ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
REGULATIONS - 2019
CHOICE BASED CREDIT SYSTEM
B.E. INDUSTRIAL ENGINEERING

VISION :

To emerge as a Centre of excellence in the field of Industrial Engineering where the world class practices of teaching, learning and research synergize.

MISSION :

- Development of state of the art curriculum to meet the dynamic industry needs.
- Knowledge dissemination through student centric teaching learning process.
- Enriching laboratories with modern facilities
- Research contribution in the field of Industrial Engineering
- Maintaining continuous interaction with industry
- Cultivate the spirit of Entrepreneurship.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

I. Find gainful employment in manufacturing and service sector.
II. Get elevated to managerial position and lead the organization competitively.
III. Enter into higher studies leading to post-graduate and research degrees.
IV. Become consultant and provide solutions to the practical problems of any organization.
V. Become an entrepreneur and be part of a supply chain or make and sell products in the open market.

PROGRAMME OUTCOMES (POs):

After going through the four years of study, our Industrial Engineering Graduates will exhibitability to:

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

PROGRAM SPECIFIC OUTCOMES (PSOs):

By the completion of Industrial Engineering program the student will have following Program specific outcomes:

1. Foundation: Graduates will have a strong foundation in engineering, science and current industrial engineering practices and will have experience in solving structured and un structured problems using conventional and innovative solutions.
2. Communication: Graduates will have developed their communication and inter personal skills through a variety of individual and team - related activities, both multi - functional and intra - disciplinary.
3. Responsibility: Graduates will have an understanding of ethical and professional responsibilities of an engineer and the impact of engineering solutions on society and the global environment.
4. Design: Graduates will be able to effectively describe the problem, analyze the data, develop potential solutions, evaluate these solutions, and present the results using their oral, written and electronic media skills.

PEO / PO Mapping:

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

Mapping of Course Outcome and Programme Outcome

		Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	P011	PO12
YEAR 1	Sem 1	Technical English												
		Engineering Mathematics - I												
		Engineering Physics												
		Engineering Chemistry												
		Engineering Graphics	✓		✓		✓					✓		✓
		Basic Sciences Laboratory												
		Workshop Practices Laboratory	✓	✓	✓	✓								
	Sem 2	Engineering Mathematics - II												
		Problem Solving and Python Programming	✓	✓	✓	✓	✓			✓	✓			✓
		Basics of Electrical and Electronics Engineering	✓	✓	✓	✓	✓							
		Engineering Mechanics	✓		✓									
		Materials Science	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Problem Solving and Python Programming Laboratory	✓	✓	✓	✓	✓			✓	✓			✓
		Electrical and Electronics Engineering	✓	✓	✓	✓					✓		✓	

	Sem 3	Probability and Statistics												
		Mechanics of Materials	✓	✓	✓	✓	✓				✓			
		Engineering Economics	✓	✓	✓									
		Manufacturing Processes	✓	✓	✓		✓					✓		
		Facilities Design	✓			✓				✓				✓
		Manufacturing Technology Laboratory	✓	✓	✓	✓								
	Sem 4	Environmental Sciences	✓	✓	✓									
		Fluid Mechanics and Machinery	✓	✓	✓									
		Work System Design	✓	✓	✓									
		Thermodynamics		✓	✓	✓	✓							
		Mechanics of Machines	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
		Strength of Materials and Fluid Machinery Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Work System Design Laboratory		✓	✓	✓	✓							
		Employability Skills	✓	✓	✓	✓								
YEAR 3	Sem 5	Total Quality Management							✓	✓				✓
		Operations Research	✓	✓	✓									
		Machine Design	✓	✓	✓									
		Engineering Quality Control	✓	✓	✓	✓	✓					✓	✓	✓
		Professional Elective-I												
		Optimization Laboratory	✓	✓	✓	✓	✓						✓	✓
		Computer Aided Drawing Laboratory	✓		✓		✓							
	Sem 6	Production and Operations	✓	✓	✓	✓	✓	✓			✓		✓	✓
		Design of Experiments	✓	✓	✓	✓			✓					
		Reliability Engineering		✓	✓		✓						✓	
		Manufacturing Automation	✓	✓	✓	✓	✓				✓		✓	✓
		Professional Elective-II												
		Open Elective-I												
		Data Analytics Laboratory	✓		✓	✓								
		Automation Laboratory	✓	✓		✓	✓							

YEAR 4	Sem 7	Applied Ergonomics	✓	✓	✓	✓	✓					✓		✓
		Simulation Modeling and Analysis	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Supply Chain Management	✓		✓		✓	✓		✓			✓	✓
		Professional Elective-III												
		Professional Elective-IV												
		Open Elective-II												
		Discrete Simulation Laboratory		✓	✓	✓	✓							✓
		Project I		✓	✓	✓	✓				✓	✓		
		Ergonomics Laboratory		✓		✓	✓				✓	✓		
	Sem 8	Professional Elective-V												
		Professional Elective-VI												
		Professional Elective-VII												
		Project II		✓	✓	✓	✓				✓	✓		

ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

B.E. INDUSTRIAL ENGINEERING

REGULATIONS - 2019

CHOICE BASED CREDIT SYSTEM

CURRICULA AND SYLLABI FOR I TO VIII SEMESTERS

SEMESTER I

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

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA5252	Engineering Mathematics- II	BSC	3	1	0	4	4
2.	GE5153	Problem Solving and Python Programming	ESC	3	0	0	3	3
3.	EE5251	Basics of Electrical and Electronics Engineering	ESC	3	0	0	3	3
4.	GE5152	Engineering Mechanics	ESC	3	1	0	4	4
5.	PH5251	Materials Science	BSC	3	0	0	3	3
PRACTICALS								
6.	GE5161	Problem Solving and Python programming Laboratory	ESC	0	0	4	4	2
7.	EE5261	Electrical and Electronics Engineering Laboratory	ESC	0	0	4	4	2
			TOTAL	**15**	**2**	**8**	**25**	**21**

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Elective – Humanities I	HSMC	3	0	0	3	3
2.	MA5354	Probability and Statistics	BSC	3	1	0	4	4
3.	ML5352	Mechanics of Materials	ESC	3	0	0	3	3
4.	IE5301	Engineering Economics	PCC	3	0	0	3	3
5.	ME5251	Manufacturing Processes	PCC	3	0	0	3	3
6.	IE5302	Facilities Design	PCC	3	0	0	3	3
PRACTICALS								
7.	ME5461	Manufacturing Technology Laboratory	PCC	0	0	4	4	2
			TOTAL	**18**	**1**	**4**	**23**	**21**

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Elective – Humanities II	HSMC	3	0	0	3	3
2.	GE5251	Environmental Sciences	BSC	3	0	0	3	3
3.	CE5251	Fluid Mechanics and Machinery	ESC	3	0	0	3	3
4.	IE5401	Work System Design	PCC	3	0	0	3	3
5.	MF5351	Thermodynamics	PCC	3	0	0	3	3
6.	ME5452	Mechanics of Machines	PCC	3	0	0	3	3
7.		Audit Course – I*	AC	3	0	0	3	0
PRACTICALS								
8.	CE5361	Strength of Materials and Fluid Machinery Laboratory	ESC	0	0	4	4	2
9.	IE5411	Work System Design Laboratory	PCC	0	0	2	2	1
10.	HS5461	Employability Skills	EEC	0	0	4	4	2
			TOTAL	**21**	**0**	**10**	**31**	**23**

*****Audit Course is optional.

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	GE5451	Total Quality Management	HSMC	3	0	0	3	3
2.	IE5552	Operations Research	PCC	3	0	0	3	3
3.	ME5553	Machine Design	PCC	3	1	0	4	4
4.	IE5551	Engineering Quality Control	PCC	3	0	0	3	3
5.		Professional Elective-I	PEC	3	0	0	3	3
6.		Audit Course – II*	AC	3	0	0	3	0
PRACTICALS								
7.	IE5511	Optimization Laboratory	PCC	0	0	2	2	1
8.	ME5361	Computer Aided Machine Drawing	PCC	0	0	4	4	2
			TOTAL	**18**	**1**	**6**	**25**	**19**

*****Audit Course is optional.

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	IE5652	Production and Operations Management	PCC	3	0	0	3	3
2.	IE5601	Design of Experiments	PCC	3	0	0	3	3
3.	IE5653	Reliability Engineering	PCC	3	0	0	3	3
4.	IE5651	Manufacturing Automation	PCC	3	0	0	3	3
5.		Professional Elective-II	PEC	3	0	0	3	3
6.		Open Elective-I	OEC	3	0	0	3	3
PRACTICALS								
7.	IE5611	Data Analytics Laboratory	PCC	0	0	4	4	2
8.	IE5612	Automation Laboratory	PCC	0	0	2	2	1
			TOTAL	**18**	**0**	**6**	**24**	**21**

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	IE5701	Applied Ergonomics	PCC	3	0	0	3	3
2.	IE5702	Simulation Modeling and Analysis	PCC	3	0	0	3	3
3.	IE5751	Supply Chain Management	PCC	3	0	0	3	3
4.		Professional Elective-III	PEC	3	0	0	3	3
5.		Professional Elective-IV	PEC	3	0	0	3	3
6.		Open Elective-II	OEC	3	0	0	3	3
PRACTICALS								
7.	IE5711	Discrete Simulation Laboratory	PCC	0	0	2	2	1
8.	IE5712	Ergonomics Laboratory	PCC	0	0	2	2	1
9.	IE5713	Project I	EEC	0	0	6	6	3
			TOTAL	**18**	**0**	**10**	**28**	**23**

SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Professional Elective-V	PEC	3	0	0	3	3
2.		Professional Elective-VI	PEC	3	0	0	3	3
3.		Professional Elective-VII	PEC	3	0	0	3	3
PRACTICALS								
4.	IE5811	Project II	EEC	0	0	16	16	8
			TOTAL	**9**	**0**	**16**	**25**	**17**

Total Number of Credits: 166

HUMANITIES AND SOCIAL SCIENCES (HSMC) – MANAGEMENT AND OTHERS

Sl. No	Course Code	Course Title	Periods per week			Credits	Semester
			Lecture	Tutorial	Practical		
1.	HS5151	Technical English	4	0	0	4	1
2.	GE5451	Total Quality Management	3	0	0	3	4

HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

Sl. No	Course Code	Course Title	Periods per week			Credits
			Lecture	Tutorial	Practical	
1.	HU5171	Language and Communication	3	0	0	3
2.	HU5172	Values and Ethics	3	0	0	3
3.	HU5173	Human Relations at Work	3	0	0	3
4.	HU5174	Psychological Processes	3	0	0	3
5.	HU5175	Education, Technology and Society	3	0	0	3
6.	HU5176	Philosophy	3	0	0	3
7.	HU5177	Applications of Psychology in Everyday Life	3	0	0	3

HSMC– ELECTIVES – HUMANITIES II (EVEN SEMESTER)

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

BASIC SCIENCE COURSE [BSC]

Sl. No	Course Code	Course Title	Periods per week			Credits	Semester
			Lecture	Tutorial	Practical		
1.	MA5158	Engineering Mathematics - I	3	1	0	4	1
2.	PH5151	Engineering Physics	3	0	0	3	1
3.	CY5151	Engineering Chemistry	3	0	0	3	1
4.	BS5161	Basic Sciences Laboratory	0	0	4	2	1
5.	MA5252	Engineering Mathematics-II	3	1	0	4	2
6.	PH5251	Materials Science	3	0	0	3	2
7.	MA5354	Probability and Statistics	3	1	0	4	3
8.	GE5251	Environmental Sciences	3	0	0	3	4

ENGINEERING SCIENCE COURSE [ESC]

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

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 CORE COURSES [PCC]

Sl. No.	Course Code	Course Title	Periods per week			Credits	Semester
			Lecture	Tutorial	Practical		
1	IE5301	Engineering Economics	3	0	0	3	3
2	IE5302	Facilities Design	3	0	0	3	3
3	ME5251	Manufacturing Processes	3	0	0	3	3
4	ME5461	Manufacturing Technology Laboratory	0	0	4	2	3
6	IE5401	Work System Design	3	0	0	3	4
7	MF5351	Thermodynamics	3	0	0	3	4
8	ME5452	Mechanics of Machines	3	0	0	3	4
9	CE5391	Strength of Materials and Fluid Machinery Laboratory	0	0	4	2	4
10	IE5411	Work System Design Laboratory	0	0	2	1	4
11	IE5552	Operations Research	3	0	0	3	5
12	ME5553	Machine Design	3	1	0	4	5
13	IE5551	Engineering Quality Control	3	0	0	3	5
14	IE5511	Optimization Laboratory	0	0	2	1	5
15	ME5361	Computer Aided Drawing Laboratory	0	0	4	2	5
16	IE5652	Production and Operations Management	3	0	0	3	6
17	IE5601	Design of Experiments	3	0	0	3	6
18	IE5653	Reliability Engineering	3	0	0	3	6
19	IE5651	Manufacturing Automation	3	0	0	3	6
20	IE5611	Data Analytics Laboratory	0	0	2	1	6
21	IE5612	Automation Laboratory	0	0	2	1	6

22	IE5701	Applied Ergonomics	3	0	0	3	7
23	IE5702	Simulation Modeling and Analysis	3	0	0	3	7
24	IE5751	Supply Chain Management	3	0	0	3	7
25	IE5711	Discrete Simulation Laboratory	0	0	2	1	7
26	IE5712	Ergonomics Laboratory	0	0	2	1	7

PROFESSIONAL ELECTIVE COURSES

SEMESTER V, ELECTIVE I

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	IE5001	Applied Multi-Variate Statistical Analysis	PEC	3	0	0	3	3
2.	IE5002	Computational Methods and Algorithms	PEC	3	0	0	3	3
3.	IE5073	Lean Six Sigma	PEC	3	0	0	3	3

SEMESTER VI, ELECTIVE II

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	IE5074	Machine Learning Algorithms	PEC	3	0	0	3	3
2.	IE5003	Accounting and Finance for Management	PEC	3	0	0	3	3
3.	IE5004	Advanced Optimization Techniques	PEC	3	0	0	3	3

SEMESTER VII, ELECTIVE III

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	IE5005	Maintenance Engineering and Management	PEC	3	0	0	3	3
2.	IE5006	Robotics Engineering	PEC	3	0	0	3	3
3.	IE5007	Productivity Management and Re-engineering	PEC	3	0	0	3	3

SEMESTER VII, ELECTIVE IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	IE5008	Manufacturing Systems and Models	PEC	3	0	0	3	3
2.	IE5009	Operations Scheduling	PEC	3	0	0	3	3
3.	ME5075	Entrepreneurship Development	PEC	3	0	0	3	3
4.	MG5451	Principles of Management	PEC	3	0	0	3	3

SEMESTER VIII, ELECTIVE V

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	IE5010	Product Design and Value Engineering	PEC	3	0	0	3	3
2.	IE5077	Systems Engineering	PEC	3	0	0	3	3
3.	IE5011	Metrology and Inspection	PEC	3	0	0	3	3
4.	IE5012	Project Management	PEC	3	0	0	3	3

SEMESTER VIII, ELECTIVE VI

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	IE5072	Enterprise Resource Planning	PEC	3	0	0	3	3
2.	IE5013	Software Engineering and Methodologies	PEC	3	0	0	3	3
3.	IE5076	Safety Engineering and Management	PEC	3	0	0	3	3
4.	IE5075	Principles of Computer Integrated Manufacturing Systems	PEC	3	0	0	3	3

SEMESTER VIII, ELECTIVE VII

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	IE5014	Introduction to Automotive Systems	PEC	3	0	0	3	3
2.	IE5015	Cost Estimation and Cost Control	PEC	3	0	0	3	3
3.	IE5016	Applied Soft Computing	PEC	3	0	0	3	3
4.	IE5071	Decision Support and Intelligent Systems	PEC	3	0	0	3	3

EMPLOYABILITY ENHANCEMENT COURSES [EEC]

SL. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEM
			L	T	P		
1	HS5461	Employability Skills	0	0	4	2	4
2	IE5713	Project I	0	0	6	3	7
3	IE5811	Project II	0	0	16	8	8

SUMMARY

Name of the Programme										
	Subject Area	Credits per Semester								Credits Total
		I	II	III	IV	V	VI	VII	VIII	
1.	HSMC	04	00	03	03	03	00	00	00	13
2.	BSC	12	07	04	03	00	00	00	00	26
3.	ESC	05	14	00	00	00	00	00	00	19
4.	PCC	00	00	14	15	13	15	11	00	68
5.	PEC	00	00	00	00	03	03	06	09	21
6.	OEC	00	00	00	00	00	03	03	00	06
7.	EEC	00	00	00	02	00	00	03	08	13
	Non Credit/AC				0	0				
	Total Credit	**21**	**21**	**21**	**23**	**19**	**21**	**23**	**17**	**166**

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

COURSE OBJECTIVES:

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

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

UNIT I INTRODUCING ONESELF 12

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

UNIT II DIALOGUE WRITING 12

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

UNIT III FORMAL LETTER WRITING 12

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

UNIT IV WRITING COMPLAINT LETTERS 12

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

UNIT V WRITING DEFINITIONS AND PRODUCT DESCRIPTION 12

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

TOTAL: 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 MATHEMATICS – 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, photoprocesses and instrumentation & applications of spectroscopic techniques.
- To familiarize the operating principles and applications of energy conversion, its processes and storage devices.
- To inculcate sound understanding of water quality parameters and water treatment techniques.

