Vels Institute of Science, Technology and Advanced Studies School of Engineering
Scheme for Revision of Syllabus 2018-2019
B.E – Mechanical Engineering

S. No	Name of the Programme under Revision	Courses followed as per Regulation 2015-16	No of Credits	Revision of courses as per Regulation 2018-19	No of Credits	Percentage of Revision
1	First year syllabus and curriculum of B.E – Automobile Engineering is revised as per the guideline of AICTE under regulation 2018	Technical English	3	English	2	85%
2		Mathematics – I	4	Mathematics – I (Calculus and Linear Algebra)	4	
3		Engineering Physics	3	Physics (Introduction to Electromagnetic Theory)	4	
4		Engineering Graphics	3	Engineering Graphics & Design	3	
5		Engineering Physics Lab	3	Physics Lab	1	
6		Communication Skills	3	English Lab	1	
7		Computer Practice Laboratory	3	Programming for problem solving Lab	2	
8		Engineering Chemistry	3	Chemistry	3	
9		Material Science	3	Engineering Materials and Metallurgy	3	
10		Computer Aided Drafting Laboratory	3	Computer Aided Drafting and Modeling Laboratory	2	
11		Engineering Chemistry Laboratory	3	Chemistry Lab	2	
12		Electrical Engineering Laboratory	3	Electrical Drives and Control	3	
13		Statistics and numerical methods	3	Mathematics IV	3	
14		CAM Laboratory	3	Advanced Machining laboratory	2	
15		In-Plant Training	2	Internship	1	
16		Mini Project & Seminar	2	Project Phase I	5	
17		Project Work	12	Project Phase II	8	
		Unconventional machining processes	3	Unconventional machining processes	3	
18				Computational Fluid Dynamics	3	
19				Advanced Computer Integrated Manufacturing Systems	3	
20				Industrial Robotics	3	

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Pallavaram, Chennai - 600 117.

21				Flexible Manufacturing System	3	
22				Intellectual Property Rights	3	
23				Non Destructive Testing and Materials	3	
24				Constitution of India	3	
25				Human Rights	3	
26				Disaster Management	3	
27				NSS	2	
28				Yoga	1	
29				Personality Development I	2	
30				Personality Development II	2	
31				Personality Development III	2	
32				Personality Development IV	2	

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VELS UNIVERSITY

VELS INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)

(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)

NAAC ACCREDITED

PALLAVARAM - CHENNAI - INDIA

B.E
Mechanical Engineering

Curriculum and Syllabus
(Based on Choice Based Credit System)
Effective from the Academic year
2018-2019

Department of Mechanical Engineering
School of Engineering

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DEPARTMENT OF MECHANICAL ENGINEERING

Vision of the Department

The Department of Mechanical Engineering envisages to be recognized as a role model in advanced fields of Mechanical Engineering Education and Research and to cater the ever changing industrial demands and social needs.

Mission of the Department

M1: Educate, motivate and prepare the students to know the fundamental and technical skills in Mechanical Engineering through effective teaching learning Methodologies.

M2: To imbibe professional and ethical standards in the minds of the young engineers by continuous learning and professional activities.

M3: To impart the employability skills to the students as industry ready by implant training and industrial visits.

M4: To create entrepreneurship skills by industrial collaborations and mentoring.

M5: To encourage students to undertake R&D activities for the societal needs with high ethical standards.

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PROGRAMME OUTCOMES:

PO 1: Engineering knowledge

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

PO 2: Problem analyses

Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/development of solutions

Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5 Modern tool usage

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

PO 6: The engineer and society

Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and sustainability

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

PO 8: Ethics

Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work

Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication

Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: Project management and finance

Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning

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

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Pallavaram, Chennai - 600 117.

Programme Educational Objectives (PEO's)

The Graduates will be Mechanical Engineering related technical and aptitude skills to offer best solution to industrial and societal problems.

PEO 1: To impart fundamentals of Engineering and Technology and applied Mathematics to transform the students as Mechanical Engineers.

PEO 2: To nurture design, analysis and implementation skills to innovate the process or system in Mechanical Engineering with global context.

PEO 3: To imbibe Mechanical Engineering related technical and aptitude skills to offer best solution to industrial and societal problems.

PEO 4: To initiate the entrepreneurial activities and leadership qualities of the students through the effective communication skills.

PEO 5: To develop the awareness among the students about the various social responsibilities related to Engineering ethics and human values with ecological.

Program Specific Outcomes (PSOs)

PSO 1	Graduate will be able to acquire core Mechanical Engineering knowledge and able to solve industrial as well as societal problems with ethical and environmental consciousness.
PSO 2	Graduate will be able to build the nation, by imparting technological concepts and tools on emerging fields through the Managerial and entrepreneurs skills.

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BOARD OF STUDIES

The details of the suggested Board of Studies (BOS) Members for the Department of Mechanical Engineering are shown below.

S. No	Name of the Board Member	Designation	Institute / Industry
INTERNAL MEMBERS			
1	**Dr. M. Chandrasekaran**	Director, Mechanical Engineering	Vels Institute of Science, Technology & Advanced Studies (VISTAS)
2	**Dr. C. Dhanasekaran**	Engineering Coordinator & Head of the Department, Department of Mechanical Engineering	Vels Institute of Science, Technology & Advanced Studies (VISTAS)
3	**Dr. V. Muthuraman**	Professor, Department of Mechanical Engineering	Vels Institute of Science, Technology & Advanced Studies (VISTAS)
4	**Dr. R. Pugazhenthi**	Associate Professor, Department of Mechanical Engineering	Vels Institute of Science, Technology & Advanced Studies (VISTAS)
5	**Dr. S. Sivaganesan**	Associate Professor, Department of Mechanical Engineering	Vels Institute of Science, Technology & Advanced Studies (VISTAS)
EXTERNAL EXPERT MEMBERS			
1	**Dr. V. Santhanam**	Associate Professor, Department of Mechanical Engineering	Rajalakshmi Engineering College, Chennai, Tamilnadu.
2	**Mr. S. Dwarakanathan**	Vice President (Retd.)	Brakes India Limited, Chennai, Tamilnadu.
3	**Mr. V. Venkatesh**	Unit Head	Suprajit Engineering Limited, Sriperumbadur, Chennai, Tamilnadu.

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B.E. - MECHANICAL ENGINEERING

COURSE OF STUDY AND SCHEME OF ASSESSMENT

TOTAL NUMBER OF CREDITS: 170

Category	Code No.	Course	Hours / Week			Credits	Maximum Marks		
			Lecture	**T**utorial	**P**ractical	**C**redits	CA	SEE	Total
SEMESTER I									
Humanities and Social Sciences Courses	18HS101	English	2	0	0	2	40	60	100
Basic Science Courses	18BS101	Physics (Introduction to Electromagnetic Theory)	3	1	0	4	40	60	100
Basic Science Courses	18BS102	Mathematics – I (Calculus and Linear Algebra)	3	1	0	4	40	60	100
Engineering Science Courses	18ES101	Basic Electrical Engineering	3	1	0	4	40	60	100
Engineering Science Courses	18ES102	Engineering Graphics & Design	1	0	4	3	40	60	100
Basic Science Courses	18BL101	Physics Lab	0	0	4	2	40	60	100
Engineering Science Courses	18EL101	Electrical Engineering Lab	0	0	2	1	40	60	100
Humanities and Social Sciences Course	18HL101	English Lab	0	0	2	1	40	60	100
		Total	**12**	**3**	**12**	**21**			
SEMESTER II									
Basic Science Courses	18BS201	Chemistry	3	1	0	4	40	60	100
Basic Science Courses	18BS202	Mathematics – II	3	1	0	4	40	60	100
Engineering Science Courses	18ES201	Programming for Problem Solving	3	0	0	3	40	60	100
Basic Science Courses	18BL201	Chemistry Lab	0	0	4	2	40	60	100
Engineering Science Courses	18EL201	Programming for problem solving Lab	0	0	4	2	40	60	100
Engineering Science Courses	18ES202	Manufacturing Practices Lab	1	0	4	3	40	60	100
Mandatory courses	18MC201	Constitution of India	2	-	-	0	-	-	-
Mandatory courses	18MC202	Computer Aided Drafting and Modeling Laboratory	-	-	3	0	-	-	-
		Total	**12**	**2**	**15**	**18**			

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Pallavaram, Chennai - 600 117.

B.E. - MECHANICAL ENGINEERING

CURRICULUM

Category	Code No.	Course	Hours / Week			Credits	Maximum Marks		
			Lecture	**T**utorial	**P**ractical	**C**redits	CA	SEE	Total
SEMESTER III									
Basic Science Courses	18BS301	Mathematics III	3	0	0	3	40	60	100
Professional Core Courses	18PCME301	Engineering Thermodynamics	3	0	0	3	40	60	100
Engineering Science Courses	18ES301	Electrical Drives and Control	3	0	0	3	40	60	100
Professional Core Courses	18PCME302	Engineering Mechanics	3	0	0	3	40	60	100
Professional Core Courses	18PCME303	Manufacturing Technology – I	3	0	0	3	40	60	100
Professional Core Courses	18PCME304	Engineering Materials and Metallurgy	3	0	0	3	40	60	100
Professional Core Courses	18PLME301	Computer Aided Machine Design Laboratory	0	0	3	1	40	60	100
Professional Core Courses	18PLME302	Manufacturing Technology Laboratory	0	0	3	1	40	60	100
Employability Enhancement Courses	18HS301	Personality Development I	2	0	0	2	40	60	100
Industrial Enhancement Courses	18MC301	Industrial Safety	2	0	0	2	40	60	100
		Total	**22**	**0**	**6**	**24**			
SEMESTER IV									
Basic Science	18BSME401	Mathematics IV	3	0	0	3	40	60	100
Engineering Science	18ESME401	Strength of Materials	3	0	0	3	40	60	100
Professional Core	18PCME401	Manufacturing Technology	3	0	0	3	40	60	100
Professional Core	18PCME401	Kinematics of Machinery	3	0	0	3	40	60	100
Professional Core	18PCME402	Fluid Mechanics and Machinery	3	1	0	4	40	60	100
Environmental Science Courses	18MCME401	Environmental Science and Engineering	3	0	0	3	40	60	100
Employability Enhancement Course	18HSME401	Personality Development II	2	0	0	2	40	60	100
Professional Core	18PLME401	Fluid Mechanics and Strength of Materials lab	0	0	3	1	40	60	100
Professional Core	18PLME402	Kinematics and Dynamics Laboratory	0	0	3	1	40	60	100
Human Value Courses	18MCME401	Yoga	0	0	2	1	40	60	100
		Total	**20**	**1**	**8**	**24**			

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Pallavaram, Chennai - 600 117.

B.E. - MECHANICAL ENGINEERING

CURRICULUM

Category	Code No.	Course	Hours / Week			Credits	Maximum Marks		
			Lecture	**T**utorial	**P**ractical		CA	SEE	Total
SEMESTER V									
Professional Core	18PCME 501	Engineering Metrology and Measurements	3	1	0	4	40	60	100
Professional Core	18PCME 502	Design of Machine Elements	3	0	0	3	40	60	100
Professional Core	18PCME 503	Dynamics of Machinery	3	0	0	3	40	60	100
Professional core	18PCME 504	Applied Hydraulics and Pneumatics	3	0	0	3	40	60	100
General Elective courses	18OEME 501	General Elective courses I	3	0	0	3	40	60	100
Professional Elective Courses	18PEME 501	Professional Elective I	3	0	0	3	40	60	100
Employability Enhancement Courses	18HSME 501	Personality Development III	2	0	0	2	40	60	100
Professional Core	18PLME 501	Metrology and Measurements Laboratory	0	0	3	1	40	60	100
Professional Core	18PLME 502	Computer Aided Simulation and Analysis Laboratory	0	0	3	1	40	60	100
Industrial Enhancement Courses	18MCM E501	Industrial Visit	0	0	0	0	0	0	0
		Total	**20**	**1**	**6**	**23**			
SEMESTER VI									
Professional Core	18PCME 601	Finite Element Analysis	3	0	0	3	40	60	100
Professional Core	18PCME 602	Thermal Engineering	3	0	0	3	40	60	100
Professional Core	18PCME 603	Design of Transmission Systems	3	0	0	3	40	60	100
Professional Elective courses	18PEME 601	Professional Elective courses II	3	0	0	3	40	60	100
Professional Elective courses	18PEME 602	Professional Elective courses III	3	0	0	3	40	60	100
General Elective courses	18OEME 601	General Elective courses II	3	0	0	3	40	60	100
Employability Enhancement Courses	18HSME 601	Personality Development IV	2	0	0	2	40	60	100
Professional Core	18PLME 601	Thermal Engineering LAB	0	0	3	1	40	60	100
Professional Core	18PLME 602	Advanced Machining laboratory	0	0	3	1	40	60	100
Industrial Enhancement Courses	18MCM E601	Internship	0	0	2	1	40	60	100
		Total	**20**	**0**	**8**	**23**			

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Vels Institute of Science, Technology
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Pallavaram, Chennai - 600 117.

B.E. - MECHANICAL ENGINEERING

CURRICULUM

Category	Code No.	Course	Hours / Week			Credits	Maximum Marks		
			Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER VII									
Professional Elective courses	18PEME701	Professional Elective courses IV	3	0	0	3	40	60	100
Professional Elective courses	18PEME702	Professional Elective courses V	3	0	0	3	40	60	100
Professional Elective courses	18PEME703	Professional Elective courses VI	3	0	0	3	40	60	100
General Elective courses	18OEME701	General Elective courses III	3	0	0	3	40	60	100
Professional Course	18PLME701	Mechatronics Systems Lab	0	0	3	1	40	60	100
Human Value Courses	18NSS701	NSS	2	0	0	2	40	60	100
Industrial Enhancement Courses	18PRME701	Project Phase I	0	0	10	5	40	60	100
		Total	**14**	**0**	**13**	**20**			
SEMESTER VIII									
Professional Elective courses	18PEME801	Professional Elective courses VII	3	0	0	3	40	60	100
General Elective courses	18OEME801	General Elective courses IV	3	0	0	3	40	60	100
General Elective courses	18OEME802	General Elective courses V	3	0	0	3	40	60	100
Industrial Enhancement Courses	18PRME801	Project Phase II	0	0	16	8	40	60	100
		Total	**9**	**0**	**16**	**17**			

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Pallavaram, Chennai - 600 117.

B.E. - MECHANICAL ENGINEERING

CURRICULUM

LIST OF PROFESSIONAL ELECTIVE COURSES (PEC)

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
18DBME31	Special Casting Techniques	3	0	0	3
18DBME32	Failure Analysis and Design	3	0	0	3
18DBME33	Manufacture and Inspection of Gears	3	0	0	3
18DBME34	Refrigeration and Air Conditioning	3	0	0	3
18DBME35	Welding Technology	3	0	0	3
18DBME43	Heat and Mass Transfer	3	0	0	3
18DBME44	Cryogenic Engineering	3	0	0	3
18DBME45	Renewable Energy Sources	3	0	0	3
18DBME46	Composite Materials and Mechanics	3	0	0	3
18DBME51	Automobile Engineering	3	0	0	3
18DBME53	Design of Pressure Vessels and Piping	3	0	0	3
18DBME54	Vibration and Noise Engineering	3	0	0	3
18DBME55	Gas Dynamics and Jet Propulsion	3	0	0	3
18DBME56	Design of Jigs, Fixtures and Press Tools	3	0	0	3
18DBME61	Industrial Automation, CNC and Robotics	3	0	0	3
18DBME62	Unconventional Machining Processes	3	0	0	3
18DBME64	Manufacture of Automotive Components	3	0	0	3
18DBME65	Design of Heat Exchangers	3	0	0	3
18DBME66	Additive Manufacturing	3	0	0	3
18DBME71	Rapid Prototyping, Tooling and Manufacture	3	0	0	3
18DBME73	Mechatronics	3	0	0	3
18DBME74	Computer Integrated Manufacturing	3	0	0	3
18DBME75	Power Plant Engineering	3	0	0	3
18DBME76	Computational Fluid Dynamics	3	0	0	3
18DBME81	Advanced I.C. Engines	3	0	0	3
18DBME82	Fundamentals of Nano science	3	0	0	3
18DBME83	Product Development and Manufacture	3	0	0	3
18DBME84	Non Destructive Testing and Materials	3	0	0	3
18DBME85	Industrial Robotics	3	0	0	3
18DBME86	Advanced Computer Integrated Manufacturing Systems	3	0	0	3
18DBME87	Micro Electro Mechanical Systems	3	0	0	3
18DBME88	Flexible Manufacturing System	3	0	0	3

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Pallavaram, Chennai - 600 117.

B.E - Mechanical Engineering

CURRICULUM

LIST OF GENERAL ELECTIVE COURSES (GEC)

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
18GBME51	Principles of Management	3	0	0	3
18GBME52	Operations Research	3	0	0	3
18GBME62	Quality Control and Reliability Engineering	3	0	0	3
18GBME71	Total Quality Management	3	0	0	3
18GBME72	Production Planning and Control	3	0	0	3
18GBME74	Quality Control and Reliability Engineering	3	0	0	3
18GBME81	Process Planning and Cost Estimation	3	0	0	3
18GBME82	Supply Chain Management	3	0	0	3
18GBME83	Industrial Marketing and Market Research	3	0	0	3
18GBME84	Intellectual Property Rights	3	0	0	3
18GBME86	Engineering Economics	3	0	0	3

LIST OF BASIC SCIENCE COURSES (BSC)

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
18BS101	Physics (Introduction to Electromagnetic Theory)	3	1	0	4
18BS102	Mathematics – I (Calculus and Linear Algebra)	3	1	0	4
18BL101	Physics Lab	0	0	4	2
18BS201	Chemistry	3	1	0	4
18BS202	Mathematics – II	3	1	0	4
18BL201	Chemistry Lab	0	0	4	2
18BS302	Mathematics III	3	0	0	3
18BS402	Mathematics IV	3	0	0	3

LIST OF ENVIRONMENTAL SCIENCE COURSES (ENSC)

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
	Environmental Science and Engineering	3	0	0	3
	Energy Audit and Energy Conservation Methods	3	0	0	3

Registrar
Vels Institute of Science, Technology
& Advanced Studies (VISTAS)
Pallavaram, Chennai - 600 117.

B.E - Mechanical Engineering

CURRICULUM

LIST OF ENGINEERING SCIENCE COURSE (ESC)

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
18ESME101	Basic Electrical Engineering	3	1	0	4
18ESME102	Engineering Graphics & Design	1	0	4	3
18ELME101	Electrical Engineering Lab	0	0	2	1
18ESME201	Programming for Problem Solving	3	0	0	3
18ELME201	Programming for problem solving Lab	0	0	4	2
18ESME202	Manufacturing Practices Lab	1	0	4	3
18ESME301	Electrical Drives and Control	3	0	0	3
18ESME401	Strength of Materials	3	0	0	3

LIST OF HUMANITIES AND SOCIAL SCIENCE COURSES (HSC)

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
18HS101	English	2	0	0	2
18HL101	English Lab	0	0	2	1

LIST OF HUMAN VALUE COURSES (HVC)

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
18NSS255	NSS	2	0	0	2
18MCME402	Yoga	0	0	2	1
18GBME61	Professional Ethics in Engineering	3	0	0	3
18GBME53	Human Rights	3	0	0	3
18GBME63	Value Analysis and Value Engineering	3	0	0	3

LIST OF MANDATORY COURSES (MC)

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
18MC201	Constitution of India	2	-	-	0
18MC202	Computer Aided Drafting and Modeling Laboratory	-	-	3	0

Registrar
Vels Institute of Science, Technology
& Advanced Studies (VISTAS)
Pallavaram, Chennai - 600 117.

B.E - Mechanical Engineering

CURRICULUM

LIST OF EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
18SUPD31	Personality Development I	2	0	0	2
18SUPD41	Personality Development II	2	0	0	2
18SUPD51	Personality Development III	2	0	0	2
18SUPD61	Personality Development IV	2	0	0	2

LIST OF INDUSTRIAL ENHANCEMENT COURSES (IEC)

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
18ECME301	Industrial Safety	2	0	0	2
18ECME501	Industrial Visit	0	0	0	0
18ECME601	Internship	0	0	2	1
18PRME701	Project Phase I	0	0	10	5
18PRME801	Project Phase II	0	0	16	8

B.E. - MECHANICAL ENGINEERING

SUMMARY OF CURRICULUM COMPONENTS

Sl. No.	Subject Area	Credits Per Semester								Credits Total	Percentage %
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities and Social Science Courses	2	-	-	-	-	-	-	-	2	2.99%
2	Basic Science Courses	3	3	1	1	-	-	-	-	8	11.94%
3	Engineering Science Courses	3	3	1	1	-	-	-	-	8	11.94%
4	Employability Enhancement Courses	-	-	1	1	1	1	-	-	4	5.97%
5	Human Value Courses	-	-	-	1	-	-	1	-	2	2.99%
6	Industrial Enhancement Courses	-	-	1	-	1	1	1	1	5	7.46%
7	Environmental Science Courses	-	-	-	1	-	-	-	-	1	1.49%
8	Professional Elective Courses	-	-	-	-	1	1	1	2	5	7.46%
9	General Elective Courses	-	-	-	-	1	2	3	1	7	10.45%
10	Professional Core Courses	-	-	6	5	6	5	1		23	34.33%
11	Mandatory Courses	-	2	-	-	-	-	-	-	2	2.99%
	Total	**8**	**8**	**10**	**10**	**10**	**10**	**7**	**4**	**67**	**100.00%**

Registrar
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18HS101	ENGLISH	L	T	P	C
		2	0	0	2

COURSE OBJECTIVE:

- To acquire ability to speak effectively in real life situations.
- To write letters and reports effectively in formal and business situations.
- To develop listening skills for academic and professional purposes.
- To gain effective speaking and listening skills in communication.
- To develop the soft skills and interpersonal skills to excel in their career.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment procedures.

UNIT I VOCABULARY BUILDING **10**

General Vocabulary –Nouns- Compound nouns, Word borrowing & Word making, Foreign machinery in English, Dictionary and Thesaurus usages, Synonyms, Antonyms, Prefixes and Suffixes, Homonyms, Homographs and Homophones, Changing words from one form to another, Acronyms and Abbreviations.

UNIT II BASIC WRITING **10**

Sentences structures –Kinds of sentences, Types of sentences, Clauses and Phrases, Punctuations, Word Links and Connectives, Summarizing, Precise writing, Paragraph Writing.

UNIT III IDENTIFYING COMMON ERRORS IN ENGLISH **10**

Articles, Prepositions, Subject-verb Agreement, Pronouns - Relative pronouns, Demonstrative pronouns, Misplaced Modifiers, Redundancies, Clichés, Infinitives& Gerund

UNIT IV NATURE AND STYLE OF SENSIBLE WRITING **10**

Describing people, place and situations, Process description, Definitions, Numerical Expressions, Information Transfer- Flow chart Bar chart and Pie chart, Checklists, Writing introduction and conclusion.

UNIT V WRITING PRACTICES **10**

Letter Writing- Formal & Informal Letters, Report Writing- Letter Report, Accident Report, Investigation Report and Survey, Essay writing, Comprehension Passages.

TOTAL: 50 Hours

COURSE OUTCOMES:

After successful completion of the Technical English course, the student will be able to

CO1: Improve the language proficiency of a technical under-graduate in English with emphasis on Learn, Speak, Read and Write skills.
CO2: Develop listening skills for academic and professional purposes.
CO3: Acquire the ability to speak effectively in English in real life situations.
CO4: Provide learning environment to practice listening, speaking, reading and writing skills.
CO5: Variety of self-instructional modes of language learning and develop learner autonomy.

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TEXT BOOKS:

1. K.R. Lakshminarayanan, "English for Scientists'', Tamilnadu Scitech Publications (INDIA PVT.LTD) 2014.
2. Department of English, Anna University, Mindscapes, "English for Technologists and Engineers'', Orient Longman Pvt. Ltd, Chennai: 2012.
3. Department of Humanities and Social Sciences, Anna University, "English for Engineers and Technologists", Combined Edition (Volumes 1 and 2), Chennai: Orient Longman Pvt. Ltd., 2006.
4. Department of English, Anna University, Mindscapes, "English for Technologists and Engineers", Orient Longman Pvt. Ltd, Chennai: 2012.
5. Department of Humanities and Social Sciences, Anna University, ''English for Engineers and Technologists'' Combined Edition (Volumes 1 and 2), Chennai: Orient Longman Pvt. Ltd., 2006.
6. M. Ashraf Rizvi, "Effective Technical Communication", Tata McGraw-Hill Publishing Company Limited, New Delhi.2009.

REFERENCE BOOKS:

1. Michael Swan, "Practical English Usage". OUP. 1995.
2. F.T. Wood, "Remedial English Grammar", Macmillan. 2007.
3. William Zinsser , "On Writing Well". Harper Resource Book. 2001.
4. Liz Hamp-Lyons and Ben Heasly, "Study Writing", Cambridge University Press. 2006.
5. Sanjay Kumar and PushpLata, "Communication Skills". Oxford University Press. 2011.

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18BS102	MATHEMATICS – I (Calculus and Linear Algebra)	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE:

- The objective of this course is to familiarize the prospective engineers with techniques in calculus and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

UNIT I Calculus **12**

Evolutes and involutes - Evaluation of definite and improper integrals - Beta and Gamma functions and their properties.

UNIT II Calculus **12**

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders- indeterminate forms and L'Hospital's rule.

UNIT III Sequences and series **12**

Convergence of sequence and series, tests for convergence- Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.

UNIT IV Multivariable Calculus (Differentiation) **12**

Limit, continuity and partial derivatives, directional derivatives, total derivative- Tangent plane and normal line- Maxima, minima and saddle points- Method of Lagrange multipliers.

UNIT V Matrices **12**

Introduction to matrix and rank of a matrix-System of linear equations- Symmetric, skew-symmetricand orthogonalmatrices-Eigenvaluesandeigenvectors- Diagonalization of matrices-Cayley-Hamilton Theorem, and Orthogonal transformation.

TOTAL: 60 Hours

COURSE OUTCOMES:

After successful completion of the Mathematics – I course; the student will be able to

CO1: To introduce the idea of applying differential and integral calculus to Notions of curvature and to improper integrals. Apart from some applications it gives a basic introduction on Beta and Gamma functions.

CO2: To introduce the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.

CO3: To develop the tool of power series for learning advanced Engineering Mathematics.

CO4: To familiarize the student with functions of several variables that is essential in most branches of engineering.

CO5: To develop the essential tool of matrices in engineering.

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TEXT BOOKS:

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9th Edition, Pearson, Reprint, 2002.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill New Delhi-11, Reprint, 2010.

REFERENCE BOOKS:

1. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T., "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi, 2008.
3. D. Poole, "Linear Algebra: A Modern Introduction", 2nd Edition, Brooks/Cole, 2005.
4. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.
5. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 36th Edition, 2010.

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18ES101	BASIC ELECTRICAL ENGINEERING	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE:

- To provide exposure to the students of basic electrical engineering.

UNIT I DC Circuits **12**

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, Mesh and Nodal analysis, Analysis of simple circuits with dc excitation, Wye↔Delta Transformation, Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT II AC Circuits **12**

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III Transformers **12**

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT IV Electrical Machines & Power Converters **12**

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Single phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. DC-DC buck and boost converters, duty ratio control. Single phase Bridge Rectifier, Single Phase voltage source inverters.

UNIT V Electrical Installations **12**

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

TOTAL: 60 Hours

COURSE OUTCOMES:

After successful completion of the Basic Electrical Engineering course, the student will be able to

CO1: Understand the basics of electrical circuits and measurements.
CO2: Understand the Ohm's and Kirchhoff's Laws.
CO3: Understand the principle and construction of DC motor and generator.
CO4: Understand the principle and construction of single phase and three phase induction motors.
CO5: Able to calculate energy consumption and power factor

TEXT / REFERENCES:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

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18ES102	ENGINEERING GRAPHICS & DESIGN	L	T	P	C
		1	0	4	3

COURSE OBJECTIVE:

- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination)

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 INTRODUCTION TO ENGINEERING DRAWING AND PLANE CURVES 12

Curves used in engineering practices: Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid, Epicycloid, Hypocycloid – construction of involutes of squad and circle – Drawing of tangents and normal to the above curves. Scales – Plain, Diagonal and Vernier Scales.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 12

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to both reference planes - Auxiliary Planes.

UNIT III PROJECTION OF SOLIDS 12

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method - Auxiliary Views.

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 12

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section - Auxiliary Views. Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

UNIT V ORTHOGRAPHIC PROJECTION AND ISOMETRIC PROJECTION 12

Free hand sketching: Representation of Three-Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement - layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones.

TOTAL: 60 Hours

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COURSE OUTCOMES:

After successful completion of the Engineering Graphics course, the student will be able to

- **CO1:** Understand the theory of projection.
- **CO2:** Improve their visualization skills so that they can apply these skills in developing new products.
- **CO3:** Able to prepare the simple layout of factory buildings.
- **CO4:** Understand the various concepts like dimensioning, conventioning and standards related to working drawings in order to become professionally efficient.
- **CO5:** Impart the knowledge for understanding and drawing of simple residential/office buildings.
- **CO6:** Ability to convert sketches into engineered drawings will increase.

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", 28th Ed., 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. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. Whenever the total number of candidates in a college exceeds 150, the University Examination in that college will be conducted in two sessions (FN and AN on the same day) for 50 percent of student (approx) at a time.

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18DL101	PHYSICS LAB	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE:

- To study and understand the basic physics concepts and study the young's modulus of the uniform and non uniform bending of the materials.

LIST OF EXPERIMENTS

1. Deflection magnetometer – Tan A position
2. Deflection magnetometer – Tan B position
3. Copper voltameter - Determination of BH
4. Carey Foster Bridge – Determination of specific resistance of unknown coil
5. Potentiometer – EMF of thermocouple
6. Potentiometer - Calibration of Ammeter
7. Potentiometer - Calibration of Low range voltmeter
8. Potentiometer - Calibration of High range voltmeter
9. Deflection magnetometer - Field along the axis of a circular coil- Determination of BH
10. Ballistic Galvanometer – Internal resistance of a cell

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Engineering Physics Laboratory course, the student will be able to

CO1: Ability to Design and Conduct experiments as well as to Analyze and Interpret Data.

CO2: Ability to Identify, Formulate, and Solve Engineering Problems.

CO3: Ability to use Techniques and Skills associated with Modern Engineering Tools such as Lasers and Fiber Optics.

CO4: Provide pre requisite hands-on experience for engineering laboratories.

CO5: Study and understand the basic physics concepts and study the Young's modulus of the uniform and nonuniform bending of the materials.

REFERENCES:

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

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18EL101	ELECTRICAL ENGINEERING LAB	L	T	P	C
		0	0	2	1

COURSE OBJECTIVE:

- To provide exposure to the students with hands on experience on various basic engineering practices in Electrical Engineering.

List of Laboratory Experiments/Demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification.
3. Resonance in R-L-C circuits.
4. Loading of a transformer: measurement of primary and secondary voltages and currents, and power
5. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).
6. Load Characteristics of a DC Motor
7. Torque - Slip Characteristic of an Induction motor
8. Three phase induction motors - Direction reversal by change of phase-sequence of connections.
9. Demonstration of DC-DC converter.
10. Demonstration of DC-AC converter.
11. Demonstration of AC-DC converter.

