface properties and surface modification techniques
5. Analyze the various types of materials used in the friction and wear applications.

TEXT BOOKS:

1. G.W.Stachowiak andA.W.Batchelor, “Engineering Tribology”, Butterworth-Heinemann, 2005.
2. S.K.Basu, S.N.Sengupta and B.B.Ahuja ,”Fundamentals of Tribology”, Prentice Hall of India, 2005.

REFERENCES:

1. Fontana G., “Corrosion Engineering”, McGraw Hill, 1985.
2. Halling, J. (Editor), “Principles of Tribology “, MacMillian, 1984.
3. Rabinowicz.E., “Friction and Wear of materials”, John Willey &Sons,1995.
4. Williams J.A., “Engineering Tribology”, Oxford University Press, 1994.
5. Joseph R. Davis, Corrosion: Understanding the Basics, ASM International, 2000.

CO	PO												PSO		
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1	1	2		2	2			2				2	3	2	1
2	2	2		2	2			2				2	3	2	1
3	1	2		2	2			2				2	2	3	1
4	1	2		2	3			2				2	2	3	1
5	1	1		2	1			2				3	1	2	1

GE5072 **HUMAN RIGHTS** **L T P C**

3 0 0 3

COURSE OBJECTIVES

The course aims to

- make students learn about the concept and regulation of human rights
- make students aware about the constitutional human rights

UNIT I INTRODUCTION TO HUMAN RIGHTS **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II REGULATIONS IN HUMAN RIGHTS **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III MONITORING AGENCIES **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV HUMAN RIGHTS-INDIAN PERSPECTIVE **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V IMPLEMENTATION OF HUMAN RIGHTS IN VARIOUS SCENARIO 9

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

COURSE OUTCOMES

At the end of the course the students will be able to

CO1 acquire the basic knowledge of human rights.

CO2 acquire knowledge about the regulatory bodies involved in human rights

REFERENCES

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

ME5008 DESIGN OF HEAT EXCHANGERS LTPC 3003

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Classifying heat exchangers and its types.
2. Analysing flow and stress related failure issues in heat exchangers.
3. Calculating the pressure drop and simulating performance of heat exchangers.
4. Designing compact heat exchangers for various applications
5. Designing condenser and cooling towers for different applications.

UNIT I FUNDAMENTALS OF HEAT EXCHANGER 9

Temperature distribution and its implications types – shell and tube heat exchangers – regenerators and recuperators – analysis of heat exchangers – LMTD and effectiveness method.

UNIT II FLOW AND STRESS ANALYSIS 9

Effect of turbulence – friction factor – pressure loss – stress in tubes – header sheets and pressure vessels – thermal stresses, shear stresses - types of failures.

UNIT III DESIGN ASPECTS 9

Heat transfer and pressure loss – flow configuration – effect of baffles – effect of deviations from ideality – design of double pipe - finned tube - shell and tube heat exchangers - simulation of heat exchangers.

UNIT IV COMPACT AND PLATE HEAT EXCHANGERS 9

Types – merits and demerits – design of compact heat exchangers, plate heat exchangers – performance influencing parameters – limitations

UNIT V CONDENSERS AND COOLING TOWERS 9

Design of surface and evaporative condensers – cooling tower – performance characteristics

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Classify heat exchangers and its types.
2. Predict flow and stress related failure issues in heat exchangers.
3. Calculate the pressure drop and simulate performance of heat exchangers.
4. Design a compact heat exchanger.
5. Design a condenser and cooling tower for a specific application.

TEXT BOOKS:

1. Arthur. P Frass, Heat Exchanger Design, John Wiley & Sons, 1988.

2. SadikKakac and Hongtan Liu, Heat Exchangers Selection, Rating and Thermal Design, CRC Press, 2002.

REFERENCES:

1. Hewitt.G.F, Shires.G.L and Bott.T.R, Process Heat Transfer, CRC Press, 1994.
2. Taborek.T, Hewitt.G.F and Afgan.N, Heat Exchangers, Theory and Practice, McGraw Hill, 1980.
3. TD Eastop and DR Croft, Energy Efficiency for Engineers and Technologies, John Wiley & Sons, 1990.
4. T.W.Fraser Russell, Anne Skaja Robinson and Norman J.Wagner, Mass and Heat Transfer – Analysis of Mass Contractors and Heat Exchangers, Cambridge University Press, 2012.
5. DG Kern, Process Heat Transfer, McGraw-Hill , 1950.

CO	PO												PSO		
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ME5072 COMPUTATIONAL TECHNIQUES FOR FLUID DYNAMICS LTPC 3003

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Applying the fundamentals of CFD, and developing case specific governing equations.
2. Performing finite difference and finite volume based analysis for steady and transient diffusion problems.
3. Implementing various mathematical schemes under finite volume method for convention diffusion.
4. Solving complex problems in the field of fluid flow and heat transfer with the support of high speed computers.
5. Applying the various discretization methods, solution procedure and the concept of turbulence modeling.

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 9

Basics of computational fluid dynamics – Governing equations– 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– General Methods for first and second order accuracy – Finite volume formulation for steady and transient diffusion problems –Example problems– Use of Finite Difference and Finite Volume methods

UNIT III FINITE VOLUME METHOD FOR CONVECTION DIFFUSION 9

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes, properties of discretization schemes, Hybrid, Power-law, QUICK Schemes, Conservativeness, Boundedness, Transportiveness.

UNIT IV FLOW FIELD ANALYSIS 9

Stream function and vorticity, Representation of the pressure gradient term, 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-Є) models – High and low Reynolds number models, Mesh Generation and refinement Techniques-software tools.

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Apply the fundamentals of CFD, and develop case specific governing equations.
2. Perform finite difference and finite volume based analysis for steady and transient diffusion problems.
3. Implement various mathematical schemes under finite volume method for convention diffusion.
4. Solve complex problems in the field of fluid flow and heat transfer with the support of high speed computers.
5. Apply the various discretization methods, solution procedure and the concept of turbulence modeling.

TEXT BOOKS:

1. Versteeg, H.K., and Malalasekera, W.,"An Introduction to Computational Fluid Dynamics": The finite volume Method, Pearson Education, 2014
2. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill, 1998.

REFERENCES:

1. John. F. Wendt, "Computational Fluid Dynamics – An Introduction", Springer, 2013.
2. K.Muralidhar&T.Sundararajan, Computational Fluid Flow and Heat Transfer, Narora Publishing House, 1994.
3. Suhas V, Patankar, "Numerical Heat transfer and Fluid flow", Taylor & Francis, 2009.
4. Uriel Frisch, Turbulence, Cambridge University Press, 1999.
5. YogeshJaluria& Kenneth E. Torrance, "Computational Heat Transfer", CRC press, 2002.

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ME5085 QUALITY AND RELIABILITY ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is

1. To provide an overview about quality concepts and SPC tools for continuous improvement.
2. To impart knowledge on the control charts and process capability studies.
3. To give an insight on acceptance sampling plan and its parameters.
4. To inculcate the fundamentals of the reliability concepts
5. To render exposure on improving the reliability and its optimization.

UNIT I INTRODUCTION AND STATISTICAL PROCESS CONTROL 9

Introduction:-definitions of quality, Evolution of Quality: Inspection, Quality Control, Quality assurance Customer-Orientation: Internal & External Customer Concept, Life cycle approach to quality costs- Prevention; Appraisal and Failure costs. Seven SPC tools -Histogram, Check sheets, Ishikawa diagrams, Pareto, Scatter diagrams, Control charts and flow chart.

UNIT II ONLINE QUALITY CONTROL 9

Control chart for attributes –control chart for non conforming– p chart and np chart – control chart for nonconformities– C and U charts, Control chart for variables – X chart, R chart andσchart -State of control and process out of control identification in charts, pattern study and process capability studies.

UNIT III OFFLINE QUALITY CONTROL 9

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producers Risk and consumers Risk. AQL, LTPD, AOQL concepts standard sampling plans for AQL and LTPD- uses of standard sampling plans.

UNIT IV RELIABILITY CONCEPTS 9

Reliability engineering - fundamentals – failure data analysis, Mean failure rate, Mortality curves concept of burn –in period, useful life and wear out phase of a system, mean time to failure, meantime between failure, hazard rate – failure density and conditional reliability-Maintainability and availability – simple problems

UNIT V RELIABLITY ESTIMATION 9

System reliability: Series, Parallel and Mixed configurations, Reliability improvement techniques, use of Pareto analysis – design for reliability – redundancy unit and standby redundancy- fault tree analysis – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Apply the 7 QC tools in problem solving for continuous improvement.
2. Design online sampling plan for quality control using control charts and perform process capability studies.
3. Use the strategies of acceptance sampling plan to perform quality audit in the customer site.
4. Evaluate the different reliability measurements while applying the reliability concepts
5. Select the suitable method of improving the reliability and integrate reliability concepts in new product design and development.

TEXT BOOKS:

1. Douglas.C. Montgomery, “Introduction to Statistical quality control”, 7th edition, John Wiley2012.
2. Srinath. L.S., “Reliability Engineering”, 4th edition Affiliated East west press, 2011

REFERENCES:

1. Besterfield D.H., “Quality Control”, 8th edition, Prentice Hall, 2009..
2. Connor, P.D.T.O., “Practical Reliability Engineering”, 5 theditionWiley India, 2012
3. Grant, Eugene .L “Statistical Quality Control”, TMH, 2005
4. John.S. Oakland. “Statistical process control”, Elsevier Butterworth-Heinemann, 2008.
5. Monohar Mahajan, “Statistical Quality Control”, DhanpatRai& Sons 2016.

CO	PO												PSO		
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IE5652 PRODUCTION AND OPERATIONS MANAGEMENT

L T P C
3 0 0 3

COURSE OBJECTIVES:

- Recognize and appreciate the concept of Production and Operations Management in creating and enhancing a firm’s competitive advantages.

- Describe the concept and contribution of various constituents of Production and Operations Management (both manufacturing and service) .
- Relate the interdependence of the operations function with the other key functional areas of a firm .
- Teach analytical skills and problem-solving tools to the analysis of the operations problems .
- Apply scheduling and Lean Concepts for improving System Performance.

UNIT I INTRODUCTION 9

Objectives of Operations Management, Scope of Operations Management, Relationship of Operations with other Functional areas, Manufacturing Vs Service sector, Operations Decision making, Phases in Product Design and Development, Product Life Cycle, Process Selection.

UNIT II FORECASTING 9

Need, Determinants of Demand, Demand Patterns, Qualitative Forecasting Methods-Delphi techniques. Market Research, Nominal Group Technique. Quantitative Forecasting methods – Moving Average Methods, Exponential Smoothing Methods, Regression methods, Monitoring and Control of Forecasts, Requirements and Selection of Good forecasting methods.

UNIT III AGGREGATE PLANNING AND MATERIAL REQUIREMENT PLANNING 9

Role of aggregate Product planning, Managerial inputs to Aggregate planning, Pure and Mixed strategies, Mathematical Models for Aggregate planning – Transportation Method, Linear programming Formulation, Linear Decision Rues, Master Production Schedule(MPS), Procedure for developing MPS, MRP -Lot sizing methods – Implementation issues, MRP – II, Introduction to ERP.

UNIT IV CAPACITY MANAGEMENT 9

Measures of capacity, Factors affecting capacity, Capacity Planning, Systematic approach to capacity planning, Long-term and short-term capacity decisions, Tools for capacity planning, Capacity Requirement Planning- Business Process Outsourcing

UNIT V PRODUCTION ACTIVITY CONTROL AND LEAN MANUFACTURING 9

Objectives and Activities of Production Activity Control -JIT- Kanban- Introduction to Scheduling in different types of Production Systems. Lean Manufacturing - Principles – Activities - Tools and techniques - Case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: The students will appreciate the role of Production and Operations management in enabling and enhancing a firm's competitive advantages in the dynamic business environment.

CO2: The students will obtain sufficient knowledge and skills to forecast demand for Production and Service Systems.

CO3: The students will able to Formulate and Assess Aggregate Planning strategies and Material Requirement Plan.

CO4: The students will be able to develop analytical skills to calculate capacity requirements and developing capacity alternatives.

CO5: The students will be able to apply scheduling and Lean Concepts for improving System Performance.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											✓
CO2		✓	✓									
CO3		✓	✓	✓								
CO4		✓	✓	✓								
CO5			✓	✓								

TEXT BOOK:

1. Panneerselvam. R, Production and operations Management, PHI, 3rd Edition, 2012.

REFERENCES:

1. Lee J. Krajewski, Manoj K. Malhotra, Larry P. Ritzman,Operations Management: Processes and Supply Chains Pearson Education,11th Edition,2015
2. Norman Gaither, Greg Frazier, Operations Management, Thomson Learning, 9th Edition, 2002.
3. William J Stevenson,OperationsManagement,McGraw Hill,13th Edition,2018.

ME5074 DESIGN OF JIGS, FIXTURES AND PRESS TOOLS LTPC
3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Applying the principles of locating and clamping in Jigs and fixtures and various components related to Press tools.
2. Designing various types of Jigs for given components and draw multiple views of the same with dimensions and parts List.
3. Designing various types of Fixtures for given components and draw multiple views of the same with dimensions and parts List.
4. Designing various parts of cutting dies and draw the standard dimensioned views.
5. Designing various parts of forming dies and draw the standard dimensioned views.

UNITI PRINCIPLES OF JIGS, FIXTURES AND PRESS WORKING 9

Objectives and importance of tool design—work holding devices- Basic elements of jigs and fixtures- location – clamping-indexing-operational chart-Fits and Tolerances Tools for press working- Press Working Terminologies –cutting and non cutting operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances – Press Work Materials – Center of pressure– knockouts – direct and indirect – pressure pads – Ejectors- Die Block – Punch holder, Die set, 103 guide plates – Stops – Strippers – Pilots – Selection of Standard parts –Recent trends in toolingrecent 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.

