ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

B.E. PRODUCTION ENGINEERING

REGULATIONS – 2019

CHOICE BASED CREDIT SYSTEM

VISION OF THE DEPARTMENT

To develop disciplined, socially committed and technically competent Production Engineers with Creativity, Comprehension and Managerial skills to design and manufacture innovative cost effective quality products for the benefit of mankind.

MISSION OF THE DEPARTMENT

1. Train the students who will be able to design and manufacture Innovative, Environment Friendly, Ergonomic and Cost Effective Quality Products and Services.
2. Improve the technical quality of the students to meet the challenges, competitions and opportunities in production engineering.
3. Prepare the students who will be able to solve socially relevant engineering problems and other complex problems by means of inculcating Managerial Skills.
4. Enhance the department industry / research centre interaction by means of training, internship and student projects to solve industrial problems.

PROGRAMME EDUCATIONAL OBJECTIVES

1. The graduates acquire ability to create model, design, synthesize and analyze essential production operational skills, mechanism and automation system.
2. The graduates use their talent, self-confidence, knowledge and engineering practice which facilitate them to presume position of scientific and/or managerial leadership in their career paths.
3. The graduates apply their consciousness of moral, professional responsibilities and motivation to practice life-long learning in a team work environment.

PROGRAMME OUTCOMES

1. Graduate will demonstrate strong basics in mathematics, science and engineering which serve as the foundation for the Programme.
2. Graduate will demonstrate the ability to design and conduct experiments, as well as to analyse and interpret data in the spheres of fundamental engineering.
3. Graduate will demonstrate the ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
4. Graduate will become familiar with modern engineering tools and analyse the problems within the domains of Production Technology as the members of multidisciplinary teams
5. Graduate will acquire the capability to identify, formulate and solve engineering problems related to production engineering.
6. Graduate will demonstrate an understanding of professional and ethical responsibility with reference to their career in the field of production engineering.
7. Graduate will be able to communicate effectively both in verbal and non verbal forms.
8. Graduate will be trained towards developing and understanding the impact of development of Production Technology on global, economic, environmental and societal context.
9. Graduate will be capable of understanding the value for life-long learning.
10. Graduate will demonstrate knowledge of contemporary issues pertaining to the health and well being of desirable living forms inhabiting the environment.
11. Graduate will demonstrate the ability to use the techniques, skills and modern engineering tools necessary for engineering practice in the field of Production Engineering.
12. Graduate will be able to design and develop innovative/ manufacturable / marketable /

environmental friendly products useful to the nation and the society.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	✓	✓	✓	✓				✓	✓	✓	✓	✓
PEO2	✓	✓	✓	✓			✓	✓	✓			
PEO3					✓	✓	✓		✓			

Mapping of PEOs and POs

PROGRAMME SPECIFIC OUTCOMES (PSOs)

By completion of Production Engineering, the graduates will have following Program specific outcomes:

1. Knowledge on Production system: Familiarization of basic and advanced systems and practices.
2. Knowledge on design, analysis and development of Production processes, automation and quality systems.
3. Foundation of continuous improvement: Knowledge on application of appropriated materials, production processes and production system and development of an optimal solution to achieve continuous improvement to cater the needs of industry and society.

MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES:

SEMESTER I

S. No	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Theory													
1	Technical English												
2	Engineering Mathematics- I												
3	Engineering Physics												
4	Engineering Chemistry												
5	Engineering Graphics	✓		✓		✓					✓		✓
Practical													
6	Basics Sciences Laboratory												
7	Workshop Practices Laboratory	✓	✓	✓	✓								

SEMESTER II

S. No	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Theory													
1	Professional Communication												
2	Engineering Mathematics-II												
3	Problem Solving and Python Programming	✓	✓	✓	✓	✓			✓	✓			✓
4	Basics of Electrical and Electronics Engineering	✓	✓	✓	✓	✓							
5	Engineering	✓		✓									

	Mechanics												
6	Materials Science												
Practical													
7	Problem Solving and Python Programming Laboratory	✓	✓	✓	✓	✓			✓	✓			✓
8	Electrical and Electronics Engineering Laboratory	✓	✓	✓	✓								✓

SEMESTER III

S. No	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Theory													
1.	Numerical Methods												
2.	Mechanics of Solids	✓	✓	✓	✓	✓				✓	✓	✓	✓
3.	Thermodynamics and Thermal Engineering	✓	✓	✓	✓	✓				✓	✓	✓	✓
4.	Fluid Mechanics and Fluid Machines	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Practical													
5.	Computer Aided Drafting and Machining Laboratory	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
6.	Material Testing and Thermal Engineering Laboratory	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓

SEMESTER IV

S.No.	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
Theory													
1.	Environmental Sciences	✓		✓	✓				✓	✓	✓	✓	✓
2.	Foundry and Welding Technology	✓	✓	✓	✓				✓	✓	✓	✓	✓
3.	Engineering Materials	✓	✓	✓	✓				✓	✓	✓	✓	✓
4.	Machining Processes and Machine Tools	✓	✓	✓	✓				✓	✓	✓	✓	✓
5.	Kinematics and Dynamics of Machines	✓	✓	✓	✓				✓	✓	✓	✓	✓
Practical													
6.	Machining Processes Laboratory	✓	✓		✓				✓	✓	✓	✓	✓
7.	Foundry, Welding and Metallurgy Laboratory	✓	✓		✓				✓	✓	✓	✓	✓

SEMESTER V

S. No	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
Theory													
1	Statistics for Production Management	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
2	Constitution of India						✓	✓	✓	✓	✓		
3	Engineering Metrology	✓	✓	✓	✓				✓	✓	✓	✓	✓
4	Fluid Power Systems	✓	✓	✓	✓				✓	✓	✓	✓	✓
5	Machine Components Design	✓	✓	✓	✓				✓	✓	✓	✓	✓
6	Professional Elective I												
Practical													
7	Fluid Power Systems Laboratory	✓	✓		✓				✓	✓	✓	✓	✓
8	Engineering Metrology Laboratory	✓	✓		✓				✓	✓	✓	✓	✓

SEMESTER VI

S.No	Corse Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Theory													
1	Metal Forming	✓			✓				✓	✓	✓	✓	✓
2	CNC Machines	✓			✓				✓	✓	✓	✓	✓
3	Computer Aided Design and Analysis	✓	✓	✓	✓				✓	✓	✓	✓	✓
4	Professional Elective II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	Professional Elective III	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6	Open Elective I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Practical													
7	CNC and Metal Forming Laboratory	✓	✓		✓				✓	✓	✓	✓	✓
8	Modeling and Analysis Laboratory	✓	✓		✓				✓	✓	✓	✓	✓

SEMESTER VII

S.No	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
Theory													
1	Mechatronics for Automation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	Computer Integrated Manufacturing Systems	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
3	Professional Elective IV												
4	Professional Elective V												
5	Professional Elective VI												
6	Open Elective II												
Practical													
7	Internship/ Certificate Courses (4 Weeks)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	Project I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

SEMESTER VIII

S.No	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Professional Elective VII												
2	Project II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

PROFESSIONAL ELECTIVE COURSES (PEC)

S. No	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
1.	Smart Materials for Manufacturing	✓	✓	✓	✓				✓	✓	✓	✓	✓
2.	Surface Engineering	✓	✓	✓	✓				✓	✓	✓	✓	✓
3.	Disaster Management	✓			✓				✓	✓	✓	✓	✓
4.	Human Rights	✓		✓			✓	✓	✓	✓	✓	✓	
5.	Engineering Ethics and Human Values		✓			✓	✓	✓	✓	✓	✓		✓
6.	Electronic Materials and Processing	✓	✓	✓	✓				✓	✓	✓	✓	✓
7.	Advances in Operations Research	✓	✓	✓	✓				✓	✓	✓	✓	✓
8.	Heat Transfer	✓	✓	✓	✓				✓	✓	✓	✓	✓
9.	Elements of Green Manufacturing	✓	✓	✓	✓				✓	✓	✓	✓	✓
10.	Industrial Management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
11.	Design of Casting and Weldments	✓	✓	✓	✓				✓	✓	✓	✓	✓
12.	Computer Aided Product Design	✓	✓	✓	✓				✓	✓	✓	✓	✓
13.	Quantitative Techniques in Management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
14.	Green Electronics Manufacturing	✓			✓				✓	✓	✓	✓	✓
15.	Lean Manufacturing	✓		✓	✓				✓	✓	✓	✓	✓
16.	Micro Electro Mechanical Systems and Nano Technology	✓	✓	✓	✓				✓	✓	✓	✓	✓
17.	Micromachining and Fabrication	✓	✓	✓	✓				✓	✓	✓	✓	✓
18.	Modern Concepts in Manufacturing	✓	✓	✓	✓				✓	✓	✓	✓	✓
19.	Non Destructive Testing Methods	✓	✓	✓	✓				✓	✓	✓	✓	✓
20.	Processing of Plastics and Polymers	✓		✓	✓				✓	✓	✓	✓	✓
21.	Processing and Properties of Composites	✓		✓	✓				✓	✓	✓	✓	✓
22.	Purchasing and Materials Management	✓		✓	✓		✓		✓	✓	✓	✓	✓
23.	Selection and Treatment of Materials	✓			✓				✓	✓	✓	✓	✓
24.	Supply Chain Management	✓		✓	✓		✓		✓	✓	✓	✓	✓
25.	Total Quality Management: Principles and Applications	✓		✓	✓		✓		✓	✓	✓	✓	✓
26.	Unconventional Machining Processes	✓	✓	✓	✓				✓	✓	✓	✓	✓
27.	Integrated Product Development	✓	✓	✓	✓				✓	✓	✓	✓	✓
28.	Production of automotive Components	✓	✓	✓	✓				✓	✓	✓	✓	✓
29.	Additive Manufacturing	✓		✓	✓				✓	✓	✓	✓	✓
30.	Process Planning and Cost Estimation	✓		✓	✓		✓		✓	✓	✓	✓	✓
31.	Robotic Technology	✓	✓	✓	✓				✓	✓	✓	✓	✓

32.	Finite Element Analysis in Application	✓	✓	✓	✓				✓	✓	✓	✓	✓
33.	Theory of Metal Cutting	✓	✓	✓	✓				✓	✓	✓	✓	✓
34.	Tool Design	✓	✓	✓	✓				✓	✓	✓	✓	✓

ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
B.E. PRODUCTION ENGINEERING
REGULATION-2019
CHOICE BASED CREDIT SYSTEM

CURRICULA AND SYLLABI FOR I TO VIII SEMESTERS

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	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	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	HS5251	Professional Communication	HSMC	4	0	0	4	4
2.	MA5252	Engineering Mathematics - II	BSC	3	1	0	4	4
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.	PH5251	Materials Science	BSC	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	**19**	**2**	**8**	**29**	**25**

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1		Elective – Humanities I	HSMC	3	0	0	3	3
2	MA5353	Numerical Methods	BSC	3	1	0	4	4
3	AU5352	Mechanics of Solids	PCC	3	0	0	3	3
4	AU5351	Thermodynamics and Thermal Engineering	PCC	3	1	0	4	4
5	AE5351	Fluid Mechanics and Fluid Machines	PCC	3	0	0	3	3
PRACTICALS								
6.	PR5311	Computer Aided Drafting and Machining Laboratory	PCC	0	0	4	4	2
7.	PR5312	Material Testing and Thermal Engineering Laboratory	PCC	0	0	4	4	2
			TOTAL	**15**	**2**	**8**	**25**	**21**

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Elective – Humanities II	HSMC	3	0	0	3	3
2.	GE5251	Environmental Sciences	BSC	3	0	0	3	3
3.	PR5401	Foundry and Welding Technology	PCC	3	0	0	3	3
4.	PR5402	Engineering Materials	PCC	3	0	0	3	3
5.	PR5403	Machining Processes and Machine Tools	PCC	3	0	0	3	3
6.	PR5451	Kinematics and Dynamics of Machines	PCC	3	1	0	4	4
7.		Audit Course – I*	AC	3	0	0	3	0
PRACTICALS								
8.	PR5411	Machining Processes Laboratory	PCC	0	0	4	4	2
9.	PR5412	Foundry, Welding and Metallurgy Laboratory	PCC	0	0	4	4	2
			TOTAL	**21**	**1**	**8**	**30**	**23**

*Audit Course is optional.

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	GE5551	Statistics for Production Management	HSMC	3	0	0	3	3
2.	PR5501	Engineering Metrology	PCC	3	0	0	3	3
3.	PR5502	Fluid Power Systems	PCC	3	0	0	3	3
4.	PR5503	Machine Components Design	PCC	3	1	0	4	4
5.		Professional Elective I	PEC	3	0	0	3	3
6.		Audit Course – II*	AC	3	0	0	3	0
PRACTICALS								
7.	PR5511	Fluid Power Systems Laboratory	PCC	0	0	4	4	2
8.	PR5512	Engineering Metrology Laboratory	PCC	0	0	4	4	2
			TOTAL	**18**	**1**	**8**	**27**	**20**

*****Audit course is optional.

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	PR5601	Metal Forming	PCC	3	0	0	3	3
2.	PR5602	CNC Machines	PCC	3	0	0	3	3
3.	PR5603	Computer Aided Design and Analysis	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
PRACTICALS								
7.	PR5611	CNC and Metal Forming Laboratory	PCC	0	0	4	4	2
8.	PR5612	Modeling and Analysis Laboratory	PCC	0	0	4	4	2
			TOTAL	**18**	**0**	**8**	**26**	**22**

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	PR5701	Mechatronics for Automation	PCC	3	0	2	5	4
2.	PR5702	Computer Integrated Manufacturing Systems	PCC	3	0	0	3	3
3.		Professional Elective IV	PEC	3	0	0	3	3
4.		Professional Elective V	PEC	3	0	0	3	3
5.		Professional Elective VI	PEC	3	0	0	3	3
6.		Open Elective II	OEC	3	0	0	3	3
PRACTICALS								
7.	PR5711	Internship/ Certificate Courses (4 Weeks)	EEC	0	0	4	4	2
8.	PR5712	Project I	EEC	0	0	6	6	3
			TOTAL	**18**	**0**	**12**	**30**	**24**

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

SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Professional Elective VII	PEC	3	0	0	3	3
PRACTICALS								
2.	PR5811	Project II	EEC	0	0	16	16	8
			TOTAL	**3**	**0**	**16**	**19**	**11**

TOTAL CREDITS: 167

HUMANITIES AND SOCIAL SCIENCES (HSMC) – MANAGEMENT AND OTHERS

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	C
				L	T	P		
1.	HS5151	Technical English	HSMC	4	0	0	4	4
2.	HS5251	Professional Communication	HSMC	3	0	0	3	3
3.	GE5551	Statistics for Production Management	HSMC	3	0	0	3	3

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 SCIENCES COURSES (BSC)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	C
				L	T	P		
1.	MA5158	Engineering Mathematics - I	BSC	3	1	0	4	4
2.	PH5151	Engineering Physics	BSC	3	0	0	3	3
3.	CY5151	Engineering Chemistry	BSC	3	0	0	3	3
4.	BS5161	Basic Sciences Laboratory	BSC	0	0	4	4	2
5.	MA5252	Engineering Mathematics-II	BSC	3	1	0	4	4
6.	PH5251	Materials Science	BSC	3	0	0	3	3
7.	MA5353	Numerical Methods	BSC	3	1	0	4	4
8.	GE5251	Environmental Sciences	BSC	3	0	0	3	3

ENGINEERING SCIENCES COURSES (ESC)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	C
1.	GE5151	Engineering Graphics	ESC	1	0	4	5	5
2.	GE5162	Workshop Practices Laboratory	ESC	0	0	4	4	2
3.	GE5161	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
4.	GE5153	Problem Solving and Python Programming	ESC	3	0	0	3	3
5.	GE5152	Engineering Mechanics	ESC	3	1	0	4	4
6.	EE5251	Basics of Electrical and Electronics Engineering	ESC	3	0	0	3	3
7.	EE5261	Electrical and Electronics Engineering Laboratory	ESC	0	0	4	4	2

PROFESSIONAL CORE COURSES (PCC)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	C
				L	T	P		
1.	AU5352	Mechanics of Solids	PCC	3	0	0	3	3
2.	AU5351	Thermodynamics and Thermal Engineering	PCC	3	1	0	4	4
3.	AE5351	Fluid Mechanics and Fluid Machines	PCC	3	0	0	3	3
4.	PR5402	Engineering Materials	PCC	3	0	0	3	3
5.	PR5403	Materials Science for Production Engineers	PCC	3	0	0	3	3
6.	PR5401	Foundry and Welding Technology	PCC	3	0	0	3	3
7.	PR5403	Machining Processes and Machine Tools	PCC	3	0	0	3	3
8.	PR5451	Kinematics and Dynamics of Machines	PCC	3	1	0	4	4
9.	PR5501	Engineering Metrology	PCC	3	0	0	3	3
10.	PR5502	Fluid Power Systems	PCC	3	0	0	3	3
11.	PR5503	Machine Components Design	PCC	3	1	0	4	4
12.	PR5602	CNC Machines	PCC	3	0	0	3	3
13.	PR5603	Computer Aided Design and Analysis	PCC	3	0	0	3	3
14.	PR5701	Mechatronics for Automation	PCC	3	0	2	5	4
15.	PR5702	Computer Integrated Manufacturing Systems	PCC	3	0	0	3	3
16.	PR5601	Metal forming	PCC	3	0	2	5	4
17.	PR5311	Computer Aided Drafting and Machining Laboratory	PCC	0	0	4	4	2
18.	PR5312	Material Testing and Thermal Engineering Laboratory	PCC	0	0	4	4	2
19.	PR5411	Machining Processes Laboratory	PCC	0	0	4	4	2
20.	PR5412	Foundry, Welding and Metallurgy Laboratory	PCC	0	0	4	4	2
21.	PR5511	Fluid Power Systems Laboratory	PCC	0	0	4	4	2
22.	PR5512	Engineering Metrology Laboratory	PCC	0	0	4	4	2
23.	PR5611	CNC and Metal Forming Laboratory	PCC	0	0	4	4	2
24.	PR5612	Modeling and Analysis Laboratory	PCC	0	0	4	4	2

AUDIT COURSES (AC)

Registration for any of these courses is optional to students

Sl. No	Course Code	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 ELECTIVE COURSES

Semester V, Elective I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	Periods per Week			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	PR5001	Micromachining and Fabrication	PEC	3	0	0	3	3
2.	PR5002	Modern Concepts in Manufacturing	PEC	3	0	0	3	3
3.	MF5652	Additive Manufacturing	PEC	3	0	0	3	3
4.	PR5003	Tool Design	PEC	3	0	0	3	3
5.	PR5004	Unconventional Machining Processes	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.	PR5074	Materials Procurement Management	PEC	3	0	0	3	3
2.	PR5005	Selection and Treatment of Materials	PEC	3	0	0	3	3
3.	IE5751	Supply Chain Management	PEC	3	0	0	3	3
4.	PR5006	Theory of Metal Cutting	PEC	3	0	0	3	3
5.	GE5001	Industrial 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.	PR5007	Elements of Green Manufacturing	PEC	3	0	0	3	3
2.	PR5008	Design of Casting and Weldments	PEC	3	0	0	3	3
3.	PR5009	Computer Aided Product Design	PEC	3	0	0	3	3
4.	PR5010	Green Electronics Manufacturing	PEC	3	0	0	3	3
5.	PR5072	Production of automotive Components	PEC	3	0	0	3	3

Semester VII, Elective IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	Periods per Week			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	ME5081	Process Planning and Cost Estimation	PEC	3	0	0	3	3
2.	PR5073	Robotic Technology	PEC	3	0	0	3	3
3.	PR5011	Finite Element Analysis in Application	PEC	3	0	0	3	3
4.	GE5002	Quantitative Techniques in Management	PEC	3	0	0	3	3

Semester VII, Elective V

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	Periods per Week			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	PR5012	Advances in Operations Research	PEC	3	0	0	3	3
2.	PR5013	Heat Transfer	PEC	3	0	0	3	3
3.	PR5014	Lean Manufacturing	PEC	3	0	0	3	3
4.	PR5015	Non - Destructive Testing Methods	PEC	3	0	0	3	3
5.	PR5071	Processing of Plastics and Polymers	PEC	3	0	0	3	3

Semester VII, Elective VI

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	Periods per Week			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	PR5016	Processing of Composites	PEC	3	0	0	3	3
2.	PR5017	Smart Materials for Manufacturing	PEC	3	0	0	3	3
3.	PR5018	Corrosion Engineering	PEC	3	0	0	3	3
4.	GE5071	Disaster Management	PEC	3	0	0	3	3
5.	GE5077	Engineering Ethics and Human Values	PEC	3	0	0	3	3

Semester VIII, Elective VII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	Periods per Week			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	GE5072	Human Rights	PEC	3	0	0	3	3
2.	PR5019	Electronic Materials and Processing	PEC	3	0	0	3	3
3.	PR5020	Micro Electro Mechanical Systems and Nano Technology	PEC	3	0	0	3	3
4.	PR5021	Total Quality Management: Principles and Applications	PEC	3	0	0	3	3
5.	PR5022	Integrated Product Development	PEC	3	0	0	3	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	Periods per Week			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	PR5711	Internship/Certificate Courses	EEC	0	0	4	4	2
2.	PR5712	Project - I	EEC	0	0	6	6	3
3.	PR5811	Project - II	EEC	0	0	16	16	8

UG : Production Engineering									
	Subject Area	Credit per semester							Credit Total
		I	II	III	IV	V	VI	VII	VIII	
1.	HSMC	04	04	03	03	03	-	-	-	**17**
2.	BSC	12	07	04	03	-	-	-	-	**26**
3.	ESC	05	14	04	-	-	-	-	-	**23**
4.	PCC	-	-	11	17	14	13	07	-	**62**
5.	PEC	-	-	-	-	03	06	09	03	**21**
6.	OEC	-	-	-	-	-	03	03	-	**06**
7.	EEC	-	-	-	-	-	-	05	08	**13**
8.	AC	-	-	-	-	-	-	-	-	**00**
		21	**25**	**22**	**23**	**20**	**22**	**24**	**11**	**168**

HS5151 **TECHNICAL ENGLISH** **L T P C**
4 0 0 4

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) - **Vocabulary Development**: 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: 60 PERIODS

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 MATHEMATI CS – I (Common to all branches of B.E. / B.Tech. Programmes in I Semester)	L 3	T 1	P 0	C 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 n 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.

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, New Delhi, 2017.
2. James Stewart, "Calculus with Early Transcendental Functions", Cengage Learning, 6th Edition, 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.,), 7th Edition, 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**

COURSE OBJECTIVES:

- 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

COURSE OUTCOMES:

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.

CY5151 ENGINEERING CHEMISTRY (COMMON TO ALL BRANCHES)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- 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, photo processes 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

COURSE OUTCOMES:

- 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. R. Gowariker, 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.

UNIT I 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

UNIT II 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.

UNIT III 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.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 15

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.

UNIT V 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, 2nd Ed., 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	0.9				0.9					0.6		0.6	0.6	0.9	0.6
2	0.9									0.6		0.6	0.6	0.6	
3	0.9				0.9					0.6		0.6	0.6	0.6	
4	0.9		0.6		0.9					0.6		0.6	0.6	0.6	
5	0.9		0.9		0.9					0.6		0.6	0.6	0.6	

BS5161	BASIC SCIENCES LABORATORY	L	T	P	C
	(Common to all branches of B.E. / B.Tech Programmes)	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 (8th 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; Sawing; planing; making joints in wood materials used in common household wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
4. 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) Assembling an air conditioner.

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 (P: 60) = 60 PERIODS

COURSE OUTCOMES:

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

1. Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
2. Wire various electrical joints in common household electrical wire work.
3. Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
4. Solder and test 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	0.6	0.3											0.3	0.3	
2		0.6	0.6											0.6	
3		0.6	0.3										0.6	0.6	
4		0.6	0.6	0.3										0.6	

HS5251 PROFESSIONAL COMMUNICATION L T P C
4 0 0 4

COURSE OBJECTIVES

The course entitles 'Professional Communication' aims to,

- Improve the relevant language skills necessary for professional communication.
- Develop linguistic and strategic competence in workplace context.
- Enhance language proficiency and thereby the employability of budding engineers and technologists.

UNIT I TECHNICAL COMMUNICATION 12

Listening: Listening to telephone conversations (intent of the speaker and note taking exercises)- Speaking: Role play exercises based on workplace contexts, introducing oneself- Reading: Reading the interview of an achiever and completing exercises (skimming, scanning and predicting)- Writing: Writing a short biography of an achiever based on given hints- Grammar: Asking and answering questions, punctuation in writing, prepositional phrases- Vocabulary Development: use of adjectives.

UNIT II SUMMARY WRITING 12

Listening: Listening to talks/lectures both general and technical and summarizing the main points- Speaking: Participating in debates- Reading: Reading technical essays/ articles and answering comprehension questions-Writing: Summary writing-Grammar: Participle forms, relative clauses- Vocabulary Development: Use of compound words, abbreviations and acronyms.

UNIT III PROCESS DESCRIPTION 12

Listening: Listening to a process description and drawing a flowchart-Speaking: Participating in Group Discussions, giving instructions- Reading: Reading instruction manuals- Writing: Writing process descriptions- Writing instructions- Grammar: Use of imperatives, active and passive voice, sequence words- Vocabulary Development: Technical jargon

UNIT IV REPORT WRITING 12

Listening: Listening to a presentation and completing gap-filling exercises- Speaking: Making formal presentations- Reading: Reading and interpreting charts/tables and diagrams- Writing: Interpreting charts/tables and diagrams, writing a report- Grammar: Direct into indirect speech, use of phrases- Vocabulary Development: reporting words

UNIT V WRITING JOB APPLICATIONS 12

Listening: Listening to a job interview and completing gap=filling exercises- Speaking: Mock interview, telephone interviews- Reading: Reading a job interview, SOP, company profile and completing comprehension exercises- Writing: job applications and resumes and SOPs-Grammar: Present perfect and continuous tenses- Vocabulary Development: Technical vocabulary.