TOTAL: 30 Hours

COURSE OUTCOMES:

After successful completion of the Electrical Engineering Laboratory course, the student will be able to

CO 1: Measure power in three phase circuits.

CO 2: Distinguish between the effects of Eddy current and hysteresis losses in magnetic materials.

CO 3: Measure performance characteristics of DC generators and three-phase induction motors.

CO 4: Perform power transformer open and short circuit tests and determine the values of elements of the equivalent circuit.

CO 5: Design the experiments for measuring characteristics of different semiconductor diodes.

REFERENCES:

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

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18EL101	ENGLISH LAB	L	T	P	C
		0	0	2	1

COURSE OBJECTIVE:

- To gain effective speaking and listening skills in communication.
- To develop the soft skills and interpersonal skills to excel in their job.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

ORAL COMMUNICATION

(This unit involves interactive practice sessions in Language Lab)

Listening comprehensions, Pronunciation, Phonology, Intonation, Stress and Rhythm, Situational Dialogues, Communication in workplace, Interviews, Seminar, Formal Presentations, Group Discussions, Debates, JAM sessions

TOTAL: 40 Hours

COURSE OUTCOMES:

After successful completion of the Language Laboratory course, the student will be able to

CO1: Improve the listening capability.

CO2: Get the writing capability through the practices.

CO3: Use strong vocabulary and fluently like foreigners.

CO4: Prepare their, own resume in professional method.

CO5: Understand the Structure of presentation and the tools available in the power point presentation.

TEXT BOOKS:

1. Anderson, P.V, "Technical Communication", Thomson Wadsworth, Sixth Edition, New Delhi, 2007.
2. Prakash, P, "Verbal and Non-Verbal Reasoning", Macmillan India Ltd., Second Edition, New Delhi, 2004.

REFERENCES:

1. John Seely, "The Oxford Guide to Writing and Speaking", Oxford University Press, New Delhi, 2004.
2. Evans, D, "Decisionmaker", Cambridge University Press, 1997.
3. Thorpe, E, and Thorpe, S, "Objective English", Pearson Education, Second Edition, New Delhi, 2007.
4. Turton, N.D and Heaton, J.B, "Dictionary of Common Errors", Addison Wesley, 1996.

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18BS201	CHEMISTRY	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE:

- To learn about the molecular orbitals, ionic interactions and periodic properties.
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electro negativity.
- List major chemical reactions that are used in the synthesis of molecules.

UNIT I Atomic and molecular structure, Intermolecular forces and potential energy surfaces **14**

Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties.

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN.

UNIT II Spectroscopic techniques and applications **12**

Principles of spectroscopy and selection rules. Electronic spectroscopy. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Diffraction and scattering.

UNIT III Use of free energy in chemical equilibria **12**

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion.

UNIT IV Periodic Properties **12**

Variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

UNIT V Organic reactions and synthesis of a drug molecule **10**

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Total: 60 Hours

COURSE OUTCOMES:

After successful completion of the Engineering Chemistry course, the student will be able to

CO1: Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.

CO2: Rationalise bulk properties and processes using thermodynamic considerations.

CO3: Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.

CO4: Able to understand the Organic reactions and synthesis of drug molecule

CO5: Able to understand the periodic properties

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TEXT BOOKS:

1. Jain P. C. & Monica Jain., "Engineering Chemistry", 16th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015.
2. 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.
4. C. N. Banwell, "Fundamentals of Molecular Spectroscopy", McGraw-Hill, 1994.
5. B. L. Tembe, Kamaluddin and M. S. Krishnan, "Engineering Chemistry" (NPTEL Web-book)

REFERENCE BOOKS:

1. Schdeva M V, "Basics of Nano Chemistry", Anmol Publications Pvt Ltd., 2010.
2. B.Sivasankar, "Instrumental Methods of Analysis", Oxford University Press. 2012.
3. Friedrich Emich, "Engineering Chemistry", Scientific International Ltd., 1989.
4. V. R. Gowariker, N. V. Viswanathan and Jayadev Sreedhar, "Polymer Science" New AGE International Publishers, 2009.

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18BS202	PHYSIS (Introduction to Electromagnetic Theory)	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE:

- To learn the basics of Ultrasonic, Lasers, Fiber optics and applications, Quantum physics and crystal physics etc., and to apply these fundamental principles to solve practical problems related to materials used for engineering applications.

UNIT I Electrostatics in vacuum **9**

Coulomb's inverse square law, Super position principle – Gauss theorem and its application (intensity at a point due to charged sphere and cylinder), Laplace's and Poisson's equations for electrostatic potential- uniqueness theorem, potential difference – equipotential surface-potential at a point due to a point charge.

UNIT II Electrostatics in a linear dielectric medium **9**

Electric dipole- potential energy of a dipole – Electric field due to an electric dipole (axial point and equatorial line)- dielectric- dielectric constant- Electric susceptibility - Types of polarization- point charge at centre of dielectric sphere in uniform magnetic field- Lorentz method- Clausius Mosotti equation.

UNIT III Magneto-statics in a linear magnetic medium **9**

Bio-Savart law - magnetic induction at a point due to a straight conductor carrying current – magnetic field at centre of a circular coil carrying current- Ampere's circuital law-Field along the axis of a circular coil and solenoid. Intensity of magnetisation - Magnetic susceptibility - Magnetic permeability - Classification of magnetic material - Domain theory of ferromagnetism – BH curve.

UNIT IV Faraday's law and Maxwell's equation **9**

Faraday's law - Differential form of Faraday's law – Self and mutual inductance- Self-inductance of a long solenoid- Experimental determination of self-inductance (Rayleigh's method) and mutual inductance- Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation– Displacement current - Maxwell's equations and their derivation – Physical significance of Maxwell's equation.

UNIT V Electromagnetic waves **9**

The wave equation - Plane electromagnetic waves in vacuum, their transverse nature - Relation between electric and magnetic fields of an electromagnetic wave -Energy carried by electromagnetic waves–Hertz experiment: production and detection of electromagnetic wave - Reflection and transmission of electromagnetic waves at normal incidence.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Mathematics – II course, the student will be able to

CO1: Apply the fundamental principles to solve practical problems related to materials used for engineering applications and Formulate general mechanics parameters and distinguish between central and non-central forces.

CO2: Learn the basics of Ultrasonic and Understanding about the Fiber optics.

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CO3: Explain types of waves and interference of light and Derive thermodynamic parameters and apply fundamental laws to solve thermodynamic problems

CO4: Differentiate between the terms atomic number, atomic mass, isotopes, etc. and apply various rules such as rules, octet rules, and Bohr's energy levels. Know about various applications of Lasers.

CO5: Categorize between various environmental pollutants, study the harmful effects of pollutants, and elaborate the concepts such as global warming, BOD, COD, ozone depletion and acid rain.

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

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18BS202	MATHEMATICS-II (Calculus, Ordinary Differential Equations and Complex Variable)	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE:

- The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

UNIT I Multivariable Calculus (Integration) 12

Multiple Integration: Double integrals (Cartesian)-change of order of integration in double integrals-Change of variables(Cartesian to polar)- Triple integrals(Cartesian)-orthogonal curvilinear coordinates- Green ,Gauss and Stokes theorems (statement only)-Simple problems.

UNIT II First order ordinary differential equations 12

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

UNIT III Ordinary differential equations of higher orders 12

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials.

UNIT IV Complex Variable–Differentiation 12

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

UNIT V Complex Variable–Integration 12

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof)-Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.

TOTAL: 60 Hours

COURSE OUTCOMES:

After successful completion of the Mathematics – II course, the student will be able to

CO1: Introduce the idea of applying integral calculus to improper integrals.

CO2: Applications of Differential equations in engineering

CO3: Develop the ordinary differential equation for learning advanced Engineering Mathematics.

CO4: Familiarize the student with functions of several variables that is essential in most branches of engineering.

CO5: Develop the essential tool of complex variable (Integration) in engineering.

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TEXT / REFERENCE BOOKS:

1. G.B. Thomas and R.L. Finney, "Calculus and Analyticgeometry",9th Edition, Pearson, Reprint,2002.
2. Erwinkreyszig, "Advanced Engineering Mathematics",9th Edition, John Wiley & Sons, 2006.
3. W.E. Boyce and R. C.Di Prima, "Elementary Differential Equations and Boundary Value Problems", 9th Edn., Wiley India, 2009.
4. S.L. Ross, "Differential Equations", 3rd Ed., Wiley India, 1984.
5. E.A. Coddington, "An Introduction to Ordinary Differential Equations", Prentice Hall India, 1995.
6. E.L. Ince, "Ordinary Differential Equations", Dover Publications,1958.
7. J.W. Brown and R.V. Churchill, "Complex Variables and Applications", 7th Ed., Mc-Graw Hill, 2004.
8. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", LaxmiPublications, Reprint, 2008.
9. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 36th Edition, 2010.

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18ES201	PROGRAMMING FOR PROBLEM SOLVING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To understand the basic concepts of programming – Flow chart, Pseudo code.
- To learn the fundamentals of C programming - declarations, operators, expressions and control statements.
- To learn the manipulation of strings, functions, pointers and file operations.
- To understand the concepts of arrays, basic sorting and searching algorithms.
- To find the order of time complexity of basic algorithms

UNIT I Introduction to Programming **9**

Introduction to Programming (Flow chart/pseudo code, compilation etc.), Variables (including data types) -Arithmetic expressions and precedence, Conditional Branching and Loops -Writing and evaluation of conditionals and consequent branching - Iteration and loops.

UNIT II Arrays and Basic Algorithms **9**

Arrays (1-D, 2-D), Character arrays and Strings, Searching, Basic Sorting Algorithms, Finding roots of equations, Notion of order of time complexity through example programs.

UNIT III Function and Pointers **9**

Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference, Recursion with example programs such as Finding Factorial, Fibonacci series, etc. Pointers - Defining pointers, Use of Pointers in self-referential structures.

UNIT IV Structures and Unions **9**

Structures - Defining structures and Array of Structures, Structures containing Pointers, Unions - Storage classes: auto, static, extern, register – Dynamic memory allocation.

UNIT V String Functions and Files **9**

Strings - library string functions, pointers in strings, pointers and function arguments, Files - file Operations, processing a file, Preprocessor directives, use of type def, Command line arguments, Enumerated data types.

TOTAL: 45 Hours

COURSE OUTCOME:

After successful completion of the Programming for Problem Solving course, the student will be able to

CO 1: Understand the principles of algorithm, flowchart and pseudo code.
CO 2: Find the order of time complexity of algorithms.
CO 3: Write programs involving control instructions, arrays, structures and unions.
CO 4: Use string manipulations, and to write functions for various applications using C programming constructs.
CO 5: Handle file operations in 'C' programming.

TEXT BOOKS:

1. Byron Gottfried, "Schaum's Outline of Programming with C", McGraw-Hill, 2nd ed., 1996.
2. E. Balaguruswamy, "Programming in ANSI C", Tata McGraw-Hill, 2010

REFERENCES BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", PrenticeHall of India, 2017.
2. Yashavant Kanetkar, "Let Us C", BPB Publications, 2015.

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18BL201	CHEMISTRY LAB	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE:

- The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.
- The students will learn to:
  - ✓ Estimate rate constants of reactions from concentration of reactants/products as a function of time.
  - ✓ Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
  - ✓ Synthesize a small drug molecule and analyse a salt sample.

Choice of 10-12 experiments from the following

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Colligative properties using freezing point depression
6. Determination of the rate constant of a reaction
7. Determination of cell constant and conductance of solutions
8. Potentiometry - determination of redox potentials and emfs
9. Synthesis of a polymer/drug
10. Saponification/acid value of an oil
11. Chemical analysis of a salt
12. Lattice structures and packing of spheres
13. Models of potential energy surfaces
14. Chemical oscillations- Iodine clock reaction
15. Determination of the partition coefficient of a substance between two immiscible liquids.
16. Adsorption of acetic acid by charcoal
17. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of engineering.

TOTAL: 45 Hours

LABORATORY OUTCOME:

- The students will know to estimate the rate constants of reactions, freezing point depression and partial coefficient of immiscible liquids.
- To Synthesize a small drug molecule and analyse a salt sample.
- To find the viscosity and partition coefficient of a substance.

TEXT BOOKS:

1. S. Sundaram and K. Raghavan, "Practical Chemistry", S. Viswanathan. Co. 3rd edition 2011.
2. Gnanaprakasam, Ramamurthy, "Organic Chemistry Lab Manual" S. Viswanathan Pvt. Ltd. 3rd edition 2011.

REFERENCE BOOKS:

1. Vogel's, "Textbook of qualitative organic Analysis", Longmann, 12th edition, 2011.
2. J. N. Gurtu and R. Kapoor, "Advanced experimental Chemistry", S. Chand and Co. 6th edition, 2010.

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18EL201	PROGRAMMING FOR PROBLEM SOLVING LAB	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE:

- To design and develop C Programs for various applications

LIST OF EXPERIMENTS:

1. Familiarization with programming environment
2. Simple computational problems using arithmetic expressions
3. Problems involving if-then-else structures
4. Iterative problems
5. 1D Array manipulation
6. Matrix problems
7. String operations
8. Simple functions
9. Solving Numerical methods problems
10. Recursive functions
11. Pointers and structures
12. File operations

TOTAL: 45 Hours

COURSE OUTCOME:

At the end of this course, the Student will be able to

CO 1: Familiarize with the Programming Environment.

CO 2: Develop programs using various control instructions and operator precedence in C Programming.

CO 3: Implement string manipulations, arrays and functions for various applications in C.

CO 4: Analyze the use of structures, unions and pointers in C.

CO 5: Handle various file operations in C.

REFERENCE BOOKS:

1. Byron Gottfried, "Schaum's Outline of Programming with C", McGraw-Hill, 2nd ed., 1996.
2. E. Balaguruswamy, "Programming in ANSI C", Tata McGraw-Hill, 2010
3. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", PrenticeHall of India, 2017.
4. Yashavant Kanetkar, "Let Us C", BPB Publications, 2015.

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18ES202	MANUFACTURING PRACTICES LAB	L	T	P	C
		1	0	4	3

COURSE OBJECTIVE:

- To study bench fitting drawings for making male and female fittings as per the given dimensions and Tolerances.
- To study Arc welding drawings for making common weld joints as per the given dimensions.
- To study sheet metal development drawings for making common metal parts/components as per the given dimensions.

Part A: Workshop/Manufacturing Practices **[L : 1; T:0; P : 0 (1 credit)]**

Detailed contents:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods. (3 lectures)
2. CNC machining, Additive manufacturing (1 lecture)
3. Fitting operations & power tools (1 lecture)
4. Electrical & Electronics (1 lecture)
5. Carpentry (1 lecture)
6. Plastic moulding, glass cutting (1 lecture)
7. Metal casting (1 lecture)
8. Welding (arc welding & gas welding), brazing (1 lecture)

Lectures & videos: (10 hours)

Part B: Workshop Practice: **L : 0; T:0 ; P : 4 (2 credits)]**

1. Machine shop **(10 hours)**

To make Facing and plain turning, step turning, drilling in the lathe

2. Fitting shop **(8 hours)**

To make square, V joint in bench fitting as per the given dimension and tolerances

3. Carpentry **(6 hours)**

To make half lap joint, dovetail, TEE Lap joint

4. Electrical & Electronics **(8 hours)**

i. To make fluorescent lamp wiring.
ii. To make stair case wiring.
iii. To make residential wiring.
iv. To measure Peak-peak, rms, period, frequency using CRO.
v. To solder components devices and circuits by using general purpose PCB.

5. Welding shop **(8 hours (Arc welding 4 hrs + gas welding 4 hrs)**

- To make single, butt, lap and T fillet joint by arc welding with the back hand and fore hand welding techniques as per the given dimensions.

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6. Plumbing Works **(5 hours)**

- Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

7. Sheet Metal Work **(5 hours)**

- To make simple Dust pan, Rectangular trays in sheet metal with the jigs as per the given dimensions.

TOTAL: 60 Hours

COURSE OUTCOMES:

After successful completion of the Engineering Practices Laboratory course, the student will be able to

CO1: Familiarity with different types of woods used and tools used in wood Working technology.
CO2: Developments of sheet metal jobs from GI sheets, knowledge of basic concepts of soldering.
CO3: Familiarity with different types of tools used in fitting technology.
CO4: Utilize the hands-on experience in various fields.
CO5: Basic Engineering Practices in Civil, Mechanical, Electrical and Electronics Engineering.

REFERENCE BOOKS:

1. Lab manual
2. Kalpakjian, S., "Manufacturing Engineering and Technology", Pearson Education India Edition, 2006.
3. S. Gowri, P. Hariharan, A. Suresh Babu, Manufacturing Technology I, Pearson Education, 2008
4. Roy. A. Lindberg, Processes and Materials of Manufacture, PHI / Pearson Education, 2006
5. Hajra Choudhury S.K and Hajra Choudhury. A.K., Elements of Workshop Technology, Volume I and II, Media Promoters and Publishers Private Limited, Mumbai, 1997.
6. Paul Degarma E, Black J.T. and Ronald A. Kosher, Elighth Edition, Materials and Processes, in Manufacturing Prentice – Hall of India, 1997.
7. Sharma, P.C., A Text book of Production Technology, S. Chand and Co. Ltd., 2004.
8. P.N. Rao, Manufacturing Technology Foundry, Forming and Welding, TMH-2003; 2ndEdition, 2003.

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18MC201	CONSTITUTION OF INDIA	L	T	P	C
		0	0	0	0

COURSE OBJECTIVE:

- The purpose of the course is to acquaint the students with basic principles of the Constitution of India and its working.

UNIT I NATURE, OBJECT AND SCOPE OF THE CONSTITUTION 6

Nature, object and scope of Constitutional Law and Constitutionalism – Historical Perspective of the Constitution of India – Salient Features and Characteristics of Constitution of India.

UNIT II FUNDAMENTAL RIGHTS 6

Nature and scope of Fundamental Rights – Scheme of Fundamental Rights – Right to Equality – Right to Freedom of Speech and Expression – Right to Life – Right against Exploitation – Right to Religious Freedom – Minority Rights.

UNIT III DIRECTIVE PRINCIPLES OF STATE POLICY AND FUNDAMENTAL DUTIES 6

Directive Principles of State Policy – Importance and Implementation – Scheme of Fundamental Duties and its Legal Status.

UNIT IV FEDERAL STRUCTURE 6

Federal Structure – Distribution of Legislative and Financial Powers between the Union and the States – Parliamentary Form of Government in India – Constituent Powers and Status of the President of India.

UNIT V AMENDMENT AND EMERGENCY PROVISIONS 6

Amendment of the Constitution – Procedure – Historical Perspective of the Constitutional Amendments in India – Emergency Provisions – National Emergency – President Rule – Financial Emergency – Local Self Government – Constitutional Scheme in India.

TOTAL: 30 Hours

COURSE OUTCOMES:

After successful completion of the Constitution of India course, the student will be able to

CO1: Understand the historical perspective of the Constitution of India and Meaning of the constitution law.

CO2: Know the Fundamental Rights and Fundamental Duties and its legal status

CO3: Understand the Federal structure and distribution of legislative and financial powers between the Union and the States.

CO4: Know the Parliamentary Form of Government in India; The constitution powers and status of the President of India.

CO5: Understand the Emergency Provisions of National Emergency, President Rule, and Financial Emergency.

REFERENCE BOOKS:

1. V.N. Shukla, "Constitutional Law of India", Eastern Book Company, 1982.
2. D.D. Basu, "Commentary on the Constitution of India"; Vol 12; LexisNexis, 2
3. S Pal, "India's Constitution –Origins and Evolution", LexisNexis, 2018.
4. Dr J N Pandey, "Constitutional Law Of India", Central Law Agency, 2020.
5. V.D. Mahajan, "Constitutional Law of India", Eastern Book Company

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PC01	MATHEMATICS – III	L	T	P	C
	(Fourier Series and Transforms)	3	1	0	3

COURSE OBJECTIVE:

- To understand Fourier series representation of periodic signals. The analysis of signal is far more convenient in the frequency domain.

UNIT I FOURIER SERIES **12**

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

UNIT II FOURIER TRANSFORM **12**

Fourier integral theorem (without proof) – Fourier transform pair – Fourier Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS **12**

Formation of partial differential equations - singular integrals- Solutions of standard types of first order partial differential equations – Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of homogeneous functions.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **12**

Classification PDE-Method of separation of variables – One dimensional wave and heat equation – Steady state solution of two-dimensional heat equation (square plate only).

UNIT V Z -TRANSFORM AND DIFFERENCE EQUATIONS **12**

Z-transform –Introduction- properties – Inverse Z-transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z- transform.

TOTAL: 60 Hours

COURSE OUTCOME:

After successful completion of the Mathematics - III course, the student will be able to

- **CO1:** Develop Fourier series for different types of functions.
- **CO2:** Define and determine Fourier Transform.
- **CO3:** Derive and obtain the solution of wave, heat equation
- **CO4:** Problems of Fourier series and Fourier transforms used in engineering applications.
- **CO5:** Students understand the z-transforms and its properties

TEXT BOOKS:

1. Grewal. B.S, "Higher Engineering Mathematics", Khanna Publications ,Delhi,43rd Edition, 2013.
2. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 6th reprint,2008.

REFERENCE BOOKS:

1. Bali.N.P. and Manish Goyal, "A Textbook of Engineering Mathematics", Laxmi Publications, 9th edition, 2011.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 9th Edition, 2011.
3. SivaramakrishnaDas. P & Vijayakumari. C , "A Text book of Engineering Mathematics-III", 2018.

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PC02	ENGINEERING THERMODYNAMICS	L	T	P	C
		3	1	0	3

COURSE OBJECTIVE:

- To familiarize the students to understand the fundamentals of thermodynamics and to perform thermal analysis on their behavior and performance. (Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart permitted

UNIT I BASIC CONCEPT AND FIRST LAW 9

Basic concepts - concept of continuum, macroscopic approach, thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat, Concept of ideal and real gases, First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments.

UNIT II SECOND LAW AND ENTROPY 9

Second law of thermodynamics – Kelvin's and Clausius statements of second law, Reversibility and irreversibility. Carnot theorem, Carnot cycle, reversed carnot cycle, efficiency, COP, Thermodynamic temperature scale, Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy.

UNIT III THERMODYNAMIC AVAILABILITY 9

Basics – Energy in non-flow processes: Expressions for the Energy of a closed system- Equivalence between mechanical energy forms and Energy – Flow of energy associated with heat flow – Energy consumption and entropy generation. Energy in steady flow processes: Expressions for Energy in steady flow processes – Energy dissipation and entropy generation.

UNIT IV PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE 9

Properties of pure substances – Thermodynamic properties of pure substances in solid, liquid and vapour phases, phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces, thermodynamic properties of steam. Calculations of work done and heat transfer in non-flow and flow processes, Standard Rankine cycle, Reheat and regenerative cycle.

UNIT V PSYCHROMETRY 9

Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling, problems.

(Use of standard thermodynamic tables, Mollier diagram, Psychrometric chart and refrigerant property tables are permitted)

TOTAL: 45 Hours

After successful completion of the Engineering Thermodynamics course, the student will be able to

CO1: Understand the fundamentals of the first and second laws of thermodynamics and their application.

CO2: Apply the second law of thermodynamics for the solving the problems in Carnot cycle, Clausius equality.

CO3: Formulate the steady flow energy equation in non-flow processes and apply it to solve

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the problems in steady flow processes.

CO4: Analyzing the properties of pure substance and calculation of work done and heat transfer in steam power cycles.

CO5: Calculate the properties of gas mixtures and moist air and its use in psychometric processes.

TEXT BOOKS:

1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 1998.
2. Lynn D Russell, George A, Adebiyi, "Engineering Thermodynamics" Indian Edition, Oxford University Press, New Delhi, 2007.

REFERENCES:

1. E.Ratha Krishnan, "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice Hall of India Pvt. Ltd., 1998.
2. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
3. Merala C, Pother, Craig W, Somerton, "Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
4. Venwylen and Sontag, "Classical Thermodynamics", Wiley Eastern, 1987.
5. Holman. J. P., "Thermodynamics", 3rd Ed. McGraw-Hill, 1995.

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PC 03	ELECTRICAL DRIVES AND CONTROL	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

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

UNIT I INTRODUCTION **9**

Fundamentals of electric drives – advances of electric drive-characteristics of loads – different types of mechanical loads – choice of an electric drive – control circuit components: Fuses, switches, circuit breakers, contactors, Relay – control transformers.

UNIT II SPEED CONTROL OF DC MACHINES **9**

DC shunt motors – Speed Torque characteristics - Ward Leonard method, DC series motor – series parallel control – solid state DC drives – Thyristor bridge rectifier circuits- chopper circuits.

UNIT III SPEED CONTROL OF AC MACHINES **9**

Induction motor – Speed torque Characteristics – pole changing, stator frequency variation - slip-ring induction motor – stator voltage variation - Rotor resistance variation, slip power recovery – basic inverter circuits- variable voltage frequency control.

UNIT IV MOTOR STARTERS AND CONTROLLERS **9**

DC motor starters: using voltage sensing relays, current sensing relays and time delay relays - wound rotor induction motor starters – starters using frequency sensing relays - DOI –starter and auto transformers starter.

UNIT V HEATING AND POWER RATING OF DRIVE MOTORS **9**

Load diagram, over load capacity, insulating materials, heating and cooling of motors, service condition of electric drive – continuous, intermittent and short time – industrial application.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Electrical Drives and Control course, the student will be able to

CO1: Identify the need and choice of various electrical drives and their controls.
CO2: Designing the circuit with the Microprocessors.
CO3: Understand the DC motor by Single phase converters.
CO4: Discuss the four quadrant operation of DC drives.
CO5: Explain the control of induction motor; through station voltage.

TEXT BOOKS:

1. N.K De and P.K Sen, "Electric Drives", Prentice Hall of India Private Ltd, 2002.
2. Vedam Subramaniam, "Electric Drives", Tata McGraw Hill, New Delhi, 2007.
3. V.K Mehta and RohitMehta "Principle of Electrical Engineering", SChand & Company, 2008.

REFERENCE BOOKS:

1. S.K Bhattacharya Brinjinder Singh, "Control of Electrical Machines", New Age International Publishers, 2002.
2. John Bird, "Electrical Circuit theory and technology", Elsevier, First Indian Edition, 2006.

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PC 04	ENGINEERING MECHANICS	L	T	P	C
		3	1	0	3

COURSE OBJECTIVE:

- At the end of this course the student should be able to understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions. Further, he should understand the principle of work and energy. He should be able to comprehend the effect of friction on equilibrium. He should be able to understand the laws of motion, the kinematics of motion and the interrelationship. He should also be able to write the dynamic equilibrium equation. All these should be achieved both conceptually and through solved examples.

UNIT I BASICS AND STATICS OF PARTICLES 12

Introduction – Units and Dimensions – Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector operations: additions, subtraction, dot product, cross product – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT II EQUILIBRIUM OF RIGID BODIES 12

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples.

UNIT III PROPERTIES OF SURFACES AND SOLIDS 12

Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section, Hollow section by using standard formula – second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES 12

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12

Frictional force – Laws of Coulomb friction – simple contact friction – Rolling resistance – Belt friction. Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion.

TOTAL: 60 Hours

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COURSE OUTCOMES:

After successful completion of the Engineering Mechanics course, the students have the ability to

CO1: To Solve engineering problems dealing with force, displacement, velocity and acceleration.

CO2: To evaluate problems on equilibrium of rigid bodies.

CO3: To determine the areas and volumes of surface and solids.

CO4: To explain dynamics of particles and their relationships between motions.

CO5: To analyze friction and elements of rigid body dynamics.

TEXT BOOKS:

1. Beer, F.P and Johnson Jr. E.R., "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, 1997.
2. Rajasekaran. S, Sankarasubramanian. G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., 2000.

REFERENCE BOOKS:

1. Hibbeller, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
2. Palanichamy, M.S., Nagam, S., "Engineering Mechanics – Statics and Dynamics", Tata McGraw-Hill, 2001.
3. Irving H. Shames, "Engineering Mechanics – Statics and Dynamics", IV Edition – Pearson Education Asia Pvt. Ltd., 2003.
4. Ashok Gupta, "Interactive Engineering Mechanics – Statics – A Virtual Tutor (CDROM)", Pearson Education Asia Pvt., Ltd., 2002.

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PC 05	MANUFACTURING TECHNOLOGY-I	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and manufacture of plastic components.

UNIT I METAL CASTING PROCESSES 12

Sand casting – Sand moulds - Type of patterns – Pattern materials – Pattern allowances –Types of Moulding sand – Properties – Core making – Methods of Sand testing – Moulding machines – Types of moulding machines - Melting furnaces –Working principle of Special casting processes – Shell, investment casting – Ceramic mould – Lost Wax process – Pressure die casting – Centrifugal casting – CO2 process – Defects in Casting – Inspection methods.

UNIT II METAL JOINING PROCESSES 12

Fusion welding processes – Types of Gas welding – Equipments used – Flame characteristics – Filler and Flux materials - Arc welding equipments - Electrodes – Coating and Specifications – Principles of Resistance welding – Spot/butt, seam welding – Percusion welding - Gas metal arc welding – Flux cored – Submerged arc welding – Electro slag welding – TIG welding – Principle and application of special welding processes - Plasma arc welding – Thermit welding – Electron beam welding – Friction welding – Diffusion welding – Weld defects – Brazing and soldering process – Methods and process capabilities – Filler materials and fluxes – Types of Adhesive bonding.

UNIT III BULK DEFORMATION PROCESSES 12

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

UNIT IV SHEET METAL PROCESSES 12

Sheet metal characteristics - Typical shearing operations, bending and drawing operations – Stretch forming operations –– Formability of sheet metal – Test methods – Working principle and application of special forming processes - Hydro forming – Rubber pad forming – Metal spinning – Introduction to Explosive forming, Magnetic pulse forming, Peen forming, Super plastic forming.

UNIT V MANUFACTURING OF PLASTIC COMPONENTS 12

Types and characteristics of plastics –- Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding – Plunger and screw machines – compression moulding, Transfer moulding - Typical industrial applications – Introduction to Blow moulding – Rotational moulding – Film blowing – Extrusion - Thermoforming - Bonding of Thermoplastics.

TOTAL: 60 Hours

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COURSE OUTCOMES:

After successful completion of the Production Technology course, the student will be able to

CO1: Understand the basic concepts of manufacturing processes such as casting and molding and to create different new components using various patterns, materials and allowances.

CO2: Elaborate the working principle and basic equipment needed for metal joining process and to learn about fabrication techniques of different types of welding and forming process.

CO3: Learn the importance of metal forging and rolling processes.

CO4: Plan for making required component using sheet metal operations and application of special forming processes.

CO5: Make them to select appropriate moulding process based on plastic applications

TEXT BOOKS:

1. Kalpakjian, S., "Manufacturing Engineering and Technology", Pearson Education India Edition, 2006.
2. S. Gowri, P. Hariharan, A. Suresh Babu, "Manufacturing Technology I", Pearson Education, 2008.

REFERENCE BOOKS:

1. Roy. A. Lindberg, "Processes and Materials of Manufacture", PHI / Pearson Education, 2006.
2. Hajra Choudhury 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", Elighth Edition, Prentice – Hall of India, 1997.
4. Sharma, P.C., "A Text book of Production Technology", S. Chand and Co. Ltd., 2004.
5. P.N. Rao, "Manufacturing Technology Foundry, Forming and Welding", TMH-2003; 2nd Edition, 2003.