UNITII JIGS 9

Design and development of jigs for given component - Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs

UNITIII FIXTURES 9

Design and development of fixtures for given component- General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures

UNIT IV DESIGN OF CUTTING DIES 9

Complete design and preparation of standard views of simple blanking, piercing, compound and progressive dies -fine Blanking dies

UNITV DESIGN OF BENDING, FORMING, DRAWING AND MISCELLANEOUS DIES 9

Difference between bending forming and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back– 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

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Apply the principles of locating and clamping in Jigs and fixtures and various components related to Press tools.

2. Design various types of Jigs for given components and draw multiple views of the same with dimensions and parts List.
3. Design various types of Fixtures for given components and draw multiple views of the same with dimensions and parts List.
4. Design various parts of cutting dies and draw the standard dimensioned views.
5. Design various parts of forming dies and draw the standard dimensioned views.

TEXT BOOKS:

1. Joshi, P.H. “Jigs and Fixtures”, Second Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2010.
2. Joshi P.H “Press tools - Design and Construction”, S. Chand & Co Ltd. 2001.

REFERENCES:

1. “ASTME – Fundamentals of tool design”, Prentice Hall of India, 1984.
2. Donaldson, Lecain and Goold, “Tool Design”, Tata McGraw Hill, 2000.
3. Hoffman “Jigs and Fixture Design” – Thomson Delmar Learning, Singapore, 2004.
4. Kempster, “Jigs and Fixture Design”, Hoddes and Stoughton, 1974.
5. K. Venkataraman, “Design of Jigs Fixtures & Press Tools”, Anne Publications, 2015.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	3		1							1	3	3	3
2	3	2	3		1							1	3	3	3
3	3	3	3		1							1	3	2	3
4	3	3	3		1							1	3	2	1
5	3	2	3		1							1	2	3	2

ME5009 MECHANICAL VIBRATIONS AND NOISE CONTROL LTPC 3003

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Apply the fundamental concepts of vibration.
2. Apply the fundamentals of noise.
3. Describe the various sources of noise for automotive applications.
4. Determine the natural frequencies and mode shapes of the two degree freedom systems.
5. Apply the various control techniques to reduce the vibration and noise to improve the life of the components .

UNIT I BASICS OF VIBRATION 9

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree systems, torsional vibration - determination of natural frequencies and critical speed of shafts.

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.

UNITIII 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 necessary contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.

UNITIV TWO DEGREE FREEDOM SYSTEM 9

Introduction-Free Vibration Of Undamped And Damped - Forced Vibration With Harmonic Excitation System –Coordinate Couplings And Principal Coordinates – Vibration absorbers

UNITV CONTROL OF VIBRATION AND NOISE 9

Major sources of noise – Noise survey techniques – Measurement technique for vehicular noise – Road vehicle noise standards – Industrial noise sources – Control Strategies – Noise control at the source and along the path – use of acoustic barriers – Noise control at the receiver – vibration isolation methods

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Apply the fundamental concepts of vibration.
2. Apply the fundamentals of noise.
3. Describe the various sources of noise for automotive applications.
4. Determine the natural frequencies and mode shapes of the two degree freedom systems.
5. Apply the various control techniques to reduce the vibration and noise to improve the life of the components

TEXT BOOKS:

1. Ambekar. A. G., Mechanical Vibrations and Noise Engineering", Prentice Hall of India Pvt. Ltd., 2006
2. Singiresu S. Rao, "Mechanical Vibrations", Pearson Education Incorporated, 2017

REFERENCES:

1. Benson H. Tongue, "Principles of Vibrations", Oxford University, 2007.
2. David A. Bies and Colin H. Hansen, "Engineering Noise Control – Theory and Practice", Spon Press, 2009.
3. Grover. G.K., edited by Nigam. S. P., "Mechanical Vibrations", Nem Chand and Bros., 2014.
4. Julian Happian-Smith - "An Introduction to Modern Vehicle Design", Butterworth-Heinemann, 2001.
5. William T. Thomson, "Theory of Vibration with Applications", Taylor & Francis, 2003.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	2			1	1				1	2	2	1
2	3	2	2	2			1	1				1	2	2	1
3	3	2	2	2			1	1				1	2	2	1
4	3	2	2	2			1	1				1	2	2	1
5	3	2	2	2			1	1				1	2	2	1

GE5071 DISASTER MANAGEMENT L T P C

3 0 0 3

COURSE OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste,

class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXTBOOKS:

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

GE5075 **ENGINEERING ETHICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Applying the core values toward the ethical behavior of an engineer.
2. Applying the ethical and moral principles in engineering experimentation.
3. Applying the ethical and moral principles in engineering for safety.
4. Applying standard codes of moral conduct toward the ethical behavior of an engineer.
5. Applying ethical and moral principles for engineers as managers, consultants, expert witness. Resolving global issues of ethics concerning weapon development and multinational companies.

UNIT I ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas– Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy –Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics- Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

UNIT III ENGINEERING FOR SAFETY 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk –The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal.

UNIT IV ENGINEER'S RESPONSIBILITIES AND RIGHTS 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality –Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights –Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES 9

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics –Role in Technological Development – Weapons Development – Engineers as Managers –Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

TOTAL (L: 45) = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Apply the core values toward the ethical behavior of an engineer.
2. Apply the ethical and moral principles in engineering experimentation.
3. Apply the ethical and moral principles in engineering for safety.
4. Apply standard codes of moral conduct toward the ethical behavior of an engineer.
5. Apply ethical and moral principles for engineers as managers, consultants, expert witness. Resolve global issues of ethics concerning weapon development and multinational companies.

TEXT BOOKS:

1. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics Concepts and Cases", Thompson Learning, 2000.
2. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, 2005.

REFERENCES:

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999.
2. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, 2003.

3. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, 2001.
4. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, 2003.
5. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, “Business Ethics – An Indian Perspective”, Biztantra, New Delhi, 2004.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1						0.	0.3	0.9				0.6	0.3		
2						0.6	0.6	0.9				0.6	0.3	0.6	
3						0.9	0.6	0.9				0.6	0.3	0.6	
4						0.9	0.6	0.9				0.6	0.3	0.6	
5						0.6	0.6	0.9				0.6	0.3		

ME5010 ENERGY CONSERVATION IN INDUSTRIES LTPC

3003

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Quantifying the energy demand and energy supply scenario of nation and explaining the need for energy auditing for becoming environmentally benign
2. Analyzing factors behind energy billing and applying the concept of demand side management for lowering energy costs
3. Computing the stoichiometric air requirement for any given fuel and quantifying the energy losses associated with thermal utilities of industries
4. Diagnosing the causes for under performance of various electrical utilities and suggesting remedies for improving their efficiency
5. Applying CUSUM and other financial evaluation techniques to estimating the accruable energy savings/monetary benefits for any energy efficiency project

UNIT I INTRODUCTION 9

Energy scenario of World, India and TN - Environmental aspects of Energy Generation – Material and Energy balancing - Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Basic instruments for Energy Auditing.

UNIT II ELECTRICAL SUPPLY SYSTEMS 9

Electricity Tariff structures – Typical Billing - Demand Side Management - HT and LT supply - Power Factor – Energy conservation in Transformers – Harmonics

UNIT III ENERGY CONSERVATION IN MAJOR THERMAL UTILITIES 9

Stoichiometry - Combustion principles.

Energy conservation in:Boilers - Steam Distribution Systems - Furnaces - Thermic Fluid Heaters – Cooling Towers – D.G. sets. Insulation and Refractories - Waste Heat Recovery Devices.

UNIT IV ENERGY CONSERVATION IN MAJOR ELECTRICAL UTILITIES 9

Energy conservation in : Motors - Pumps – Fans – Blowers - Compressed Air Systems - Refrigeration and Air Conditioning Systems - Illumination systems

UNIT V ENERGY MONITORING, TARGETING, LABELLING AND ECONOMICS 9

Elements of Monitoring & Targeting System – CUSUM - Energy / Cost index diagram – Energy Labelling - Energy Economics – Cost of production and Life Cycle Costing - Economic evaluation techniques – Discounting and Non Discounting - ESCO concept – PAT scheme

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Quantify the energy demand and energy supply scenario of nation and appreciate the need for energy auditing for becoming environmentally benign

2. Analyze factors behind energy billing and apply the concept of demand side management for lowering energy costs
3. Compute the stoichiometric air requirement for any given fuel and quantify the energy losses associated with thermal utilities of industries
4. Diagnose the causes for under performance of various electrical utilities and suggest remedies for improving their efficiency
5. Apply CUSUM and other financial evaluation techniques to estimate the accruable energy savings/monetary benefits for any energy efficiency project

TEXT BOOKS:

1. Guide book for National Certification Examination for "Energy Managers and Energy Auditors" (4 Volumes). Available at http://www.em-ea.org/gbook1.asp. This website is administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India.
2. K. NagabhushanRaju, Industrial Energy Conservation Techniques: (concepts, Applications and Case Studies), Atlantic Publishers &Dist, 2007.

REFERENCES:

1. Abbi Y P, Shashank Jain., Handbook on Energy Audit and Environment Management, TERI Press, 2006.
2. Albert Thumann and Paul Mehta D, "Handbook of Energy Engineering", 7thEdition, The Fairmont Press, 2013.
3. Murphy.W.R. and McKay.G, "Energy Management", Butterworth, London 1982.
4. Paul W.O'Callaghan, Design and management for energy conservation: A handbook for energy managers, plant engineers, and designers, Pergamon Press, 1981.
5. Steve Doty, Wayne Turner C, Energy Management Handbook 7th Edition, The Fairmont Press, 2009.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	1	1	1			1						1		1
2	2	2	3	3			1						2	2	2
3	2	2	3	3			1						2	2	2
4	2	2	3	3			1						2	2	2
5	2	2	3	3			1				2	2	2	2	2

ME5011 ENERGY EFFICIENT BUILDINGS DESIGN LTPC

3003

COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:

1. Comparing the conventional vis-à-vis energy efficient buildings and developing proficiency in energy conservation building codes.
2. Designing an energy efficient landscape system.
3. Examining different solutions for HVAC in buildings
4. Analyzing the heat transmission in buildings.
5. Adopting integration of renewable energy in buildings.

UNIT I INTRODUCTION 9

Conventional versus energy efficient BUILDINGS – Historical perspective – Water – Energy – IAQ requirement analysis – Future building design aspects – critically of resources and needs of modern living – Building assessment and green building processes - Energy conservation building codes.

UNIT II LANDSCAPE AND BUILDING ENVELOPES 9

Energy efficient landscape design – Micro climates – various methods – Shading, water bodies – Building envelope: Building materials, Envelope heat loss and heat gain and its evaluation, paints, insulation, Design methods and tools.

UNIT III HEATING, VENTILATION AND AIR CONDITIONING 9

Natural Ventilation, Passive cooling and heating: Thermal mass effects – Application of wind, water and earth for cooling, evaporative cooling, radiant cooling – Hybrid methods – energy conservation measures, thermal storage integration in buildings

UNIT IV HEAT RANSMISSION IN BUILDINGS 9

Surface co-efficient: air cavity, internal and external surfaces, overall thermal transmittance, wall and windows; heat transfer due to ventilation / infiltration, internal heat transfer; solar temperature; decrement factor; phase lag. Design of day lighting; estimation of building loads: steady state method, network method, numerical method, correlations; computer packages for carrying out thermal design of buildings and predicting performance. Thermal load estimation: Heat balance method. Degree day method for seasonal energy consumption.

UNIT V BUILDING COOLING AND RENEWABLE ENERGY IN BUILDINGS 9

Passive cooling concepts, Application of wind, water and earth cooling; shading, paints and cavity walls for cooling; roof radiation traps, Earth air tunnel. Solar sorption cooling and Solarvapour compression cooling for buildings – Solar water heating systems in buildings – Small wind turbines, standalone PV, Hybrid systems for residential buildings with economics.

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Compare conventional vis-à-vis energy efficient buildings and versatile with energy conservation building codes.
2. Design an energy efficient landscape system.
3. Examine different solutions for HVAC in buildings
4. Analyze the heat transmission in buildings.
5. Adopt integration of renewable energy in buildings.

TEXT BOOKS:

1. Krieder. J., and Rabi. A., Heating and cooling of buildings: design for efficiency, McGraw Hill, 1994.
2. Charles. J. Kibert, Sustainable Construction: Green Building Design and Deliver, John Wiley & Sons, 2016.

REFERENCES:

1. Duffie, A and Beckmann, W. A., Solar Engineering of Thermal Processes, John Wiley, 1991.
2. R. Velraj, 'Sensible heat Storage for solar heating and cooling systems' in the book titled "Advances in Solar Heating and Cooling" – Pages 399 - 428 Elsevier Publication, 2016.
3. Sukhatme, S.P., Solar Energy, Tata McGraw Hill, 1984.
4. UrsalaEicker, "Solar Technologies for buildings", Wiley Publications, 2003.3 Guide book for national certification examination for energy managers and energy auditors (downloaded from www.energymanagertraining.com).
5. Michael Bauer, Peter Mosle and Michael Schwarz, Green Building - Guidebook for Sustainable Architecture, 2009.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	1	1				2							1	
2	2	2	2	1			2						1	2	2
3	2	2	2	2			2						2	2	2
4	2	2	2	2			2						2	2	2
5	2	2	2	2			2						1	2	2

IE5073 **LEAN SIX SIGMA** **L T P C**
3 0 0 3

OBJECTIVES:

- Explain the basics of Lean and Six Sigma.
- Teach the need and the process of integrating Lean and Six sigma.
- Summarize to identify and select the resources required for LSS Projects and selection of projects including Team building.
- Teach the DMAIC process and study the various tools for undertaking LSS projects.
- Illustrate to institutionalize the LSS efforts.

UNIT I INTRODUCTION TO LEAN AND SIX SIGMA 9

Introduction to Lean- Definition, Purpose, Features of Lean ; Top seven wastes, Need for Lean management, The philosophy of lean management, Creating a lean enterprise, Elements of Lean, Lean principles, the lean metric, Hidden time traps. Introduction to quality, Definition of six sigma, origin of six sigma, Six sigma concept and Critical success factors for six sigma.