TOTAL : 45 PERIODS

LEARNING OUTCOMES

At the end of the second semester the learners should be able to,

- Read and comprehend technical texts effortlessly.
- Write reports of a technical kind.
- Speak with confidence in interviews and thereby gain employability

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.

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.

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

COURSE OBJECTIVES:

- 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.
- Simple programs on print statements, arithmetic operations.

SUGGESTED EVALUATION METHODS:

- Assignments on pseudocodes and flowcharts.
- Tutorials on Python programs.

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 implementation using Operators, Conditionals, Iterative Constructs and Functions.
- Implementation of a simple 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, dictionaries etc.
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

COURSE OBJECTIVES:

- 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

COURSE OUTCOMES:

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.

UNIT II 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.

UNIT III 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, Sanjeev Sanghi, 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, 4th Edition, 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 Sukumar Pati, Engineering Mechanics, 5th Edition, McGraw Hill Higher Education, 2013.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	0.9	0.6	0.6	0.3								0.6	0.9	0.3	0.3
2	0.9	0.6	0.6	0.3								0.6	0.9	0.3	0.3
3	0.9	0.6	0.9	0.3								0.6	0.9	0.3	0.6
4	0.9	0.6	0.9	0.3								0.6	0.9	0.3	0.6
5	0.9	0.6	0.9	0.3								0.6	0.9	0.3	0.6

PH5251 MATERIALS SCIENCE L T P C

(Common to Mechanical, Manufacturing, Industrial, Mining, Aeronautical, Automobile and Production Engineering & Rubber and Plastics Technology) **3 0 0 3**

COURSE OBJECTIVES:

- To make the students to understand the basics of crystallography and crystal imperfections.
- To introduce various strengthening methods of materials, and also various mechanical properties and their measurement.
- To impart knowledge on the basics of phase diagrams and their applications.
- To learn about iron-carbon system, and about various ferrous and non-ferrous alloys.
- To introduce the preparation, properties and applications of ceramics, composites and nanomaterials.

UNIT I CRYSTALLOGRAPHY 9

Crystallographic directions and planes – metallic crystal structures: BCC, FCC and HCP – linear and planar densities – crystal imperfections- edge and screw dislocations, Burgers vector and elastic strain energy- surface imperfections – grain and twin boundaries – Polymorphism – phase changes – nucleation and growth – homogeneous and heterogeneous nucleation.

UNIT II MECHANICAL PROPERTIES 9

Tensile test - plastic deformation by slip – slip systems – mechanisms of strengthening in metals: strain hardening, grain size reduction, solid solution strengthening, precipitation hardening – Creep: creep curves, stress and temperature effects, mechanisms of creep, creep-resistant materials – Fracture: ductile and brittle fractures - the Griffith criterion – fracture toughness - Fatigue failure: the S-N curve – factors that affect fatigue life – Hardness: Rockwell and Brinell hardness tests, Knoop and Vickers microhardness tests.

UNIT III PHASE DIAGRAMS 9

Basic concepts - Gibbs phase rule – Unary phase diagram (iron) - Binary phase diagrams: isomorphous systems (Cu-Ni) – determination of phase composition and phase amounts – tie line and lever rule - binary eutectic diagram with no solid solution and limited solid solution (Pb-Sn) – eutectoid and peritectic reactions - other invariant reactions – micro structural development during the slow cooling: eutectic, hypereutectic and hypoeutectic compositions.

UNIT IV FERROUS AND NONFERROUS ALLOYS 9

The Fe-Fe_3C phase diagram: phases, invariant reactions, development of microstructure in eutectoid, hypoeutectoid and hypereutectoid alloys – influence of other alloying elements in the Fe-C system - phase transformations – isothermal transformation diagram for eutectoid iron-carbon alloy – microstructures: pearlite, bainite, spheroidite and martensite – steels, stainless steels and cast irons – copper alloys – aluminum alloys – titanium alloys.

UNIT V CERAMICS, COMPOSITES AND NANO MATERIALS 9

Ceramics – types and applications- refractories, abrasives and cements – Composites: classification, role of matrix and reinforcement - Fiber reinforced composites – carbon-carbon composites – Nanomaterials: types, physical, chemical and mechanical properties - carbon nanotubes: properties and applications - synthesis of nanomaterials: sonochemical, molecular epitaxy, physical vapor deposition (PVD) and chemical vapor deposition (CVD). Characterization: Transmission electron microscopy - scanning electron microscopy - Atomic force microscopy - X-ray powder diffraction - Nanoparticle size calculation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will

- Understand the basics of crystallography and its importance in materials properties
- Understand the significance of dislocations, strengthening mechanisms, and tensile, creep, hardness and fracture behavior of materials
- Gain knowledge on binary phase diagrams, and also will be able to determine the phase composition and phase amount.
- Understand about the Fe-C system and various microstructures in it, and also about various ferrous and non-ferrous alloys.
- Get adequate understanding on the preparation, properties and applications of ceramics, composites and nanomaterials.

REFERENCES

1. W.D.Callitser and D.G.Rethwish. Materials Science and Engineering. John Wiley & Sons, 2014.
2. V.Raghavan. Materials Science and Engineering: A First Course. PHI Learning, 2015.
3. M.F.Ashby, P.J.Ferreira and D.L.Schodek. Nanomaterials, Nanotechnologies and Design: An Introduction for Engineers, 2011.
4. J.F.Shackelford. Introduction to Materials Science for Engineers. Pearson, 2015.
5. D.R. Askeland and W.J.Wright. Essentials of Materials Science and Engineering, Cengage Learning, 2013.
6. W.F.Smith, J.Hashemi and R.Prakash. Materials Science and Engineering. McGraw Hill Education, 2017.

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

COURSE OBJECTIVES:

- 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	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

EE5261 ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES

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

COURSE OUTCOMES:

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

MA5353 **NUMERICAL METHODS** **L T P C**
3 1 0 4

COURSE OBJECTIVES:

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

UNIT I SOLUTION 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 II INTERPOLATION 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 III NUMERICAL 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 IV INITIAL 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.

AU5352 MECHANICS OF SOLIDS L T P C
3 0 0 3

COURSE OBJECTIVES:

The objective of this course is

i. To know about how a solid (materials, structures) behaves when it is exposed to forces and deformations.
ii. To apply the fundamental concepts of principle of superposition, equilibrium, compatibility, force- deformation, and stress-strain relationships to the solid and structural mechanics problems
iii. To analyze determinate and indeterminate bars, beams, to determine axial forces, torques, shear forces, and bending moments
iv. To have physical insight into distribution of stresses and strains in structural members
v. To identify the biaxial stresses in acting in a body or an element.

UNIT I STRESS - STRAIN, AXIAL LOADING 9

Stress and strain, elastic limit, Hooke's law, factor of safety, shear stress, shear strain, relationship between elastic constants. Stresses in stepped bars, uniformly varying sections, composite bars due to axial force. Lateral strain, Poisson's ratio, volumetric strain, changes in dimensions and volume. Thermal stresses and impact loading.

UNIT II STRESSES IN BEAMS 9

Beam – Definition, types of end supports, types of beam, types of loading. Shear force diagram and bending moment diagram for cantilever, simply supported and overhanging beams under point load, UDL, UVL and moments. Euler beam theory - Bending equation, section modulus, Bending stress in beams – Shear stress in beams.

UNIT III DEFLECTION OF BEAMS AND COLUMNS 9

Governing differential equation - Problems on Double integration method -Macaulay's Method – Moment area method. Concepts of Conjugate Beam method and Method of superposition. Columns – different end conditions – buckling load – Euler's theory – Rankine's formula.

UNIT IV TORSION AND SPRINGS 9

Theory of torsion and assumptions - torsion equation, polar modulus, stresses in solid and hollow circular shafts, power transmitted by a shaft, shafts in series and parallel, deflection in shafts fixed at the both ends. Springs – types, Deflection expression for closed coiled helical spring – Stress in springs - design of springs.

UNIT V BIAXIAL STRESS 9

Principal stresses, normal and tangential stresses, maximum shear stress - analytical and graphical method. Stresses in combined loading. Thin walled cylinder under internal pressure – changes in dimensions – volume. spherical shells subjected to internal pressure – deformation in spherical shells – Lame's theory.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students are expected to

i. Know about how a solid (materials, structures) behaves when it is exposed to forces and deformations.
ii. Apply the fundamental concepts of principle of superposition, equilibrium, compatibility, force- deformation, and stress-strain relationships to the solid and structural mechanics problems
iii. Analyze determinate and indeterminate bars, beams, to determine axial forces, torques, shear forces, and bending moments
iv. Have physical insight into distribution of stresses and strains in structural members
v. Identify the biaxial stresses in acting in a body or an element.

TEXT BOOKS:

1. James M Gere, Barry J Goodno, "Mechanics of Materials, SI Edition", Ninth Edition, Cengage Learning, 2018
2. Russell C. Hibbeler, "Mechanics of Materials", Tenth Edition, Pearson education, 2017
3. Stephen Timoshenko, 'Strength of Materials', Vol I & II, CBS Publishers and Distributors, 3rd edition, 2004.

REFERENCES:

1. Clive L. Dym , Irving H. Shames, "Solid Mechanics : A Variational Approach, Augmented Edition", Springer publishers, 2013
2. Roy R Craig, "Mechanics of Materials", Third Edition, John Wiley & Sons, 2011
3. R.K.Rajput, 'Strength of Materials', S Chand; 4th Rev. Edition 2007.
4. Timothy A. Philpot, "Mechanics of Materials: An Integrated Learning System," 3rd Edition, Wiley, 2012.
5. William A. Nash, Merle C. Potter, "Schaum's Outline of Strength of Materials", 6th Edition, McGraw Hill Education, 2014

AU5351 THERMODYNAMICS AND THERMAL ENGINEERING L T P C
3 1 0 4

COURSE OBJECTIVES:

i. To impart knowledge of basic principles of thermodynamics via real world engineering examples
ii. To analyse and evaluate cardinal air standard cycles
iii. To analyse and evaluate cardinal Steam power cycles
iv. Summarize the governing concepts of Refrigeration and Air conditioning
v. To introduce various modes of heat transfer, related to real time scenarios of thermodynamics applied in engineering practice

UNIT I BASIC THERMODYNAMICS 12

Systems, closed, open and isolated. Property, state, path and process, quasi-static process, Zeroth low, First law. Steady flow energy equation. Engineering Applications of Steady flow energy equation Heat and work transfer in flow and non-flow processes. Second law, Kelvin-Planck statement – Clausius statement - Concept of Entropy, Clausius inequality, Entropy change in non-flow processes. Availability and Un Availability. Properties of gases and vapours

UNIT II AIR STANDARD CYCLES AND COMPRESSORS 12

Cycle, Carnot cycle, Otto, Diesel, Dual combustion and Brayton cycles. Air standard efficiency. Mean effective pressure. Comparison of cycles, Efficiency versus compression ratio, For the same compression ratio and the same heat input Compressors, Classifications of compressors, Single stage and multi stage, Effect of intercooler in multi stage compressor, Perfect and imperfect intercooler, work done by the compressor, Reciprocating, Rotary, Axial, Vane compressors.

UNIT III STEAM AND JET PROPULSION 12

Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface

Properties of steam, Dryness fraction, Quality of steam by steam tables and Mollier chart – Rankine cycle, Work done, Steam rate – Steam Nozzles, Types of nozzles, Friction in nozzles - Simple jet propulsion system – Thrust rocket motor – Specific impulse.

UNIT IV REFRIGERATION AND AIR-CONDITIONING 12

Principles of refrigeration, Vapour compression – Types of VCR system with respect to condition of vapour, Problems, Vapour absorption types, comparison - Co-efficient of performance (COP), Properties of refrigerants – Basic Principle, Summer, winter and Year round Air conditioning.

UNIT V HEAT AND MASS TRANSFER 12

Modes of heat transfer, Heat conduction in parallel, radial and composite wall – Heat conduction through hollow and composite cylinders, spheres. Basics of Convective heat transfer. Fundamentals of Radiative heat transfer – Flow through heat- exchangers, Logarithmic Mean Temperature Difference (LMTD) for parallel flow and Arithmetic Mean Temperature Difference (AMTD) counter flow heat exchangers.

TOTAL: 45 PERIODS

(Use of standard Steam tables with mollier chart and Refrigerant tables are permitted)

COURSE OUTCOMES:

i. Will demonstrate understanding of the nature of the thermodynamic processes for pure substances of ideal gases
ii. Will interpret First Law of Thermodynamics and its application to systems and control volumes
iii. Will solve any flow specific problem in an engineering approach based on basic concepts and logic sequences.
iv. Will compare and contrast between various types of refrigeration cycles
v. Will get exposed to the basics and modes of heat transfer

TEXT BOOKS:

1. Chattopadhyay. P Engineering Thermodynamics", oxford University Press, New Delhi, 2010.
2. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 2007.
3. Rathakrishnan E., "Fundamentals of Engineering Thermodynamics" Prentice-Hall India, 2005.

REFERENCES:

1. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
2. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 2007.
3. Mathur& Sharma Steam Tables, Jain Publishers, New Delhi.
4. Merala C, Pother, Craig W, Somerton, "Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
5. Ramalingam K.K. "Thermodynamics", Sci-Tech Publications, 2006

AE5351 FLUID MECHANICS AND FLUID MACHINES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES: Of this course are

- To learn about the basic properties of fluids.
- To introduce the concept of incompressible and viscous flows.
- To have a thorough knowledge on dimensional analysis and model studies.
- To study the applications of conservation laws to flow through pipes and hydraulic machines.
- To learn the basics of water turbines, their classification and working principles.

UNIT I BASIC EQUATIONS 9

Definition of fluid, Newton's law of viscosity, Units and dimensions-Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, Control volume- application of continuity equation and momentum equation, Incompressible flow, Bernoulli's equation and its applications.

UNIT II INCOMPRESSIBLE VISCOUS FLOW 9

Exact flow solutions in channels and ducts, Couette and Poisuielle flow, laminar flow through circular conduits and circular annuli- concept of boundary layer – measures of boundary layer thickness – Darcy Weisbach equation, friction factor, Moody's diagram.

UNIT III DIMENSIONAL ANALYSIS AND MODEL STUDIES 9

Need for dimensional analysis–methods of dimension analysis–Similitude–types of similitude Dimensionless parameters–application of dimensionless parameters–Model analysis.

UNIT IV PUMPS 9

Euler's equation – Theory of Roto dynamic machines – various efficiencies – velocity components at entry and exit of the rotor, velocity triangles – Centrifugal pumps, working principle, work done by the impeller, performance curves – Cavitation in pumps- Reciprocating pump–working principle.

UNIT V TURBINES 9

Classification of water turbines, heads and efficiencies, velocity triangles- Axial, radial and mixed flow turbines- Pelton wheel, Francis turbine and Kaplan turbines, working principles – draft tube Specific speed, unit quantities, performance curves for turbines – governing of turbines.

TOTAL: 45 PERIODS

OUTCOMES: Upon completion of the course, Students will be able to

CO1: Exhibit the basic understanding on fluid properties and fluid statics.

CO2: Demonstrate the understanding in fluid kinematics and governing equations.

CO3: Use the governing equations for fluid flow problems and understand the elementary plane flows.

CO4: Analyse laminar and turbulent flow problems.

CO5: Acquire knowledge on the various types of fluid machines.

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

TEXT BOOKS:

1. Ojha C.S.P, Berndtsson R and Chadramouli P. N., Oxford University Press, 2010
2. Rathakrishnan. E, Fluid Mechanics, Prentice Hall of India,2nd Edition, 2007
3. Subramanya K,' Theory and Applications of Fluid Mechanics',Tata McGraw Hill,1993.
4. Yunus A.Cengel and John M.Cimbala, Fluid Mechanics, McGraw Hill, 2nd, Edition, 2013.

REFERENCES:

1. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi, 9th edition,2015.
2. Kumar. K.L. Engineering Fluid Mechanics (VII Ed.) S Chand publishers 2006 edition Reprint Edition (1 December 2010).
3. Ramamurtham. S, Hydraulics, Fluid Mechanics and Fluid Machines, Dhanpat Rai Publishing Co Pvt., Ltd, 9th edition, 2012.

PR5311 COMPUTER AIDED DRAFTING AND MACHINING LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES

- To get hands on experience in drafting of engineering components
- To get hands on experience in the conventional machines.
- To prepare the process planning sheets for all the operations and then follow the sequences during the machining processes.

LIST OF EXPERIMENTS

Machining Exercises

1. Preparation of part drawing to machine a raw material in a lathe – (involving facing, turning, stepped turning, knurling, taper turning, thread cutting and parting)
2. Preparation of part drawing to machine a blank material in a shaper – (involving horizontal, vertical surface machining, V-shape, dove-tail end)
3. Preparation of part drawing to machine the given part in drilling machine – (involving single hole, multi hole, equidistant, equi-pitch, reaming, boring, counter boring, counter sinking).
4. Preparation of part drawing to mill the groove part in a milling machine – (involving key way, slot, spur gear, patched milling, spline, gang milling).
5. Preparation of part drawing to grind the part in a grinding machine-(involving flat surface, cylindrical surface).
6. Preparation of part drawing to machine a part in combination of machine-(Lathe and Milling, Lathe and Grinding, Shaper and Grinding).

Drafting Exercises

1. Any CAD software with 2D modeling to used by students for drafting exercises
2. Practice on Drafting Software using Measuring commands; Basic Draw Commands; Display Commands GRID, SNAP, CIRCLE, LINE, ARC LIMITS, ZOOM, PAN.
3. Practice on using Editing commands; Creating layers: CHANGE,ERASE, EXTEND, TRIM, GRIPS. Construction Commands; ARRAY, COPY, MIRROR, MOVE, OFFSET, FILLET, CHAMFER, OSNAP.
4. Placing lettering on a drawing; Crosshatching a drawing TEXT BHATCH.

5. 2D drafting of automobile components like engine crank shaft , connecting rod etc.,
6. 2D drafting of machine components.
7. 2D drafting of machine shop drawing.
8. 2D drafting of pin joints, cotter joints and bearings.

The drafting exercise include process planning sheet where student shall fill up the data for producing the product as per drawing. As per the process planning sheet the machining operations are to be conducted.

1. Step turning, Taper Turning/ Threading and Knurling operations in Lathe.
2. Eccentric turning in a Lathe
3. Multi start Threading/ Burnishing operations in a Turret Lathe.
4. Machining to make a cube/ V-Block using shaper.
5. Counter sinking, Counter Boring and Tapping operation in a drilling machine.
6. Surfacing/Pocket Milling in a vertical milling machine.
7. Polygonal shape milling in a horizontal milling machine.
8. Flat surface grinding and cylindrical grinding operations.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

- Enable to interpret drawing of component, process sheet, etc.
- Trained to draft part drawing with use of CAD software and operate basic machining tools.
- Impart practical knowledge on the selection of machines and processes to manufacture components.

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

PR5312 MATERIAL TESTING AND THERMAL ENGINEERING LABORATORY

L T P C
0 0 4 2

COURSE OBJECTIVES:

- To study the mechanical properties of materials when subjected to different types of loading.
- To study the performance characteristics of various engines
- To understand the working principle of IC engines
- To understand the modes of heat transfer
- To enable the students to apply the heat transfer knowledge to real applications.

MATERIAL TESTING

1. Tension test on mild steel rod
2. Torsion test on mild steel rod
3. Hardness test on metal beam (Rockwell,Vicker's and Brinell Hardness Tests)
4. Compression test on helical spring
5. Deflection test on carriage spring
6. Impact Test (Izod and Charpy)

THERMAL ENGINERRING LAB

1. Valve timing diagram
2. Port timing diagram
3. Performance test on four stroke diesel engine
4. Performance test on air compressor
5. Composite wall apparatus

6. Determination of convective heat transfer coefficient
7. Determination of thermal conductivity for pipe application.
8. Emissivity apparatus
9. Stefan Boltzmann apparatus
10. Pin fin apparatus

TOTAL:60 PERIODS

COURSE OUTCOMES:

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

CO1: Perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.
CO2: Understand the performance parameters of IC engines and their significance
CO3: Understand the importance of valve timing, and overlap on performance
CO4: Analyze the performance characteristics of the given engine.
CO5: Distinguish different modes of heat transfer.

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

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 analyse effect 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. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. (2013).

PR5401 FOUNDRY AND WELDING TECHNOLOGY L T P C
3 0 0 3

COURSE OBJECTIVES:

- To impart knowledge about principles/methods of casting with detail design of gating/riser system needed for casting, defects in cast objects and requirements for achieving better casting.
- To understand the basic principle, procedure and applications of various Foundry and Welding methods.
- To inculcate the principle, thermal and metallurgical aspects during solidification of metal and alloys.
- To study SMAW, GMAW, GTAW, Oxy-acetylene welding and resistance spot welding processes
- To have a broad knowledge to design a casting and welding process and metallurgical and weld-ability aspects of different common engineering materials.

UNIT I CASTING PROCESSES 9

Introduction to casting – pattern – materials allowances – coding – types – moulds – mould making, sand – properties, types and testing of sands – core making – type of cores – single box, two box and three box moulding processes, runner, riser and gate and chills chaplets.

UNIT II SPECIAL CASTING PROCESSES 9

Pressure die casting – Centrifugal – continuous – investment – shell moulding – squeeze – electro slag casting – CO2 moulding – Plaster Mould castings – Antioch process – Slush casting- Counter gravity low pressure casting - electro-magnetic casting.

UNIT III METAL JOINING PROCESSES 9

Introduction to soldering, brazing and welding Types of joints – plane of welding – edge preparation – filler material – flux – shielding gases – fusion welding – gas welding – flame types – Manual arc welding – arc theory – power supply – braze welding – Thermit welding – Resistance welding – spot, seam, projection, percussion and flash- Shielded Metal Arc welding, Gas Metal Arc Welding-Gas Tungsten Arc Welding.

UNIT IV SPECIAL WELDING PROCESSES 9

Submerged arc welding – Flux Cored Arc Welding – Electro slag welding – friction welding – explosive welding – Underwater welding – Diffusion bonding – EBW – LBW – PAW – Stud welding – welding of dissimilar materials – Friction stir welding – High frequency induction welding.

UNIT V TESTING OF CASTINGS AND WELDMENTS 9

Causes and remedies for casting defects – welding defects – Destructive testing – Non Destructive Testing (NDT) methods– Testing: Dye penetrant – magnetic particle – X-ray - Radiography - ultrasonic - Case studies in testing of welded joints and castings.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the process of Pattern making, Moulding and core making
CO2: Analyze the thermal, metallurgical aspects during solidification in casting and welding and their role on quality of cast or weld objects
CO3: Analyze the welding process behavior for common and newer welding techniques
CO4: Have generalized knowledge on various welding technology used in manufacturing.
CO5: Design the gating and riser system needed for casting and requirements to achieve defect free casting.

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

TEXT BOOKS:

1. Jain .P.L., “Principle of Foundry Technology”, Tata McGraw Hill ,4th edition, 2004.
2. Parmer .R.S ,“Welding Engineering and Technology”, Khanna Publishers , 2004.

REFERENCES:

1. Curry .B.,“Modern Welding Technology” , Prentice Hall ,2008.
2. Heime, Looper and Rosenthal, “Principle of metal casting” , Tata McGraw Hill ,2nd edition 2002.
3. Little, “Welding Technology”, Tata McGraw Hill, 2008.
4. Taylor HF Fleming, “Foundry Engineering”, M.C. and Wiley Eastern Ltd., 2003.
5. Ramana Rao, T. V., Metal Casting – Principles and Practice, New Age International Pvt. Ltd. (2003).

PR5402 ENGINEERING MATERIALS L T P C

3 0 0 3

COURSE OBJECTIVES:

- To impart knowledge on the various microstructural features of metallic materials.
- To illustrate the role of heat treatment on microstructure and properties.
- To desire the various non ferrous alloys and their applications.
- To introduce the concepts of mechanical behaviour of the materials.
- To describe the properties and applications of polymers and ceramics.

UNIT I MICROSTRUCTURAL DEVELOPMENT AND METALLOGRAPHY 9

Basics of Metallographic microscopy -sample preparation – resolution – contrast – Metallographic microscope - quantitative techniques - Homogenous and Heterogeneous nucleation - grain growth- directional solidification- cast and weld microstructure- ingot and continuous casting - microstructures of Steels and Cast irons - spinodal decomposition - Pearlitic, bainitic and martensitic transformations - Effect of alloying elements on steel (Mn, Si, Cr, Ni, Mo, V, Ti and W) – Specification and Standards, Properties and application -stainless and tool steels – HSLA steels – TRIP steel- maraging steels – Gray, white, malleable, spheroidal / graphite, alloy cast irons

UNIT II HEAT TREATMENT AND KINETICS 9

Diffusion in solids - Fick's law - - Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram CCR - Types and stages of annealing, stress relief, recrystallisation and spheroidizing – normalizing, Hardenability, Jominy end quench test - hardening and tempering of steel –Cryotreatment, Austempering, martempering – case hardening,

carburizing, nitriding cyaniding, carbonitriding – Flame, Induction Laser and Electron beam and plasma phase hardening, Special and Duplex surface hardening processes.

UNIT III NON FERROUS METALS 9

Specification, Properties and application: Copper and Copper alloys, Brass, Bronze and Cupronickel – Aluminium alloys and AI-Cu –precipitation strengthening treatment – Bearing alloys, Alloys of Titanium, Zinc, Magnesium and Nickel –Intermetallics - Ni, Ti Aluminides – Refractory alloys- Superalloys- Shape memory alloys- high entropy alloys- Bulk Metallic glasses.