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PC 06	ENGINEERING MATERIALS AND METALLURGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

UNIT I ALLOYS AND PHASE DIAGRAMS 8

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

UNIT II HEAT TREATMENT 10

Definition – Full annealing, stress relief, recrystallisation and spheroidising – normalising, hardening and Tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram CCR – Hardenability, Jominy end quench test - Austempering, martempering – case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening.

UNIT III FERROUS AND NON-FERROUS METALS 9

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

UNIT IV NON-METALLIC MATERIALS 9

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET,PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes)-Engineering Ceramics – Properties and applications of Al2O3, SiC, Si3N4, PSZ and SIALON – Composites-Classifications- Metal Matrix and FRP - Applications of Composites.

UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS 9

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

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Engineering Materials and Metallurgy course, the student will be able to

CO1: Understand constitutions of alloys and its metallurgical studies.

CO2: Acquire knowledge about various types of heat treatment process and tests.

CO3: Compare various types of ferrous and non-ferrous metals.

CO4: Gain knowledge about non-metallic materials and composites.

CO5: Able to create a new material that will have some desirable properties and testing.

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TEXT BOOKS:

1. Avner,, S.H., “Introduction to Physical Metallurgy”, McGraw Hill Book Company, 1994.
2. Williams D Callister, “Material Science and Engineering” Wiley India Pvt Ltd, Revised Indian Edition 2007.

REFERENCE BOOKS:

1. Raghavan. V, “Materials Science and Engineering”, Prentice Hall of India Pvt. Ltd., 1999.
2. Kenneth G. Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall of India Private Limited, 4th Indian Reprint 2002.
3. Upadhyay. G.S. and Anish Upadhyay, “Materials Science and Engineering”, Viva Books Pvt. Ltd., New Delhi, 2006.
4. U.C. Jindal : Material Science and Metallurgy, "Engineering Materials and Metallurgy", First Edition, Dorling Kindersley, 2012.

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PC 07	COMPUTER AIDED MACHINE DESIGN LABORATORY	L	T	P	C
		0	0	3	1

COURSE OBJECTIVE:

- To develop skill to use software to create 2D and 3D models.

INTRODUCTION

Introduction to machine components and interpret drawings of machine component so as to prepare assembly drawing either manually and using standard CAD packages.

DRAWING STANDARDS

Code of practice for engineering drawing, BIS specifications-conventional representation of details- Welding symbols, riveted joints, keys, Fasteners. Reference to hand book for the selection of standard components like-bolts, nuts, washers, screws, cotters, pins, circlips, bearings, gears, springs and flanges.

2-D DRAWINGS

Limits, Fits- Tolerancing of Individual Dimensions-Specification of Fits -Manual preparation of production drawings and reading of part and assembly drawings.

CAD PRACTICE (USING APPLICATION PACKAGES)

Drawing, Editing, Dimensioning, Plotting Commands, Layering Concepts, Hatching, Detailing, Assembly, Basic principles of GD&T (geometric dimensioning &tolerancing).

ASSEMBLY DRAWING (MANUAL & USING APPLICATION PACKAGES)

Making free hand sketches of typical subassemblies-Plummer block, Screw jack, Lathe Tailstock, Universal Joint-Machine Vice-Stuffing Box-safety Valves-rolling element bearings, keyed joints, cotter joints, C clamp.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Computer aided Machine Design Laboratory course, the student will be able to

CO1: Construct both 2-D and 3-D drawings of any components using Auto CAD software.

CO2: Construct assemblies such as vice, screw jack and tailstock of the lathe, etc. from the concepts learned using drafting software and create the different wireframe primitives using parametric representations

CO3: Create surface primitives using parametric modeling and different solid primitives using the different representation schemes

CO4: Apply geometric transformations on the created wireframe, surface and solid models.

CO5: Get exposure to the contemporary computer design tools for aerospace and mechanical engineers. Evaluate the validity of the sketch for later operations.

TEXT BOOKS:

1. Gopalakrishna K R, "Machine Drawing", Seventeenth Edition, Subhas Stores, Bangalore, 2003.
2. CAD/CAM Manual, PSG College of Technology, Coimbatore, 2002.

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REFERENCE BOOKS:

1. Varghese P I and John K C, "Machine Drawing", Jovast Publishers, Thrissur, 2007.
2. BIS, SP: 46-2003 – “Engineering Drawing Practice for Schools and Colleges", New Delhi, 2003.
3. Faculty of Mechanical Engineering, PSG College of Technology, "Design Data Book", M/s. DPV Printers, Coimbatore, 1993.
4. ASME Y 14.5M-1994, “Dimensioning and Tolerancing”, ASME, New York, 1995.

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PC 08	MANUFACTURING TECHNOLOGY LABORATORY	L	T	P	C
		0	0	3	1

COURSE OBJECTIVE:

- To Study and practice the various operations that can be performed in lathe, shaper, drilling, milling machines etc. and to equip with the practical knowledge required in the core industries.

LIST OF EXPERIMENTS

1. Assembly of core and cavity
2. Assembly of die and punch
3. Machining an internal keyway using slotting machine
4. Shaping round to square
5. Surface grinding
6. Keyway milling
7. Drilling and tapping
8. Turning and cylindrical grinding

TOTAL: 45 Hours

LIST OF EQUIPMENT

1.	Center lathe	- 14 Nos.
2.	Capstan lathe	- 01 No.
3.	Turret lathe	- 01 No.
4.	Pillar type drilling machine	- 01 No.
5.	Radial drilling machine	- 01 No.
6.	Shaper	- 02 Nos.
7.	Surface grinding machine	- 01 No.
8.	Cylindrical grinding machine	- 01 No.
9.	Gear hobbing machine	- 01 No.
10.	Horizontal milling machine	- 02 Nos.
11.	Slotting machine	- 01 No.

COURSE OUTCOMES:

After successful completion of the Manufacturing Technology Laboratory course, the student will be able to

CO1: Impart knowledge on Mechanics of metal cutting & Machining Operations Study and practice the various operations that can be performed in lathe machines

CO2: Understand the concept of shaper machines and its functions and Study the drilling operations performed in different types of drilling machine and its applications.

CO3: Study and practice the milling machines for various operations that can be performed in milling machine and Equip with the practical knowledge required in the core industries.

CO4: Study of the construction details of different types of machines used in manufacturing process and Different types of tools used in machines and the measuring instruments.

CO5: Propose the most economical route to fabricate the required engineering component and Predict and develop a methodology and establish a manufacturing sequence to fabricate engineering components.

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REFERENCE BOOKS:

1. Roy. A. Lindberg, "Processes and Materials of Manufacture", PHI / Pearson Education, 2006
2. Hajra Choudhury 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", Elighth Edition, Prentice – Hall of India, 1997.
4. Sharma, P.C., "A Text book of Production Technology", S. Chand and Co. Ltd., 2004.
5. P.N. Rao, "Manufacturing Technology Foundry, Forming and Welding", TMH-2003; 2nd Edition, 2003.

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MM 01 **INDUSTRIAL SAFETY** **L T P C**
2 0 0 2

COURSE OBJECTIVE:

- To provide the necessary basic concepts of safety in the industrial environment
- To enable the students to learn about various functions and activities of safety department.
- To have knowledge about sources of information for safety promotion and training.
- To familiarize students with evaluation of safety performance in manufacturing environment.

UNIT I SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES **6**

General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines.

UNIT II PRINCIPLES OF MACHINE GUARDING **6**

Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS – guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction- guard opening Selection and suitability: lathe-drilling-boring-milling -grinding-shaping

UNIT III SAFETY IN WELDING AND GAS CUTTING **6**

Gas welding and oxygen cutting, resistances welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing – leak detection-pipe line safety-storage and handling of gas cylinders.

UNIT IV SAFETY IN COLD FARMING AND HOT WORKING OF METALS **6**

Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls.
Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills Safety in gas furnace operation.

UNIT V SAFETY IN FINISHING, INSPECTION AND TESTING **6**

Heat treatment operations, electro plating, sand and shot blasting, safety in inspection and testing, dynamic balancing, hydro testing
Health and welfare measures in engineering industry-pollution control in engineering industry-industrial waste disposal.

TOTAL: 30 Hours

COURSE OUTCOMES:

After successful completion of the Industrial Safety course, the student will be able to

CO1: Understand the safety measures in metal & wood machinery
CO2: Know the principles of machine guarding
CO3: Acquire the knowledge in welding & gas cutting
CO4: Understand Safety precautions in cold & hot farming metals
CO5: Gain knowledge in inspection & testing

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REFERENCE BOOKS:

1. John V. Grimaldi and Rollin H. Simonds, "Safety Management" , All India Travelers Book seller, New Delhi, 1989.
2. N.V. Krishnan, "Safety in Industry" Jaico Publishery House, 1996.
3. "Accident Prevention Manual" – NSC, Chicago, 1982.
4. "Occupational safety Manual" BHEL, Trichy, 1988.
5. Indian Boiler acts and Regulations, Government of India.
6. Safety in the use of wood working machines, HMSO, UK 1992.
7. Health and Safety in welding and Allied processes, welding Institute, UK, High Tech. Publishing Ltd., London, 1989.

PC 09	MATHEMATICS-IV (STATISTICAL AND NUMERICAL METHODS)	L	T	P	C
		3	1	0	3

COURSE OBJECTIVE:

- The objective is to provide the necessary basic concepts of a few statistical and numerical methods familiar with the procedures for solving numerically different kinds of problems occurring in engineering.

UNIT I Testing of Hypothesis **12**

Sampling distributions – Large samples-Tests for single mean, Proportion, Difference of means Small samples – Tests for single mean, two mean and paired t-test-F-test – chi-square test for goodness of fit – Independence of attributes-Design of Experiments-Completely randomized design – Randomized block design – Latin square design.

UNIT II Correlation and Regression Analysis **12**

Introduction to Correlation Analysis- Karl Pearson's Coefficient of Correlation-Rank Correlation-Regression Analysis-Curve fitting-Introduction- method of least squares.

UNIT III Solution of Equations **12**

Introduction-Bisection method-Newton-Raphson's method- Regula falsi method- Gauss Elimination method -Gauss-Jordan methods –Matrix Inversion by Gauss-Jordan method.

UNIT IV Interpolation, Numerical Differentiation and Numerical Integration **12**

Introduction–Newton's forward and backward interpolation – Lagrange's Interpolation formula-Derivatives using Newton's forward and backward difference formula -Numerical integration using Trapezoidal, Simpson's 1/3 rules and Simpson's 3/8 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS **12**

Introduction-Taylor's series method -Euler's method - Modified Euler's method – Second and Fourth order Runge-Kutta method for solving first order equations-Milne's Predictor corrector method and Adams-Bashforth method (Simple problems).

TOTAL: 60 Hours

COURSE OUTCOMES:

After successful completion of the Industrial Safety course, the student will be able to

CO1: Acquire the skill on testing of hypothesis

CO2: Familiar the concepts of correlation & regression

CO3: Attain the knowledge on solution of equations and eigen value problems

CO4: Describe the applications of interpolation, numerical differentiation and numerical integration.

CO5: Attain the knowledge on numerical solution of ordinary differential equations.

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TEXT BOOKS:

1. Johnson R.A. and Gupta C.B, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th edition, 2007 (For units 1 and 2).
2. Grewal, B.S. and Grewal,J.S., "Numerical methods in Engineering and Science", 9th Edition, Khanna Publishers, New Delhi, 2012. (For units 3, 4 and 5).
3. Dr.Kandasamy .P, Dr. Thilagavathi, Dr. Gunavathi. K, "Statistics and numerical methods", S.Chand and company, first edition, 2010.

REFERENCE BOOKS:

1. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", Tata McGraw-Hill, New Delhi, 7th Edition, 2014.
2. Walpole R.E, Myers R.H, Myers S.L, and Ye. K, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia , 9th edition, 2011.

PC 10	STRENGTH OF MATERIALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

UNIT II BEAMS - LOADS AND STRESSES 9

Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shear flow.

UNIT III TORSION 9

Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness – Compound shafts – Fixed and simply supported shafts – Application to close-coiled helical springs – Maximum shear stress in spring section including Wahl Factor – Deflection of helical coil springs under axial loads – Design of helical coil springs – stresses in helical coil springs under torsion loads.

UNIT IV BEAM DEFLECTION 9

Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method, Macaulay Method, and Moment-area Method –Columns and its types – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula for columns.

UNIT V ANALYSIS OF STRESSES IN TWO DIMENSIONS 9

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr's circle for biaxial stresses – Maximum shear stress - Strain energy in bending and torsion.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Strength of Materials course, the student will be able to

CO1: Analyze the rigid bodies and deformable solids response when subjected to different stresses and measure the strain and the relationship of stress and strain.

CO2: Analyze the different types of beam response when subjected to different types of loads, shear stresses and evaluation of shear force and bending moment diagram.

CO3: Analyze the different types of shaft and spring response when subjected to torsion forces axially and design of helical coil spring, analysis of deflection and stresses.

CO4: Evaluation of beam deflection and slope using different mathematical methods and column subjected to different end conditions.

CO5: Analyses of stresses in two dimensions of thin cylindrical and spherical shells and solve stresses at a point and inclined planes.

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TEXT BOOKS:

1. Popov E.P, “Engineering Mechanics of Solids”, Prentice-Hall of India, New Delhi, 1997.
2. Beer F. P. and Johnston R, “Mechanics of Materials”, McGraw-Hill Book Co, Third Edition, 2002.

REFERENCE BOOKS:

1. Nash W.A, “Theory and problems in Strength of Materials”, Schaum Outline Series, McGraw-Hill Book Co, New York, 1995.
2. Kazimi S.M.A, “Solid Mechanics”, Tata McGraw-Hill Publishing Co, New Delhi, 1981.
3. Ryder G.H, “Strength of Materials”, Macmillan India Ltd., Third Edition, 2002.
4. Ray Hulse, Keith Sherwin & Jack Cain, “Solid Mechanics”, Palgrave ANE Books, 2004.
5. Singh D.K “Mechanics of Solids” Pearson Education 2002.
6. Timoshenko S.P, “Elements of Strength of Materials”, Tata McGraw-Hill, New Delhi 1997.

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PC11	MANUFACTURING TECHNOLOGY-II	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- The main objective of this course is to provide wider and depth knowledge to the students in machine tools cutting methodology of various manufacturing machines.

UNIT I THEORY OF METAL CUTTING 12

Introduction to types of machine tools, Theory of metal cutting -material removal processes: chip formation, orthogonal cutting and oblique cutting. Merchant circle-problems, cutting tool materials, tool wear, tool life-problems, surface finish, cutting fluids.

UNIT II CENTRE LATHE AND SPECIAL PURPOSE LATHES 12

Centre lathe, constructional features, cutting tools, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes – automatic lathes: semi automatic, automats – single spindle : cutting off, swiss type, automatic screw type – multi spindle; cutting off, bar type.

UNIT III RECIPROCATING AND MILLING MACHINES 12

Reciprocating machine tools: shaper, planer, slotter; milling: types, milling cutters, operations; hole making: drilling, reaming, boring, tapping.

UNIT IV SURFACE FINISHING PROCESSES 12

Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centre less grinding – honing, lapping, super finishing, polishing and buffing, abrasive jet grinding.

UNIT V SAWING, BROACHING AND GEAR CUTTING 12

Sawing machine: hack saw, band saw, circular saw; broaching machines: broach construction – push, pull, surface and continuous broaching machines, gear cutting: forming, generation, shaping, hobbing.

TOTAL: 60 Hours

COURSE OUTCOMES:

After successful completion of the Manufacturing Technology course, the student will be able to

CO1: Understand the concept and basic mechanics of metal cutting process and classify ideas about cutting tool materials, tool life, tool wear.

CO2: To learn the importance of constructional features and working principle of center lathe and special purpose lathe.

CO3: Develop knowledge about reciprocating machine tools and milling machines for various machining operations.

CO4: To create the constructive knowledge in surface finishes process such as surface grinding, honing, lapping, polishing, buffing and abrasive jet grinding.

CO5: To understand the concept and working principle of various sawing machines, broaching machines and various gear cutting operations.

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TEXT BOOKS:

1. Rao, P.N., "Manufacturing Technology", Metal Cutting and Machine Tools, Tata McGraw–Hill, New Delhi, 2003.
2. Richerd R. Kibbe, John E. Neely, Roland O. Merges and Warren J. White, "Machine Tool Practices", Prentice Hall of India, 2003.

REFERENCE BOOKS:

1. HMT, "Production Technology", Tata McGraw-Hill, 1998.
2. P.C. Sharma, "A Text Book of Production Engineering", S.Chand and Co. Ltd, IV edition, 1993.
3. Hajra Choudry, "Elements of Work Shop Technology – Vol. II", Media Promoters. 2002.
4. Geofrey Boothroyd, "Fundamentals of Metal Machining and Machine Tools", McGraw Hill, 1984.

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PC 18	KINEMATICS OF MACHINERY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To understand the basic components and layout of linkages in the assembly of a system / machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.

UNIT I BASICS OF MECHANISMS 9

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler's criterion – Grashof's Law – Kinematic inversions of four-bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission Angle – Description of some common mechanisms – Quick return mechanisms, Dwell mechanisms, Ratchets and Escapements, Universal Joint.

UNIT II KINEMATICS OF LINKAGE MECHANISMS 9

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method – Velocity and acceleration polygons – Velocity analysis using instantaneous centres – Kinematic analysis by complex algebra methods – Vector approach –Coincident points – Coriolis component of Acceleration.

UNIT III KINEMATICS OF CAM MECHANISMS 9

Classification of cams and followers – Terminology and definitions – Displacement diagrams – Uniform velocity, parabolic, simple harmonic, cycloidal and polynomial motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting.

UNIT IV GEARS AND GEAR TRAINS 9

Law of toothed gearing – Involutes and cycloidal tooth profiles –Spur Gear terminology and definitions –Gear tooth action – contact ratio – Interference and undercutting – Non-standard gear teeth – Helical, Bevel, Worm, Rack and Pinion gears – Gear trains – Speedratio, train value – Parallel axis gear trains – Epicyclic Gear Trains – Differentials.

UNIT V FRICTION 9

Kinds of friction – Laws of friction – coefficient of friction - Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction aspects in brakes.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the kinematics of machinery course, the student will be able to

CO1: Understand the principles of kinematic pairs, chains and their classification, DOF, inversions, and basics of mechanisms.

CO2: Analyze the planar mechanisms for position, velocity and acceleration.

CO3: Design and synthesize the cam mechanism for specified kinematic conditions.

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CO4: Explain the basic concepts of toothed gearing and kinematics of gear trains.

CO5: Solving the Problems related with friction and its applications in machine elements like belt and rope drives, brakes and clutches.

TEXT BOOKS:

1. Ambekar A.G, "Mechanism and Machine Theory", Prentice Hall of India, New Delhi, 2007.
2. Shigley J.E., PennockG.R.andUicker.J.J., 'Theory of Machines and Mechanisms", Oxford University Press, 2003.

REFERENCE BOOKS:

1. Thomas Bevan, 'Theory of Machines', CBS Publishers and Distributors, 1984.
2. Ghosh.A, and A.K.Mallick, 'Theory of Mechanisms and Machines', Affiliated East-West Pvt. Ltd., New Delhi, 1988.
3. Rao.J.S. andDukkipati.R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., NewDelhi, 1992.
4. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
5. V.Ramamurthi, "Mechanics of Machines", Narosa Publishing House, 2002.
6. Robert L.Norton, "Design of Machinery", McGraw-Hill, 2004.

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PC 13	FLUID MECHANICS AND MACHINERY	L	T	P	C
		3	1	0	3

COURSE OBJECTIVE:

The applications of the conservation laws to flow through pipes and hydraulic machines are studied

- To understand the importance of dimensional analysis.
- To understand the importance of various types of flow in pumps and turbines.

UNIT I INTRODUCTION **9**

Units & Dimensions. Properties of fluids – Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws – capillarity and surface tension. Flow characteristics: concepts of system and control volume. Application of control volume to continuity equation, energy equation, momentum equation and moment of momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS **9**

Laminar flow through circular conduits and circular annuli, Boundary layer concepts, Boundary layer thickness. Hydraulic and energy gradient, Darcy – Weisbach equation, Friction factor and Moody diagram, Commercial pipes, Minor losses, Flow through pipes in series and in parallel.

UNIT III DIMENSIONAL ANALYSIS **9**

Dimension and units: Buckingham's π theorem, Discussion on dimensionless parameters, Models and similitude, Applications of dimensionless parameters.

UNIT IV ROTO DYNAMIC MACHINES **9**

Homologus units, Specific speed, Elementary cascade theory, Theory of turbo machines, Euler's equation, Hydraulic efficiency, Velocity components at the entry and exit of the rotor. Velocity triangle for single stage radial flow and axial flow machines, Centrifugal pumps, turbines, performance curves for pumps and turbines.

UNIT V POSITIVE DISPLACEMENT MACHINES **9**

Positive displacement pumps and classification of pumps, Reciprocating pumps, characteristics of reciprocating pump, Indicator diagrams, Work saved by air vessels. Rotary pumps, Classification, Working and performance curves.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Fluid Mechanics and Machinery course, the student will be able to

CO1: Understand and apply the basic concepts of Fluid Mechanics to carry out professional engineering activities in the field of fluids and to apply scientific method strategies to fluid mechanics: analyzed qualitatively and quantitatively the problem situation, propose hypotheses and solutions.

CO2: Use the appropriate means of knowledge, procedures, results, skills and aspects inherent to fluid mechanics and to understand the major and minor losses in flow through circular conduits.

CO3: Plan and carry out dimensional analysis, similitude and model analysis in accordance with the relevant specific technology

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CO4: To estimate the conservation laws to flow through pipes and hydraulic machines and the importance of various types of flow in pumps and turbines.

CO5: To apply and study the basic concepts of pumps, air vessels and its performance curves.

TEXT BOOKS:

1. Streeter. V. L., and Wylie, E.B., :Fluid Mechanics", McGraw Hill, 1983.
2. Rathakrishnan. E, "Fluid Mechanics", Prentice Hall of India (II Ed.), 2007.

REFERENCE BOOKS:

1. Ramamritham. S, "Fluid Mechanics, Hydraulics and Fluid Machines", Dhanpat Rai & Sons, Delhi, 1988.
2. Kumar. K.L., "Engineering Fluid Mechanics (VII Ed.)", Eurasia Publishing House (P) Ltd., New Delhi, 1995.
3. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", Laxmi Publications (P) Ltd., New Delhi, 2018.

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MC 02	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To inculcate the importance of environmental pollution, preservation of nature and environmental management for human welfare.
- The student is expected to understand what constitutes the environment, what precious resources in the environment are, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity.
- The role of government and non – governmental organization in environmental managements.

UNIT I ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY 9

Definition – Scope and importance – Need for public awareness – Concepts 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 – Biogeographical 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 and Birds. Field study of simple ecosystems - pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 9

Definition – Causes, Effects and Control Measures of (A) Air Pollution (B) Water Pollution (C) Soil Pollution (D) Marine Pollution (E) Noise Pollution (F) Thermal Pollution (G) Nuclear Hazards – Solid 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 9

Forest resources -Use and over – Exploitation – Deforestation – Case studies – Timber extraction –Mining – Dams and their 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 Degradation, Man Induced Landslides, Soil Erosion and Desertification – Role of an Individual in Conservation of Natural Resources – Equitable use of Resources for Sustainable Lifestyles.

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Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 9

From Unsustainable To Sustainable Development – Urban Problems Related to energy – Water conservation, Rain Water Harvesting, Watershed Management – Resettlement and Rehabilitation of People, 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 Production 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 9

Population Growth, Variation among Nations – Population Explosion Family Welfare Programme – environment and Human Health – Human Rights –Value Education – HIV /AIDS – Women and Child Welfare – Role of Information Technology in Environment and Human Health – Case Studies.

TOTAL: 30 Hours

COURSE OUTCOME

At the end of this course, the Student will be able to

CO1: Understand the nature and facts about environment and implement scientific, technological, economic solutions to environmental problems and interrelationship between living organisms and environment.

CO2: Understand the integrated themes and biodiversity, natural resources, pollution control and waste management.

CO3: Analyze the importance of environment by assessing its impact on the human world.

CO4: Study the dynamic processes and understand the features of the earth's interior and surface; know the role of an individual in Conservation of Natural Resources and the various social issues.

CO5: Understand the role of government in solving the environmental problems and Know about Population Growth and variation among Nations.

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).

REFERENCE BOOKS:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media, 2010.
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.

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PC 14	FLUID MECHANICS AND STRENGTH OF MATERIALS LABORATORY	L	T	P	C
		0	0	3	2

FLUID MECHANICS

COURSE OBJECTIVE:

- Upon Completion of this subject, the students can able to have hands on experience in flow measurements using different devices and also perform calculation related to losses in pipes and also perform characteristic study of pumps, turbines etc.
- After completion of this laboratory the students can ability to use the measurement equipments for flow measurement and they can ability to do performance trust on different fluid machinery.

LIST OF EXPERIMENTS

1. Calibration of Flow Measuring instruments – venturimeter, orifice meter, rotometer,
2. Calibration of flows in open channels – weirs and notches.
3. Estimation of friction factor in flow through pipes.
4. Determination of performance characteristics of pumps – centrifugal pumps, submersible pumps, turbine pumps and positive displacement pumps and reciprocating and gear pumps.
5. Determination of performance characteristics of turbines – reaction turbines and impulse turbines.

TOTAL: 45 Hours

After successful completion of the Fluid Mechanics and Strength of Materials Laboratory course, the student will be able to

CO1: Understand the calibration of Flow Measuring instruments

CO2: Know the calibration of flows in open channels – weirs and notches.

CO3: Understand the estimations of friction factor through pipes

CO4: Determine the performance characteristics of pumps

CO5: Determine the performance characteristics of turbines

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.

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STRENGTH OF MATERIALS

COURSE OBJECTIVE:

- To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads. This would enable the student to have a clear understanding of the design for strength and stiffness.

LIST OF EXPERIMENTS

1. Tension test on mild steel rod.
2. Double shear test on metals.
3. Torsion test on mild steel rod.
4. Impact test on metal specimen.
5. Hardness test on metals.
6. Compression test on helical spring.
7. Deflection test on carriage spring.

TOTAL: 45 Hours

After successful completion of the Fluid Mechanics and Strength of Materials Laboratory course, the student will be able to

CO1: Understanding of the fundamental principles of mechanics of materials and determining the strength of materials under externally applied loads

CO2: Analyzing deflection test on beams and compression test on helical springs and Measure deformations, forces, and strains under a variety of loading conditions, including tension, compression, bending.

CO3: Identify the suitable materials with required properties. Understand fluid mechanics system, especially in flow measurements using different devices.

CO4: Determine the fluid coefficient of discharge of giving Orifice and Venturi meter. Conduct the experiments and draw characteristic curves of centrifugal and reciprocating pumps.

CO5: To do experiments and draw characteristic curves of Francis and Kaplan turbines. Demonstrate the limitations and applicability of theory.

REFERENCES:

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

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PC 15	KINEMATICS AND DYNAMICS LABORATORY	L	T	P	C
		0	0	3	2

COURSE OBJECTIVE:

- To supplement the principles learnt in kinematics and dynamics of machinery.
- To understand how certain measuring devices are used for dynamic testing.

STUDY EXPERIMENT

1. Study the Four bar chain mechanism
2. Study the Single slider crank mechanism
3. Study of Gear Mechanism

LIST OF EXPERIMENTS

1. Governors - Determination of sensitivity, effort, etc. for Watt, Porter, Proell, Hartnell governors
2. Cam - Study of jump phenomenon and drawing profile of the cam.
3. Motorised Gyroscope-Verification of laws -Determination of gyroscopic couple.
4. Whirling of shaft-Determination of critical speed of shaft with concentrated loads.
5. Balancing of reciprocating masses.
6. Balancing of rotating masses.
7. Determination of moment of inertia by oscillation method for connecting rod and flywheel.
8. Vibrating system - spring mass system-Determination of damping co-efficient of single degree of freedom system.
9. Determination of influence co-efficient for multi-degree freedom suspension system.
10. Determination of transmissibility ratio - vibrating table.
11. Determination of torsional frequencies for compound pendulum and flywheel system with lumped Moment of inertia.
12. Transverse vibration –free- Beam. Determination of natural frequency and deflection of beam.

TOTAL: 45 Hours

LIST OF EQUIPMENTS (For a batch of 30 students)

1. Cam analyzer.
2. Motorised gyroscope.
3. Governor apparatus - Watt, Porter, Proell and Hartnell governors.
4. Whirling of shaft apparatus.
5. Dynamic balancing machine.
6. Static and dynamic balancing machine.
7. Vibrating table
8. Vibration test facilities apparatus

COURSE OUTCOMES:

After successful completion of the Dynamics Laboratory course, the student will be able to

CO1: Understand the principles of kinematic and dynamic behavior of machine parts, Analyze how certain measuring devices are used for dynamic testing.

CO2: Demonstrate the effect of unbalances resulting from rotary motions. Understand vibrations in single and multi degree of freedom system

CO3: Able to learn working principle of the governor /gyroscope and demonstrate the effect of forces and moments on their motion, Evaluate cutting forces acting on machine elements using a dynamometer

CO4: Analyze moment of inertia by an oscillation method for connecting rod and flywheel, Understand determination of torsional frequencies for compound pendulum and flywheel system with lumped Moment of inertia.

CO5: Exposure on cam, governor, balancing masses and forces on various equipments based on theoretical and experimental methods.

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REFERENCES:

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", Oxford University Press, 2017.
2. Ramamurthi. V, "Mechanics of Machines", Narosa Publishing House, 2002.
3. AmitabhaGhosh and Asok Kumar Mallik, "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., 1988.
4. Rao.J.S. and Dukkipati.R.V. "Mechanism and Machine Theory", New Age International Pvt. Ltd., 2006.
5. Rattan, S.S, "Theory of Machines", McGraw-Hill Education Pvt. Ltd., 2014.
6. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGraw-Hill, 2009.
7. Wilson and Sadler, Kinematics and Dynamics of Machinery, Pearson, 2008.

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PC 16	ENGINEERING METROLOGY AND MEASUREMENTS	L	T	P	C
		3	1	0	3

COURSE OBJETCTIVE:

- To provide knowledge on various Metrological equipments available to measure the dimension of the components.
- To provide knowledge on the correct procedure to be adopted to measure the dimension of the components.

UNIT I CONCEPT OF MEASUREMENT 9

General concept – Generalised measurement system-Units and standards-measuring instruments: sensitivity, stability, range, accuracy and precision-static and dynamic response-repeatability-systematic and random errors-correction, calibration - Introduction to Dimensional and Geometric Tolerancing – interchangeability.

UNIT II LINEAR AND ANGULAR MEASUREMENT 9

Definition of metrology-Linear measuring instruments: Vernier, micrometer, Slip gauges and classification, - Tool Makers Microscope - interferometery, optical flats, - Comparators: limit gauges Mechanical, pneumatic and electrical comparators, applications. Angular measurements: -Sine bar, Sine center, bevel protractor and angle Decker.