UNIT II INTEGRATION OF LEAN AND SIX SIGMA 9

Evolution of lean six sigma, the synergy of Lean and six sigma, Definition of lean six sigma, the principles of lean six sigma, Scope for lean six sigma, Features of lean six sigma. The laws of lean six sigma, Key elements of LSS, the LSS model and the benefits of lean six sigma. Initiation - Top management commitment – Infrastructure and deployment planning, Process focus, organizational structures, Measures – Rewards and recognition, Infrastructure tools, structure of transforming event and Launch preparation.

UNIT III PROJECT SELECTION AND TEAM BUILDING 9

Resource and project selection, Selection of Black belts, Training of Black belts and Champions, Identification of potential projects, top down (Balanced score card) and Bottom up approach – Methods of selecting projects – Benefit/Effort graph, Process mapping, value stream mapping, Predicting and improving team performance, Nine team roles and Team leadership.

UNIT IV THE DMAIC PROCESS AND TOOLS 9

The DMAIC process – Toll gate reviews; The DMAIC tools; Define tools – Project definition form, SIPOC diagram; Measure tools – Process mapping, Lead time/cycle time, Cause and Effect matrix, Idea – generating and organizing tools – Brainstorming, Nominal group technique and Multi-voting; Data collection and accuracy tools- Check sheet, Gauge R&R; Understanding and eliminating variation- run charts; Analyze tools - Scatter plots, ANOVA, Regression analysis, Time trap analysis; Improve tools – Mistake proofing, Set up time reduction (SMED) and the pull system; Control tools – statistical process control.

UNIT V INSTITUTIONALIZING AND DESIGN FOR LSS 9

Institutionalizing lean six sigma – improving design velocity, creating cycle time base line, valuing projects, gating the projects, reducing product line complexity, Design for lean six sigma, QFD, Theory of Inventive Problem solving (TRIZ), Robust design; Case study presentations.

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1: The students will be able to understand what is Lean and Six sigma and their importance in the globalized competitive world.

CO2: The students will be able to understand the importance of integrating Lean and Six sigma and also the process of their integration.

CO3: The students will be able to plan the Resources required to undertake the LSS projects and also acquire how to select the suitable projects and the teams.

CO4: The students will be able apply DMAIC methodology to execute LSS projects and in this regard they will be acquainted with various LSS tools.

CO5: The students will be able to understand the process of institutionalizing the LSS effort and also understand the Design for LSS.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓										✓
CO2						✓				✓		✓
CO3					✓				✓			
CO4	✓				✓		✓				✓	✓
CO5			✓			✓	✓	✓				

TEXT BOOK:

1. Michael L. George, Lean Six Sigma, McGraw-Hill., 2002.

REFERENCES:

1. James P. Womack, Daniel T. Jones, Lean Thinking, Free press business., 2003.
2. Ronald G.Askin and Jeffrey B.Goldberg, Design and Analysis of Lean Production Systems, John Wiley &Sons., 2003.
3. Salman Taghizadegan, Essentials of Lean Six Sigma, Elsevier., 2010.

ME5012 INDUSTRIAL ROBOTICS TECHNOLOGY L T P C

3 0 0 3

COURSE OBJECTIVES: The main learning objective of this course is:

1. To explain the concepts of industrial robots with respect to its classification, specifications and coordinate systems. Reviewing the need and application of robots in different engineering fields.
2. To exemplifying the different types of robot drive systems as well as robot end effectors.
3. To apply the different sensors and image processing techniques in robotics to improve the ability of robots.
4. To Develop robotic programs for different tasks and analyzing the kinematics motions of robot.
5. To Implementing robots in various industrial sectors and interpolating the economic analysis of robots.

UNIT I FUNDAMENTALS OF ROBOT 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.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 9

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION 9

Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications, Inspection, Identification, Visual Serving and Navigation.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 9

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Expert system, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS 9

RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Explain the concepts of industrial robots with respect to its classification, specifications and coordinate systems. Review the need and application of robots in different engineering fields.
2. Exemplify the different types of robot drive systems as well as robot end effectors.
3. Apply the different sensors and image processing techniques in robotics to improve the ability of robots.
4. Develop robotic programs for different tasks and analyze the kinematics motions of robot.
5. Implement robots in various industrial sectors and interpolate the economic analysis of robots.

TEXT BOOKS:

1. Fu. K.S, Gonzalez. R.C, Lee. C.S.G “Robotics – Control, Sensing, Vision, and Intelligence”, McGraw Hill, 2015
2. GrooverMikell .P, “Industrial Robotics -Technology Programming and Applications”, McGraw Hill, 2014.

REFERENCES:

1. Craig J.J., “Introduction to Robotics Mechanics and Control”, Pearson Education, 2009.
2. Deb S.R., “Robotics Technology and Flexible Automation” Tata McGraw Hill Book Co., 2013.
3. Koren Y., “Robotics for Engineers", McGraw Hill Book Co., 1992
4. Maja J Mataric, “The Robotics Primer “Universities Press. 2013.
5. Robin R. Murphy “ Introduction to AI Robotics” PHI Learning Private Limited, 2000.

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ME5013 APPLIED FINITE ELEMENT ANALYSIS LTPC

3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Applying concepts of Finite Element Analysis to solve production processes
2. Applying concepts of Finite Element Analysis to solve fluid mechanics and heat transfer problems
3. Applying concept of Finite Element Analysis to solve problems involving geometric and material non linearity
4. Creating solution techniques to solve dynamic problems
5. Investigating error norms, convergence rates and refinement.

UNITI ANALYSIS OF PRODUCTION PROCESSES 9

Governing Equations of production processes- Application to bulk forming, sheet metal forming, casting, metal cutting, welding.

UNITII FLUID MECHANICS AND HEAT TRANSFER 9

Governing Equations of Fluid Mechanics – Solid structure interaction - Inviscid and Incompressible Flow – Potential Formulations – Slow Non-Newtonian Flow – Metal and Polymer Forming – Navier Stokes Equation – Steady and Transient Solution.

UNITIII NON-LINEAR ANALYSIS 9

Introduction to Non-linear problems- some solution techniques-computational procedure-simple material nonlinearity-Plasticity and viscoplasticity, stress stiffening, contact interfaces- problems of gaps and contact - geometric non-linearity- modeling considerations - Impact analysis

UNITIV DYNAMIC PROBLEMS 9

Direct Formulation – Free, Transient and Forced Response – Solution Procedures – Eigen solution-Subspace Iterative Technique – Response analysis-Houbolt, Wilson, Newmark – Methods – Explicit & Implicit Methods- Lanchzos, Reduced method for large size system equations.

UNIT V ERROR ESTIMATES AND ADAPTIVE REFINEMENT 9

Error norms and Convergence rates – h-refinement with adaptivity – Adaptive refinement.

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Apply concepts of Finite Element Analysis to solve production processes
2. Apply concepts of Finite Element Analysis to solve fluid mechanics and heat transfer problems
3. Apply concept of Finite Element Analysis to solve problems involving geometric and material non linearity
4. Create solution techniques to solve dynamic problems
5. Investigate error norms, convergence rates and refinement.

TEXT BOOKS:

1. Rao, S.S., “The Finite Element Method in Engineering”, 6th Edition, Butterworth-Heinemann,2018.
2. Reddy,J.N. “Introduction to the Finite Element Method”, 4th Edition, Tata McGrawHill,2018

REFERENCES:

1. David Hutton, “Fundamentals of Finite Element Analysis”, Tata McGrawHill, 2005
2. Dhanaraj. R and Prabhakaran Nair. K, “Finite Element Analysis”, Oxford Publications, 2015.
3. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, “Concepts and Applications of Finite Element Analysis”, 4th Edition, Wiley Student Edition, 2004.
4. Seshu.P, “Text Book of Finite Element Analysis”, PHI Learning Pvt. Ltd., NewDelhi, 2012.
5. TirupathiR.Chandrupatla and Ashok D.Belegundu, “Introduction to Finite Elements in Engineering”, International Edition, Pearson Education Limited, 2014.

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ME5014 METAL FORMING TECHNOLOGY LTPC
3003

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Explaining the stress-strain concepts of materials during plastic deformation.
2. Applying the theory of plasticity and its application for analyzing various metal formingProcesses.
3. Applying the principle of forging and rolling for load calculation and its applications.
4. Applying the principle of extrusion and drawing for load calculations and its applications.
5. Explaining the various sheet metal forming methods and its applications.

UNITI STRESS - STRAIN TENSOR 9

State of stress, components of stress, symmetry of stress tensor, principle stresses, stress deviator, Von Mises, Tresca Yield criteria, comparison of yield criteria, Octahedral shear stress and shear strain, Slip, twinning, Forming load calculations, Strain Rate Tensor

UNITII FUNDAMENTALS OF METAL FORMING 9

Classification of forming process- Mechanics of metal working, Flow stress determination, Effect of temperature, strain rate and metallurgical structure on metal working, Friction and lubrication. Deformation zone geometry, Workability, Residual stresses.

UNITIII FORGING AND ROLLING 9

Forging-Hot, Cold and Warm Forging – types of presses and hammers. Classification, Open die forging and Closed die forging, die design, forging in plane strain, calculation of forging loads, use of software for analysis - forging defects – causes and remedies, residual stresses in forging. Rolling: Classification of rolling processes, types of rolling mills, hot and cold rolling, rolling of bars and shapes, forces and geometrical relationship in rolling, analysis of rolling load, torque and power, rolling mill control, rolling defects- causes and remedies.

UNITIV EXTRUSION AND DRAWING 9

Direct and indirect extrusion, variables affecting extrusion, deformation pattern, equipment's, port – hole extrusion die, hydrostatic extrusion, defects and remedies, simple analysis of extrusion ,tube extrusion and production of seamless pipe and tube. Drawing of road, wires and tubes.

UNITV SHEET METAL FORMING AND OTHER PROCESSES 9

Forming methods – Shearing, Fine and Adiabatic blanking, bending, stretch forming, deep drawing, defects in formed part, sheet metal formability, forming limit diagram. High velocity forming, Comparison with conventional forming, Explosive forming, Electro hydraulic, Electro Magnetic forming, Dynapark and petroforge forming

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Explain the stress-strain concepts of materials during plastic deformation.
2. Apply the theory of plasticity and its application for analyzing various metal forming Processes.
3. Apply the principle of forging and rolling for load calculation and its applications.
4. Apply the principle of extrusion and drawing for load calculations and its applications.
5. Explain the various sheet metal forming methods and its applications.

TEXT BOOKS:

1. Dieter.G.E., "Mechanical Metallurgy", McGraw – Hill Co., SI Edition, 2007.
2. Surender Kumar, "Technology of Metal Forming Processes", PHI, New Delhi, 2008.

REFERENCES:

1. Avitzur, "Metal Forming – Process and Analysis", Tata McGraw – Hill Co., New Delhi, 1977.
2. Kurt Lange, "Handbook of Metal Forming", Society of Manufacturing Engineers, Michigan, USA, 1998
3. Nagpal G. R., "Metal Forming Processes", Khanna Pub., New Delhi, 2000

4. ShiroKobayshi, Altan. T, Metal Forming and Finite Element Method, Oxford University Press, 1987.
5. Sadhu Singh, “Theory of plasticity and Metal Forming Processes”, Khanna Publishers, 2005.

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ME5076 MARKETING MANAGEMENT LTPC
3003

COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:
1. Understanding the basic concepts in marketing.
2. Appreciating the various buying behaviour methods.
3. Studying the various product pricing concepts.
4. Scrutinizing the various marketing planning principles and its strategies.
5. Relating the trends of advertising, sales promotion methods.

UNITI CONCEPTS IN MARKETING 9
Definition, Marketing Process, Dynamics, Needs, Wants and Demands, Marketing Concepts, Environment, Mix, Types, Philosophies, Selling vs Marketing, Consumer Goods, Industrial Goods.

UNITII BUYING BEHAVIOUR AND MARKET SEGMENTATION 9
Cultural, Demographic factors, Motives, Types, Buying Decisions, Segmentation factors, Demographic, Psycho graphic and Geographic Segmentation, Process, Patterns. Services marketing and Industrial marketing.

UNITIII PRODUCT, PRICE AND MARKETING RESEARCH 9
Product, Classifications of product, Product Hierarchy, Product Life Cycle, New product development, Branding. Price: Objectives, Pricing Decisions and Pricing Methods, Pricing Management, Introduction, Uses, Process of Marketing Research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9
Components of a Marketing Plan, Strategy Formulation and the Marketing Process, Implementation, Portfolio Analysis, BCG, GEC, DPM, Ansoff Grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9
Advertising-Characteristics, Impact, Goals, Types, Sales Promotion – Point of purchase, Unique Selling Propositions, Characteristics, Wholesaling, Retailing, Channel Design, Logistics, Modern Trends in Retailing, Modern Trends, e-Marketing.

TOTAL = 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Explain the basic concepts in marketing.
2. Explain the various buying behaviour methods.
3. Analyze the various product pricing concepts.
4. Analyze the various marketing planning principles and its strategies.
5. Describe the trends of advertising, sales promotion methods.

TEXT BOOKS:
1. Govindarajan. M, “Marketing management – concepts, cases, challenges and trends”, Prentice hall of India, second edition, 2007.

2. Philip Kolter& Keller, “Marketing Management”, Prentice Hall of India, XII edition, 2006

REFERENCES:

1. Adrain palmer, “Introduction to marketing theory and practice”, Oxford university press IE 2004.
2. Czinkota&Kotabe, “Marketing management”, Thomson learning, Indian edition 2007.
3. Donald S. Tull and Hawkins, “Marketing Research”, Prentice Hall of Inida-1997.
4. Philip Kotler and Gary Armstrong “Principles of Marketing” Prentice Hall of India, XII Edn, 2000.
5. Ramasamy and Namakumari, “Marketing Management: Planning, Implementation and Control, Macmillan and Company”, 2002.

