K.S.R. COLLEGE OF ENGINEERING : TIRUCHENGODE - 637 215
(Autonomous)
DEPARTMENT OF MECHANICAL ENIGNEERING
(REGULATION 2012)

Vision of the Institution

IV	We envision to achieve status as an excellent Educational Institution in the global knowledge hub, making self-learners, experts, ethical and responsible engineers, technologists, scientists, managers, administrators and entrepreneurs who will significantly contribute to research and environment friendly sustainable growth of the nation and the world.

Mission of the Institution

IM 1	To inculcate in the students self-learning abilities that enable them to become competitive and considerate engineers, technologists, scientists, managers, administrators and entrepreneurs by diligently imparting the best of education, nurturing environmental and social needs.
IM 2	To foster and maintain mutually beneficial partnership with global industries and Institutions through knowledge sharing, collaborative research and innovation.

Vision of the Department / Programme: (Mechanical Engineering)

DV	To be a centre of excellence in the field of Mechanical Engineering for providing its students and faculty with opportunities to excel in education and targeted research themes in emerging areas.

Mission of the Department / Programme: (Mechanical Engineering)

DM 1	To excel in academic and research activities that meet the industrial and social needs.
DM 2	To develop competent, innovative and ethical mechanical Engineers.

Programme Educational Objectives (PEOs) : (Mechanical Engineering)

The graduates of the programme will be able to

PEO 1	**Successful career:** Identify, design and apply the technical skills to solve mechanical engineering problems for enhancing the quality of life.
PEO 2	**Lifelong Learning:** Apply the modern tools and techniques to face the challenges in mechanical and related engineering areas.
PEO 3	**Service to society:** Understand the responsibility, communicate and implement innovative ideas in multidisciplinary teams ethically for uplifting the society.

PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs)

Programme Outcomes (POs)	
PO1	**Engineering Graduates will be able to:** **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**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.
PO4	**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.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resource, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**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.
PO7	**Environmental 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.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader diverse teams, and in multidisciplinary settings.
PO10	**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.
PO11	**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.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadcast context of technological change.
Programme Specific Outcomes (PSOs)	
PSO1	**Research Culture:** Read literature, do research on new mechanical engineering problems and publish the results through patents, journals, conferences and symposium.
PSO2	**Core Values:** Contribute core universal values and social good to the community.

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Department	Mechanical Engineering
Programme	B.E.- Mechanical Engineering

SEMESTER - I

Sl. No.	Course Code	Course Name	Hours/ Week			Credit
			L	T	P	C
THEORY						
1.	12HS1101	Technical English – I (Common To All Branches)	3	0	0	3
2.	12MA1102	Engineering Mathematics – I (Common To All Branches)	3	1	0	4
3.	12PH1103	Engineering Physics – I (Common To All Branches)	3	0	0	3
4.	12CY1104	Engineering Chemistry (Common To All Branches)	3	0	0	3
5.	12CS1105	Fundamentals of Computing and Programming (Common To All Branches)	3	0	0	3
6.	12ME2106	Engineering Drawing (Common To AU, CE & ME)	1	3	0	4
PRACTICAL						
7.		Physics and Chemistry Laboratory * (Common To All Branches)	-	-	3	-
8.	12CS1110	Computer Practices Laboratory – I (Common To All Branches)	0	0	3	2
9.	12AU2111	Computer Aided Drawing Laboratory (Common To AU & ME)	0	0	3	2
10.	12HR1112	Career Development Skills – I (Common To All Branches)	0	2	0	1
Total Credits						**25**