UNIT I POLYMER CHEMISTRY 9

Introduction: Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermosetting. Types and mechanism of polymerization: addition (free radical, cationic, anionic and living); condensation and copolymerization. Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Structure, Properties and uses of: PE, PVC, PC, PTFE, PP, Nylon 6, Nylon 66, Bakelite, Epoxy; Conducting polymers – polyaniline and polypyrrole.

UNIT II NANOCHEMISTRY 9

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

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY 9

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

UNIT IV ENERGY CONVERSIONS AND STORAGE 9

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

UNIT V WATER TECHNOLOGY 9

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

TOTAL: 45 PERIODS

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, 2ndEd., 2009.
5. Venugopal, K. and Prabhu Raja, V., “Engineering Graphics”, New Age,2008.

Publication of Bureau of Indian Standards:

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

Special points applicable to University Examinations on Engineering Graphics:

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

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	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 (8^{th} edition, 2014).

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

COURSE OBJECTIVES:

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

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; 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 = 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	

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.
CO 5 To be able to understand the characteristics and working of current controlled and voltage controlled devices.

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

TEXT BOOKS:

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

REFERENCES:

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

GE5152 **ENGINEERING MECHANICS** **L T P C**
3 1 0 4

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

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

UNIT I STATICS OF PARTICLES (9+3)
Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles -Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle- Newton's First Law of Motion, Space and Free-Body Diagrams, Forces in Space, Equilibrium of a Particle in Space.

UNITII EQUILIBRIUM OF RIGID BODIES (9+3)
Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point, Varignon's Theorem, Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a Force about an Axis, Couple - Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force -Couple system, Further Reduction of a System of Forces, Equilibrium in Two and Three Dimensions - Reactions at Supports and Connections.

UNITIII DISTRIBUTED FORCES (9+3)
Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration , Theorems of Pappus-Guldinus, Distributed Loads on Beams, Centre of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies , Determination of Centroids of Volumes by Integration.
Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration , Polar Moment of Inertia , Radius of Gyration of an Area , Parallel-Axis Theorem , Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates, Determination of the Moment of Inertia of a Three-Dimensional Body by Integration

UNIT IV FRICTION (9+3)
The Laws of Dry Friction. Coefficients of Friction, Angles of Friction, Wedges, Wheel Friction. Rolling Resistance, Ladder friction.

UNITV DYNAMICS OF PARTICLES (9+3)
Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion -Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods - Work of a Force , Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact, Method of Virtual Work - Work of a Force, Potential Energy, Potential Energy and Equilibrium.

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

COURSE OUTCOMES:

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

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

MA5354 **PROBABILITY AND STATISTICS** **L T P C**
3 1 0 4

COURSE OBJECTIVES:

- To understand the basics of random variables with emphasis on the standard discrete and continuous distributions.
- To understand the basic probability concepts with respect to two dimensional random variables along with the relationship between the random variables and the significance of the Central Limit theorem.
- To apply the small/ large sample tests through Tests of hypothesis.
- To understand the concept of analysis of variance and use it to investigate factorial dependence.
- To monitor a process and detect a situation when the process is out of control.

UNIT I RANDOM VARIABLES 12

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions – Functions of a random variable.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTS OF SIGNIFICANCE 12

Type I and Type II errors – Tests for single mean, proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – Chi-square test for goodness of fit – Independence of attributes – Non-parametric tests: Test for Randomness and Rank – Sum test (Wilcoxon test).

UNIT IV DESIGN OF EXPERIMENTS 12

Completely Randomized Design – Randomized Block Design – Latin Square Design – Factorial design – Taguchi's robust parameter design.

UNIT V STATISTICAL QUALITY CONTROL 12

Control charts for measurements ($\bar{X}$ and R charts) – Control charts for attributes (p, c and np charts) Tolerance limits – Acceptance sampling.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

- To analyze the performance in terms of probabilities and distributions achieved by the determined solutions
- To be familiar with some of the commonly encountered two dimensional random variables and be equipped for a possible extension to multivariate analysis
- To apply the basic principles underlying statistical inference(estimation and hypothesis testing)
- To demonstrate the knowledge of applicable large sample theory of estimators and tests
- To obtain a better understanding of the importance of the methods in modern industrial processes.

TEXT BOOKS:

1. Devore, J.L. "Probability and Statistics for Engineering and the Sciences", Cengage Learning, 9th Edition, Boston, 2017.
2. Johnson, R.A. and Gupta, C.B. "Miller and Freund's Probability and Statistics for Engineers", Pearson India Education, Asia, 9th Edition, New Delhi, 2017.
3. Walpole, R.E., Myers R.H., Myres S.L., and Ye, K. "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th Edition, New Delhi, 2011.

REFERENCES:

1. Krishnaiah, K. and Shahabudeen, P. "Applied Design of Experiments and Taguchi Methods", Prentice Hall of India, New Delhi, 2012.
2. Milton, J.S. and Arnold, J.C. "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 3rd Reprint, New Delhi, 2008.
3. Ross, S.M. "Introduction to Probability and Statistics for Engineers and Scientists", Elsevier, 5th Edition, New Delhi, 2014.
4. Spiegel, M.R., Schiller, J., Srinivasan, R.A. and Goswami, D., "Schaum's Outline of Theory and Problems for Probability and Statistics", McGraw Hill Education, 3rd Edition, Reprint, New Delhi, 2017.

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

COURSE OBJECTIVES:

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

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

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumertric strains

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending – Bending stress distribution – Flitched beams – Shear stress distribution.

UNIT III TORSION 9

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

UNIT IV DEFLECTION OF BEAMS 9

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

UNIT V THICK & THIN SHELLS & PRINCIPAL STRESSES 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

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

TEXT BOOKS:

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

REFERENCES:

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	0.9	0.9	0.9										0.9	0.6	
C02	0.9	0.9	0.9										0.9	0.6	
C03	0.9	0.9	0.9										0.9	0.6	
CO4	0.9	0.9	0.9										0.9	0.6	
CO5	0.9	0.9	0.9										0.9	0.6	

IE5301 ENGINEERING ECONOMICS L T P C
3 0 0 3

COURSE OBJECTIVES:

- Understanding the concept of Engineering Economics.
- Implement various micro economics concept in real life.
- Gaining knowledge in the field of macro economics to enable the students to have better understanding of various components of macro economics.
- Understanding the different procedures of pricing.
- Learn the various cost related concepts in micro economics.

UNIT I INTRODUCTION TO MANAGERIAL ECONOMICS AND DEMAND ANALYSIS 9

Definition of Managerial Economics - Nature and scope of Managerial Economics - Managerial Economics and other disciplines. Objectives of the firm - Factors influencing Managerial decisions, Demand Analysis – Defining demand, Types of demand and Determinants of demand, Elasticity of Demand and Supply.

UNIT II PRODUCTION AND COST ANALYSIS 9

Production Analysis – Production function, Returns to a factor, Returns to scale, ISO quants and least cost combination of inputs. Cost Analysis – Cost concepts, Determinants of cost, Short-run cost-output Relationship, Long-run cost output relationship, Economies and Diseconomies of scale and Estimating cost-Output Relationship.

UNIT III PRICING 9

Determinants of Price – Pricing under different objectives – Pricing under different market structures – Price discrimination – Pricing of Joint products – Pricing methods in practice.

UNIT IV MACRO ECONOMICS – I 9

National Income – Definition and Measurement – GDP, GNP, NDP, Personal Income – Business Cycles – Two and Four phases – Inflation – Causes and Effects of inflation.

UNIT V MACRO ECONOMICS - II 9

MRTP – FERA – International Trade – Balance of Trade – Balance of payments – Terms of Trade – Fiscal Policy – Foreign Exchange.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Students will become familiar with principles of micro economics and demand forecasting.
CO2: Good understanding and knowledge in production and detailed cost analysis.
CO3: The principles of pricing methodologies are familiarized.
CO4: Macro Economics of various parameters of Gross National Product.
CO5: Awareness in business dynamics in macro economics.

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

TEXT BOOKS:

1. Nag A, “Macro Economics for Management Students” MacMillan India Ltd., New Delhi, 2005.
2. Yogesh Maheshwari, “Managerial Economics”, Third edition, PHI 2012.

REFERENCES:

1. Mote V L, Samuel Paul and G.S.Gupta, “ Managerial Economics – concepts and cases”,McGraw Hill Education (India), 2011.
2. Paneerselvam R, “Engineering Economics”, PHI, 2013.
3. Ramachandra Aryasri A and Ramana Murthy V V, “Engineering Economics and Financial Accounting”, McGraw Hill Education (India), New Delhi, 2004.

ME5251 MANUFACTURING PROCESSES L T P C
3 0 0 3

COURSE OBJECTIVES:

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

1. Applying the working principles of various metal casting processes.
2. Applying the working principles of various metal joining processes.
3. Analyzing the working principles of bulk deformation of metals.
4. Applying the working principles of sheet metal forming process.
5. Applying the working principles of plastics molding.

UNIT I METAL CASTING PROCESSES 9

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

UNIT II METAL JOINING PROCESSES 9

Fusion welding processes – Type of Gas welding – Flame characteristics – Filler and Flux materials – Arc welding, Electrodes, Coating and specifications – Principles and types of Resistance welding – Gas metal arc welding – Submerged arc welding – Electro slag welding – Gas Tungsten arc welding – Principle and application of special welding processes – Plasma arc welding – Thermit Welding – Electron beam welding – Friction welding – Friction stir welding – Diffusion welding – Weld defects – Brazing and soldering – methods and process capabilities – Adhesive bonding, Types and application

UNIT III BULK DEFORMATION PROCESSES 9

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

UNIT IV SHEET METAL PROCESSES 9

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

UNIT V MANUFACTURE OF PLASTIC COMPONENTS 9

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

TOTAL = 45 PERIODS

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

1. Apply the working principles of various metal casting processes.
2. Apply the working principles of various metal joining processes.
3. Analyze the working principles of bulk deformation of metals.
4. Apply the working principles of sheet metal forming process.
5. Apply the working principles of plastics molding.

TEXT BOOKS:

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

REFERENCES:

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

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

IE5302 **FACILITIES DESIGN** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- Explain the basic principles in facilities planning and plant location.
- Interpret the basic principles in facility layout design decisions through proper analysis.
- Illustrate and explain various modern trends while designing a layout.
- Develop knowledge in line balancing concepts to implement improved system.
- Summarize basic principles in designing, measuring and analyzing material flow to improve the efficiency of the system .

UNIT I PLANT LOCATION 9

Introduction, Factors affecting location decisions, Qualitative models, Quantitative models, Break-Even analysis model, Brown & Gibbs model, Single facility location models, Gravity location models, Mini-Sum model, Mini-Max model, Multi facility location models, Covering model, Warehouse location model.

UNIT II FACILITIES LAYOUT DESIGN 9

Need for layout study, Objectives of a good facility layout, Classification of layout, Layout procedure – Nadler's ideal system approach – Immer's basic steps – Apple's layout procedure – Reed's layout procedure, Layout planning – Systematic layout planning(SLP) – Information gathering, Flow analysis & Activity analysis, Relationship diagram, Space requirement and availability, Designing the layout.

UNIT III COMPUTERIZED LAYOUT PLANNING 9

Designing the process layout – CRAFT, ALDEP, CORELAP – Trends in computerized layout, Group technology models – Production flow analysis (PFA) – Rank order clustering (ROC).

UNIT IV DESIGNING PRODUCT LAYOUT 9

Line balancing – Objectives, Line balancing techniques – Largest candidate rule (LCR) – Kilbridge & Wester method (KWM) – Rank Positional Weight method (RPW) – COMSOAL, Mixed model assembly line balancing.

UNIT V MATERIALS HANDLING AND PACKAGING 9

Scope and definitions of material handling – Objectives, Principles of material handling, Unit load concept, Material handling system design, Classification of material handling equipments, Equipment selection & specification, JIT impact on facilities design, Packaging.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students should be able to

CO1: apply and evaluate appropriate location models for various facility types.
CO2: effectively design and analyze various facility layouts.
CO3: apply and analyze various computerized techniques while designing a layout.
CO4: effectively implement a strategy to level the workload across all the workstations .
CO5: implement smooth and cost effective system in the material handling process.

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

TEXT BOOK:

1. Tompkins, J.A. and White J A et al., "Facilities planning", John Wiley & Sons, 2010.

REFERENCES:

1. James, Apple, “Material Handling System Design”, Ronald Press, 1980.
2. Krajewski. J and Ritzman, “Operations management – Strategy and Analysis”, Addison – Wesley publishing company, 5th edition, 1999.
3. Pannerselvam.R, “Production and Operations Management”, PHI, 2017
4. Richard Francis. L. and John A. White, “Facilities Layout and location - an analytical approach”, PHI., 2002.

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

COURSE OBJECTIVES:

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

1. Selecting appropriate tools, equipments and machines to complete a given job.
2. Performing various welding process using GMAW.
3. Performing various machining process such as rolling, drawing, turning, shaping, drilling, milling.
4. Fabricating gears using gear making machines.
5. Analyzing the defects in the cast and machined components. .

LIST OF EXPERIMENTS

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

TOTAL = 60 PERIODS

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

1. Select appropriate tools, equipments and machines to complete a given job.
2. Perform various welding process using GMAW.
3. Perform various machining process such as rolling, drawing, turning, shaping, drilling, milling.
4. Fabricate gears using gear making machines.
5. Analyze the defects in the cast and machined components.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	0.9						0.3					0.3	0.3	0.6	0.6
2	0.9						0.3					0.3	0.3	0.6	0.6
3	0.9						0.3					0.3	0.3	0.6	0.6
4	0.9						0.3					0.3	0.3	0.6	0.6
5	0.9						0.3					0.3	0..3	0.6	0.6

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).

CE5251 FLUID MECHANICS AND MACHINERY L T P C
3 0 0 3

COURSE OBJECTIVE:

To introduce the students about properties of the fluids, behaviour of fluids under static conditions and to impart basic knowledge of the dynamics of fluids and to expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on pipe bends with an exposure to the significance of boundary layer theory and its thicknesses with expose to basic principles of working of hydraulic machineries and to design Pelton wheel, Francis and Kaplan turbine, centrifugal and reciprocating pumps.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 10

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

UNIT II FLOW THROUGH PIPES AND BOUNDARY LAYER 9

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

UNIT III DIMENSIONAL ANALYSIS AND MODEL STUDIES 7

Fundamental dimensions - Dimensional homogeneity - Rayleigh's method and Buckingham Pi theorem - Dimensionless parameters - Similitude and model studies - Distorted and undistorted models.

UNIT IV TURBINES 10

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

UNIT V PUMPS 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- **CO1** Understand the difference between solid and fluid, its properties and behaviour in static conditions.
- **CO2** Understand the conservation laws applicable to fluids and its application through fluid kinematics and dynamics.
- **CO3** Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performances of prototype by model studies.
- **CO4** Estimate losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel.
- **CO5** Understand the concept of boundary layer and its application to find the drag force excreted by the fluid on the flat solid surface.

TEXT BOOKS:

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

REFERENCES:

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

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

IE5401 **WORK SYSTEM DESIGN** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- Explain the concepts of work study productivity and productivity measurement approaches.
- Plan and record and analyze selected tasks using different flowcharts .
- Use method study to improve a task. Apply principles of motion economy to improve performance .
- Plan and conduct a time study to improve the efficiency of the system.
- Appraise the standard times to assess the office work condition.

UNIT I PRODUCTIVITY **9**

Work Study and Productivity - Total time for a job or operation, total work content and ineffective time, – Production and Productivity- Productivity and standardofliving, Factors affecting Productivity, Productivity measurement Models.- procedure of work study

UNIT II METHODS ENGINEERING **9**

Methods Engineering-Steps –Recording Tools and techniques - Design of work place layout-Motion study -micromotion study- therbligs - cyclegraph and chronocyclegraph- simochart-Principles of motion economy.

UNIT III WORK MEASUREMENT **9**

Purpose of work measurement –Techniques of work measurement- Time study- Equipment - selecting and timing the job - performance rating –allowances – Standard time – setting time standard for work with machines - learning effect

UNIT IV APPLIED WORK MEASUREMENT **9**

Work sampling and Structured estimating - Group sampling Technique-predetermined time standards (PTS),types- use of time standard - Methods Time Measurement (MTM)- MOST technique - Wage incentive plans.

UNIT V WORK DESIGN FOR OFFICE WORK **9**

Method Study in office- Organization and methods(O&M) - Work measurement of office work-Work Analysis techniques applied to support staff - Form design and control.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Ability to understand the concepts of work study productivity and productivity measurement approaches.
CO2: Ability to Record and analyze selected tasks using different flowcharts .
CO3: Ability to apply method study to improve a task. Apply principles of motion economy to improve performance .
CO4:Ability to conduct a time study to improve the efficiency of the system.
CO5: Ability to Estimate the standard times to assess the office work condition.

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

TEXT BOOKS:

1. Barnes, R.M, “Motion and Time Study, Design and measurement of work”, John Wiley sons (Asia), Seventh edition, 2003.
2. ILO, “Introduction to Work Study”, Oxford and IBH publishing, 2008.