UNIT III FORM MEASUREMENT 9

Measurement of screw threads: Thread gauges, floating carriage micrometer-measurement of gear tooth thickness: constant chord and base tangent method-Gleason gear testing machine – radius measurements-surface finish: equipment and parameters, straightness, flatness and roundness measurements.

UNIT IV LASER AND ADVANCES IN METROLOGY 9

Precision instruments based on laser-Principles- laser interferometer-application in measurements and machine tool metrology- Coordinate measuring machine (CMM): need, construction, types, applications- computer aided inspection.

UNIT V MEASUREMENT OF MECHANICAL PARAMETERS 9

Force, torque, power:-mechanical, pneumatic, hydraulic and electrical type-Pressure measurement - Flow: Venturi, orifice, rotameter, pitot tube –Temperature: bimetallic strip, thermocouples, pyrometer, electrical resistance thermistor.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Engineering metrology and measurements course, the student will be able to

CO1: Get the knowledge of various meteorological equipments and measure the dimension of the components and Grant knowledge on the correct procedure to be adopted to measure the dimension of the components

CO2: Know the fundamental science and engineering principles relevant to the measurements and have the experimental and computational skills for a professional career or graduate study in mechanical instruments

CO3: Know the fundamental science and engineering principles relevant to the measurements and have the experimental and computational skills for a professional career or graduate stud Know the fundamental science and engineering principles relevant to the measurements and have the experimental and computational skills for a

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professional career or graduate study in mechanical instruments in mechanical instruments

CO4: Demonstrate the use of advanced measurement techniques and to Select and employ suitable instruments for measurement

CO5: Understand various Advancements in meteorological and measurement systems and General math, science and engineering skills to design and conduct experiments, and to analyze data

TEXT BOOKS:

1. Jain R.K., "Engineering Metrology", Khanna Publishers, 2005.
2. Alan S. Morris, "The Essence of Measurement", Prentice Hall of India, 1997.

REFERENCES:

1. Gupta S.C, "Engineering Metrology", Dhanpatrai Publications, 2005.
2. Jayal A.K, "Instrumentation and Mechanical Measurements", Galgotia Publications 2000.
3. Beckwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education, 2006.
4. Donald Deckman, "Industrial Instrumentation", Wiley Eastern, 1985.

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PC 17 **DESIGN OF MACHINE ELEMENTS**

L	T	P	C
3	1	0	3

COURSE OBJECTIVE:

- To gain knowledge on the principles and procedure for the design of Mechanical power Transmission components.
- To understand the standard procedure available for Design of Transmission of Mechanical elements.
- To learn to use standard data and catalogues.

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 9

Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – Design of curved beams – crane hook and 'C' frame - Factor of safety - theories of failure – stress concentration – design for variable loading – Soderberg, Goodman and Gerber relations.

UNIT II DESIGN OF SHAFTS AND COUPLINGS 9

Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys and key ways - Design of rigid and flexible couplings – Introduction to gear and shock absorbing couplings - design of knuckle joints.

UNIT III DESIGN OF FASTENERS AND WELDED JOINTS 9

Threaded fasteners - Design of bolted joints including eccentric loading – Design of welded joints for pressure vessels and structures - theory of bonded joints.

UNIT IV DESIGN OF SPRINGS AND LEVERS 9

Design of helical, leaf, disc and torsional springs under constant loads and varying loads – Concentric torsion springs - Belleville springs – Design of Levers.

UNIT V DESIGN OF BEARINGS AND FLYWHEELS 9

Design of bearings – sliding contact and rolling contact types – Cubic mean load – Design of journal bearings – Mckees equation – Lubrication in journal bearings – calculation of bearing dimensions – Design of flywheels involving stresses in rim and arm.

TOTAL: 45Hours

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

COURSE OUTCOMES:

After successful completion of the Dynamics of Machinery course, the student will be able to understand

CO1: Identify the force-motion relationship in components subjected to external forces and analysis of standard mechanisms and to know the undesirable effects of unbalances resulting from prescribed motions in mechanism

CO2: Find the effect of dynamics of undesirable vibrations and to solve balancing problems in rotating and reciprocating machinery.

CO3: Understand the principle mechanism used for speed control and stability control and to Analyze free response of one and two degree freedom systems.

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CO4: Analyzing the gyroscopic effects in ships, aero planes and road vehicles and to Determine the natural frequencies of continuous systems starting from the general equation of displacement.

CO5: Estimate Force transmissibility and amplitude transmissibility and Analyze the Gyroscopic effects in Automobiles, ships and airplanes

.

TEXT BOOKS:

1. Juvinall R.C, and Marshek K.M, "Fundamentals of Machine Component Design", John Wiley & Sons, Third Edition, 2002.
2. Bhandari V.B, "Design of Machine Elements", Tata McGraw-Hill Book Co, 2003.

REFERENCES:

1. Norton R.L, "Design of Machinery", Tata McGraw-Hill Book Co, 2004.
2. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
3. Ugural A.C, "Mechanical Design – An Integral Approach, McGraw-Hill Book Co, 2004.
4. Spotts M.F., Shoup T.E "Design and Machine Elements" Pearson Education, 2004.

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PC 12	DYNAMICS OF MACHINERY	L	T	P	C
		3	1	0	3

COURSE OBJECTIVE:

- To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
- To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
- To understand the effect of Dynamics of undesirable vibrations.
- To understand the principles in mechanisms used for speed control and stability control.

UNIT I FORCE ANALYSIS **12**

Rigid Body dynamics in general plane motion – Equations of motion - Dynamic force analysis - Inertia force and Inertia torque – D'Alemberts principle - The principle of superposition - Dynamic Analysis in Reciprocating Engines – Gas Forces - Equivalent masses - Bearing loads - Crank shaft Torque - Turning moment diagrams - Fly wheels –Engine shaking Forces - Cam dynamics - Unbalance, Spring, Surge and Windup.

UNIT II BALANCING **12**

Static and dynamic balancing - Balancing of rotating masses - Balancing a single cylinder Engine - Balancing Multi-cylinder Engines - Partial balancing in locomotive Engines - Balancing linkages - balancing machines.

UNIT III FREE VIBRATION **12**

Basic features of vibratory systems - idealized models - Basic elements and lumping of parameters - Degrees of freedom - Single degree of freedom - Free vibration - Equations of motion - natural frequency - Types of Damping - Damped vibration critical speeds of simple shaft - Torsional systems; Natural frequency of two and three rotor systems.

UNIT IV FORCED VIBRATION **12**

Response to periodic forcing - Harmonic Forcing - Forcing caused by unbalance - Support motion – Force transmissibility and amplitude transmissibility - Vibration isolation.

UNIT V MECHANISMS FOR CONTROL **12**

Governors - Types - Centrifugal governors - Gravity controlled and spring controlled centrifugal governors –Characteristics - Effect of friction - Controlling Force - other Governor mechanisms. Gyroscopes - Gyroscopic forces and Torques - Gyroscopic stabilization - Gyroscopic effects in Automobiles, ships and airplanes.

TOTAL: 60 Hours

COURSE OUTCOMES:

After successful completion of the Design of Machine Elements course, the student will be able to

CO1: Determine the rigid body dynamics and the principle of superposition.

CO2: Analyze static and dynamic balancing and balancing of rotating masses.

CO3: Classify features of vibratory systems, degrees of freedom and equations of motions.

CO4: Determine the harmonic forcing and forcing caused by unbalance and understand force transmissibility and amplitude transmissibility.

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CO5: Classify the governors and analyze its mechanisms and gyroscopes.

TEXT BOOK:

1. Rattan S.S., "Theory of Machines", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1994

REFERENCES:

1. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
2. Ghosh A. and Mallick A.K., "Theory of Mechanisms and Machines", Affiliated East-West Press Pvt. Ltd., New Delhi, 1988.
3. Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", McGraw-Hill, Inc., 1995.
4. Rao J.S. and Dukkipati R.V., "Mechanism and Machine Theory ", Wiley-Eastern Limited, New Delhi, 1992.
5. John Hannah and Stephens R.C., "Mechanics of Machines", Viva low-Priced Student Edition, 1999.
6. Sadhu Singh “Theory of Machines” Pearson Education, 2002.

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PC 19	APPLIED HYDRAULICS AND PNEUMATICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To expose the learner to the fundamentals of hydraulic and pneumatic power control and their circuits with industrial applications

UNIT I FLUID POWER SYSTEMS AND FUNDAMENTALS 12

Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – General types of fluids – Fluid power symbols. Basics of Hydraulics-Applications of Pascals Law- Laminar and Turbulent flow – Reynold's number – Darcy's equation – Losses in pipe, valves and fittings.

UNIT II HYDRAULIC SYSTEM & COMPONENTS 12

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

UNIT III HYDRAULIC CONTROL AND CIRCUITS 12

Construction of Control Components : Director control valve – 3/2 way valve – 4/2 way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram. Accumulators and Intensifiers: Types and sizing of accumulators – intensifier – Applications of Intensifier. circuits for controlling single acting and double acting cylinders, Accumulators circuits – Intensifier circuit.

UNIT IV PNEUMATIC CONTROL AND CIRCUITS 12

Pneumatic Components: Properties of air – Compressors – Filter, Regulator, Lubricator Unit – Air control valves, Quick exhaust valves, pneumatic actuators. Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Pneumo hydraulic circuit, Sequential circuit design for simple applications using cascade method.

UNIT V SERVO SYSTEMS, FLUIDICS AND FLUID POWER TROUBLE SHOOTING 12

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

TOTAL: 60 Hours

COURSE OUTCOMES:

After successful completion of the Applied Hydraulics and Pneumatics course, the student will be able to

CO1: Understand properties of fluid and fluid power systems. Understand the concepts of fluid statics and dynamics applied to commercial and industrial applications.

CO2: Understand the hydraulic system and components. Study and understand the operations, applications, and maintenance of common fluid power components such as pumps, cylinders, motors, rotary actuators

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CO3: Study various types of control valves and circuits. Understand electrical controls, relays, solenoids, accumulator, Intensifier and application circuits

CO4: Study of Pneumatic components such as Compressor, FRL and valves and its functions. Design of various circuits such as synchronizing, sequence and Electro pneumatic circuits.

CO5: "Understand the servo system and fluid power trouble shooting. Demonstrate application of fluid power in Electro Hydraulic Pneumatic logic circuits and construction of ladder diagrams pneumatic control and PLC applications."

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education, 2000.
2. Majumdar S.R., "Oil Hydraulics", Tata McGraw-Hill, 2000.

REFERENCE BOOKS:

1. Majumdar S.R., "Pneumatic systems – Principles and maintenance", Tata McGraw Hill, 1995.
2. Anthony Lal, "Oil hydraulics in the service of industry", Allied publishers, 1982.
3. Harry L. Stevart D.B, "Practical guide to fluid power", Taraoeala sons and Port Ltd. Broadey, 1976.
4. Michael J, Prinches and Ashby J. G, "Power Hydraulics", Prentice Hall, 1989.
5. Dudelyt, A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 1987.

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PC 20	METROLOGY AND MEASUREMENTS LABORATORY	L	T	P	C
		0	0	3	2

COURSE OBJECTIVE:

- To familiar with different measurement equipments and use of this industry for quality Inspection and Ability to handle different measurement tools and performs measurements in quality impulsion.

LIST OF EXPERIMENTS

1. Calibration of Vernier / Micrometer / Dial Gauge
2. Checking Dimensions of part using slip gauges
3. Measurements of Gear Tooth Dimensions
4. Measurement of Angle using sine bar / sine center / tool makers microscope
5. Measurement of straightness and flatness
6. Measurement of thread parameters
7. Setting up of comparators for inspection (Mechanical / Pneumatic / Electrical)
8. Measurement of Temperature using Thermocouple / Pyrometer
9. Measurement of Displacement
10. Measurement of Force
11. Measurement of Torque
12. Measurement of Vibration / Shock

TOTAL: 45Hours

LIST OF EQUIPMENTS (For a batch of 30 students)

Micrometer	-	5Nos.
Vernier Caliper	-	5Nos.
Vernier Height Gauge	-	2Nos.
Vernier depth Gauge	-	2Nos.
Slip Gauge Set	-	1No.
Gear Tooth Vernier	-	1No.
Sine Bar	-	1No.
Sine Center	-	1 No.
Bevel Protractor	-	1 No.
Floating Carriage Micrometer	-	1 No.
Profile Projector / Tool Makers Microscope	-	1 No.
Mechanical / Electrical / Pneumatic Comparator	-	1 No.
Autocollimator	-	1 No.
Temperature Measuring Setup	-	1 No.
Displacement Measuring Setup	-	1 No.
Force Measuring Setup	-	1 No.
Torque Measuring Setup	-	1 No.

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Vibration / Shock Measuring Setup - 1 No.

COURSE OUTCOMES:

After successful completion of the Metrology and Measurements Laboratory course, the student will be able to

CO1: Predict given Vernier height gauge, Micrometer and Vernier caliper using given slip gauge.

CO2: Evaluate the important parameter in thread using Tool makers Microscope, Floating carriage micrometer and Gear tooth Vernier.

CO3: Evaluate the bore diameter using Telescope gauge, Micrometer and Comparator.

CO4: Estimate the surface finish using surface finish measuring equipment's and Auto collimator.

CO5: Measure, Force, Torque, Temperature and angle using Proving ring measurement, LVDT measurement, Thermocouple measurement and sine bar measurement devices.

REFERENCES:

1. Dotson Connie, "Dimensional Metrology", Cengage Learning, First edition, 2012.
2. Mark Curtis, Francis T. Farago, "Handbook of Dimensional Measurement", Industrial Press, Fifth edition, 2013.
3. AmmarGrous, J "Applied Metrology for Manufacturing Engineering", Wiley-ISTE, 2011.
4. Galyer, J.F.W. Charles Reginald Shotbolt, "Metrology for Engineers", Cengage Learning EMEA; 5th revised edition, 1990.
5. National Physical LaboratoryGuideNo. 40, No. 41, No. 42, No. 43, No. 80, No. 118, No. 130, No. 131. http://www.npl.co.uk. (relevant to syllabus).

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PC 21	COMPUTER AIDED SIMULATION AND ANALYSIS LABORATORY	L	T	P	C
		0	0	3	2

COURSE OBJECTIVE:

- To give exposure to software tools needed to analyze engineering problems.
- To expose the students to different applications of simulation and analysis tools.

LIST OF EXPERIMENTS

A. SIMULATION

1. Simulation of Air conditioning system with condenser temperature and evaporator temperatures as input to get COP using C /MAT Lab.
2. Simulation of Hydraulic / Pneumatic cylinder using C / MAT Lab.
3. Simulation of cam and follower mechanism using C / MAT Lab.

B. ANALYSIS (SIMPLE TREATMENT ONLY)

1. Stress analysis of a plate with a circular hole.
2. Stress analysis of rectangular L bracket
3. Stress analysis of an axi-symmetric component
4. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
5. Mode frequency analysis of a 2 D component
6. Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)
7. Harmonic analysis of a 2D component
8. Thermal stress analysis of a 2D component
9. Conductive heat transfer analysis of a 2D component
10. Convective heat transfer analysis of a 2D component

TOTAL: 45 Hours

LIST OF EQUIPMENTS (For a batch of 30 students)

Computer System	30
17" VGA Color Monitor	
Pentium IV Processor	
40 GB HDD	
512 MB RAM	
Color Desk Jet Printer	01

Software

Suitable analysis software	30 licenses
C / MATLAB	5 licenses

COURSE OUTCOMES:

After successful completion of the Computer Aided Simulation and Analysis Laboratory course, the student will be able to

CO1: Understand and solve simple problems in vibration using MATLAB.

CO2: Carry out mechanism simulation using Multibody Dynamic software.

CO3: Solve stress analysis problems of link elements in Trusses, cables, beams, flat plates, simple shells and axi–symmetric components.

CO4: Solve thermal stress and heat transfer analysis of plates, cylindrical shells.

CO5: Examine the model analysis of beams and harmonic, transient and spectrum analysis of simple systems.

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REFERENCES:

1. Ibrahim Zeid "Mastering CAD CAM" Tata McGraw-Hill Publishing Co., 2007.
2. Groover, M. P., CAD/CAM: Computer-Aided Design and Manufacturing, Pearson Education, 2008.
3. Chris McMahon and Jimmie Browne "CAD/CAM Principles, practice and manufacturing management "Pearson education Asia, 2001.
4. Foley, Wan Dam, Feiner and Hughes – "Computer graphics principles & practice", Pearson Education - 2003.
5. David Houcque, "INTRODUCTION TO MATLAB FORENGINEERING STUDENTS", Northwestern University, 2015.
6. The MathWorks Inc. MATLAB 7.0 (R14SP2). The MathWorks Inc., 2005.

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PE 15	INDUSTRIAL AUTOMATION, CNC AND ROBOTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To understand the functions of the basic components of a Robot.
- To study the use of various types of End of Effectors and Sensors
- To impart knowledge in Robot Kinematics and Programming
- To learn Robot safety issues and economics.

UNIT I AUTOMATION **12**

Basic principles of automation; Hard Automation, Flexible Automation extending the capabilities of conventional machines through improved devices and manipulators; Transfer Machines for Assembly, Multi spindle Automatics.

UNIT II CNC **12**

Basic principles of numerical control; Methods of coding and programming; CNC, DNC and Machining Centres; Manual Programming, Computer Aided (APT) programming; Adaptive control; Economics of numerical control.

UNIT III FUNDAMENTALS OF ROBOT **12**

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 Functions – Need for Robots – Different Applications.

UNIT IV ROBOT DRIVE SYSTEMS AND END EFFECTORS **12**

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of 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 V SENSORS AND MACHINE VISION **12**

Requirements of a sensor, Principles and Applications of the following types of sensors – Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors), Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors. Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis – Data Reduction: Edge detection, Feature Extraction and Object Recognition.

TOTAL: 60 Hours

COURSE OUTCOMES:

After successful completion of the Automation, CNC and Robotics course, the student will be able to

CO1: Explain the principles of automation

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CO2: Applying the programming knowledge on CNC machining.

CO3: Design and development of robot anatomy model and its structure.

CO4: Construction of Robot End effectors and drive system.

CO5: Measure the sensors data and explain the machine vision system to robotics.

TEXT BOOK:

1. M.P.Groover, "Industrial Robotics – Technology, Programming and Applications", McGraw-Hill, 2001.

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. YoramKoren, "Robotics for Engineers", McGraw-Hill Book Co., 1992.
3. Janakiraman.P.A., "Robotics and Image Processing", Tata McGraw-Hill, 1995.

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PC 23	THERMAL ENGINEERING	L	T	P	C
		3	1	0	3

COURSE OBJECTIVE:

- To integrate the concepts, laws and methodologies from the first course in thermodynamics into analysis of cyclic processes.
- To apply the thermodynamic concepts into various thermal application like IC engines, Steam Turbines, Compressors and Refrigeration and Air conditioning systems.

UNIT I GAS POWER CYCLES **9**

Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure and air standard efficiency, Actual and theoretical PV diagram of Four stroke engines, Actual and theoretical PV diagram of two stroke engines.

UNIT II INTERNAL COMBUSTION ENGINES **9**

Classification of IC engine, IC engine components and functions. Valve timing diagram and port timing diagram. Comparison of two stroke and four stroke engines. Fuel supply systems, Ignition Systems, Performance calculation. Comparison of petrol & diesel engine. Fuels, Air-fuel ratio calculation, Knocking and Detonation. Lubrication system and cooling system. Exhaust gas analysis.

UNIT III STEAM NOZZLES AND TURBINES **9**

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow. Impulse and reaction principles, compounding, velocity diagrams for simple and multistage turbines, speed regulations-governors and nozzle governors.

UNIT IV AIR COMPRESSOR **9**

Classification and working principle, work of compression with and without clearance. Volumetric efficiency, Isothermal efficiency and isentropic efficiency of reciprocating air compressors. Multistage air compressor and inter cooling – work of multistage air compressor, various types of compressors (Descriptive treatment only).

UNIT V REFRIGERATION AND AIR-CONDITIONING **9**

Vapour compression Refrigeration cycle – super heat, sub cooling, performance calculations. Working principle of vapour absorption system. Ammonia – water, Lithium bromide – water systems, Comparison between vapour compression and absorption systems. Psychrometry, Psychometric chart, Cooling load calculations. Concept of RSHF, GSHF, ESHF, Air conditioning systems.

TOTAL : 45 Hours

(Use of standard thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables are permitted in the Examination)

COURSE OUTCOMES:

After successful completion of the Thermal Engineering course, the student will be able to

CO1: Apply the thermodynamic concepts into various thermal applications like IC engines, Steam Turbines and to Learn the concepts, laws and methodologies from the first course in thermodynamics into an analysis of cyclic processes.

CO2: Evaluate the performance of an internal combustion engine and various gas power cycles and understand the principles involved in air-conditioning systems and able to Estimate cooling loads.

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CO3: Understand computational aspects of isentropic flow through variable area and Analyse gas turbine cycles and able to compare the operational aspects of jet engines

CO4: Know the different cycles used in thermal engineering and Get exposure on internal combustion engine and able to analyze their performance

CO5: Study the vapour compression and absorption system and Calculate cooling load calculation for Refrigeration and Air conditioning systems.

TEXT BOOKS:

1. Rajput. R. K., "Thermal Engineering", S. Chand publishers, 2000.
2. Rudramoorthy R, "Thermal Engineering", Tata McGraw-Hill, New Delhi, 2003.

REFERENCES:

1. Kothandaraman.C.P., Domkundwar. S. and A.V. Domkundwar., "A course in Thermal Engineering", DhanpatRai& Sons, Fifth edition, 2002.
2. Holman. J.P., "Thermodynamics", McGraw-Hill, 1985.
3. Rogers, Meyhew, "Engineering Thermodynamics", ELBS, 1992.
4. Arora.C.P., "Refrigeration and Air conditioning", TMH, 1994.
5. Sarkar B.K, "Thermal Engineering", Tata McGraw-Hill, 1998.

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PC 24	DESIGN OF TRANSMISSION SYSTEMS	L	T	P	C
		3	1	0	3

COURSE OBJECTIVE:

- To gain knowledge on the principles and procedure for the design of Mechanical power Transmission components.
- To understand the standard procedure available for Design of Transmission of Mechanical elements.
- To learn to use standard data and catalogues.

UNIT I DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS 12

Selection of V belts and pulleys – selection of Flat belts and pulleys - Wire ropes and pulleys – Selection of Transmission chains and Sprockets, Design of pulleys and sprockets.

UNIT II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 12

Gear Terminology-Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects - Fatigue strength - Factor of safety - Gear materials – Module and Face width-power rating calculations based on strength and wear considerations - Parallel axis Helical Gears – Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces and stresses, Estimating the size of the helical gears.

UNIT III BEVEL, WORM AND CROSS HELICAL GEARS 12

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears.

Worm Gear: Merits and demerits- Terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair.

Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

UNIT IV DESIGN OF GEAR BOXES 12

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box -Constant mesh gear box. – Design of multi speed gear box.

UNIT V DESIGN OF CAM CLUTCHES AND BRAKES 12

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses. Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches-internal and external shoe brakes.

TOTAL: 60 Hours

NOTE: ***(Usage of P.S.G Design Data Book is permitted in the University examination)***

COURSE OUTCOMES:

After successful completion of the Design of Transmission Systems course, the student will be able to

CO1: Understand the principles and the procedure for the design of mechanical power transmissions components.

CO2: Analyse the gear terminology of spur gear and helical gear and its parallel axis.

CO3: Estimate the dimensions of bevel, worm and cross helical gears.

CO4: Construct the gear boxes

CO5: Design cams, clutches and brakes

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TEXT BOOKS:

1. Shigley J.E and Mischke C. R., “Mechanical Engineering Design”, Sixth Edition, Tata McGraw-Hill , 2003.
2. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.

REFERENCES:

1. Maitra G.M., Prasad L.V., “Hand book of Mechanical Design”, II Edition, Tata McGraw-Hill, 1985.
2. Bhandari, V.B., “Design of Machine Elements”, Tata McGraw-Hill Publishing Company Ltd., 1994.
3. Prabhu. T.J., “Design of Transmission Elements”, Mani Offset, Chennai, 2000,
4. Hamrock B.J., Jacobson B., Schmid S.R., “Fundamentals of Machine Elements”, McGraw-Hill Book Co., 1999.
5. Ugural A, C, "Mechanical Design, An Integrated Approach", McGraw-Hill , 2003.

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PC 25	THERMAL ENGINEERING LABORATORY	L	T	P	C
		0	0	3	2

COURSE OBJECTIVE:

- To study the value timing-V diagram and performance of IC Engines.
- To Study the characteristics of fuels/Lubricates used in IC Engines.
- To study the Performance of steam generator/ turbine.

LIST OF EXPERIMENTS

I.C ENGINE LAB AND FUELS LAB

1. Valve Timing and Port Timing Diagrams
2. Performance Test on 4-stroke Diesel Engine.
3. Heat Balance Test on 4-stroke Diesel Engine
4. Morse Test on Multicylinder Petrol Engine
5. Determination of Viscosity – Red Wood Viscometer
6. Determination of Flash Point and Fire Point
7. Study of Steam Generators and Turbines

HEAT TRANSFER

1. Thermal conductivity of pipe insulation using lagged pipe apparatus
2. Natural convection heat transfer from a vertical cylinder
3. Forced convection inside tube
4. Determination of Stefan-Boltzmann constant
5. Effectiveness of Parallel/counter flow heat exchanger

REFRIGERATION AND AIR CONDITIONING

1. Determination of COP of a refrigeration/ air conditioning system
2. Performance test on single/two stage reciprocating air compressor

TOTAL: 45Hours

COURSE OUTCOMES:

After successful completion of the Thermal Engineering Laboratory course, the student will be able to

CO1: Analyze the performance of internal combustion Engines

CO2: Estimate the performance of different thermal equipment's like reciprocating compressors, refrigeration and air conditioning systems

CO3: To predict the valve timing diagram and port timing diagram of IC engines

CO4: Identify the Thermal conductivity of pipe insulation using lagged pipe apparatus

CO5: Identify the Natural convection heat transfer from a vertical cylinder

REFERENCES:

1. Rajput. R. K., "Thermal Engineering", S. Chand publishers, 2000.
2. Rudramoorthy R, "Thermal Engineering", Tata McGraw-Hill, New Delhi, 2003.
3. Kothandaraman.C.P., Domkundwar. S. and A.V. Domkundwar., "A course in Thermal Engineering", DhanpatRai& Sons, Fifth edition, 2002.

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15PBME62 **ADVANCED MACHINING LABORATORY** **L T P C**
0 0 3 2

COURSE OBJECTIVE:

- To gain practical experience in handling 2D drafting and 3D modeling software systems.
- To study the features of CNC Machine Tool.
- To expose students to modern control systems (Fanuc, Siemens etc.,)
- To know the application of various CNC machines like CNC lathe, CNC Vertical Machining centre, CNC EDM and CNC wire-cut and studying of Rapid prototyping.

1. **MANUAL CNC PART PROGRAMMING**(Ex: Manual CNC Part Programming Using Standard G and M Codes - Tool Path Simulation – Exposure to Various Standard Control Systems- Machining simple components by Using CNC machines.

2. **COMPUTER AIDED PART PROGRAMMING**
   (Ex**:** CL Data Generation by Using CAM Software– Post Process Generation for Different Control System – Machining of Computer Generated Part Program by Using Machining Center and Turning Center.)

3. **STUDY EXPERIMENTS**

Multi-axial Machining in CNC Machining Center –EDM – EDM Wire Cut - Rapid Prototyping

LIST OF EQUIPMENTS (Requirement for a batch of 30 students)

S.No.	Description of Equipment	Quantity Required
HARDWARE		
1.	Computer Server	1 No.
2.	Computer nodes or systems (High end CPU with at least 1 GB main memory) networked to the server	30 Nos.
3.	A3 size plotter	1 No.
4.	Laser Printer	1 No.
5.	Trainer CNC Lathe	1 No.
6.	Trainer CNC milling	1 No.
SOFTWARE		
7.	CAD/CAM software (Pro-E or IDEAS or Unigraphics or CATIA)	15 licenses
8.	CAM Software (CNC Programming and tool path simulation for FANUC /Sinumeric and Heiden controller)	15 licenses
9.	Licensed operating system	Adequate
10.	AutoCAD	
11.	ANSYS	
12.	Master CAM	

TOTAL: 45 Hours

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COURSE OUTCOMES:

After successful completion of the CAM Laboratory course, the student will be able to

CO1: Understanding the Computer Aided Design concepts and Fundamentals of AutoCAD.

CO2: Build the 3D modeling including Solids, Curves, Surfaces.

CO3: Creation of Flange coupling, screw jack, Bushed bearing and stuffing box assembly using Solid Works.

CO4: Understand the basic concepts of Tolerance Analysis, concept of Geometric dimensioning and Tolerance from 2D Drawings.

CO5: Formulate the manual part programming for given drawing to execute CNC turning lathe and milling machine.

REFERENCES:

1. Ibrahim Zeid "Mastering CAD CAM" Tata McGraw-Hill Publishing Co.2007.
2. Mikell .P. Groover "Automation, Production Systems and Computer Integrated Manufacturing", PEARSON, 2018.
3. Chris McMahon and Jimmie Browne "CAD/CAM Principles, practice and manufacturing management "Pearson education Asia, 2001.
4. Foley, Wan Dam, Feiner and Hughes – "Computer graphics principles & practice", Pearson Education - 2003.

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INDUSTRIAL VISIT

L	T	P	C
0	0	0	0

COURSE OBJECTIVE:

- Provide students an insight regarding internal working system of the industries.
- Industrial visit helps to combine theoretical knowledge with industrial knowledge.
- Industrial realities are opened to the students through industrial visits.

GUIDELINE FOR REVIEW AND EVALUATION

- Internship undergone in Research and Development organization or reputed institutions.
- Student shall undergo Industrial visit / internship after getting prior permission from the department.
- A report should be submitted after the successful completion of Industrial visit / internship training.

COURSE OUTCOMES:

After successful completion of the industrial visit course, the student will be able to

CO	COURSE OUTCOME STATEMENTS	KNOWLEDGE LEVEL
CO1	Recognize the requirement of the industry and cope up with the industrial scenario.	**K2**
CO2	Prepare a report about the work experience in industry.	**K3**
CO3	Explain effectively through technical presentation.	**K3**

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PROJECT WORK	L	T	P	C
	0	0	16	8

COURSE OBJECTIVE:

To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination

GUIDELINE FOR REVIEW AND EVALUATION

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member. The group of students prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project evaluated based on a minimum of three reviews, the review committee constituted by the Head of the Department. A project report is required at the end of the semester. The project work evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

COURSE OUTCOMES:

After successful completion of the project work course, the student will be able to

CO	COURSE OUTCOME STATEMENTS	KNOWLEDGE LEVEL
CO1	Identify and compare the technical and practical issues related to the area of course specialization	**K5**
CO2	Organize a report by employing the elements of technical writing and critical thinking.	**K3**
CO3	Identify the methods and materials to carry out experiments/develop code.	**K3**
CO4	Analyze and discuss the results to draw valid conclusions.	**K4**
CO5	Develop the possibility of publishing papers in peer reviewed journals/conference proceedings.	**K3**

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YOGA	L	T	P	C
	0	0	2	1

COURSE OBJECTIVE:

1. Meaning of yoga, Importance of yoga in our daily life, important aspects during of yoga.
2. Different type of yoga.
3. Renowned Yogies of India.
4. Importance of Way of Meditation.
5. Knowledge of Samadhi and Nabhi- Pariksha.