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ME5015 GAS DYNAMICS AND SPACE PROPULSION L T PC
30 0 3

COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:

1. Understanding the compressible flow concepts and the use of gas tables.
2. Analyzing the compressible flow behavior in constant area ducts with friction and heat transfer.
3. Analyzing the formation of shock waves and its effect on flow parameters.
4. Understanding the working of different jet engines and their performance parameters.
5. Classifying types of rocket engines, propellants and their performance parameters.

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS 9

Energy and momentum equations of compressible fluid flows, Concepts of compressible flow – Mach waves and Mach cone. Flow regimes, effect of Mach number on compressibility. Stagnation, static, critical properties and their interrelationship. Isentropic flow and its relations. Isentropic flow through variable area ducts – nozzles and diffusers. Use of Gas tables.

UNIT II COMPRESSIBLE FLOW THROUGH DUCTS 9

Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties. Choking. Isothermal flow with friction. Use of Gas tables.

UNIT III NORMAL AND OBLIQUE SHOCKS 9

Governing equations - Rankine-Hugoniot Relation. Variation of flow parameters across the normal and oblique shocks. Prandtl – Meyer expansion and relation. Use of Gas tables.

UNIT IV JET PROPULSION 9

Theory of jet propulsion – thrust equation – Performance parameters - thrust, power and efficiency. Operation, cycle analysis and performance of ram jet, turbojet, turbofan, turbo prop and pulse jet engines.

UNIT V SPACE PROPULSION 9

Types of rocket engines and propellants. Characteristic velocity – thrust equation. Theory of single and multistage rocket propulsion. Liquid fuel feeding systems. Solid propellant geometries. Orbital and escape velocity. Rocket performance calculations.

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Understandthe compressible flow concepts and the use of gas tables.
2. Evaluate the compressible flow behavior in constant area ducts with friction and heat transfer.
3. Analyze the development of shock waves and its effects.
4. Understand types of jet engines and their performance parameters.
5. Classify types of rocket engines, propellants and their performance parameters.

TEXT BOOKS:

1. Anderson, J.D., "Modern Compressible flow", Third Edition, McGraw Hill, 2003.
2. S.M. Yahya, "Fundamentals of Compressible Flow with Aircraft and Rocket propulsion", New Age International (P) Limited, 4th Edition, 2012.

REFERENCES:

1. R. D. Zucker and O Biblarz, "Fundamentals of Gas Dynamics", 2nd edition, Wiley, 2011.
2. Balachandran, P., "Fundamentals of Compressible Fluid Dynamics", Prentice-Hall of India, 2007.
3. Radhakrishnan, E., "Gas Dynamics", Printice Hall of India, 2006.
4. Hill and Peterson, "Mechanics and Thermodynamics of Propulsion", Addison – Wesley, 1965.
5. Babu, V., "Fundamentals of Compressible Flow", CRC Press, 1st Edition, 2008.

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ME5016 SOLAR ENERGY TECHNOLOGY L T P C

3 0 0 3

COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:

1. Understanding the basics of solar radiation and types of solar collectors.
2. Outlining the working of solar thermal systems and their applications.
3. Inferring the fundamentals of solar PV systems and performance evaluation.
4. Evaluating Solar PV systems design and its economic analysis.
5. Understanding the basics of solar passive architectureand its performance.

UNIT I SOLAR RADIATION AND COLLECTORS 9

Solar angles – Sun path diagrams – Radiation - extraterrestrial characteristics - measurement and estimation on horizontal and tilted surfaces - flat plate collector thermal analysis - testing methods- evacuated tubular collectors - concentrator collectors – classification - design and performance parameters - tracking systems - compound parabolic concentrators - parabolic trough concentrators - concentrators with point focus - Heliostats – performance of the collectors

UNIT II SOLAR THERMAL TECHNOLOGIES 9

Principle of working, types, design and operation of - Solar heating and cooling systems - Thermal Energy storage systems – Solar Desalination – Solar cooker : domestic, community – Solar pond – Solar drying-solar chimney-solar thermal electricity conversion

UNIT III SOLAR PV FUNDAMENTALS 9

Semiconductor – properties - energy levels - basic equations of semiconductor devices physics. Solar cells - p-n junction: homo and hetero junctions - metal-semiconductor interface - dark and illumination characteristics - figure of merits of solar cell - efficiency limits - variation of efficiency

with band-gap and temperature - efficiency measurements - high efficiency cells – Solar thermo-photovoltaics

UNIT IV SPV SYSTEM DESIGN AND APPLICATIONS 9

Solar cell array system analysis and performance prediction- Shadow analysis: reliability - solar cell array design concepts - PV system design - design process and optimization - detailed array design - storage autonomy - voltage regulation - maximum tracking - centralized and decentralized SPV systems - standalone - hybrid and grid connected system - System installation - operation and maintenances - field experience - PV market analysis and economics of SPV systems

UNIT V SOLAR PASSIVE ARCHITECTURE 9

Thermal comfort - bioclimatic classification – passive heating concepts: direct heat gain - indirect heat gain - isolated gain and sunspaces - passive cooling concepts: evaporative cooling - Radiative cooling- application of wind, water and earth for cooling; shading - paints and cavity walls for cooling – roof radiation traps - earth air-tunnel – energy efficient landscape design - thermal comfort

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Infer the basics of solar radiation and types of solar collectors
2. Examine the performance of various solar thermal systems and their applications
3. Compare the various solar PV cell materials and their conversion efficiencies
4. Estimate and analyse various Solar PV systems design and their economic analysis
5. Evaluate different solar passive building techniques and their performance.

TEXT BOOKS:

1. G.D. Rai, “Non-Conventional Energy Sources”, Khanna Publishers, New Delhi, 2014.
2. Twidell, J.W. & Weir, A., “Renewable Energy Resources”, EFN Spon Ltd., UK, 2015.

REFERENCES:

1. Chetan Singh Solanki, Solar Photovoltatics – Fundamentals, Technologies and Applications, PHI Learning Private limited, 2011.
2. John A. Duffie, William A. Beckman, Solar Engineering of Thermal Processes, John Wiley & Sons, 2013.
3. Lovegrove K., Stein W., Concentrating Solar Power Technology, Woodhead Publishing Series in Energy, Elsevier, 1st Edition, 2012.
4. Solar Energy International, Photovoltaic – Design and Installation Manual, New Society Publishers, 2006.
5. Sukhatme S P, Nayak J K, Solar Energy – Principle of Thermal Storage and collection, Tata McGraw Hill, 2008.

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ME5080 PRECISION MANUFACTURING L T P C
3 0 0 3

COURSE OBJECTIVES: The main learning objective of this course are to:

1. Introduce the need and basic terminology of precision engineering.
2. Give an overview of the various commonly used precision machining techniques.
3. Explain the design aspects of machines used in precision manufacturing.
4. Give an understanding of the various errors involved in precision manufacturing.

5. Expose the science behind the commonly used techniques for measurements of precision components.

UNIT I PRECISION ENGINEERING 9

Introduction to Precision Engineering, Need for precision manufacturing, Taniguchi diagram, Four Classes of Achievable Machining Accuracy – Normal, Precision, High-precision, Ultra-precision Processes and Nanotechnology.

UNIT II PRECISION MACHINING 9

Overview of Micro- and Nano-machining, Conventional micro machining techniques - micro-turning, micro-milling, micro-grinding, Ultra-precision diamond turning, Non-conventional micromachining techniques – abrasive jet and water jet micromachining, Ultrasonic micromachining, micro electrical discharge machining, photochemical machining, electro chemical micromachining, laser beam micromachining, Electron beam micromachining, Focused Ion Beam micromachining, etc.

UNIT III MACHINE DESIGN FOR PRECISION MANUFACTURING 9

Philosophy of precision machine design, Ultra-Precision Machine Elements: Guide- ways, Drive Systems, Friction Drive, Linear Motor Drive, Spindle Drive. Bearings: Principle, construction and application of Rolling, Hydrodynamic and Hydrostatic Bearings, Aerostatic Bearings, Magnetic bearings.

UNIT IV MECHANICAL AND THERMAL ERRORS 9

Sources of error, Principles of measurement, Errors due to machine elements, bearings, spindles, Kinematic design, Structural compliance. Vibration, Thermal errors – background, thermal effects, Environmental control of precision machinery. Error mapping and error budgets.

UNIT V MEASUREMENT AND CHARACTERISATION 9

Optical dimensional metrology of precision features – Machine vision, Multi-sensor coordinate metrology, Laser Tracking Systems, Laser scanners, White-Light Interference 3D Microscopes, Focus-Based Optical Metrology- Fringe projection method, Measurement of Typical Nanofeatures.
Surface metrology - 3D surface topography - Need, Measurement – Chromatic confocal Microscopy, Interferometry, Non-optical Scanning Microscopy – Scanning electron Microscopes, Scanning probe microscopes, Parameters for characterizing 3D surface topography.

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Explain the need, significance and progress of precision manufacturing and the different levels of manufacturing.
2. Explain the principle and working of different methods of precision machining.
3. Explain the special construction requirements of precision machine tools.
4. Explain the errors involved in precision machine tools and calculate the error budgets for a given situation.
5. Select a suitable measurement solution to measure and characterize precision machined features.

TEXTBOOKS:

1. Jain, V.K., Introduction to micromachining, Narosa publishers, 2018
2. Venktesh V.C., SudinIzman, Precision Engineering, Tata Mc.Graw Hill Publishing Company, New Delhi 2007.

REFERENCES:

1. David Dornfeld, Dae-Eun Lee, Precision Manufacturing, Springer, 2008.
2. Jain, V.K., Micromanufacturing Processes, CRC Press, 2012.
3. Joseph McGeough, Micromachining of Engineered Materials, Marcel Dekker Inc., 2002.
4. Kevin Harding, “Handbook of Optical Dimensional Metrology, Series: Series in Optics and optoelectronics”, Taylor & Francis, 2013.
5. Murty, R.L., Precision Engineering in Manufacturing, New Age publishers, 2005.

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ME5078 MEMS AND MICROSYSTEMS L T P C
3 0 0 3

COURSE OBJECTIVES: The main learning objective of this course are:

1. To throw light on the fundamental concepts of MEMS.
2. To inculcate knowledge about micromanufacturing techniques
3. To provide expertise on Electrostatic and thermal based MEMS
4. To make students get acquainted with the piezo- resistive/electric and magnetic based MEMS.
5. To enlighten on Microfluidics and applications of MEMS.

UNIT I BASIC ENGINEERING FOR MEMS 9

History of MEMS Development, Multidisciplinary Nature of Microsystems, Energy Domains, Scaling Laws in Miniaturization, Essential Electrical and Mechanical Concepts in MEMS, Materials for MEMS and Microsystems.

UNIT II MICROMANUFACTURING TECHNIQUES 9

Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition, Physical Vapour Deposition-Sputtering, Deposition by Epitaxy, Etching, Bulk Micromanufacturing, Micromachining Processes, LIGA Process, Microsystem Assembly and Testing.

UNIT III ELECTROSTATIC AND THERMAL BASED MEMS 9

Introduction to Electrostatic Sensors and Actuators, Parallel-Plate Capacitor, Application of Parallel-Plate Capacitors, Interdigitated Finger Capacitors, Applications of Comb-Drive Devices, Introduction to Thermal Sensors and Actuators, Sensors and Actuators Based on Thermal Expansion, Thermocouples, Thermal Resistors, Shape Memory Alloy, Applications of Thermal Sensors and Actuators.

UNIT IV PIEZO-RESISTIVE / ELECTRIC AND MAGNETIC BASED MEMS 9

Introduction to Piezoresistive& Piezoelectric effects, Piezoresistive& Piezoelectric materials, Stress Analysis of Mechanical Elements, Applications of Piezoresistive& Piezoelectric Sensors and Actuators, Essential Concepts and Principles of Magnetic Sensors and Actuators, Fabrication of Micro Magnetic Components, Applications of Magnetic Sensors and Actuators.

UNIT V MICROFLUIDICS AND APPLICATIONS OF MEMS 9

Microfluidics - Fluid Mechanics Concepts, Design and Fabrication of Channels, Valves, Pumps, Case Studies - Accelerometer, Gyros, RF MEMS and MOEMS.

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Identify suitable material for MEMS and Microsystems, and also describe the scaling laws involved in miniaturization.
2. Discuss the various micromanufacturing processes
3. Interpret the working principle and applications of electrostatic and thermal based MEMS sensors and actuators.
4. Recognize the utility of piezoresistive, piezoelectric and magnetic effect in the making of MEMS devices.

5. Design the elements of Microfluidic systems, and also select suitable MEMS devices for Industrial applications.

TEXT BOOKS:

1. Chang Liu, “Foundations of MEMS”, Pearson Education, 2011.
2. Tai-Ran Hsu, “MEMS and Microsystems: Design and Manufacture”, McGraw Hill Education, 2002.

REFERENCES:

1. Marc J. Madou, “Fundamentals of Microfabrication and Nanotechnology”, CRC Press, 2011.
2. Mohamed Gad-el-Hak, “The MEMS handbook: MEMS Applications”, CRC press, 2006.
3. NitaigourPremchandMahalik, “MEMS”, McGraw Hill Education, 2007.
4. Stephen D Senturia, “Microsystem Design”, Kluwer Academic Publishers, 2001.
5. Thomas M. Adams and Richard A. Layton, “Introductory MEMS: Fabrication and Applications”, Springer, 2010.

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4	3	2	3	2					1			1	3		2
5	3	2	3	2					1			3	3		2

ME5017 MACHINE VISION **L T P C**
3 0 0 3

COURSE OBJECTIVES:

The main learning objectives of this course are:

1. To provide the concepts of Physics behind Digital Image Processing.
2. To give insight into the Methods of Image Acquisition.
3. To impart knowledge on different techniques involved in image Processing.
4. To provide competence on different image analysis techniques
5. To render exposure in Machine Vision Applications.