UNIT IV DEFORMATION AND FAILURE OF METALS 9

Elastic, anelastic and viscoelastic behaviour - Dislocation in FCC,BCC,HCP – stress field - interaction between dislocations -Strengthening mechanism- effect of temperature- deformation mechanism maps - cyclic loading - Types of Fracture – Fracture mechanics - fracture toughness ductile-brittle transition - types of wear - corrosion - Basics of Scanning electron microscope (SEM)- Energy Dispersive Spectroscopy (EDS)- Failure analysis

UNIT V NON METALLIC MATERIALS 9

Polymers- Thermo, Thermoset Polymers, Co and mixed Polymers- Commodity Polymers, PE, PS,PVS PMMA, PC, PET, ABS- Engineering Polymers, PA, PPS, PI, PFE- Natural and Synthetic rubbers, Elastomers- Adhesives- Ceramics- Natural and Synthetic Ceramic- Feldspar, Corrundum, Garnet- WC, TC,TiC, Si_3N_4,Al_2O_3, CBN, PCD, Uses of abrasives and cutting tools.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: identify the microstructural features of ferrous materials.
CO2: relate the heat treatment, microstructure and properties.
CO3: understand the properties and uses of non ferrous alloys.
CO4: correlate the mechanical behaviour with the mechanisms of strengthening.
CO5: suggest suitable polymer and ceramic for a given application.

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

TEXT BOOKS:

1. Balasubramanian.R, Callister's 'Materials Science and Engineering', 7th Edition, Wiley India Pvt. Limited, 2010.
2. Kenneth G.Budinski and Michael K.Budinski ,"Engineering Materials", 9th Indian Reprint, Prentice-Hall of India Private Limited, 2011.

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1. Callisers's Jr. W.D, Rethuish, D.G, Materials Science and Engineering, 9th Edition, Wiley, 2014.
2. Donald R. Askeland, Pradeep P. Fulay and Wendelin J. Wright, "The Science and Engineering of Materials", 7 th Edition, Cengage Learning, Inc. 2017.
3. Raghavan V., "Materials Science and Engg: A first Course", 6th Edition, Prentice Hall of India Pvt Ltd., 5th edition, 2004.
4. Sidney H. Avner, "Introduction to Physical Metallurgy", McGraw Hill Book Company, 2nd Edition, 2008.
5. Yang Leng, "Materials Characterization: Introduction to Microscopic and Spectroscopic Methods", John Wiley and Sons, 2ndedition, 2013.

PR5403 MACHINING PROCESSES AND MACHINE TOOLS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To provide students with fundamental knowledge and principles in material removal processes.
- To understand the fundamentals aspects of metal cutting principles by studying various machining processes.
- To study the constructional features and various operations related to milling, drilling and grinding.
- To know the factors influencing the processes and their applications.
- To recommend appropriate manufacturing process when provided a set of functional requirements and constraints.

UNIT I LATHE 9

Introduction to production processes – types of production (job, batch and mass) – production processes – Casting, Forming, Machining and Welding, Machine Tool – Lathe – Engine Lathe – block diagram – sketch – functions of each part – work holding devices in lathe – functions – Chuck, Centre, Dogs, Steady Rest and Follower Rest, mechanism of lathe – Apron, Feed, Tumbler Gear, various operations performed in Lathe – facing, turning, chamfering and knurling – relative positions of tool and job – Taper turning operations (three methods)_ thread cutting – RH and LH thread, single start and multi start with application – Method of thread cutting – selection and arrangement of tool and work. Problems in metric and inch thread conversion – Specifications of Lathe – Burnishing.

UNIT II SHAPER, PLANER and SLOTTER 9

Purpose of shaping – block diagram – functions of each part. Purpose of planer – block diagram – functions of each part. Purpose of slotting machine – block diagram – functions and working principle. Operations carried out – horizontal plane, vertical plane, v type with relative position – Comparison of planer with shaper – work holding devices in shaper and planer – Quick return mechanism in shaper – mechanical and hydraulic – cross feed mechanism – Types of planer with application – Comparison of shaping with slotting – tool holding devices in shaper, planer and slotter – specifications of shaper, planer and slotter simple problems to calculate the velocity – speed, feed and depth of cut.

UNIT III DRILLING 9

Purpose of drilling – block diagram and function – types of drilling machines – portable drilling – bench type – sensitive drilling – radial arm drilling – functions of parts – purpose and operation – gang drilling, multiple drill head, upright drilling, relative operations – reaming, boring, tapping, counter boring, courses sinking, trepanning and spot facing (with simple sketch, purpose and application). Work holding devices – specification torque calculation – speed, feed and depth of cut.

UNIT IV MILLING 9

Milling machine purpose – up and down milling – classification of milling machines – slot, keyway machining – methods of milling – single piece, string, rotary, index, gang, progressive, copy. Horizontal milling machine – block diagram – functions of each part- applications – Vertical milling machine – block diagram – functions of each part applications – Gear cutting using milling machine – procedure with neat sketch – milling cutters – peripheral, face, end T slot, form etc. – attachments and special accessories for milling – rotary, slotting attachment – indexing mechanism – methods of indexing – direct, plain, compound and differential indexing – problems – specifications – cutting conditions and parameters.

UNIT V GRINDING 9

Purpose – classification – surface finish – applications – grinding wheel – types – specifications – selection – surface grinding machine – block diagram – functions of each part – cylindrical grinding – Centre less grinding – Comparison – in-feed, end feed and through feed. Balancing, dressing, loading and Truing of wheel – special grinding machines – specification of machine – cutting condition.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the features and applications of lathe, milling, drilling and grinding machines

CO2: Discuss the features and applications of reciprocating machine tools and like shaper, planer and slotting machine.

CO3: Explain the machine tool structures and machining economics.

CO4: Explain the working principles of various machines used in manufacturing.

CO5: Identify the appropriate production process and machines.

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

TEXT BOOKS:

1. HMT Bangalore, “Production Technology”, Tata Mc-Graw Hill Publishing Company Limited, New Delhi, 2008.
2. Sharma.P.C., “A Text Book of Production Technology”, S.Chand and Company, 11th edition. 2010.

REFERENCES:

1. HajraChoudharyetal, “Elements of Production Technology –Vol.II”, Asia Publishing House, 2010.
2. Jain.R.K., “Production Technology”, Khanna Publishers, New Delhi, 17th edition.
3. Kalpakjain, “Manufacturing Process for Engineering Material”, Addison –WesleyPublication, 2000.
4. Kumar B., “Manufacturing Technology”, Khanna Publishers, New Delhi 2000.
5. Radhakrishnan P., “Manufacturing Technology, Vol.I”, Scitech Publications, edition-1, 2002

PR5451 KINEMATICS AND DYNAMICS OF MACHINES L T P C
3 1 0 4

COURSE OBJECTIVES:

- To impart knowledge on various types of mechanisms and synthesis.
- To impart skills and analyze the position, velocity and acceleration of mechanisms.
- To understand the effects of friction in motion in transmission and machine components.
- To familiarize higher pairs like cams and gears.
- To study the undesirable effects of unbalances resulting from prescribed motions in mechanisms.

UNIT I MECHANISMS 9+3

Definition – Machine and Structure – Kinematic link, pair and chain – classification of Kinematic pairs – Constraint and motion – Degrees of freedom - Slider crank – single and double – Crank rocker mechanisms – Inversions, applications – Introduction to Kinematic analysis and synthesis of simple mechanisms – Determination of velocity and acceleration of simple mechanisms.

UNIT II FRICTION 9+3

Types of friction – friction in screw and nut – screw jack – pivot, collar and thrust bearings – plate and cone clutch – belt (Flat and V) and rope drives – creep in belts – open and crossed belt drives – Ratio of tensions – Effect of centrifugal and initial tensions – condition for maximum power transmission.

UNIT III GEARS AND CAMS 9+3

Gear – Types and profile – nomenclature of spur and helical gears – laws of gearing – interference – requirement of minimum number of teeth in gears – gear trains – simple, compound and reverted gear trains – determination of speed and torque in epicyclic gear trains – cams different types of followers – Cam – Types of cams and followers – Cam design for different follower motions.

UNIT IV VIBRATION 9+3

Free, forced and damped vibrations of single degree of freedom systems – force transmitted to supports – vibration Isolation – vibration absorption – torsional vibration of shafts – single and multi-rotor systems – geared shafts – critical speed of shafts.

UNIT V BALANCING 9+3

Static and dynamic balancing – single and several masses in different planes – primary and secondary balancing of reciprocating masses – Balancing of single and multi-cylinder engines – Governors and Gyroscopic effects.

TOTAL:60 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the kinematics and dynamics of machinery in design and analysis of engineering problems.
CO2: Demonstrate the ability to synthesize and analysis mechanisms
CO3: Design and analyze cam and their motion.
CO4: Select the gears and gear trains for their applications.
CO5: Examine the concept of free, forced and damped vibrations.

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

TEXT BOOKS:

1. Bansal R.K., “Theory of Machines”, Laxmi Publications Pvt Ltd., New Delhi, 20th edition 2009.
2. Rattan S.S., “Theory of machines”, Tata McGraw Hill publishing Co., New Delhi, 2nd edition 2011.

REFERENCES:

1. Gosh A and Mallick A.K., “Theory of Machines and Mechanisms”, Affiliated East West press, 2009.
2. Malhotra D.R. and Gupta H.C ,“The Theory of machines”, Satya Prakasam, Tech. India Publications, 2008.
3. Rao J.S. and Dukkipati R.V., “Mechanism and Machine Theory”, Second Edition, Wiley Eastern Limited, 2006.
4. Shigley J.E. and Uicker J.J., “Theory of Machines and Mechanisms”, McGraw Hill, 2006.
5. Ambekar A.G., “Mechanism and Machine Theory”, PHI India Pvt Ltd, 2007

PR5411 MACHINING PROCESSES LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

- To impart students with the knowledge of various machine tools and its operations
- To familiarize with the selection of suitable production process for the desired component.
- To train students into machining operations to enrich their practical skills.

- To inculcate team qualities and expose students to shop floor activities.
- To educate students about ethical, environmental and safety standards.

LIST OF EXPERIMENTS

1. Taper Turning and Eccentric Turning using lathe
2. External and Internal Thread cutting using lathe
3. Knurling
4. Shaping – Square and Hexagonal Heads
5. Drilling and Reaming
6. Contour milling - vertical milling machine
7. Spur and helical gear cutting using milling machine
8. Gear generation using gear hobber
9. Gear generation using gear shaper
10. Grinding – Cylindrical, Surface and Centerless grinding
11. Tool angle grinding with tool and Cutter Grinder
12. Spline Broaching
13. Measurement of cutting forces in Milling /Turning Process
14. CNC Part Programming

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the working principles of various machines used in manufacturing.
CO2: Select cutting tools materials and tool geometries for different materials.
CO3: Select appropriate machining processes and conditions for different metals.
CO4: Write programs for CNC turning and machining centre.
CO5: To produce different part features to the desired quality.

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

PR5412 FOUNDRY, WELDING AND METALLURGY LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

- To train the students in the area of non-ferrous metal casting with the simple shapes.
- To study the basic requirements of given moulding sand by standard tests.
- To train the students to make the simple joints by various welding techniques.
- To study the solidification of metals and alloys also find the various micro structure of given specimens.
- To train the students for various heat treatment processes.

LIST OF EXPERIMENTS:

FOUNDRY

1. Green and Dry Strength of Moulding sand.
2. Permeability testing.
3. Determining the clay content.
4. Sieve analysis of dry silica sand.
5. Determining the moisture content.
6. Melting any non-ferrous metal and making simple castings – Demonstration.

WELDING

1. Welding of basic joints using gas and arc welding.
2. Welding of pipes in different positions.
3. GTAW / GMAW of ferrous and non - ferrous metals.
4. Spot welding of plates.
5. Brazing practice – Dissimilar metals.
6. Welding of standard grill structures.

METALLURGY

1. Cooling curve- Pure metal and alloy (Pb-Sn).
2. Specimen preparation for macro – examination.
3. Specimen preparation for micro examination (steel/cast iron/non-ferrous alloys).
4. Quantitative metallography – Estimation of volume fraction, particle size, shape and distribution.
5. Heat treatments of Steel-Micro structural study: Annealing/ Normalising / Quench
6. Hardening/ Tempering.
7. Jominy End Quench Test.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the casting procedure of different methods.
CO2: Find the quality of moulding sand.
CO3: Make simple joints by welding.
CO4: Understand the concept of phase diagrams and metallographic techniques.
CO5: Understand the concept of various heat treatment process and their applications.

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

GE5551 STATISTICS FOR PRODUCTION MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

- To train the students so that students will be able to design experimental designs and use these concepts for research design.
- To introduce the concept of probability so that they can be used for industrial applications.
- To stress upon the importance of the sampling theory and its usefulness in industrial quality control.
- To make students familiarize with the concepts of estimation theory and its applications.
- To help students the usefulness of test of significance and its applications in industry and research.

UNIT I PROBABILITY THEORY 12

Random variables – Discrete and continuous random variable- Probability mass and density functions- Joint density and mass functions-Moment about mean and origin- Moment generating and characteristic functions – Binomial, Poisson, Normal distributions and their applications- to manufacturing problems.

UNIT II SAMPLING THEORY 12

Sampling with and without replacement- Random sample- Sampling distributions of means, proportions, difference of means and proportions-Student 't' distribution- Chi square distribution-Fisher's distribution and their applications to production problems.

UNIT III ESTIMATION THEORY 6

Point and Interval estimation- Confidence limits for mean, proportions, difference of means, proportions- Confidence limits using student 't' distribution, Chi square and F distribution-applications.

UNIT IV TESTING OF HYPOTHESIS 10

Procedure for testing hypothesis and significance- Level of Significance of large samples for means, proportions, difference of means and difference of proportions- Tests based on student t distribution, chi square distribution and F distribution – Applications to manufacturing.

UNIT V ANOVA 5

One factor experiments – Mathematical model for one factor experiments- Two factor experiments-Mathematical model for two factor experiments- Applications to production problems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Design of experiments for research and industry.
CO2: Apply the concept of probability so that they can be used for industrial applications.
CO3: Use sampling theory and its usefulness in industrial quality control.
CO4: Apply the concepts of estimation theory to industrial problems.
CO5: Apply the test of significance and its applications to industry and research.

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

TEXT BOOKS:

1. Richard I.Levin and David S. Rubin, "Statistics for Management", Pearson India, 2018.
2. Richard Barrett clements, "Handbook of Statistical Methods in Manufacturing" , PH, 1991.

REFERENCES:

1. Gupta.S.C. and Kapoor.V.K, "Fundamentals of Mathematical Statistics", Sultanchand, 2017.
2. Hooda.R.P.,"Statistics for business and economics", Vikas Publications, 2010.
3. Morris. H. Degroot, Mark J. Schervish , Probability and Statistics, Pearson Education, 2018.
4. Vijay K. Rohatgi, Ehsanes Saleh A.K Md, "An Introduction to Probability and Statistics" , Wiley, 2008.
5. Rukmangadachari.E, Probability and Statistics, Pearson, 2012.

PR5501 ENGINEERING METROLOGY L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the concept of engineering metrology.
- To familiarize the metrology instruments used for linear and angular measurements.
- To learn about the surface texture and measuring instruments
- To learn about the metrology of screw threads and gears
- To introduce the concepts of Laser and computer applications in metrology.

UNIT I FUNDAMENTALS OF MEASUREMENT 9

Fundamentals of Engineering metrology – Line, end and wave length standards of measurement – Accuracy, Precision and Calibration of instruments - Errors in measurements – Limits, fits, tolerance and gauge design – Inter changeability and selective assembly – Uncertainties in measurements.

UNIT II LINEAR AND ANGULAR MEASURING SYSTEMS 9

Linear and Angular measuring systems. Vernier calipers, micrometers, Slip gauges, dial gauges and surface plates – Concept of comparators - mechanical, electrical, optical and pneumatic comparators – Angular measuring systems – angle gauges – Sine bar – Precision spirit level, Auto collimators – Angle dekkor – Clinometers.

UNIT III MEASUREMENT OF SURFACE TEXTURE AND MEASURING INSTRUMENTS 9

Surface texture – Definitions – types of surface texture – surface texture measurement methods Comparison – Profilometer – Surface texture measuring instruments – Straightness and flatness measurement using precision level and auto collimators-Measurement of roundness and camming– Tool makers microscope – Optical and Laser Alignment telescope – Geometric Dimensioning and Tolerancing

UNIT IV METROLOGY OF SCREW THREADS AND GEARS 9

Metrology of screw threads and gears Internal and external screw threads – terminology - measurement of various elements of screw threads – thread micrometer two wire and three wire - methods, gear terminology measurement of various elements of gears pitch circle method, constant chord method, base tangent method – plug method – Rolling gear tester.

UNIT V LASER METROLOGY AND COMPUTER AIDED METROLOGY 9

Laser micrometer - Laser interferometer – non contact and in-process inspection using laser – Co-ordinate measuring machines – Probe sensors – Errors – Environmental factors – vision systems – Atomic force microscope - Scanning tunneling microscope - 3D Computed Tomograpghy.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the principles of Engineering Metrology.
CO2: Identify appropriate metrology equipment for measuring linear and angular measurements.
CO3: Apply the suitable equipment to measure the surface textures.
CO4: Identify appropriate methodology to measure the parameters of screw threads and gears.
CO5: Employ the advanced metrology equipment

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

TEXT BOOKS:

1. Jain.R.K., “Engineering Metrology”, Khanna Publishers, 20th edition, 2009.
2. Gupta.I.C.,“A text book of Engineering Metrology”, Dhanpat Rai and Sons, 7th edition 2012.

REFERENCES:

1. “ASTE Hand book of Industrial Metrology”, Prentice Hall of India Limited 2002.
2. Gayler G.N. and ShotboltC.R.,“Metrology for Engineers”, ELBS 2000.
3. Rajput R.K., “Engineering Metrology and Instrumentation”, Kataria and Sons Publishers, 2013.
4. Raghavendra and L.Krishnamurthy, “Engineering Metrology and Measurements”OUP India, 2013.

5. Francis T. Farago and Mark A.Curtis, “Handbook of Dimensional Measurements”, Industrial Press Inc, 3 rd Edition, 1994.

PR5502 FLUID POWER SYSTEMS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the basic principles of fluid power.
- Know the different properties of hydraulic fluids and their effects
- Explain the working principles of various pumps
- To understand the working principle of hydraulic and pneumatic components and its selection.
- To design hydraulic and pneumatic circuits for different applications.

UNIT I BASICS OF FLUID POWER 9

Introduction to fluid power controls – Hydraulics and pneumatics – Selection criteria, Application of Fluid power, Application of Pascal’s Law, Transmission and multiplication of force – Pressure Losses – Fluids, selection and properties – Gas laws- properties of air with pressure and temperature - ISO symbols.

UNIT II FLUID POWER SOURCES 9

Fluid Power drives – Pumps – working principle and construction details of Gear, vane and piston pumps, Hydraulic motors, Hydrostatic transmission drives and characteristics, Hydraulic supply components Pneumatic power supply – compressors, air distribution, air motors.

UNIT III FLUID POWER ACTUATORS AND ELEMENTS 9

Control valves – pressure, flow, direction - working principle and construction – Special type - valves – Cartridge, modular, proportional, and servo – Selection and actuation methods. Actuators – Selection and specification, cylinders, mounting, cushioning, pipe fittings – Fluid conditioning elements – Accumulators- Intensifier.

UNIT IV HYDRAULIC AND PNEUMATIC CIRCUITS DESIGN 9

Regenerative, speed control, synchronizing circuits -Design of Hydraulic and pneumatic circuits for automation, selection and specification of circuit components, sequencing circuits, cascade, and Karnaugh – Veitch map method – Circuits for industrial application - grinding, milling, shaping, press and material handling- Case studies.

UNIT V ELECTRO PNEUMATICS AND PLC CIRCUITS 9

Fluidics -Moving part logic circuits - Use of electrical timers, switches, solenoid, relays, proximity sensors - electro pneumatics sequencing Ladder diagram – PLC – elements, functions and selection – PLC programming– Ladder and different programming methods - Sequencing circuits.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1: Acquire the knowledge on principles and applications of fluid power.
CO2: Acquire knowledge on working principle of pump, actuators, control elements of fluid power system
CO3: Understand the principles of accumulators and circuits
CO4: Design circuit for typical applications like material handling, press, shaping, milling, grinding.
CO5: Design electro pneumatics and PLC Circuits.

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

CO4	√		√	√			√		√		√	√
CO5	√		√	√			√		√		√	√

TEXT BOOKS:

1. Anthony Esposito, “Fluid power with applications”, Pearson education, 7th edition, 2014.
2. Srinivasan R, “Hydraulics and Pneumatic Controls”, Vijay Nicole Imprints, 2nd edition, 2008.

REFERENCES:

1. Andrew Parr, “Hydraulics and Pneumatics”, Jaico Publishing House,3rd edition, 2011.
2. Jagadeesha T, "Pneumatics:Concepts, Design and Applications", University Press, 2015.
3. Majumdar, “Oil hydraulics: Principles and Maintenance”, Tata McGraw Hill,13th edition, 2006.
4. Majumdar, “Pneumatic system: Principles and Maintenance”, Tata McGraw Hill, 7th edition 2008.
5. Peter Rohner, “Fluid Power Logic circuit Design”, Macmillan Press Ltd., 2000.

PR5503 MACHINE COMPONENTS DESIGN L T P C
3 1 0 4

COURSE OBJECTIVES:

- To introduce the students to the fundamentals of machine design, material selection and to solve the basic design problems.
- To introduce the design of bolts & joints and selection of keys.
- To introduce the design of shafts, coupling & brakes.
- To give information about design of gears and belt drives.
- To provides knowledge on various springs and bearings.

UNIT I INTRODUCTION 9+3

Fundamentals of Machine Design-Engineering Design, Phases of Design, Design Consideration - Standards and Codes - Selection of Materials –Design against Static and Dynamic Load –Modes of Failure, Factor of Safety, Principal Stresses, Theories of Failure-Stress Concentration, Stress Concentration Factors, Variable Stress, Fatigue Failure, Endurance Limit, Design for Finite and Infinite Life, Soderberg and Goodman Criteria.

UNIT II JOINTS 9+3

Design of Bolts under Static Load, Design of Bolt with tightening / Initial Stress, Design of Bolts subjected to Fatigue – Keys -Types, Selection of Square and Flat Keys-Design of Riveted Joints and Welded Joints.

UNIT III SHAFTS AND COUPLINGS 9+3

Design of Shaft –Static and Varying Loads, Strength and Rigidity- Design of Coupling-Types, Flange, Muff and Flexible Rubber Bushed Coupling

UNIT IV GEARS AND BELT DRIVES 9+3

Design of Spur, Helical, Bevel and Worm Gear drives- Design of Belt drives- Flat , V Belts and Timer Belts

UNIT V SPRINGS AND BEARINGS 9+3

Design of Helical Spring-Types, Materials, Static and Variable Loads- Design of Leaf Spring-Design of Journal Bearing -Antifriction Bearing-Types, Life of Bearing, Reliability Consideration, Selection of Ball and Roller Bearings.

TOTAL:60 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the fundamentals of Engineering design, Failure theories and solve the basic machine problems.

CO2: Implement their ideas onto design bolts & joints and exposes them to selection of keys.
CO3: Acquire knowledge on design of shafts, various types of couplings and brakes.
CO4: Develop in-depth knowledge on design of different types of gears and belt drives.
CO5: Gain knowledge on design of various springs and bearings.

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

TEXTBOOKS:

1. Prabhu. T.J., "Design of Machine Elements", Kasthuri Publications, Chennai, 2003.
2. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, 2015.

REFERENCES:

1. Bhandari. V.B., "Design of Machine Elements", Tata McGraw-Hill Publishing Company Limited, 3rd edition, 2010.
2. Jalaludeen. S.Md.,"Machine Design Vol - I & Vol - II", Anuradha publications,2006.
3. Joseph Edward Shigley, Charles R. Mischke, "Mechanical Engineering Design", McGraw Hill, International Edition, 4th edition 2011.
4. "P.S.G.Design Data Hand Book", PSG College of Tech Coimbatore.
5. Robert L.Norton, "Machine Design – An Integrated Approach", Prentice Hall International Edition, 5th edition, 2013.

PR 5511 FLUID POWER SYSTEMS LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

- To study the functional aspects of different pneumatic Components and its use in circuits.
- To study the functional aspects of different hydraulic components and its use in circuits
- To train the student in designing different pneumatics for different applications.
- To train the student in designing different hydraulics for different applications.
- To train the student in designing of PLC circuits using hydraulic circuit applications

LIST OF EXPERIMENTS

1. Study and use of pneumatic and hydraulic elements.
2. Basic hydraulic and Basic Electro hydraulic circuits.
3. Single and double acting cylinder circuits using different directional control valves.
4. Basic Electro-pneumatic circuits.
5. Logic pneumatic circuits.
6. Speed control circuits in a pneumatic trainer kit.
7. Pneumatic sequencing circuits.
8. Electro pneumatic sequencing circuits.
9. PLC based electro hydraulic sequencing circuits.
10. PLC based electro pneumatic sequencing circuits.
11. Simulation of pneumatic, Electro pneumatic and electro hydraulic sequencing circuits using software.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Get Hands on experience in handling various components of pneumatic systems.

CO2: Get Hands on experience in handling various components of hydraulic systems
CO3: Design circuit for desired sequence of practical application in pneumatics
CO4: Acquire to design electro pneumatics for desired sequence of practical application in pneumatics
CO5: Design circuit for desired sequence of practical application in PLC.

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

PR5512 ENGINEERING METROLOGY LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

- To practice various measurement methods.
- To get acquainted with the instruments used for linear and angular measurements.
- To learn about the form measurements.
- To familiarize with surface texture measurements.
- To get acquainted with the advanced instruments such as machine vison system and CMM.