REFERENCES:
1. BenjaminW.Niebel,AndrisFreivalds,“Methods,standardsandWorkDesign”,McGraw hill, Eleventh edition, 2002.
2. Maynard H.B, “Industrial Engineering Hand book”, McGraw-Hill,2008

MF5351 THERMODYNAMICS L T P C
3 0 0 3

COURSE OBJECTIVES:
- To describe the basic concepts and first law of thermodynamics.
- To analyse the second law of thermodynamics.
- To evaluate the properties of pure substances.
- To gain knowledge on the concepts of conduction, convection and radiation.
- To apply the concepts of thermodynamics in IC engines, boilers, turbines, refrigeration and air-conditioning.

UNIT I BASICS CONCEPTS AND FIRST LAW OF THERMODYNAMICS 9

Basic concepts; Continuum and macroscopic approach; thermodynamic systems (closed and open); thermodynamic properties and equilibrium; state of a system, state postulate for simple compressible substances, paths and processes on state diagrams; concepts of heat and work, different modes of work; zeroth law of thermodynamics; concept of temperature. First Law of Thermodynamics; Concept of energy and various forms of energy; internal energy, enthalpy; specific heats; first law applied to elementary processes, closed systems and control volumes, steady and unsteady flow analysis.

UNIT II SECOND LAW OF THERMODYNAMICS 9

Second law of thermodynamics; Limitations of the first law of thermodynamics, concepts of heat engines and heat pumps/refrigerators, Kelvin-Planck and Clausius statements and their equivalence; reversible and irreversible processes; Carnot cycle and Carnot theorems; thermodynamic temperature scale; Clausius inequality and concept of entropy; the principle of increase of entropy, T-s diagrams; second law analysis of control volume; availability and irreversibility; third law of thermodynamics.

UNIT III PROPERTIES OF PURE SUBSTANCE 9

Thermodynamic properties of pure substances in solid, liquid and vapour phases; P-v-T behaviour of simple compressible substances, thermodynamic property tables and charts, psychrometric charts ideal and real gases : Vander waals equations - Reduced property - Compressibility chart - Properties of mixture of gases - Dalton’s law and Gibbs - Internal energy, Enthalpy and specific heats of gas mixtures.

UNIT IV HEAT TRANSFER 9

Modes of Heat Transfer-Concept of heat resistance and electrical analogy -Conduction: One dimensional heat conduction in plane wall, composite walls and cylinder system, fins - Simple Problems - Convection - Free and forced -Flow over flat plates and tubes - Heat exchangers-Radiation -radiation laws, black, grey body radiation - radiation Shield.

UNIT V APPLICATIONS 9

Internal Combustion Engines: Air-standard Otto, Diesel and dual cycles, air compressors, C.I and S.I Engines - Four Stroke and two stroke engines-Gas turbines, boilers :Fire tube boiler & Water Tube Boilers, Steam turbines; Impulse turbine and reaction turbine - Refrigeration Cycle - Vapour Compression & vapour absorption system, gas refrigeration system - Environmental friendly refrigerants -Air-Conditioning.

TOTAL: 45 PERIODS

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

- CO1. Apply first law of thermodynamics to engineering applications.
- CO2. Differentiate first and second law of thermodynamics.
- CO3. Estimate the properties of real and ideal gas mixtures using thermodynamic charts.
- CO4. Evaluate the heat transfer through conduction, convection and radiation
- CO5. Analyse the operation of IC engine, boilers, turbine, refrigerator etc.

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

TEXT BOOKS:

1. Cengel Y.A. and Boles M.A., "Thermodynamics an Engineering Approach", 8th edition, McGraw hill, United States, 2017.
2. Nag P.K., "Engineering Thermodynamics", 6th edition, McGraw Hill, United States, 2017.

REFERENCES:

1. Arora C.P., "Refrigeration and Air Conditioning", 3rd Edition, Tata McGraw Hill, United States, 2017.
2. Claus Borgnakke, "Fundamentals of Engineering Thermodynamics" 8th edition, John Wiley & Sons, United States, 2013.
3. Holman J.P., "Heat transfer", 10th edition, McGraw Hill, United States 2017.
4. Moran M.J. and Shapiro H.N., "Fundamentals of Engineering Thermodynamics", 9th Edition, Wiley, United States, 2018.
5. Rathakrishnan E., "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice Hall of India, 2005.
6. Van Wylen and Sonntag, "Classical Thermodynamics", 4th Edition, Wiley, United States, 1994.

ME5452 MECHANICS OF MACHINES L T P C
3 0 0 3

COURSE OBJECTIVES:

1. To understand the principles in the formation of mechanisms and their kinematics.
2. To learn the basic concepts of toothed gearing and kinematics of gear trains.
3. To study the effect of friction in different machine elements.
4. To analyze the forces and torque acting on simple mechanical systems
5. To understand the importance of balancing and vibration.

UNIT I KINEMATIC ANALYSIS IN SIMPLE MECHANISMS AND CAMS 9

Mechanisms – Terminology and definitions – kinematics inversions and anlaysis of 4 bar and slide crank chain – velocity and acceleration polygons – cams – classifications – displacement diagrams - layout of plate cam profiles.

UNIT II TOOTHED GEARING AND GEAR TRAINS 9

Gear terminology – law of toothed gearing – involute gearing – Gear tooth action - Interference and undercutting – gear trains – parallel axis gear trains – epicyclic gear trains.

UNIT III FRICTION ASPECTS IN MACHINE COMPONENTS 9

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Friction clutches – Belt drives – Friction aspects in brakes.

UNIT IV STATIC AND DYNAMIC FORCE ANALYSIS 9

Applied and Constrained Forces – Free body diagrams – Static equilibrium conditions – Static Force analysis in simple mechanisms – Dynamic Force Analysis in simple machine members – Inertia Forces and Inertia Torque – D'Alembert's principle.

UNIT V BALANCING OF ROTATING MASSES AND VIBRATION 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

1. design the linkages and the cam mechanisms for specified output motions.
2. determine the gear parameters of toothed gearing and speeds of gear trains in various applications.
3. evaluate the frictional torque in screw threads, clutches, brakes and belt drives.
4. determine the forces on members of mechanisms during static and dynamic equilibrium conditions.
5. determine the balancing masses on rotating machineries and the natural frequencies of free and forced vibratory systems.

TEXT BOOK:

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", Oxford University Press, 2017.

REFERENCES:

1. Cleghorn. W. L., Nikolai Dechev, "Mechanisms of Machines", Oxford University Press, 2015.
2. Rao.J.S. and Dukkipati.R.V. "Mechanism and Machine Theory", New Age International Pvt. Ltd., 2006.
3. Rattan, S.S, "Theory of Machines", McGraw-Hill Education Pvt. Ltd., 2014.
4. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGraw-Hill, 2009.
5. Thomas Bevan, "The Theory of Machines", Pearson Education Ltd., 2010.

CE5361	STRENGTH OF MATERIALS AND FLUID MACHINERY LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

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

PART – I STRENGTH OF MATERIALS 30

LIST OF EXPERIMENTS

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

PART – II FLUID MECHANICS AND MACHINES LABORATORY 30

LIST OF EXPERIMENTS

A. FLOW MEASUREMENT

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

B. METACENTER

5. Determination of metacentric height

C. PUMPS

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

D. TURBINES

10. Characteristics of Pelton wheel turbine

TOTAL :60 PERIODS

OUTCOMES:

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

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

REFERENCES:

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

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	M	H	H	H	H	H
PO2	Problem analysis	M	M	H	H	H	H
PO3	Design / development of solutions	L	L	M	M	M	M
PO4	Investigation	H	H	H	H	H	H
PO5	Modern Tool Usage	L	L	L	L	L	L

PO6	Individual and Team work	M	M	H	H	H	H
PO7	Communication	L	L	L	L	L	L
PO8	Engineer and Society	M	M	M	M	M	M
PO9	Ethics	L	L	L	L	L	L
PO10	Environment and Sustainability	M	M	M	M	M	M
PO11	Project Management and Finance	L	L	L	L	L	L
PO12	Life Long Learning	M	M	M	M	M	M
PSO1	Knowledge of Civil Engineering discipline	M	H	H	H	H	H
PSO2	Critical analysis of Civil Engineering problems and innovation	L	L	M	M	M	M
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	L	L	L	L	L	L

IE5411 WORK SYSTEM DESIGN LABORATORY L T P C
0 0 2 1

COURSE OBJECTIVES:

- Develop different flowcharts by recording and analyzing selected tasks.
- Use and conduct time study to improve the efficiency of the system.
- Describe and perform performance rating experiments.
- Explain and perform peg board activities.
- Develop work sampling activities.

1. Application of outline process chart for method study
2. Application of Flow process chart for method study.
3. Application of Two handed process chart for method study
4. Application of Man Machine Chart for method study
5. Determine the performance rating of the operator and rating capacity of the analyst using card dealing
6. Determine the performance rating of the operator and rating capacity of the analyst using walking
7. Determine the standard time using Peg board experiment
8. Determine the standard time using Stop watch time study
9. Determine the utilization of working operator by Work sampling using Monte Carlo simulation techniques.
10. Determine the standard time using MTM practice
11. Determine the standard time using Time Study Trainer.

TOTAL: 30 PERIODS

COURSE OUTCOMES: Students should be able
CO1: Able to record and analyze selected tasks using different flowcharts .
CO2: Able to conduct a time study to improve the efficiency of the system.
CO3: Able to perform performance rating experiments.
CO4: Able to perform peg board activities.
CO5: Able to perform work sampling .

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

HS5461 **EMPLOYABILITY SKILLS** **L T P C**
0 0 4 2

COURSE OBJECTIVES:

- To enhance the employability skills of students with a special focus on presentation skills, group discussion skills and interview skills
- To help them improve their reading skills, writing skills, and soft skills necessary for the workplace situations
- To make them employable graduates

UNIT I WRITING SKILLS **12**

Preparing job applications - writing covering letter and résumé - applying for jobs online - email etiquette – writing official letters (placing an order, letters to consumers, etc.)

UNIT II SOFT SKILLS **12**

Hard skills & soft skills – soft skills: self-management skills & people skills - training in soft skills - persuasive skills – sociability skills –interpersonal skills – team building skills – leadership skills – problem solving skills – adaptability– motivation techniques – life skills.

UNIT III PRESENTATION SKILLS **12**

Preparing slides with animation related to the topic – organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice– – presenting the visuals effectively – 5 minute presentation.

UNIT IV GROUP DISCUSSION SKILLS **12**

Participating in group discussions – understanding group dynamics - brainstorming the topic -– questioning and clarifying –GD strategies (expressing opinions, accepting or refusing others opinions, turn taking) – activities to improve GD skills – viewing recorded GD - mock GD.

UNIT V INTERVIEW SKILLS **12**

Interview etiquette – dress code – body language – mock interview -–attending job interviews – answering questions confidently – technical interview – telephone/Skype interview - one to one interview &panel interview – FAQs related to job interview- Emotional and cultural intelligence.

TOTAL: 60 PERIODS

Teaching Methods

Seminar, Presentation, Group Discussion, Employability skills practice in the language laboratory

Evaluation

Continuous Assessment – 100 marks

a) Group Discussion Skills - 25 marks
b) Presentation skills - 25 marks
c) Interview skills - 25 marks
d) Assignment (Job Application and official letters) - 25 marks

Total -100 marks

End Semester examination – NIL

COURSE OUTCOMES:

After the completion of the course, the learners will be able to,

- Perform well at placement interviews, group discussions and other recruitment exercises
- Acquire adequate competence in speaking, reading and writing skills needed for workplace related situations
- Gain a comprehensive knowledge about soft skills

REFERENCES:

1. Corneilssen, Joep. How to Prepare for Group Discussion and Interview. New Delhi: Tata-McGraw-Hill, 2009.
2. Dabreo, Desmond A. Group Discussion and Team Building. Mumbai: Better Yourself Books, 2004.
3. Ramesh, Gopalswamy, and Mahadevan Ramesh. The ACE of Soft Skills. New Delhi: Pearson, 2010.
4. Gulati, Sarvesh. Corporate Soft Skills. New Delhi: Rupa and Co. 2006.
5. Van Emden, Joan, and Lucinda Becker. Presentation Skills for Students. New York: Palgrave Macmillan, 2004.

WEB RESOURCES

1. www.humanresources.about.com
2. www.careerride.com
3. https://bemycareercoach.com/softskills

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

COURSE OBJECTIVES:

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

UNIT I INTRODUCTION 9

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

UNIT II TQM PRINCIPLES 9

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

UNIT III TQM TOOLS & TECHNIQUES I 9

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

UNIT IV TQM TOOLS & TECHNIQUES II 9

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

UNIT V QUALITY MANAGEMENT SYSTEM 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

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

TEXT BOOK:

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

REFERENCES:

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

IE5552 OPERATIONS RESEARCH L T P C
3 0 0 3

COURSE OBJECTIVES:

- Provide knowledge of optimization techniques and approaches.
- Formulate a real-world problem as a mathematical programming model.
- Enable the students apply mathematical, computational and communication skills needed for the practical utility of Operations Research.
- Knowledge to solve networking problems.
- Knowledge to solve various inventory problems.
- Gain knowledge on solving different waiting line models .

UNIT I LINEAR PROGRAMMING 9

Introduction to Operations Research – assumptions of linear programming problems - Formulations of linear programming problem – Graphical method. Solutions to LPP using simplex algorithm – Two phase method – Big M method

UNIT II ADVANCES IN LINEAR PROGRAMMING 9

Revised simplex method - primal dual relationships – Dual simplex algorithm – Sensitivity analysis – changes in RHS value – changes in Coefficient of constraint – Adding new constraint – Adding new variable.

UNIT III NETWORK ANALYSIS 9

Transportation problems: Northwest corner rule, least cost method, Vogel's approximation method - stepping stone method - MODI method – Unbalanced transportation – Assignment problem – Hungarian algorithm –Project Management CPM & PERT. Minimum spanning tree problem: Prim's algorithm, Kruskal's algorithm - Shortest path problem: Dijkstra's algorithms, Floyds algorithm - maximal flow problem: Maximal-flow minimum cut theorem - Maximal flow algorithm

UNIT IV INVENTORY MODELS 9

Purchase model with no shortages – Manufacturing model with no shortages - Model with price breaks - Reorder point model - Probabilistic inventory model

UNIT V QUEUING THEORY 9

Queuing theory terminology – Single server, multi server- limited and unlimited queue capacity-limited and unlimited population –limited and infinite queue length.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Learned to translate a real-world problem, given in words, into a mathematical Formulation.

CO2: An understanding of the role of algorithmic thinking in the solution of operations research problems.

CO3: Be able to build and solve Transportation Models and Assignment Models, maximal flow problem, minimum spanning tree and shortest path problem.

CO4: Able to handle issues in various Inventory models.

CO5: The students acquire capability in applying and using of queuing models for day today problem

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

TEXT BOOKS:

1. Panneerselvam R, "Operations Research", PHI, 2009.
2. Srinivasan G., "Operations Research Principles and Applications", PHI, 2017.

REFERENCES:

1. Hamdy A Taha, "Operations Research – An Introduction", Pearson, 2017.
2. Philips, Ravindran and Solberg, "Operations Research principle and practise", John Wiley, 2007.
3. Ronald L Rardin, "Optimisation in Operations Research", Pearson, 2018.

ME5553 **MACHINE DESIGN** **L T P C**
3 1 0 4

COURSE OBJECTIVES:

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

1. Designing machine members subjected to static loads.
2. Designing shafts, couplings, welded joints, riveted joints and bearings for various applications.
3. Designing helical springs,flywheels, connecting rods and crankshafts for various applications.
4. Designing flexible elements like belt, ropes and chain drives for engineering applications.
5. Designing spur ,helical gear drives and multi speed gear box for power transmission.

UNIT I STEADY STRESSES IN MACHINE MEMBERS 9+3

Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading -Factor of safety - theories of failure – Design based on strength and stiffness.

UNIT II SHAFTS, COUPLINGS, JOINTS AND BEARINGS 9+3

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, key ways and splines –Rigid and flexible couplings. Threaded fasteners, Welded joints and riveted joints for structures, Sliding contact and rolling contact bearings (Simple problems)

UNIT III ENERGY STORING ELEMENTS AND ENGINE COMPONENTS 9+3

Various types of springs, optimization of helical springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

UNIT IV DESIGN FOR FLEXIBLE ELEMENTS 9+3

Design of Flat belts and pulleys - Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

UNIT V SPUR GEARS, HELICAL GEARS AND GEAR BOXES 9+3

Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects - Fatigue strength - Factor of safety - Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations. Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box -Constant mesh gear box. – Design of multi speed gear box for machine tool applications – Variable speed gear box.

TOTAL: 60 PERIODS

Note: (Use of P S G Design Data Book is permitted in the University examination)

COURSE OUTCOMES:

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

1. Design machine members subjected to static loads.
2. Design shafts, couplings, welded joints, riveted joints and bearings for various applications.
3. Design helical springs, flywheels, connecting rods and crankshafts for various applications.
4. Design flexible elements like belt, ropes and chain drives for engineering applications.
5. Design spur ,helical gear drives and multi speed gear box for power transmission.

TEXT BOOK:

1. Bhandari V B, “Design of Machine Elements”, 4th Edition , Tata McGraw-Hill Book Co, 2016.

REFERENCES:

1. Ansel C Ugural, “Mechanical Design – An Integral Approach”, 1st Edition, Tata McGraw-Hill Book Co, 2004.
2. Design Data Hand Book”, PSG College of Technology, Coimbatore, 2013.