SEMESTER - II

THEORY						
1.	12HS1201	Technical English – II (Common To All Branches)	3	0	0	3
2.	12MA1202	Engineering Mathematics – II (Common To All Branches)	3	1	0	4
3.	12PH1203	Engineering Physics – II (Common To All Branches)	3	0	0	3
4.	12CY1204	Environmental Science and Engineering (Common To All Branches)	3	0	0	3
5.	12EE2205	Basics of Electrical and Electronics Engineering (Common To AU, CE & ME)	3	1	0	4
6.	12CE2206	Engineering Mechanics (Common To AU, CE & ME)	3	1	0	4
PRACTICAL						
7.	12GE1210	Physics and Chemistry Laboratory (Common To All Branches)	0	0	3	2
8.	12CS1211	Computer Practice Laboratory – II (Common To All Branches)	0	0	3	2
9.	12GE1212	Engineering Practices Laboratory (Common To AU & ME)	0	0	3	2
10.	12HR1213	Career Development Skills – II (Common To All Branches)	0	2	0	1
Total Credits						**28**

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Department	Mechanical Engineering	
Programme	B.E.- Mechanical Engineering	

SEMESTER - III

Sl. No.	Course Code	Course Name	Hours/ Week L	T	P	Credit C
THEORY						
1.	12MA2301	Engineering Mathematics – III (Common To AU,CE,EC,EE, IT & ME)	3	1	0	4
2.	12ME2322	Fluid Mechanics and Machinery (Common To AU & ME)	3	0	0	3
3.	12ME3303	Engineering Thermodynamics	3	0	0	3
4.	12EE3324	Electrical Drives and Controls	1	3	0	4
5.	12ME3305	Manufacturing Technology - I	3	0	0	3
6.	12ME3306	Machine Drawing	3	0	0	3
PRACTICAL						
7.	12ME3310	Fluid Mechanics and Machinery Laboratory (Common To AU & ME)	0	0	3	2
8.	12ME3311	Manufacturing Technology Laboratory - I	0	0	3	2
9.	12EE3312	Electrical Drives and Controls Laboratory	0	0	3	2
10.	12HR1313	Career Development Skills- III	0	2	0	1
					Total Credits	**27**

SEMESTER - IV

Sl. No.	Course Code	Course Name	Hours/ Week L	T	P	Credit C
THEORY						
1.	12MA2401	Numerical Methods (Common To AU,CE,CS,EE & ME)	3	1	0	4
2.	12ME3402	Thermal Engineering	3	0	0	3
3.	12ME3403	Kinematics of Machinery	3	1	0	4
4.	12ME3404	Strength of Materials	3	0	0	3
5.	12ME3405	Manufacturing Technology-II	3	0	0	3
6.	12ME3426	Engineering Materials and Metallurgy (Common To AU & ME)	3	0	0	3
PRACTICAL						
7.	12ME3410	Thermal Engineering Laboratory	0	0	3	2
8.	12ME3411	Strength of Materials Lab	0	0	3	2
9.	12ME3412	Manufacturing Technology Laboratory-II	0	0	3	2
10.	12HR1413	Career Development Skills- IV (Common To All Branches)	0	2	0	1
					Total Credits	**27**

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Department	Mechanical Engineering
Programme	B.E.- Mechanical Engineering

SEMESTER - V

Sl. No.	Course Code	Course Name	Hours/ Week L	T	P	Credit C
THEORY						
1.	12ME3501	Operations Research	**3**	**0**	**0**	**3**
2.	12ME3502	Dynamics of Machinery	**3**	**1**	**0**	**4**
3.	12ME3503	Heat and Mass Transfer	**3**	**0**	**0**	**3**
4.	12ME3504	Design of Machine Elements	**3**	**1**	**0**	**4**
5.	12ME3505	Engineering Metrology and Measurements	**3**	**0**	**0**	**3**
6.	12ME3506	Hydraulic and Pneumatic Systems	**3**	**0**	**0**	**3**
PRACTICAL						
7.	12ME3510	Dynamics of Machinery Laboratory	**0**	**0**	**3**	**2**
8.	12ME3511	Heat and Mass Transfer Laboratory	**0**	**0**	**3**	**2**
9.	12ME3512	Engineering Metrology and Measurements Lab	**0**	**0**	**3**	**2**
10.	12HR1513	Career Development Skills – V (Common To All Branches)	**0**	**2**	**0**	**1**
				Total Credits		**27**