UNIT I INTRODUCTION **9**

Human Vision – Machine vision and Computer Vision – Benefits of Machine Vision – Block Diagram and Function of Machine Vision System Implementation of Industrial Machine Vision System – Physics of Light – Interactions of Light – Refraction at a Spherical Surface – Thin Lens Equation.

UNIT II IMAGE ACQUISITION **9**

Scene Constraints – Lighting Parameters – Lighting Sources, Selection – Lighting Techniques – Types and Selection – Machine Vision Lenses and Optical Filters, Specifications and Selection – Imaging Sensors – CCD and CMOS, Specifications – Interface Architectures – Analog and Digital Cameras –Digital Camera Interfaces – Camera Computer Interfaces, Specifications and Selection – Geometrical Image Formation Models – Camera Calibration.

UNIT III IMAGE PROCESSING **9**

Machine Vision Software – Fundamentals of Digital Image – Image Acquisition Modes – Image Processing in Spatial and Frequency Domain – Point Operation, Thresholding, Grayscale Stretching – Neighborhood Operations, Image Smoothing and Sharpening – Edge Detection – Binary Morphology – Color image processing.

UNIT IV IMAGE ANALYSIS **9**

Feature Extraction – Region Features, Shape and Size Features – Texture Analysis – Template Matching and Classification – 3D Machine Vision Techniques – Decision Making.

UNIT V MACHINE VISION APPLICATIONS 9

Machine Vision Applications in Manufacturing, Electronics, Printing, Pharmaceutical, Textile, Applications in Non-Visible Spectrum, Metrology, Vision Guided Robotics – Field and Service Applications – Agricultural, and Bio Medical Field, Augmented Reality, Surveillance, Bio-Metrics .

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Explain the concepts of Physics behind Digital Image Processing.
2. Illustrate the Methods of Image Acquisition.
3. Discuss various image processing techniques.
4. Discuss various image analysis techniques.
5. Implement Machine Vision in various Applications.

TEXT BOOKS:

1. AlexandaerHornberg, “Hand Book of Machine Vision”, Wiley-VCH, 2006.
2. Davies E.R., “Machine Vision Theory, Algorithms and Practicalities”, Elsevier, 2005.

REFERENCES:

1. NelloZuech, “Understanding and Applying Machine Vision”, Marcel Decker, 2000.
2. Bruce Batchelor and Frederick Waltz, “Intelligent Machine Vision Techniques, Implementations and Applications”, Springer-Verlag, 2001.
3. Rafael C. Gonzales, Richard. E. Woods and Steven L. Eddins, “Digital Image Processing Using MATLAB”, McGraw Hill Education, 2014.
4. Milan Sonka, Vaclav Hlavac and Roger Boyle, “Image Processing, Analysis, and Machine Vision”, Cengage Learning, 2014.
5. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, PHI Learning, 2011.
6. Chanda B. and Dutta Majumder D., “Digital Image Processing and Analysis”, PHI Learning, 2011.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	1	1								1	2	1	
2	3	2	2	1								1	2	1	
3	3	2	2	1								1	2	1	
4	3	2	2	1								1	2	1	
5	3	3	3	2								1	2	1	

ME5018 APPLIED OPERATIONS RESEARCH L T P C

3 0 0 3

COURSE OBJECTIVES: The main learning objective of this course is

1. To provide an insight to the fundamentals of linear programming problems.
2. To inculcate the methodology of formulation and solution to Transportation and assignment problems.
3. To enlighten the principles of the inventory management.
4. To outline the basics of the queuing theory, Simulation and its application.
5. To expose the essentials of project management and Replacement problems

UNIT I LINEAR PROGRAMMING PROBLEMS 9

OR-Definition - Phases - models, LP problem formulation – Graphical solution, GLPP, Standard and Canonical forms of LPP- simplex methods- Big M, Two phase methods, Alternate optimal solutions, Duality in LP.

UNIT II TRANSPORTATION 9

Transportation problems- Basic feasible solution, Optimal solution By MODI method, Balanced and Unbalanced TP, Degeneracy, Production problems. Assignment problems – Hungarian method Traveling salesman problems - Sequencing models- Johnson algorithm, n job 2 machines,n job 3 machines and n job m machines.

UNIT III INVENTORY CONTROL 9

Types of inventory- Inventory cost - EOQ - Deterministic inventory problems – Purchase and Production models with and without shortages-EOQ with price breaks - Stochastic inventory problems - Multi product problems - Systems of inventory control (P and Q Systems)-Determination of buffer stock and re-order levels -Selective inventory control techniques (ABC,VED, SDE, etc.)

UNIT IV QUEUING THEORY 9

Queuing system - Characteristics - symbols - Poisson process and exponential distribution –Single server queuing models - Multiserver queuing models, Simulation Monte Carlo technique- Inventory& Queuing problems.

UNIT V PROJECT MANAGEMENT AND REPLACEMENT MODELS 9

Project management: Network logic – Ford-Fulkerson's rule - AON diagram - CPM and PERT techniques, Critical path and float calculations Replacement models -types of failures – Gradual failures-replacement of items: Efficiency deteriorates with time, sudden failures- individual and group replacement policies.

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Select the constraints on the availability of resources, develop a model and render an optimal solution during the given circumstances.
2. Appraise the challenges in the transportation and production problems and furnish a rational solution to maximize the benefits.
3. Plan the purchase/ manufacturing policies, manage the spares/ stocks and meet the customer demands..
4. Analyze the queue discipline and explore the avenues for better customer service.
5. Investigate the nature of the project/ failure and offer methodical assistance towards decision making.

TEXT BOOKS:

1. Wayne.L.Winston, “Operations research applications and algorithms”,4thedition,Cengage learning, 2004.
2. HamdyATaha, “Operations research an introduction”, 10th edition, PHI/Pearson education, 2017.

REFERENCES:

1. Srinivasan G, “Operations research principles and applications”, 3rd edition EEE PHI, 2017.
2. Pannerselvam R, “Operations research”, 2nd edition, PHI, 2009.
3. Ravindran, Phillips and Solberg, “Operations research principles and practice”, 2nd edition, Wiley India, 2007.
4. Sharma J K, “Operations research theory and applications”,5th edition, Macmillan India, 2013.
5. Premkumar Gupta and D.S.Hira, “Problems in Operations research”, S.Chand, 2009.
6.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	2	2	2	3	1	1	1		1		1	1	2	1
2	1	2	2	2	3	1	1	1		1		1	1	2	1
3	1	2	2	2	3	1	1	1		1		1	1	2	1
4	1	2	2	2	3	1	1	1		1		1	1	2	1
5	1	2	2	2	3	1	1	1		1		1	1	2	1

IE5077 SYSTEMS ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:

- Illustrate the life cycle phases and framework for systems engineering.
- Describe about systems engineering process.
- Apply ergonomic and system dynamic models for evaluation of alternatives.
- Create knowledge on Reliability, Markov and Time series models for analysis of alternatives.
- Describe about decision assessment methods in systems engineering.

UNIT I INTRODUCTION 9

Definitions of Systems Engineering, Systems Engineering Knowledge, Life cycles, Life-cycle phases, logical steps of systems engineering, Frame works for systems engineering.

UNIT II SYSTEMS ENGINEERING PROCESSES 9

Formulation of issues with a case study, Value system design, Functional analysis, Business Process Reengineering, Quality function deployment, System synthesis, Approaches for generation of alternatives.

UNIT III ANALYSIS OF ALTERNATIVES - I 9

Cross-impact analysis, Structural modeling tools, System Dynamics models with case studies, Economic models: present value analysis – NPV, Benefits and costs over time, ROI, IRR; Work and Cost breakdown structure.

UNIT IV ANALYSIS OF ALTERNATIVES – II 9

Reliability, Availability, Maintainability, and Supportability models; Stochastic networks and Markov models, Queuing network optimization, Time series and Regression models, Evaluation of large scale models

UNIT V DECISION ASSESSMENT 9

Decision assessment types, Five types of decision assessment efforts, Utility theory, Group decision making and Voting approaches, Social welfare function; Systems Engineering methods for Systems Engineering Management

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will

CO1: Be able to recognize life cycle phases in systems engineering.
CO2: Apply steps in systems engineering process for large scale problems.
CO3: Able to develop system dynamic models for analyzing alternatives.
CO4: Gain ability to evaluate alternatives in large scale problems.
CO5: Be able Attain confidence in assessment and arrive decisions for complex problems.

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
CO1		✓	✓	✓	✓				✓			
CO2		✓	✓	✓	✓				✓			
CO3		✓	✓	✓	✓	✓			✓			
CO4		✓	✓	✓	✓	✓			✓			
CO5		✓	✓	✓	✓	✓			✓			

TEXT BOOK:

1. Andrew P. Sage, James E. Armstrong Jr. “Introduction to Systems Engineering”, John Wiley and Sons, Inc, 2000.

REFERENCES:

1. Andrew P.Sage, “Systems Engineering”, John Wiley & Sons, 1992.

2. Andrew P.Sage, William B.Rouse, “Hand book of Systems Engineering and Management”, John Wiley & Sons, 1999.

AD5091 CONSTITUTION OF INDIA

L T P C
3 0 0 0

COURSE OBJECTIVES:

- Teach history and philosophy of Indian Constitution.
- Describe the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Summarize powers and functions of Indian government.
- Explain emergency rule.
- Explain structure and functions of local administration.

UNIT I INTRODUCTION 9

History of Making of the Indian Constitution-Drafting Committee- (Composition & Working) - Philosophy of the Indian Constitution-Preamble-Salient Features

UNIT II CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES 9

Fundamental Rights-Right to Equality-Right to Freedom-Right against Exploitation Right to Freedom of Religion-Cultural and Educational Rights-Right to Constitutional Remedies Directive Principles of State Policy-Fundamental Duties

UNIT III ORGANS OF GOVERNANCE 9

Parliament-Composition-Qualifications and Disqualifications-Powers and Functions-Executive President-Governor-Council of Ministers-Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions

UNIT IV EMERGENCY PROVISIONS 9

Emergency Provisions - National Emergency, President Rule, Financial Emergency

UNIT V LOCAL ADMINISTRATION 9

District’s Administration head- Role and Importance-Municipalities- Introduction- Mayor and role of Elected Representative-CEO of Municipal Corporation-Pachayati raj- Introduction- PRI- Zila Pachayat-Elected officials and their roles- CEO ZilaPachayat- Position and role-Block level-Organizational Hierarchy (Different departments)-Village level- Role of Elected and Appointed officials-Importance of grass root democracy

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Able to understand history and philosophy of Indian Constitution.
CO2: Able to understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
CO3: Able to understand powers and functions of Indian government.
CO4: Able to understand emergency rule.
CO5: Able to understand structure and functions of local administration.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									✓			✓
CO2									✓			✓
CO3									✓			✓
CO4									✓			✓
CO5									✓			✓

TEXTBOOKS:

1. Basu D D, Introduction to the Constitution of India, Lexis Nexis, 2015.
2. Busi S N, Ambedkar B R framing of Indian Constitution, 1st Edition, 2015.

3. Jain M P, Indian Constitution Law, 7thEdn., Lexis Nexis, 2014.
4. The Constitution of India (Bare Act), Government Publication,1950

AD5092 VALUE EDUCATION

L T P C
3 0 0 0

COURSE OBJECTIVES:

- Develop knowledge of self-development
- Explain the importance of Human values
- Develop the overall personality through value education
- Overcome the self destructive habits with value education
- Interpret social empowerment with value education

UNIT I INTRODUCTION TO VALUE EDUCATION 9

Values and self-development –Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non- moral valuation, Standards and principles, Value judgements

UNIT II IMPORTANCE OF VALUES 9

Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness. Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline

UNIT III INFLUENCE OF VALUE EDUCATION 9

Personality and Behaviour development - Soul and Scientific attitude. Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendshipHappiness Vs suffering, love for truth.

UNIT IV REINCARNATION THROUGH VALUE EDUCATION 9

Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature Character and Competence –Holy books vs Blind faith, Self-management and Good health, Science of reincarnation

UNIT V VALUE EDUCATION IN SOCIAL EMPOWERMENT 9

Equality, Non violence, Humility, Role of Women, All religions and same message,Mind your Mind, Self-control, Honesty, Studying effectively

TOTAL: 45PERIODS

COURSE OUTCOMES:

CO1 Gain knowledge of self-development
CO2 Learn the importance of Human values
CO3 Develop the overall personality through value education
CO4 Overcome the self destructive habits with value education
CO5 Interpret social empowerment with value education

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							✓	✓				✓
CO2							✓	✓	✓			✓
CO3							✓	✓	✓			✓
CO4							✓	✓				✓
CO5							✓	✓				✓

REFERENCES:

1. Chakroborty , S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press ,New Delhi

AD5093 **PEDAGOGY STUDIES** **L T P C**
3 0 0 0

COURSE OBJECTIVES:

- Understand the methodology of pedagogy.
- Compare pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Infer how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Illustrate the factors necessary for professional development.
- Identify the Research gaps in pedagogy.

UNIT I INTRODUCTION AND METHODOLOGY: 9

Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions **-** Overview of methodology and Searching.