COURSE CONTENT

Meaning & Importance of Yoga, Importance of Precautions of Place. Time and Food. Helpful and disturbing aspects during practice of yoga.Various Kinds of yoga:-Bhakti Yoga, Karma Yoga, Hatha Yoga & Ashtang Yoga. Introduction of some prominent yogis-Maharishi Patanjali Swami Shivananda. Chakras and their importance,Kundalini,Five Kleshs,Five States (Bhumies) of Chitra.

REFERENCES:

1. Ghosh,A.K., "A Synthetic approach to Diet and Nutrition", Swami Mangalteerthama Nutan Publication, Deoghar, 2005.
2. Iyengar, B.K.S., "Astadal Yoga Mala, (Vol I – VIII)", Allied publishers Pvt. Ltd., Lucknow, 2009.
3. Dr. Rakhee Mehra, "Ayurveda Eka Parichaya", MDNIY, New Delhi, 2010.
4. Goel, Aruna & Goel, S. L., "Stress Management and Education", Deep & Deep Publications New Delhi, 2005.

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PE 01	REFRIGERATION AND AIR CONDITIONING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the underlying principles of operations in different Refrigeration & Air conditioning systems and components.
- To provide knowledge on design aspects of Refrigeration & Air conditioning systems.

UNIT I INTRODUCTION **7**

Introduction to Refrigeration – Unit of Refrigeration and C.O.P.– Ideal cycles- Refrigerants Desirable properties – Classification – Nomenclature – ODP & GWP.

UNIT II VAPOUR COMPRESSION REFRIGERATION SYSTEM **10**

Vapor compression cycle: p-h and T-s diagrams – deviations from theoretical cycle – subcooling and super heating- effects of condenser and evaporator pressure on COP- multipressure system – low temperature refrigeration – Cascade systems – problems. Equipments: Type of Compressors, Condensers, Expansion devices, Evaporators.

UNIT III OTHER REFRIGERATION SYSTEMS **8**

Working principles of Vapour absorption systems and adsorption cooling systems – Steam jet refrigeration- Ejector refrigeration systems- Thermoelectric refrigeration- Air refrigeration – Magnetic – Vortex and Pulse tube refrigeration systems.

UNIT IV PSYCHROMETRIC PROPERTIES AND PROCESSES **8**

Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temperature Thermodynamic wet bulb temperature, Psychrometric chart; Psychrometric of air-conditioning processes, mixing of air streams.

UNIT V AIR CONDITIONING SYSTEMS AND LOAD ESTIMATION **12**

Air conditioning loads: Outside and inside design conditions; Heat transfer through structure, Solar radiation, Electrical appliances, Infiltration and ventilation, internal heat load; Apparatus selection; fresh air load, human comfort & IAQ principles, effective temperature & chart, calculation of summer & winter air conditioning load; Classifications, Layout of plants; Air distribution system; Filters; Air Conditioning Systems with Controls: Temperature, Pressure and Humidity sensors, Actuators & Safety controls.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Refrigeration and Air Conditioning course, the student will be able to

CO1: Demonstrate the operations in different Refrigeration.
CO2: Design Refrigeration cycle.
CO3: Know the various refrigeration systems.
CO4: Demonstrate the operations Air conditioning systems.
CO5: Design Air conditioning systems.

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TEXT BOOK:

1. Arora, C.P., "Refrigeration and Air Conditioning", 3rd edition, McGraw Hill, New Delhi, 2010.

REFERENCES:

1. Roy J. Dossat, "Principles of Refrigeration", 4th edition, Pearson Education Asia, 2009.
2. Stoecker, W.F. and Jones J. W., "Refrigeration and Air Conditioning", McGraw Hill, New Delhi, 1986.
3. ASHRAE Hand book, Fundamentals, 2010 4. Jones W.P., "Air conditioning engineering", 5th edition, Elsevier Butterworth-Heinemann, 2001.

PE02	MECHANICAL HANDLING SYSTEMS AND EQUIPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To develop competency for system visualization and design the mechanical handling systems and equipments.

UNIT I INTRODUCTION **9**

Elements of Material Handling System-Importance, Terminology, Objectives and benefits of better Material Handling; Principles and features of Material Handling System; Interrelationships between material handling and plant layout, physical facilities and other organizational functions; Classification of Material Handling Equipment.

UNIT II SELECTION OF MATERIAL HANDLING SYSTEM **9**

Selection of Material Handling Equipment-Factors affecting for selection; Material Handling Equation; Choices of Material Handling Equipment; General analysis Procedures; Basic Analytical techniques; The unit load concept; Selection of suitable types of systems for applications ; Activity cost data and economic analysis for design of components of Material Handling Systems; functions and parameters affecting service; packing and storage of materials.

UNIT III DESIGN **9**

Design of Mechanical Handling Equipment- Design of Hoists, Drives for hoisting, components, and hoisting mechanisms; rail travelling components and mechanisms; hoisting gear operation during transient motion; selecting the motor rating and determining breaking torque for hoisting mechanisms. Design of Cranes, Hand-propelled and electrically driven E.O.T. overheat Travelling cranes; Traveling mechanisms of cantilever and monorail cranes; design considerations for structures of rotary cranes with fixed radius ; fixed post and overhead travelling cranes; Stability of stationary rotary and travelling rotary cranes.

UNIT IV ATTACHMENTS **9**

Design of load lifting attachments- Load chains and types of ropes used in Material Handling System; Forged, Standard and Ramshorn Hooks; Crane Grabs and Clamps; Grab Buckets; Electromagnet; Design consideration for conveyor belts; Application of attachments.

UNIT V SYSTEMS AND EQUIPMENT **9**

Study of systems and Equipment used for Material Storage- Objectives of storage; Bulk material handling; Gravity flow of solids through slides and chutes; Storage in bins and hoppers; Belt conveyors; Bucket-elevators; Screw conveyors; Vibratory Conveyors; Cabin conveyors; Mobile racks etc.

TOTAL: 45 Hours

COURSE OUTCOME:

After successful completion of the Mechanical Handling Systems and Equipment course, the student will be able to

CO1: Know about the different types of material handling, advantages and disadvantages

CO2: Suggest the selection procedure for the material handling along with its specifications

CO3: Proficiency in supply chain operations, utilizing appropriate methods to plan and implement processes necessary for the purchase and conveyance of goods in a timely and cost-effective manner

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CO4: Need for Material handling also explained with different techniques like Automated Material handling Design Program, Computerized material handling Planning will be dealt

CO5: Selection procedure of material handling is depending on different function oriented systems. This also related with plant layout by which the minimization of the handling charges will come down

TEXT/REFERENCE BOOKS:

1. N. Rudenko, „Material Handling Equipments", Peace Publishers, Moscow, 1999.
2. James M. Apple, „Material Handling System Design", John-Willlwy and Sons Publication, New York, 1989.
3. John R. Immer, „Material Handling" McGraw Hill Co. Ltd., New York, 2000.
4. Colin Hardi, „Material Handling in Machine Shops". Machinery Publication Co. Ltd., London, 2002.

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PE 03	APPLIED ELASTICITY AND PLASTICITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To develop the knowledge on Plastics and Elastic nature of the bodies with different cross sections through differential equations.

UNIT I INTRODUCTION **9**

Theory of Elasticity- Analysis of stress and strain, equilibrium, Compatibility and constitutive equations, Plane stress and plane strain problems, General equation in Polar coordinates, Rotating discs and stresses in circular discs, Stress function in terms of harmonic and complex functions, Equation of equilibrium of a deformed body in curvilinear coordinates.

UNIT II BENDING OF BEAMS **9**

Principle of superposition and principle of virtual work, Torsion of thin tubes, Bending of cantilevers, Uniformly and continuous loaded beams, Bending of circular, elliptical and rectangular cross-section bars, Axisymmetric formulation and deformation of solids of revolution.

UNIT III THREE DIMENSIONAL STRESS ANALYSIS **9**

Theory of Plasticity-Nature of engineering plasticity, Differential equations of equilibrium, 3D stress analysis, infinitesimal deformation, finite deformation, Von Mises', Tresca's and anisotropic yield criteria, Halgh-Westergard stress space representation of yield criteria, experimental verification of yield criteria, Subsequent yield surfaces.

UNIT IV ELASTIC & PLASCTIC STRESS STRAIN **9**

Elastic and plastic stress-strain relations and stress strain rate equations, Prandtle-Reuaa equations, Generalized plastic stress strain relations, Anisotropy and instability.

UNIT V PLASTIC DEFORMATION **9**

Plane plastic flow, Slip-line field theory, Application of slip line field theory to plane strain metal forming processes Plane plastic stress and pseudo plane stress analysis and its applications, Extremum principle for rigid perfectly plastic material, surfaces of stress and velocity discontinuity. Upper bound and lower bound theorems and applications.

TOTAL: 45 Hours

COURSE OUTCOME:

After successful completion of the Applied Elasticity and Plasticity course, the student will be able to

CO1: Understand the basic concepts of elastic analysis.
CO2: Understand and solve the plane stress and plane strain of the bending of beams problems.
CO3: Solve three dimensional stress analysis problems.
CO4: Understand and have the knowledge in various theories of failure and plasticity.
CO5: Familiar with the concept of plastic deformation.

TEXT/REFERENCE BOOKS:

1. Arthur Boresi& Omar Sidebottom, "Advanced Mechanics of Materials," John Wiley & Sons, 6th Edition, 2002.
2. Den Hartong, “Advanced Strength of Materials”, McGraw Hill Book Co., New York 1952.
3. Wang, “Applied Elasticity”, McGraw Hill., 1979.

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PE 04	RENEWABLE ENERGY SOURCES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- At the end of the course, the students are expected to identify the new methodologies / technologies for effective utilization of renewable energy sources.

UNIT I SOLAR ENERGY **9**

Solar Radiation – Measurements of solar Radiation and sunshine – Solar Thermal Collectors – Flat Plate and Concentrating Collectors – Solar Applications – fundamentals of photo Voltaic Conversion – solar Cells – PV Systems – PV Applications.

UNIT II WIND ENERGY **9**

Wind Data and Energy Estimation – wind Energy Conversion Systems – Wind Energy generators and its performance – Wind Energy Storage – Applications – Hybrid systems.

UNIT III BIO – ENERGY **9**

Biomass, Biogas, Source, Composition, Technology for utilization – Biomass direct combustion – Biomass gasifier – Biogas plant – Digesters – Ethanol production – Bio diesel production and economics.

UNIT IV OTEC, TIDAL, GEOTHERMAL AND HYDEL ENERGY **9**

Tidal energy – Wave energy – Data, Technology options – Open and closed OTEC Cycles – Small hydro, turbines – Geothermal energy sources, power plant and environmental issues.

UNIT V NEW ENERGY SOURCES **9**

Hydrogen, generation, storage, transport and utilisation, Applications: power generation, transport – Fuel cells – technologies, types – economics and the power generation.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Renewable Energy Sources course, the student will be able to

CO1: Understand the Concepts of energy conversions and understand the chronological evaluation of solar energy system..

CO2: Understand the chronological evaluation of Wind energy system and understand the function and process involved in the Hydel energy system.

CO3: Understand the function and process involved in the Geo thermal energy system and explain the working principle of the Ocean thermal power plant.

CO4: Analyze, understand and explain actual load of the power system and the central reserve system.

CO5: Analyze the various power fluctuation load system and explain Cost analysis of energy system.

TEXT BOOKS:

1. Rai G.D., "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 1999.
2. Sukhatme S.P., "Solar Energy", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.

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REFERENCES:

1. Godfrey Boyle, Renewable Energy, "Power for a Sustainable Future", Oxford University Press, U.K., 1996.
2. Twidell, J.W. & Weir, A., "Renewable Energy Sources", EFN Spon Ltd., UK, 1986.
3. Tiwari G.N., "Solar Energy – Fundamentals Design, Modeling and applications", Narosa Publishing House, New Delhi, 2002
4. Freris L.L., "Wind Energy Conversion systems", Prentice Hall, UK, 1990.

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PE 05	TURBO MACHINERY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the various systems, principles, operations and applications of different types of turbo machinery components

UNIT I STEAM TURBINES **9**

Steam Turbines-Types of turbines, constructional details, application of turbines, types of seals, and packing to reduce leakage, losses in turbines. Compounding of turbine, velocity diagrams, output efficiency, losses in turbines, reaction turbine, velocity, diagrams, degree of reaction, constructional features of blades. Governing of turbines.

UNIT II GAS TURBINES **9**

Gas Turbine-Theory and fundamentals of gas turbines, principles, classification, Joule‟s cycles, assumptions for simple gas turbines, cycle analysis, work ratio, concept of maximum and optimum pressure ratio, actual cycle, effect of operating variable on thermal efficiency. Regeneration, inter cooling, reheating, their effects on performance. Closed cycle and semi closed cycles gas turbine plant/ Applications of gas turbines.

UNIT III JET ENGINES **9**

Jet Propulsion-Introduction, types of jet engines, application of jet engines. Theory of jet propulsion, energy flow through jet engines, thrust, thrust power, and propulsive efficiency. Turbo jet, turbo prop, turbo fan engines, pulse jet and ram jet engines, performance characteristics thrust segmentation. Concept of rocket propulsion.

UNIT IV COMPRESSOR **9**

Rotary Compressor- Concepts of: Rotary compressors, Root blower and vane type compressors, Centrifugal compressors. Velocity diagram construction and expression for work done, introduction to slip factor, power input factor.

UNIT V HYDRAULIC TURBINES **9**

Hydraulic Turbines- Classification of hydraulic turbines, Heads & various efficiencies. Impulse momentum principle, Fixed and moving flat plate and curve vanes, series of plates & vanes. Velocity triangles and their analysis, work done, efficiency etc. Impulse turbine: Main components and constructional features of pelton wheel, velocity diagrams & work done, condition for max. Hydraulic Efficiency, number of buckets, jets, Non dimensional parameters (speed ratio, jet ratio).Governing mechanisms for pelton wheel. Reaction turbine, main components & constructional features, types of reaction turbine (Francis, Kaplan), draft tube types, efficiency, cavitation, , Francis, Kaplan turbines, Types of characteristic curves, unit quantities, selection of turbine considering various factors, specific speed, Application of similarity as applied to turbines, scale effect.

TOTAL: 45 Hours

COURSE OUTCOMES

After successful completion of the Turbo Machinery course, the student will be a

CO1: Understand the working principles of Steam Turbines.

CO2: Understand the performance and working of Gas Turbines.

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CO3: Study and analyze the performance characteristics of Jet Engines.

CO4: Study and analyze the concepts of compressors.

CO5: Study the working principles and types of Hydraulic Turbines.

TEXT BOOKS:

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

REFERENCES:

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

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PE 06	WELDING TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the basics of welding and to know about the various types of welding processes

UNIT I INTRODUCTION **9**

Introduction- Welding as a production process – its advantages and limitations. Gas welding process, Types of fuels, Acetylene, Indane, Butane etc. Gas welding equipment, Gas welding technique. Electric arc welding – Manual metal arc welding – Power supplies, cables and other accessories for arc welding, Welding technique - atomic, hydrogen welding, Thermit welding, soldering, brazing and braze welding.

UNIT II SPECIAL WELDING PROCESS **9**

Special Welding Processes- Power sources, equipments and accessories, application, limitation and other characteristics of: (a) Gas tungsten arc (TIG) welding (b) Gas metal arc (MIG) welding (c) Submerged arc welding (d) Electro slag welding processes. Resistance welding processes-principle-Types (spot, seam, projection, percussion, flash), Equipment required for each application.

UNIT III MODERN WELDING PROCESS **9**

Modern Welding Processes-Electron beam welding, Laser beam welding, Plasma arc welding, Friction welding, Explosive welding, Ultrasonic welding, Stud welding, Under water welding, Diffusion bonding, Cold welding, Welding of dissimilar metals.

UNIT IV WELDING DEFECTS AND TESTING **9**

Weldment Testing- Defects in welding in various processes-Causes and remedies; Destructive testing of weldments - Strength, hardness, ductility, fatigue, creep properties etc. Nondestructive testing of weldments; Ultrasonic dye penetrant, magnetic particle inspection. X-ray testing procedures and identification of defects – case studies. Weld thermal cycle – Residual stressed distortion in welding stress relieving techniques.

UNIT V DESIGN OF WELDMENTS **9**

Weldability, Automation And Design in Welding- Weldability – definition. Temperature distribution in welding –heat affected zone weldability of steel, cast iron. Aluminum, Pre heating and post heating of weldments. Estimation of transition temperature. Automation in welding – Seam tracking vision and arc sensing welding robots. Design of weldments-Welding symbols positions of welding joint and groove design. Weld stress –Calculations – Design of weld size.

TOTAL: 45 Hours

COURSE OUTCOMES

After successful completion of the welding technology course, the student will be able to

CO1: Understand the theoretical aspects of welding technology in depth.

CO2: Learn the special welding process

CO3: Study the various Modern Welding Processes

CO4: Identify the various welding defects and testing

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CO5: Design the various weldments

TEXT/REFERENCE BOOKS:

1. Radhakrishnan.V.M., "Welding Technology and Design", New Age International Pub. Ltd., 2019.
2. Little R.L., Welding Technology Tata McGraw-Hill, 1992.
3. Lancaster J.F., "Metallurgy of Welding", George Allen and Unwin, 1989.
4. R.S.Parmar, 'Welding Engineering and Technology', Khanna Publishers, 2010.
5. Baldev Raj, Shankar V, Bhaduri A K, "Welding Technology for Engineers", Narosa
6. Publications, 2009.

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PE 07	AUTOMOBILE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To understand the construction and working principle of various parts of an automobile.
- To have the practice for assembling and dismantling of engine parts and transmission system.

UNIT I VEHICLE STRUCTURE AND ENGINES 9

Types of automobiles vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines –components-functions and materials, variable valve timing (VVT).

UNIT II ENGINE AUXILIARY SYSTEMS 9

Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system.

UNIT III TRANSMISSION SYSTEMS 9

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

UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS 9

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS) and Traction Control

UNIT V ALTERNATIVE ENERGY SOURCES 9

Use of Natural Gas, Liquefied Petroleum Gas. Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell.

Note: *Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.*

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Automobile Engineering course, the student will be able to

CO1: Understand the basic vehicle structure and engines

CO2: Understand the various elements of engine auxiliary systems

CO3: Study and understand transmission systems

CO4: Study and understand the steering, brakes and suspension systems

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CO5: Study alternative energy sources

TEXT BOOKS:

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

REFERENCES:

1. Newton, Steeds and Garet, "Motor Vehicles", Butterworth Publishers, 1989.
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. Heinz Heisler, "Advanced Engine Technology," SAE International Publications USA, 1998.
5. R. Pugazhenthi, et.al., "Automobile Engineering", sams publications, 2015.
6. Ganesan V." Internal Combustion Engines", Third Edition, Tata Mcgraw-Hill, 2007.

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PE 08	TRIBOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To introduce and expose students to the field and fundamentals in tribology and its applications.

UNIT I INTRODUCTION **9**

Surfaces and Friction- Topography of Engineering surfaces- Contact between surfaces - Sources of sliding Friction -Adhesion Ploughint- Energy dissipation mechanisms, Friction Characteristics of metals - Friction of non-metals. Friction of lamellar solids - friction of Ceramic materials and polymers - Rolling Friction. Source of Rolling Friction - Stick slip motion - Measurement of Friction.

UNIT II TYPES OF WEAR **9**

Wear- Types of wear - Simple theory of Sliding Wear Mechanism of sliding wear of metals - Abrasive wear. Materials for Adhesive and Abrasive wear situations - Corrosive wear - Surface Fatigue wear situations - Brittle Fracture wear - Wear of Ceramics and Polymers – Wear Measurements.

UNIT III LUBRICATION **9**

Lubricants and Lubrication Types- Types and properties of Lubricants – Testing methods - Hydrodynamic Lubrication – Elasto hydrodynamic lubrication- Boundary Lubrication - Solid Lubrication Hydrostatic Lubrication.

UNIT IV THEORY OF LUBRICATION **9**

Film Lubrication Theory- Fluid film in simple shear - Viscous flow between very close parallel plates - Shear stress variation, Reynolds Equation for film Lubrication - High speed unloaded journal bearings - Loaded journal bearings - Reaction torque on the bearings –Virtual Coefficient of friction - The Somerfield diagram.

UNIT V SURFACE ENGINEERING AND MATERIALS FOR BEARINGS **9**

Surface modifications - Transformation Hardening, surface fusion - Thermo chemical processes - Surface coatings. Plating and anodizing Fusion Processes - Vapour Phase processes - Materials for rolling Element bearings - Materials for fluid film bearings - Materials for marginally lubricated and dry bearings.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Tribology course, the student will be able to

CO1: Understand the basic concepts of Tribology
CO2: Ability to identify different types of sliding & rolling friction, Wear and related theories
CO3: Ability to distinguish among the different Lubricant regime
CO4: Understand the basics of surface Engineering
CO5: Able to Select materials for bearing

TEXT/REFERENCE BOOKS:

1. I.M. Hutchings, Tribology, Friction and Wear of Engineering Material, Edward Arnold, 1998.
2. T.A. Stolarski, Tribology in Machine Design , Industrial Press Inc., 2010.
4. A. Cameron, Basic Lubrication theory , Longman, U.K.., 1981.

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PE 09	COMPUTER AIDED DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS 9

Product cycle- Design process- sequential and concurrent engineering- Computer aided design – CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations- homogeneous coordinates – Line drawing -Clipping- viewing transformation.

UNIT II GEOMETRIC MODELING 9

Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves- Techniques for surface modeling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG and B-rep.

UNIT III VISUAL REALISM 9

Hidden – Line-Surface-Solid removal algorithms – shading – colouring – computer animation.

UNIT IV ASSEMBLY OF PARTS 9

Assembly modeling – interferences of positions and orientation – tolerance analysis - mass property calculations – mechanism simulation and interference checking.

UNIT V CAD STANDARDS 9

Standards for computer graphics- Graphical Kernel System (GKS) – standards for exchange images- Open Graphics Library (OpenGL) – Data exchange standards – IGES, STEP, CALS etc. – communication standards.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the computer aided design course, the student will be able to

CO 1: Understand the basic concepts of fundamentals of computer graphics
CO 2: Understand the concepts of geometric modeling
CO 3: Understand the surface removal algorithm.
CO 4: Understand the mechanisms of simulation and interference.
CO 5: Understand the concepts of Standards for computer graphics

TEXT BOOKS:

1. Ibrahim Zeid, "Mastering CAD CAM", Tata McGraw-Hill Publishing Co.2007.

REFERENCES:

1. Chris McMahon and Jimmie Browne, "CAD/CAM Principles, Practice and Manufacturing management " Second Edition, Pearson Education, 1999.
2. William M Neumann and Robert F. Sproul "Principles of Computer Graphics", McGraw Hill Book Co. Singapore, 1989.
3. Donald Hearn and M. Pauline Baker "Computer Graphics"'. Prentice Hall, Inc, 1992.
4. Foley, Wan Dam, Feiner and Hughes – "Computer graphics principles & practice" Pearson Education – 2003.

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PE 10	GAS DYNAMICS AND JET PROPULSION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To understand the basic difference between incompressible and compressible flow.
- To understand the phenomenon of shock waves and its effect on flow.
- To gain some basic knowledge about jet propulsion and Rocket Propulsion.

(Use of Standard Gas Tables permitted)

UNIT I COMPRESSIBLE FLOW – FUNDAMENTALS 9

Energy and momentum equations for compressible fluid flows, various regions of flows, reference velocities, stagnation state, velocity of sound, critical states, Mach number, critical Mach number, types of waves, Mach cone, Mach angle, effect of Mach number on compressibility.

UNIT II FLOW THROUGH VARIABLE AREA DUCTS 9

Isentropic flow through variable area ducts, Nozzle flow - T-s and h-s diagrams for nozzle and diffuser flows, area ratio as a function of Mach number, mass flow rate through nozzles and diffusers, chocked mass flow rate of the nozzle - effect of friction in flow through nozzles.

UNIT III FLOW THROUGH CONSTANT AREA DUCTS 9

Flow in constant area ducts with friction – Fanno curves and Fanno flow equation, variation of flow properties, variation of Mach number with duct length. Isothermal flow with friction in constant area ducts. Flow in constant area ducts with heat transfer, Rayleigh line and Rayleigh flow equation, variation of flow properties, maximum heat transfer.

UNIT IV NORMAL SHOCK 9

Governing equations, variation of flow parameters like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock, Prandtl - Meyer equation, impossibility of shock in subsonic flows, flow in convergent and divergent nozzle with shock, normal shock in Fanno and Rayleigh flows, flow with oblique shock.

UNIT V PROPULSION 9

Aircraft propulsion – types of jet engines – energy flow through jet engines, study of turbojet engine components – diffuser, compressor, combustion chamber, turbine and exhaust systems, performance of turbo jet engines – thrust, thrust power, propulsive and overall efficiencies, thrust augmentation in turbo jet engine, ram jet and pulse jet engines. Rocket propulsion – rocket engines thrust equation – effective jet velocity specific impulse – rocket engine performance, solid and liquid propellants, comparison of different propulsion systems.

TOTAL: 45 Hours

Note: *(Use of approved gas tables is permitted in the University examination)*

COURSE OUTCOMES:

After successful completion of the Gas Dynamics and Jet Propulsion course, the student will be able to

CO 1: Understand the basic concepts and laws of fluid flows using Mach number and to understand the isentropic flow characteristics in nozzles.

CO 2: Analyze the flow through ducts with friction (Fanno flow) and heat transfer (Rayleigh flow).

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CO 3: Analyze the flow with normal and oblique shocks.

CO 4: Apply the concepts of gas dynamics principles in various jet propulsion systems.

CO 5 Apply the concepts of gas dynamics principles in various rocket propulsion systems.

TEXT BOOKS:

1. Yahya. S.M., "Fundamental of compressible flow", New Age International (p) Ltd., New Delhi, 1996.
2. Patrich.H. Oosthvizen, William E. Carscallen, "Compressible fluid flow", McGraw-Hill, 1997.

REFERENCES:

1. Cohen. H., Rogers R.E.C and Sravanamutoo, "Gas turbine theory", Addison Wesley Ltd., 1987.
2. Ganesan. V., "Gas Turbines", Tata McGraw-Hill, New Delhi, 1999.
3. Rathakrishnan. E, "Gas Dynamics", Prentice Hall of India, New Delhi, 2001.

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PE 11	MODERN CONTROL THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- The objective is to study controllability and observability that are the basis of modern control theory, and also understand design methods such as optimal regulators. It is hoped that the course provides a basis for a more advanced topic such as robust control theory

UNIT I INTRODUCTION **9**

Introduction-State Space analysis of continuous time multivariable systems: State equations for dynamic systems, State equations using phase, physical and canonical variables, realization of transfer matrices, Minimal realization, Solution of state equation, concepts of controllability, reachability, observability, Controllability and Observability tests: Kalman's test matrix, Gilbert's test, Popov-Belevitch-Hautus test, stability.

UNIT II CONTROL THEOREM AND TRANSFORMATION **9**

Discrete time control systems: sampling theorem, pulse transfer function, modified Ztransform, stability analysis.

UNIT III ANALYSIS OF SYSTEMS **9**

Approach- State space analysis of discrete time multivariable systems: Discretization of State equations for dynamic systems, State equations using phase, physical and canonical variables, realization of transfer matrices, Minimal realization, Solution of state equation, stability.

UNIT IV MATRIX FRACTION DESCRIPTION **9**

Transfer function-State Space and Matrix-Fraction Descriptions of Multivariable systems: State observability, controllability and matrix-fraction descriptions, Some properties of polynomial matrices, Some basic state space realization, The Smith-McMillan form of a transfer function matrix, Poles and Zeros of a transfer function matrix, Matrix-fraction description (MFD) of a transfer function, State space realization from a transfer function matrix, Internal stability, The generalized Nyquist and inverse Nyquist stability criterion.

UNIT V PARAMETERIZATION TECHNIQUES **9**

Parameterization techniques-Controller parameterization: Affine parameterization for stable systems, PID synthesis using Affine parameterization, Affine parameterization for systems with dead time. Affine parameterization of multivariable control systems.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Modern Control Theory course, the student will be able to

- **CO1:** Study the basic state Space analysis of continuous time multivariable systems and lean the concepts of controllability, reachability, observability, Controllability and Observability.
- **CO2:** Understand the Transfer function and Matrix-Fraction Descriptions of Multivariable systems.
- **CO3:** Analyze the equations for phase, physical and canonical variables of dynamic systems.
- **CO4:** Study some basic properties of polynomial matrices, space realization and the Smith-McMillan transfer function matrix.
- **CO5:** Understand and analyze the parameterization techniques for stable systems

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TEXT/REFERENCE BOOKS:

1. Chen C. T., „Linear Systems: Theory & Design", Oxford University Press New York, 1984.
2. Gopal M., „Modern Control Systems Theory", New Age International New Delhi, 1984
3. Goodwin , Graebe S F & Salgado M E, „Control Systen Design", Prentice Hall, 1986.
4. Ogata K., "Discrete Time Control Systems", Prentice Hall of India, Delhi, 1997.

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PE 12	COMPUTATIONAL FLUID DYNAMICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- The objective of the course is to learn how to solve the Navier-Stokes and Euler equations for engineering problems using computational algorithms and programming. Various numerical solution techniques will be introduced and applied to several course projects.

UNIT I FINITE DIFFERENCE METHODS **9**

Governing Differential Equations and Finite Difference Method- Classification of PDEs - Initial and Boundary conditions - Initial and Boundary value problems - Finite difference method - Central, Forward, Backward difference for a uniform grid – Central difference expressions for a non-uniform grid - Numerical error - Accuracy of solution – Grid independence test.

UNIT II CONDUCTION HEAT TRANSFER **9**

Conduction Heat Transfer- Applications of Heat conduction - Steady and Unsteady conductions - One dimensional steady state problems - Two dimensional steady state problems - Three dimensional steady state problems - Transient one dimensional problems.

UNIT III CONVECTION HEAT TRANSFER **9**

Convection Heat Transfer- Introduction - Steady one dimensional Convection Diffusion - Unsteady one. Dimensional Convection – Diffusion – Unsteady two dimensional Convection - Diffusion.

UNIT IV INCOMPRESSIBLE FLUID FLOW **9**

Incompressible Fluid Flow- Introduction - Governing equations - Difficulties in solving Navier- Stokes equation - Stream function - Vorticity method - In viscid flow (steady) - Determination of pressure for viscous flow.

UNIT V APPLICATIONS OF COMPUTATIONAL FLUID DYNAMICS **9**

Applications of Computational Fluid Dynamics- Computer graphics in CFD - Future of CFD - Enhancing the design process - understanding - Applications - Automobile, Engine, Industrial, Civil, Environmental.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the computational fluid dynamics course, the student will be able to

CO1: Understand basic properties of computational methods – accuracy of solutions, stability, consistency.

CO2: Learn computational solution techniques for time integration of ordinary differential equations.

CO3: Learn computational solution techniques for various types of partial differential equations.

CO4: Learn how to computationally solve Euler and Navier-Stokes equations.