SEMESTER - VI

Sl. No.	Course Code	Course Name	Hours/ Week L	T	P	Credit C
THEORY						
1.	12ME3601	Design of Transmission Systems	**3**	**0**	**0**	**3**
2.	12ME3602	Computer Aided Manufacturing	**3**	**0**	**0**	**3**
3.	12ME3603	Gas Dynamics and Jet Propulsion	**3**	**0**	**0**	**3**
4.	12ME3604	Power Plant Engineering	**3**	**0**	**0**	**3**
5.	12EC3625	Electronics and Microprocessor	**3**	**0**	**0**	**3**
6.		Elective – I	**3**	**0**	**0**	**3**
PRACTICAL						
7.	12ME3610	Computer Aided Manufacturing Laboratory	**0**	**0**	**3**	**2**
8.	12HS2611	Communication Skills Laboratory (Common To CE and ME)	**0**	**0**	**3**	**2**
9.	12EC3612	Electronics and Microprocessor Laboratory	**0**	**0**	**3**	**2**
10.	12ME3613	Comprehension	**0**	**2**	**0**	**1**
				Total Credits		**25**

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SEMESTER - VII

Sl. No.	Course Code	Course Name	Hours/ Week			Credit
			L	T	P	C
THEORY						
1.	12HS1701	Professional Ethics (Common to all Branches)	**3**	**0**	**0**	**3**
2.	12ME3702	Mechatronics	**3**	**0**	**0**	**3**
3.	12ME3703	Finite Element Analysis	**3**	**0**	**0**	**3**
4.	12ME3704	Quality, Reliability and Maintenance Engineering	**3**	**0**	**0**	**3**
5.		Elective – II	**3**	**0**	**0**	**3**
6.		Elective – III	**3**	**0**	**0**	**3**
PRACTICAL						
7.	12ME3710	Mechatronics Laboratory	**0**	**0**	**3**	**2**
8.	12ME3711	Computer Aided Simulation and Analysis Laboratory	**0**	**0**	**3**	**2**
9.	12ME3712	Repair and Maintenance Laboratory	**0**	**0**	**3**	**2**
		Total Credits				**24**

SEMESTER - VIII

Sl. No.	Course Code	Course Name	Hours/ Week			Credit
			L	T	P	C
THEORY						
1.	12HS2821	Total Quality Management (Common to AU, CE, CS, EE, IT & ME)	**3**	**0**	**0**	**3**
2.		Elective - IV	**3**	**0**	**0**	**3**
3.		Elective - V	**3**	**0**	**0**	**3**
PRACTICAL						
4.	12ME3810	Project Work	**0**	**0**	**12**	**6**
		Total Credits				**15**

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Programme	B.E.- Mechanical Engineering

List of Electives

ELECTIVE – I (SEMESTER – VI)

Sl.No.	Course Code	Course Name	Hours/ Week			Credit
			L	T	P	C
1.	12MA4621	Probability and Statistics (Common To CE & ME)	3	0	0	3
2.	12ME4602	Fundamentals of Nano Science	3	0	0	3
3.	12ME4603	Value and Re Engineering	3	0	0	3
4.	12ME4604	Design of Jigs, Fixtures and Press tools	3	0	0	3
5.	12ME4605	Composite Materials	3	0	0	3

ELECTIVE – II (SEMESTER – VII)

Sl.No.	Course Code	Course Name	Hours/ Week			Credit
			L	T	P	C
1.	12ME4701	Thermal turbo Machines	3	0	0	3
2.	12ME4702	Nuclear Engineering	3	0	0	3
3.	12ME4703	Refrigeration and Air Conditioning	3	0	0	3
4.	12ME4704	Automobile Engineering	3	0	0	3
5.	12ME4705	Renewable Sources of Energy	3	0	0	3

ELECTIVE – III (SEMESTER – VII)