UNIT II THEMATIC OVERVIEW 9

Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT III EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES 9

Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV PROFESSIONAL DEVELOPMENT 9

Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes

UNIT V RESEARCH GAPS AND FUTURE DIRECTIONS 9

Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

TOTAL: 45PERIODS

COURSE OUTCOMES:

- Understand the methodology of pedagogy.
- Understand Pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Find how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Know the factors necessary for professional development.
- Identify the Research gaps in pedagogy.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												✓
CO2												✓
CO3												✓
CO4												✓
CO5												✓

REFERENCES:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

AD5094 STRESS MANAGEMENT BY YOGA L T P C
3 0 0 0

COURSE OBJECTIVES:

- Develop healthy mind in a healthy body thus improving social health also improve efficiency
- Invent Do's and Don't's in life through Yam
- Categorize Do's and Don't's in life through Niyam
- Develop a healthy mind and body through YogAsans
- Invent breathing techniques through Pranayam

UNIT I INTRODUCTION TO YOGA 9

Definitions of Eight parts of yog. (Ashtanga)

UNIT II YAM 9

Do`s and Don't's in life.
Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT III NIYAM 9

Do`s and Don't's in life.
Ahinsa, satya, astheya, bramhacharya and aparigraha

UNIT IV ASAN 9

Various yog poses and their benefits for mind & body

UNIT V PRANAYAM 9

Regularization of breathing techniques and its effects-Types of pranayam

TOTAL: 45PERIODS

COURSE OUTCOMES:

CO1 – Develop healthy mind in a healthy body thus improving social health also improve efficiency
CO2 – Learn Do's and Don't's in life through Yam
CO3 – Learn Do's and Don't's in life through Niyam
CO4 – Develop a healthy mind and body through YogAsans
CO5 – Learn breathing techniques through Pranayam

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							✓	✓				✓
CO2							✓	✓				✓
CO3							✓	✓				✓
CO4							✓	✓				✓
CO5							✓	✓				✓

REFERENCES:

1. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata
2. 'Yogic Asanas for GroupTarining-Part-I": Janardan Swami Yogabhyasi Mandal, Nagpur

AD5095 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

L T P C
3 0 0 0

COURSE OBJECTIVES:

- Develop basic personality skills holistically
- Develop deep personality skills holistically to achieve happy goals
- Rewrite the responsibilities
- Reframe a person with stable mind, pleasing personality and determination
- Discover wisdom in students

UNIT I NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - I 9

Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue)

UNIT II NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - II 9

Verses- 52,53,59 (dont's) - Verses- 71,73,75,78 (do's)

UNIT III APPROACH TO DAY TO DAY WORK AND DUTIES 9

Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48

UNIT IV STATEMENTS OF BASIC KNOWLEDGE – I 9

Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 - Verses 13, 14, 15, 16,17, 18

UNIT V PERSONALITY OF ROLE MODEL - SHRIMAD BHAGWADGEETA 9

Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TOTAL: 45PERIODS

COURSE OUTCOMES:

CO1: To develop basic personality skills holistically
CO2: To develop deep personality skills holistically to achieve happy goals
CO3: To rewrite the responsibilities
CO4: To reframe a person with stable mind, pleasing personality and determination
CO5: To awaken wisdom in students

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									✓			✓
CO2									✓			✓
CO3									✓			✓
CO4									✓			✓
CO5									✓			✓

REFERENCES:

1. Gopinath,Rashtriya Sanskrit Sansthanam P, Bhartrihari'sThreeSatakam , Niti-sringar-vairagya, New Delhi,2010
2. Swami Swarupananda , Srimad Bhagavad Gita, AdvaitaAshram,Publication Department, Kolkata,2016

AD5097 ESSENCE OF INDIAN KNOWLEDGE TRADITION L T P C
3 0 0 0

COURSE OBJECTIVES

The course will introduce the students to

- get a knowledge about Indian Culture
- Know Indian Languages and Literature religion and philosophy and the fine arts in India
- Explore the Science and Scientists of Ancient, Medieval and Modern India
- Understand education systems in India

UNIT I INTRODUCTION TO CULTURE 9

Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT II INDIAN LANGUAGES AND LITERATURE 9

Indian Languages and Literature – I: Languages and Literature of South India, – Indian Languages and Literature – II: Northern Indian Languages & Literature

UNIT III RELIGION AND PHILOSOPHY 9

Major religions practiced in India and Understanding their Philosophy – religious movements in Modern India (Selected movements only)

UNIT IV FINE ARTS IN INDIA (ART, TECHNOLOGY& ENGINEERING) 9

Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT V EDUCATION SYSTEM IN INDIA 9

Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course the students will be able to

- Understand philosophy of Indian culture.
- Distinguish the Indian languages and literature.
- Learn the philosophy of ancient, medieval and modern India.
- Acquire the information about the fine arts in India.
- Know the contribution of scientists of different eras.
- Understand education systems in India

REFERENCES:

1. Kapil Kapoor, “Text and Interpretation: The India Tradition”,ISBN: 81246033375, 2005
2. “Science in Samskrit”, Samskrita Bharti Publisher, ISBN 13: 978-8187276333, 2007
3. NCERT, “Position paper on Arts, Music, Dance and Theatre”, ISBN 81-7450 494-X, 200
4. Narain, “Examinations in ancient India”, Arya Book Depot, 1993
5. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989
6. M. Hiriyanna, “Essentials of Indian Philosophy”, Motilal Banarsidass Publishers, ISBN 13: 978- 8120810990, 2014

AD5098 SANGA TAMIL LITERATURE APPRECIATION L T P C
3 0 0 0

COURSE OBJECTIVES:
The mainlearning objectiveofthis course istomake the students an appreciationfor:
1. IntroductiontoSangaTamil Literature.
2.‘Agathinai’ and‘Purathinai’ in SangaTamil Literature.
3.‘Attruppadai’ in SangaTamil Literature.
4.‘Puranaanuru’ in SangaTamil Literature.
5.‘Pathitrupaththu’ in SangaTamil Literature.

UNITI SANGA TAMIL LITERATUREANINTRODUCTION 9
IntroductiontoTamilSangam–HistoryofTamil ThreeSangams–IntroductiontoTamilSangam Literature–Special Branchesin TamilSangam Literature- TamilSangamLiterature’sGrammar-Tamil Sangam Literature’sparables.

UNIT II ‘AGATHINAI’AND‘PURATHINAI’ 9
Tholkappiyar’sMeaningfulVerses–Threeliteraturematerials–Agathinai’smessage-HistoryofCulturefromAgathinai–Purathinai–Classification–MesaagetoSocietyfromPurathinai.

UNITIII ‘ATTRUPPADAI’. 9
AttruppadaiLiterature–Attruppadaiin‘Puranaanuru’-Attruppadaiin‘Pathitrupaththu’–Attruppadaiin ‘Paththupaattu’.

UNITIV ‘PURANAANURU’ 9
Puranaanuru onGood Administration,Rulerand Subjects–Emotion&itsEffectin Puranaanuru.

UNITV ‘PATHITRUPATHTHU’ 9
Pathitrupaththuin‘Ettuthogai’–Pathitrupaththu’sParables–Tamildynasty:Valor,Administration, Charity in Pathitrupaththu- MesaagetoSocietyfromPathitrupaththu.

TOTAL (L:45) = 45PERIODS

COURSE OUTCOMES: Upon completionofthiscourse, the studentswillbeable to:
1. Appreciateandapplythemessages inSangaTamil Literaturein theirlife.
2. Differentiate‘Agathinai’ and‘Purathinai’in their personal andsocietallife.
3. Appreciateandapplythemessages in‘Attruppadai’in theirpersonal and societallife.
4. Appreciateandapplythemessages in‘Puranaanuru’in theirpersonal andsocietallife.
5. Appreciateandapplythemessages in‘Pathitrupaththu’intheir personalandsocietallife.

REFERENCES:

1. Sivaraja Pillai, TheChronology oftheEarlyTamils,SagwanPress,2018.
2. HankHeifetz andGeorgeL. Hart, The Purananuru,Penguin Books,2002.
3. Kamil Zvelebil, The Smile ofMurugan:OnTamilLiterature ofSouthIndia, Brill Academic Pub,1997.
4. GeorgeL. Hart, Poetsof theTamil Anthologies: AncientPoemsofLove andWar, PrincetonUniversity Press,2015.
5. XavierS.Thani Nayagam, Landscapeand poetry:a studyofnature inclassical Tamil poetry,Asia Pub.House, 1967.

	P												PS		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1									0.9						0.6
2									0.9						0.6
3									0.9						0.6
4									0.9						0.6
5									0.9						0.6

HU5171 LANGUAGE AND COMMUNICATION LT P C
3 0 0 3

COURSE DESCRIPTION

This course offers an introduction to language and communication. The primary goal of this course is to familiarize students with key ideas related to communication using language as well as non verbal means. Ideas related to the use of language and the underlying power structures are also examined. The course also examines the role of media in communication and in the dissemination of ideas as well as opinions.

Objectives

- ✓ To familiarize students with the concept of communication using linguistic and non linguistic resources.
- ✓ To help students ask critical questions regarding facts and opinions.
- ✓ To provide students with the material to discuss issues such as language and power structures.
- ✓ To help students think critically about false propaganda and fake news.

Learning Outcomes

- ➢ Students will be able to use linguistic and non linguistic resources of language in an integrated manner for communication.
- ➢ Students will be able to analyse communication in terms of facts and opinions.
- ➢ Students will be able to discuss, analyse and argue about issues related to language and power.

UNIT I LINGUISTIC AND NON-LINGUISTIC RESOURCE OF COMMUNICATION: 9

a) Writing and Speech
b) Distinction between language structure and language use, form and function, acceptability and grammaticality
c) Gestures and Body language, pictures and symbols, cultural appropriacy
d) Communicative Competency, context and situation, combination of linguistic and non-linguistic elements of communication

UNIT II STRUCTURE OF WRITING/CONVERSATION: 9

a) Language skills and the communication cycle; speaking and listening, writing and reading
b) Initiating and closing conversations, intervention, turn taking
c) Writing for target reader, rhetorical devices and strategies
d) Coherence and Cohesion in speech and writing

UNIT III POWER STRUCTURE AND LANGUAGE USE: 9

a) Gender and language use
b) Politeness expressions and their use
c) Ethical dimensions of language use
d) Language rights as part of human rights

UNIT IV MEDIA COMMUNICATION: 9

a) Print media, electronic media, social media
b) Power of media
c) Manufacturing of opinion, fake news and hidden agendas

UNIT V PERSUASIVE COMMUNICATION AND MISCOMMUNICATION: 9

a) Fundamentals of persuasive communication
b) Persuasive strategies
c) Communication barriers

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Austin, 1962, J.L. How to do things with words. Oxford: Clarendon Press. Grice, P.1989. Studies in the way of words. Cambridge, M.A: Harvard University Press.
2. Chomsky, N.1966. Aspects of the theory of syntax, The MIT press, Cambridge. Chomsky, N.2006. Language and Mind, Cambridge University Press.

3. Hymes. D.N. 1972, On communication competence in J.B. Pride and J.Holmes (ed), Sociolinguistics, pp 269-293, London Penguin.
4. Gilbert, H.Harman, 1976. Psychological aspect of the theory of syntax in Journal of Philosophy, page 75-87.
5. Stephen. C. Levenson, 1983, Pragmatics, Cambridge University press.
6. Stangley, J. 2007. Language in Context. Clarendon press, Oxford. 7. Shannon, 1942. A Mathematical Theory of Communication. 8. Searle, J.R. 1969. Speech acts: An essay in the philosophy of language. Cambridge: Cambridge University Press.

HU5172 VALUES AND ETHICS L T P C
3 0 0 3

OBJECTIVES:

- Teach definition and classification of values.
- Explain Purusartha.
- Describe Sarvodaya idea.
- Summarize sustenance of life.
- Conclude views of hierarchy of values.

UNIT I DEFINITION AND CLASSIFICATION OF VALUES 9

Extrinsic values- Universal and Situational values- Physical- Environmental-Sensuous- Economic-Social-Aesthetic-Moral and Religious values

UNIT II CONCEPTS RELATED TO VALUES 9

Purusartha-Virtue- Right- duty- justice- Equality- Love and Good

UNIT III IDEOLOGY OF SARVODAYA 9

Egoism- Altruism and universalism- The Ideal of Sarvodaya and VasudhaivaKutumbakam

UNIT IV SUSTENANCE OF LIFE 9

The Problem of Sustenance of value in the process of Social, Political and Technological Changes

UNIT V VIEWS ON HIERARCHY OF VALUES 9

The Problem of hierarchy of values and their choice, The views of Pt. Madan Mohan Malviya and Mahatma Gandhi

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Able to understand definition and classification of values.
CO2: Able to understand purusartha.
CO3: Able to understand sarvodaya idea.
CO4: Able to understand sustenance of life.
CO5: Able to understand views of hierarchy of values.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								✓	✓			✓
CO2								✓	✓			✓
CO3								✓	✓			✓
CO4								✓	✓			✓
CO5								✓	✓			✓

TEXTBOOKS:

1. AwadeshPradhan :MahamanakeVichara. (B.H.U., Vanarasi-2007)
2. Little, William, : An Introduction of Ethics (Allied Publisher, Indian Reprint 1955)
3. William, K Frankena : Ethics (Prentice Hall of India, 1988)

HU5173 **HUMAN RELATIONS AT WORK** **L T P C**
3 0 0 3

OBJECTIVES:

- Illustrate human relations at work its relationship with self.
- Explain the importance of interacting with people at work to develop teamwork.
- Infer the importance of physical health in maintaining human relations at work.
- Describe the importance of staying psychologically healthy.
- Identify the essential qualities for progressing in career.

UNIT I UNDERSTANDING AND MANAGING YOURSELF 9

Human Relations and You: Self-Esteem and Self-Confidence: Self-Motivation and Goal Setting; Emotional Intelligence, Attitudes, and Happiness; Values and Ethics and Problem Solving and Creativity.

UNIT II DEALING EFFECTIVELY WITH PEOPLE 9

Communication in the Workplace; Specialized Tactics for Getting Along with Others in the Workplace; Managing Conflict; Becoming an Effective Leader; Motivating Others and Developing Teamwork; Diversity and Cross-Cultural Competence.

UNIT III STAYING PHYSICALLY HEALTHY 9

Yoga, Pranayam and Exercise: Aerobic and anaerobic.

UNIT IV STAYING PSYCHOLOGICALLY HEALTHY 9

Managing Stress and Personal Problems, Meditation.

UNIT V DEVELOPING CAREER THRUST 9

Getting Ahead in Your Career, Learning Strategies, Perception, Life Span Changes, and Developing Good Work Habits.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

CO1: Understand the importance of self-management.
CO2: Know how to deal with people to develop teamwork.
CO3: Know the importance of staying healthy.
CO4: Know how to manage stress and personal problems.
CO5: Develop the personal qualities essential for career growth.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						✓		✓	✓			✓
CO2									✓	✓		✓
CO3						✓		✓	✓			✓
CO4								✓				✓
CO5								✓	✓	✓		✓

TEXT BOOK:

1. Dubrien, A. J. (2017). Human Relations for Career and Personal Success: Concepts, Applications, and Skills, 11th Ed. Upper Saddle River, NJ: Pearson.