CO5: Acquire basic programming and graphic skills to conduct the flow field calculations and data analysis.

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TEXT BOOKS:

1. Versteeg, H.K., and Malalasekera, W.,"An Introduction to Computational Fluid Dynamics": The finite volume Method, Pearson Education, 2014.
2. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill, 1998.

REFERENCES:

1. John. F. Wendt, "Computational Fluid Dynamics – An Introduction", Springer, 2013.
2. K.Muralidhar&T.Sundararajan, Computational Fluid Flow and Heat Transfer, Narora Publishing House, 1994.
3. Suhas V, Patankar, "Numerical Heat transfer and Fluid flow", Taylor & Francis, 2009.
4. Uriel Frisch, Turbulence, Cambridge University Press, 1999.
5. YogeshJaluria& Kenneth E. Torrance, "Computational Heat Transfer", CRC press, 2002.

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PE 13	INDUSTRIAL ROBOTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- The objective of the course is to provide a mathematical introduction to the mechanics and control of robots that can be modeled as kinematic chains.

UNIT I INTRODUCTION **9**

Introduction to Robotics- Robot, Robotics, Types of Robot, Robot classification, Types of Robot, Degrees of freedom.

UNIT II KINEMATICS AND DYNAMICS OF ROBOTIC LINKS **9**

Kinematics and Dynamics of Robotic linkages (open ended type manipulators)- Frames, Transformations: Translation and rotation, Denavit-Hartenberg parameters, Forward and Inverse Kinematics, Jacobian, Dynamics: Equations of motion, Newton-Euler formulation.

UNIT III SENSORS AND ACTUATORS **9**

Sensors and actuators- Strain gauge, resistive potentiometers, Tactile and force sensors, tachometers, LVDT, Piezoelectric accelerometer, Hall effect sensors, Optical Encoders, Pneumatic and Hydraulic actuators, servo valves, DC motor, stepper motor, drives.

UNIT IV CONTROLLERS **9**

Control of Manipulators- Feedback control of II order linear systems, Joint control, Trajectory control, Controllers, PID control.

UNIT V ROBOT PROGRAMMING **9**

Robot Programming-Language-overview, commands for elementary operations.

TOTAL: 45 Hours

COURSE OUTCOMES

After successful completion of the Industrial Robotics course, the student will be able to

CO1: Identify the electrical, electronic and mechanical components and use of them design or machine elements and transmission system.

CO2: Understand the features and operation of automation products.

CO3: Identify the various sensors and actuators using in the manufacturing cells with robotic control.

CO4: Understand the various controllers' manipulators using in industrial robotics.

CO5: Write the programming for the industrial robotics.

TEXT/REFERENCE BOOKS:

1. Fu. K.S, Gonzalez. R.C, Lee. C.S.G "Robotics – Control, Sensing, Vision, and Intelligence", McGraw Hill, 2015.
2. GrooverMikell .P, "Industrial Robotics -Technology Programming and Applications", McGraw Hill, 2014.
3. Craig J.J., "Introduction to Robotics Mechanics and Control", Pearson Education, 2009.
4. Deb S.R., "Robotics Technology and Flexible Automation" Tata McGraw Hill Book Co., 2013.
5. Koren Y., "Robotics for Engineers", McGraw Hill Book Co., 1992 .

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PE 14	SIMULATION OF MECHANICAL SYSTEMS	L	T	P	C
		3	0	0	3

Simulation and Fault Identification, I. K. International Publishing House Pvt. Ltd.

COURSE OBJECTIVES:

- The objective for this course is to develop an understanding of the interaction of different components of a system. This understanding will include concepts such as analysis of rigid bodies, structural systems, hydraulic systems, thermal systems, electronic and mechatronic systems, multibody systems and control strategies.

UNIT I INTRODUCTION **9**

Introduction-A review of basic probability and statistics, random variables and their properties, Estimation of means variances and correlation.

UNIT II PHYSICAL MODELING **9**

Physical Modeling-Concept of System and environment, Continuous and discrete systems, Linear and nonlinear systems, Stochastic activities, Static and Dynamic models, Principles of modeling, Basic Simulation modeling, Role of simulation in model evaluation and studies, advantages of simulation.

UNIT III SYSTEM SIMULATION **9**

System Simulation and Approach-Techniques of simulation, Monte Carlo method, Experimental nature of simulation, Numerical computation techniques, Continuous system models, Analog and Hybrid simulation, Feedback systems, Computers in simulation studies, Simulation software packages. System Dynamics: Growth and Decay models, Logistic curves, System dynamics diagrams. Probability Concepts in Simulation: Stochastic variables, discrete and continuous probability functions, Random numbers, Generation of Random numbers.

UNIT IV SIMULATION OF MECHANICAL SYSTEMS **9**

Variance reduction techniques, Determination of length of simulation runs. Simulation of Mechanical Systems: Building of Simulation models, Simulation of translational and rotational mechanical systems, Simulation of hydraulic systems.

UNIT V SIMULATION OF MANUFACTURING SYSTEMS **9**

Simulation of waiting line systems, Job shop with material handling and Flexible manufacturing systems, Simulation software for manufacturing, Case studies.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Simulation of Mechanical Systems course, the student will be able to

CO1: Understand the probability and statistics.
CO2: Understand the physical Modelling.
CO3: Understand the system simulation approaches.
CO4: Understand the variance reduction techniques.
CO5: Understand the simulation of Manufacturing System.

TEXT / REFERENCE BOOKS:

1. Robert E. Shannon, "System Simulation: The Art and Science",Prentice Hall, 2000.
2. J. Schwarzenbach and K.F. Gill Edward Arnold, "System Modelling and Control", 1988.
3. M Close and Dean K. Frederick, "Modeling and Analysis of Dynamic Systems" Houghton Mifflin, 1986.

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PC 22	FINITE ELEMENT ANALYSIS	L	T	P	C
		3	1	0	3

OBJECTIVE:

- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To appreciate the use of FEM to a range of Engineering Problems.

UNIT I FINITE ELEMENT FORMULATION OF BOUNDARY VALUE PROBLEMS 9

Weighted residual methods –general weighted residual statement – weak formulation of the weighted residual statement –comparisons – piecewise continuous trial functions- example of a bar finite element –functional and differential forms – principle of stationary total potential – Rayleigh Ritz method – piecewise continuous trial functions – finite element method – application to bar element.

UNIT II ONE DIMENSIONAL FINITE ELEMENT ANALYSIS 9

General form of total potential for 1-D applications – generic form of finite element equations – linear bar element – quadratic element –nodal approximation – development of shape functions –element matrices and vectors – example problems – extension to plane truss– development of element equations – assembly – element connectivity – global equations – solution methods – beam element – nodal approximation – shape functions – element matrices and vectors – assembly – solution – example problems.

UNIT III TWO DIMENSIONAL FINITE ELEMENT ANALYSIS 9

Introduction – approximation of geometry and field variable – 3 noded triangular elements – four noded rectangular elements – higher order elements – generalized coordinates approach to nodal approximations – difficulties – natural coordinates and coordinate transformations – triangular and quadrilateral elements – iso-parametric elements – structural mechanics applications in 2-dimensions – elasticity equations – stress strain relations – plane problems of elasticity – element equations – assembly –example problems in plane stress, plane strain and axisymmetric applications.

UNIT IV DYNAMIC ANALYSIS USING FINITE ELEMENT METHOD 9

Introduction – vibrational problems – equations of motion based on weak form – longitudinal vibration of bars – transverse vibration of beams – consistent mass matrices – element equations –solution of eigenvalue problems – vector iteration methods – normal modes – transient vibrations – modeling of damping – mode superposition technique – direct integration methods.

UNIT V APPLICATIONS IN HEAT TRANSFER & FLUID MECHANICS 9

One dimensional heat transfer element – application to one-dimensional heat transfer problems- scalar variable problems in 2-Dimensions – Applications to heat transfer in 2-Dimension – Application to problems in fluid mechanics in 2-Dimensional.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Finite Element Analysis course, the student will be able to

CO1: Understand the basics of finite element method.

CO2: Solve the problems on one dimensional structures including trusses, beams and frames.

CO3: Solve the problems on two dimensional structures including plain stress, plane strain and axisymmetric applications.

CO4: Understand and solve problems on longitudinal and transverse vibration problems.

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CO5: Understand and solve two dimensional problems in the applications of fluid mechanics and heat transfer.

TEXT BOOK:

1. P.Seshu, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.

REFERENCE BOOKS:

1. J.N.Reddy, "An Introduction to the Finite Element Method", McGraw-Hill International Editions (Engineering Mechanics Series), 1993.
2. Chandrupatla & Belagundu, "Introduction to Finite Elements in Engineering", 3rd Edition, Prentice-Hall of India, Eastern Economy Editions, 2000.
3. David V.Hutton, "Fundamentals of Finite Element Analysis", Tata McGraw-Hill Edition 2005.
4. Cook,Robert.D., Plesha,Michael.E&Witt,Robert.J. "Concepts and Applications of Finite Element Analysis",Wiley Student Edition, 2004.

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PE 16	UNCONVENTIONAL MACHINING PROCESSES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To learn about various unconventional machining processes, the various process parameters and their influence on performance and their applications.

UNIT I INTRODUCTION AND MECHANICAL ENERGY BASED PROCESSES 9

Unconventional machining Process – Need – classification – merits, demerits and applications. Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining - Ultrasonic Machining. (AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR-Applications.

UNIT II THERMAL AND ELECTRICAL ENERGY BASED PROCESSES 9

Electric Discharge Machining (EDM) – Wire cut EDM – Working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing –– Applications. Laser Beam machining and drilling, (LBM), plasma, Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications.

UNIT III CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES 9

Chemical machining and Electro-Chemical machining (CHM and ECM)- Etchants – Maskant - techniques of applying maskants - Process Parameters – Surface finish and MRR-Applications. Principles of ECM- equipments-Surface Roughness and MRR Electrical circuit-Process Parameters-ECG and ECH - Applications.

UNIT IV ADVANCED NANO FINISHING PROCESSES 9

Abrasive flow machining, chemo-mechanical polishing, magnetic abrasive finishing, magneto rheological finishing, magneto rheological abrasive flow finishing their working principles, equipments, effect of process parameters, applications, advantages and limitations.

UNIT V RECENT TRENDS IN NON-TRADITIONAL MACHINING PROCESSES 9

Recent developments in non-traditional machining processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Comparison of non-traditional machining processes.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Unconventional Machining Processes course, the student will be able to

CO1: Explain the need for unconventional machining processes and its classification.

CO2: Compare various thermal energy and electrical energy based unconventional machining processes.

CO3: Summarize various chemical and electro-chemical energy based unconventional machining processes.

CO4: Explain various nano abrasives based unconventional machining processes.

CO5: Distinguish various recent trends based unconventional machining processes.

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TEXT / REFERENCES BOOKS:

1. Vijay. K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd., New Delhi, 2002.
2. Benedict. G.F., "Nontraditional Manufacturing Processes" Marcel Dekker Inc., New York, 1987.
3. Pandey P.C. and Shan H.S. "Modern Machining Processes", Tata McGraw-Hill, New Delhi. 1980.
4. McGeough, "Advanced Methods of Machining", Chapman and Hall, London, 1998.

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PE 17	DESIGN AND OPTIMIZATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- This course aims at providing basic knowledge in recent design optimization methods and tools. Typical examples of design optimization problems involve the minimization of structural weight and cost while satisfying performance constraints.

UNIT I INTRODUCTION **9**

Introduction to Optimum design. Introduction to detail design optimization by simulation, prototyping and optimum. Selection of configuration, materials and processes.

UNIT II OPTIMIZATION APPROACH **9**

Optimization approach-Classical mathematical methods of optimization. Mechanical System Design problem-economic political environment, issues of human safety & welfare, and professional ethics.

UNIT III OPTIMUM MECHANICAL DESIGN CONCEPTS **9**

Overview and application of optimization methods to machine elements and mechanical system design. Prototyping, simulation, and use of standards for detail design optimization.

UNIT IV OPTIMIZATION TECHNIQUES **9**

Optimization techniques- Optimum selection of material & processes in mechanical design using material selection charts and optimization methods.

UNIT V APPLICATIONS OF OPTIMIZING **9**

Applications- Optimizing product design functionality, aesthetics and economics by employing industrial design principles and by suitable selection of material & processing including use of polymers, composites and other non metallic materials.

TOTAL: 45 Hours

COURSE OUTCOME:

After successful completion of the Design and Optimization course, the student will be able to

CO1: Learn the basics concepts of optimum design.

CO2: Study the various types of optimization techniques.

CO3: Understand the optimum mechanical design concepts.

CO4: Apply the optimization techniques on material selection.

CO5: Know the applications of optimization in the mechanical design.

TEXT/REFERENCE BOOKS:

1. H. Adeli. Advances in Design Optimization, 1998.

2. Robert F. Rhyder, Manufacturing Process Design and Optimization, , New York: Marcel Dekker, 2000.

3. S.S. Rao, Optimization: Theory & Application Wiley Eastern, 1986.

4. K. Deb, Optimization for engineering design, Prentice Hall India, 1999.

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PE 18	QUANTITY PRODUCTION METHODS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- By studying this course, the students can able to know the Production methods and its applications and non-traditional processes.

UNIT I INTRODUCTION **9**

Introduction-Engineering production; Aim and objectives, history of progress, definition and requirements. Levels of production; piece, batch, lot, mass and quantity production, Mechanization and automation; need, degree and types of automation, Role of automation on industrial production.

UNIT II CLASSIFICATIONS OF PRODUCTION METHODS **9**

Classifications and methods- Broad classification of engineering production methods. Major sequential steps in industrial production; performing, semi finishing, treatments finishing and assembly and inspection at different levels. Quantity production methods of common engineering components; metallic rods, bars, plates, sheets, tubes and wire; shafts and spindles. Metallic discs, pulley, rims, clutches and cams; threaded objects; screws, bolt and nuts, and lead screws different types of bearings; gears (teeth); comparison of the methods w.r.t. process, productivity, product-quality and economy automobile parts; engine block, piston, connecting rod and crank shaft. Methods of quantity production of cutting tools and tool inserts. Small size products in large volume; pins, clips, needles, metallic caps of bottles, washers, metallic utensils, chain links, paste tubes and coins; Quantity production by spinning, bulging, hydroforming, magneto forming and explosive forming.

UNIT III APPLICATIONS OF QUANTITY PRODUCTION **9**

Applications of quantity production-Process planning and scheduling for quantity production in; single spindle automatic lathe, transfer machines, CNC machine tools, Design and use of jigs and fixtures in machine shops.

UNIT IV MECHANIZATION OF QUANTITY PRODUCTION **9**

Mechanization of quantity production- Group technology; principle and application in quantity production. Inspection and quality control in quantity production. Computerization and robotization in quantity production.

UNIT V QUANTITY METHODS FOR NON-TRADITIONAL PROCESSES **9**

Quantity methods for non-traditional processes- Quantity production by non-traditional manufacturing processes. Methods and systems of quantity production of various ceramic and polymer products of common use.

TOTAL: 45 Hours

COURSE OUTCOME:

After successful completion of the Quantity Production Methods course, the student will be able to

CO1: Understand the basics of Engineering Production.

CO2: Know the different types of Production Methods.

CO3: Understand the applications of Quantity Production.

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CO4: Know Mechanization of quantity production.

CO5: Understand the non-traditional processes of production.

TEXT/REFERENCE BOOKS:

1. Bhandari V B, "Design of Machine Elements", 4th Edition , Tata McGraw-Hill Book Co, 2016
2. Joseph Shigley, Richard G. Budynas and J. Keith Nisbett "Mechanical Engineering Design", 10th Edition, Tata McGraw-Hill , 2015.
3. Ansel C Ugural, "Mechanical Design – An Integral Approach", 1st Edition, Tata McGraw-Hill Book Co, 2004.
4. Design Data Hand Book", PSG College of Technology, Coimbatore, 2013.
5. Merhyle Franklin Spotts, Terry E. Shoup, and Lee EmreyHornberger, "Design of Machine Elements" 8th Edition, Printice Hall, 2004.
6. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine component Design",6th Edition, Wiley, 2017.
7. Sundararajamoorthy T. V. and Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.

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PE 19	THEORY OF COMBUSTION AND EMISSION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To demonstrate extensive mastery of the fundamental principles which govern the design and operation of internal combustion engines as well as a sound technical framework for understanding real world problems.
- To understand combustion in spark ignition and diesel engines.
- To identify the nature and extent of the problem of pollutant formation and control in internal combustion engines.

UNIT I INTRODUCTION **9**

Combustion Principles- Combustion - Combustion equations, heat of combustion - Theoretical flame temperature, Chemical equilibrium and dissociation - Theories of Combustion - Pre-flame reactions, Reaction rates-Laminar and Turbulent, Flame Propagation in Engines.

UNIT II SI ENGINES **9**

Combustion in SI Engine- Initiation of combustion, stages of combustion, normal and abnormal combustion, knocking combustion, pre-ignition, knock and engine variables, features and design consideration of combustion chambers.- Flame structure and speed, Cycle by cycle variations, Lean burn combustion, stratified charge combustion systems. Heat release correlations. After treatment devices for SI engines.

UNIT III CI ENGINES **9**

Combustion in CI Engine- Stages of combustion, vaporization of fuel droplets and spray formation, air motion, swirl measurement, knock and engine variables, features and design considerations of combustion chambers- delay period correlations, heat release correlations, and influence of the injection system on combustion. Direct and indirect injection systems. After treatment devices for diesel engines.

UNIT IV GAS TURBINES **9**

Combustion in Gas Turbines- Flame stability, re-circulation zone and requirements – Combustion chamber configuration, materials.

UNIT V EMISSION CHARACTERISTICS **9**

Emissions- Main pollutants in engines, Kinetics of NO formation, NOx formation in SI and CI engines. Unburned-hydrocarbons, sources, formation in SI and CI engines, Soot formation and oxidation, Particulates in diesel engines, Emission control measures for SI and CI engines, Effect of emissions on Environment and human beings.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Theory of Combustion and Emission course, the student will be able to

CO1: Understand the chemical equilibrium and dissociation during combustion.

CO2: Understand the various stages of combustion of the SI Engines.

CO3: Understand the various stages of combustion of the CI Engines.

CO4: Know the Flame stability, re-circulation zone, requirements of the combustion chamber of the Gas turbine.

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CO5: Understand the emission characteristics of NOx formation in SI and CI engines.

TEXT/REFERENCE BOOKS:

1. V .Ganesan, Internal Combustion Engines, Tata McGraw Hill Book Co., 2000.
2. John B. Heywood, Internal Combustion Engine Fundamentals. Tata McGraw Hill New Delhi, 1988.
3. Mathur, M. L, and Sharma. R. P., A Course in Internal Combustion Engines, Dhanpat Rai-Publications New Delhi, 1987.
4. Obert, E. F., Internal Combustion Engine and Air Pollution, International Text Book Publishers, 1986.
5. K.K. Ramalingam, Internal Combustion Engines, Scitech Publications (India) Pvt. Ltd., 1987.
6. Cohen, H, Rogers, G. E. C, and Saravanamuttoo, H. I. H., Gas Turbine Theory, Longmans, 1999.

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PE 20	MECHATRONICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To impart knowledge about the elements and techniques involved in Mechatronics systems Which are very much essential to understand the emerging field of automation.

UNIT I MECHATRONICS, SENSORS AND TRANSDUCERS **9**

Introduction to Mechatronics Systems – Measurement Systems – Control Systems – Microprocessor based Controllers. Sensors and Transducers – Performance Terminology – Sensors for Displacement, Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Light Sensors – Selection of Sensors.

UNIT II ACTUATION SYSTEMS **9**

Pneumatic and Hydraulic Systems – Directional Control Valves – Rotary Actuators. Mechanical Actuation Systems – Cams – Gear Trains – Ratchet and pawl – Belt and Chain Drives – Bearings. Electrical Actuation Systems – Mechanical Switches – Solid State Switches – Solenoids – Construction and working principle of DC and AC Motors – speed control of AC and DC drives, Stepper Motors-switching circuitries for stepper motor – AC & DC Servo motors.

UNIT III SYSTEM MODELS AND CONTROLLERS **9**

Building blocks of Mechanical, Electrical, Fluid and Thermal Systems, Rotational – Transnational Systems, Electromechanical Systems – Hydraulic – Mechanical Systems. Continuous and discrete process Controllers – Control Mode – Two – Step mode – Proportional Mode – Derivative Mode – Integral Mode – PID Controllers – Digital Controllers – Velocity Control – Adaptive Control – Digital Logic Control – Micro Processors Control.

UNIT IV PROGRAMMING LOGIC CONTROLLERS **9**

Programmable Logic Controllers – Basic Structure – Input / Output Processing – Programming – Mnemonics – Timers, Internal relays and counters – Shift Registers – Master and Jump Controls – Data Handling – Analogs Input / Output – Selection of a PLC.

UNIT V DESIGN OF MECHATRONICS SYSTEM **9**

Stages in designing Mechatronics Systems – Traditional and Mechatronic Design - Possible Design Solutions. Case studies of Mechatronics systems- Pick and place Robot- Autonomous mobile robot-Wireless surveillance balloon- Engine Management system- Automatic car park barrier.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Mechatronics course, the student will be able to

CO1: Discuss the interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical, Electronic Systems and sensor technology.

CO2: Understand the different types of sensors and different types of Actuation Systems.

CO3: Recognize the development of Mechatronics systems.

CO4: Know the basics of Programmable Logic Control.

CO5: Study the various Mechatronics Systems in the mechanical engineering applications .

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TEXT BOOKS:

1. Bolton,W, “Mechatronics” , Pearson education, sixth edition, 2015.
2. Smaili.A and Mrad.F , " Mechatronics integrated technologies for intelligent machines", Oxford university press, 2008.

REFERENCE BOOKS:

1. Rajput. R.K, A textbook of mechatronics, S. Chand & Co, 2007.
2. Michael B. Histand and David G. Alciatore, “Introduction to Mechatronics and Measurement Systems”, McGraw-Hill International Editions, 2000.
3. Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, “Mechatronics”, Chapman and Hall, 1993.
4. Dan Necsulesu, “Mechatronics”, Pearson Education Asia, 2002.
5. Lawrence J. Kamm, “Understanding Electro – Mechanical Engineering”, An Introduction to Mechatronics, Prentice – Hall of India Pvt., Ltd., 2000.
6. Nitaigour Premchand Mahadik, “Mechatronics”, Tata McGraw-Hill publishing Company Ltd, 2003.

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PE 21	COMPUTER INTEGRATED MANUFACTURING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To understand the application of computers in various aspects of manufacturing viz., design, proper planning, manufacturing cost, layout & material handling system.

UNIT I COMPUTER AIDED DESIGN **9**

Concept of CAD as drafting and designing facility, desirable features of CAD package, drawing features in CAD – Scaling, rotation, translation, editing, dimensioning, labeling, Zoom, pan, redraw and regenerate, typical CAD command structure, wire frame modeling, surface modeling and solid modeling (concepts only) in relation to popular CAD packages.

UNIT II COMPONENTS OF CIM **9**

CIM as a concept and a technology, CASA/SME model of CIM, CIM II, benefits of CIM, communication matrix in CIM, fundamentals of computer communication in CIM – CIM data transmission methods – serial, parallel, asynchronous, synchronous, modulation, demodulation, simplex and duplex. Types of communication in CIM – point to point (PTP), star and multiplexing. Computer networking in CIM – the seven layer OSI model, LAN model, MAP model, network topologies – star, ring and bus, advantages of networks in CIM.

UNIT III GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING **9**

History Of Group Technology – role of G.T in CAD/CAM Integration – part families- classification and coding – DCLASS and MCLASS and OPTIZ coding systems – facility design using G.T – benefits of G.T – cellular manufacturing. Process planning - role of process planning in CAD/CAM Integration – approaches to computer aided process planning – variant approach and generative approaches – CAPP and CMPP systems.

UNIT IV SHOP FLOOR CONTROL AND INTRODUCTION TO FMS **9**

Shop floor control – phases – factory data collection system – automatic identification methods – Bar code technology – automated data collection system.

FMS – components of FMS – types – FMS workstation – material handling and storage system – FMS layout- computer control systems – applications and benefits.

UNIT V COMPUTER AIDED PLANNING AND CONTROL AND COMPUTER MONITORING **9**

Production planning and control – cost planning and control – inventory management – material requirements planning (MRP) – shop floor control, Lean and Agile Manufacturing. Types of production monitoring systems – structure model of manufacturing – process control and strategies – direct digital control.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Computer Integrated Manufacturing course, the student will be able to

CO1: Understand the basic Concepts of drafting, designing facility of CAD package and CAD drawing command structure.

CO2: Identify and classify the various communication system used in Computer integrated manufacturing.

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CO3: Understand the process planning and group technology.
CO4: Know the various Shop Floor Control and FMS.
CO5: Understand the Computer Aided Planning and Control.

TEXT BOOK:

1. Mikell. P. Groover "Automation, Production Systems and Computer Integrated Manufacturing", Pearson Education 2001.

REFERENCE BOOKS:

1. Mikell. P. Groover and Emory Zimmers Jr., "CAD/CAM", Pearson Education India, 2006.
2. James A. Regh and Henry W. Kreabber, "Computer Integrated Manufacturing", Pearson Education second edition, 2005.
3. Chris McMahon and Jimmie Browne, "CAD CAM Principles, Practice and Manufacturing Management", Pearson Education second edition, 2005.
4. Ranky, Paul G., "Computer Integrated Manufacturing", Prentice hall of India Pvt. Ltd., 2005.
5. YoremKoren, "Computer Integrated Manufacturing", McGraw Hill, 2005.
6. P N Rao, "CAD/CAM Principles and Applications", TMH Publications, 2007.

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PE 22	POWER PLANT ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

UNIT I INTRODUCTION TO POWER PLANTS AND BOILERS 9

Layout of Steam, Hydel , Diesel , MHD, Nuclear and Gas turbine Power Plants Combined Power cycles – comparison and selection , Load duration Curves Steam boilers and cycles – High pressure and Super Critical Boilers – Fluidized Bed Boilers.

UNIT II STEAM POWER PLANT 9

Rankine Cycle: Classification – Reheat cycle – Regenerative cycle – Reheat – regenerative cycle. Fuel and ash handling, Combustion Equipment for burning coal, Mechanical Stokers. Pulveriser, Electrostatic Precipitator, Draught- Different Types, Surface condenser types, cooling Towers.

UNIT III NUCLEAR AND HYDEL POWER PLANTS 9

Nuclear Energy-Fission , Fusion Reaction, Types of Reactors, Pressurized water reactor ,Boiling water reactor, Waste disposal and safety Hydel Power plant- Essential elements, Selection of turbines, governing of Turbines- Micro hydel developments.

UNIT IV DIESEL AND GAS TURBINE POWER PLANT 9

Types of diesel plants, components, Selection of Engine type, applications- Gas turbine plant cycle – classification – simple cycle – regenerative cycle – reheat cycle – regenerative – reheat cycle – inter-cooling. Steam and gas turbine Power plants – cycle analysis.

UNIT V OTHER POWER PLANTS AND ECONOMICS OF POWER PLANTS 9

Geo thermal- OTEC- Tidel- Pumped storage –Solar central receiver system Cost of electric Energy- Fixed and operating costs-Energy rates- Types tariffs- Economics of load sharing, comparison of various power plants.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Power Plant Engineering course, the student will be able to

- **CO1:** Understand the functions of the component of power plant, modern boilers & subsystems of power plants.
- **CO2:** Solve problems based on rankine cycle and binary cycle and explain the subsystems of steam power plant.
- **CO3:** Evaluate the design layout and working of Nuclear and hydroelectric power plants.
- **CO4:** Analyze diesel and gas turbine power plant.
- **CO5:** Analyze economic of power plants and feasibility of its implications on power generating units.

TEXT / REFERENCE BOOKS:

1. EI-Wakil M.M, Power "Plant Technology," Tata McGraw-Hill 1984.
2. Nag P. K, "Power Plant Engineering", Third edition Tata McGraw- Hill, 2007.
3. Arora S.C and Domkundwar S, "A Course in Power Plant Engineering", DhanpatRai , 2001.
4. K. K. Ramalingam, "Power Plant Engineering", Scitech Publications, 2002.
5. G. R. Nagpal, "Power Plant Engineering", Khanna Publishers, 1998.

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PE 23	ADVANCED I.C. ENGINES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To understand the underlying principles of operation of different IC Engines and components.
- To provide knowledge on pollutant formation, control, alternate fuel etc.

UNIT I SPARK IGNITION ENGINES **9**

Mixture requirements – Fuel injection systems – Mono point, Multipoint & Direct injection - Stages of combustion – Normal and Abnormal combustion – Knock - Factors affecting knock – Combustion chambers.

UNIT II COMPRESSION IGNITION ENGINES **9**

Diesel Fuel Injection Systems - Stages of combustion – Knocking – Factors affecting knock – Direct and Indirect injection systems – Combustion chambers – Fuel Spray behavior – Spray structure and spray penetration – Air motion - Introduction to Turbocharging.

UNIT III POLLUTANT FORMATION AND CONTROL **9**

Pollutant – Sources – Formation of Carbon Monoxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters, Selective Catalytic Reduction and Particulate Traps – Methods of measurement – Emission norms and Driving cycles.

UNIT IV ALTERNATIVE FUELS **9**

Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits - Engine Modifications.

UNIT V RECENT TRENDS **9**

Air assisted Combustion, Homogeneous charge compression ignition engines – Variable Geometry turbochargers – Common Rail Direct Injection Systems - Hybrid Electric Vehicles – NOx Adsorbers - Onboard Diagnostics.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Advanced I.C Engine course, the student will be able to

CO1: Analyze and understand the reasons for differences among operating characteristics of different engine types and designs.

CO2: Predict the concentration of Primary exhaust pollutants based on an in-depth analysis of the combustion process.

CO3: Analyze the skills to run engine dynamometer experiments and alternative fuels.

CO4: Compare and contrast experimental results with theoretical trends.

CO5: Develop the ability to optimize future engine designs for specific sets of constraints fuel economy, performance and emissions.

TEXT / REFERENCE BOOKS:

1. Ramalingam. K.K., "Internal Combustion Engine Fundamentals", Scitech Publications, 2002.
2. Ganesan, "Internal Combustion Engines", II Edition, TMH, 2002.
3. Mathur. R.B. and R.P. Sharma, "Internal Combustion Engines".,DhanpatRai& Sons 2007.
4. Duffy Smith, "Auto Fuel Systems", The Good Heart Willcox Company, Inc., 1987.

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PE 24	FUNDAMENTAL OF NANOSCIENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To understand the different types of stresses and their effects in pressure vessel.
- To understand the piping layout and the stresses acting on it.

UNIT I INTRODUCTION **9**

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering classifications of nanostructured materials- nano particles- quantum dots, nano wires-ultra-thin films ultilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, ptical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II PREPARATION METHODS **9**

Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES **9**

Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wetetching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography.

UNIT IV PREPARATION ENVIRONMENTS **9**

Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, Chemical purification, chemical and biological on tamination, Safety issues, flammable and toxichazards, biohazards.

UNIT V CHARACTERIZATION TECHNIQUES **9**

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM,STM, SNOM, ESCA, SIMS-Nano indentation.