1.	12ME4706	Optimization in Design	3	0	0	3
2.	12ME4707	Industrial Tribology	3	0	0	3
3.	12ME4708	Vibration and Noise Control	3	0	0	3
4.	12ME4709	Pressure Vessel and Piping Design	3	0	0	3
5.	12ME4710	Product Design and Development	3	0	0	3

ELECTIVE – IV (SEMESTER – VIII)

Sl.No.	Course Code	Course Name	Hours/ Week			Credit
			L	T	P	C
1.	12ME4801	Process Planning and Cost Estimation	3	0	0	3
2.	12ME4802	Unconventional Machining Processes	3	0	0	3
3.	12ME4803	Flexible Manufacturing Systems	3	0	0	3
4.	12ME4804	Industrial Robotics	3	0	0	3
5.	12ME4805	Welding Technology	3	0	0	3

ELECTIVE – V (SEMESTER – VIII)

1.	12ME4806	Human Resources Management	3	0	0	3
2.	12ME4807	Internal Combustion Engines	3	0	0	3
3.	12ME4808	Entrepreneurship Development	3	0	0	3
4.	12ME4809	Business Concepts	3	0	0	3
5.	12ME4810	Enterprises Resource Planning	3	0	0	3

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SEMESTER - I

12HS1101 **TECHNICAL ENGLISH – I**
(Common To All Branches)

L	T	P	C
3	0	0	3

Objective(s): *To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills through improvement of LSRW skills*

UNIT – I LANGUAGE FOCUS 10 Hrs

General and Technical Vocabulary - Parts of Speech - Changing from one form to another – Compound Nouns – Numerical Adjectives – Prefix Suffix – Tenses – British And American Vocabulary – Kinds of Sentences – Question Pattern – ' Wh' Question – Yes/No Question.

UNIT – II LANGUAGE FOCUS 10 Hrs

Articles – Tense – Active, Passive and Impersonal Passive voice – Gerunds and Infinitives, Cause and Effect, Purpose and Function – Linking Devices (Comparison, Contrast, Additive and Sequential Relation) – Homonyms – Aux. Verbs – One Line Definition.

UNIT – III READING 07 Hrs

Skimming – Scanning for Specific Information – Inference – Context Based Meaning – Statistical Interpretation – Graphic Forms / Flow Charts – Tabular Column – Spelling and Punctuation.

UNIT – I WRITING 11 Hrs

Description of Objects – Checklist – Need Based Correspondence (requisition for joining hostel, bonafide certificate, permission for Industrial Visit, to attend a program, etc), Making Complaints – Letter of Invitation – Permission Letter – Pictorial representations based on Information – Tables, Flow Chart, etc - Hints Development.

UNIT – V LISTENING 07 Hrs

Listening to News – Understand and Present (Problems) – Critical Analysis – Implications – Listening to Dialogues – Listening to Telephonic Conversation.

Total : 45 hrs.

Course Outcomes:

C01: Understand and apply Grammar in context for professional communication.
C02: Understand the gist and specific information.
C03: Critically interpret by reading a text and comprehend a given text.
C04: Correspond and communicate for jobs
C05: Able to improve the capability of Listening

Text Book:

1. Division of Humanities and Social Sciences Anna University, Chennai, English for Engineers and Technologists (Vols. I & II combined edition) Orient Longmans Rept. (2008).

Reference:

1. Dr. S. Sumant, Technical English I, Tata McGraw Hill, Chennai (2012).

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SEMESTER - I

12MA1102 **ENGINEERING MATHEMATICS – I**
(Common To All Branches)

L	T	P	C
3	1	0	4

Objective(s): *On completion of the course, the students are expected, to apply advanced matrix knowledge to engineering problems, to expose the concept of three dimensional analytical geometry, to improve their ability in solving geometrical applications of differential calculus problems, to equip themselves familiar with the functions of several variables, to understand double and triple integrations and enable them to handles integrals of higher orders.*