LIST OF EXPERIMENTS

1. Measurement of angle using Sine bar/bevel protractor.
2. Measurement of external taper angle.
3. Measurement of internal taper angle
4. Measurement of Bore Diameter.
5. Calibration of a Dial gauge.
6. Measurement of Roundness.
7. Inspection of screw thread parameters using three wire method.
8. Measurement of gear tooth thickness
9. Measurements using Tool makers microscope.
10. Measurements using profile projector.
11. Measurements using Autocollimator
12. Measurements using Vision Measuring System.
13. Measurements using CMM.
14. Contact and Non-contact surface roughness measurements.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to

CO1: Carry out various types of measurements using different instruments.
CO2: Use the most appropriate equipment for the given application.
CO3: Choose the best method to accomplish various types of form measurements.
CO4: Carry out the measurements related to screw thread and gears.
CO5: Use the advanced equipment's such as machine vision system and CMM.

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

PR5601 METAL FORMING L T P C
3 0 0 3

COURSE OBJECTIVES:

- Students will gain knowledge on the mechanism involved in plastic deformation and parameter representation.
- Students will read and understand various bulk forming process and its recent technology.
- Student will have a knowledge on various sheet metal forming process
- Students will study the powder metallurgy techniques and Special metal forming processes.
- Student will understand the significance of heat treatment based on the application.

UNIT I FUNDAMENTALS OF METAL FORMING 9

State of stress – Components of stress, symmetry of stress tensor, principle stresses – Stress deviator – Von-Mises, Tresca yield criteria – Octahedral shear stress and shear strain theory – Flow stress determination – Temperature in metal forming – Hot, cold and warm working – strain rate effects – metallurgical structures – residual stresses – Spring back.

UNIT II FORGING AND ROLLING 9

Principle – classification – equipment – tooling – processes parameters and calculation of forces during forging and rolling processes – Ring compression test – Post forming heat treatment – defects causes and remedies – applications – Roll forming.

UNIT III EXTRUSION AND DRAWING PROCESSES 9

Classification of extrusion processes – tool, equipment and principle of these processes – influence of friction – extrusion force calculation – defects, causes and remedies – Rod / Wire drawing – tool, equipment and principle – defects – Tube drawing and sinking processes – Mannessmann process of seamless pipe manufacturing – Tube bending.

UNIT IV SHEET METAL FORMING PROCESSES 9

Classification – conventional and High Energy Rate Forming processes – presses – types and selection of presses – formability studies – Formability Limit Diagram, Limiting Draw ratio – processes: Deep drawing, spinning, stretch forming, plate bending, Rubber pad forming, bulging and press brake forming – Explosive forming, electro hydraulic forming, Magnetic pulse forming and Super plastic forming.

UNIT V POWDER FORGING AND RECENT ADVANCES 9

Metal Powder and fabrication procedures, Applications, Preparation of powders, Compaction and sintering, Yield criteria and flow rules, Hot and cold pressing – Electro forming – fine blanking – Hydro forming – Peen forming – Laser Forming – Micro forming – Isothermal forging – high speed for forging and extrusion near net shape forming – Ultra fine grained materials by severe plastic deformation CAD and CAM in forming.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Represent the state of stress in metal forming process.
CO2: Identify the appropriate bulk forming process based on the application.
CO3: Understand the conventional sheet metal forming process and grasp the significance of various high energy rate forming techniques.
CO4: Really understand the powder metallurgy technique.
CO5: Select appropriate surface heat treatment technique based on the application.

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

TEXT BOOKS:

1. Dieter G.E., "Mechanical Metallurgy", McGraw Hill, Co., S.I. 5th Edition, 2012.
2. Nagpal G.R. ,"Metal forming processes", Khanna Publishers, New Delhi, 2nd edition 2009.

REFERENCES:

1. Edward M. Mielink, "Metal working science engineering", McGraw Hill, Inc, 2007
2. Metal Hand book Vol 14, "Forming and Forging", Metal Park, Ohio, USA, 2006
3. Rao, P.N., "Manufacturing Technology", TMH Ltd., 3rd edition, 2014.
4. SeropeKalpakjian, Steven R Schmid, "Manufacturing Process for Engineering Materials", Pearson Education, 7th Edition, 2007.
5. Taylan Atlan and A. ErmanTekkaya ," Sheet Metal Forming Fundamentals", ASM International, 1st Edition, 2012.

PR5602 CNC MACHINES L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the applications and advantages of CNC machines and technology.
- To understand the various CNC control and calculate technological data for CNC machining.
- To understand modern CNC systems and its importance in manufacturing.
- To impart the knowledge in CNC programming.
- To understand the concepts of CNC machine and its construction.

UNIT I INTRODUCTION 9

Evolution Of CNC Technology, Principles, Features, Advantages, Applications, CNC And DNC Concept, Classification Of CNC Machines – Turning Centre, Machining Centre, Grinding Machine, EDM, Types Of Control Systems, CNC Controllers, Characteristics, Interpolators– Computer Aided Inspection- Economics Of CNC.

UNIT II STRUCTURE OF CNC MACHINE 9

CNC Machine Building, Structural Details, Configuration And Design, Guide Ways – Friction, Anti Friction And Other Types Of Guide Ways, Elements Used To Convert The Rotary Motion To A Linear Motion – Screw And Nut, Recirculating Ball Screw, Planetary Roller Screw, Recirculating Roller Screw, Rack And Pinion, Spindle Assembly, Torque Transmission Elements – Gears, Timing Belts, Flexible Couplings, Bearings- Maintenance Of CNC Machines.

UNIT III CNC MACHINING 9

Coordinates, Axes, and Motion - CNC Systems - CNC Controls - Operating a CNC Machine – CNC Milling – Types, Machines axes, Machining centers, CNC Turning – Types, Number of axes, Axes designation -Advantages and Disadvantages of CNC Technology - Applications .

UNIT IV CNC PROGRAMMING 9

Coordinate Systems and Reference Points -The Ten Steps of CNC Programming - Structure Of A Part Program, G Codes and M Codes, Tool Length Compensation, Cutter Radius And Tool Nose Radius Compensation, Do Loops, Subroutines, Canned Cycles, Mirror Image, Parametric Programming, Machining Cycles, Programming For Machining Centre And Turning Centre For Well Known Controllers, Generation of CNC Codes From CAM Packages.

UNIT V TOOLING AND WORK HOLDING DEVICES 9

Introduction To Cutting Tool Materials – Carbides, Ceramics, CBN, PCD–Inserts Classification-PMK, NSH, Qualified, Semi Qualified And Preset Tooling, Tooling System For Machining Centre And Turning Centre, Work Holding Devices For Rotating And Fixed Work Parts.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand Evolution and Principle of CNC Machine Tools
CO2: Describe Constructional Features Of CNC Machine Tools.
CO3: Write the CNC program for given components.
CO4: Understand the working principle of CNC machine and its construction.
CO5: Select the required tooling and work holding devices.

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

TEXT BOOKS :

1. HMT, “Mechatronics”, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
2. Warren S.Seamers, “Computer Numeric Control”, Fourth Edition, Thomson Delmar, 2002.

REFERENCES :

1. Rao P.N., “CAD/CAM” ,Third Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi,2010.
2. Michael Fitzpatrick “ Machining and CNC Technology” McGraw-Hill Higher Education (2013)
3. Graham T. Smith “ CNC Machining Technology, Volume II Cutting, Fluids and Work holding Technologies” Springer-Verlag London (1993)
4. Daniel Kandray ,” Programmable automation technologies - an introduction to CNC, Robotics and PLCs” Industrial Press (2010).
5. Radhakrishnan P, “ Computer Numerical Control (CNC) Machines” , New Age International Publishers, 2018.

PR5603 COMPUTER AIDED DESIGN AND ANALYSIS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the concepts and applications of CAD.

- To introduce the various concepts and techniques used for product design and to develop product design skills
- To analyse a given problem using finite element techniques.
- To impart knowledge about various factors, pre-processing and post-processing steps with implementation of computer in FEA.
- To introduce the concepts of FEA and to apply in the field of manufacturing.

UNIT I COMPUTER GRAPHICS AND GEOMETRIC MODELING 9

Introduction to Engineering Design Computer graphics – applications – principals of interactive computer graphics – 2D 3D transformations – projections – curves – Bezier, B-Spline and NURBS – Concepts- Geometric Modeling – types – Wire frame surface and solid modeling – Boundary Representation, constructive solid geometry – Graphics standards – assembly modeling – use of software packages.

UNIT II PRODUCT DESIGN CONCEPTS 9

Design for product life cycle - Product modeling – types of product models; product development process tools – TRIZ – Altshuller's inventive principles – Modeling of product metrics – Design for reliability – design for manufacturability – machining, casting, and metal forming – design for assembly and disassembly – Design for Ergonomics - Design for environment; Bench marking – FMEA – QFD – DOE – Taguchi method of DOE – Quality loss functions .

UNIT III ELEMENTS OF FINITE ELEMENT ANALYSIS 9

General field problems in engineering-Discrete and continuous models-Characteristics-the relevance and place of finite element method- The method of weighted residuals-Rayleigh-Ritz and Galerkin methods - Solution of large system of equations- Gaussian elimination procedures - Discretization of Domain selection of interpolation polynomials-Convergence requirements - Formulation of element characteristics matrices and load vectors – Assembly of element characteristics matrices-Solution of finite element equations-Post processing of results.

UNIT IV FINITE ELEMENT ANALYSIS OF ONE DIMENSIONAL AND TWO DIMENSIONAL PROBLEMS 9

One dimensional finite element analysis - Beam element - Frame elements - One dimensional heat transfer - Two dimensional finite element analysis approximation of geometry and field variables - triangular and rectangular element- - Natural coordinates and coordinate transformation – Numerical integration - Incorporation of boundary conditions. Dynamic analysis - Equations of motion using Lagrange's approach-Consistent and Lumped mass matrices-Formulation of FE equations for vibration problems- Solution of Eigen value problems - Transient vibration analysis-Thermal transients- Isoparametric elements.

UNIT V APPLICATION OF FINITE ELEMENT ANALYSIS 9

Finite element analysis of Machine elements - Axisymmetric FEA of a pressure vessel-Application of FEM in various metal forming processes – Solid formulation and flow formulation – FEA simulation of Metal cutting, Solidification of castings and Weldments.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the features of modern design tools and data handling product development.
CO2: Develop depth knowledge on techniques of FEA and tools for analysis of typical manufacturing processes.
CO3: Get idea of implementation of computer on solving FEA based problems.
CO4: Discretize and solve one-dimensional solid mechanics and heat transfer problems in FEA.
CO5: Analyze a production process through FEA and control it's parameters.

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

TEXT BOOKS:

1. Ibrahim Zeid, “CAD/CAM theory and Practice”, Tata McGraw Hill, 2nd edition, 2008
2. Reddy. J.N., “An Introduction to Finite Element Method”, McGraw Hill, Third Edition, 2005.

REFERENCES:

1. Chandraputla T.R., and Belegundu A.D., “Introduction of Finite Element in Engineering”, Prentice Hall of India, Fourth Edition, 2012.
2. David F.Rogers.J, Alan Adams, “Mathematical Elements for Computer Graphics”, McGraw Hill, 2nd edition, 2009.
3. Kevin Otto, Kristin Wood, “Product Design”, Pearson Education, 7th Reprint , 2011.
4. Seshu.P., “Text Book of Finite Element Analysis”, Prentice Hall of India, tenth print, 2010.
5. Segarland. L.J., “Applied Finite Element Analysis”, John Wiley and Sons, second edition, 1984.

PR5611 CNC AND METAL FORMING LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

- To familiarize metal cutting principles.
- To study the characteristic features of CNC lathe.
- To impart knowledge in 3D profile cutting.
- To impart knowledge in mechanical behavior of metals in various metal forming operations.
- To train the students to write, simulate and carry out various operations in CNC machines.

LIST OF EXPERIMENTS

CNC LAB

1. Programming and machining of step turning and taper turning operation in CNC Lathe.
2. Programming and machining of thread cutting and grooving operation in CNC Lathe.
3. Programming and simulation for canned cycle in CNC lathe.

(i) Stock removing in facing cycle.
(ii) Stock removing in turning cycle.
(iii) Grooving cycle.
(iv) Thread cutting cycle.

4. Programming for milling operations in a CNC milling simulation.
5. Programming for mirroring / scaling function / Pocket milling and drilling cycle in a CNC milling.
6. Programming for spur gear cutting operation and Programming for hexagonal cutting operation.
7. Programming and Simulation of profile cutting in CNC Router.
8. Programming for cross drilling in a four axis CNC machining center.
9. 3D Profile cutting in CNC machining center.

METAL FORMING LABORATORY

1. Construction Flow Stress – Strain curve.
2. Erichsen cupping Test.
3. Determination of interface friction factor using ring compression test.
4. Construction of FLD of a sheet metal.
5. Water hammer forming.
6. Determination of Power consumption in sheet rolling process and wire drawing process.
7. Determination of strain rate sensitivity index of given specimen.
8. Superplastic forming studies on Pb-Sn alloys.
9. Deep drawing.
10. Forward Extrusion process.
11. Micro-forming.
12. Simulation studies on metal forming.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Understand various metal cutting operations on CNC machine.
CO2: Have hands on experience with various operations on CNC machine Centre.
CO3: Write NC program for various operations and perform machining in CNC machine
CO4: Understand the mechanical behavior of metals in various metal forming operations.
CO5: Perform various metal forming operations and calculate the required parameters associated with it.

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

PR5612 MODELING AND ANALYSIS LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

- The course is intended to provide a basic understanding of Modeling and Analysis techniques.
- To acquire a basic understanding of Modeling and Analysis software.
- To train the students to various approaches involved in assembly modeling.
- To understand the different kinds of analysis and apply the basic principles to find out the stress and other related parameters of bars, beams loaded with loading conditions.
- To learn to apply the basic principles to carry out dynamic analysis to know the natural frequency of different kind of beams.

LIST OF EXPERIMENTS

MODELLING EXPERIMENTS

1. 3-D Assembly of Bolt and Nut
2. 3-D Assembly if Protected Type Flange Coupling
3. 3-D Assembly of Universal Coupling
4. 3-D Assembly of Plummer Block
5. 3-D Assembly if Swivel Bearing

ANALYSIS EXPERIMENTS

1. One Dimensional FEA Problem.
    a. Truss structure analysis.
    b. Cantilever beam analysis.
    c. Temperature distribution problem.
2. Two Dimensional FEA Problems.
    a. Plane stress analysis.
    b. Axisymmetric analysis.
    c. Vibration Analysis.
3. Three Dimensional FEA Problems.
    a. 3D Shell Analysis.
    b. 3D Contact Analysis.
4. FEA Application in metal forming, Metal cutting, Casting process etc.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Perform finite element modeling in manufacturing applications and analysis package.

CO2: Work on various analysis packages available.

CO3: Enable the student to perform finite element modeling analysis for solid mechanics, heat transfer problems, vibration problems, shell and contact problems in 2D and 3D simulation

CO4: Carry out dynamic analysis and finding natural frequencies for various boundary conditions and also analyze with forcing function.

CO5: Use the modern tools to formulate the problem, and able to create geometry, discretize, apply boundary condition to solve problems of bars, truss, beams, plate to find stress with different loading conditions.

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

PR5701 MECHATRONICS FOR AUTOMATION L T P C
3 0 2 4

COURSE OBJECTIVES:

- To acquire overview of multi-domain engineering integration and make the students get acquainted with the sensors and transducers and its interfacing.
- To understand and apply the various types of actuators and its drives for interfacing.
- To apply modeling of basic mechanical system elements and cognize the need of control systems.
- To impart knowledge about the fundamentals of microcontroller to realize the interfacing and control.
- To render exposure in the design and development of mechatronics systems.

UNIT I MECHATRONICS SYSTEMS AND SENSORS 9

Introduction to Mechatronics Systems, Key Elements, Ways of Integration – Hardware and Software. Sensors – Characteristics – Static and Dynamic, Types - Linear, Rotational, Velocity Acceleration, Force, Torque, Flow, Temperature, Proximity, Optical, Micro and Nano Sensors, Selection of Sensors. Analog and Digital Signals - Signal Condition Module – Amplifiers - Inverting Amplifier, Non-Inverting Amplifier, Instrumentation Amplifier, Filters, A/D and D/A Converter.

UNIT II ACTUATORS 9

Electrical Actuators and Its Characteristics – DC Motors, AC Motors - Servo Motor and Stepper Motor. AC Drives - H-Bridge Circuits and Stepper Motor Driving Circuits - Switching Devices – Mechanical, Solenoids, Relays - Overview of Fluid Power Actuators and Control - Types and Characteristics of Micro and Nano Actuators.

UNIT III SYSTEM MODELING AND CONTROL 9

Transfer Function - Mechanical System Modeling – Characterization of System Time Response – Stable and Unstable System - Open Loop and Closed Loop Control Systems. Controllers - P, PD, PI, PID Controllers - Comparison of Control Realization in Hardware – Microprocessor – Microcontroller – PLC.

UNIT IV MICROCONTROLLERS 9

8051 Microcontrollers – Architecture, Address Modes, Instruction Sets, Programming Exercises - Memories – Different Types – Different I/O Devices, Stepper and Servo Motor Interface. Overview of Advanced Microcontrollers - Typical Applications.

UNIT V MECHATRONICS SYSTEM DESIGN AND APPLICATIONS 9

Stages in Designing Mechatronics Systems – Traditional and Mechatronic Design – Mechatronics System Elements and Architecture of CNC Machine, Serial Manipulator, Engine Management System, Car Production and its Assembly Line Automation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify suitable sensors to develop mechatronics systems.
CO2: Select the appropriate actuators and its drives for integration.
CO3: Develop the mathematical model of the mechanical systems elements for control.
CO4: Use the microcontroller for input and output interfacing.
CO5: Demonstrate the steps involved mechatronic system integration for automation for various applications.

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

TEXT BOOKS:

1. Bolton .W.,"Mechatronics" ,Pearson Education Limited, 5th Edition, 2011.
2. Devadas Shetty, Richard A. Kolk, "Mechatronics System Design", CENGAGE Learning Custom Publishing, 2nd International student edition, 2010.

REFERENCES:

1. Mazidi. M.A and Mazidi .M.J., MCkinlay.R.D, "The 8051 Microcontroller and Embedded Systems Using Assemblyand C", Pearson India, 2nd Edition, 2008.
2. Patranabis D., "Sensor and Actuators", Prentice Hall of India Pvt Ltd., 2nd edition 2005.
3. Vijayaraghavan G.K., BalasundaramM.S , Ramachandran K.P. , Mechatronics: Integrated Mechanical Electronic Systems, Willey, 2008.
4. John P. Bentley., "Principle of Measurement systems", Pearson Prentice Hall, Fourth edition, 2005.
5. K. Ogata, "Modern Controls Engineering", Prentice Hall of India Pvt. Ltd., New Delhi, 2005.

MECHATRONICS FOR AUTOMATION LABORATORY

COURSE OBJECTIVES:

- To assess the functioning of various sensors, transducers, and actuators.
- To acquires the hands on experience in simulation software, microcontroller programming and I/O interfacing.

LIST OF EXPERIMENTS:

1. Experimentation on Characterization and Application of Optical Sensors.
2. Experimentation on Characterization of Temperature Transducers.
3. Experiments on LVDT and Ultrasonic Transducer for Displacement Measurements.
4. Experiments on Resistive Transducers for Force and Torque Measurements
5. 8 bit and 16 bit Arithmetic Operation in 8051 Microcontroller.
6. I/O Port Programming of 8051 Microcontroller for Sensor and Motor Interfacing.
7. Modeling and Simulation of Mechanisms using Simulation Software.
8. Kinematic Analysis and Verification of 2 DOF RR Configuration Robot.

9. Position, Speed and Direction Measurement and Control of Servomotor.
10. Robot Control with Stepper Motor Interfacing.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1: Select and use suitable sensors and actuators more confidently.
CO2: Able to simulate the various mechanism for system development.
CO3: Practice the use microcontroller for automation in various applications.

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

PR5702 COMPUTER INTEGRATED MANUFACTURING SYSTEMS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the various automated manufacturing activities and to study the application of computer Technology in the manufacturing activities
- To familiarize the various material handling equipments
- To learn about the concepts of cellular manufacturing.
- To introduce the concepts of Flexible Manufacturing System
- To study about the principles of automated assembly system

UNIT I INTRODUCTION TO AUTOMATED PRODUCTION SYSTEMS 9

Product design – General Design Process – Elements of CAD, CAM and CIM – Functions of CIM – Benefits of CIM - Three step process for implementation of CIM – Types of Automation - Automation strategies – USA Principle – Ten strategies for automation – Automation Migration Strategy - Automated Production Lines – System Configurations – Work part Transfer Mechanisms – Storage Buffers- Industry 4.0-Digital Manufacturing.

UNIT II MATERIAL HANDLING AND STORAGE SYSTEM 9

Factors influencing material handling system – Ten principles of Material handling —Types of Material Transport Equipments; Industrial Trucks – conveyors - cranes and Hoists – Automated guided vehicle system – Mono-rails and other rail-guided vehicles – Types - Automated Storage and Retrieval systems – carousel storage systems.

UNIT III CELLULAR MANUFACTURING 9

Group Technology - Part families – Parts classification and coding – Production flow analysis – Types of Process Planning - Cellular Manufacturing – Composite part concept – Machine cell design – Key machine concept - quantitative analysis in cellular manufacturing using Holier Method.

UNIT IV FLEXIBLE MANUFACTURING SYSTEM 9

Flexible Manufacturing System - Types – FMS components – Workstations, Material Handling and storage system – types of FMS Layouts - computer control system- Human resource – Dead lock in FMS – FMS application and benefits – FMS planning and implementation issues.

UNIT V AUTOMATED ASSEMBLY AND AUTOMATED DATA COLLECTION 9

Automated assembly – Fundamentals – system configurations - Parts delivery at work stations - Applications - Shop floor control – Three phases – Factory data collection system – manual data

input techniques – Automated and semi-automated data collection (ADC) systems – Bar code technologies and other ADC Technologies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Gain and apply the knowledge using computers for various manufacturing activities
CO2: Employ the most suitable material handling equipment to accomplish the given task
CO3: Employ the principles of cellular manufacturing
CO4: Gain and apply the knowledge using flexible manufacturing system
CO5: Identify the appropriate ADC technology

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

TEXT BOOKS:

1. Kant Vajpayee.S, “Principles of Computer-Integrated Manufacturing”, Prentice Hall of India Private Limited,1st edition, 2006.
2. MikellP.Groover, “Automation, Production Systems and Computer-integrated Manufacturing”, Prentice Hall of India Private Limited, 4th edition 2014.

REFERENCES:

1. Radhakrishnan.P, Subramanyan.S and Raju.V, “CAD/CAM/CIM”, New Age International Publishers, 2nd edition 2008.
2. James A.Retrg and Henry W. Kraebher, “Computer Integrated Manufacturing”, Pearson Education, Asia, 2001.
3. Viswanathan.N and Narahari.Y, “Performance modelling of automated manufacturing system”, Prentice Hall of India Private Limited, 1st edition, 2008.
4. Alavudeen.A and Venkateshwaran.N, “Computer Integrated Manufacturing”, PHI Learning Private Limited, 2010.
5. A.W.Scheer, “Computer Integrated Manufacturing”, Springer-Verlag, 2 nd edition, 1991.

PR5711 **INTERNSHIP/ CERTIFICATE COURSES** **L T P C**
0 0 4 2

The main objective of the industrial training / internship is to experience and understand the real life situations in any industrial organization and their related environmental aspects. The students are advocated to take a small project during the training / internship.

The students have to undergo practical training for minimum of **FOUR weeks** (during 4th or 5th semester holidays) in recognized industrial establishments. The student has to submit a report at the end of 6th semester about the training / internship with the following information.

CERTIFICATE COURSES MUST BE STATED

1. Industry profile.
2. Organization structure.
3. Plant layout.

4. Process/ Machines/ Equipment/ Devices details.
5. Labor welfare schemes.
6. Training schedule.
7. Project work carried out.
8. Learning points.

The assessment will be based equally on the report in the prescribed format and Viva Voce examination by a committee nominated by the Head of the Department.

PR5712 **PROJECT I** **L T P C**
0 0 6 3

COURSE OBJECTIVES:

- A project topic may be selected based on the literature survey and the creative ideas of the students themselves in consultation with their project supervisor.
- The topic should be so chosen that it will improve and develop the skills to design, fabricate, analyse, test and research. Literature survey and a part of the project work be carried out in phase I.
- The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.
- A project report for phase I is to be submitted at the end.

EVALUATION:

- A project topic may be selected based on the literature survey and the creative ideas of the students themselves in consultation with their project supervisor.

COURSE OUTCOMES:

The students would be able to:

CO1: Apply the knowledge gained from theoretical and practical courses in solving problems
CO2: Give confidence to the students to be
CO3: Be creative, well planned
CO4: Organized
CO5: Coordinated

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

PR5811 **PROJECT II** **L T P C**
0 0 16 8

COURSE OBJECTIVES:

- To continue the work from Project Work I and complete the Project Work II in order to meet the stated objectives of the topic chosen.
- The progress of the project is evaluated based on a minimum of three reviews.
- The review committee may be constituted by the Head of the Department.
- A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report
- To improve the research and development activities of the students.

EVALUATION:

A project area must be selected by the students in consultation with the faculty members who act as a guide. The objective of the project work is to deepen comprehension of principles by applying them to a problem which may be; design and fabrication of a device / a research project with a focus on the application needed by the industry; a software oriented project involving design and analysis; a management project to apply the latest technique for an industrial problem; material characterization (or) any inter- disciplinary topic of due weightage / continued work of internship in a company etc.,

The progress of this project is evaluated based on a minimum of three reviews. The review committee will be constituted by the Head of the Department. A project report is to be submitted at the end of the project. The final end semester exam will be evaluated jointly by external and internal examiners based on oral presentation and the demonstration of the project work.