3. Merhyle Franklin Spotts, Terry E. Shoup, and Lee EmreyHornberger, “Design of Machine Elements” 8th Edition, Printice Hall, 2004.
4. Robert C. Juvinall and Kurt M. Marshek, “Fundamentals of Machine component Design”,6th Edition, Wiley, 2017.
5. Sundararajamoorthy T. V. and Shanmugam .N, “Machine Design”, Anuradha Publications, Chennai, 2003.

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

IE5551 ENGINEERING QUALITY CONTROL L T P C
3 0 0 3

COURSE OBJECTIVES:

- Developing the basic concepts of quality control procedures.
- Impart knowledge to design and implement Statistical Process control inanyindustry.
- Design and implement acceptance sampling inspection methods in industry.
- Study the process and machine capability.
- Develop the applications of various charts.

UNIT I QUALITY FUNDAMENTALS 9

Importance of quality- evolution of quality- definitions of quality- dimensions of quality- quality control- quality assurance- areas of quality- quality planning- quality objectives and policies- quality costs- economics of quality- Quality loss function- quality Vs productivity- Quality Vs reliability.

UNIT II CONTROL CHARTS FOR VARIABLES 9

Process variation- preliminary decisions- control limits and their computation- construction and application of X bar, R and S charts - warning and modified control limits- process adjustment for trend- Comparison of process variation with specification limits- O.C. curve for X bar chart.

UNIT III STATISTICAL PROCESS CONTROL 9

Process stability- process capability study using control charts- capability indices- Cp, Cpk and Cpm – capability analysis using histogram and normal probability plot- machine capability study-gauge capability study- setting statistical tolerances for components and assemblies- individual measurement charts- X-chart, moving average and moving range chart, multi-vari chart.

UNIT IV CONTROL CHARTS FOR ATTRIBUTES 9

Limitations of variable control charts- Control charts for fraction non-conforming- p and np charts, variable sample size, operating characteristic function, run length- Control chart for nonconformities (defects)- c, u, ku charts, demerits control chart- applications.

UNIT V ACCEPTANCE SAMPLING 9

Need- economics of sampling- sampling procedure- single and double sampling- O.C. curves- Average outgoing quality- Average sample number- Average total inspection- Multiple and sequential sampling- Standard sampling plans- MIL Standards, Dodge-Roming, IS 2500.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Students will become familiar with details of quality costs, economies and planning.

CO2: Control the quality of processes using control charts for variables in manufacturing/service industries.
CO3: Good understanding and in depth knowledge has been imparted in the process capability study.
CO4: Control the occurrence of defects in product or services industries.
CO5: Determination of acceptance sampling procedures are practiced.

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

TEXT BOOKS:

1. Douglus C. Montgomery, “Introduction to Statistical Quality Control”, Wiley-India, Seventh Edition, 2013.
2. Krishnaiah K.,” Applied Statistical Quality Control and Improvement”, PHI, 2014.

REFERENCES:

1. AmitavaMitra, “Fundamentals of Quality Control and Improvement”, Wiley, Third Edition, 2008.
2. Dale H. Besterfield, Quality Control, Pearson Education Asia, Eigth Edition, 2008.
3. Eugene L. Grant and Richard S. Leaven Worth, “Statistical Quality Control”, McGraw-Hill Education, Seventh Edition, 2000.

IE5511 **OPTIMIZATION LABORATORY** **L T P C**
0 0 2 1

COURSE OBJECTIVES:

- Give adequate exposure to use different optimization software packages for solving Operations Research problems.
- Practice to solve Linear programming problems.
- Learn problem solving techniques, writing algorithms and procedures.
- Solve optimization problems using 'C' programming language .
- Practice C code for simple logic on OR problem.

LABORATORY EXPERIMENTS

Experiment 1: LP Models formulation and solving using softwares
Experiment 2: Formulation of Transportation Problem and solving using software package
Experiment 3: Formulation of Assignment Problems and solving using software package
Experiment 4: Solving Maximal Flow problem
Experiment 5: Solving Minimal Spanning Tree problems
Experiment 6: Solving shortest route problems
Experiment 7: Solving Project Management problems
Experiment 8: Solving Waiting line problems
Experiment 9: Solving Queuing problems
Experiment 10: Solving Inventory problems

TOTAL:30 PERIODS

COURSE OUTCOMES:

CO1: Use computer tools to solve a mathematical model for practical problems.
CO2: Acquired knowledge in using Optimization software Package .

CO3: Ability to develop C++ programming for solving optimization problem.
CO4: Able to design new simple models, like: CPM, MSPT to improve decision –making develop critical thinking and objective analysis of decision problems.
CO5: Ability to use logical thinking for solving OR problem.

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

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

COURSE OBJECTIVES:
The main learning objective of this course is to provide hands on training to the students in:
1. Applying standard drawing practices using fits and tolerances.
2. Modeling orthogonal views of machine components.
3. Modeling orthogonal views of assembled components.
4. Preparing standard drawing layout for modeled parts or assemblies with BoM.

PART I DRAWING STANDARDS & FITS AND TOLERANCES 4
Code of practice for Engineering Drawing, BIS specifications – Welding symbols, riveted joints, keys, fasteners – Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc. - Limits, Fits – Tolerancing of individual dimensions – Specification of Fits – Preparation of production drawings and reading of part and assembly drawings, basic principles of Geometric Dimensioning &Tolerancing.

PART II 2D DRAFTING 56
Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed Drawing.
1. Bearings – Bush Bearing
2. Valves – Safety and Non-return Valves.
3. Couplings – Flange, Oldham's, Muff, Gear couplings.
4. Joints – Universal, Knuckle, Gib& Cotter, Strap, Sleeve &Cotter joints.
5. Engine parts – Piston, Connecting Rod, Crosshead (vertical and horizontal), Stuffing box, Multi-plate clutch.
6. Machine Components – Screw Jack, Machine Vice, LatheTail Stock, Lathe Chuck, Plummer Block,Vane and Gear pumps.

Total: 20% of classes for theory classes and 80% of classes for practice
Note: 25% of assembly drawings must be done manually and remaining 75% of assembly drawings must be done by using any CAD software. The above tasks can be performed manually and using standard commercial 2D CAD software.

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

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Apply standard drawing practices using fits and tolerances.
2. Model orthogonal views of machine components.
3. Model orthogonal views of assembled components.
4. Prepare standard drawing layout for modeled parts or assemblies with BoM.

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

IE5652 PRODUCTION AND OPERATIONS MANAGEMENT

L T P C
3 0 0 3

COURSE OBJECTIVES:

- Recognize and appreciate the concept of Production and Operations Management in creating and enhancing a firm's competitive advantages.
- Describe the concept and contribution of various constituents of Production and Operations Management (both manufacturing and service) .
- Relate the interdependence of the operations function with the other key functional areas of a firm .
- Teach analytical skills and problem-solving tools to the analysis of the operations problems .
- Apply scheduling and Lean Concepts for improving System Performance.

UNIT I INTRODUCTION 9

Objectives of Operations Management, Scope of Operations Management, Relationship of Operations with other Functional areas, Manufacturing Vs Service sector, Operations Decision making, Phases in Product Design and Development, Product Life Cycle, Process Selection.

UNIT II FORECASTING 9

Need, Determinants of Demand, Demand Patterns, Qualitative Forecasting Methods-Delphi techniques. Market Research, Nominal Group Technique. Quantitative Forecasting methods – Moving Average Methods, Exponential Smoothing Methods, Regression methods, Monitoring and Control of Forecasts, Requirements and Selection of Good forecasting methods.

UNIT III AGGREGATE PLANNING AND MATERIAL REQUIREMENT PLANNING 9

Role of aggregate Product planning, Managerial inputs to Aggregate planning, Pure and Mixed strategies, Mathematical Models for Aggregate planning – Transportation Method, Linear programming Formulation, Linear Decision Rues, Master Production Schedule(MPS), Procedure for developing MPS, MRP -Lot sizing methods – Implementation issues, MRP – II, Introduction to ERP.

UNIT IV CAPACITY MANAGEMENT 9

Measures of capacity, Factors affecting capacity, Capacity Planning, Systematic approach to capacity planning, Long-term and short-term capacity decisions, Tools for capacity planning, Capacity Requirement Planning- Business Process Outsourcing

UNIT V PRODUCTION ACTIVITY CONTROL AND LEAN MANUFACTURING 9

Objectives and Activities of Production Activity Control -JIT- Kanban- Introduction to Scheduling in different types of Production Systems. Lean Manufacturing - Principles – Activities - Tools and techniques - Case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: The students will appreciate the role of Production and Operations management in enabling and enhancing a firm's competitive advantages in the dynamic business environment.

CO2: The students will obtain sufficient knowledge and skills to forecast demand for Production and Service Systems.

CO3: The students will able to Formulate and Assess Aggregate Planning strategies and Material Requirement Plan.

CO4: The students will be able to develop analytical skills to calculate capacity requirements and developing capacity alternatives.

CO5: The students will be able to apply scheduling and Lean Concepts for improving System Performance.

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

TEXT BOOK:

1. Panneerselvam. R, Production and operations Management, PHI, 3rd Edition, 2012.

REFERENCES:

1. Lee J. Krajewski, Manoj K. Malhotra, Larry P. Ritzman,Operations Management: Processes and Supply Chains Pearson Education,11th Edition,2015
2. Norman Gaither, Greg Frazier, Operations Management, Thomson Learning, 9th Edition, 2002.
3. William J Stevenson,OperationsManagement,McGraw Hill,13th Edition,2018.

IE5601 DESIGN OF EXPERIMENTS L T P C
3 0 0 3

COURSE OBJECTIVES:

- Explain the concepts of Classical Design of Experiments (DOE) .
- Illustrate Single Factor Experiment and Post hoc tests .
- Describe about Factorial experiments and its extensions.
- Apply Taguchi method for parameter Optimization.
- Create exposure on Response Surface Method and Shainin DOE.

UNIT I FUNDAMENTALS OF EXPERIMENTAL DESIGNS 9

Hypothesis testing – single mean, two means, dependant/ correlated samples – confidence intervals, Experimentation – need, Conventional test strategies, F-test, terminology, basic principles of design, steps in experimentation – choice of sample size – Normal and half normal probability plot – simple linear and multiple linear regression, Analysis of variance.

UNIT II SINGLE FACTOR EXPERIMENTS 9

Completely Randomized Design- effect of coding the observations- model adequacy checking - estimation of model parameters, residuals analysis- treatment comparison methods- Duncan's multiple range test, Newman-Keuel's test, Fisher's LSD test, Tukey's test- Testing using contrasts- Randomized Block Design – Latin Square Design- Graeco Latin Square Design – Applications.

UNIT III FACTORIAL DESIGNS 9

Main and Interaction effects - Two and three factor full factorial designs- Fixed effects and random effects model - Rule for sum of squares and Expected Mean Squares- 2^K Design with two and three factors- Yate's Algorithm- fitting regression model- Randomized Block Factorial Design. Blocking and Confounding in 2^K Designs- blocking in replicated design- 2^K Factorial Design in two blocks- Complete and partial confounding- Confounding 2^K Design in four blocks - Two level Fractional Factorial Designs- Construction of one-half and one-quarter fraction of 2^K Design

UNIT IV TAGUCHI METHODS 9

Design of experiments using Orthogonal Arrays, Data analysis from Orthogonal experiments- Response Graph Method, ANOVA- Attribute data analysis- Robust design- noise factors, Signal to Noise ratios, Inner/outer OA design- case studies.

UNIT V RESPONSE SURFACE METHODS AND SHAININ DOE 9

Introduction to Response Surface Methods, Central Composite Design. Basics of Shainin DOE - Problem Solving Algorithm - Problem Identification Tools- Shainin DOE Tools - case studies.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will

CO1: Understand the fundamental principles of Classical Design of Experiments .

CO2: Be able to apply single factor experiment for process parameter understanding and optimization.

CO3: Be able to apply Factorial Design principles for understanding of process parameters and its optimization .

CO4: Will gain knowledge on Taguchi's approach to experimental design for attaining robustness .

CO5: Be able to apply Response Surface Method and Shainin DOE to evaluate quality.

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

TEXT BOOK:

1. Krishnaiah K, and Shahabudeen P, "Applied Design of Experiments and Taguchi Methods", PHI,1st Edition, 2011.

REFERENCES:

1. Box, G. E., Hunter,W.G., Hunter, J.S., Hunter,W.G., "Statistics for Experimenters: Design, Innovation, and Discovery", 2nd Edition, Wiley, 2005.
2. Douglas C. Montgomery, "Design and Analysis of Experiments", John Wiley & sons, 2012.
3 Krishnaiah K, Applied Statistical Quality Control and Improvement,1st Edition,2014
4. Phillip J. Ross, "Taguchi Techniques for Quality Engineering", Tata McGraw-Hill, India, 2005.

IE5653 **RELIABILITY ENGINEERING** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- Describe reliability concepts.
- Teach the students in filling the life data into theoretical distribution.
- Teach the students in reliability evaluation of various configuration.
- Describe knowledge in reliability monitoring methods.
- Appraise effectively various techniques to improve reliability of the system.

UNIT I RELIABILITY CONCEPT **9**

Reliability definition –Reliability parameters- f(t), F(t) and R(t) functions- Measures of central tendency – Bath tub curve – A priori and posteriori probabilities of failure – Component mortality - Useful life.

UNIT II LIFE DATA ANALYSIS **9**

Data classification – Non parametric methods: Ungrouped, Grouped, Complete, Censored data – Time to failure distributions - Survival graphs – Probability plotting: Exponential, Weibull - Goodness of fit tests – -Bartlett's test, KS test, chi-square test.

UNIT III RELIABILITY ESTIMATION **9**

Series parallel configurations – Parallel redundancy – m/n system – Complex systems: RBD approach – Baye's method – Minimal path and cut sets - Fault Tree analysis – Standby system.

UNIT IV RELIABILITY MANAGEMENT **9**

Reliability testing: Failure terminated test – Time terminated test – Upper and lower MTBFs – Sequential Testing – Reliability growth monitoring – Reliability allocation.

UNIT V RELIABILITY IMPROVEMENT **9**

Analysis of downtime – Repair time distribution – Maintainability prediction – Measures of maintainability – Availability definitions – System Availability – Replacement decisions – Economic life.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Students will be able to conduct failure data analysis.
CO2: Students will be able to estimate reliability of standard systems as well as complex systems.
CO3: Students will be able to explore reliability management tools and techniques.
CO4: Students will be able to contribute in maintainability and availability demonstration programs.
CO5: Students will be able to take decisions on inspection and replacement.

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

TEXT BOOK:

1. Charles E.Ebeling, "An Introduction to Reliability and Maintainability Engineering", TMH, 2007

REFERENCE:

1. Roy Billington and Ronald N. Allan, "Reliability Evaluation of Engineering Systems", Springer, 2007.

IE5651 **MANUFACTURING AUTOMATION**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Define automation and justification in manufacturing.
- Explain the control technologies in automation.
- Explain the concept of fixed automation using transfer lines.
- Describe the programmable automation such as CNC and industrial robotics.
- Use of automated material handling, storage and data capture .

UNIT I MANUFACTURING OPERATIONS 9

Automation in production systems, principles and strategies, Product/production relationships, Production concepts and mathematical models, manufacturing economics.

UNIT II CONTROL TECHNOLOGIES 9

Automated systems – elements, functions, levels, Continuous Vs discrete control, Computer process control, Sensors, Actuators, ADC, DAC, Programmable logic controllers – ladder logic diagrams.

UNIT III TRANSFER LINES 9

Automated production lines – applications, Analysis – with and without buffers, automated assembly systems, line unbalancing concept.

UNIT IV NUMERICAL CONTROL AND ROBOTICS 9

NC - CNC – Part programming – DNC – Adaptive control – Robot anatomy – Specifications – End effectors – Industrial applications.

UNIT V AUTOMATED HANDLING AND STORAGE 9

Automated guided vehicle systems, AS/RS, Carousel storage, Automatic data capture - Bar code technology.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Selection of automated equipment with cost justification .
CO2: Ability to understand control technologies.
CO3: Selection of buffer size and location in transfer lines.
CO4: Ability to prepare a simple CNC program, select a robot configuration for given application.
CO5: Recommend an appropriate automated material handling, storage and data capture method.

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

TEXT BOOK:

1. Mikell P.Groover, Automation, “Production Systems and Computer Integrated Manufacturing” PHI, 2008.

REFERENCES:

1. Mikell P.Groover, Emory W. Zimmers, Jr., “CAD/CAM: Computer - Aided Design and Manufacturing”, PHI, 2007.

IE5611 **DATA ANALYTICS LABORATORY** **L T P C**
0 0 4 2

COURSE OBJECTIVES:
This course aims to:

- Design a data analysis strategy that answers a hypothesis, including specifications for data elements, requirements of the statistic, and limitations to the interpretation.
- Understand how to select appropriate techniques
- Understand how to conduct a variety of statistical analyses, including testing of statistical assumptions, data transformations, and validation of statistical findings
- Understand how to interpret the results of statistical analyses.
- Understand how to present the results of statistical analyses.