UNIT – I MATRICES 12 Hrs

Characteristic equation – Eigen values and eigen vectors of a real matrix – Properties of eigen values and eigen vectors (without proof) – Cayley-Hamilton theorem (statement only) and its applications – Orthogonal transformation of a symmetric matrix to diagonal form – Nature of Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT – II THREE DIMENSIONAL ANALYTICAL GEOMETRY 12 Hrs

Direction cosines and ratios – Angle between two lines – Equation of a straight line – Coplanar lines Shortest distance between skew lines - Equation of a plane – Equation of a sphere – Plane section of a sphere – Tangent Plane – Orthogonal spheres.

UNIT – III DIFFERENTIAL CALCULUS 12 Hrs

Curvature in Cartesian co-ordinates – radius of curvature – Centre of curvature and Circle of curvature – Involutes and Evolutes – Envelopes – Properties of envelopes and evolutes - Evolute as envelope of normals.

UNIT – IV FUNCTIONS OF SEVERAL VARIABLES 12 Hrs

Partial derivatives – Euler‘s theorem for homogenous functions – Total derivatives – differentiation of implicit functions – Jacobians – Taylor‘s expansion – Maxima and Minima – Method of Lagrangian multipliers

UNIT – V MULTIPLE INTEGRALS 12 Hrs

Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between Cartesian and polar coordinates – Triple integration in Cartesian co-ordinates – Area as double integral – Volume as triple integral.

L = 45 T = 15 Total Hours: 60

Course Outcomes:

CO1: Interpret the basics of Matrix applications in the field of engineering.
CO2: To acquire knowledge in solving ordinary differential equations.
CO3: Understand and apply the concepts of differential calculus problems.
CO4: Skills in Developing and solving the functions of several variables.
CO5: Understanding the concepts of three dimensional analytical geometry and apply in the field of engineering.

Text Book:

1. Ravish R Singh and Mukul Bhatt, Engineering Mathematics - I, Third Edition, Mcgraw Hill Publications, New Delhi (2012)

References :

1. Grewal B.S, Higher Engineering Mathematics, Tata Mcgraw Hill Publishing Company, New Delhi (2007).
2. Erwin Kreyszig, Advanced Engineering Mathematics, 7 th Edition, Wiley India,(2007).
3. Bali N. P and Manish Goyal, Text book of Engineering Mathematics I & II, Third edition, Laxmi Publications(p) Ltd.(2008).

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SEMESTER - I

12PH1103 **ENGINEERING PHYSICS – I**
(Common To All Branches)

L	T	P	C
3	0	0	3

Objective(s): *On completion of the course, the student will be able to:*

- *Understand the fundamentals of Physics that have a direct application in the field of Engineering.*
- *Compute and analyze various problems related to Engineering Physics.*
- *Understand the properties, production of Ultrasonic waves and their application in non-destructive testing and Sonogram.*
- Understand *the basic configuration of Laser, different types of lasers and their industrial applications*
- *Know the principle behind the fiber optic communication and the applications of optical fiber in sensors.*

UNIT – I ACOUSTICS 09 Hrs

Introduction – Classification of sound – Characteristics of musical sound – Loudness – Weber – Fechner law - Decibel – Absorption coefficient – Reverberation – Reverberation time – Sabine's formula: growth & decay (derivation) – Factors affecting acoustics of buildings (reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies

UNIT – II ULTRASONICS 09 Hrs

Introduction – Production – magnetostriction effect - magnetostriction generator - piezoelectric effect - piezoelectric generator-Detection of ultrasonic waves – properties – Cavitations - Velocity measurement – acoustic grating - Industrial applications –drilling, welding, soldering and cleaning – SONAR - Non Destructive Testing – pulse echo system through transmission and reflection modes -A,B and C –scan displays, Medical applications – Sonograms.