COURSE OUTCOMES:

The students would be able to:

CO1: Apply the knowledge gained from theoretical and practical courses in solving problems
CO2: Give confidence to the students to be
CO3: Be creative, well planned
CO4: Organized
CO5: Coordinated

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

PR5001 MICROMACHINING AND FABRICATION L T P C
3 0 0 3

COURSE OBJECTIVES:

- To educate on mechanism of machining in micro and nano level based on molecular dynamics.
- To introduce to various methods of microfabrication based on material addition.
- To introduce to various methods of micromachining with aid of high rate energy input.
- To introduce to micromachining processes based on abrasive flow and enhanced rheology.
- To introduce the concepts of hybrid machining for high material removal and surface finish.

UNIT I INTRODUCTION 9

Introduction to micromachining process – Classification of micromachining and nanomachining processes – Molecular dynamics (MD), principle of molecular dynamics simulation potential energy function – Boundary condition – MD simulation procedure.

UNIT II MICROFABRICATION METHODS 9

Methods of microfabrication — Electro deposition, Chemical vapour deposition, physical vapour deposition – Electro Chemical spark deposition – LIGA (**Li**thographie, **G**alvanoformung, **A**bformung) process- Stereolithoigraphy- MicroMoulding

UNIT III MECHANICAL MICROMACHINING 9

Ultrasonic machining – Abrasive jet machining – Abrasive water jet machining, water jet machining – Beam energy micromachining – Electron beam machining, Electro discharge machining, Ion beam machining, Focused ion beam machining.

UNIT IV MICROMACHINING AND NANO FUNCTIONING WITH ABRASIVE FLOW 9

Process principle and description – Process Technology Selection of machine Effect of process parameter on performance – Mechanism of materials removal Magneto Rheological Nano functioning Process. Nano functioning – Smart Rheological fluids – Magneto Rheological polishing fluid – Rheological characteristics of MR fluid – MR Abrasive Flow Finishing Process – MR Jet Finishing technology .

UNIT V HYBRID MICRO MACHINING 9

Surface Integrity of Machined surface-Chemical Mechanical polishing – Electro chemical spark micro machining – Electro discharge grinding – Electrolytic in process dressing – Laser and Ultrasonic aided Machining – High/Low temperature aided Machining -Application.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand on the molecular dynamics mechanism in micro-nano machining
CO2: Familiarize on various methods of microfabrication based on material addition.
CO3: Get the Overview of various methods of micromachining with aid of high rate energy input.
CO4: Acquire Knowledge on micromachining processes based on rheology of abrasive medium.
CO5: Realize hybrid machining for better material removal and surface finish.

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

TEXT BOOKS:

1. Jain.V.K.,"Introduction to Micromachining", Narrosa Publishing house, 2nd edition Reprint 2018.
2. Marc Madou,"Fundamentals of Microfabrication", 3rd Edition, CRC Press, 2011

REFERENCES:

1. Jain V.K., "Advanced machining process", Allied Publisher, Delhi, 2002.
2. Mohammed Gad-el-Hat,"The MEMS Hand book", CRC Press, 2nd edition, 2006.
3. Sami Franssito, "Introduction to Micro fabrication", John Wiley and sons, 2nd edition 2010.
4. MojtabaKahrizi, "Micromachining Techniques for Fabrication of Micro and Nano Structures", InTech, Chapters published, 2012.
5. Ja Mc Geogh, "Micro Machining of Engineering Materials", CRC Press, 2001.

PR5002 MODERN CONCEPTS IN MANUFACTURING L T P C

3 0 0 3

COURSE OBJECTIVES:

- The objective of this course is to teach the lean tools to attain optimum level in quality.
- Students will get knowledge on how to meet the needs of customers while maintaining high standards of quality and controlling the overall costs involved in the production of a particular product.
- Aims to develop the students to conserve energy and natural resources, and to ensure that they have minimal impact on the environment and society.
- To introduce students the basics of additive manufacturing/rapid prototyping and its applications in various fields, reverse engineering techniques
- To give students an introduction to an advanced information process techniques.

UNIT I LEAN MANUFACTURING 9

Objectives of lean manufacturing-key principles and implications of lean manufacturing -traditional Vs lean manufacturing- flow-continuous improvement/Kaizen –worker involvement- 5S principles-elements of JIT - uniform production rate - Kanban system - Lean implementation, Reconciling lean with other systems - lean six sigma- lean and ERP - lean with ISO 9001:2000.

UNIT II AGILE MANUFACTURING 9

The Agile Production Paradigm – Agile Manufacturing Vs Mass Manufacturing - Agile Practices - Agile practice for product development - Manufacturing agile practices - Implementing new technology - A checklist, technology applications that enhance agility - agile technology make or buy decisions. - Costing for Agile Manufacturing practices - Creating the learning factory: Imperative for success, factory becoming a learning factory, building a road map for becoming a learning factory

UNIT III GREEN MANUFACTURING 9

Introduction to Green Manufacturing- impact of manufacturing in environmental ecology - green manufacturing strategies - Principles of green manufacturing and its efficiency – System model architecture and module- design and planning- control or tools for green manufacturing.(Qualitative Analysis, Consumption Analysis, Life Cycle Analysis, Efficiency, Sustainability tools). - Enabling techniques for assuring green manufacturing - Carbon footprint analysis and management of manufacturing processes

UNIT IV ADDITIVE MANUFACTURING 9

Overview- Additive Manufacturing Technology in product Development - CAD and Reverse Engineering - Data Processing for Additive Manufacturing Technology: CAD model preparation – Stereo lithography – Stereo lithography Apparatus (SLA)- Principle, process, advantages and applications - Powder Based Additive Manufacturing Systems - Selective Laser Sintering – Principles of SLS process - Process, advantages and applications.

UNIT V INTELLIGENT MANUFACTURING 9

Goals of AI in manufacturing- Methods for production equipment selection and layout, Heuristic scheduling of multiple resources, Fuzzy multiple attribute decision making methods- Application of neural networks and fuzzy sets to machining and metal forming.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Demonstrate the knowledge of Additive Manufacturing and Rapid Prototyping technologies
CO2: Apply the concepts of JIT, Lean Manufacturing, and Agile Manufacturing methodologies
CO3: Assess the product life cycle, impact on environment and development of green manufacturing processes.
CO4: Implement variety of Additive Manufacturing (AM) technologies, their potential to support design and manufacturing
CO5: Apply artificial intelligence (AI) and data mining (DM) techniques to improve the efficiency of manufacturing systems

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	√		√		√		√	√				√
CO2	√		√		√		√	√				√
CO3	√		√		√		√	√				√
CO4	√		√		√		√	√				√
CO5	√		√		√		√	√				√

TEXT BOOKS:

1. Badiru A.B., "Expert Systems Applications in Engineering and Manufacturing", Prentice-Hall, New Jersey, 1st edition, 1992.
2. Kusiak, Andrew, "Intelligent Manufacturing Systems", Prentice Hall, 1st edition, 1990.

REFERENCES:

1. Black .J.T. and Kohser R.A, "DeGarmo's Materials and Processes in Manufacturing", Published by Wiley, 11th edition, 2011.
2. Chowdiah.M.P., "Agile Manufacturing", IK International Publishing House Pvt Ltd,
3. Christian N. Madu, "Handbook of environmentally conscious manufacturing", Springer US
4. Publishers, 1st edition, 2001.
5. John Schey, "Introduction to Manufacturing Processes", Tata McGraw-Hill Education ,3rd edition,1999 .
6. Rao R. V, "Advanced Modeling and Optimization of Manufacturing Processes", 2nd edition, 2006.
7. Ronald G. Askin and Jeffrey B. Goldberg, "Design and Analysis of Lean Production Systems",John Wiley and Sons, 2003.

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.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	0.9						0.3	0.9		0.6		0.9	0.3	0.3	0.3
2	0.9	0.6	0.3	0.3	0.6		0.9	0.6		0.6		0.9	0.3	0.9	0.6
3	0.9	0.3					0.6			0.6		0.9	0.6	0.6	0.3
4	0.9	0.3					0.6			0.6		0.9	0.6	0.6	0.3
5	0.9	0.3					0.6			0.6		0.9	0.6	0.6	0.3

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.

PR5003 **TOOL DESIGN** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To introduce the concepts of various types of jigs, fixtures and dies.
- To design jig / fixture/ die for a given component.
- To learn the designing of jigs, fixtures for various machining processes widely used in industries.
- To understand the elements of various work holding devices.
- To impart knowledge in tool design concepts.

UNIT I TOOL DESIGN 9

Tool design process – Material used for tooling – Cutting tool design – Work holding concepts – Computer applications in tool design – geometric dimensions and tolerancing- Principles of Jigs and Fixture – Design concepts – Different types of locating devices – different types of clamps – Drill bushes – types – Elements of fixtures – Analysis of clamping forces, tolerances and error analysis – safety factors while designing of jigs and fixtures.

UNIT II DESIGN OF JIGS AND FIXTURES 9

Design concepts of Template Jig, Plate Jig, Sandwich Jig, Vice Jaw Jig, Latch Jig, Turnover Jig, Box Jig – Design of Jigs, Fixtures for Milling, Grinding, Turning, Welding, and Assembly – Modular fixtures.

UNIT III CONCEPTS OF DIES AND ITS ELEMENTS 9

Design concepts of the following elements of progressive, compound and Combination dies – Die block – Die shoe – Bolster plate – punch – punch plate – punch holder – guide pins and guide bushes – strippers – knockouts – stops - pilots – selection of standard die sets – strip layout and development.

UNIT IV DESIGN OF DIES 9

Die design – fourteen steps to design a die - Design of Blanking, Piercing, lancing, notching and bending dies, Design features of dies for drawing, extrusion, wire drawing and forging, Design of Progressive die – compound die –combination die- Bending and drawing dies

UNIT V CASE STUDIES IN JIGS, FIXTURES AND DIES 9

Design of jigs, fixtures and dies for industrial components.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the elements of various work holding devices.
CO2: Understand the design concepts of jigs and fixtures.
CO3: Understand the different types of dies and its design concepts.
CO4: Design jigs , fixtures and dies for given component.
CO5: Identify various jigs, fixtures and dies used in industries.

TEXT BOOKS:

1. Venkataraman.K ,"Design of Jigs Fixtures and Press Tools" ,Wiley press, Ane Books, Pvt Ltd, 2015.
2. Edward G. Hoffman, "Jigs and Fixtures Design",Thomson-Delmar Learning, Singapore,2004

REFERENCES:

1. Jones.E.J.H. "Jigs and Tool Design", Ballou Press, 2009.
2. Paquin.J.R,Crowley.R.E.,"Die Design Fundamentals", Industrial Press Inc., New York, 1987.
3. Cyril Donaldson," Tool design", McGraw-Hill Education, 5th edition, 2017.
4. Handbook of die design, McGraw-Hill Education, 2nd edition 2006.
5. Joshi P H,"Jigs and Fixtures", 2nd Edition, Tata Mcgraw Hill Publications, 2001.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	√		√	√			√					√
CO2	√		√	√			√					√
CO3	√		√	√			√					√
CO4	√		√	√			√					√
CO5	√		√	√			√					√

PR5004 UNCONVENTIONAL MACHINING PROCESSES L T P C
3 0 0 3

COURSE OBJECTIVES:

- To make acquainted the various unconventional machining processes and its applications
- To encourage the students for developing the models (experimental/theoretical) of unconventional machining Processes
- To inculcate specialized knowledge and skill in unconventional machining processes using the principles and methods of engineering analysis and design.
- To cultivate the ability to develop and implement new improved manufacturing processes resulting in creation and distribution of value in engineering applications.
- To impart knowledge about the significance of controlling process parameters for the optimal performance for newly developed engineering materials used in industries and research organizations.

UNIT I MECHANICAL ENERGY BASED PROCESSES 9

Abrasive Jet Machining (AJM) – Water Jet machining (WJM) - Abrasive Water Jet Machining (AWJM) –Working Principle – equipments used – Process parameters – MRR – Applications - Ultrasonic machining (USM) – Grain throwing and Grain hammering mechanisms**.**

UNIT II CHEMICAL AND ELECTRO CHEMICAL ENERGY BASED PROCESSES 9

Chemical machining - Etchants – maskants - techniques of applying maskants – Process Parameters – MRR – Applications – Chemical blanking – Chemical milling - Electro-Chemical machining (ECM) –Principles of ECM – Equipments – MRR – Electrochemical Grinding (ECG) and Electrochemical Honing (ECH) – Applications- Micro ECM.

UNIT III ELECTRICAL ENERGY BASED PROCESSES 9

Electric Discharge Machining (EDM) – working principle – equipments –Process Parameters – MRR – Electrode- Power circuits – Tool Wear – Dielectric – Flushing – Wire cut – EDM – Applications – Micro EDM.

UNIT IV THERMAL ENERGY BASED PROCESSES 9

Laser Beam machining (LBM) - Plasma Arc machining (PAM) - Electron Beam Machining (EBM) – Ion Beam Machining (IBM) - Principle – Parameters – Equipment – Types– MRR -Applications.

UNIT V HYBRID MACHINING 9

Abrasive based hybrid machining processes - Thermal based hybrid machining processes - Electro based hybrid machining processes – Vibration assisted EDM - Vibration assisted ECM.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: The students will be in a position to select and employ an appropriate unconventional machining process for a specific application in industries.
CO2: To categorized the various unconventional manufacturing process based on energy sources and mechanism employed
CO3: To select the best suitable advanced manufacturing process for processing of unconventional materials employed in modern manufacturing industries
CO4: To study the parametric influences during processing of materials using developed models
CO5: Analyze the processes and evaluate the role of each process parameter during machining of various advanced materials.

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

TEXT BOOKS:

1. Jain.V.K, “Advanced Machining Processes”, Allied Publishers Pvt.Ltd., New Delhi, 2002.
2. Hassan Abdel,Gawad El, Hofy ,”Advanced Machining Processes”, Tata McGraw Hill, 2005.

REFERENCES :

1. Pandey, P.C. and Shan H.S., Modern Machining Processes, Tata McGraw Hill (2004).
2. Mishra, P.K., Non Conventional Machining, Narosa Publications (2006).
3. Hofy, H.E., Advanced Manufacturing Process, B and H Publication (1998).
4. Jain, V.K., Advanced Machining processes, Allied Publishers Private Limited (2004).
5. Ghosh, A. and Mullik, A., Manufacturing Science, East –West private Limited (2010)

PR5074 MATERIALS PROCUREMENT MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the various aspects of Purchasing.
- To introduce concepts of stores management.
- To familiarize the students about basic inventory management
- To introduce MRP, aggregate planning, JIT concepts.
- To illustrate the usefulness of quantitative techniques in materials management.

UNIT I PURCHASING MANAGEMENT 9

Introduction to materials management – objectives – organization — value analysis – make or buy decisions-Purchasing and procedures – Selection of sources of supply – Vendor development – Vendor evaluation and rating – Vendor rating methods- Imports – Buyer and Seller relationship.

UNIT II STORES MANAGEMENT 9

Store function – Location – Layout – Stock taking – Materials handling Travel chart method– Transportation– Codification – Inventory pricing– warehousing –Logistics.

UNIT III BASIC INVENTORY MANAGEMENT 9

Basic EOQ Models- Assumptions- Quantity discount model- Q system- P system- Reorder level- ABC analysis- Deterministic and Probabilistic models- Finite Production

UNIT IV ADVANCED INVENTORY MANAGEMENT 9

Bill of Materials-Market Production Schedule requirements planning– Aggregate planning-Aggregate planning strategies-Costs-Techniques-Tabulation method-Linear Programming Method – JIT- Lot size under constraints.

UNIT V O .R TECHNIQUES IN MATERIAL MANAGEMENT 9

Application of O.R. Techniques in Materials Management- Linear Programming – Distribution model- Replacement analysis- Scheduling – Forecasting-Forecasting techniques.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify a suitable vendor for a given requirement.
CO2: Design stores layout, select materials handling equipment.
CO3: Select a suitable inventory system for a given requirement.
CO4: Develop suitable aggregate planning strategies.
CO5: Identify suitable quantitative technique for a given situation.

TEXT BOOKS:

1. Gopalakrishnan. P, “Purchasing and Material Management”, Text and cases, Tata McGraw Hill, 1996.
2. Kesavan.R, Elanchezhian.C and VijayaRamnath.B, “Engineering Management”, Eswar Press. 2005.

REFERENCES:

1. Gupta P.K. and Man Mohan, “Problems in Operations Research”, Sultan chand and Sons, 2014.
2. Jhamb L.C,” Inventory Management”, Everest Publishing House, 2013.
3. Menan K.S and Sarikakulkarni, Purchasing and Inventory Management, Shross, 2011.
4. Stephan.N, Chapmen J.R and Tany Arnold, “Introduction to Materials Management”, Pearson , 2017.
5. Nair N.K, “Purchasing and Materials Management”, Vikas Publishing, 1990.

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

PR5005 SELECTION AND TREATMENT OF MATERIALS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the role of materials in the evolution of engineering.
- To illustrate the various factors to be considered in materials selection.
- To indicate the various methods and steps to be adopted in materials selection.
- To inform the need and emergence of alternate materials.
- To train in performing specific case studies in selection of materials.

UNIT I MATERIALS AND PROPERTIES 9

Classes of engineering materials - Evolution of Engineering Materials-Definition of materials properties- Displaying material properties using materials selection charts- Forces for change in materials selection and design, Materials and the environment.

UNIT II FACTORS IN SELECTION PROCESS 9

Design process - types of design, design requirements, function, Material attributes. Shape and Manufacturing processes - Materials processing and design processes and their influence on design, Process attributes, Systematic process selection, Process selection diagrams, Process cost, Energy consumption for production, Material costs, availability and recyclability, Environmental consideration

UNIT III MATERIALS SELECTION PROCESS 9

Materials selection methods: Screening, Ranking - weighted ranking, Performance indices - Materials selection charts, Deriving property limits and material indices, Structural indices. Shape factors, Efficiency of standard sections, Material limits for shape factors, Material indices which include shape-microscopic or micro structural shape factor, Co-selecting material and shape.

UNIT IV ALTERNATE MATERIALS 9

Environmental design, Economics and environmental impact of materials, Hybrid materials: composites, sandwich structure, lattices and segmented structure, applications of hybrid materials, polymer foams.

UNIT V CASE STUDIES 9

Automobile materials (Body panels, Engine Components), Marine structural materials (Hull and Propeller), Aircraft structural materials (Wings and landing gears), Materials for Aero engines and compressor and Gas turbines, Materials for power generation machinery (Boilers and Pressure vessels), Materials for medical applications (Surgical knives and Bone replacements), Chemical and petrochemical industries (Acid storage tanks and Fuel carrying pipes).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the relationship between the evolution of materials and the development in engineering.
CO2: Find out the various factors governing the materials selection.
CO3: Adopt suitable method and essential steps in materials.
CO4: Identify suitable alternate materials for various engineering applications.
CO5: Suggest and select appropriate materials in an engineering industry.

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

TEXT BOOKS:

1. Ashby. M.F., "Materials Selection in Mechanical Design", Third edition, Butterworth-Heineman, New York, 16th edition, 2012.
2. Charles. J. A. and Crane. F. A. A, "Selection and Use of Engineering Materials", second edition, Butterworth-Heinemann Ltd., 3rd edition 2005.

REFERENCES:

1. "ASM Handbook, Volume 20: Materials Selection and Design", ASM International, 2010.
2. Budinski. K. G., Budinski. M. K., "Engineering Materials: Properties and Selection", 2th edition, Prentice Hall, 9th edition, 2010.
3. Dieter. G. E, "Engineering Design: A Materials and Processing Approach", 5th,Edition, McGraw-Hill, 2007.
4. Mahmoud M.Farag, "Materials and Process Selection for Engineering Design", CRC Press, New York, 2nd edition, 2007.
5. Petroski. H, "Invention by Design", Harvard University Press, 1997.

IE5751 SUPPLY CHAIN MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

- Describe the role and drivers of and supply chain management in achieving competitiveness.
- Explain about Supply Chain Network Design.
- Illustrate about the issues related to Logistics in Supply Chain .
- Appraise about Sourcing and Coordination in Supply Chain.
- Application of Information Technology and Emerging Concepts in Supply Chain.

UNIT I INTRODUCTION 9

Role of Logistics and Supply chain Management: Scope and Importance - Evolution of Supply Chain – Examples of supply Chains - Decision Phases in Supply Chain - Competitive and Supply chain Strategies – Drivers of Supply Chain Performance and Obstacles.

UNIT II SUPPLY CHAIN NETWORK DESIGN 9

Role of Distribution in Supply Chain – Factors influencing Distribution network design – Design options for Distribution Network- Distribution Network in Practice - Role of network Design in Supply Chain – Framework for network Decisions.

UNIT III LOGISTICS IN SUPPLY CHAIN 9

Role of transportation in supply chain – Factors affecting transportations decision – Design option for transportation network – Tailored transportation – Routing and scheduling in transportation - 3PL- 4PL- Global Logistics **-** Reverse Logistics; Reasons, Activities and issues**.**

UNIT IV SOURCING AND COORDINATION IN SUPPLY CHAIN 9

Role of Sourcing in supply chain - Supplier selection - Contracts - Design Collaboration - Sourcing planning and analysis - Supply chain co-ordination - Bull whip effect – Effect of lack of co-ordination in supply chain and obstacles – Building strategic partnerships and trust within a supply chain.

UNIT V IT AND EMERGING CONCEPTS IN SUPPLY CHAIN 9

The role IT in supply chain-The supply chain IT framework - Customer Relationship Management – Internal supply chain management – supplier relationship management – future of IT in supply chain – E-Business in supply chain- Introduction to Warehouse Management, Risks in Supply Chain, Lean supply Chains, Sustainable supply Chains.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After undergoing this course, students will acquire

CO1: Ability to understand the scope of Supply Chain Management and the Drivers of SC performance.
CO2: Ability to design suitable SC network for a given situation.
CO3: Ability to solve the issues related to Logistics in SCM.
CO4: Ability to understand Sourcing, Coordination and current issues in SCM.
CO5: Ability to appraise about the applications of IT in SCM and apply SCM concepts in selected enterprise.

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

TEXT BOOK:

1. Sunil Chopra, Peter Meindl and D.V. Kalra, “Supply Chain Management: Strategy, Planning, and Operation", Pearson Education, 2016.

REFERENCES:

1. Ravi Ravindran A, Donald P. Warsing, Jr”, Supply Chain Engineering: Models and Applications, “CRC Press, 2012.
2. Srinivasan G.S, “Quantitative models in Operations and Supply Chain Management”, PHI, 2010.

PR5006 THEORY OF METAL CUTTING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To impart the knowledge to the students about the tool nomenclature and the mechanisms of tool wear
- To make the students familiar with the principles of mechanics of metal cutting
- To learn about the thermal aspects of machining and the usage of cutting fluids
- To familiarize about the various cutting tool materials
- To impart knowledge about the various gear cutting methods

UNIT I TOOL NOMENCLATURE, TOOL WEAR AND TOOL LIFE 9

Nomenclature of single point cutting tool and nomenclature of multi point cutting tools – Twist Drill – milling cutter – Tool geometry - Mechanisms of tool wear – Abrasion – Adhesion – Diffusion – Types of tool wear – flank wear – crater wear – Tool life – Tool life equations - factors affecting tool life – Illustrative problems – Theory of chatter

UNIT II MECHANICS OF METAL CUTTING 9

Types of chips – Continuous chips – Discontinuous chips – continuous chips with BUE – Mechanism of chip formation- Chip thickness ratio - Orthogonal cutting – Oblique cutting - Merchant circle diagram – Force relationships - shear angle - shear stress - shear strain – velocity relationships – Illustrative Problems.

UNIT III THERMAL ASPECTS AND CUTTING FLUIDS 9

Sources of heat generation in metal cutting- Experimental determination of tool temperatures – Tool – work piece thermocouple- embedded thermocouple – Infrared photographic technique- Economics of metal cutting - Cutting fluid – properties – types of cutting fluids – Selection of cutting fluids.

UNIT IV CUTTING TOOL MATERIALS 9

Types of motions in machining – Desirable properties of tool materials – Characteristics of cutting tool materials – High carbon steel, High speed steel, cast alloys, carbides, ceramics, Diamond and CBN tools- coating of tools – bits and inserts - Need for rational approach to the problem of cutting materials - Machinability

UNIT V GEAR CUTTING 9

Methods of gear manufacture – Gear Generation Methods; Gear shaping - gear planning - gear hobbing – kinematics - Bevel gear generation – Gear finishing methods – burnishing - shaving – grinding - lapping and gear honing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the principles of metal cutting theory.
CO2: Employ the various aspects of mechanics of metal cutting in manufacturing activities.
CO3: Understand the thermal aspects of metal cutting and identify the appropriate cutting fluid for the given metal cutting operation.
CO4: Identify the appropriate cutting tool material for the given metal cutting operation.
CO5: Employ the most suitable gear cutting operation for the given application.

TEXT BOOKS

1. Juneja B.L., Sekhan G.S. and Nitin Seth, “Fundamentals of metal cutting and machine tools”, New Age International Publishers, 2012.
2. Nagpal G.R., “Machine Tool Engineering”, Khanna Publishers, 2011.

REFERENCES

1. Bhattacharya.A., “Metal Cutting Theory and practice”, Central Book Publishers, India, 1984.
2. Boothroid D.G. & Knight W.A., “Fundamentals of machining and machine tools”, Marcel Dekker, Newyork, 1989.
3. Shaw.M.C.,”Metal cutting principles”, Oxford Clare don press, 1984.
4. David A.Stephenson and JognS.Agapiou, “Metal Cutting and Theory Practices”, Taylor and Francis, CRC press, 3rd Edition, 2016.