Students will perform analysis of data in the following topics using Data Analysis package

1. Control Charts
2. Correlation Analysis
3. Simple Regression
4. Multiple Regression
5. Single factor Experiment
6. Factorial experiment
7. Factor Analysis
8. Discriminant Analysis
9. Cluster Analysis
10. Estimation of model parameters of the system to predict Reliability

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Upon completion of the laboratory course, the students will
CO1: Able to independently formulate, perform and assess hypothesis
CO2: Able to select appropriate techniques
CO3: Able to apply various data analysis techniques
CO4: Able to interpret the results
CO5: Able to present the results properly to extract meaningful information from data sets for effective decision making

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

IE5612 **AUTOMATION LABORATORY** **L T P C**
0 0 2 1

COURSE OBJECTIVES:

- Write CNC programming using G-code and M-code .
- Develop robot control programs
- Use of PLC for actuation.
- Design ladder logic for automation.
- Develop PLC program for automation.

1. Part programming and Machining of Simple Turning using CNC Lathe
2. Part programming and Machining of Taper Turning using CNC Lathe
3. Part programming and Machining using Multiple Turning cycle in CNC Lathe
4. Part programming and Simulation of Thread Cutting using CNC Lathe
5. Part programming and Machining of Contour using CNC Milling Machine
6. Part programming and Machining using Mirroring Cycle in CNC Milling Machine
7. Programming Exercise for Robots
8. Programming of PLC using Ladder Logic Diagram
9. PLC Programming –Experiment 1
10. PLC Programming –Experiment 2

TOTAL: 30 PERIODS

COURSE OUTCOMES:

CO1: Ability to write CNC programming using G-code and M-code .
CO2: Ability to write programming for robot control .
CO3: Ability to use PLC for actuation.
CO4: Ability to design ladder logic for automation.
CO5: Ability to write PLC program for automation.

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

IE5701 APPLIED ERGONOMICS L T P C
3 0 0 3

COURSE OBJECTIVES:

- Explain the knowledge of basic human science and Engineering science .
- Teach skills associated with ergonomic measurement methods and analytical techniques to workplace ergonomic problems.
- Plan and conduct an ergonomic analysis and ergonomic recommendations for modern work environment problems .
- Use the occupational health and safety rules to improve the work place.
- Teach and apply ergonomic principles to design workplaces for the improvement of human performance.

UNIT I INTRODUCTION 9

Brief history of human factors Engineering/Ergonomics – Interdisciplinary nature- Human–machine systems -Ergonomics and its areas of application in the work system - Future directions for ergonomics- Biostatic and Biodynamic Mechanics

UNIT II WORK PLACE DESIGN 9

Problems of body size- Anthropometry measures- Work posture– Design for standing and seated workers - Design of repetitive tasks **-** Design of manual handling tasks- VDT work stations – Hand tool design

UNIT III PHYSIOLOGICAL ASPECTS OF HUMAN AT WORK 9

Stress and fatigue -Physical work capacity - Physiological factors affecting work capacity –Fitness for work –Working hours and shift work- Quantitative work load analysis – Psychological work Demands.

UNIT IV DESIGN OF ENVIRONMENT 9

Design and Assessment in Hot, cold workplaces and the design of the physical environment– Noise and vibration- Vision –Human errors and Accidents – OSHA: Ergonomics Safety and Health Management rules – Personal Protective Equipments.

UNIT V HUMAN PERFORMANCE 9

Human Information receiving and processing – Information theory and its application – Cognitive systems - Mental Work Load -Signal detection theory -–Design of Displays and controls

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Ability to apply Knowledge of basic human science and Engineering science .
CO2: Ability to Apply skills associated with ergonomic measurement methods and analytical techniques to workplace ergonomic problems.
CO3: Ability to conduct an ergonomic analysis and ergonomic recommendations for modern work environment problems.
CO4: Ability to implement the occupational health and safety rules to improve the work place.
CO5: Ability to apply ergonomic principles to design workplaces for the improvement of human performance.

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

TEXT BOOKS:

1. Bridger, R. S."Introduction to Ergonomics", 3rd ed. CRC Press, New York and London,2008
2. Martin Helander, "A guide to Ergonomics of Manufacturing", TMH, 2006.

REFERENCES:

1. Philips, Chandler A, "Human Factors Engineering", John Wiley and Sons, Inc. 2000
2. Sanders, M.M. & McCormick, E.J. "Human Factors in Engineering & Design "7th ed., McGraw-Hill, NY,1993

IE5702 SIMULATION MODELING AND ANALYSIS L T P C
3 0 0 3

COURSE OBJECTIVES:

- Knowledge about generation of the random numbers using different algorithms.
- Enable to generate random variates.
- Enable to design the simulation experiment.
- Solving different simulation problems using various simulation softwares.
- Learn to study the various applications of simulation models.

UNIT I INTRODUCTION AND RANDOM NUMBERS 9

Systems – Modelling – Types – Systems components – Simulation basics- Random numbers – Methods of generation : Manual, table, algorithms – mid square, multiplier, constant multiplier, additive and multiplicative congruential algorithms

UNIT II RANDOM VARIATES GENERATION AND TESTING 9

Random variates for standard distributions like uniform, exponential, Poisson, binomial, normal etc – Testing of Random variates – Input Data Modeling - Monte Carlo Simulation.

UNIT III DESIGN OF SIMULATION EXPERIMENTS 9

Steps on Design of Simulation Experiments – Development of models using of High level language for systems like Queuing, Inventory, Replacement, Production etc., Model validation and verification, Output analysis.

UNIT IV SIMULATION LANGUAGES 9

Need for simulation Languages – Study of GPSS and introduction to ARENA.

UNIT V CASE STUDIES USING SIMULATION LANGUAGES 9

Waiting line models, inventory models, and production models.

COURSE OUTCOMES:

CO1: Learned to generate random numbers and variates.
CO2: Learned to le to test the statistical stability of random variates.
CO3: Learned to develop simulation models for real life systems .
CO4: Learned to use simulation language to simulate and analyze systems.
CO5: Able to solve various waiting line model, inventory models and production models problems using simulation .

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

TEXT BOOKS:

1. Jerry Banks, John S Corson, Barry.L. Nelson, David M.Nicol and P.Shahabudeen, Discrete Event Systems Simulation, Pearson education, Fourth edition, 2007.
2. Thomas J Schriber, “Simulation Using GPSS”, John Wiley, 2002.

REFERENCES:

1. David Kelton, Rondall P Sadowski and David T Sturrock, “Simulation with Arena”, McGraw Hill, 2004
2. Law A M and Kelton W D, Simulation Modelling and analysis, Tata McGraw Hill, 2003.

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.

IE5711 DISCRETE SIMULATION LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- Knowledge to generate random numbers and random Variate.
- Practice to test the statistical stability of random Variate.
- Knowledge to develop simulation models for real life systems.
- Practice using various simulation software packages.
- Able to analyze various simulation models.

Experiment 1. Random Number Generation
Mid Square, Constant Multiplier, Congruential
Experiment 2. Random variates Generation
Exponential, Poisson, Normal, Binomial
Experiment 3. Testing of Random variates
Chi-Square, KS, Run,Poker
Experiment 4. Monte Carlo Simulation: Random Walk Problem
Experiment 5. Monte Carlo Simulation : Paper vendor problem
Experiment 6. Single Server Queuing Model
Experiment 7. Multi Server Queuing Model
Experiment 8. Alternate service queuing model
Experiment 9. Inventory Model
Experiment 10. Use of Simulation Language; Servers in series queuing system

TOTAL: 30 PERIODS

COURSE OUTCOMES:

CO1: Hands on experience in generation of random numbers and random Variate.
CO2: Hands on experience in testing the statistical stability of random Variate.
CO3: Hands on experience in developing simulation models for real life problems.
CO4: Hands on experience in the use simulation softwares to simulate .
CO5: Hands on experience in analyzing various simulation models.

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

IE5712 ERGONOMICS LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- Design equipment and the workplace to fit people .
- Identify and understand effects of walking on tread mill.
- Summarize and analyze noise levels in different environment.
- Design the industry with ergonomics consideration .
- Use and conduct an ergonomic analysis for physical ergonomics topics.

1. Effect of speed of walking on tread mill using heart rate and energy expenditure
2. Effect of workload on heart rate using Ergo cycle.
3. Evaluation of physical fitness using step test
4. Effect of work-rest schedule on physical performance (Ergo cycle / tread mill)
5. Development of anthropometric data for male and female.
6. Application of Ergo Software for the design of desk for students
7. Evaluation of physical facilities (chairs, tables etc.)Through comfort rating.
8. Analysis of noise level in different environment
9. Analysis of Illumination of work places.
10. Estimation of metabolic rate using metabolic Analyzer.
11. Experiment using Vibrometer.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

The Students should be able to

CO1: Design equipment and the workplace to fit people .
CO2: Able to understand effects of walking on tread mill.
CO3: Able to analyse noise levels in different environment.
CO4: Design the industry with ergonomics consideration .
CO5: Conduct an ergonomic analysis for physical ergonomics topics.

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

IE5713 **PROJECT I** **L T P C**
0 0 6 3

COURSE OBJECTIVE:

The objective is to develop skill in applying industrial engineering techniques to real/ practical problems.

A student is expected to select a topic in the industrial engineering area such as Forecasting, production planning, scheduling, operations research, facilities planning and lay out, transportation and distribution, quality, supply chain, simulation etc. Identify a problem and collect necessary data and analyse using appropriate tool / technique.

Data can be collected from industry or standard data sets available in literature can be used. A comprehensive report is to be submitted towards the end of the VIIth semester. Report and oral examination will be evaluated by two member committee constituted by the Head of the Department.

TOTAL : 90 PERIODS

IE5814 **PROJECT II** **L T P C**
0 0 16 8

COURSE OBJECTIVE:

To apply the principles/techniques that they have learnt to a new problem situation which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

A project topic must be selected either from published list or students themselves can propose suitable topics in consultation with the guides. It can be a theoretical research projector industry oriented. Generally it is a group project.

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

TOTAL : 240 PERIODS

IE5001 **APPLIED MULTI-VARIATE STATISTICAL ANALYSIS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- Extract knowledge on the applications of multivariate statistical analysis.
- Understanding the simple regression, multiple regression and correlation procedures.
- Develop the implementation of factor analysis in real life applications.
- Study the classification and implementation of discriminant analysis to various cases.
- Study the classification and implementation of cluster analysis to various cases.

UNIT I MULTIVARIATE METHODS **9**

Review of basic matrix operations and random vectors, Eigen values and Eigen vectors. An overview of multivariate methods, Multivariate normal distribution.

UNIT II REGRESSION **9**

Inferences about population parameters - Simple Regression, and Correlation – Estimation using the regression line, correlation analysis, Multiple Regression– Logistic Regression - Canonical Correlation analysis-Multivariate analysis of variance.

UNIT III FACTOR ANALYSIS **9**

Principal components analysis – Objectives, estimation of principal components, testing for independence of variables, Factor analysis model – Method of estimation – Factor rotation – Factor Scores - EFA and CFA.

UNIT IV DISCRIMINANT ANALYSIS **9**

Discriminant analysis – Classification with two multi Variate normal populations- Evaluating classification function – Classification with several populations – Fishers Method for Discriminating among several Populations.

UNIT V CLUSTER ANALYSIS **9**

Cluster analysis – Clustering methods, Hierarchical clustering methods – Single Linkage, Complete Linkage, Average Linkage, Ward's Hierarchical Clustering Method, Non Hierarchical Clustering methods - K-means Method, Validation and profiling of clusters

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students should be able to:

CO1: Predict the values of one or more variables on the basis of observations on the other variables.

CO2: Formulate the specific statistical hypotheses, in terms of the parameters of multivariate populations.

CO3: Data reduction or structural simplification as simply as possible without sacrificing valuable information and will make interpretation easier.

CO4: Sorting and Grouping "similar" objects or variables are created, based upon measured characteristics.

CO5: Able to understand appropriate use of methods.

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

TEXT BOOKS:

1. Dallas E Johnson, Applied Multivariate methods for data analysis, Duxbury Press(1998).
2. Joseph F. Hair, Jr. William C. Black Barry J. Babin, Rolph E. Anderson, Multivariate Data Analysis, Pearson Edition, (2010).

REFERENCES:

1. Richard I Levin, Statistics for Management, PHI (2000).

IE5002 COMPUTATIONAL METHODS AND ALGORITHMS

L T P C
3 0 0 3

COURSE OBJECTIVES:

- Articulate the C / C++ syntax .
- Use of algorithm design methods for heuristic design.
- Compare various data structures and its applications.
- Analysis of the complexity of Algorithms.
- Use of search procedure for IE applications.

UNIT I REVIEW OF A LANGUAGE **9**

Review of C/C++ - writing and debugging large programs - Controlling numerical errors.

UNIT II ALGORITHM DESIGN METHODS **9**

Greedy – Divide and conquer – Backtracking – Branch & bound – Heuristics- Meta heuristics

UNIT III BASIC TOOLS **9**

Structured approach – Networks – Trees – Data structures

UNIT IV COMPUTATIONAL PERFORMANCE **9**

Time complexity – Space complexity – Algorithm complexity

UNIT V APPLICATIONS **9**

Sorting – Searching - Networks – Scheduling – Optimization models – IE applications

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Will be able to use a structured language for programming .
CO2: Will be able to use various algorithm design methods .
CO3: Will be able to choose appropriate data structure .
CO4: Will be able to analyse the time complexity of algorithm.
CO5: Ability to choose appropriate search and sort procedure in IE applications.

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

TEXT BOOK:
1. Panneerselvam.R, “Design and Analysis of Algorithms”, Prentice Hall of India, 2008

REFERENCES:
1. Dromey,R.G., “How to solve it with computers?”,PHI, 2002
2. Goodman S F and HeadtruemuST , “Introduction to design of algorithms”, McGraw Hill,2002.
3. Sahni, “Data Structures, algorithms and applications in C++”, McGraw Hill, 2003.

IE5073 LEAN SIX SIGMA L T P C
3 0 0 3

COURSE OBJECTIVES:
- Explain the basics of Lean and Six Sigma.
- Teach the need and the process of integrating Lean and Six sigma.
- Summarize to identify and select the resources required for LSS Projects and selection of projects including Team building.
- Teach the DMAIC process and study the various tools for undertaking LSS projects.
- Illustrate to institutionalize the LSS efforts.

UNIT I INTRODUCTION TO LEAN AND SIX SIGMA 9
Introduction to Lean- Definition, Purpose, Features of Lean ; Top seven wastes, Need for Lean management, The philosophy of lean management, Creating a lean enterprise, Elements of Lean, Lean principles, the lean metric, Hidden time traps. Introduction to quality, Definition of six sigma, origin of six sigma, Six sigma concept and Critical success factors for six sigma.

UNIT II INTEGRATION OF LEAN AND SIX SIGMA 9
Evolution of lean six sigma, the synergy of Lean and six sigma, Definition of lean six sigma, the principles of lean six sigma, Scope for lean six sigma, Features of lean six sigma. The laws of lean six sigma, Key elements of LSS, the LSS model and the benefits of lean six sigma. Initiation - Top management commitment – Infrastructure and deployment planning, Process focus, organizational structures, Measures – Rewards and recognition, Infrastructure tools, structure of transforming event and Launch preparation.

UNIT III PROJECT SELECTION AND TEAM BUILDING 9
Resource and project selection, Selection of Black belts, Training of Black belts and Champions, Identification of potential projects, top down (Balanced score card) and Bottom up approach – Methods of selecting projects – Benefit/Effort graph, Process mapping, value stream mapping, Predicting and improving team performance, Nine team roles and Team leadership.

UNIT IV THE DMAIC PROCESS AND TOOLS 9

The DMAIC process – Toll gate reviews; The DMAIC tools; Define tools – Project definition form, SIPOC diagram; Measure tools – Process mapping, Lead time/cycle time, Cause and Effect matrix, Idea – generating and organizing tools – Brainstorming, Nominal group technique and Multi-voting; Data collection and accuracy tools- Check sheet, Gauge R&R; Understanding and eliminating variation- run charts; Analyze tools - Scatter plots, ANOVA, Regression analysis, Time trap analysis; Improve tools – Mistake proofing, Set up time reduction (SMED) and the pull system; Control tools – statistical process control.

UNIT V INSTITUTIONALIZING AND DESIGN FOR LSS 9

Institutionalizing lean six sigma – improving design velocity, creating cycle time base line, valuing projects, gating the projects, reducing product line complexity, Design for lean six sigma, QFD, Theory of Inventive Problem solving (TRIZ), Robust design; Case study presentations.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: The students will be able to understand what is Lean and Six sigma and their importance in the globalized competitive world.

CO2: The students will be able to understand the importance of integrating Lean and Six sigma and also the process of their integration.

CO3: The students will be able to plan the Resources required to undertake the LSS projects and also acquire how to select the suitable projects and the teams.

CO4: The students will be able apply DMAIC methodology to execute LSS projects and in this regard they will be acquainted with various LSS tools.

CO5: The students will be able to understand the process of institutionalizing the LSS effort and also understand the Design for LSS.

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

TEXT BOOK:

1. Michael L. George, Lean Six Sigma, McGraw-Hill., 2002.

REFERENCES:

1. James P. Womack, Daniel T. Jones, Lean Thinking, Free press business., 2003.
2. Ronald G.Askin and Jeffrey B.Goldberg, Design and Analysis of Lean Production Systems, John Wiley &Sons., 2003.
3. Salman Taghizadegan, Essentials of Lean Six Sigma, Elsevier., 2010.