UNIT – III LASERS AND APPLICATIONS 09 Hrs

Introduction – Principle of Spontaneous emission and stimulated emission- Population inversion, pumping - Einstein's A and B coefficients (derivation). Types of lasers – He - Ne, CO_2 , Nd-YAG, Semiconductor lasers (homojunction & heterojunction) – Qualitative Industrial Applications - Lasers in welding, heat treatment, cutting – Medical applications - Holography (construction & reconstruction).

UNIT – IV FIBER OPTICS & APPLICATIONS 09 Hrs

Principle and propagation of light in optical fibers – Numerical aperture and Acceptance angle (derivation) - Types of optical fibers (material, refractive index, mode) – Double crucible technique of fiber drawing - Splicing, Loss in optical fiber – attenuation, dispersion, bending –Fiber optical communication system (Block diagram) – Light sources - Detectors - Fiber optic sensors – temperature & displacement - Endoscope.

UNIT – V QUANTUM PHYSICS 09 Hrs

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect - Theory and experimental verification – Matter waves – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope – Scanning electron microscope - Transmission electron microscope

Total Hours: 45

Course Outcomes:

CO1: Describe the impact of engineering solutions in the constructional and designing environment.
CO2: Gain the knowledge of the ultrasonic waves in various applications
CO3: Categorize the types of laser and utilize it for specific application based on their desirable requisite.
CO4: Comprehend the fundamental ideas of optical fibers and to fabricate it for the potential applications.
CO5: Enumerate the preambles of quantum physics and to implement its concepts to tackle the cumbersome engineering problems.

Text Books:

1. Dr.G.Senthil Kumar, Engineering Physics – I VRB Publishers Pvt Ltd, (2009).
2. M.N. Avadhanulu and P.G.Kshirsagar, A Text Book of Engineering Physics, S. Chand & Co, New Delhi (2005).

References:

1. Dr. P. Mani, Engineering Physics, Dhanam Publications, Chennai (2007).
2. Brij Lal and Subramaniam, Text Book of Sound, S. Chand & Co Ltd, New Delhi (2005)
3. Dr. P. Mani, Engineering Physics – I, Dhanam Publications, Chennai, (2012).
4. S. Selladurai, Engineering Physics-I, PHI Learning Pvt, Ltd., New Delhi, (2010).

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SEMESTER – I

12CY1104 **ENGINEERING CHEMISTRY**
(Common To All Branches)

L	T	P	C
3	0	0	3

Objective(s): *The student should be conversant with the principles of water characterization and treatment of water for potable and industrial purposes, polymer chemistry and engineering applications of polymers, corrosion and its control, non-conventional energy sources and energy storage devices and chemistry of fuels.*

UNIT – I WATER TREATMENT **09 Hrs**

Characteristics – Alkalinity – types of alkalinity and determination; Hardness – units, types and estimation by EDTA method (problems); Boiler feed water – requirements, disadvantages of using hard water in boilers, internal conditioning and external conditioning – zeolite process and demineralization process; Domestic water treatment; Desalination – Reverse Osmosis and Electrodialysis.

UNIT – II POLYMERS AND COMPOSITES **09 Hrs**

Polymers – definition; Polymerization – types – addition and condensation polymerization – free radical polymerization mechanism; Plastics – classification, preparation, properties and uses of bakelite, polycarbonate, polyurethane, nylon-6,6, PET; Compounding and Fabrication of Polymers – Compression and Injection moulding; Rubber – vulcanization of rubber, synthetic rubbers – butylrubber and SBR; Composites – definition, types, polymer matrix composites – FRP only.

UNIT – III CHEMISTRY OF CORROSION AND ITS CONTROL **09 Hrs**

Introduction – Electrochemical cells – reversible and irreversible cells; Electrochemical series – significance; Corrosion – chemical corrosion – Pilling-Bedworth rule, electrochemical corrosion – mechanism, galvanic corrosion and differential aeration corrosion; Factors influencing corrosion; Corrosion control – cathodic protection methods, corrosion inhibitors and protective coatings – preliminary treatment, Paints – constituents and functions; Metallic coatings – Electroplating (Au) and Electroless plating (Ni).