5. Geoffrey Boothroyd, Winston A, Knight, “Fundamentals of Machining and Machine Tools”, Taylor and Francis, CRC press, 3rd Edition, 2006.

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

GE5001 INDUSTRIAL MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

- To familiarize student about the concepts of inventory management.
- To introduce the students about Production Management Techniques such as work study, Plant location, Layout, Materials handling.
- To illustrate to the students about importance of financial management.
- To introduce Profit Planning and management as a concept to plan for profit.
- To familiarize the students, HR ad Marketing concepts and techniques.

UNIT I INVENTORY MANAGEMENT 11

Inventory – Purpose – Economic Order Quantity – Quantity Discount Model – Material Requirement Planning –Q System-P system- Finite Replenishment– ABC Analysis.

UNIT II PRODUCTION MANAGEMENT 10

Work Study – Method Study – Steps in method study – Motion economy – Principles – Work measurement – Stop watch – Time study – Work sampling – Plant location decision making – Plant layout – Principles types- Selection – Material handling – Principles – Selection – Plant layout, location techniques-Aggregate Planning

UNIT III FINANCIAL MANAGEMENT 10

Financial Accounting- Income statement-Balance sheet- Assets- types- Liabilities- Consumers equity- Sources of finance- Capital budgeting- Working Capital Management- Inventory Pricing.

UNIT IV PROFIT MANAGEMENT 6

Break Even Analysis – Profit planning – Angle of incidence – Margin of safety – Multi product break even analysis – Effect of variation in selling price, Fixed cost and Variable cost on break even quantity, angle of incidence and margin of safety.

UNIT V HUMAN RESOURCE MANAGEMENT AND MARKETING MANAGEMENT 8

Human resource management – Organization- Recruitment- Selection – Training and Development- Communication – Motivation – Trade union – Industrial relations – Marketing – Organization – Difference between marketing and selling – Sales promotion- Distribution channels- Advertisement – Publicity – Packaging – Market research.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Design a suitable inventory system for a given situation.
CO2: Understand work study and develop Layout and materials handling system.
CO3: Prepare financial statement such as balance sheet, income statement.
CO4: Apply concepts of Break Even Analysis for profit planning.
CO5: Develop marketing and HR skills.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓					✓			✓	✓

CO2		√	√						√			√
CO3						√			√		√	
CO4						√			√		√	
CO5									√	√	√	√

TEXT BOOKS:

1. Kesavan. R, Elanchezhian.C, and SundarSelwyn. T, "Engineering Management", Eswar Press, Chennai, 2005.
2. Panneerselvam.R, "Production and Operations Management" , PHI – 2012.

REFERENCES:

1. Aswathappa" Human Resources Management" McGraw Hill (India) - 2018.
2. Chary S.N, "Production and Operation Management" , Tata McGraw Hill-2012.
3. Philips Kotler, "Marketing Management" Pearson Education – 2015.
4. Prasanna Chandra, "Financial Management" McGraw Hill (India) - 2018.
5. Martland Telsand, "Industrial Engineering and Production Management". S.Chand. 2006.

PR5007 ELEMENTS OF GREEN MANUFACTURING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To expose the students to the basics of environmental sustainability and impact assessment objectives.
- To incorporate knowledge about the environmental based improvements towards lean manufacturing systems.
- To analyze various machineries with intent to conserve energy
- To analyze hazardous and solid wastes with intent to point out areas of adverse environmental impact and how this impact could be minimized or prevented.
- To impart the knowledge about the need, procedure and benefits of Green-Co rating.

UNIT I ENVIRONMENTAL SUSTAINABILITY AND IMPACT ASSESSMENT 9

Environmental impact assessment objectives – Legislative development – European community directive – Hungarian directive. Strategic environmental assessment and sustainability appraisal. Regional spatial planning and environmental policy.

UNIT II LEAN MANUFACTURING AND GREEN ENERGY SYSTEM 9

Conventional Manufacturing versus Lean Manufacturing – Principles of Lean Manufacturing. World energy consumption – Green house effect, Global warming. Energy conservation and measurement principles with their applicability in engineering and process industries.

UNIT III ENERGY SAVING MACHINERY AND COMPONENTS 9

Electricity Billing: Components and Costs – kVA – Need and Control – Determination of kVA demand and Consumption. Selection of fans, pumps and Compressors – Performance Evaluation – Cause for inefficient operation – scope for energy conservation.

UNIT IV HAZARDOUS AND SOLID WASTE MANAGEMENT 9

Hazardous waste: definition, terminology, classification and Sources – Need for hazardous waste management: Need, Handling, methods of collection, storage and transport with suitable examples. Solid waste management: Need, Waste prevention and Life cycle assessment. Collection, storage, reuse and recycling of solid waste with suitable examples.

UNIT V GREEN CO-RATING 9

Ecological Footprint - Need For Green Co-Rating – Green Co-Rating System – Intent – System Approach – Weightage- Assessment Process – Types Of Rating – Green Co-Benefits – Case Studies of Green Co-Rating.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the Concepts of environmental sustainability and environmental impact assessment objectives are well known to the students.

CO2: Apply suitable schemes towards design of green manufacturing requirements.

CO3: Analyze manufacturing processes towards conservation of energy.

CO4: Analyze manufacturing processes towards minimization or prevention of hazardous and solid wastes.

CO5: Acquire Knowledge of green co-rating and its benefits are well known to the students.

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

TEXT BOOKS:

1. Ronald G. Askin and Jeffrey B. Goldberg, “Design and Analysis of Lean Production Systems”, John Wiley and Sons, 2003.
2. Stephen Doven, “Environment and Sustainability Policy : Creation, implementation, Evaluation”, The Federation Press, 2005.
3. “Green Co Case Study Booklet”, CII – Sohrabji Godrej Green Business Centre, 2015

REFERENCES:

1. Clive George, Collin.C, Kirkpolarice.H, “Impact Assessment and sustainable development”, Edward Elgar Publishing 2007.
2. “Green Manufacturing: Case Studies in Lean and Sustainability, Association for Manufacturing Excellence”, CRC press,2007.
3. Chaigier N.A. “Energy Consumption and Environment”, McGraw Hill, 2007.
4. Hamies, “Energy Auditing and Conservation, Methods Measurements, management and Case Study”, Hemisphere, Washington, 1980.
5. Bhide A.D., Sundaresan B.B., “Solid Waste Management – Collection Processing and Disposal”, Mudrashilpa offset printers, Nagpur, 2001.

PR5008 DESIGN OF CASTINGS AND WELDMENTS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To expose the students to design for conducting the machining processes
- To impart knowledge to the students about the design principles of casting.
- To impart knowledge to the students about the design principles of welding.
- To conduct some of the cleaning and coating processes.

- To outline various casting processes, several defects that appear in cast part and corresponding remedial measures, and general recommendations to achieve a good quality casting.

UNIT I DESIGN FOR MACHINING

Introduction to machining, Recommended materials for machinability, Design recommendations, Design for tuning operation: Process description, Typical characteristics and applications, Suitable materials, Design recommendations, Design for machining round holes: Introduction, Suitable materials, Design recommendations, Recommended tolerances, Parts produced by milling: Process description, Characteristics and applications of parts produced on milling machines, Design recommendations for milling, Dimensional factors and tolerances, Parts produced by planning, shaping and slotting: Process description, Design recommendation planning, Design for broached parts: Process description, Typical characteristics of broached parts, Suitable materials for broaching, Design recommendations.

UNIT II DESIGN FOR CASTING

Introduction to sand casting, Typical characteristics of a sand cast part, Design recommendation for sand casting, Investment casting: Introduction, Steps in investment casting, Design consideration of Investment casting, Typical characteristics and applications, Die casting: Introduction to die casting, Advantages of the die casting process, Disadvantages of the die casting process, Applications, Suitable material consideration, General design consideration, Specific design recommendation,

UNIT III DESIGN FOR WELDING

Different types of welding processes, Design for welding: Design for recommendation for welding process, Design for solder and brazed assembly: Process, Typical characteristics, Suitable materials, Detail Design recommendations, Design for adhesively bonded assemblies: Introduction, Typical characteristics, Suitable materials, Design recommendations for adhesive joint,

UNIT IV DESIGN FOR CLEANING

Introduction to cleaning process, In-process cleaning operations, Cleaning processes and their applications, Design recommendations, Design for polishing and plating: Introduction to Polishing processes, Design recommendations for polishing process, Design for plated surface: Electroplating process, Typical characteristics, Design recommendations for plating, Hot Dip Metallic Coating: Process, Design recommendations for Hot Dip Metallic coating, Thermal sprayed coating: Process, Design recommendations for thermal sprayed coating, Vacuum Metalized surfaces: The process, Typical characteristics and applications, Design recommendations, Design for heat treatment: Introduction to heat treatment, Heat treating process for steel, Applications of heat-treated parts, Design recommendations for heat treatment.

UNIT V DESIGN FOR ASSEMBLY

The assembly process, Characteristics and applications, Example of common assembly, Economic significance of assembly, General taxonomies of assembly operation and systems, Limits fits and tolerances - Interchangeability, selective assembly, limits, fit and tolerances, limit gauging, design of limit gauges, Assembling a product, Design for Assembly: Introduction, Design consideration, Design for Fasteners: Introduction, Design recommendation for fasteners.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the machining practices to produce various parts/products.

CO2: Design the gating and riser system needed for casting and requirements to achieve defect free casting.

CO3: The students will become capable to employ the design principles of weldments in the industries.

CO4: Develop new products with clean and coated products to enhance assembly process.
CO5: Design a weld joint to improve the joint performance, and to avoid the possible welding defects.

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

TEXT BOOKS:

1. Parmar,R.S., Welding Processes and Technology, Khanna Publishers, 2006.
2. Jain,P.L., Principles of Foundry Technology, Tata McGraw Hill, 2006.

REFERENCES:

1. J. Lesko, (1999) Industrial Design, Materials and Manufacture Guide, John Willy and Sons, Inc
2. George E. Dieter and Linda C. Schmidt (2009), Engineering Design, Fourth edition, McGraw-Hill companies, New York, USA
3. Geoffrey Boothroyd, Peter Dewhurst and Winston Knight (2002) Product Design for Manufacture and Assembly, Second Edition, CRC press, Taylor & Francis, Florida, USA
4. O. Molloy, S. Tilley and E.A. Warman (1998) Design for Manufacturing and assembly, First Edition, Chapman &Hall, London, UK.
5. D. E. Whitney, (2004) Mechanical Assemblies: Their Design, Manufacture, and Role in Product Development, Oxford University Press, New York

PR5009 COMPUTER AIDED PRODUCT DESIGN L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the general design process and software tools being used in the academics and Industries.
- To introduce the computer graphics and concepts related to the design.
- To introduce the concepts on geometric modelling and applications of CAD.
- To give information about product design and process tools.
- To exhibit the knowledge in product data management and product life cycle.

UNIT I INTRODUCTION TO COMPUTER AIDED DESIGN 9

Introduction to Engineering Design – Various phases of systematic design – sequential engineering and concurrent engineering – Computer hardware and Peripherals – software packages for design and drafting.

UNIT II COMPUTER GRAPHICS FUNDAMENTALS 9

Computer graphics – applications – principals of interactive computer graphics – 2D 3D transformations – projections – curves – Bezier, B-Spline and NURBS – Concepts.

UNIT III GEOMETRIC MODELING 9

Geometric Modeling – types – Wire frame surface and solid modeling – Boundary Representation, constructive solid geometry – Graphics standards – assembly modeling – use of software packages

UNIT IV PRODUCT DESIGN CONCEPTS 9

Design for product life cycle - Product modeling – types of product models; product development process tools – TRIZ – Altshuller's inventive principles – Modeling of product metrics – Design for reliability – design for manufacturability – machining, casting, and metal forming – design for

assembly and disassembly – Design for Ergonomics - Design for environment; Bench marking – FMEA – QFD – DOE – Taguchi method of DOE – Quality loss functions .

UNIT V PRODUCT DATA MANAGEMENT 9

Product Data Management – concepts – Collaborative product design and commerce – Information Acquisition – Sourcing factor – manufacturing planning factor – Customization factor – Product life cycle management.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course students could be able to

CO1: Understand the basic design process and features of modern design tools.
CO2: Get exposure in fundamentals of computer graphics and its concepts.
CO3: Acquire knowledge on geometric modelling and usage of CAD software packages.
CO4: Develop in-depth knowledge on product design and process tools.
CO5: Gain knowledge on data handling and product life cycle management.

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

TEXT BOOKS:

1. Ibrahim Zeid, “CAD/CAM theory and Practice”, Tata McGraw Hill, 2nd edition, 2008
2. Kevin Otto, Kristin Wood, “Product Design”, Pearson Education, 7th Reprint, 2011.

REFERENCES:

1. Biren Prasad, “Concurrent engineering Fundamentals Vol. II”, Prentice Hall, 1st edition, 2007.
2. James G.Bralla , “Handbook of Product Design for Manufacturing”, McGraw Hill, 2nd edition, 2004.
3. David F.Rogers.J, Alan Adams, “Mathematical Element for Computer Graphics”, McGraw Hill, 2nd edition, 2009.
4. Donald Hearn and Pauline Baker, “Computer Graphics C Version”, Pearson Education, 2004.
5. Michael E Mortenson, “Geometric Modeling”, John Wiley & Sons Inc., 2004.

PR5010 GREEN ELECTRONICS MANUFACTURING L T P C
3 0 0 3

COURSE OBJECTIVES:

The students will be able to

- Familiarize the various standards and legislation of modern electronic manufacturing.
- Know the conventional electronic processing and lead free electronic manufacturing techniques.
- Recognize the steps involved in assembly process and understand the need of recycle of electronics
- Implement reliability and product life cycle estimation tools in green electronic manufacturing.
- Demonstrate the green electronic manufacturing procedure in applications.

UNIT I INTRODUCTION TO GREEN ELECTRONICS 9

Environmental concerns of the modern society- Overview of electronics industry and their relevant regulations in China, European Union and other key countries- global and regional strategy and policy on green electronics industry. Restriction of Hazardous substances (RoHS) - Waste Electrical and electronic equipment (WEEE - Energy using Product (EuP) and Registration - Evaluation, Authorization and Restriction of Chemical substances (REACH).

UNIT II GREEN ELECTRONICS MATERIALS AND PRODUCTS 9

Basics of IC manufacturing and its process – Electronics with Lead (Pb) -free solder pastes, conductive adhesives, Introduction to green electronic materials and products - halogen-free substrates and components. Substitution of non-recyclable thermosetting polymer based composites with recyclable materials X-Ray Fluorescence (XRF) for identifying hazardous substances in electronic products

UNIT III GREEN ELECTRONICS ASSEMBLY AND RECYCLING 9

Various processes in assembling electronics components - the life-cycle environmental impacts of the materials used in the processes - substrate interconnects. Components and process equipments used. Technology and management on e-waste recycle system construction, global collaboration, and product disassembles technology.

UNIT IV PRODUCT DESIGN AND SUSTAINABLE ECO-DESIGN 9

Stages of product development process in green design: Materials- Manufacturing - Packaging and use - End of Life and disposal - Design for recycling - Life Cycle Assessment (LCA), and Eco-design tools - Environmental management systems, and International standards - Eco-design in electronics industry

UNIT V CASE STUDIES 9

Reliability of green electronics systems , Reuse and recycle of End-of-Life(EOL) electrical and electronic equipment for effective waste management – Introduction of Green Supply Chain, and Modeling green products from Supply Chain point of view - A life-cycle assessment for eco-design of Cathode Ray Tube Recycling.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Get concise awareness of standards and legislation of modern electronic manufacturing for green environment.

CO2: Explain the conventional electronic processing and lead free electronic manufacturing techniques.

CO3: Realize the assembly process and the need of recycle of electronics

CO4: Use reliability and product life cycle estimation tools for electronic manufacturing.

CO5: Validate the green electronic manufacturing procedures in applications.

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

TEXT BOOKS:

1. Lee H.Goldberg and Wendy Middleton, “Green Electronics/ Green Bottom Line”, Newnes Publications, 2000.
2. Sammy G. Shina, “Green Electronics Design and Manufacturing”, McGraw Hill., 2008.

REFERENCES:

1. David Austen, “Green Electronic Morning”, Ingleby Gallery, 2006.
2. John Hu. Mohammed Ismail, “CMOS High Efficiency on – Chip Power Management”, Springer Publications 4th edition, 2011.
3. SankaGanesan, Michael Pecht, “Lead-free Electronics”, John Wiley & Sons, 2006.

4. Yuhang yang and Maode Ma, “Green Communications and Networks”, Springer Publication., 2014.
5. Charles A. Harper, “Electronic Materials and Processes Hand book”, McGraw-Hill, 2010.

PR5072 PRODUCTION OF AUTOMOTIVE COMPONENTS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To impart knowledge in various manufacturing methods in developing automotive components.
- To study the concepts of automobile engineering.
- To impart the knowledge in various parts of automotive engine.
- To understand the concepts of fuel and transmission system.
- To learn the recent developments in automobile industries.

UNIT I ENGINE 9

Working principle of two strokes, four stroke and wankel engines – wet and dry liners – Piston and Piston rings – types – classification. Production of Cylinder block, Cylinder head, liners, oil pan, piston and piston rings and testing.

UNIT II ENGINE COMPONENTS 9

Working principle of crank shaft – Cam shaft – valve operating mechanisms – carburetors - spark plug– connecting rod - Production of Connecting rod , Crankshaft , push rod and rocker arm ,valves, tappets , carburetors and spark plugs.

UNIT III FUEL AND TRANSMISSION SYSTEM 9

Working principle of – Fuel pumps – fuel injection pumps of diesel engines – multi point fuel injection system – Gear Box – clutch system – differential mechanism – steering system – braking system. Production of Friction lining materials for clutch and brakes, propeller shaft, gear box housing, steering column, Energy absorbing steering column.

UNIT IV CHASSIS AND SUSPENSION SYSTEM 9

Working principle of – Suspension system – leaf spring and shock absorbers – wheel housing – design concepts of chassis (aerodynamics and cross worthiness) - Production of Brake shoes, leaf spring, wheel disc, wheel rim –usage of non-metallic materials for chassis components.

UNIT V RECENT ADVANCEMENTS 9

Application of sensors and actuators – Emission control system – catalytic converter – Hydro forming of exhaust manifold and lamp housing – stretch forming of Auto body panels – MMC liners – thermal barrier coating of Engine head and valves – Selection of materials for Auto components – sensors and actuators- exhaust gas recycler (EGR)

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Acquire knowledge of production of various automotive components.
CO2: Learn the working principles of engines.
CO3: Get knowledge about various engine components.
CO4: Learn working of Fuel and Transmission System and its types.
CO5: Acquire knowledge of recent development in automobile industries.

TEXT BOOKS:

1. Hiroshi yamagata, “The Science and Technology of materials in Automotive Engines”, CRC Press Word head publishing Limited, Cambridge, England, 2005.
2. Mohamed A.Omar, “The Automotive Body Manufacturing System and Processes”, John Wiley Publications, USA, 2011.

REFERENCES:

1. Brian Cantor, “Automotive Engineering”, CRC Press, Taylor and Francis Group, London, 2008.
2. Garrett. T.K., Newton. K., Steeds. W.,"The Motor Vehicle ",Butterworth-Heinemann, 13th edition, 2001
3. Kirpal Singh, “Automobile Engineering.,Vol.Iand II”, Standard Publishers, New Delhi,13th edition,2012.
4. SeropeKalpakjian and Steven R. Schmid, “Manufacturing Processes for Engineering Materials”, Fourth Edition – Pearson Education publications, 2003.
5. V Ganesan, “Internal Combustion Engines”, Tata Mc GrawHil Publications, 4th Edition, 2017.

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

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

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Creating a process plan for a given Product.
2. Preparing cost elements for a given product.
3. Allocating overhead to different departments.
4. Estimating cost for the casting and forging products.
5. Analyzing the costs for machining a product.

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
Overhead, 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. Prepare Cost elements for a given Product.
3. Allocate Overhead to different departments.
4. Estimate cost forth Casting and Forging products.
5. 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		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	0.9	0.9	0.6	0.6							0.3	0.3	0.6		
2	0.9	0.9	0.6	0.3							0.3	0.3	0.6		
3	0.9	0.9	0.6	0.6							0.3	0.3	0.6		
4	0.9	0.9	0.6	0.6							0.3	0.3	0.6		
5	0.9	0.9	0.6	0.6							0.3	0.3	0.6		

PR5073 ROBOTIC TECHNOLOGY L T P C
3 0 0 3

COURSE OBJECTIVES:

- To study the kinematics, drive systems and programming of robots.
- To study the basics of robot laws and transmission systems.
- To familiarize students with the concepts and techniques of robot manipulator, its kinematics.
- To familiarize students with the various Programming and Machine Vison application in robots.
- To build confidence among students to evaluate, choose and incorporate robots in engineering systems.

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 KINEMATICS 9

Forward kinematics, inverse kinematics and the difference: forward kinematics and inverse Kinematics of Manipulators with two, three degrees of freedom (in 2 dimensional), four degrees of freedom (in 3 dimensional) – derivations and problems. Homogeneous transformation matrices, translation and rotation matrices Dennavit and Hartenberg transformation.

UNIT III ROBOT DRIVE SYSTEMS AND END EFFECTORS 9

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of All These Drives. End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers,

Magnetic grippers, vacuum grippers, two fingered and three fingered grippers, internal grippers and external grippers, selection and design considerations of a gripper - gripper force calculation and analysis.

UNIT IV SENSORS IN ROBOTICS 9

Force sensors, touch and tactile sensors, proximity sensors, non-contact sensors, safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance mechanism. Machine vision system - 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 V PROGRAMMING AND APPLICATIONS OF ROBOT 9

Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion Commands, Sensors commands, End-Effector Commands, and simple programs - Role of robots in inspection, assembly, material handling, underwater, space and medical fields.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Interpret the features of robots and technology involved in the control.
CO2: Apply the basic engineering knowledge and laws for the design of robotics.
CO3: Explain the basic concepts like various configurations, classification and parts of end effectors compare various end effectors and grippers and tools and sensors used in robots.
CO4: Explain the concept of kinematics, degeneracy, dexterity and trajectory planning.
CO5: Demonstrate the image processing and image analysis techniques by machine vision system.

TEXT BOOKS:

1. Ganesh.S.Hedge ,"A textbook of Industrial Robotics", Lakshmi Publications, 2006. McGraw Hill 2th edition 2012.
2. Mikell.P.Groover , "Industrial Robotics – Technology, Programming and applications",

REFERENCES:

1. Fu K.S. Gonalz R.C. and ice C.S.G."Robotics Control, Sensing, Vision andIntelligence", McGraw Hill book co. 2007.
2. YoramKoren, "Robotics for Engineers", McGraw Hill Book, Co., 2002.
3. Janakiraman P.A., "Robotics and Image Processing", Tata McGraw Hill 2005.
4. John. J.Craig, "Introduction to Robotics: Mechanics and Control" 2nd Edition, 2002.
5. Jazar, "Theory of Applied Robotics: Kinematics, Dynamics and Control", Springer India reprint, 2010.

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

PR5011 FINITE ELEMENT ANALYSIS IN APPLICATION L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the concept of FEA and to apply in the field of Manufacturing.
- To analyze a given problem using finite element techniques.
- To impart knowledge about various factors, pre-processing and post-processing steps with implementation of computer in FEA.
- To impart knowledge in the area of finite element methods and
- To know the applications of FEA in manufacturing sector .

UNIT I INTRODUCTION 9

General field problems in engineering-Discrete and continuous models-Characteristics-the relevance and place of finite element method- variational calculus- variational formulation of boundary value problems-The method of weighted residuals-Rayleigh-Ritz and Galerkin methods-Solution of large system of equations- Choleski Decomposition-Gaussian elimination procedures.

UNIT II GENERAL PROCEDURE OF FEA 9

Discretization of Domain selection of interpolation polynomials-Convergence requirements-Formulation of element characteristics matrices and load vectors – Assembly of element characteristics matrices-Solution of finite element equations-Post processing of results.

UNIT III FINITE ELEMENT ANALYSIS OF ONE DIMENSIONAL AND TWO DIMENSIONAL PROBLEMS 9

One dimensional finite element analysis-Linear bar element-Quadratic bar element-Beam element-Frame elements-One dimensional heat transfer-Two dimensional finite element analysis approximation of geometry and field variables-Three nodded triangular element-Four nodded rectangular element-Six nodded triangular element-Natural coordinates and coordinate transformation – Numerical integration-Incorporation of boundary conditions

UNIT IV ISO-PARAMETRIC ELEMENTS 9

Isoparametric elements-Dynamic analysis-Equations of motion using Lagrange's approach-Consistent and Lumped mass matrices-Formulation of FE equations for vibration problems-Solution of Eigen value problems-Transient vibration analysis-Thermal transients.

UNIT V APPLICATION OF FINITE ELEMENT ANALYSIS 9

Finite element analysis of Machine elements - Axisymmetric FEA of a pressure vessel-Application of FEM in various metal forming processes – Solid formulation and flow formulation – FEA simulation of Metal cutting, Solidification of castings and Weldments.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Acquire knowledge about fundamentals of solving Finite element problems.
CO2: Discretize and solve one-dimensional solid mechanics and heat transfer problems in FEA.
CO3: Get knowledge about the impact of shape functions and usage of higher order formulation in converging solution to FEA problem.
CO4: Implement of computer on solving FEA based problems.
CO5: Analyze a production process through FEA and control it's parameters.

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

TEXT BOOKS:

1. Chandraputla T.R., and Belegundu A.D., "Introduction of Finite Element in Engineering", Prentice Hall of India, Fourth Edition, 2012.
2. Reddy. J.N., "An Introduction to Finite Element Method", McGraw Hill, Third Edition, 2005.