REFERENCES:

1. Greenberg, J. S. (2017). Comprehensive stress management (14th edition), New York: McGraw Hill.
2. Udai, Y. (2015). Yogasanaurpranayam. New Delhi: N.S. Publications.

HU5174 PSYCHOLOGICAL PROCESSES L T P C
3 0 0 3

COURSE DESCRIPTION

Psychological Processes course is designed for students to be aware of the basic principles of psychology for the better understanding of people's psyche and behaviour around them. This course enables learners to use the optimal use of different forms of thinking skills and thereby results in effective communication in diverse situations. Every unit of the syllabus highlights the psychological process of people, the most powerful and constructive use of perceptions.

OBJECTIVES

The major objectives of this course is

- To develop students' awareness – on psychology, learning behavior and usage of perception effectively.
- To learn to use the various kinds of thinking in a formal context.
- To critically evaluate content and comprehend the message on the bases of perception, personality and intelligence.

UNIT I INTRODUCTION

What is psychology? - Why study psychology? - Psychology as science – Behavior and its role in human communication – socio-cultural bases of behaviour – Biological bases of behavior - Brain and its functions – Principles of Heredity – Cognition and its functions Fields of psychology – Cognitve and Perceptual – Industrial and Organizational.

UNIT II SENSORY & PERCEPTUAL PROCESSES

Some general properties of Senses: Visual system – the eye, colour vision – Auditory system – Hearing, listening, Sounds - Other senses - Selective attention; physiological correlates of attention; Internal influences on perception learning – set - motivation & emotion - cognitive styles; External influences on perception figure and ground separation – movement – organization – illusion; Internal- external interactions: Constancy - Depth Perception- Binocular & Monocular Perception; Perceptual defense & Perceptual vigilance; Sensory deprivation -Sensory bombardment; ESP - Social Perception.

UNIT III COGNITION & AFFECT

Learning and memory – philosophy of mind – concepts - words – images – semantic features – Association of words – Repetition – Retrieval – Chunking - Schemata - Emotion and motivation – nature and types of motivation – Biological & Psychosocial motivation – nature and types of emotions – physiological & cognitive bases of emotions – expressions of emotions – managing negative emotions - enhancing positive emotions.

UNIT IV THINKING, PROBLEM-SOLVING & DECISION MAKING

Thinking skills – Types of thinking skills – Concrete & Abstract thinking – Convergent & Divergent - Analytical & Creative thinking – Problem & Possibility thinking – Vertical & Lateral thinking – Problem solving skills – stages of problem solving skills – Decision making - intuition and reasoning skills - Thinking and language - The thinking process- concepts, problem solving, decision-making, creative thinking; language communication.

UNIT V PERSONALITY & INTELLIGENCE

Psychological phenomena & Attributes of humans - cognition, motivation, and behavior - thoughts, feelings, perceptions, and actions – personality dimensions, traits, patterns - Specialized knowledge, performance accomplishments, automaticity or ease of functioning, skilled performance under challenge - generative flexibility, and speed of learning or behavior change.

REFERENCES

1. Morgan, C.T.and King, R.A (1994) Introduction to Psychology, Tata McGraw Hill Co Ltd, New Delhi.
2. Robert A. Baron (2002), Psychology, 5th Edition, Prentice Hall, India.
3. Michael W.Passer, Ronald E.smith (2007), Psychology: The science of mind and Behavior,3rd Edition Tata McGraw-Hill Edition.
4. Robert S.Feldman (2004) Understanding Psychology 6th Edition Tata McGraw – Hill.
5. Endler, N. S., &Summerfeldt, L. J. (1995). Intelligence. personality. psychopathology. and adjustment. In D. H. Saklofske& M. Zeidner (Eds.). International handbook of personality

and intelligence (pp. 249-284). New York: Plenum Press.
6. Ford, M. E. (1994). A living systems approach to the integration of personality and intelligence. In R. J. Sternberg. & P. Ruzgis (Eds.). Personality and intelligence (pp. 188-21 7). New York: Cambridge University Press.
7. De Bono, E (1990) Lateral Thinking, Harper Perennial, New York.

HU5175 EDUCATION, TECHNOLOGY AND SOCIETY L T P C
3 0 0 3

COURSE DESCRIPTION

This course introduces students to multidisciplinary studies in Education, Technology and Society. Students will get an understanding of the relationship between education, technology and society. They will also learn about the long lasting impact of good education in a technologically advanced society.

COURSE OBJECTIVES:

The course aims

- To help learners understand the basics of different types of technology utilised in the field of education
- To make them realize the impact of education in society
- To make them evolve as responsible citizen in a technologically advanced society

LEARNING OUTCOMES

By the end of the course, learners will be able to

- Understand the various apps of technology apps and use them to access, generate and present information effectively.
- Apply technology based resources and other media formats equitably, ethically and legally.
- Integrate their technical education for betterment of society as well as their personal life.

UNIT I INDIAN EDUCATION SYSTEM

Gurukul to ICT education – Teacher as facilitator – Macaulay's Minutes – English medium vs Regional medium – Importance of Education in Modern India - Challenges in Education

UNIT II LEARNING THEORIES

Learning Theories – Behaviorism – Cognitivism – Social Constuctivism – Humanism Learning Styles – Multiple Intelligences – Emotional Intelligence – Blooms Taxonomy

UNIT III TECHNOLOGICAL ADVANCEMENTS

Web tools – Social media in education – elearning – MOOCs – Mobile assisted learning – Learning Apps – Blended learning - Self-directed learning

UNIT IV EDUCATIONAL TECHNOLOGY

Technological implications on Education – Teaching, Learning & Testing with Technology - Advantages and drawbacks – Critical analysis on the use of technology

UNIT V ETHICAL IMPLICATIONS

Plagiarism – Online Copyright issues – Ethical and value implications of education and technology on individual and society.

TOTAL:45 PERIODS

TEACHING METHODS

Teaching modes include guest lectures, discussion groups, presentations, visual media, and a practicum style of learning.

EVALUATION

As this is course is not a content based course, it focuses more on the ethical use of technology in education and society, and so, evaluation can be based on assignments and discussions. So there is no need for an end semester examination. Internals marks can be taken for the total marks.

INTERNAL (100 % WEIGHTAGE)

(a) Written Test (40 marks)
(b) Assignment: Write a real time report of the technology use in any school / college (15 marks)
(c) Presentation: Students choose any one of the technological tools and present its relevance to education and society (15 marks)
(d) Group discussion: Students discuss in groups on case studies relating to various challenges in education and technology use in society (20 marks)
(e) Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others' posts. (10 marks)

REFERENCES

1) Education and Social order by Bertrand Russel
2) Theories of learning by Bower and Hilgard
3) Technology and Society by Jan L Harrington

HU5176 PHILOSOPHY L T P C
3 0 0 3

OBJECTIVES

- To create a new understanding by teaching philosophy through a comparison of Indian and Western traditions.
- To Fosters critical thinking and imagination by dealing with inter-related concepts in literature and science.
- To bridge the gap between the sciences and humanities through introspective analyses.
- To nurture an understanding of the self and elucidates ways to progress towards a higher understanding of one's self and others.

UNIT I KNOWLEDGE 9

Knowledge (Vidya) Versus Ignorance (Avidya)- Brihadaranyaka Upanishad. Unity and Multiplicity – Isha Upanishad. What is True Knowledge? Ways to True Knowledge. Introduction to Philosophy of Yoga, Socratic Debate, Plato's Views. Asking and Answering Questions to Stimulate Critical Thinking and to Draw Ideas. Argumentative Dialogues. Dialectical Methods to Arrive at Conclusions.

UNIT II ORIGIN 9

Origin of Universe And Creation – 'NasidiyaSukta' in Relation With Big Bang Theory. Greek Concept of Chaos. The Concept of Space – Space as the Final Goal – Udgitha. Relationship Between Teacher And Student – The Knowledge Of Combinations, Body And Speech – Siksha Valli – Taittriya Upanishad.

UNIT III WORD 9

Aum- Speech and Breath as Pair – Chandogya Upanishad and Brihadaryanaka Upanishad. Significance of Chants, Structure of Language and Cosmic Correspondences. The Non-Dual Word – Bhartrihari'sVakyapadiyam. Sphota-Ultimate Reality Expressed Through Language. Intention. Thought 'Sabdanaor' and Speaking.

UNIT IV KNOWLEDGE AS POWER/OPPRESSION 9

Power- as Self-Realization in Gita. Krishna's Advice to Arjuna on How to Conquer Mind. Francis Bacon – Four Idols – What Prevents One From Gaining Knowledge? Michel Foucault- Knowledge as Oppression. Panopticon. Rtam (Truth) and Satyam (Eternal Truth).

UNIT V SELF KNOWLEDGE/BRAHMAN 9

Knowledge about Self, Transcendental Self. The Different Chakras and the Stages of Sublimation. Philosophy of Yoga and Siva for Union of Mind and Body. Concept of Yin/Yang. Aspects of the Feminine / Masculine.

TOTAL : 45 PERIODS

OUTCOMES:

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

1. Think sceptically, ask questions and to arrive at deductions.

2. Connect and relate different branches of thought.
3. Comprehends the relation between language, thought and action.
4. Arrive at a better understanding of self and others and forms a new outlook.

REFERENCES:

1. Swami Nikhilananda: The Upanishads, Swami Nikhilananda, Advaita Ashrama, Kolkata.
2. Swamy Tapasyananda: Srimad Bhagavad Gita, The Scripture of Mankind, Sri Ramakrishna Math, Chennai.
3. Subrahmanyam, Korada: Vakyapadiyam of BhartrhariBrahmakanda, Sri Garib Dass series.
4. Swami Lokeswarananda: Chandogya Upanishad, Swami Lokeswarananda, Ramakrishna Mission Institute of Culture, Kolkata.
5. Brahma, Apuruseya: The Four Vedas: Translated in English.
6. Haich, Elizabeth: Sexual Energy and Yoga.
7. Bacon, Francis: Power as Knowledge
8. Vlastos, Gregory: Socrates Ironist and Moral Philosopher.
9. Plato: The Republic, Penguin.
10. Gutting, Garry: Foucault A Very Short Introduction, Oxford.

HU5177APPLICATIONS OF PSYCHOLOGY IN EVERYDAY LIFE **LTP C**
3003

UNITI INTRODUCTION **7**
Natureandfields.

UNITII PSYCHOLOGYININDUSTRIESAND ORGANIZATIONS **9**
Jobanalysis; fatigueandaccidents;consumerbehavior.

UNITIII PSYCHOLOGY AND MENTALHEALTH **11**
Abnormality,symptomsandcausespsychological disorders

UNITIV PSYCHOLOGY AND COUNSELING **7**
NeedofCounseling, CounselorandtheCounselee,CounselingProcess,Areasof Counseling.

UNITV PSYCHOLOGY AND SOCIALBEHAVIOUR **11**
Group, groupdynamics, teambuilding,Prejudiceandstereotypes; EffectiveCommunication, conflictandnegotiation.

TOTAL:45PERIODS

TEXTBOOKS

1. Schultz,D.&Schultz,S.E.(2009). PsychologyandWorkToday(10thed.). New Jersey:Pearson/PrenticeHall
2. Butcher,J.N., Mineka,S.,&Hooley,J. M.(2010). Abnormal psychology(14th ed.).NewYork: Pearson
3. Gladding,S.T. (2014).Counselling:Acomprehensiveprofession. NewDelhi: PearsonEducation
4. Aronson, E.,Wilson, T. D.,&Akert, R. M.(2010).Social Psychology(7th Ed.). UpperSaddleRiver,NJ: PrenticeHall

HSMC– ELECTIVES – HUMANITIES II (EVEN SEMESTER)

HU5271 GENDER, CULTURE AND DEVELOPMENT L T P C
3 0 0 3

COURSE DESCRIPTION

This course offers an introduction to Gender Studies that asks critical questions about the meanings of sex and gender in Indian society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary drawing from Indian literature and media studies, to examine cultural assumptions about sex, gender, and sexuality. This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with class, caste and other social identities. This course also seeks to build an understanding of the concepts of gender, gender-based violence, sexuality, and rights and their impact on development through a number of discussions, exercises and reflective activities.

Objectives

- ✓ To familiarize students with the concepts of sex and gender through literary and media texts.
- ✓ To help students ask critical questions regarding gender roles in society.
- ✓ To provide students with the material to discuss gender issues such as gender based discrimination, violence and development.
- ✓ To help students think critically about gender based problems and solutions.

Learning Outcomes

- ➢ Students will be able to critically read literary and media texts and understand the underlying gender perspectives in them.
- ➢ Students will be able to analyse current social events in the light of gender perspectives.
- ➢ Students will be able to discuss, analyse and argue about issues related to gender and their impact on society, culture and development.

UNIT I: Introduction to Gender

- Definition of Gender
- Basic Gender Concepts and Terminology
- Exploring Attitudes towards Gender
- Social Construction of Gender

Texts:

1. Sukhu and Dukhu (Amar Chitra Katha)
2. The Cat who Became a Queen (Folk tale, J. Hinton Knowles, Folk-Tales of Kashmir. London: Kegan Paul, Trench, Trübner, and Company, 1893, pp. 8-10.)