IE5074 MACHINE LEARNING ALGORITHMS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand basic concepts of learning.
- To understand decision tree learning.
- To evaluate hypotheses.
- To understand Bayesian learning.
- To understand computational learning theory.

UNIT I CONCEPT LEARNING 9

A Concept Learning Task: Notation, The Inductive Learning Hypothesis,Concept Learning as Search, FIND-S: Algorithm for finding a Maximally Specific Hypothesis: Version Spaces and the CANDIDATE-ELIMINATION Algorithm; Convergence of CANDIDATE-ELIMINATION Algorithm to the correct Hypothesis; Appropriate Training Examples for learning; Applying Partially Learned Concept, Inductive Bias: A Biased Hypothesis Space; An Unbiased Learner; The Futility of Bias-Free Learning.

UNIT II DECISION TREE LEARNING 9

Decision Tree Representation, Appropriate problems for decision tree learning,The basic decision tree Learning Algorithm, Hypothesis Space Search in decision tree learning, Inductive Bias in Decision Tree Learning, Issues in Decision Tree Learning: Over fitting the Data; Incorporating Continuous-Valued Attributes; Alternative Measures for Selecting Attributes; Handling Training Examples with Missing Attribute Values; Handling Attributes with differing Costs.

UNIT III EVALUATING HYPOTHESES 9

Estimating Hypothesis Accuracy: Sample Error and True Error; Confidence Intervals for Discrete-Valued Hypotheses. Basics of Sampling Theory: Error Estimation and Estimating Binomial Proportions; the Binomial Distribution; Mean and Variance; Estimators, Bias; and Variance; Confidence Intervals; Two-sided and one-sided bounds. A General approach for deriving confidence intervals: Central Limit Theorem. Difference in Error of two hypotheses; Hypothesis Testing. Comparing Learning Algorithms: Paired *t* Tests; Practical Considerations.

UNIT IV BAYESIAN LEARNING 9

Bayes Theorem, Bayes Theorem and Concept Learning, Maximum Likelihood and Least-Squared Error Hypotheses, Maximum Likelihood Hypotheses for predicting probabilities: Gradient search to maximize likelihood in a neural net.Minimum description length principle, Bayes Optimal Classifier, Gibbs Algorithm, Naive Bayes Classifier, Bayesian Belief Networks: Conditional Independence; Representation; Inference; Learning Bayesian Belief Networks; Gradient Ascent Training of Bayesian Networks; Learning the structure of Bayesian Networks; The EM Algorithm: Estimating Means of *k* Guassions; General Statement of EM Algorithm; Derivation of the *k* Means Algorithm.

UNIT V COMPUTATIONAL LEARNING THEORY 9

Introduction, probably learning an approximately correct hypothesis: The Problem Setting; Error of a Hypothesis; Learnability. Sample Complexity for Finite Hypothesis Spaces: Agnostic Learning and Inconsistent Hypotheses; Conjunctions of Boolean earnability of Other Concept Classes. Sample Complexity for infinite hypothesis spaces: Shattering a set of Instances; The Vapnik-Chervonenkis Dimension; Sample Complexity and the VC Dimension. The mistake bound model of learning: Mistake bound for the FIND-S Algorithm; Mistake bound for the HALVING Algorithm; Optimal Mistake Bounds; WEIGHTED-MAJORITY Algorithm.

COURSE OUTCOMES:

CO1: Ability to understand basic concepts of learning.
CO2: Ability to understand decision tree learning.
CO3: Ability to evaluate hypotheses.
CO4: Ability to understand Bayesian learning.
CO5: Ability to understand computational learning theory.

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

CO5		✓				✓			✓			

TEXT BOOK:

1. Machine Learning by Tom M. Mitchell ,McGraw-Hill International Edition, 1997

IE5003 ACCOUNTING AND FINANCE FOR MANAGEMENT

L T P C
3 0 0 3

COURSE OBJECTIVES

- Understanding the Basics of accounting and accounting standards.
- Evaluating P&L statements, Balance sheets and other accounting statements.
- Learn and apply the various cost accounting methods.
- Study the various cost control procedures.
- Sketch and prepare a budget and make investment decisions.

UNIT I INTRODUCTION 9

Basics of accounting – Management Accounting – Financial accounting – cost accounting – comparison of financial accounting, cost accounting and management Accounting – generally accepted accounting principles – Accounting standards – Accounting cycle.

UNIT II FINANCIAL ACCOUNTING 9

Salient features of Balance Sheet and Profit and Loss statement, cash flow and Fund flow Analysis (Elementary), working capital management, ratio analysis – Depreciation.

UNT III COST ACCOUNTING 9

Cost accounting systems: Job Costing, process costing, allocation of overheads, Activity based costing, variance analysis – marginal costing – Break even analysis.

UNTI IV BUDGETING 9

Requirements for a sound budget, fixed budget – preparation of sales and production budget, flexible budgets, zero based budgets and budgetary control.

UNIT V FINANCIAL MANAGEMENT 9

Investment decisions – Investment appraisal techniques – payback period method, accounting rate of return, net present value method, internal rate of return and profitability index method-cost of capital.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Ability to apply accounting principles in a selected enterprise.
CO2: Ability to prepare P&L A/C, Balance sheet and other accounting statements.
CO3: Ability to apply the various cost accounting methods.
CO4: Ability to prepare a budget and make investment decisions.
CO5: Ability to understand concepts of financial management.

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

TEXT BOOK:

1. Palanivelu VR, “Accounting for Management”, Lexmi Publication (P) Ltd., 2007.

REFERENCES:

1. Bhattacharya. S.K. and John Deardon, “Accounting for Management – Text and cases”, Vikas publishing House, New Delhi, 1996.
2. James, Van Horne, “Fundamental of Financial Management” Pearson Education, 12th Edition, 2002

IE5004 ADVANCED OPTIMIZATION TECHNIQUES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Knowledge to model and solve Integer programming problems.
- Knowledge to model and solve problems using dynamic programming.
- Enable to make decision under certainty and uncertainty situations.
- Knowledge to solve single- and multiple-variable unconstrained and constrained nonlinear.
- Learn to solve non-linear problem using KKT condition , quadratic programming and separable programming .

UNIT I INTEGER PROGRAMMING AND GOAL PROGRAMMING 9

Branch and Bound technique –cutting plane algorithm method - Traveling Salesman Problem - Branch and Bound Algorithms for TSP - Heuristics for TSP. Goal programming - Goal programming formulation - Goal programming algorithms – The weights method – Pre-emptive method

UNIT II DYNAMIC PROGRAMMING 9

Characteristics of Dynamic Programming Problems - Deterministic Dynamic Programming - Forward and Backward recursive recursion – selected dynamic programming application – investment model – inventory model – replacement model –reliability model – stage coach problem.

UNIT III DECISION ANALYSIS &GAME THEORY 9

Decision Making under certainty - Decision Making under risk - Decision Trees – Decision making under certainty - Utility Theory**-** The Formulation of Two-Person, Zero-Sum Games **-** Solving Simple Games -Games with Mixed Strategies - Graphical Solution Procedure - Solving by Linear Programming

UNIT IV NONLINEAR PROGRAMMING I 9

Types of Nonlinear Programming Problems - One-Variable Unconstrained Optimization - Multivariable Unconstrained Optimization -

UNIT V NONLINEAR PROGRAMMING II 9

The Karush-Kuhn-Tucker (KKT) Conditions for Constrained Optimization - Quadratic Programming - Separable Programming - Convex Programming - Nonconvex Programming

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Acquired knowledge how to solve integer programming problems.
CO2: Learned how to solve various dynamic programming problems.
CO3: Acquired knowledge to make decision under certainty and uncertainty situations and selecting strategies for players in Two player zero sum game.
CO4: Knowledge to solve nonlinear unconstrained problems.
CO5: Knowledge to solve nonlinear constrained problems. Apply resource management techniques to industrial operations.

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

TEXT BOOKS:

1. Panneerselvam R, “Operations Research”, PHI, 2009
2. Srinivasan G., “Operations Research Principles and Applications”, PHI, 2017.

REFERENCES:

1. Hamdy A Taha, “Operations Research – An Introduction”, Pearson, 2017.
2. Philips, Ravindran and Solberg, “Operations Research principles and practices”, John Wiley,2007.
3. Ronald L Rardin, “Optimisation in Operations Research”, Pearson, 2018.

IE5005 MAINTENANCE ENGINEERING AND MANAGEMENT

L T P C
3 0 0 3

COURSE OBJECTIVES:

- Explain maintenance concepts and maximize profit and minimize downtime in maintenance .
- Summarize and take optimum maintenance decisions.
- Plan analyze the root cause for maintenance problems .
- Plan manage the spare parts for maintenance activity .
- Define and describe the losses and improve the Overall Equipment Effectiveness .

UNIT I MAINTENANCE CONCEPT 9

Maintenance definition – Maintenance objectives – Maintenance challenges – Tero Technology Maintenance costs – Scope of maintenance department.

UNIT II MAINTENANCE MODELS 9

Proactive/reactive maintenance – Maintenance policies – Imperfect maintenance – Preventive/breakdown maintenance – Optimal PM schedule and product characteristics – Inspection decisions – Maximizing profit – Minimizing downtime – Replacement Models.

UNIT III MAINTENANCE QUALITY 9

Five zero concept – FMEA- FMECA – Root cause analysis – Repair time distribution – Analysis of downtime – Maintainability prediction – Design for maintainability – Reliability Centered Maintenance.

UNIT IV MAINTENANCE MANAGEMENT 9

Human factors – Maintenance staffing – Learning curves – Simulation – Optimal size of service facility – Optimal repair effort – Spare parts management – Maintenance planning – Maintenance scheduling.

UNIT V TOTAL PRODUCTIVE MAINTENANCE 9

TPM philosophy – Chronic and sporadic losses – Equipment defects – Six major losses – Overall equipment effectiveness – TPM pillars – Autonomous maintenance.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Able to understand the equipment availability and downtime.
CO2: Able to implement maintenance policies for maximizing the profit .
CO3: Able to make a diagnosis of maintenance problems .
CO4: Able to improve uptime of machines by effective spare parts management .
CO5: Able to improve the overall Equipment Effectiveness.

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

TEXT BOOKS:

1. Andrew K.S.Jardine& Albert H.C. Tsang, “Maintenance, Replacement and Reliability” Taylor and Francis, 2006.
2. Mishra R C and Pathak K., “Maintenance Engineering and Management”, PHI,2012

REFERENCES:

1. BikasBadhury&S.K.Basu, “Tero Technology: Reliability Engineering and Maintenance Management”, Asian Books, 2003.
2. Seichi Nakajima, “Total Productive Maintenance”, Productivity Press, 1993.

IE5006 ROBOTICS ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:

- Classify and Recognize different robots and its specifications .
- Identify the appropriate drives and grippers required based on application .
- Specify the sensors for particular application .
- Control various robot links using kinematic equations .
- Perform a justification check before implementation of robots in industry .

UNIT I FUNDAMENTALS OF ROBOT 9

Robot Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Their Functions – Need for Robots – Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 9

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of all these Drives. End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION 9

Sensory Devices - Non optical - Position sensors - Optical position sensors - Velocity sensors- Proximity sensors - Contact and noncontact type - Tactile and slip sensors - Force and torque sensors- Introduction to Image Processing

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 9

Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional)- Homogeneous Transformation- D-H Representation of forward kinematics. Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs.

UNIT V ROBOT CELL DESIGN, CONTROL AND ECONOMICS 9

Work cell control - Robot and machine Interface - Robot cycle time analysis – Economic analysis of robots - Pay back method, EUAC method, Rate of return method.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Able to identify the type of robot required for applications.
CO2: Able to suggest a suitable robot drive, gripper and sensors required for particular application.
CO3: Perform selection of sensor for a particular task .
CO4: Able to analyse robot arm kinematics and understand simple programs.
CO5: Able to analyse the robot cycle time and economics of robot implementation.

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

TEXT BOOK :

1. M.P.Groover, “Industrial Robotics – Technology, Programming and Applications”, second Edition Tata McGraw-Hill, 2012.

REFERENCES :

1. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw-Hill Book Co., 1987.
2. Janakiraman.P.A., “Robotics and Image Processing”, Tata McGraw-Hill, 1995.
3. Richard D. Klafter., Thomas A. Chmielewski, Michael Negin, “Robotic Engineering: An Integrated Approach”, PHI.,1989.
4. SaeedB.Niku., “Introduction to Robotics: Analysis, Control, Applications”,PHI, 2003.
5. YoramKoren, “Robotics for Engineers”, McGraw-Hill Book Co., 1992.

IE5007 PRODUCTIVITY MANAGEMENT AND RE-ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:

- Explain the concept of productivity and significance of productivity.
- Appraise, measure and evaluate productivity.
- Plan and implement various productivity techniques .
- Rewrite the process for improving the productivity .
- Use and implement BPR tools for improving the productivity.

UNIT I INTRODUCTION 9

Basic concept and meaning of Productivity – Significance of Productivity – Factors affecting Productivity – Productivity cycle, Scope of Productivity Engineering and Management.

UNIT II PRODUCTIVITY MEASUREMENT AND EVALUATION 9

Productivity measurement in International, National and Industrial level – Total Productivity Model – Productivity measurement in Manufacturing and Service sectors – Performance Objective Productivity (POP) model – Need for Productivity Evaluation – Evaluation Methodology.

UNIT III PRODUCTIVITY PLANNING AND IMPLEMENTATION 9

Need for Productivity Planning – Short term and long term productivity planning – Productivity improvement approaches, Principles - Productivity Improvement techniques – Technology based, Material based, Employee based, Product based techniques – Managerial aspects of Productivity Implementation schedule, Productivity audit and control.

UNIT IV REENGINEERING PROCESS 9

Definition, Fundamentals of process reengineering – Principles, Methodology and guidelines for Organization Transformation, DSMCQ and PMP organization Transformation models – Process Improvement Models like PMI, Edosomwan, LMICIP and NPRDC Models.

UNIT V BPR TOOLS AND IMPLEMENTATION 9

Analytical and Process Tools and Techniques - Role of Information and Communication Technology in BPR – Requirements and steps in BPR Implementation – Case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1 : Ability to understand the concept of productivity and significance of productivity.
CO2 : Ability to Measure and evaluate productivity.
CO3 : Ability to Plan and implement various productivity techniques .
CO4 : Ability to Reengineer the process for improving the productivity .
CO5 : Ability to Implement BPR tools for improving the productivity.

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

TEXT BOOKS:

1. Edosomwan, J.A, “Organizational Transformation and Process re- Engineering”, British Cataloging in publications,1996.
2. Sumanth, D.J, “Productivity Engineering and Management”, TMH, New Delhi, 1990.

REFERENCE:

1. Premvrat, Sardana, G.D. and Sahay, B.S, “Productivity Management - A systems approach”, Narosa Publications, New Delhi, 1998.

IE5008 MANUFACTURING SYSTEMS AND MODELS

L T P C
3 0 0 3

COURSE OBJECTIVES:

- Compare different manufacturing systems and its performance measures.
- Use DTMC models for industrial problems.
- Use CTMC models for industrial problems.
- Design and analysis of manufacturing systems for queuing problems.
- Solve the industrial problems using Petrinet-models

UNIT I MANUFACTURING SYSTEMS- PERFORMANCE MEASURES 9

Manufacturing systems- Types, Concepts. Performance measures- types. Manufacturing Models- Types.

UNIT II DISCRETE TIME MARKOV CHAINS 9

Introduction to Markov Chains, DTMC, Properties of DTMC, Sojourn Times in DTMC Models, Applications of DTMC Models in Manufacturing Systems

UNIT III CONTINUOUS TIME MARKOV CHAINS 9

Introduction to CTMC, Properties of CTMC, Sojourn Times in CTMC Models, Applications of CTMC Models in Manufacturing Systems

UNIT IV QUEUING MODELS 9

Birth and death process, performance measures in queuing models, open queuing networks and closed queuing networks- applications in manufacturing systems

UNIT V PETRINET MODELS 9

Introduction to petrinet models-Representational powers of Petri nets- Reachability graphs, Markings, Applications of petrinet models in manufacturing systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Able to identify and measure the performance of manufacturing system.
CO2: Able to apply the DTMC model to a Manufacturing Problem.
CO3: Able to apply the CTMC model to a Manufacturing Problem.
CO4: Able to apply the Queuing model to a Manufacturing Problem.
CO5: Able to apply the Peterinet model to a Manufacturing Problem.

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

TEXT BOOK:

1. Viswanadham, N., &Narahari, Y., Performance modeling of automated manufacturing systems, Prentice Hall, 1992.

IE5009 OPERATIONS SCHEDULING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Define the basic concepts of scheduling theory.
- Illustrate the application of single machine scheduling algorithms.
- Transfer knowledge in parallel machine scheduling algorithms.
- Teach the concept of flow shop scheduling and its algorithm.
- Describe the use of algorithms for job shop scheduling algorithms.

UNIT I SCHEDULING THEORY 9

Scheduling background - Scheduling function – Sequencing – Measures of performance – Scheduling theorems – Pure sequencing model assumptions.