REFERENCES:

1. Rao.S.S., “The Finite Element Method in Engineering”, Butterworth-Heinemann, fourth edition, 2004.
2. Segarland. L.J., “Applied Finite Element Analysis”, John Wiley and Sons, second edition, 1984.
3. Seshu.P., “Text Book of Finite Element Analysis”, Prentice Hall of India, tenth print, 2010.
4. AngelosP.Markopoulos, “Finite Element Method in Machining Processes”, Springer, 2013.
5. J. Paulo Davim,” Finite Element Method in Manufacturing Processes”, Wiley, 2011.

GE5002 QUANTITATIVE TECHNIQUES IN MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

- To familiarize the students with concepts of Linear Programming so that they can be used in industry.
- To introduce the replacement models to students so that optimal replacement policy on machine can be made.
- To enable the students to utilize the queuing models for application to waiting line problems.
- To stress on importance on forecasting and sequencing models and their use in industry.
- To familiarize project network and decision tree problems to students so that they can use them in project management.

UNIT I LINEAR PROGRAMMING 9

Problem formulation - Graphical method – simplex method- Big M method- Two Phase Method– Dual Simplex method- Special cases of LP– transportation model- assignment model – applications.

UNIT II REPLACEMENT MODELS AND GAME THEORY 9

Basic replacement model – individual replacement and group replacement problems – applications – game theory – terminology – decision criteria – solution to a 2 x 2 and 2 x n games – applications of LP in game theory – applications.

UNIT III QUEUING MODELS AND SIMULATION 9

Elements of queue – queue discipline – Poisson arrival and exponential service – queue length – waiting time – steady state conditions – applications – concept of simulation – Monte Carlo method – applications.

UNIT IV FORECASTING, SEQUENCING AND LINE BALANCING 9

Forecasting – purpose – methods – measures of forecast error; scheduling – priority rules - sequencing – methods of sequencing – Johnson’s rule – Heuristic approach, line balancing – applications.

UNIT V PROJECT NETWORK ANALYSIS AND DECISION TREE ANALYSIS 9

Network – CPM/PERT – Project time estimation – critical path – crashing of network, Decision tree analysis – applications

TOTAL: 45 PERIODS

COURSE OUTCOMES:

To students will be able to

CO1: Use the simplex method to solve problems in industry
CO2: Identify a suitable replacement model so that replacement of equipments can be done optimally
CO3: Utilize the knowledge on queuing models for banking industry
CO4: Identify forecasting model for a specific industry
CO5: Identify a suitable project network technique for project management

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

TEXT BOOKS:

1. Hamdy A.Taha, "Operations Research – An Introduction", Prentice Hall of India, 8th edition 2008.
2. Panneerselvam R., "Operation Research", Prentice Hall of India, 2008.

REFERENCES:

1. Guptha.P.K. and Man-Mohan, "Problems in Operations Research", Sultan chand and Sons, 2014.
2. Monks. J.G, "Operations Management theory and Practice", McGraw Hill, 2nd edition 1996.
3. Ravindran, Philips and Sojberg, "Operations Research Principles and Practice", John Wiley and Sons, Singapore, 2nd edition, 2007.
4. Sharma J.K., "Operations Research Theory and Applications", Macmillan India Ltd., 4th edition, 2009.
5. Kothari D P,Awari G K, "Quantitative Techniques in Business, Management and Finance", CRC Press, Taylor and Francis Group, 2016.

PR5012 ADVANCES IN OPERATIONS RESEARCH L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the basics of operation research and its engineering application
- To gain knowledge on linear and its techniques
- To gain knowledge on non- linear programming and its techniques
- To apply basic concepts of mathematics to formulate an integer programming.
- To gain the basic concepts of networking techniques

UNIT I INTRODUCTION 8

Optimization – Historical Development – Engineering applications of optimization – Statement of an Optimization problem – classification of optimization problems.

UNIT II CLASSICAL OPTIMIZATION TECHNIQUES 9

Linear programming– simplex method – dual simplex method – revised simplex method – duality in LP – Sensitivity Analysis - Parametric Linear programming.

UNIT III NON-LINEAR PROGRAMMING 10

Introduction – Lagrangian Method – Kuhn-Tucker conditions – Quadratic programming – Separable programming – Stochastic programming

UNIT IV INTEGER PROGRAMMING AND DYNAMIC PROGRAMMING 9

Integer Programming- Cutting plane algorithm – Branch and bound technique - Zero-one implicit enumeration; Geometric Programming- Dynamic Programming.

UNIT V NETWORK TECHNIQUES 9

Shortest path model- Minimum spanning tree- Maximal Flow problem

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the basic and advanced techniques of operations research.
CO2: Provide a formal quantitative approach to problem solving and an intuition about situations where such an approach is appropriate.
CO3: Introduce some widely used advanced operations research models.
CO4: Identify and develop operational research models from the verbal description of the real system.
CO5: Solve operation research problems using algorithms.

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

TEXT BOOKS:

1. Panneerselvam. R., "Operations Research", Prentice Hall of India Private Limited, NewDelhi ,2005.
2. Sharma.S.D., "Operations Research: Theory, Methods and Applications", KedarNath Ram Nath publisher, 15th edition, 1972.

REFERENCES:

1. Gupta. P.K. and Man-Mohan, "Problems in Operations Research", Sultan chand and Sons, 1994.
2. Ravindran, Philips and Solberg, "Operations Research Principles and Practice", John Wiley and Sons, Singapore, 1992.
3. Sharma.J.K.," Operations Research Theory and Applications" – Macmillan India Ltd.,1997.
4. Hamdy A. Taha, "Operations Research – An Introduction", Prentice Hall of India, 1997.
5. Srinivasan G, Operation Research, PHI, 2nd Edition, 2010

PR5013 HEAT TRANSFER L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the basic concepts and the science behind heat transfer.
- To understand the mechanism of steady and unsteady conduction heat transfer and extended surfaces
- To learn the convective heat transfer
- To understand the concepts of radiation heat transfer
- To learn the thermal analysis and sizing of heat exchangers

UNIT I MODES OF HEAT TRANSFER AND GOVERNING EQUATION 9

Modes of heat transfer - effect of temperature on thermal conductivity of different solids, liquids and gases- derivation of generalized equation in Cartesian ,cylindrical and spherical coordinates and its reduction to specific cases- General laws

UNIT II CONDUCTION 9

Fourier's law- One dimensional steady state conduction- heat conduction through plane and composite walls, cylinders and spheres-electrical analogy-critical radius of insulation for cylinder and sphere, overall heat transfer coefficient- Transient heat conduction- lumped heat capacity analysis, time constant, transient heat conduction in solids with finite conduction and convective resistances -Heat transfer from extended surface-Types of fin, heat flow through rectangular fin, infinitely long fin, fin insulated at the tip and fin losing heat at the tip-efficiency and effectiveness of fin-Biot number-Estimation of error in temperature measurement in a thermometer well.

UNIT III CONVECTION 9

Newton's law of cooling-Dimensional analysis applied to forced and free convection-dimensionless numbers and their physical significance-empirical correlations for free and forced convection -Continuity, momentum and energy equations-thermal and hydrodynamic boundary layer-Blasius solution for laminar boundary layer- General solution of Von-Karman integral momentum equation

UNIT IV RADIATION 9

Absorptivity, reflectivity and transmissivity- black, white and grey body-emissive power and emissivity-laws of radiation – Planck, Stefan-Boltzmann, Wein's displacement, Kirchhoff's law, intensity of radiation and solid angle- Lambert's cosine law Radiation heat exchange between black bodies, shape factor, heat exchange between non-black bodies- infinite parallel planes and infinite long concentric cylinders- radiation shield- heat exchange between two grey surfaces-electrical analogy

UNIT V HEAT EXCHANGER 9

Classification- heat exchanger analysis- LMTD for parallel and counter flow exchanger- condenser and evaporator- overall heat transfer coefficient- fouling factor- correction factors for multi pass arrangement- effectiveness and number of transfer unit for parallel and counter flow heat exchanger- introduction of heat pipe and compact heat exchanger.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand basic concept of heat transfer and write the general governing equation

CO2: Do calculation for steady and transient heat conduction problems.

CO3: Model convective heat transfer and solve problems

CO4: Apply scientific and engineering principles in the radiative heat transfer solve problems.

CO5: Analyze and design aspects heat exchanger and solve problems.

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

TEXT BOOKS:

1. Nag. P.K., "Heat and Mass Transfer" ,McGraw Hill, 3rd edition, 2011.
2. YunusCengel, "Heat and Mass Transfer: Fundamentals and Application", McGraw Hill, 5th edition, 2014.

REFERENCE BOOKS:

1. Dutta, Binay K, "Heat Transfer: Principles and Applications" , PHI Publication , 1st edition, 2006.
2. Holman. J P , "Heat Transfer", McGraw Hill , 10th edition, 2011.
3. Incropera and Dewitt, "Fundamental of Heat and Mass Transfer", Wiley Publication, 7th edition.
4. Mills and Ganesan, "Heat Transfer", Pearson Education , 2nd edition, 2009.
5. Rajput. R. K, "Heat and Mass Transfer", S.Chand Publication, 2007.

PR5014 **LEAN MANUFACTURING** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To introduce the lean manufacturing and identify the waste.
- To study the various tools for lean manufacturing (LM).
- To apply the above tools to implement LM system in an organization.
- To provide knowledge on perfect value creation process that has zero waste.
- To apply the lean manufacturing tools and techniques through case studies

UNIT I INTRODUCTION TO LEAN MANUFACTURING 9

Conventional Manufacturing versus Lean Manufacturing – Identification and Elimination of wastes in all forms - Principles of Lean Manufacturing – Basic elements of lean manufacturing – Introduction to LM Tools.

UNIT II CELLULAR MANUFACTURING, JIT AND TPM 9

Cellular Manufacturing – Types of Layout, Principles of Cell layout, Implementation. JIT – Principles of JIT and Implementation of Kanban. TPM – Pillars of TPM, Principles and implementation of TPM.

UNIT III SET UP TIME REDUCTION, TQM, 5S AND VSM 9

Set up time reduction – Definition, philosophies and reduction approaches. TQM – Principles and implementation. 5S Principles and implementation - Value stream mapping - Procedure and principles, EOQ, EPQ.

UNIT IV SIX SIGMA 9

Six Sigma – Definition, statistical considerations, variability reduction, design of experiments – Six Sigma implementation

UNIT V CASE STUDIES 9

Various case studies of implementation of lean manufacturing at industries.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify the waste in various manufacturing process.
CO2: Understand the principles of cellular manufacturing, JIT and TPM
CO3: Reduce the manufacturing time by applying concepts of TQM, 5S and VSM.
CO4:Get the knowledge on six sigma approach
CO5:Get knowledge on applying the lean manufacturing tools and Techniques

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

TEXT BOOKS:

1. Lonnie Wilson,"How to Implement Lean Manufacturing", McGraw-Hill Professional; 1 edition, 2009.
2. Ronald G. Askin and Jeffrey B. Goldberg, "Design and Analysis of Lean Production Systems", John Wiley and Sons, 2003.

REFERENCES:

1. Mikell P. Groover, "Automation, Production Systems and Computer-Integrated Manufacturing", 3rd Edition, 2007.
2. Rother M. and Shook J, "Learning to See: Value Stream Mapping to Add Value and Eliminate Muda" , Lean Enterprise Institute, Brookline, MA.1999.
3. William M. Field, "Lean Manufacturing: Tools, Techniques and How to use them",CRC Press, Taylor and Francis Group,2000.
4. Pascal Dennis, Lean Production Simplified- CRC press, 2007.
5. Micheal l George, David Rowlands, Mark Price, John Mazy, Lean Six Sigma, MC-Graw Hill, 2005.

PR5015 NON-DESTRUCTIVE TESTING METHODS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand principle behind various NDT techniques.
- To learn working procedures of various NDT techniques.
- To understand the concepts of NDT in various manufacturing processes.
- To impart the knowledge in selection of required NDT for specific applications.
- To learn the importance of inspection and its techniques.

UNIT I INTRODUCTION 9

Introduction to various non-destructive methods – need for inspection – types of inspection systems – quality of inspection – conditions for effective Non-destructive testing – Comparison of Destructive and Non destructive Tests, Visual Inspection, Optical aids used for visual inspection, Applications – benefits of Non-destructive testing.

UNIT II LIQUID PENETRANT TESTING AND MAGNETIC PARTICLE TESTING 9

Physical principles, procedure for penetrant testing, Pentrant testing materials, Penetrant testing methods – Applications Principle of MPT, Magnetising technical and procedure used for testing a component, Equipment used for MPT, Applications

UNIT III EDDY CURRENT TESTING AND ACOUSTIC EMISSION TESTING 9

Principles, Instrumentation for ECT, Various Techniques – High sensitivity Techniques, Single, Multi and high frequency ECT, Applications Principle of AET, AE signal parameters, Applications.

UNIT IV ULTRASONIC TESTING 9

Principle, Ultrasonic transducers, Inspection Methods – Normal incident pulse-echo Inspection, through – transmission testing, angle Beam Pulse-echo testing, Techniques A-Scan, B-Scan , C-Scan – Applications.

UNIT V RADIOGRAPHY, COMPARISON AND SELECTION OF NDT METHODS 9

Basic principle, Effect of radiation of Film, Thermography-Radiographic Imaging – Inspection Techniques – Single wall single image, Double wall Penetration and Multiwall Penetration technique – Comparison and selection of various NDT techniques.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the concepts of non- destructive testing and its applications.
CO2: Understand the procedures of Liquid Penetrant Testing and Magnetic
CO3: Apply the concepts of non- destructive techniques in various manufacturing processes.
CO4: Understand the principle of ultrasonic testing and various scanning techniques.
CO5: Select the required NDT for specific applications.

TEXT BOOKS:

1. Baldev Raj, Jeyakumar. T, Thavasimuthu. M., "Practical Non-Destructive Testing", Narosa Publishing house, New Delhi, 3rd edition, 2015.
2. Peter J. Shull, "Non Destructive Evaluation: Theory, Techniques and Application",
3. Marcel Dekker, Inc., New York, 2nd edition, 2002

REFERENCES:

1. Baldev Raj and B.Venkataraman, “Practical Radiology”, Narosa Publishing House,2011.
2. Birchan.B, “Non-Destructive Testing”, Oxford, London, 1975.
3. Krautkramer.J, “Ultrasonic Testing of Materials”, 4th Edition, Springer – Verlag Publication, New York, 1996.
4. Prasat.J and Nair C.G.K, “ Non Destructive Test and Evaluation of Materials, Tata MacGraw Hill Education, 2nd Edition, 2011.
5. Raj.B, Jayakumar.T and Thavasamuthu. M, “Practical Non Destructive Testing”, Alpha Science Internationals Limited, 3rd Edition,2002.

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

PR5071 PROCESSING OF PLASTICS AND POLYMERS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To expose the students to the basics of plastics and their applications.
- To expose the students to the basics of polymers and their applications.
- To impart knowledge about various plastic and polymer processing techniques.
- To enlighten the students about the various polymer mixing and blending techniques.
- To impart knowledge about various properties of polymers and its testing methods.

UNIT I INTRODUCTION TO PLASTICS 9

Plastics – Classification – Structure – Properties of Thermo plastics – Properties of Thermosetting Plastics – Engineering Plastics, Specialty Plastics and High temperature plastics. Properties and application of Epoxy, polyester, PMMA, PEEK, Poly propylene, polymide, phenolics, polyetherimide – Merits and Disadvantages.

UNIT II INTRODUCTION TO POLYMERS 9

Chemistry and Classification of Polymers – Glass transition temperature, thermal expansion and its effects, molecular weight, stress strain behaviour. Types of polymers - plastics and rubbers . Applications of various types of polymers.

UNIT III PROCESSING OF PLASTICS AND POLYMERS 9

Extrusion - Injection Moulding –Thermoforming – Compression moulding - Transfer moulding – Blow molding - reaction injection molding - pultrusion – calendaring - rotational molding - Rubber processing in two-roll mill, internal mixer.

UNIT IV POLYMER MIXING AND BLENDING 9

Introduction - mechanism of mixing and dispersion - mixing of solid-solid - liquid-liquid and liquids-solids - dispersive mixing distributive mixing - laminar mixing - overview of polymer mixing and blending machinery.

UNIT V POLYMER TESTING 9

Mechanical-static and dynamic: tensile, flexural, compressive, abrasion, endurance, fatigue, hardness, tears, resilience, impact, toughness. Conductivity-thermal and electrical, dielectric constant, dissipation factor, power factor, electric resistance, Surface resistivity, volume resistivity, swelling, ageing resistance, environmental stress, Cracking resistance.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: acquire knowledge of plastics and their applications are well known to the students.
CO2: acquire knowledge of polymers and their applications are well known to the students.
CO3: acquire knowledge of uses and techniques of plastics and polymer processing are well known to the students.
CO4: expose about various polymer mixing and blending techniques is well known to the students.
CO5: collect Information of various properties of polymers and its testing methods are well known to the students.

TEXT BOOKS:

1. Brent Strong. A,"Plastics Materials and Processing", Pearson Prentice Hall, Inc., New Jersey, 3rd Edition, 2005.
2. Jean-Michel Charrier ,"Polymer materials and Processing: Plastics, Elastomers, and Composites" ,Hanser Publishing, Munich Vienna New York, 1990.

REFERENCES:

1. Krishan K Chawla , "Composite Material Science and Engineering", Third Edition, Springer, 2013.
2. HoraldBelofsky, " Plastics Product design and Process Engineering", Hanser Publications,2002.
3. Charles A.Harper,"ModernPlasticsHandBook",McGraw-Hill,NewYork,2000.
4. Anand. J.S, "Applications of Plastics", CIPET,Chennai,1997.
5. B.R. Gupta, "Polymer Processing Technology", Asian Books Pvt. Ltd, 2008

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

PR5016 PROCESSING OF COMPOSITES L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the concept of composites and various types of composites.
- To enlighten the students about the different types of fibres and matrix materials
- To analyze the different polymer matrix composites processing methods and their applications
- To expose the students to the various metal matrix composite processing methods
- To analyze the various processing techniques of various ceramic matrix composites.

UNIT I COMPOSITES 9

Definition and fundamentals of composites– need for composites – enhancement of properties - Reinforcement, classification, general characteristics, rule of mixture – Theory of composites – Mechanical behavior – Stress strain relationships. Applications of various types of composites.

UNIT II FIBRES AND MATRIX MATERIALS ` 9

Fibres – Types, Fabrication, Structure, properties and applications – Glass, Boron, carbon, polyethylene, Kevlar, Aramid, Alumina, SiC ,Si_3N_4, B_4C, ceramic and metallic fibers whiskers – Matrix materials structure – Polymers – metals and ceramics – Physical and chemical properties.

UNIT III POLYMER MATRIX COMPOSITES 9

Open mould process, bag moulding, Hand layup and spray up techniques filament winding, compression and transfer moulding, BMC and SMC– pultrusion – centrifugal casting – injection moulding – structure, properties and application of PMC's – Carbon Matrix Composites – Interfaces – Properties – recycling of PMC.

UNIT IV METAL MATRIX COMPOSITES 9

Processing of MMCs: Types, Important metallic materials, Processing – solid state, Liquid state, deposition, insitu fabrication methods. Interfaces – diffusion bonding – powder metallurgy technique - properties - Applications.

UNIT V CERAMIC MATRIX COMPOSITES 9

Ceramic matrix materials – Processing – Hot pressing, liquid infiltration techniques lanxide process, Insitu, solgel, chemical reaction techniques - CVD, CVI process. Interface in CMCs. Thermal shock resistance. Applications. Properties. Surface treatment.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: acquire Knowledge about various composites and their properties are well known to the students.

CO2: acquire Knowledge about various types of fibres and matrix materials are well known to the students.

CO3: exposure of the various polymer matrix composites, processing method are well known to the students.

CO4: analyze the various processing methods of metal matrix composites.

CO5: analyze the various processing techniques of ceramic matrix composites.

TEXT BOOKS:

1. MallickP.K., "Fiber-Reinforced Composites: Materials, Manufacturing, and Design", Third Edition, CRC Press, Taylor & Francis group, 2007.
2. Krishan K Chawla, "Composite materials science and engineering", Third Edition, Springer, 2013.

REFERENCES:

1. Chawla K.K. "Composite Materails", Springer Verlag, 2013
2. Kenneth,Budinski.G and Michael K. Budinski, "Engineering Materials", Prentice Hall of India pvt ltd., 4th Indian reprint, 2010
3. Mathews F.L. and Rawlings R.D., "Composite materials, Engineering and Science", Chapman. Woodhead Publishing, 1999.
4. Strong. B, "Fundamentals of composite manufacturing", SME, 2008
5. Sharma. S.C, "Composite materials", Narosa publications, 2000
6. Weatherhead R.G. "FRP technology" (Fibre Reinforced Resin System), Applied Science Publishers Limited, London, 2012

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

PR5017 SMART MATERIALS FOR MANUFACTURING L T P C
3 0 0 3

COURSE OBJECTIVES:

- Basic concepts, types and industrial application of shape memory alloys.
- To emphasize the importance of cutting fluids and its effect in the manufacturing process
- To understand the efficiency of electrochemical energy systems for industrial application
- To familiarize the stages, measurement and control of wear.
- To know about battery technology and disseminate the student about clean and green alternate energy sources

UNIT I SHAPE MEMORY ALLOYS 9

Shape Memory Alloys – Introduction, one way memory effect, two way memory effect – Types (copper-aluminium-nickel, and nickel-titanium (Ni-Ti) alloys), manufacturing methods, properties, crystal structures, applications and limitations.

UNIT II CUTTING FLUIDS 9

Cutting Fluids – definition, types - oil, water, emulsion fluid as coolant and lubricant, selection parameters for cutting fluids, functions of cutting fluid- shear – strength reduction mechanism, applications, Smart Fluids – introduction, applications - Magnetorhelogical fluids (MR Fluids), preparation of demineralized water (ion exchange method and permanganate method).

UNIT III ELECTROCHEMICAL ENERGY SYSTEMS 9

Electrochemical cell, definition, types – difference between a galvanic cell and an electrolytic cell – a Daniel cell – electrochemical cell notations – the origin of the electrode potential – measurement of electrode potential – derivation of Nernst equation – applications (EMF measurement) – Electrodes – types – ion selective electrodes – principle and applications – reference electrode – primary and secondary electrodes – Determination of pH of a solution using glass and calomel electrodes – concentration cells – types and applications.

UNIT IV WEAR MECHANISM 9

Wear – definition, stages of wear (primary, secondary, tertiary), types – adhesive, abrasive, surface fatigue, fretting, erosion wear, measurement – Tribometry (Pin/ball on disc method), control of wear – Lubrication – theory, mechanism, types of lubricants (liquid, semi-solid, solid and gaseous), selection of lubricants.

UNIT V BATTERY TECHNOLOGY AND ENERGY SOURCES 9

Battery technology: Principle, characteristics – classification – applications – Dry cells, Lead - acid, alkaline, Nickel – cadmium and Lithium batteries, discharging and recharging mechanism. Fuel cells – merits – types – H_2 – O_2 Fuel cells, alkaline fuel cells, PEMFC, MCFC, SOFC. Alternate energy sources – nuclear energy, hydro energy, wind energy, bio energy and solar cells, UPS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Familiarize with the use chemicals in the field manufacturing

CO2: Gain knowledge about the types and applications of shape memory alloys in various industrial applications.

CO3: Understand the efficiency of the cutting fluids and its effect in the manufacturing process.

CO4: Gain knowledge about the efficiency of electrochemical energy systems for industrial application

CO5: Familiarize the various stages, measurement and control of wear.

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

CO5	✓		✓	✓	✓		✓	✓		✓		✓

TEXT BOOKS:

1. Kannan P, Ravikrishnan A, "Engineering Chemistry", Sri Krishna Hitech Publishing Company Pvt. Ltd. Chennai, Revised Edition, 2014.
2. Jain P.C. and Monika Jain., "Engineering Chemistry", Dhanpat Rai Publishing Company Pvt Ltd, New Delhi, Revised Paper Back edition, 2014.

REFERENCES:

1. Sivasankar, B., "Engineering Chemistry", Tata McGraw-Hill Publications Co Ltd, New Delhi, 1st edition, 2008.
2. Sharma, B. K., "Engineering Chemistry", Krishna Prakasan Media Pvt Ltd., Meerut, 7th edition, 2005.
3. Alexander Thaler, Daniel Watzenig, "Automotive Battery Technology" , Springer International Publishing 2014.
4. Dara S.S, Umare S.S., "Engineering Chemistry", S. Chand and Company Ltd., New Delhi,1st edition, 2014.
5. Vairam S, Kalyani P and Subaramesh., " Engineering Chemistry"., Wiley India PvtLtd.,New Delhi, 2011.

PR5018 CORROSION ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the types, mechanism of electro-chemical and its control.
- To introduce the types and mechanism of hot corrosion.
- To introduce to various types of metallic coatings to combat corrosion.
- To introduce to various types of organic coatings to combat corrosion.
- To provide overview of various techniques for surface analysis.

UNIT I CORROSION AND ITS CONTROL 9

Introduction- chemical and electrochemical corrosions- mechanism of electrochemical and galvanic corrosions- concentration cell corrosion- passivity-Pourbaix diagram- soil, pitting, inter-granular, water line, stress and microbiological corrosions- galvanic series- factors influencing corrosion - measurement of corrosion rate. Corrosion control – material selection and design - electrochemical protection – sacrificial anodic protection and impressed current cathodic protection.

UNIT II HOT CORROSION AND REFRACTORIES 9

Oxidation, sulfidation and carbonization. Ellingham diagram, Hot corrosion-– Coatings for combation; Refractories- characteristics, classification, properties – refractoriness and Refractoriness Under Load (RUL), dimensional stability, thermal spalling, thermal expansion, porosity; acidic refractories – fire clay, silica; basic refractories – magnesite, dolomite; neutral refractories – silicon carbide, zirconia.