TOTAL : 45 Hours

COURSE OUTCOMES:

After successful completion of the Product Development and Manufacture course, the student will be able to

CO1: Familiarize about the science of nanomaterials.

CO2: Know about the Preparation of the Environments.

CO3: Familiarize patterning and lithography for nanoscale devices.

CO4: Demonstrate the preparation of nanomaterials.

CO5: Develop knowledge in characteristic nanomaterial.

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TEXT BOOKS:

1. A.S. Edelstein and R.C. Cammearata, eds., Nano materials: Synthesis, Properties and Applications, (Institute of Physics Publishing, Bristol and Philadelphia, 1996)
2. N John Dinardo, Nano scale charecterisation of surfaces & Interfaces, Second edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCE BOOKS:

1. G Timp (Editor), Nanotechnology, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia (Editor) The Hand Book of Nano Technology, "NanometerStructure", Theory, Modeling and Simulations. Prentice-Hall of India (P) Ltd, NewDelhi, 2007.

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PE 25	PRODUCT DEVELOPMENT AND MANUFACTURE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To introduce the various concepts of product design tools and techniques while designing a product.

UNIT I INTRODUCTION **9**

Product Development process – Product development organizations, Gather raw data – Interpret raw data- organize the needs into a hierarchy – Relative importance of the needs. Product life cycle management - concepts, benefits, value addition to customer. Lifecycle Models- creation of projects and roles, users and project management, system administration, Access control and its use in life cycle.

UNIT II PRODUCT SPECIFICATIONS **9**

Establishing the product specifications– Target specifications – Refining specifications, concept, Generation-Clarify the problem – Search internally – Search externally – Explore systematically.

UNIT III PRODUCT ARCHITECTURE **9**

Concept selection- Screening – scoring, Product architecture – Implication of architecture – Establishing the architecture – Related system level design issues.

UNIT IV INDUSTRIAL DESIGN **9**

Need for industrial design – Impact of industrial design – Industrial design process – Management of industrial design process – Assessing the quality of industrial design, design for Manufacturing- cost considerations, Impact of DFM decisions on other factors.

UNIT V PRINCIPLES OF PROTOTYPING AND ECONOMIC ANALYSIS **9**

Principles of prototyping – Planning for prototypes, economics of product development projects, Elements of economic analysis – Base – Case financial model – Sensitivity analysis – Influence of the quantitative factors.

TOTAL: 45 Hours

COURSE OUTCOMES

After successful completion of the Product Development and Manufacture course, the student will be able to

CO1: Design some products for the given set of applications.
CO2: Understand and gain the knowledge through prototyping technology.
CO3: Make a prototype of a problem.
CO4: Know the economic analysis of prototyping.
CO5: Know the Industrial Design.

TEXT BOOKS:

1. Karal, T. Ulrich Steven D. Eppinger, Product Design and Development, McGraw Hill, International Editions, 2003.
2. Stephan C. Wheelwright, Kim B. Clark, Managing New Product and Process Development: Text and Cases, Free Press, 1992.

REFERENCE BOOKS:

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

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PE 26	FLEXIBLE MANUFACTURING SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To introduce the various Modern manufacturing systems.
- To understand the concepts and applications of flexible manufacturing systems

UNIT I PLANNING, SCHEDULING AND CONTROL OF FLEXIBLE MANUFACTURING SYSTEMS **9**

Introduction to FMS– development of manufacturing systems – benefits – major elements – types of flexibility – FMS application and flexibility –single product, single batch, n – batch scheduling problem – knowledge based scheduling system.

UNIT II COMPUTER CONTROL AND SOFTWARE FOR FLEXIBLE MANUFACTURING SYSTEMS **9**

Introduction – composition of FMS– hierarchy of computer control –computer control of work center and assembly lines – FMS supervisory computer control – types of software specification and selection – trends.

UNIT III FMS SIMULATION AND DATA BASE **9**

Application of simulation – model of FMS– simulation software – limitation – manufacturing data systems – data flow – FMS database systems – planning for FMS database.

UNIT IV GROUP TECHNOLOGY AND JUSTIFICATION OF FMS **9**

Introduction – matrix formulation – mathematical programming formulation –graph formulation – knowledge based system for group technology – economic justification of FMS-application of possibility distributions in FMS systems justification.

UNIT V APPLICATIONS OF FMS AND FACTORY OF THE FUTURE **9**

FMS application in machining, sheet metal fabrication, prismatic component production – aerospace application – FMS development towards factories of the future – artificial intelligence and expert systems in FMS – design philosophy and characteristics for future.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Product Development and Manufacture course, the student will be able to

CO1: Perform Planning, Scheduling and control of Flexible Manufacturing systems

CO2: Perform simulation on software's use of group technology to product classification

CO3: Make a prototype of a FMS simulation and data base.

CO4: Make Group Technology and justification of FMS layout

CO5: Identify the applications of FMS and factory of the future

TEXT BOOKS:

1. Jha, N.K. "Handbook of flexible manufacturing systems", Academic Press Inc., 1991.
2. DR. H.K. Shivanand, M.M. Benal, V. Koti, "Flexible Manufacturing Systems", New Age International (P) Limited, Publishers, 2006.

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REFERENCES:

1. Radhakrishnan P. and Subramanyan S., "CAD/CAM/CIM", Wiley Eastern Ltd., New Age International Ltd., 1994.
2. Raouf, A. and Ben-Daya, M., Editors, "Flexible manufacturing systems: recent development", Elsevier Science, 1995.
3. Groover M.P., "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India Pvt., New Delhi, 1996.
4. Kalpakjian, "Manufacturing Engineering and Technology", Addison-Wesley Publishsing Co., 1995.
5. TaiichiOhno, "Toyota Production System: Beyond large-scale Production", Productivity Press (India) Pvt. Ltd. 1992.

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PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.
- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I OVERVIEW OF MANAGEMENT **9**

Definition - Management - Role of managers - Evolution of Management thought – Organization and the environmental factors – Trends and Challenges of Management in Global Scenario.

UNIT II PLANNING & ORGANIZING **9**

Nature and purpose of planning and Organizing - Planning process - Types of plans – Managing by objective (MBO) Strategies - Types of strategies - Policies - Decision Making - Types of decision - Decision Making Process - Rational Decision Making Process - Decision Making under different conditions. - Organization structure - Formal and informal groups I organization - Line and Staff authority - Depart mentation - Span of control - Centralization and Decentralization - Delegation of authority - Staffing - Selection and Recruitment - Orientation - Career Development - Career stages – Training - Performance Appraisal.

UNIT III DIRECTING & CONTROLLING **9**

Creativity and Innovation - Motivation and Satisfaction - Motivation Theories - Leadership Styles - Leadership theories - Communication - Barriers to effective communication – Organization Culture - Elements and types of culture - Managing cultural diversity. Process of controlling - Types of control - Budgetary and non-budgetary control techniques - Managing Productivity - Cost Control - Purchase Control - Maintenance Control - Quality Control - Planning operations.

UNIT IV ENGINEERING ETHICS & HUMAN VALUES **9**

Definition - Societies for engineers – Code of Ethics – Ethical Issues involved in cross border research - Ethical and Unethical practices – case studies – situational decision making - Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT V SAFETY RESPONSIBILITIES AND RIGHTS **9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination – Global issues - Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

TOTAL : 45 Hours

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COURSE OUTCOMES:

After successful completion of the Principles of Management course, the student will be able to

CO1: Discuss the management roles and skills and evolution of the management.

CO2: Analyze the planning and organizing system of the management.

CO3: Discuss directing and controlling system of the management.

CO4: Develop engineering ethics and improve human values.

CO5: Explain safety responsibilities and environmental ethics.

TEXT BOOKS:

1. Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition.
2. Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, Special Indian Edition, 2007.
3. Mike W. Martin and Roland Schinzinger, “Ethics in Engineering”, Tata McGraw Hill, New Delhi, 2003.

REFERENCE BOOKS:

1. Hellriegel, Slocum & Jackson, ' Management - A Competency Based Approach', Thomson South Western, 10th edition, 2007.
2. Harold Koontz, Heinz Weihrich and Mark V Cannice, 'Management - A global & Entrepreneurial Perspective', Tata Mcgraw Hill, 12th edition, 2007.
3. Andrew J. Dubrin, 'Essentials of Management', Thomson Southwestern, 7th edition, 2007.
4. Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, 2004.
5. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.

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ENGINEERING SYSTEM ANALYSIS AND DESIGN

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- This module aims to as to introduce variety of new software used by analysts, designers to manage projects, analyze and document systems, design new systems and implement their plans.
- It introduces also a recent coverage of UML, wireless technologies and ERP; web based systems for e-commerce and expanded coverage on RAD and GUI design.

UNIT I INTRODUCTION **9**

Systems, Elements of a system, Types of systems, Subsystems, Super systems, Need for system analysis and design, CASE tools for analysis and its limitations.

UNIT II SYSTEM ANALYSIS **9**

Methods of system analysis, system development life cycle, structured approach, development tools, data base and networking techniques.

UNIT III SYSTEM DESIGN **9**

Design technologies, Design principles, Design tools and methodologies, feasibility survey, conversion and testing tools, design management and maintenance tools.

UNIT IV MODELLING AND ANALYSIS **9**

Object oriented analysis and design- Introduction, Object modeling, Dynamic modeling, functional modelling, UML diagrams and tools.

UNIT V CASE STUDIES **9**

Case studies- Developing prototypes for systems like, online exam management, Computer gaming and online website management.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the engineering system analysis and design Course, the student will be able to

CO1: Understand the principles and tools of systems analysis and design.

CO2: Understand the application of computing in different context.

CO3: Understand the professional and ethical responsibilities of practicing.

CO4: Develop computer professional including understanding the need for quality.

CO5: Developing prototypes.

TEXT BOOKS:

1. Perry Edwards, “System analysis and design”, McGraw Hill international edition, 1993.

2. Len Fertuck, “System analysis and design with CASE tools”, Wm C. Brown Publishers, 1992.

REFERENCE BOOKS:

1. Er. V.K. Jain, “System analysis and design “, Dreamtech Press.

2. Kenneth E.Kendall and Julie E.Kendall, “System analysis and design”, Prentice Hall, India, 2007.

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QUALITY CONTROL AND RELIABILITY ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- To make the students to understand the various quality control techniques and to construct the various quality control charts for variables and attributes and also the design concepts for reliable system and maintenance aspects in industries.

UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES 9

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality control: Quality cost-Variation in process causes of variation –Theory of control chart- uses of control chart – Control chart for chart -process capability – process capability studiesσvariables – X chart, R chart and simple problems, Six sigma concepts.

UNIT II PROCESS CONTROL FOR ATTRIBUTES 9

Control chart for attributes –control chart for non-conforming – p chart and np chart – control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.

UNIT III ACCEPTANCE SAMPLING 9

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standard sampling plans.

UNIT IV LIFE TESTING – RELIABILITY 9

Life testing – Objective – failure data analysis, Mean failure rate, means time to failure, mean time between failure, hazard rate – Weibull model, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability –simple problems, Acceptance sampling based on reliability test – O.C Curves.

UNIT V QUALITY AND RELIABLITY 9

Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

Note: *Use of approved statistical table permitted in the examination*

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Quality Control and Reliability Engineering course, the student will be able to

CO1: The student can identify different areas of Quality and Reliability Engineering.

CO2: Can find the applications of all the areas in industry.

CO3: Discuss the standard sampling plans of a product.

CO4: Explain the reliability and life testing of the component.

CO5: Analyze the Quality and Reliability of the product.

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TEXT BOOKS:

1. Douglas. C. Montgomery, "Introduction to Statistical quality control", John wiley, 4th edition 2001.
2. Srinath L. S., "Reliability Engineering", Affiliated East west press, 1991.

REFERENCES:

1. John. S. Oakland. Statistical process control", Elsevier, 5th edition, 2005
2. Grant, Eugene .L "Statistical Quality Control", McGraw-Hill, 1996.
3. Monohar Mahajan, "Statistical Quality Control", DhanpatRai& Sons, 2001.
4. Gupta R. C., "Statistical Quality control", Khanna Publishers, 1997.
5. Besterfield D.H., "Quality Control", Prentice Hall, 1993.

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ENGINEERING RISK – BENEFIT ANALYSIS

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- To facilitate risk analysis in several fields, including engineering risk analysis, environmental risk analysis, and security risk analysis.

UNIT I INTRODUCTION **9**

Knowledge and Ignorance, Information Uncertainty in Engineering Systems, Introduction and overview of class; definition of Engineering risk; overview of Engineering risk analysis. Risk Methods: Risk Terminology, Risk Assessment, Risk Management and Control, Risk Acceptance, Risk Communication, Identifying and structuring the Engineering risk problem; developing a deterministic or parametric model.

UNIT II SYSTEM DEFINITION AND STRUCTURE **9**

System Definition Models, Hierarchical Definitions of Systems, System Complexity. Reliability Assessment: Analytical Reliability Assessment, Empirical Reliability Analysis Using Life Data, Reliability Analysis of Systems Module.

UNIT III CONSEQUENCE ASSESSMENT **9**

Types, Cause-Consequence Diagrams, Microeconomic Modelling, Value of Human Life, Flood Damages, Consequence Propagation-Engineering Economics: Time Value of Money, Interest Models, Equivalence Module.

UNIT IV DECISION ANALYSIS **9**

Risk Aversion, Risk Homeostasis, Influence Diagrams and Decision Trees, Discounting Procedures, Decision Criteria, Tradeoff Analysis, Repair and Maintenance Issues, Maintainability Analysis, Repair Analysis, Warranty Analysis, Insurance Models Module.

UNIT V CASE STUDIES **9**

Data Needs for Risk Studies: Elicitation Methods of Expert Opinions, Guidance.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the engineering risk – benefit analysis course, the student will be able to

CO1: Understand the basic concepts of risk analysis and the relationship between probability theory and modeling, risk analysis, and decision analysis.

CO2: Understand how to interpret probability and probabilistic modeling, in the evaluation of risk.

CO3: Learn how to understand and interpret the basic tools of risk analysis – fault trees, event trees, and simulation models.

CO4: Understand the issues surrounding the use of risk analysis in decision making.

CO5: Discuss the Data Needs for Risk Studies.

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TEXT BOOKS:

1. B. M. Ayyub, “Risk Analysis in Engineering and Economics”, Chapman-Hall/CRC Press, 2003.

REFERENCE BOOKS:

1. B. M. Ayyub, “Probability, “Statistics, and Reliability for Engineers and Scientists”, McCuen, 2003.
2. H. Kumamoto and E. J., “Henley Probabilistic Risk Assessment and Management for Engineers and Scientists”, Second Edition, IEEE Press, NY, 1996.
3. Bedford, T. and Cooke, R., “Probabilistic Risk Analysis: Foundations and Methods”, New York: Cambridge University Press, 2001.
4. C. Perrow, “Normal Accidents, Living with High-Risk Technologies”, Princeton University Press, 1999.
5. Accident Precursor Analysis and Management - Reducing Technological Risk Through Diligence, National Academy of Engineering, the National Academies Press, Washington, DC, 2004.

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TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION **9**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II TQM PRINCIPLES **9**

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

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

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

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

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

UNIT V QUALITY SYSTEMS **9**

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Total Quality Management course, the student will be able to

CO1: Develop an understanding on quality management philosophies and frameworks.

CO2: Adopt TQM methodologies for continuous improvement of quality.

CO3: Measure the cost of poor quality, process effectiveness and efficiency to identify areas for improvement.

CO4: Apply benchmarking and business process reengineering to improve management processes.

CO5: Determine the set of indicators to evaluate performance excellence of an organization.

TEXT BOOK:

1. Dale H. Besterfiled, etc. at "Total Quality Management", Pearson Education Asia, Third Edition, 2006.

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REFERENCE BOOKS:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6th Edition, South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2003.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,2006.
4. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd., 2000.
5. R. Pugazhenthi, A. Baradeswaran, K. Balachandran, and P. Balamurali, "Total Quality Management", sams publications, 2015.

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ENGINEERING SYSTEM MODELING AND SIMULATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- Introduce computer simulation technologies and techniques, provides the foundations for the student to understand computer simulation needs, and to implement and test a variety of simulation and data analysis libraries and programs.
- This course focuses what is needed to build simulation software environments, and not just building simulations using pre existing packages.

UNIT I INTRODUCTION **9**

Systems, System types, System Modeling, Types of system modelling, Classification and comparison of simulation models, attributes of modelling, Comparison of physical and computer experiments, Application areas and Examples Module.

UNIT II MATHEMATICAL MODELS **9**

Mathematical and Statistical Models- Probability concepts, Queuing Models, Methods for generating random variables and Validation of random numbers. Module.

UNIT III PROGRAMMING LANGUAGES **9**

Language-System modelling, programming languages, comparison of languages, Identifying and selection of programming language, feasibility study of programming language for the given application. Module

UNIT IV SIMULATION OF DIFFERENT SYSTEMS **9**

Experiments, Analysis, validation and verification of input and output simulated data, study of alternate techniques. Module.

UNIT V CASE STUDY **9**

Developing simulation model for information centers, inventory systems and analysis of maintenance systems.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the engineering system modeling and simulation course, the student will be able to

CO1: Discuss the importance of modeling to science and engineering, the history and need for modeling, the cost effectiveness of modeling.

CO2: Utilize the Modeling Process to identify the key parameters of a model, estimate model outcomes, utilize a computational tool.

CO3: Explain and conduct the transforming of continuous functions and dynamics equations into discrete computer representations.

CO4: Analyze modeling and simulation - Identify different types of models and simulations, describe the iterative development process of a model.

CO5: Develop a mathematical representation and transforms it to a computational model.

TEXT / REFERENCE BOOKS:

1. Geoffrey Gordon, "System Simulation", Second edition, Prentice Hall, India, 2002.
2. Jerry Banks and John S.Carson, Barry L.Nelson, David M.Nicol, "Discrete Event System Simulation", Third edition, Prentice Hall, India, 2002.
3. Robert E. Shannon, "System Simulation The art and science", , Prentice Hall, New Jersey, 1995.
4. D.S. Hira, "System Simulation", S.Chand and company Ltd, New Delhi, 2001.

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SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- To make the students familiar with the various concepts and functions of supply chain management, so that the students will be in a position to manage the supply chain management.

UNIT I INTRODUCTION **9**

Definition of Logistics and SCM: Evolution, Scope, Importance& Decision Phases – Drivers of SC Performance and Obstacles.

UNIT II LOGISTICS MANAGEMENT **9**

Factors – Modes of Transportation - Design options for Transportation Networks-Routing and Scheduling – Inbound and outbound logistics- Reverse Logistics – 3PL- Integrated Logistics Concepts- Integrated Logistics Model – Activities - Measuring logistics cost and performance – Warehouse Management - Case Analysis.

UNIT III SUPPLY CHAIN NETWORK DESIGN **9**

Distribution in Supply Chain – Factors in Distribution network design –Design options-Network Design in Supply Chain – Framework for network Decisions - Managing cycle inventory and safety.

UNIT IV SOURCING, AND PRICING IN SUPPLY CHAIN **9**

Supplier selection and Contracts - Design collaboration - Procurement process. Revenue management in supply chain.

UNIT V COORDINATION AND TECHNOLOGY IN SUPPLY CHAIN **9**

Supply chain coordination - Bullwhip effect – Effect of lack of co-ordination and obstacles – IT and SCM - supply chain IT frame work, E Business & SCM, Metrics for SC performance – Case Analysis.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Supply Chain Management course, the student will be able to

CO1: Study and understand the logistics and supply chain management.
CO2: Analyze the design options for Transportation Networks for logistics management.
CO3: Develop Framework for network Decisions in managing cycle inventory and safety.
CO4: Evaluating the Revenue management in supply chain Management.
CO5: Find the solution for various types of case analysis in supply chain Management.

TEXT BOOKS:

1. Supply Chain Management, Strategy, Planning, and operation – Sunil Chopra and Peter Meindl- PHI, Second edition, 2007.
2. Logistics, David J. Bloomberg, Stephen Lemay and Joe B. Hanna, PHI, 2002.

REFERENCE BOOKS:

1. Logistics and Supply Chain Management –Strategies for Reducing Cost and Improving Service. Martin Christopher, Pearson Education Asia, Second Edition, 2000.
2. Modeling the supply chain, Jeremy F.Shapiro, Thomson Duxbury, 2002.
3. Handbook of Supply chain management, James B.Ayers, St.Lucle Press, 1996.

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INDUSTRIAL MARKETING AND MARKET RESEARCH

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- To enable students to deal with newer concepts of marketing concepts like strategic marketing segmentation, pricing, advertisement and strategic formulation. The course will enable a student to take up marketing as a professional career.

UNIT I INDUSTRIAL MARKETING **9**

Nature of Industrial Marketing: Industrial Marketing Vs Consumer Marketing Relational approach to Industrial Marketing- The Nature of Industrial Demand &Industrial Customer. Types of Industrial Products: Major Equipment; Accessory Equipment; Raw and Processed Materials; Component Parts and Sub- Assemblies; Operating Supplies; Standardized and Non-standardized parts, Industrial services.

UNIT II PRICING **9**

Pricing for Industrial Products – Pricing COURSE OBJECTIVE - Price Decision Analysis – Breakeven analysis – net pricing – discount pricing – trade discounts – geographic pricing – factory pricing – freight allowance pricing – Terms of Sale – Outright purchase – Hire-purchase – Leasing.

UNIT III MARKET RESEARCH **9**

Introduction to Market Research, Types of Research – Basic & Applied, Nature, Scope, objective, Importance & Limitations of Market Research. Sources and collection of Marketing Data. Secondary data – Advantages &Limitations, Sources – Govt. & Non Govt. Primary Data – Advantages &Limitations, Sources, Methods of Collection Primary Data – Observation, Mail, Personal Interview, Telephonic Interview, Internet Interviewing.

UNIT IV TECHNIQUES **9**

Market Research Techniques. National readership survey, Retail Store Audit, Consumer Panels, Test Marketing, Research in Advertising Decisions, Marketing Audit, Data Base Marketing, Focus Group Interviews. Sampling, Questionnaire & Scaling Techniques. Probability and Non Probability Sampling, Sampling methods, Sample Design, Questionnaire design and drafting. Scaling techniques like Nominal, Ordinal, Interval, Ratio, Perceptual Map, Semantic Differential, Likert, Rating & Ranking Scales.

UNIT V IMPLEMENTATION **9**

Setting up & Implementation of Marketing Research Project, Steps in formulating Market Research Projects, One project for consumer durables and one for non-durables to be discussed.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Industrial Marketing and Market Research course, the student will be able to

CO1: Study and understand the logistics and supply chain management environment.

CO2: Analyze the design options for Transportation Networks for logistics management.

CO3: Develop Framework for network Decisions in managing cycle inventory and safety.

CO4: Evaluating the Revenue management in supply chain Management.

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CO5: Find the solution for various types of case analysis in supply chain Management.

TEXT BOOKS:

1. Ralph S. Alexander, James S. Cross, Richard M. Hill, "Industrial Marketing", Homewood, 1967.
2. Rajendra Nargundkar, "Marketing Research", Tata McGraw Hill, 2008.

REFERENCE BOOKS:

1. Robert R. Reeder; Edward G. Brierty; Betty H. Reeder**,** "Industrial Marketing – Analysis, Planning and Control", Prentice Hall, 1991**.**
2. Ghosh P K, "Industrial Marketing", Oxford University Press, India, 2005.
3. Ramanuj Majumdar, "Marketing Research-Text, Applications and Case Studies", New Age International Publication, 2007.
4. Donald R. Cooper, "Business research Methods", McGraw-Hill, 2005

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NON DESTRUCTIVE TESTING AND MATERIALS

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- To stress the importance of NDT in engineering.
- To introduce all types of NNDT and their applications in Engineering.

UNIT I OVERVIEW OF NDT **9**

NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT, Visual inspection – Unaided and aided.

UNIT II SURFACE NDE METHODS **9**

Liquid Penetrant Testing - Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing- Theory of magnetism, inspection materials Magnetisation methods, Interpretatio and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism.

UNIT III THERMOGRAPHY AND EDDY CURRENT TESTING (ET) **9**

Thermography- Principles, Contact and non-contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation - infrared radiation and infrared detectors, Instrumentations and methods, applications. Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.

UNIT IV ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION (AE) **9**

Ultrasonic Testing-Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A/Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction. Acoustic Emission Technique –Principle, AE parameters, Applications.

UNIT V RADIOGRAPHY (RT) **9**

Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use offilters and screens, geometric factors, Inverse square, law, characteristics of films - graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radio graphic equivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed Tomography.

TOTAL : 45 Hours

COURSE OUTCOMES:

After successful completion of the Non-Destructive Testing and Materials course, the student will be able to

CO1: Understand the NDT versus mechanical testing.

CO2: Analyze Liquid Penetrant Testing and its properties and, Principles and methods of demagnetization.

CO3: Determine thermography principles and eddy current testing.

CO4: Classify ultrasonic testing principles and acoustic emission technique.

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CO5: Discuss and understand the principle of radiography and film techniques.

TEXT BOOKS:

1. Baldev Raj, T. Jayakumar, M. Thavasimuthu "Practical Non-Destructive Testing", Narosa Publishing House, 2009.

2. Ravi Prakash, "Non-Destructive Testing Techniques", 1st revised edition, New Age International Publishers, 2010.

REFERENCE BOOKS:

1. ASM Metals Handbook, "Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.
2. Paul E Mix, "Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition New Jersey, 2005.
3. Charles, J. Hellier, "Handbook of Nondestructive evaluation", McGraw Hill, New York, 2001.
4. ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT Hand book, Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. 5, Electromagnetic Testing, Vol. 6, Acoustic Emission Testing, Vol.7, Ultrasonic Test.

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PROCESS PLANNING AND COST ESTIMATION

L	T	P	C
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COURSE OBJECTIVE:

- To introduce the process planning concepts to make cost estimation for various products after process planning.

UNIT I WORK STUDY AND ERGONOMICS **9**

Method study – Definition – COURSE OBJECTIVE – Motion economy – Principles – Tools and techniques – Applications – Work measurements – Purpose – Uses – Procedure – Tools and techniques – Standard time – Ergonomics – Principles – Applications.

UNIT II PROCESS PLANNING **9**

Definition – Objective – Scope – Approaches to process planning – Process planning activities – Finished part requirements – Operating sequences – Machine selection – Material selection parameters – Se t of documents for process planning – Developing manufacturing logic and knowledge – Production time calculation – Selection of cost optimal processes.

UNIT III INTRODUCTION TO COST ESTIMATION **9**

Objective of cost estimation – Costing – Cost accounting – Classification of cost – Elements of cost – Simple problems.

UNIT IV COST ESTIMATION **9**

Types of estimates – Methods of estimates – Data requirements and sources – Collection of cost – Allowances in estimation.

UNIT V PRODUCTION COST ESTIMATION **9**

Estimation of material cost, labour cost and over heads – Allocation of overheads – Estimation for different types of jobs manufactured by casting – Forging – Welding and machining.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Process Planning and Cost Estimation course, the student will be able to

CO1: Understand the concept of work study and ergonomics.

CO2: Develop manufacturing logic and knowledge with help of production planning process.

CO3: Analyze the various type of cost estimating process.

CO4: Estimate data requirements and sources, Collection of cost, Allowances in production.

CO5: Determine the machining time for various operation in various machines in production Shops.

TEXT BOOKS:

1. Sinha, B.P., "Mechanical Estimating and Costing", Tata McGraw-Hill, Publishing Co., 1995.
2. Ostwalal, P.F. and JairoMunez, "Manufacturing Processes and Systems", 9th Edition, JohnWiley, 1998.

REFERENCE BOOKS:

1. Russell, R.S. and Tailor, B.W., "Operations Management", 4th Edition, PHI, 2003.
2. Chitale, A.V. and Gupta, R.C., "Product Design and Manufacturing", 2nd Edition, PHI, 2002.

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PROJECT MANAGEMENT

L	T	P	C
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COURSE OBJECTIVE:

To focuses on project management methodology that will allow you to initiate and manage projects efficiently and effectively. You will learn key project management skills and strategies.

UNIT I Introduction to Project management **9**

Characteristics of projects, Definition and objectives of Project Management, Stages of Project Management, Project Planning Process, Establishing Project organization. Module.

UNIT II Define and Estimate the Project **9**

Work definition: Defining work content, Time Estimation Method, Project Cost Estimation and budgeting, Project Risk Management, Project scheduling and Planning Tools: Work Breakdown structure, LRC, Gantt charts, CPM/PERT Networks. Module.

UNIT III Developing Project **9**

Developing Project Plan (Baseline), Project cash flow analysis, Project scheduling with resource constraints: Resource Levelling and Resource Allocation. Time Cost Trade off: Crashing Heuristic. Module.

UNIT IV Project Implementation **9**

Project Monitoring and Control with PERT/Cost, Computers applications in Project Management, Contract Management, Project Procurement Management. Module

UNIT V Post-Project Analysis **9**

Post-Project Analysis.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the project management course, the student will be able to

CO1: Identify and link the three essential elements of true innovation.
CO2: Examine insights into the antecedents and consequences of project failure.
CO3: Define three domains required to create organizational readiness for change.
CO4: Examine seven critical success factors for launching change initiatives.
CO5: Understand the post project analysis.

TEXT / REFERENCE BOOKS:

1. Shtub, Bard and Globerson, "Project Management: Engineering, Technology, and Implementation", Prentice Hall, India, 1998.
2. HoraldKerzner, "Project Management: A Systemic Approach to Planning, Scheduling and Controlling', CBS Publishers, 2002.
3. Wayne.L.Winston, "Operations research applications and algorithms",4thedition,Cengage learning, 2004.
4. HamdyATaha, "Operations research an introduction", 10th edition, PHI/Pearson education, 2017.

Additional Readings:

1. John M Nicholas, "Project Management for Business and Technology: Principles and Practice", Prentice Hall, India, 2002.
2. N. J. Smith (Ed), "Project Management", Blackwell Publishing, 2002.
3. Robert K. Wysocki, Robert Back Jr. and David B. Crane, "Effective Project Management", John Wiley, 2002.

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DATABASE MANAGEMENT SYSTEMS

L	T	P	C
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COURSE OBJECTIVE:

- Elementary knowledge about computers including some experience using UNIX or Windows.
- Knowledge about data structures and algorithms, corresponding to the basic course on Data Structures and Algorithms.

UNIT I INTRODUCTION **9**

Database Systems versus File Systems, View of Data, Data Models, database languages, Database Users and Administrators. Transaction Management, Decision Support Systems, Components of a Database management System. Distributed Processing and Client- Server Architecture. Entity-Relationship Model – Basic Concepts, Constraints, Keys, Design Issues, E-R Diagrams.

UNIT II RELATIONAL MODEL **9**

Structures of relational databases, Integrity Constraints, Logical database Design, Tables, Views, Data Dictionary. Relational Algebra, Relational Calculus. SQL – Basic Structures, Query Handling, Embedded SQL, Open Database Connectivity (ODBC), Java Database Connectivity (JDBC), Triggers, Security and Authorization. Query By Example (QBE), User Interfaces and Tools, Forms and Graphical User Interfaces. Report Generators. Overview of Relational Query Optimization.

UNIT III RELATIONAL DATABASE DESIGN **9**

Functional Dependencies, Multi-valued Dependencies, Normal Forms, Decomposition into Normalized Relations, Physical Database Design – File Structures. Object-Relational Databases – Nested Relations, Complex Data types, Object Relational Features in SQL:1999.