UNIT II SINGLE MACHINE SCHEDULING 9

Hogdson's algorithm – Smith's application – Wilkerson-Irwin algorithm – Neighborhood search technique – Dynamic programming approach – Branch and Bound algorithm – Non simultaneous arrivals – Dependent job problems – Sequence dependent set up times.

UNIT III PARALLEL MACHINE SCHEDULING 9

Preemptive jobs: McNaughton's algorithm – Non preemptive jobs – Heuristic procedures – Minimizing weighted mean flow time: H1 &Hmheuristics – Dependent jobs: Hu's algorithm– Muntz Coffman algorithm.

UNIT IV FLOW SHOP SCHEDULING 9

Characteristics – Johnson's algorithm – Extension of Johnson's rule – Campbell Dudek Smith algorithm – Palmer's method -Gupta's algorithm– Start lag, Sop lag – Mitten's algorithm –Ignall Schrage algorithm – Despatch index heuristic. ..

UNIT V JOB SHOP SCHEDULING 9

Characteristics – Graphical tools – Jackson's algorithm – Feasible, Semi-active and active schedules – Single pass approach – Non delay schedule – Priority dispatching rules – Heuristic schedule generation – Open shop scheduling- Meta heuristics in scheduling

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Able to understand fundamental concepts of scheduling theory.

CO2: Students will be able to solve single machine sequencing problems with an objective to minimize mean flow time or mean tardiness.

CO3: Students will be able to design a parallel machine schedule which can minimize mean flow time, or makespan.

CO4: Students will be able to determine an optimal schedule for a flow shop.

CO5: Students will be able to solve complex job shop problems, design and evaluate various feasible job shop schedules.

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

TEXT BOOK:

1. Kenneth R.Baker, "Introduction to Sequencing and Scheduling", John Wiley & Sons, New York, 2000.

REFERENCE:

1. Kenneth R.Baker, Dan Trietsch, "Principles of sequencing and scheduling", John Wiley & Sons, New York, 2013.

ME5075 ENTREPRENEURSHIP DEVELOPMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

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

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

UNIT I ENTREPRENEURSHIP 9

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

UNIT II MOTIVATION 9

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

UNIT III BUSINESS 9

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

UNIT IV FINANCING AND ACCOUNTING 9

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

UNIT V SUPPORT TO ENTREPRENEURS 9

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

TOTAL (L: 45) = 45 PERIODS

COURSE OUTCOMES:

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

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

TEXT BOOKS:

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

REFERENCES:

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

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		0.3			
2						0.6		0.3	0.3	0.3		0.3		0.3	
3						0.6	0.6	0.6	0.3	0.3	0.9	0.3		0.3	
4						0.6	0.3	0.6		0.3	0.3	0.3		0.3	
5						0.6	0.6	0.3		0.3		0.3		0.3	

MG5451 PRINCIPLES OF MANAGEMENT

L T P C
3 0 0 3

COURSE OBJECTIVES:

- Sketch the Evolution of Management.
- Extract the functions and principles of management.
- Learn the application of the principles in an organization.
- Study the various HR related activities.
- Analyze the position of self and company goals towards business.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur- types of managers-managerial roles and skills – Evolution of Management –Scientific, human relations , system and contingency approaches– Types of Business organization- Sole proprietorship, partnership, company-public and private sector enterprises- Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting objectives – Policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – Organization chart – Organization structure – Types – Line and staff authority – Departmentalization – delegation of authority – Centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING 9

Foundations of individual and group behaviour– Motivation – Motivation theories – Motivational techniques – Job satisfaction – Job enrichment – Leadership – types and theories of leadership – Communication – Process of communication – Barrier in communication – Effective communication – Communication and IT.

UNIT V CONTROLLING 9

System and process of controlling – Budgetary and non - Budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling .
CO2: Have same basic knowledge on international aspect of management.
CO3: Ability to understand management concept of organizing.
CO4: Ability to understand management concept of directing.
CO5: Ability to understand management concept of controlling.

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

TEXT BOOKS:

1. Harold Koontz and Heinz Weihrich “Essentials of management” Tata McGraw Hill,1998.
2. Stephen P. Robbins and Mary Coulter, “ Management”, Prentice Hall (India)Pvt. Ltd., 10th Edition, 2009.

REFERENCES:

1. Robert Kreitner and MamataMohapatra, “ Management”, Biztantra, 2008.
2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, “Fundamentals of Management” Pearson Education, 7th Edition, 2011.
3. Tripathy PC and Reddy PN, “Principles of Management”, Tata Mcgraw Hill, 1999.

IE5010 PRODUCT DESIGN AND VALUE ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:

- Relate product development integrated with value engineering.
- Summarize the development of new products through conceptualization, design and development phases.
- Relate various aspects of product development with industrial design and manufacturing.
- Describe the value of a product using tools and techniques.
- Design products which are suitable for the needs of the society.

UNIT I VALUE ENGINEERING BASICS 9

Origin of Value Engineering, Meaning of value, Definition of Value Engineering and Value analysis, Difference between Value analysis and Value Engineering, Types of Value, function - Basic and Secondary functions, concept of cost and worth, creativity in Value Engineering.

UNIT II VALUE ENGINEERING JOB PLAN AND PROCESS 9

Seven phases of job plan, FAST Diagram as Value Engineering Tool, Behavioural and organizational aspects of Value Engineering, Ten principles of Value analysis, Benefits of Value Engineering.

UNIT III IDENTIFYING CUSTOMER NEEDS and PRODUCT SPECIFICATIONS 9

Product Development process – Product development organizations. Gather raw data – Interpret raw data- organize the needs into a hierarchy – Relative importance of the needs. Specifications – Refining specifications.

UNIT IV CONCEPT GENERATION, SELECTION AND PRODUCT ARCHITECTURE 9

Clarify the problem – Search internally – Search externally – Explore systematically. Concept Screening – Concept scoring. Product architecture – Implication of architecture –Establishing the architecture – Related system level design issues.

UNIT V INDUSTRIAL DESIGN, PROTOTYPING AND ECONOMICS OF PRODUCT DEVELOPMENT 9

Need for industrial design – Impact of industrial design – Industrial design process – Management of industrial design process – Assessing the quality of industrial design.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: The Students should be able to understand the basic concept of product development.
CO2: Design and develop new products in a systematic manner considering the concept of value engineering.
CO3: Able to understand customer requirements.
CO4: Able to understand product architecture.
CO5: Able to do prototyping.

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

TEXT BOOKS:

1. Karal, T.Ulrich Steven D.Eppinger, “Prodcut Design and Development”, McGraw Hill, International Editions, 2003.
2. Mudge, Arthur E. “Value Engineering”- A systematic approach, McGraw Hill, New York, 2000.

REFERENCES :

1. Charles Gevirtz, “Developing New products with TQM”, McGraw Hill, International Editions, 1994.
2. Rosenthal S, “Effective Product Design and Development”, Irwin, 1992.

IE5077 SYSTEMS ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:

- Illustrate the life cycle phases and framework for systems engineering.
- Describe about systems engineering process.
- Apply ergonomic and system dynamic models for evaluation of alternatives.
- Create knowledge on Reliability, Markov and Time series models for analysis of alternatives.
- Describe about decision assessment methods in systems engineering.

UNIT I INTRODUCTION 9

Definitions of Systems Engineering, Systems Engineering Knowledge, Life cycles, Life-cycle phases, logical steps of systems engineering, Frame works for systems engineering.

UNIT II SYSTEMS ENGINEERING PROCESSES 9

Formulation of issues with a case study, Value system design, Functional analysis, Business Process Reengineering, Quality function deployment, System synthesis, Approaches for generation of alternatives.

UNIT III ANALYSIS OF ALTERNATIVES - I 9

Cross-impact analysis, Structural modeling tools, System Dynamics models with case studies, Economic models: present value analysis – NPV, Benefits and costs over time, ROI, IRR; Work and Cost breakdown structure.

UNIT IV ANALYSIS OF ALTERNATIVES – II 9

Reliability, Availability, Maintainability, and Supportability models; Stochastic networks and Markov models, Queuing network optimization, Time series and Regression models, Evaluation of large scale models

UNIT V DECISION ASSESSMENT 9

Decision assessment types, Five types of decision assessment efforts, Utility theory, Group decision making and Voting approaches, Social welfare function; Systems Engineering methods for Systems Engineering Management

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will

CO1: Be able to recognize life cycle phases in systems engineering.
CO2: Apply steps in systems engineering process for large scale problems.
CO3: Able to develop system dynamic models for analyzing alternatives.
CO4: Gain ability to evaluate alternatives in large scale problems.
CO5: Be able Attain confidence in assessment and arrive decisions for complex problems.

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
CO1		✓	✓	✓	✓				✓			
CO2		✓	✓	✓	✓				✓			
CO3		✓	✓	✓	✓	✓			✓			
CO4		✓	✓	✓	✓	✓			✓			
CO5		✓	✓	✓	✓	✓			✓			

TEXT BOOK:

1. Andrew P. Sage, James E. Armstrong Jr. “Introduction to Systems Engineering”, John Wiley and Sons, Inc, 2000.

REFERENCES:

1. Andrew P.Sage, “Systems Engineering”, John Wiley & Sons, 1992.
2. Andrew P.Sage, William B.Rouse, “Hand book of Systems Engineering and Management”, John Wiley & Sons, 1999.

IE5011 METROLOGY AND INSPECTION L T P C
3 0 0 3

COURSE OBJECTIVES:

- Contrast linear and angular measuring Instruments.
- Identify the standards and applications of measurement in industries.
- Recognize the modern concepts and equipments for measurement.
- Classify various measurement devices used.
- Contrast destructive and non-destructive testing methods.

UNIT I LINEAR MEASUREMENT AND ANGULAR MEASUREMENT 9

Accuracy, Precision, Readability, Sensitivity etc., Linear measuring instruments-vernier – micrometer-Gauge blocks- dial indicator-comparators – Angle standards – vernier bevel protector-sine bar – autocollimator.

UNIT II STANDARDS FOR LINEAR AND ANGULAR MEASUREMENTS 9

Shop floor standards and their calibration, light interference, Method of coincidence, Slip gauge calibration, Measurement errors, Limits, fits, Tolerance, Gauges, Gauge design.

UNIT III MEASUREMENT APPLICATION 9

Measurement of screw threads and gears – Radius measurement – surface finish measurement - Measurement of straightness-flatness-parallelism – squareness- roundness – circularity

UNIT IV MODERN CONCEPTS 9

Image processing and its application in Metrology, Co-ordinate measuring machine, Types of CMM, Probes used, Application, Non-contact CMM using Electro-optical sensors for dimensional metrology.

UNIT V INTRODUCTION TO MEASUREMENT SYSTEMS 9

System configuration, basic characteristics of measuring devices, Displacement, force and torque measurement, standards, Calibration, Sensors, Basic principles and concepts of temperature, Pressure and flow measurement, Destructive testing – Nondestructive testing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The student must be able to

CO1: Understanding the basic theoretical technical and legislative aspects of metrology and testing.
CO2: Measure a variety of engineering parts using a variety of measuring techniques.
CO3: Present and analyze measurement results obtained.
CO4: Acquire capability to select right method of non-destructive testing.
CO5: Able to understand measurement systems concepts.

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

TEXT BOOK:

1. Galyer J.F. and Shotbolt C.R, “Metrology for Engineers” ELBS, 1992.

REFERENCES:

1. Hune, K.J, “Engineering Metrology”, Kalyani Publishers, India, 1980.
2. Robinson, S.L. and Miller R.K, “Automated Inspection and Quality Assurance”, Marcel Dekker Inc.1989.
3. Stout, K. “Quality Control in Automation”, Prentice Hall, 1986.

IE5012 **PROJECT MANAGEMENT** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- Knowledge to evaluate and select the most desirable projects.
- Ability to plan and implement the projects.
- Ability to control the projects.
- Knowledge to close the projects.
- Knowledge about software projects.

UNIT I INTRODUCTION TO PROJECT MANAGEMENT AND PROJECT SELECTION 9

Objectives of Project Management- Importance of Project Management- Types of Projects Project Management Life Cycle- Project Selection – Feasibility study: Types of feasibility- Steps in feasibility study.

UNIT II PROJECT PLANNING AND IMPLEMENTATION 9

Work break down structure- Estimate work packages – Identify task relationship – project schedule

UNIT III PROJECT MONITORING AND CONTROL 9

Resource aggregations - Resource levelling - limited resource allocation – project monitoring and control.

UNIT IV PROJECT CLOSURE 9

Process project audit – post project audit – normal project closure – premature closure – perpetual project - project closure process – Risk management.

UNIT V SPECIAL TOPICS IN PROJECT MANAGEMENT 9

Project management for modern information system – critical success factors for IT project - software project selection and initiation - project management discipline – project overall planning

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Evaluate and select the most desirable projects.
CO2: Apply appropriate approaches to plan a new project.
CO3: Apply appropriate methodologies to develop a project schedule.
CO4: Identify important risks facing a new project.
CO5: Understanding the project management skills in IT industries.

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

TEXT BOOK:

1. Arun Kanda, “Project Management A Life Cycle Approach”, Prentice Hall of India, 2011.

REFERENCES:

1) Panneerselvam R and Senthilkumar P, “Project Management”, Prentice Hall of India, 2009.
2) Khanna R B, “Project Management”, Prentice Hall of India, 2011

IE5072 ENTERPRISE RESOURCE PLANNING L T P C
3 0 0 3

COURSE OBJECTIVES:

- Describe an idea about ERP.
- Grasp the activities of ERP project management cycle.
- Understanding the emerging trends in ERP developments.
- Creating awareness of core and extended modules of ERP.
- Understand the ERP trending concepts.

UNIT I INTRODUCTION 9

Overview of enterprise systems – Evolution - Risks and benefits - Fundamental technology - Issues to be consider in planning design and implementation of cross functional integrated ERP systems.

UNIT II ERP SOLUTIONS AND FUNCTIONAL MODULES 9

Overview of ERP software solutions- Small, medium and large enterprise vendor solutions, BPR, and best business practices - Business process Management, Functional modules.

UNIT III ERP IMPLEMENTATION 9

Planning Evaluation and selection of ERP systems - Implementation life cycle - ERP implementation, Methodology and Frame work- Training – Data Migration. People Organization in implementation-Consultants, Vendors and Employees.

UNIT IV POST IMPLEMENTATION 9

Maintenance of ERP- Organizational and Industrial impact; Success and Failure factors of ERP Implementation.

UNIT V EMERGING TRENDS ON ERP 9

Extended ERP systems and ERP add-ons -CRM, SCM, Business analytics - Future trends in ERP systems-web enabled, Wireless technologies, cloud computing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Knowledge of ERP implementation cycle.
CO2: Awareness of core and extended modules of ERP.
CO3: Able to understand ERP implementation steps.
CO4: Able to understand post implementation procedure.
CO5: Able to understand ERP trending concepts.

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

TEXT BOOK:

1. Alexis Leon, ERP demystified, second Edition Tata McGraw-Hill, 2008.

REFERENCES:

1. Alexis Leon, Enterprise Resource Planning, second edition, Tata McGraw-Hill, 2008.
2. Jagan Nathan Vaman, ERP in Practice, Tata McGraw-Hill, 2008.
3. MahadeoJaiswal and Ganesh Vanapalli, ERP Macmillan India, 2009.
4. Sinha P. Magal and Jeffery Word, Essentials of Business Process and Information System, Wiley India, 2012.
5. Summer, ERP, Pearson Education, 2008.
6. Vinod Kumar Grag and N.K. Venkitakrishnan, ERP- Concepts and Practice, Prentice Hall of India, 2006.

IE5013 SOFTWARE ENGINEERING AND METHODOLOGIES L T P C
3 0 0 3

COURSE OBJECTIVES:

- Study the basics of software development.
- Study the customer needs and apply in software development.
- Design the code and do the testing analysis.
- Develop quality tools and techniques used in software industry.
- Develop and implement the software standards.

UNIT I SOFTWARE ENGINEERING AND MODELS 9

Software Development – Phases, Process Models (ISO & CMM) – Product Life Cycle – Software Life Cycle Models.

UNIT II REQUIREMENTS ANALYSIS 9

Software requirements specifications – Structured tools for Software development– Structured analysis.

UNIT III SOFTWARE COST ESTIMATION 9

Planning a Software project – Cost Estimation and models – Software configuration management plans – Project monitoring plans.

UNIT IV SOFTWARE DESIGN 9

System Design Objectives and Principles – Module level concepts – Structured design – Design methodology – Object oriented approach – Detailed design – Coding.

UNIT V SOFTWARE TESTING 9

Software testing– Functional testing – Structural testing – Testing Process – Software Quality Metrocs – Software Quality Management – Software Productivity.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: To practice the various software modeling tools and techniques.
CO2: To study the various performance measurement tools and techniques.
CO3: Able to estimate time and cost of projects.
CO4: Able to select appropriate monitoring plan.
CO5: To study the importance of software design and software testing.

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

TEXT BOOK:

1. Mayrhausen A V, Software Engineering and Management, Academic press, 1990.

REFERENCES:

1. PankajJalote, An integrated approach to Software Engineering, Naross Publishing, 2018.
2. Pressman R S , Software Engineering, McGraw Hill, 1987.
3. Somavile , Software Engineering, Addison – Wesley, 2011.
4. Stephen H. Khan, Metrics and Models and Software Quality Engineering, Addison Wesley, 2002.