UNIT III METALLIC COATINGS 9

Definition – methods of metallic coating, hot dipping - galvanizing, tinning, metal cladding, electroplating, electroless plating. Various other metallic coatings – displacement plating- Kanigen process – metal spraying or metallised coating – cementation or diffusion coatings.

UNIT IV CHEMICAL CONVERSION AND ORGANIC COATINGS 9

Chemical Conversion coatings- Types- phosphate, chromate, chemical oxide and anodized (Aluminium) coatings -Organic coatings- paint, vehicle or drying oil, thinners, driers- Formulation of paints, failure of paint film- Varnishes, Enamels, Lacquers, Epicoating, Emulsion Paints-types, advantages and disadvantages – Special paint.

UNIT V SURFACE CHARACTERIZATION 9

Surface–Interface–Bulk– Principle- instrumentation- block diagram-data analysis and applications of Scanning Electron Microscopy (SEM) and Transmission electron microscopy (TEM) – X-ray diffraction (XRD) -Atomic Force Microscopy (AFM), Surface Analysis by Brunauer–Emmett–Teller

(BET) Method – X-Ray Photoelectron Spectroscopy, Surface coating thickness measurements, Surface Profilometry, Contact Angle.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understanding on the mechanism of corrosion based on electro-chemical aqueous system and its control.
CO2: Understanding on the mechanism of corrosion at high temperature.
CO3: Familiarization on different techniques of metallic coatings to combat corrosion.
CO4: Familiarization on different techniques of organic coatings to combat corrosion.
CO5: Knowledge on application of different characterization and analytical tools for analysis of surface.

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

TEXT BOOKS:

1. Balasubramaniam. R, “Environmental Degradation of Materials”, Cengage International, 2010.
2. Denny A. Jones,” Principles and Prevention of Corrosion”, 2nd Edition, Prentice Hall, 1995.

REFERENCES:

1. David Talbot, James Talbot, “Corrosion Science and Technology”, CRC Press, 1998.
2. Mars. G. Fontana,” Corrosion Engineering”, 3rd ed., TMH.2010.
3. Pierre R. Roberge, “Corrosion Basics:An Introduction “ , 2nd Edition, NACE Press, Book,2006.
4. Uhlig, H.H. and Revie, W., “Corrosion and Corrosion Control”, Wiley, New York, 2007.
5. Jamal.Takadoum, “Materials and Surface Engineering in Tribology”, Wiley Publications, 2008.

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.

TEXT BOOKS:

1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. 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.

GE5351 ENGINEERING ETHICS AND HUMAN VALUES L T P C

3 0 0 3

COURSE OBJECTIVES

- To emphasize into awareness on Engineering Ethics and Human Values.
- To understand social responsibility of an engineer.
- To appreciate ethical dilemma while discharging duties in professional life.
- To understand the various safety measures in industry.

- To understand the various global issues.

UNIT I HUMAN VALUES 9

Morals, Values and Ethics – Integrity – Work Ethic – Honesty – Courage –Empathy – Self Confidence – Discrimination- Character.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - variety of moral issues - types of inquiry - moral dilemmas – moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest –Professional Ideals and Virtues - Issues of ethical theories. Valuing Time – Co-operation – Commitment.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics – Importance of Industrial Standards - a balanced outlook on law – anticorruption- occupational crime -the challenger case study.

UNIT IV ENGINEER'S RIGHTS AND RESPONSIBILITIES ON SAFETY 9

Collegiality and loyalty – Respect for authority – Collective Bargaining – Confidentiality- Conflict of interest – Occupational Crime – Professional Rights – IPR- Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island, Bhopal Gas plant and Chernobyl as case studies.

UNIT V GLOBAL ISSUES 9

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors –moral leadership-Sample code of conduct.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- Perform with professionalism in industry.
- Understand the various ethics in industry.
- Understand their rights, legal ,ethical issues.
- Understand the responsibilities pertaining to engineering profession.
- Engage in life-long learning with knowledge of contemporary issues.

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York 2005.
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000
3. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004.
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford Press , 2000.
5. R.Subramanian , "Professional Ethics ",Oxford University Press ,Reprint ,2015.

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

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.

PR5019 **ELECTRONIC MATERIALS AND PROCESSING** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To describe the basic processes of materials that are used to fabricate semiconductor and MEMS devices.
- To gather the knowledge on organic material and its manufacturing techniques.
- To acquire the basics of micro-electromechanical system integration on chip.
- To understand the process electronics fabrication in packing and assembly.
- To learn the thermal considerations of electronic materials for reliability.

UNIT I INTRODUCTION TO ELECTRONIC MATERIALS 9

Overview of Semiconductors and Other Basic Materials - Plastics, Elastomers, and Composites - Tables with Material Properties, Terms and Definitions, Trade Names, and Material Structure Correlation, Basic Electronic Components and Its Metallurgical Structure. Carrier Generation and Recombination; Junctions; Photovoltaic Materials and Devices

UNIT II ORGANIC MATERIALS AND PROCESSES 9

Types and Properties of Organic Materials, Manufacturing Technique – Vacuum Metallization, Vapour Phase Deposition, Thermal Imaging, Digital Lithography, Application Areas.

UNIT III MEMS MATERIALS AND PROCESS 9

MEMS Design Process - Methods, Selection of Materials for Process, Optimization Techniques in Design, Overview of Additive Process of Semiconductors, Dielectric Materials, Metals, and Polymer Materials, Piezoelectric Materials, Shape Memory Alloys , Micromachining Techniques, Packaging Methods.

UNIT IV PACKAGING AND ASSEMBLY OF ELECTRONICS 9

Solder Technologies for Electronic Packaging and Assembly, Electroplating and Deposited Metallic Coatings, Printed Circuit Board Fabrication, Materials and Processes for Hybrid Microelectronics and Multichip Modules - Adhesives under Fills, and Coatings in Electronics Assemblies.

UNIT V THERMAL MANAGEMENT OF MATERIALS AND SYSTEMS 9

Temperature Effects on Circuit Operation and Physical Construction. Laws of Heat Transfer Mechanism and Their Considerations in the Manufacturing Process. Thermal Management in Packaging of Electronic Materials.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Familiarize the various electronic materials and its fundamentals.
CO2: Know the use of organic materials and processes in electronics
CO3: Describe the MEMS materials and process.
CO4: Explain the packaging and assembly of electronics
CO5: Aware the thermal effects of electronic materials

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

TEXT BOOKS:

1. Charles A. Harper, “Electronic Materials and Processes Hand book”, McGraw-Hill, 2010.
2. Reza Ghodssi, Pinyen Lin, “MEMS Materials and Process Handbook”, Springer, 2011.

REFERENCES:

1. Hagen Klauk, Organic Electronics, “Materials, Manufacturing and Applications”, Wiley - VCH VerlagGmbh and Co, 2006.
2. Merrill L. Minges, “Electronic Materials Handbook”, ASM international, 1989.
3. Franky So, “Organic Electronics: Materials, Processing, Devices and Applications”, CRC Press, 2009.
4. Eugene A. Irene, “Electronic Material Science and Surfaces, Interfaces, and Thin Films for Microelectronics”, Wiley-Blackwell, 2008.
5. James R. Chelikowsk, “Electronic Materials: A New Era in Materials Science”, Springer, 1991.

PR5020 MICRO ELECTRO MECHANICAL SYSTEMS AND NANO TECHNOLOGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the changes in properties of materials with dimension reduction and materials for MEMS.
- To provide overview of microfabrication processes applicable for MEMS.
- To introduce students on the working principle of typical micro-sensors, micro-actuators and MEMS devices and the role of packaging.
- To apply knowledge on strength of materials, thermal and design engineering in design of MEMS devices.
- To familiarize the properties and method of synthesis of nanomaterials and progress of MEMS to nano system.

UNIT I EFFECT OF MINIATURISATION AND MATERIALS FOR MEMS 9

Definition – historical development – fundamentals – Scaling laws in miniaturization – Rigid Body dynamics, Electrostatic Forces, Electromagnetic properties, Electricity, diffusion property, optical property and Heat Transfer, Materials for MEMS and Microsystems – Si, Si compounds, Si Piezo resistors, GaAs, Quartz, Piezoelectric Crystals and Polymers – Doping of semiconductors – diffusion process.

UNIT II MICRO-FABRICATION PROCESSES 9

Photolithography – photo resist applications, light sources and post baking – Ion implantation – diffusion process – oxidation – thermal oxidation, silicon dioxide, oxidation rate, oxide thickness by colour – chemical vapour deposition – enhanced CVD – Physical vapour deposition – sputtering – deposition by epitaxy – etching – chemical and plasma etching. Bulk micro manufacturing – wet etching, dry etching and etch stop – surface micromachining – LIGA process – SLIGA process.

UNIT III MICROSYSTEM – WORKING PRINCIPLE AND PACKAGING 9

Micro sensors – Optical, Pressure, Acoustic wave and Thermal sensors – Micro actuation – thermal forces, shape memory alloys, piezoelectric crystals and Electrostatic Forces – MEMS with micro actuators – Micro gripper, Micro motor, micro valves and micro pumps – Micro accelerometers – Microfluidics – micro mirror array for video projection – Microsystem packaging – die level, device level and system level – Interfaces – Die preparation – surface bonding- wire bonding – sealing – Assembly of Microsystems – selection of packaging materials – signal mapping and transduction – pressure sensors packaging.

UNIT IV MICROSYSTEMS DESIGN 9

Static bending of thin plates – Mechanical Vibration – thin film mechanics – Design considerations – constraints, selection of materials, selection of Manufacturing processes, selection of signal transduction, electromechanical system and packaging – Process design – Mechanical Design Thermomechanical loading, Thermomechanical stress analysis, Dynamic Analysis and Interfacial fracture Analysis – simulation of Microfabrication process – Design of a Si die for a micro pressure sensor – Fluid resistance in Micro channels – capillary electrophoresis network systems – Design of MEMS cell gripper – Micro Optical Electro Mechanical System – Complementary Metal Oxide Semiconductor.

UNIT V NANO TECHNOLOGY 9

Classification of nano structures – effect of the nanometer length scale effects of nano scale dimensions on various properties – structural, thermal, chemical, mechanical, magnetic, optical and electronic properties –Fabrication methods – Top down processes – bottom up processes – nano positioning systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the changes in properties of materials with reduction of dimensions by Scaling laws and choice of materials for MEMS.

CO2: Overview of principles of microfabrication techniques applicable for MEMS.

CO3: Familiarize on typical MEMS sensors, actuators and devices as well as packaging.

CO4: Apply knowledge on strength of materials, design and thermal engineering for development of MEMS.

CO5: Understand on properties and method of synthesis of nanomaterials and their role in nano systems.

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

TEXT BOOKS:

1. Mahalik N P, MEMS, McGraw Hill (India), 2009
2. Tai– Ran Hsu, "MEMS and Microsystems Design and Manufacture", Tata-McGraw Hill, New Delhi, 2007.

REFERENCES:

1. Ananthasuresh G.K. Vinoy K.J. Gopalakrishnan S. Bhat K.N and Aatre V.K., "Microand smart systems", Wiley India Pvt. Ltd., New Delhi, 2010
2. Charles P Poole, Frank J Owens, "Introduction to Nano Technology", John Wiley and Sons, 2003
3. Julian W. Hardner, "Micro Sensors, Principles and Applications", CRC Press 1993.
4. Marc Madou , Fundamentals of Micro fabrication, CRC Press, New York, 2011.
5. Mark Madou, "Fundamentals of Microfabrication", CRC Press, New York, 1997.

PR5021 TOTAL QUALITY MANAGEMENT: PRINCIPLES AND APPLICATIONS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To learn about the evolution and the basic concepts of quality
- To understand the various principles, practices of TQM to achieve quality.
- To learn the various statistical approaches for Quality control.
- To understand the TQM tools for continuous process improvement.
- To learn the importance of ISO and Quality systems

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality - Basic concepts of TQM – TQM Framework - Barriers to TQM Contributions of Quality Gurus —Deming's 14 point principles – Crosby's 14 point principles – Juran Triology

UNIT II TQM PRINCIPLES 9

Quality statements - Customer focus –Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Continuous process improvement – PDCA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TOOLS & TECHNIQUES I 9

The seven traditional tools of quality- Histogram – Pareto diagram – Cause and effect diagram – Flow charts –Check sheet – Scatter diagram – Quality control charts – The seven new tools of quality – Why-why analysis - Affinity diagram – Interrelationship digraph - Tree diagram - Prioritization matrix - Process decision program chart - Activity network diagram

UNIT IV TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) – Taguchi methodology – Total Productive Maintenance –Concepts – Business Process Reengineering - Six-sigma – Concepts – case studies - Bench marking — Failure Mode and Effect Analysis – Stages, Types.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing QS 9000 – ISO 14000 – Concepts, Requirements and Benefits –Quality Council – Leadership, Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Apply basic concepts of quality gurus
CO2: Gain and apply the knowledge of TQM principles
CO3: Identify the appropriate the statistical tool to achieve the quality control
CO4: Employ the principles of continuous process improvement tools
CO5: Gain and apply the knowledge of quality systems

TEXT BOOKS:

1. Dale H.Besterfield Carol Besterfield-Michna, Glen H.Besterfield, Mary Besterfied- Sacre, Hemant Urdhwareshe, Rashmi Urdhwareshe, "Total Quality Management, Pearson Publications, 3 rd Edition, 2003.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition ,2003.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", (6thEdition), South-Western (Thomson Learning), 2005.
2. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases",Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006 .
4. Chapman and Hall, "Total Quality Management", 2nd Edition,1995.
5. P.N .Mukherjee, "Total Quality Management", Prentice- Hall iof India Private Limited, 2006.

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

PR5022 INTEGRATED PRODUCT DEVELOPMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EOL (End of Life) support activities for engineering customer

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT 9

Global Trends Analysis and Product decision - Social Trends - Technical Trends- Economic Trends - Environmental Trends - Political/Policy Trends - Introduction to Product Development Methodologies and Management - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle – Product Development Planning and Management.

UNIT II REQUIREMENTS AND SYSTEM DESIGN 9

Requirement Engineering - Types of Requirements - Requirement Engineering - traceability Matrix and Analysis - Requirement Management - System Design & Modeling - Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design.

UNIT III DESIGN AND TESTING 9

Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques – Challenges in Integration of Engineering Disciplines - Concept Screening & Evaluation - Detailed Design - Component Design and Verification – Mechanical, Electronics and Software Subsystems - High Level Design/Low Level Design 98 of S/W Program - Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing – Prototyping - Introduction to Rapid Prototyping and Rapid Manufacturing - System Integration, Testing, Certification and Documentation

UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT 9

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation - Sustenance -Maintenance and Repair – Enhancements - Product EoL - Obsolescence Management – Configuration Management - EoL Disposal

UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY 9

The Industry - Engineering Services Industry - Product Development in Industry versus Academia –The IPD Essentials - Introduction to Vertical Specific Product Development processes - Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

TEXT BOOKS:

1. Book specially prepared by NASSCOM as per the MoU.
2. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005.

REFERENCES:

1. Hiriyappa B, “Corporate Strategy – Managing the Business”, Author House, 2013.
2. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2013
3. Peter F Drucker, “People and Performance”, Butterworth – Heinemann [Elsevier], Oxford, 2004.
4. Vinod Kumar Garg and Venkita Krishnan N K, “Enterprise Resource Planning – Concepts”, Second Edition, Prentice Hall, 2003.
5. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011.

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, 7th Edn., 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 friendship Happiness 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: 45 PERIODS

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: 45 PERIODS

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 Yog Asans
- 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: 45 PERIODS

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 Yog Asans
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 Group Tarining-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: 45 PERIODS

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's ThreeSatakam , Niti-sringar-vairagya, New Delhi,2010
2. Swami Swarupananda , Srimad Bhagavad Gita, Advaita Ashram,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 main learning objective of this course is to make the students an appreciation for:
1. Introduction to Sanga Tamil Literature.
2. ‘Agathinai’ and ‘Purathinai’ in Sanga Tamil Literature.
3. ‘Attruppadai’ in Sanga Tamil Literature.
4. ‘Puranaanuru’ in Sanga Tamil Literature.
5. ‘Pathitrupaththu’ in Sanga Tamil Literature.

UNIT I SANGA TAMIL LITERATURE AN INTRODUCTION 9
Introduction to Tamil Sangam – History of Tamil Three Sangams – Introduction to Tamil Sangam Literature – Special Branches in Tamil Sangam Literature - Tamil Sangam Literature’s Grammar - Tamil Sangam Literature’s parables.

UNIT II ‘AGATHINAI’ AND ‘PURATHINAI’ 9
Tholkappiyar’s Meaningful Verses – Three literature materials – Agathinai’s message - History of Culture from Agathinai – Purathinai – Classification – Mesaage to Society from Purathinai.

UNIT III ‘ATTRUPPADAI’. 9
Attruppadai Literature – Attruppadai in ‘Puranaanuru’ - Attruppadai in ‘Pathitrupaththu’ – Attruppadai in ‘Paththupaattu’.

UNIT IV ‘PURANAANURU’ 9
Puranaanuru on Good Administration, Ruler and Subjects – Emotion & its Effect in Puranaanuru.

UNIT V ‘PATHITRUPATHTHU’ 9
Pathitrupaththu in ‘Ettuthogai’ – Pathitrupaththu’s Parables – Tamil dynasty: Valor, Administration, Charity in Pathitrupaththu - Mesaage to Society from Pathitrupaththu.

TOTAL (L: 45) = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Appreciate and apply the messages in Sanga Tamil Literature in their life.
2. Differentiate ‘Agathinai’ and ‘Purathinai’ in their personal and societal life.
3. Appreciate and apply the messages in ‘Attruppadai’ in their personal and societal life.
4. Appreciate and apply the messages in ‘Puranaanuru’ in their personal and societal life.
5. Appreciate and apply the messages in ‘Pathitrupaththu’ in their personal and societal life.

REFERENCES:
1. Sivaraja Pillai, The Chronology of the Early Tamils, Sagwan Press, 2018.
2. Hank Heifetz and George L. Hart, The Purananuru, Penguin Books, 2002.
3. Kamil Zvelebil, The Smile of Murugan: On Tamil Literature of South India, Brill Academic Pub, 1997.

4. George L. Hart, Poets of the Tamil Anthologies: Ancient Poems of Love and War, Princeton University Press, 2015.
5. Xavier S. Thani Nayagam, Landscape and poetry: a study of nature in classical 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

HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

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 Vasudhaiva Kutumbakam

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								✓	✓			✓

TEXT BOOKS:

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 – 'Nasidiya Sukta' 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's Vakyapadiyam. 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 Bhartrhari Brahmakanda, 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.

HU5177 APPLICATIONS OF PSYCHOLOGY IN EVERYDAY LIFE **L T P C**
3 0 0 3

UNIT I INTRODUCTION **7**

Nature and fields.

UNIT II PSYCHOLOGY IN INDUSTRIES AND ORGANIZATIONS **9**

Job analysis; fatigue and accidents; consumer behavior.

UNIT III PSYCHOLOGY AND MENTAL HEALTH **11**

Abnormality, symptoms and causes psychological disorders

UNIT IV PSYCHOLOGY AND COUNSELING **7**

Need of Counseling, Counselor and the Counselee, Counseling Process, Areas of Counseling.

UNIT V PSYCHOLOGY AND SOCIAL BEHAVIOUR **11**

Group, group dynamics, teambuilding, Prejudice and stereotypes; Effective Communication,

conflict and negotiation.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Schultz, D. & Schultz, S.E. (2009). Psychology and Work Today (10th ed.). New Jersey:Pearson/Prentice Hall
2. Butcher, J. N., Mineka, S., & Hooley, J. M. (2010). Abnormal psychology (14th ed.). New York: Pearson
3. Gladding, S. T. (2014). Counselling: A comprehensive profession. New Delhi: Pearson Education
4. Aronson, E., Wilson, T. D., & Akert, R. M. (2010). Social Psychology (7th Ed.). Upper Saddle River, NJ: Prentice Hall

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 ETHICS AND HOLISTIC LIFE L T P C

3 0 0 3

OBJECTIVES:

- To emphasize the meaning and nature of ethics, human values and holistic life for leading a good, successful and happy life through continuous examination of thoughts and conduct in day to day life.
- To understand the status and responsible role of individual in abatement of value crisis in contemporary world in order to develop a civilized and human society. Understanding the process of ethical decision making through critical assessment of incidents/cases of ethical dilemmas in personal, professional and social life.
- To view the place of Ethics and Human Values in the development of individual and society through identification and cross examination of life values and world view of his/her role models in society.

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 CREATIVE AND LEADERSHIP ABILITY AND THEIR DEVELOPMENT

Intellectual, Emotional, Creative, Ethico - spiritual development, Aesthetic sense, Self-dependency, Activeness, Development of positive attitude.

UNIT III HARMONY IN PERSONAL AND SOCIAL LIFE:

Concept of personal and group Ethics; Balance between - rights and duties-welfare of self and welfare of all, Creating a value based work culture in hostel, classroom and other places in the campus and society.

UNIT IV CHARACTER, RIGHTEOUSNESS AND VIRTUES FOR A MEANINGFUL LIFE

Egolessness, Humility, Righteousness, Purity, Truthfulness, Integrity, Self-restraint, Self-control, Sense of responsibility, Empathy, Love, Compassion, Maitri / Comradeship, Cooperation, Tolerance.

UNIT V DILEMMA BETWEEN MATERIALISTIC DEVELOPMENT AND HUMAN WELFARE

Science, Technology, Consumerism, Relation with Nature and Environment, New dimension of Global Harmony: Democracy, Equality, Social Justice

TOTAL:45 PERIODS

OUTCOMES:

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

1. Enable students to understand the concept of contemporary ethics at different levels: Individual, local and Global and enable them to cross examine the ethical and social consequences of the decisions of their life-view and world view.
2. Develop the ability of students to create a balance between their individual freedom and social responsibilities and enable them to identify the personal, professional and social values and integrate them in their personality after cross examination.
3. Enable students to cross examine their earlier decisions taken in life and understand the meaning of ethical dilemma to overcome the ethical dilemmas and engage in critical reflection.
4. Develop positive habits of thought and conduct and work cohesively with fellow beings who have variety of strengths, experiences, shortcomings and challenges, hence to enable them to handle diverse type of personalities.
5. Enable students to develop a method for making ethically sound decisions for themselves, within hostels, classrooms, university campus and society.

HU5273 LAW AND ENGINEERING L T P C

3 0 0 3

UNIT I THE LEGAL SYSTEM: SOURCES OF LAW AND THE COURT STRUCTURE 9

Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law- Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers. (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court) Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration.

UNIT II LAWS 9

Basic principles of contract law, sale of goods law, laws relating to industrial pollution, accident, environmental protection, health and safety at work, patent law, constitutional law: the supreme law of the land, Information technology law and cyber crimes.

UNIT III BUSINESS ORGANISATIONS 9

Sole traders (Business has no separate identity from you, all business property belongs to you).

Partnerships: Types of Partnerships - Limited Liability Partnership, General Partnership, Limited Partnerships. Companies: The nature of companies, Classification of companies, Formation of companies, Features of a public company, Carrying on business, Directors– Their Powers and Responsibilities/Liabilities.

UNIT IV LAW AND SOCIETY 9

Interdisciplinary nature of law, legal ideologies/philosophy/ schools of jurisprudence**.**

UNIT V CASE STUDIES 9

Important legal disputes and judicial litigations

TOTAL: 45 PERIODS

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).
- Assignment 2: 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
3 0 0 3

OBJECTIVES

- To internalize the importance of language by understanding its role in the transformation of man.
- To look at language, literature and culture as locus of identity and change.

- To extract meaning from existing literatures and cultures.
- To identify meanings in modern life by reconnecting with lost cultures.

UNIT I INTRODUCTION

Why study literature? Tracing the origin – pictures. Tokens as precursors of writing. Movement from three dimensions to two dimensions- Pictography. From visual to oral -Logography. Reading out literature to young children- Edmund J Farrell.

UNIT II READING CULTURE

Reading culture through language, signs and consumables- Roland Barthes. Culture through poems- Nissim Ezekiel's 'The night of the Scorpion' . 'Nothing's Changed'- Tatamkhulu Afrika- Apartheid. Ruskin Bond- 'Night train at Deoli'- How real life is different from movies.

UNIT III IDENTIFYING MEANING

Searching and locating meaning through literature. Looking for order in a chaotic world. The Myth of Sisyphus (Albert Camus) and Adi Shankar's 'Jagat Mithya'- the world as an illusion. The Indian version as 'meaningless meaning'.

UNIT IV POST MODERNISM

'If on a winter's night a traveler'- Italo Calvino. The book about the reader- the experience of reading as reading. Metafiction. Selfie Culture. Visual Culture as purpose of modern life.

UNIT V RETURNING TO PICTURES

Literature of the present- Emphasis on the visual world. Twitterature. SMS. Whatsapp language.

Consumer culture. Change in fixed gender notions. Interactive sessions. Introspection.

Reading list

1. Bond, Ruskin: 'Night train at Deoli'
2. Ezekiel, Nissim: ' The Night of the Scorpion'
3. Afrika,Tatamkhulu: 'Nothing's Changed'
4. Barthes, Roland: *Mythologies*
5. Shankaracharya: *Viveka Chudamani*
6. Camus, Albert- *The Myth of Sisyphus*
7. Calvino, Italo: *If on a winter's night a traveler*
8. Farrell, Edmund J: 'Listen, my children, and you shall read'

OUTCOMES:

- Can identify the connections among language, literature and culture.
- Is able to relate between seemingly different aspects of life.
- Understands the fractions in modern life and can assimilate meanings.