UNIT II: Gender Roles and Relations

- Types of Gender Roles
- Gender Roles and Relationships Matrix
- Gender-based Division and Valuation of Labour

Texts:

1. Muniyakka (Short Story, Lakshmi Kannan, Nandanvan and Other Stories, Hyderabad: Orient Blackswan, 2011)
2. Video: Witness: Freeing Women From Cleaning Human Waste (2014, HRW, Manual Scavenging, India)

UNIT III: Gender Development Issues

- Identifying Gender Issues
- Gender Sensitive Language
- Gender, Governance and Sustainable Development
- Gender and Human Rights
- Gender and Mainstreaming

Texts:
1. The Many Faces of Gender Inequality (Essay, Amartya Sen, Frontline, Volume 18 - Issue 22, Oct. 27 - Nov. 09, 2001)
2. Tell Us Marx (Poem, Mallika Sengupta, Translated by Sanjukta Dasgupta)

UNIT IV: Gender-based Violence

- The concept of violence
- Types of Gender-based violence
- The relationship between gender, development and violence
- Gender-based violence from a human rights perspective

Texts:
1. Lights Out (Play, Manjula Padmanabhan)
2. Lights Out (Video of play enacted)

UNIT V: Gender and Culture

- Gender and Film
- Gender, Media and Advertisement

Texts:
1. Mahanagar (Movie: Satyajit Ray)
2. Beti Bachao Beti Padhao Advertisements

READINGS: Relevant additional texts for readings will be announced in the class. Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments.

ASSESSMENT AND GRADING:
Discussion & Classroom Participation: 20%
Project/Assignment: 30%
End Term Exam: 50%

HU5272 ETHICSANDHOLISTICLIFE L T P C
3 0 0 3

OBJECTIVES:

- To emphasize the meaningandnatureofethics,humanvalues and holisticlifeforleadingagood,successfulandhappylifethroughcontinuous examination ofthoughts andconductindaytodaylife.
- To understand thestatusandresponsibleroleofindividualinabatementofvaluecrisis incontemporary worldin ordertodevelopacivilizedandhumansociety.Understandingtheprocess ofethical decisionmakingthroughcritical assessmentofincidents/casesofethical dilemmasin personal,professionalandsociallife.
- Toview the placeofEthicsandHumanValuesin the developmentofindividual andsocietythroughidentificationandcrossexaminationoflifevaluesandworldviewofhis/herrole modelsinsociety.

UNIT I HUMAN LIFE, ITS AIM AND SIGNIFICANCE
The concept of a successful life, happy life and a meaningful life, Ethical and decision making capability and its development: Meaning of Ethical dilemma, sharing real life experiences.

UNIT II CREATIVEANDLEADERSHIPABILITYANDTHEIRDEVELOPMENT
Intellectual,Emotional,Creative,Ethico- spiritualdevelopment,Aestheticsense,Self-dependency,Activeness, Developmentofpositiveattitude.

UNIT III HARMONYINPERSONALANDSOCIALLIFE:
ConceptofpersonalandgroupEthics; Balancebetween- rights andduties- welfareofselfandwelfareofall, Creatingavaluebasedworkcultureinhostel, classroomandotherplacesinthecampus and society.

UNIT IV CHARACTER, RIGHTEOUSNESS AND VIRTUES FOR A MEANINGFUL LIFE

Egolessness, Humility, Righteousness, Purity, Truthfulness, Integrity, Self-restraint,Self-control, Senseofresponsibility, Empathy,Love,Compassion,Maitri/Comradeship,Cooperation,Tolerance.

UNIT V DILEMMABETWEENMATERIALISTICDEVELOPMENT AND HUMANWELFARE

Science,Technology, Consumerism,RelationwithNatureandEnvironment, New dimensionofGlobalHarmony:Democracy,Equality,SocialJustice

TOTAL:45 PERIODS

OUTCOMES:

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

1. Enablestudentstounderstandtheconceptofcontemporary ethicsatdifferentlevels:Individual, localandGlobalandenablethemtocrossexaminetheethicalandsocialconsequencesofthedecisions oftheirlife-viewandworldview.
2. Developtheability ofstudentstocreateabalancebetween theirindividualfreedomandsocial responsibilitiesandenablethemtoidentify thepersonal,professionalandsocialvaluesandintegrate themintheirpersonalityaftercross examination.
3. Enablestudentstocross examinetheirearlierdecisions takeninlifeandunderstandthemeaningof ethicaldilemmatoovercometheethicaldilemmas andengageincriticalreflection.
4. Developpositivehabits ofthoughtandconductandworkcohesivelywithfellowbeingswhohave varietyofstrengths,experiences,shortcomingsandchallenges,hencetoenablethemtohandlediverse typeofpersonalities.
5. Enablestudentstodevelopamethodformakingethically sounddecisionsforthemselves,within hostels, classrooms,universitycampus andsociety.

HU5273 LAW AND ENGINEERING LTP C

3003

UNITI THE LEGALSYSTEM:SOURCES OFLAWAND THE COURTSTRUCTURE 9

Enactedlaw -ActsofParliamentareofprimarylegislation,Common LaworCaselaw- Principlestaken fromdecisionsofjudgesconstitutebindinglegalrules.TheCourtSystemin India and Foreign Courtiers. (District Court, District Consumer Forum, Tribunals, High Courts,Supreme Court) Arbitration:Asan alternative to resolvingdisputes in the normal courts,partieswhoareindisputecanagreethatthiswill insteadbe referred toarbitration.

UNITII LAWS 9

Basicprinciplesofcontractlaw,saleofgoodslaw,lawsrelating toindustrialpollution, accident,environmental protection,healthandsafetyatwork,patentlaw,constitutionallaw: thesupremelawof theland, Informationtechnology lawandcybercrimes.

UNITIII BUSINESS ORGANISATIONS 9

Soletraders(Businesshasnoseparateidentity fromyou,allbusinesspropertybelongsto you).

Partnerships:TypesofPartnerships-Limited LiabilityPartnership, GeneralPartnership, LimitedPartnerships.Companies:Thenature ofcompanies,Classificationofcompanies, Formationofcompanies, Features ofapubliccompany,Carryingonbusiness,Directors– Their PowersandResponsibilities/Liabilities.

UNITIV LAWAND SOCIETY 9

Interdisciplinarynatureoflaw,legal ideologies/philosophy/schoolsofjurisprudence**.**

UNITV CASE STUDIES 9

Importantlegal disputesand judicial litigations

TOTAL:45PERIODS

HU5274 **FILM APPRECIATION** **L T P C**
3 0 0 3

COURSE DESCRIPTION

This is an intensive course designed to promote comprehensive understanding and insights into the nature of cinema and other related forms and practices. Movies, though at times are used more as escapism, they are also a true art form and expressive tool used by writers, directors and actors. This course will explore the aesthetics of cinema, the concepts behind storytelling and various other elements of a film. It will also explore the impact of movies in our society and in our lives. It also encourages students to use films as a medium to analyse visual texts and read underlying messages.

OBJECTIVES:

- To help learners understand the various movie genres and its types.
- To understand various elements that contributes to film making.
- To make them realize the impact of film in society.
- To analyse the visual media and interpret the underlying messages.

UNIT I THE COMPONENTS OF FILMS 9

Story, Screenplay & Script – Actors – Director – Crew Members – Mis En Scene – Structure of A Film – Narrative Elements – Linear & Non-Linear – Types of Movie Genres: Mysteries, Romantic Comedies, Horror Etc.

UNIT II EVOLUTION OF FILM 9

History of Films – Early Cinema – Silent Movies – Talkies – Film Language, Form, Movement – Film Theories – Realist, Auteurists, Feminist, Psychonalyic, Idealogical Theories.

UNIT III FILMS ACROSS THE WORLD 9

European Films – Russian Films – Japanese Films – Korean Films – Hollywood Film – Studio Culture – All Time Great Movies.

UNIT IV INDIAN FILMS 9

The Early Era – History Of Indian Cinema – Movies for Social Change – Hindi Movies that Created Impact – Regional Movies – Documentaries – Cultural Identity.

UNIT V INTERPRETING FILMS 9

Film Criticism & Appreciation – Censorship in Movies – Cultural Representation in Movies – Television – New Media & Online Media – Films Beyond Entertainment.

TOTAL: 45 PERIODS

OUTCOMES

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

- Recognize types of films, their impact on society and their roles in our lives.
- Have an understanding of the concepts of storytelling, Mise en Scene, and other elements of film making.
- Interpret the underlying messages in the movies.

Teaching Methods

- Each unit consists of reading materials, learning activities videos, websites. Students are expected to watch movies sometimes in class and at times at home and discuss in class.

Evaluation

- As this is course is critical appreciation course on films, there is no written end semester examination. The course is more on learning how to critically analyse a movie and appreciate its finer elements. Therefore evaluation can be based on assignments and discussions. Internals marks can be taken for the total marks.

Internal (100 % weightage)

- Assignment 1: Write a movie review with critical analysis (20 marks).
- Assignment2 : Write a script for a scene taken from a short story / novella (20 marks).
- Presentation: Students choose any one topic related to films and present it to the audience. (25 marks)

- Group discussion : Students discuss in groups on the various aspects of movies and its impact on society. (25 marks)
- Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others' posts. (10 marks)

REFERENCES

1. A Biographical Dictionary of Film by David Thomson, Secker & Warburg, 1975
2. Signs and Meaning in the Cinema by Peter Wollen, Secker & Warburg, 1969
3. The World Viewed by Stanley Cavell 1971
4. Film Style and Technology: History and Analysis by Barry Salt, Starword, 1983
5. The Encyclopedia of Indian Cinema Edited by Ashish Rajadhyaksha and Paul Willemen, BFI, 1994.

HU5275 FUNDAMENTALS OF LANGUAGE AND LINGUISTICS L T P C
3 0 0 3

OBJECTIVES

- To broadly introduce students to the formal and theoretical aspects of linguistics.
- To enable learners to understand the various practical applications of language and recent findings in the field of applied linguistics.

CONTENTS: -

UNIT I LANGUAGE AND LINGUISTICS: AN OVERVIEW 9

Language and Linguistics-Linguistic Knowledge-Knowledge of Sound Systems & Words – Creativity of Language – Relationship of form and meaning. Grammar – descriptive, prescriptive,universal-Human Language – Animal Language – Sign Language- Computers and Language.

UNIT II MORPHOLOGY - WORDS OF LANGUAGE 9

Content and function words – morphemes -free & bound –prefixes – suffixes – roots and stems – inflectional and derivational morphology-compound words and their formation – malapropisms – slips of the tongue.

UNIT III SYNTAX- THE SENTENCE PATTERNS OF LANGUAGE AND SEMANTICS-THE MEANING OF LANGUAGE 9

Syntax : Rules of Syntax- Sentence Structure-Structural Ambiguity-Syntactic Categories. Semantics: Lexical Semantics – Anomaly-Metaphors- Idioms- Synonyms – Antonyms – Homonyms -Pragmatics– Speech Acts

UNIT IV PHONETICS – THE SOUNDS OF LANGUAGE 9

Speech sounds- Introduction to branches of Phonetics- The Phonetic Alphabet – IPA – Consonants - Vowels – Diphthongs- Tone and Intonation.

UNIT V APPLIED LINGUISTICS - THE PRACTICAL APPLICATIONS OF LANGUAGE 9

Language learning and teaching (ELT)- lexicography-translation studies-computational linguistics-neurolinguistics (speech pathology and language disorders)- forensic linguistics – sociolinguistics.

TOTAL : 45 PERIODS

Teaching Methods :

Lectures, discussion.

Evaluation Internal and External:

Internal: 2 written tests + assignments, seminars, project (50+15+15+20).
External: A 3 hour written exam (50 marks)

REFERENCES :

1.Victoria Fromkin, Robert Rodman, Nina Hyams.2019.An Introduction to Language.USA.CENGAGE.11th edition
2. Cook. G,2003. Applied linguistics.UK: Oxford University Press.

HU5276 UNDERSTANDING SOCIETY AND CULTURE THROUGH LITERATURE L T P C
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OBJECTIVES

- To internalize theimportanceoflanguagebyunderstandingitsroleinthetransformationof man.
- Tolookat language, literatureandcultureaslocusofidentityandchange.
- Toextractmeaningfromexistingliteraturesandcultures.
- Toidentifymeanings inmodernlifebyreconnectingwithlost cultures.

UNITI INTRODUCTION

Whystudyliterature?Tracingtheorigin–pictures.Tokensasprecursorsofwriting.Movement fromthreedimensionsto twodimensions-Pictography.Fromvisualtooral-Logography.Reading outliteratureto youngchildren-EdmundJFarrell.

UNITII READINGCULTURE

Readingculture through language,signs and consumables-Roland Barthes.Culture through poems-NissimEzekiel's'ThenightoftheScorpion'.'Nothing'sChanged'-TatamkhuluAfrika- Apartheid. RuskinBond-'Night trainatDeoli'-Howreal lifeisdifferentfrom movies.

UNITIII IDENTIFYING MEANING

Searchingandlocatingmeaningthroughliterature.Lookingfororderinachaoticworld.TheMyth ofSisyphus(AlbertCamus)andAdiShankar's'JagatMithya'-theworldasanillusion.The Indian versionas'meaninglesss meaning'.

UNITIV POST MODERNISM

'Ifonawinter'snightatraveler'-ItaloCalvino.Thebookaboutthereader-theexperienceof readingasreading. Metafiction. SelfieCulture.Visual Cultureaspurposeof modernlife.

UNITV RETURNINGTOPICTURES

Literatureofthepresent-Emphasisonthevisualworld.Twitterature.SMS. Whatsapplanguage. Consumer culture. Changeinfixedgender notions. Interactivesessions. Introspection.

Readinglist

1. Bond,Ruskin: 'Night trainat Deoli'
2. Ezekiel,Nissim: 'TheNightof theScorpion'
3. Afrika,Tatamkhulu:'Nothing'sChanged'
4. Barthes,Roland: *Mythologies*
5. Shankaracharya:*VivekaChudamani*
6. Camus, Albert-*TheMythof Sisyphus*
7. Calvino,Italo: *If onawinter'snightatraveler*
8. Farrell,EdmundJ: 'Listen, mychildren,and youshall read'

OUTCOMES

- Canidentifytheconnectionsamonglanguage, literatureandculture.
- Isabletorelatebetweenseeminglydifferent aspectsoflife.
- Understandsthefractionsinmodernlifeandcanassimilatemeanings.