IE5076 SAFETY ENGINEERING AND MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Identify unsafe conditions and recognize unsafe alerts.
- Interpret the rules and regulations for safety operations.
- Capable of solving problem of accidents.
- Capable of solving the present for criticizing the present for improved safety.
- Collaborate and modify processes / procedures for safety.

UNIT I INTRODUCTION 9

Evolution of modern safety concepts – Fire prevention – Mechanical hazards – Boilers, Pressure vessels, Electrical Exposure.

UNIT II CHEMICAL HAZARDS 9

Chemical exposure – Toxic materials – Radiation Ionizing and Non-ionizing Radiation - Industrial Hygiene – Industrial Toxicology.

UNIT III ENVIRONMENTAL CONTROL 9

Industrial Health Hazards – Environmental Control – Industrial Noise - Noise measuring instruments, Control of Noise, Vibration, - Personal Protection.

UNIT IV HAZARD ANALYSIS 9

System Safety Analysis –Techniques – Fault Tree Analysis (FTA), Failure Modes and Effects Analysis (FMEA), HAZOP analysis and Risk Assessment.

UNIT V SAFETY REGULATIONS 9

Explosions – Disaster management – catastrophe control, hazard control , Factories Act, Safety regulations Product safety – case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to

CO1 : Identify and prevent chemical, environmental mechanical, fire hazard .
CO2 : Collect, analyze and interpret the accidents data based on various safety techniques.
CO3 : Apply proper safety techniques on safety engineering and management .
CO4 : Able to perform hazard analysis.
CO5 : Aid to design the system with environmental consciousness by implementing safety regulation.

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

TEXT BOOK:

1. John V.Grimaldi, “Safety Management”, AITB S Publishers, 2003.

REFERENCES:

1. David L.Goetsch, “Occupational Safety and Health for Technologists”, Engineers and Managers, Pearson Education Ltd. 5th Edition, 2005.
2. Deshmukh L M, “Industrial Safety Management”, Tata McGraw-Hill Publishing Company Ltd.,2005
3. Safety Manual, “EDEL Engineering Consultancy”, 2000.

IE5075 PRINCIPLES OF COMPUTER INTEGRATED MANUFACTURING SYSTEMS

L T P C
3 0 0 3

COURSE OBJECTIVES:

- Define flexible automation and describe its components.
- Explain the process of computer aided design.
- Relate the enablers of CAD and CAM integration and business function.
- Tell the fundamentals of integrated management systems.
- Correlate CIM with DBMS.

UNIT I GT AND FMS 9

Part families, production flow analysis, cellular manufacturing, ROC, Flexible manufacturing systems- components, FMS applications, FMS analysis – Bottleneck model.

UNIT II COMPUTER-AIDED DESIGN 9

Fundamentals of CAD – design process, manufacturing database – Computer graphics –functions, constructing the geometry, transformation, wire frame Vs solid modelling.

UNIT III MANUFACTURING SUPPORT SYSTEMS 9

Product design and CAD, CAD/CAM and CIM, Computer aided process planning- Variant and generative approaches, Concurrent engineering and design for manufacture, Lean production, Agile manufacturing.

UNIT IV FUNDAMENTALS OF COMMUNICATIONS 9

Information, Communications matrix, Computer communications, Network architecture, Tools and techniques.

UNIT V DATABASE AND CIM MANAGEMENT 9

Manufacturing data, database technology, Database management, Management of CIM – role, cost justification, expert systems

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1:Analyze a cellular and flexible manufacturing system for its performance measures.
CO2: Gain knowledge in the basics of computer aided design.
CO3: Make competitive manufacturing systems with the use of appropriate tools and techniques.
CO4: Develop integrated manufacturing system with the required network structure and manufacturing database.
CO5:Able to understand DBMS concepts.

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

TEXT BOOK:

1. Mickel P Groover, “Automation production systems and computer integrated manufacturing”, PHI, second edition, 2008.

REFERENCE:

1. Kant Vajpayee S, “Principles of Computer-Integrated Manufacturing”, PHI, 2005.

IE5014 INTRODUCTION TO AUTOMOTIVE SYSTEMS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Summarize the basics of vehicle structure and engines.
- Illustrate the various auxiliary systems associated with IC engines.
- Illustrate the various components in transmission system .
- Illustrate the different steering, braking and suspension systems .
- Classify the types and applications of sensors and actuators.

UNIT I FUNDAMENTALS 9

Introduction to automotive systems - history of automobiles - Types of automobiles, Vehicle structure: functions- type - layout of chassis, frames, body. Vehicle aerodynamics: resistance and moments. Introduction to IC engines – components - functions and materials - two and four stroke cycle engines; Technology and constructional details and principle of working of: SI, CI, CNG / LPG engines. Comparison of SI, CI, CNG & LPG engines; Performance curves -Torque vs speed; BHP vs. RPM; FHP vs. RPM; SFC vs. RPM. Hybrid vehicles and alternative fuels.

UNIT II AUXILIARY SYSTEMS 9

Ignition systems: construction of spark plugs, ignition methods -transistorized coil ignition system, capacitive discharge ignition system - Fuel delivery systems – construction of fuel injector, Injection methods - Multi Point Fuel Injector (MPFI) and Common Rail Fuel Injector (CRDI). Supercharging - Turbo chargers, Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

UNIT III TRANSMISSION SYSTEMS 9

Clutch-types and construction, Gear boxes- Manual and Automatic, Gear shift mechanisms, Over drive, Transfer box, Fluid flywheel, Torque converter, Propeller shaft, Slip joints, Universal joints, Differential. Front and rear axles, Hotchkiss Drive and Torque Tube Drive.

UNIT IV STEERING, BRAKES AND SUSPENSIONS 9

Steering Control: Steering system basics, Steering geometry, steering gear box Power assisted steering. Classification of brakes, Drum brake & Disc brakes. Hydraulic and pneumatic braking system components, Antilock Braking Systems (ABS), Need of suspension system, Types of suspension, Suspension springs, Constructional details and characteristics of leaf, coil and torsion bar springs, Pneumatic suspension, Shock absorbers.

UNIT V SENSORS AND ACTUATORS IN AUTOMOTIVE SYSTEMS 9

Sensors **-** Accelerometers, Wheel speed, Brake pressure, Seat occupancy, Engine speed, Vehicle speed, Temperature, Tyre pressure and Air bag sensors etc. Actuators - Relays, Solenoids and motors in automotive technology. Active Safety Systems - ABS, Brake Assist. Passive Safety Systems - Airbag systems. Advanced Driver Assistance Systems (ADAS) principles and Applications - Lane Departure Warning, Collision Warning, Automatic Cruise Control, Pedestrian Protection, and Headlights Control.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Acquired knowledge about the basic knowledge about vehicle structure and engines.
CO2: Acquired knowledge about IC engines and associated components in automotive technology.
CO3: Acquired knowledge about various components in transmission system .
CO4: Acquired knowledge about the different steering, braking and suspension systems.
CO5: Acquired knowledge about the role of sensors and actuators in advanced automotive systems.

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

TEXT BOOKS:

1. Jain K.K. and Asthana .R.B, "Automobile Engineering" Tata McGraw Hill Publishers, New Delhi, 2002.
2. Kirpal Singh, "Automobile Engineering", Vol 1 & 2, Seventh Edition, Standard Publishers, New Delhi, 1997.

REFERENCES:

1. Heinz Heisler, "Advanced Engine Technology," SAE International Publications USA, 1998.
2. Joseph Heitner, "Automotive Mechanics," Second Edition, East-West Press, 1999.
3. Martin W, Stockel and Martin T Stockle , "Automotive Mechanics Fundamentals," The Good heart –Will Cox Company Inc, USA ,1978.
4. Newton, Steeds and Garet, "Motor Vehicles", Butterworth Publishers, 1989.
5. Robert Bosch: "Automotive Electronics Handbook", John Wiley and Sons, 2004.
6. Williams. B. Ribbens: "Understanding Automotive Electronics", 6th Edition, Elsevier Science, Newnes Publication, 2003.

IE5015 COST ESTIMATION AND COST CONTROL L T P C
3 0 0 3

COURSE OBJECTIVES:

- Gaining knowledge in the field of cost estimation.
- Enable the students to estimate the cost of various manufacturing processes.
- Controlling the manufacturing and software cost.
- Designing the cost analysis.
- Applying cost estimation procedures in all types of industries.

UNIT I ESTIMATION AND COSTING 9

Objectives, Functions, Procedure in Estimation – Importance in Costing – Cost Accounting – Classification of costs – Elements of cost – Estimation in Material cost, Labour cost and overheads – Allocation of overheads.

UNIT II PRODUCT COST ESTIMATION 9

Estimation in Forging shop – in welding shop – in Foundry Shop – in Machining Shop etc.,

UNIT III SOFTWARE COST ESTIMATION 9

Software Development Life cycle –Software Cost Estimation Models – COCOMO – Ada COCOMO – SLIM – PRICES – CHECKPOINT – FUNCTION POINTS.

UNIT IV COSTING METHODS 9

Job costing – Operating costing – Process costing.

UNIT V COST ANALYSIS FOR PLANNING AND CONTROL 9

Marginal costing – Standard costing and Variance Analysis – Budgetary control

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: To estimate the manufacturing cost and computation of software cost .
CO2: Able to estimate product cost.
CO3: To control the manufacturing and software cost.
CO4: To enable both the costing and estimating procedures for all type of industry.
CO5: Able to perform cost analysis.

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

TEXT BOOK:

1. Jawaharlal, Cost Accounting, Tata McGraw Hill, 2013.

REFERENCES:

1. Banga T R and Sharma S C, Estimating and Costing, Khanna Publishers, 2001.
2. Narang GBS and Kumar V, Production and Costing, Khanna Publishers, 2014.
3. Roger, Pressman S, Software Engineering – A Practitioner's Approach, Tata McGraw Hill, 2014.

IE5016 APPLIED SOFT COMPUTING

L T P C
3 0 0 3

COURSE OBJECTIVES:

- Understand the fundamental concepts of soft computing.
- Explain about genetic algorithms.
- Illustrate the concept of neural networks.
- Appraise about fuzzy logic systems for decision making.
- Develop hybrid systems for decision making.

UNIT I INTRODUCTION 9

History and Applications of Artificial Intelligence – Algorithmic versus Heuristic reasoning, Representation and Intelligence. Knowledge Representation: Rule based, Model based, Case based and hybrid systems. Logic based Abductive Inference, Stochastic approach to uncertainty.

UNIT II GENETIC ALGORITHMS 9

Introduction to Genetic Algorithms (GA) : Reproduction, Cross over, Mutation - Applications

UNIT III NEURAL NETWORKS 9

Machine Learning Using Neural Network, Adaptive Networks – Feed forward Networks – Supervised Learning Neural Networks – Radial Basis Function Networks - Reinforcement Learning – Unsupervised Learning Neural Networks.

UNIT IV FUZZY LOGIC 9

Crisp set versus Fuzzy Sets – Operations on Fuzzy Sets –Fuzzy Arithmetic - Fuzzy Relations – Membership Functions- Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making.

UNIT V HYBRID SYSTEMS 9

Adaptive Neuro-Fuzzy Inference Systems - Hybrid intelligence systems – AHP- ANP – DEA .

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of this course, students will be

CO1: Able to understand the fundamental concepts of soft computing.
CO2: Able to apply Genetic Algorithms for solving complex problems.
CO3: Able to use neural networks.
CO4: Able to use fuzzy logic.
CO5: Able to use hybrid systems.

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

TEXT BOOKS:

1. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications”, Prentice Hall, 1995.
2. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Pearson Edn., 2003.
3. Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, “Neuro-Fuzzy and Soft computing”, Prentice-Hall of India, 2003.
4. Rajasekarn.S and Vijayalakshmi Pai GA, "Neural Networks, Fuzzy Systems and Evolutionary Algorithms: Synthesis and Applications" , PHI , 2017

REFERENCES:

1. David E. Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley, 1997.

IE5071 DECISION SUPPORT AND INTELLIGENT SYSTEMS L T P C
3 0 0 3

COURSE OBJECTIVES:

- Explain the fundamental terms, concepts and theories associated with the phases of Decision Support Systems.
- Describe the uses of various mathematical models, data warehousing and mining.
- Discuss and develop skills in the analysis, design and implementation of group support systems and knowledge management systems.
- Illustrate expert system as a subsystem of DSS.
- Track the knowledge representation methods.

UNIT I INTRODUCTION 9

Managerial decision making, system modeling and support - preview of the modeling process-phases of decision making process.

UNIT II ANALYSIS 9

DSS components- Data warehousing, access, analysis, mining and visualization-modeling and analysis-DSS development.

UNIT III TECHNOLOGIES 9

Group support systems- Enterprise DSS- supply chain and DSS - Knowledge management methods, technologies and tools.

UNIT IV EXPERT SYSTEMS **9**

Artificial intelligence and expert systems - Concepts, structure, types - Knowledge acquisition and validation - Difficulties, methods, selection.

UNIT V SEMANTIC NETWORKS **9**

Representation in logic and schemas, semantic networks, production rules and frames, inference techniques, intelligent system development, implementation and integration of management support systems.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

CO1: Make decisions in the semi structured and unstructured problem situations.
CO2: Able to apply data warehousing and data mining principles in basic applications.
CO3: Develop knowledge management system with simple tools and techniques.
CO4: Develop intelligent based DSS.
CO5: Able to use logical and analytical thinking

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

TEXT BOOK:

1. Efraim Turban and Jay E Aronson, “Decision Support and Business Intelligent Systems”, PHI, Eighth edition, 2010.

REFERENCES:

1. Elain Rich and Kevin Knight, “Artificial intelligence”, TMH,1993.
2. Mitra SS, “Decision support systems, tools and techniques”, John Wiley, 1996.

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									✓			✓

TEXT BOOKS:

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: 45PERIODS

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: 45PERIODS

COURSE OUTCOMES:

CO1: To develop basic personality skills holistically
CO2: To develop deep personality skills holistically to achieve happy goals
CO3: To rewrite the responsibilities
CO4: To reframe a person with stable mind, pleasing personality and determination
CO5: To awaken wisdom in students

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

REFERENCES:

1. Gopinath,Rashtriya Sanskrit Sansthanam P, Bhartrihari'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).
- Assignment2 : Write a script for a scene taken from a short story / novella (20 marks).
- Presentation: Students choose any one topic related to films and present it to the audience. (25 marks)
- Group discussion : Students discuss in groups on the various aspects of movies and its impact on society. (25 marks)
- Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others' posts. (10 marks)

REFERENCES

1. A Biographical Dictionary of Film by David Thomson, Secker & Warburg, 1975
2. Signs and Meaning in the Cinema by Peter Wollen, Secker & Warburg, 1969
3. The World Viewed by Stanley Cavell 1971
4. Film Style and Technology: History and Analysis by Barry Salt, Starword, 1983
5. The Encyclopedia of Indian Cinema Edited by Ashish Rajadhyaksha and Paul Willemen, BFI, 1994.

HU5275 FUNDAMENTALS OF LANGUAGE AND LINGUISTICS L T P C
3 0 0 3

OBJECTIVES

- To broadly introduce students to the formal and theoretical aspects of linguistics.
- To enable learners to understand the various practical applications of language and recent findings in the field of applied linguistics.

CONTENTS : -

UNIT I LANGUAGE AND LINGUISTICS: AN OVERVIEW 9

Language and Linguistics-Linguistic Knowledge-Knowledge of Sound Systems & Words – Creativity of Language – Relationship of form and meaning. Grammar – descriptive, prescriptive,universal-Human Language – Animal Language – Sign Language- Computers and Language.

UNIT II MORPHOLOGY - WORDS OF LANGUAGE 9

Content and function words – morphemes -free & bound –prefixes – suffixes – roots and stems – inflectional and derivational morphology-compound words and their formation – malapropisms – slips of the tongue.

UNIT III SYNTAX- THE SENTENCE PATTERNS OF LANGUAGE AND SEMANTICS-THE MEANING OF LANGUAGE 9

Syntax : Rules of Syntax- Sentence Structure-Structural Ambiguity-Syntactic Categories. Semantics: Lexical Semantics – Anomaly-Metaphors- Idioms- Synonyms – Antonyms – Homonyms -Pragmatics– Speech Acts

UNIT IV PHONETICS – THE SOUNDS OF LANGUAGE 9

Speech sounds- Introduction to branches of Phonetics- The Phonetic Alphabet – IPA – Consonants - Vowels – Diphthongs- Tone and Intonation.

UNIT V APPLIED LINGUISTICS - THE PRACTICAL APPLICATIONS OF LANGUAGE 9

Language learning and teaching (ELT)- lexicography-translation studies-computational linguistics-neurolinguistics (speech pathology and language disorders)- forensic linguistics – sociolinguistics.

TOTAL : 45 PERIODS

Teaching Methods :

Lectures, discussion.

Evaluation Internal and External :

Internal: 2 written tests + assignments, seminars, project (50+15+15+20).
External: A 3 hour written exam (50 marks)

REFERENCES :

1.Victoria Fromkin, Robert Rodman, Nina Hyams.2019.An Introduction to Language.USA.CENGAGE.11th edition
2. Cook. G,2003. Applied linguistics.UK: Oxford University Press.

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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 'meaninglesss 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.