UNIT IV INTERNET DATABASES **9**

World Wide Web, Client Side Scripting and Applets, Web Servers and Sessions, Services, Server Side Scripting. XML – Structure of XML Data, XML Document Schema, XQuery, Storage of XML Data, XML Applications.

UNIT V CONCEPTS OF TRANSACTION MANAGEMENT **9**

Advanced Topics- Fundamental, X Concurrency Control, Recovery Systems, Data Analysis and OLAP. Introduction to Data Mining, Data Farming, Data Warehousing, Spatial and Geographic Databases, Temporal databases a, d Multimedia Databases.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the database management systems course, the student will be able to

CO1: Evaluate business information problem and find the requirements of a problem in terms of data.
CO2: Understand the uses the database schema and need for normalization.
CO3: Design the database schema with the use of appropriate data types for storage of data in database.
CO4: Examine different types of physical implementation of database.
CO5: Discuss the fundamental Concepts of Transaction Management.

TEXT REFERENCE BOOKS.

1. Catherine Ricardo and Susan Urban, "Databases Illuminated", Jones and Bartlett, 3rd Ed., , 2017
2. Korthet. Al., "Database Systems Concepts", ESBN Publication, 2001.
3. Elmasri and Navathe, "Fundamentals of Database Systems", New Age International, 1989.

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KNOWLEDGE MANAGEMENT

L	T	P	C
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COURSE OBJECTIVE:

- Learn the Evolution of Knowledge management.
- Be familiar with tools.
- Be exposed to Applications.
- Be familiar with some case studies.

UNIT I INTRODUCTION **9**

Introduction: Definition, evolution, need, drivers, scope, approaches in Organizations, strategies in organizations, components and functions, understanding knowledge; Learning organization: five components of learning organization, knowledge sources, and documentation.

UNIT II KNOWLEDGE MANAGEMENT-THE TOOLS **9**

Essentials of Knowledge Management; knowledge creation process, knowledge management techniques, systems and tools.

UNIT III CREATING THE CULTURE OF LEARNING AND KNOWLEDGE SHARING **9**

Organizational knowledge management; architecture and implementation strategies, building the knowledge corporation and implementing knowledge management in organization.

UNIT IV KNOWLEDGEMANAGEMENT-APPLICATION **9**

Knowledge management system life cycle, managing knowledge workers, knowledge audit, and knowledge management practices in organizations.

UNIT V FUTURE TRENDS AND CASE STUDIES **9**

Advanced topics and case studies in knowledge management - Development of a knowledge management map/plan that is integrated with an organization's strategic and business plan - A case study on Corporate Memories for supporting various aspects in the process life -cycles of an organization.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the knowledge management course, the student will be able to

CO1: Understand the fundamental concepts in knowledge management.
CO2: Understand the importance of knowledge sharing.
CO3: Usage of knowledge management tools for various applications.
CO4: Develop knowledge management applications.
CO5: Design and develop enterprise knowledge management applications.

TEXT BOOKS:

1. A Thohothathri Raman, "Knowledge Management – a resource book", Excel, 2004.
2. Elias M. Awad Hasan M. Ghazri, "Knowledge Management", Pearson Education, 2006.

REFERENCE BOOKS:

1. AmritTiwana, Pearson, "The KM Toolkit – Orchestrating IT, Strategy & Knowledge Platforms", PHI, II Edn. 2001.
2. Sudhir Warier, "Knowledge Management', Vikas publications, 2006.
3. Madanmohan Rao, 'Leading with Knowledge", Tata Mc-Graw Hill, 2010.

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ARTIFICIAL INTELLIGENCE AND ROBOTICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- The adoption of Artificial Intelligence (AI) technologies is widely expanding in our society. Applications of AI include: self-driving cars, personal assistants, surveillance systems, robotic manufacturing, machine translation, financial services, cyber security, web search, video games, code analysis and product recommendations.

UNIT I INTRODUCTION **9**

Scope of AI -Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems, AI techniques- search knowledge, abstraction.

UNIT II ARTIFICIAL INTELLIGENCE FUNDAMENTALS **9**

Problem solving - State space search; Production systems, search space control: depth first, breadth-first search, heuristic search - Hill climbing, best-first search, branch and bound. Problem Reduction, Constraint Satisfaction End, Means-End Analysis.

UNIT III LANGUAGE TECHNOLOGIES **9**

Knowledge Representation- Predicate Logic: Unification, modus pones, resolution, dependency directed backtracking. Rule based Systems: Forward reasoning: conflict resolution, backward reasoning: use of no backtrack. Structured Knowledge Representation: Semantic Nets: slots, exceptions and default frames, conceptual dependency, scripts.

UNIT IV MACHINE LEARNING **9**

Handling uncertainty and learning- Non-Monotonic Reasoning, Probablistic reasoning, use of certainty factors, fuzzy logic. Concept of learning, learning automation, genetic algorithm, learning by inductions, neural nets.

UNIT V ROBOTICS **9**

Robot Classification, Robot Specification, notation; Direct and Inverse Kinematics: Co-ordinates Frames, Rotations, Homogeneous Coordinates, Arm Equation of four Axis SCARA Robot, TCV, Inverse Kinematics of Four Axis SCARA Robot.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the artificial intelligence and robotics course, the student will be able to

CO1: Ability to apply knowledge of Artificial intelligence, sciences and engineering.
CO2: Understand the fundamentals of artificial intelligent systems.
CO3: Analyze the rules of artificial systems.
CO4: Ability to understand the features and operation of automation products.
CO5: Ability to identify the electrical, electronic and mechanical components and use of them design or machine elements and transmission system.

TEXT BOOKS:

1. E. Rich and K. Knight, "Artificial intelligence", TMH, 2nd ed., 1992.
2. N.J. Nilsson, "Principles of AI", Narosa Publ. House, 2000.
3. Robin R Murphy, Introduction to AI Robotics PHI Publication, 2000 .

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REFERENCE BOOKS:

1. D.W. Patterson, “Introduction to AI and Expert Systems”, PHI, 1992.
2. R.J. Schalkoff, “Artificial Intelligence - an Engineering Approach”, McGraw Hill Int. Ed., Singapore, 1992.
3. George Lugar, .Al-Structures and Strategies for and Strategies for Complex Problem solving., 4/e, 2002, Pearson Educations.

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DISASTER MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- To provide basic conceptual understanding of disasters and its relationships with development.
- To gain understand approaches of Disaster Risk Reduction (DRR) and the relationship between vulnerability, disasters, disaster prevention and risk reduction.
- To understand Medical and Psycho-Social Response to Disasters.

UNIT I INTRODUCTION TO DISASTER **6**

Introduction- Concepts and definitions: disaster, hazard, vulnerability, risk, capacity, impact, prevention, mitigation).

UNIT II APPROACHES TO DISASTER RISK REDUCTION **12**

Disasters- Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

UNIT III PRINICPLES OF DISASTER MEDICAL MANAGEMENT **5**

Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economical, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate-change and urban disasters.

UNIT IV PUBLIC HEALTH RESPONSE AND INTERNATIONAL COOPERATION **15**

Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

UNIT V DISASTER RISK MANAGEMENT **7**

Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmental-friendly recovery; reconstruction and development methods.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the disaster management course, the student will be able to

CO1: Understanding about the basic concepts of Disaster Management.

CO2: Enhance the knowledge by providing existing models in risk reduction strategies.

CO3: Develop awareness among students in the disaster medicine and make them understand and prepare the natural and manmade disaster.

CO4: Discuss about the health management of disaster is to build capacities that will reduce disaster health risks and contribute to public health.

CO5: Create awareness among participants on Disaster Management Scenario.

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TEXT/REFERENCE BOOKS:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority).
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).
3. Pradeep Sahni, "Disaster Risk Reduction in South Asia", Prentice Hall, 2004.
4. Singh B.K., "Handbook of Disaster Management: techniques & Guidelines", Rajat Publication, 2008.
5. Ghosh G.K., "Disaster Management" ,APH Publishing Corporation, 2006.

ENGINEERING SYSTEM DESIGN OPTIMIZATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- Supports the area of analysis and optimization of multidisciplinary systems during the conceive" and "design" phases.
- Develops and codifies a prescriptive approach to multidisciplinary modeling and quantitative assessment of new or existing system/product architectures.

UNIT I INTRODUCTION **9**

Introduction- Optimization problem formulation, optimization algorithms, applications and examples, different optimization methods available.

UNIT II PROBLEM FORMULATION AND SETUP **9**

Single Variable optimization-Optimization criteria, bracketing methods – Exhaustive search method, bound phase method; Region Elimination methods – Fibonacci search method, Golden search method; Gradient based methods – Newton Raphson method, Bisection method; Root finding using optimization technique.

UNIT III OPTIMIZATION AND SEARCH METHODS **9**

Multi objective optimization- Optimization criteria, Different search methods, Unidirectional search, Direct search method – Evolutionary optimization method, Powell‟s conjugate direction method; Gradient based methods – Newton‟s method and Variable metric method.

UNIT IV MULTIOBJECTIVE AND STOCHASTIC CHALLENGES **9**

Specialized Methods- Integer programming, Geometric programming, simulated annealing, Global optimization using - steep descent method, simulated annealing.

UNIT V OPTIMIZATION TECHNIQUES **9**

Genetic algorithms and evolutionary approaches-Differences and similarities between genetic algorithms and traditional techniques, operators of GA‟s, Computer program for simulated annealing, Newton Raphson method, Evolutionary optimization method.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the engineering system design optimization course, the student will be able to

CO1: Understand the Engineering systems for design and optimization.
CO2: Discuss the overview of principles, methods and tools for systems.
CO3: Analyze the review of linear and non-linear constrained optimization formulations.
CO4: Understand the Multi objective optimization and Pareto optimality.
CO5: Understand about various optimization techniques.

TEXT / REFERENCE BOOKS:

1. Kalyanmoy Deb, “Optimization for Engineering design”, Prentice Hall, India, 2005.
2. Kalyanmoy Deb, “Multi objective optimization using Evolutionary algorithms”, John Wiley, 2001.
3. Taha, “Operations Research”, TMH 2010.

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SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

- Recognize the software life cycle models and the importance of the software development process.
- To knows the importance of modeling languages and robust software products.

UNIT I INTRODUCTION **9**

Introduction- Notion of Software as a Product – characteristics of a good Software Product. Engineering aspects of Software production – necessity of automation. Job responsibilities of Programmers and Software Engineers as Software developers.

UNIT II PROCESS MODELS AND PROGRAM DESIGN TECHNIQUES **9**

Software Development Process Models – Code & Fix model, Waterfall model, Incremental model, Rapid Prototyping model, Spiral (Evolutionary) model. Good Program Design Techniques – Structured Programming, Coupling and Cohesion, Abstraction and Information Hiding, Automated Programming, Defensive Programming, Redundant Programming, Aesthetics. Software Modelling Tools – Data flow Diagrams, UML and XML. Jackson System Development.

UNIT III TESTING OF SOFTWARE PRODUCTS **9**

Verification and Validation:– Black-Box Testing and White-Box Testing, Static Analysis, Symbolic Execution and Control Flow Graphs – Cyclomatic Complexity. Introduction to testing of Real-time Software Systems.

UNIT IV SOFTWARE PROJECT MANAGEMENT **9**

Management Functions and Processes, Project Planning and Control, Organization and Intra-team Communication, Risk Management. Software Cost Estimation – underlying factors of critical concern. Metrics for estimating costs of software products – Function Points. Techniques for software cost estimation – Expert judgment, Delphi cost estimation, Work break-down structure and Process break-down structure, COCOMO and COCOMO-II.

UNIT V ADVANCED TOPICS: FORMAL METHODS IN SOFTWARE ENGINEERING **9**

Formalization of Functional Specifications – SPEC. Support environment for Development of Software Products. Representative Tools for Editors, Linkers, Interpreters, Code Generators, Debuggers. Tools for Decision Support and Synthesis, Configuration control and Engineering Databases, Project Management. Petrinets. Introduction to Design Patterns, Aspectoriented Programming.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Software Engineering course, the student will be able to

CO1: An ability to design and conduct experiments, as well as to analyze and interpret data.
CO2: An ability to identify, formulate, and solve engineering problems.
CO3: An understanding of professional and ethical responsibility.
CO4: Recognition of the need for, and an ability to engage in life-long learning.
CO5: Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

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TEXT BOOKS:

1. Carlo Ghezziet. al., “Fundamentals of Software Engineering”, Rajibmall Pub., 2017
2. Design, Reliability Management, “Software Engineering”, Pressman, 1988.

REFERENCE BOOKS:

1. Software Engineering – Ian Sommerville.
2. Software Engineering - Shoeman.
3. Software Engineering with Abstraction – Berzins and Luqi

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INFRASTRUCTURE SYSTEMS PLANNING

L	T	P	C
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COURSE OBJECTIVE

- To provide an overview of Infrastructure scenario in India and their sector specific features.
- To provide required knowledge and skills planning and appraising sustainable civil Infrastructure systems and their interactions.
- To make student aware of the procurement management process involved in the infrastructure projects.

UNIT I INTRODUCTION **9**

Infrastructure Systems Planning- An Overview Definitions, Infrastructure management activities, Evolutions of Systems since 1960s (Mainframes-to-Midrange-to-PCs-to-Client-server computing-to-New age systems) and their management, growth of internet, current business demands and IT systems issues, complexity of today's computing environment, Total cost of complexity issues, Value of Systems management for business.

UNIT II PREPARING FOR INFRASTRUCTURE SYSTEMS PLANNING & MANAGEMENT **9**

Factors to consider in designing IT organizations and IT infrastructure, Determining customer's Requirements, Identifying System Components to manage, Exist Processes, Data, applications, Tools and their integration, Patterns for IT systems management, Introduction to the design process for information systems, Models, Information Technology Infrastructure Library (ITIL).

UNIT III SERVICE DELIVERY PROCESSES **9**

Service-Level Management, Financial Management & Costing, IT Services Continuity Management, Capacity Management, Availability Management. Service Support Processes, Configuration Management, Service desk. Incident Management, Problem Management, Change Management, Release Management.

UNIT IV STORAGE AND SECURITY MANAGEMENT **9**

Introduction Security, Identity management, Single sign-on, Access Management, Basics of network security, LDAP fundamentals, Intrusion detection, Firewall; security information management Introduction to Storage, Backup & Restore, Archive & Retrieve, Space Management, SAN & NAS, Disaster Recovery, Hierarchical space management, Database & Application protection, Bare machine recovery, Data retention.

UNIT V SYSTEM MODELLING **9**

System thinking method for model-building of infrastructural planning Model observation, Construction of model structure, Simulation analysis, Multi-agent system.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the infrastructure systems planning course, the student will be able to

CO1: Understanding about the key infrastructure sectors and their related planning and management issues.

CO2: Capable of appraising an infrastructure project based on demand, technical and economic point of view.

CO3: Aware of the management process involved in the procurement of infrastructure projects.

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CO4: Discuss the knowledge storage and security management.
CO5: To Analyze and Stimulating the developed model.

TEXT/REFERENCE BOOKS:

1. Jan Van Bon, "Foundations of IT Service Management: based on ITIL" , Van Haren Publishing, 2005.
2. Floyd Piedad, Michael Hawkins, "High Availability: Design, Techniques & Processes", Prentice Hall, 2000.
3. Harris Kem, Stuart Gaiup, Guy Nemiro, "IT Organization: Building a World class Infrastructure", Prentice Hall, 2000.
4. Rich Schiesser, "IT Systems Management: Designing, Implementing, and Managing World-Class Infrastructures", Prentice Hall; 2001.

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ENTREPRENEURSHIP DEVELOPMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

UNIT I ENTREPRENEURSHIP **9**

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intra preneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION **9**

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, objective.

UNIT III BUSINESS **9**

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING **9**

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS **9**

Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures- Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TOTAL : 45 Hours

COURSE OUTCOMES:

After successful completion of the Entrepreneurship Development course, the student will be able to

CO1: Understand the basic concepts of entrepreneurship and its application

CO2: Understanding the strategies for pursuing, securing and managing financial resources in new and established organizations.

CO3: Ability to learn new business ideas, systematic process to select for successful application of design models.

CO4: Understand the financing and accounting skills

CO5: Understand the basic strategies to maintain business

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TEXT BOOKS :

1. Khanka. S.S., “Entrepreneurial Development” S.Chand& Co. Ltd., Ram Nagar, New Delhi, 2013.
2. Donald F Kuratko, “Entreprenuership – Theory, Process and Practice”, 9th Edition, Cengage Learning, 2014.

REFERENCE BOOKS:

1. Hisrich R D, Peters M P, “Entrepreneurship” 8th Edition, Tata McGraw-Hill, 2013.
2. Mathew J Manimala, "Enterprenuership theory at cross roads: paradigms and praxis” 2nd Edition Dream tech, 2005.
3. Rajeev Roy, "Entrepreneurship" 2nd Edition, Oxford University Press, 2011.
4. EDII “Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development”, Institute of India, Ahmadabad, 1986.

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OPERATIONS RESEARCH

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I LINEAR MODELS **15**

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS **8**

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

UNIT III INVENTORY MODELS **6**

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice

UNIT IV QUEUEING MODELS **6**

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V DECISION MODELS **10**

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Operations Research course, the student will be able to

CO1: The optimization techniques for use engineering and Business problems.
CO2: Understand and solve the transportation models and network models problems.
CO3: Understand and solve the inventory models.
CO4: Understand and solve the queueing models.
CO5: Understand and solve the decision models.

TEXT / REFERENCE BOOKS:

1. Hillier and Libeberman, “Operations Research”, Holden Day, 2005
2. Taha H.A., “Operations Research”, Sixth Edition, Prentice Hall of India, 2003.
3. Bazara M.J., Jarvis and Sherali H., “Linear Programming and Network Flows”, John Wiley, 2009.
4. Budnick F.S., “Principles of Operations Research for Management”, Richard D Irwin, 1990.
5. Philip D.T. and Ravindran A., “Operations Re search”, John Wiley, 1992.
6. Shennoy G.V. and Srivastava U.K., “Operation Research for Management”, Wiley Eastern, 1994.
7. Tulsian and Pasdey V., “Quantitative Techniques”, Pearson Asia, 2002.

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HUMAN RIGHTS

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I Introduction to Human Rights **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II Evolution and Laws of Human Rights **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III Theories and perspectives UN Laws and Agencies **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV Human Rights in India **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V Human Rights Various Commissions **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

Total: 45 Hours

COURSE OUTCOMES:

After successful completion of the Human Rights course, the student will be able to

CO1: Understand basics of Human Rights

CO2: Know the Evolution and Laws of Human Rights

CO3: Know the various theories and perspectives UN Laws and Agencies

CO4: Learn the Human Rights in India

CO5: Understand the Human Rights of Various Commissions in India

REFERENCE BOOKS:

1. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
2. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi, 1996.

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INTELLECTUAL PROPERTY RIGHTS

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION **9**

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs **10**

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad.

UNIT III AGREEMENTS AND LEGISLATIONS **10**

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW **9**

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs **7**

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

Total: 45 Hours

COURSE OUTCOMES:

After successful completion of the Intellectual Property Rights course, the student will be able to

- **CO1:** Ability to manage Intellectual Property portfolio to enhance the value of the firm.
- **CO2:** Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and international.
- **CO3:** Understanding various practical aspects of registration of Copy agreements and legislations of intellectual property rights.
- **CO4:** Understand and lean the digital products and law intellectual property rights Knowledge.
- **CO5:** Understand enforcement of intellectual property rights through the Case Studies.

TEXT BOOKS:

1. S.V. Satarkar, Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002.
2. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012.

REFERENCE BOOKS:

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

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ENGINEERING ECONOMICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- To enable students to understand the fundamental economic concepts applicable to engineering and to learn the techniques of incorporating inflation factor in economic decision making.

UNIT I INTRODUCTION TO ECONOMICS **8**

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis - V ratio, Elementary economic Analysis – Material selection for product Design selection for a product, Process planning.

UNIT II VALUE ENGINEERING **10**

Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor - Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT III CASH FLOW **9**

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS **9**

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

UNIT V DEPRECIATION **9**

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

TOTAL : 45 Hours

COURSE OUTCOMES:

After successful completion of the Engineering Economics course, the student will be able to

CO1: Acquire the skills to apply the basics of economics and cost analysis to engineering and take economically sound decisions.

CO2: Identify the worthiness of the product by Make or buy decision and know the value of the time value of money.

CO3: Understand the cash flow of the industrial system by various methods.

CO4: Analyze the capital recovery with return and concept of challenger and defender replacement with maintenance analysis.

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CO5: Identify the depreciation of the components of the industrial system by Straight line, declining balance, Sum of the years digits and sinking fund methods.

TEXT BOOKS:

1. Panneer Selvam, R, “Engineering Economics”, Prentice Hall of India Ltd, New Delhi, 2001.

REFERENCES:

1. Chan S.Park, “Contemporary Engineering Economics”, Prentice Hall of India, 2011.
2. Donald.G. Newman, Jerome.P.Lavelle, “Engineering Economics and analysis” Engg. Press, Texas, 2010.
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, “Engineering Economy”, Macmillan, New York, 2011.
4. Zahid A khan: Engineering Economy, "Engineering Economy", Dorling Kindersley, 2012

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17SUPD31	PERSONALITY DEVELOPMENT I	L	T	P	C
		2	0	0	2

COURSE OBJECTIVE:

- To improve the interpersonal skills, soft skills, effective team player and analyze strength and weakness to meet their professional career.

UNIT I SOFT SKILLS I **6**

Introduction to Personality Development – Meaning-Features of personality-Dimensions of Personality - Determinants of Personality-Features and Traits- Components of self concept-Barriers-Self analysis.

UNIT II SOFT SKILLS II **6**

Importance of Soft Skills – First Impression-Work Place requirements-Discipline-Cleanliness-Hygiene-general Appearance--Building Confidence—Concept of Thinking and Usage-Value of Time-Focus & Commitment.

UNIT III SOFT SKILLS IN ACTION **6**

Grooming – Attire – Understanding others- – Stability & Maturity Development – Strengths – Weakness –Opportunities-threats -Merits of SWOT Analysis-Components-how to convert weakness into strengths-Goal settings.

UNIT IV SELF AWARENESS AND SELF ESTEEM **6**

Definitions-Components of self-awareness-Developing Self Awareness-Self-esteem-meaning-Steps to improve self esteem.

UNIT V SELF MOTIVATION **6**

Motivation –Meaning-Techniques of self motivation-Motivation & goal setting – Motivation and emotion – Motivation at work.

Total: 30 Hours

COURSE OUTCOMES:

After successful completion of the Personality Development I course, the student will be able to

CO1: Learning the features of Personality; dimensions of personality and components of self concept.
CO2: Developing the soft skills and self appearance.
CO3: Develop the stability and Maturity.
CO4: Developing self-motivation, raised aspirations and belief in one's own abilities.
CO5: Develop the self motivation and emotion at work.

REFERENCES:

1. Barun K Mitra, "Personality Development and Soft Skills", Oxford Publication, 2016.
2. Stephen R. covey, "Seven habits of Higly Effective people", Free Press, 2017.
3. Nathan C. Hall, "Emotion, motivation and Self regulation", McGill University, 2010.
4. http://www.emeraldgrouppublishing.com
5. Psychology of Selfesteem – Nathaniel Branden, Nash (1st edition), Jossey-Bass (32nd anniversary edition.

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17SUPD41	PERSONALITY DEVELOPMENT II	L	T	P	C
		2	0	0	2

COURSE OBJECTIVE:

- To improve the leadership quality, team management, quantitative analyzing knowledge, ordering, sequencing and logical thinking knowledge to meet their professional career.

UNIT I SOFT SKILLS III **6**

Basic Etiquette – Email etiquette – Business etiquette – Telephone etiquette – Meeting etiquette – Adjustment of Role & Leadership – Team Management & Development.

UNIT II QUANTITATIVE APTITUDE I **6**

Percentage – Profit Loss -Discount – Ratio Proportion – Time & Work – Time, Speed & Distance. Problems relating to ages- Permutation &Combination-Probability.

UNIT III QUANTITATIVE APTITUDE II **6**

Mensuration Clocks and Calendars- Boats-Simple Interest –Compound Interest- Fractions and Decimals – Square roots – Functions.

UNIT IV ANALYTICAL PROBLEMS **6**

Introduction – Linear Sequencing – Seating Arrangements – Distribution/Double Line Up – Selection – Ordering and Sequencing – Binary Logic – Venn Diagrams –Directions.

UNIT V LOGICAL PROBLEMS **6**

Introduction to Logical problems – Cause and Effect – Course of Action – Statement and Assumption – Letter and Symbol series – Analogies.

TOTAL: 30 Hours

COURSE OUTCOMES:

After successful completion of the Personality Development II course, the student will be able to

CO1: Develop the character of etiquette in profession.
CO2: Understand the concepts of time management and accounts.
CO3: Develop the Quantitative aptitude.
CO4: Understand the concepts of management.
CO5: Develop the Logical skills.

REFERENCE BOOKS:

1. K R Dhanalakshmi And N S Raghunathan, "Personality Enrichment", Margham Publications, 2012.
2. Dr V M Selvaraj, "Personality Development", Bhavani Publications, 2008.
3. R. S Aggarwal, "Quantitative Aptitude", S.Chand, 2012.
4. A.K Gupta, "Logical and Analytical Reasoning (English)" 30th Edition, S.Chand. 2018.

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17SUPD51	PERSONALITY DEVELOPMENT III	L	T	P	C
		2	0	0	2

COURSE OBJECTIVE:

- To improve the verbal aptitude, Speech Mechanism, Sentence Stress knowledge, Personality factors, time management and team building to meet their professional career.

UNIT I VERBAL APPTITUDE I **6**

Phonetics/Neutral Accent/Pronunciation – Speech Mechanism/Mouth & Face Exercise – Vowels & Consonants – Sounds – Syllable and Syllable Stress/ Word Stress – Sentence Stress & Intonation – Articulation Exercise – Rate of Speech / Flow of Speech / Idiomatic Phrases.

UNIT II VERBAL APTITUDE II **6**

Singular/plural-present tense/past tense—genders - Prepositions-conjunctions-Choice of words—simple sentences—compound sentences- summarising phrases—Synonyms—Antonyms—Analogies—Similar Words.

UNIT III SOFT SKILLS IV **6**

Attitude—Meaning- Features of attitude-Formation-Personality Factors-Types of attitude-change in attitude-Developing Positive attitude.

UNIT IV TIME MANAGEMENT **6**

Definition –Meaning-Importance, Value of time as an important resource- comparison of Time and Money-Circle of influence and circle of control—Definition of URGENT and IMPORTANT—Time Wasters and how to reduce—Procrastination—meaning and impact- 4 Quadrants.

UNIT V TEAM BUILDING **6**

Meaning—Aspects of team building—Process of team building—Types of Teams-Team ethics and Understanding-Team trust and commitment.

TOTAL: 30 Hours

COURSE OUTCOMES:

After successful completion of the Personality Development III course, the student will be able to

CO1: Develop the spoken English skills.

CO2: Develops the grammatical skill in English.

CO3: Develop the personality of an Individual.

CO4: Understanding the importance of time management.

CO5: Learning to connect and work with others to achieve a set task.

REFERENCES BOOKS:

1. B N Ghosh, " Managing Soft Skills And Personality", Mcgraw Hill Publications, 2017.
2. Shejwalkar and Ghanekar, "Principles and Practices of Management", McGraw Hill Latest, 2010.
3. Roberta roesch, "Time management for Busy people" Tata Mcgraw-Hill Edition, 2006.
4. Dr V M Selvaraj, "Personality Development", Bhavani Publications, 1993 .

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17SUPD61	PERSONALITY DEVELOPMENT IV	L	T	P	C
		2	0	0	2

COURSE OBJECTIVE:

- To improve the communication by understanding the elements of communication, presentation skills, understanding the audience, Personality factors, improve the skill in seminars and conferences presentation.

UNIT I SOFT SKILLS V **6**

Assertiveness—Meaning—Importance of assertiveness- Characteristics of assertive communication-Merits –forms of assertion—Causes of misunderstanding.

UNIT II COMMUNICATION SKILLS **6**

Meaning—Elements of communication—Functions of communication—Principles of communication—Formal and Informal communication—Barriers in Communication—Characteristics of good communication—Feedback—communication systems.

UNIT III PRESENTATION SKILLS I **6**

Meaning—Importance of Presentation—Concept of 5 w's and one H —understanding the audience—Types of presentations—How to make effective presentation.

UNIT IV PRESENTATION SKILLS II **6**

Use of slide, PPT's. and visuals—Rules for slide presentation—precautions-seminars and conferences-Steps to eliminate Stage fear.

UNIT V CHANGE MANAGEMENT **6**

Definition – Necessity - Resistance towards Change – 10 Principles of Change Management – Leaders approach – Effective Change management.

TOTAL: 30 Hours

COURSE OUTCOMES:

After successful completion of the Personality Development IV course, the student will be able to

CO1: Development of assertive communication.

CO2: Improve the key elements of Communication skills.

CO3: Understand the key elements of presentation.

CO4: Develop the skill on presentation through PPTs.

CO5: Understand the principles of management.

REFERENCE BOOKS:

1. LaClair, J. and Rao, R., "Helping Employees Embrace Change", McKinsey Quarterly, 2002.
2. Vermilion, "Who Moved My Cheese by Spencer" Johnson published first edition, 1988.
3. Adair, "Effective Communication", John. London: Pan Macmillan Ltd., 2003.
4. Bovee, Courtland L, John V. Thill & Barbara E. Schatzman, "Business Communication Today" , Tenth Edition. New Jersey: Prentice Hall, 2010.

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17NSS701	NSS	L	T	P	C
		1	0	1	2

COURSE OBJECTIVE:

- To develop character of volunteerism with understanding the youth issues, challenges and opportunities.
- To learn about the community mobilization.

UNIT I INTRODUCTION AND BASIC CONCEPTS OF NSS **6**

NSS: History, philosophy, aims, objectives –Emblem: flag, motto, song, badge- NSS functionaries: Organizational structure, roles and responsibilities.

UNIT II NSS PROGRAMS AND ACTIVITIES **6**

Concept of regular activities- special camping-day camps-Basis of adoption of village/slums, Methodology of conducting survey-Financial pattern of the scheme- other youth program/schemes of GOI- Coordination with different agencies- Maintenance of the dairy.

UNIT III UNDERSTANDING YOUTH **6**

Youth: Definition, profile of youth, categories – youth: Issues, challenges and opportunities - Youth as an agent of social change.

UNIT IV COMMUNITY MOBILIZATION **6**

Mapping of community stakeholders-Designing the message in the context of the problem and the culture of the community-Identifying methods of mobilization-Youth adult partnership.

UNIT V VOLUNTEERISM AND SHRAMDAN **6**

Indian Tradition of volunteerism-Needs& Importance of volunteerism- Motivation and constraints of volunteerism-Shramdan as a part of volunteerism.

TOTAL: 30 Hours

COURSE OUTCOMES:

After successful completion of the Personality NSS I course, the student will be able to

CO1: Understand the basic concepts of NSS.

CO2: Learn about the NSS Programs and activities.

CO3: Understand the youth issues, challenges and opportunities.

CO4: Learn about the community mobilization.

CO5: Develop character of volunteerism.

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