UNIT – IV NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES **09 Hrs**

Energy resources – growing energy needs; Nuclear energy – fission and fusion reactions; Light water nuclear reactor for power generation and breeder reactor; Solar energy conversion – solar cells; Wind energy; Fuel cells – hydrogen – oxygen fuel cell; Batteries – alkaline batteries, lead–acid, nickel– cadmium and lithium batteries.

UNIT – V FUELS AND COMBUSTION **09 Hrs**

Fuels – calorific value, gross and net calorific values (problems); Coal – proximate and ultimate analyses; Metallurgical coke – manufacture by Otto- Hoffmann method; Petrol – fractional distillation, cracking-types; Synthetic petrol – Bergius and Fischer Tropsch process; Knocking – octane number and cetane number; Flue gas analysis – Orsat gas apparatus; Theoretical air for combustion (problems).

Total Hours: 45

Course Outcomes:

CO1 : *To be familiarized with the water quality parameters and understand the various water treatment methods*

CO2 : *Enable to know the preparation and fabrication of various types of polymers and composite materials*

CO3 : *Perceive knowledge on the concept of corrosion and it's control.*

CO4 : *Understand the importance of Non conventional Energy sources and Storage devices*

CO5 : *Gain Knowledge on various Fuels and the combustion process*

Text Books:

1. P.C. Jain and Monica Jain, Engineering Chemistry, Dhanpat Rai Pub. Co., New Delhi, 15th Edition(2009).
2. S.S.Dara, A Text book of Engineering Chemistry, S.Chand & Co.Ltd., New Delhi (2005).

References:

1. B. Sivasankar, Engineering Chemistry, Tata McGraw-Hill Pub. Co. Ltd., New Delhi (2008).
2. B.K. Sharma, Engineering Chemistry, Krishna Prakasan Media (P) Ltd., Meerut (2001).
3. N. Krishnamurthy, P. Vallinayagam and D. Madhavan, Engineering Chemistry, PHI Learning Private Ltd, New Delhi (2009).

K.S.R. COLLEGE OF ENGINEERING (Autonomous)

SEMESTER – I

12CS1105 **FUNDAMENTALS OF COMPUTING AND PROGRAMMING**
(Common To All Branches)

L	T	P	C
3	0	0	3

Objective(s): *To equip students with comprehensive knowledge of computer fundamentals and C programming so that they can develop programs on their own for various applications.*

UNIT – I INTRODUCTION TO COMPUTERS 09 Hrs

Introduction – Characteristics of Computers – Evolution of Computers – Generations of Computers – Classification of Computers – Application of Computers – Components of Computer System and Specifications – Number Systems: Natural Numbers – Integers – Decimal – Binary – Octal – Hexadecimal – Conversion of one number system to other number system – BCD – Excess 3 – Gray Code – Alphanumeric Codes – 1's and 2's Complements

UNIT – II COMPUTER SOFTWARE AND PROBLEM SOLVING 09 Hrs

Computer Software – Categories of Software – Software Development Steps – Internet Evolution – Basic Internet Terms – Types of Internet Connection – Internet Services – Program Development Lifecycle – Algorithm – Flow Charts – Pseudo code – Programming Languages

UNIT – III INTRODUCTION TO C 09 Hrs

Introduction to C – Structure of C Program – programming Rules – Executing the program– C Declaration – Character Set – Delimiters – Keywords – Identifiers – Constants – Data Types – Variables : Definition – Declaration – Initialization – Type Conversion – Constant and Volatile – Operators and Expressions – Input and Output in C – Decision Making Statements - Branching and Loop Control Statements – Storage Classes

UNIT – IV ARRAYS, FUNCTIONS AND STRUCTURES 09 Hrs

Arrays: Introduction – Definition – Types – Functions – Introduction – Declaration and Prototype – Types – Call by Value – Call by Reference – Recursive Function – Working with Strings and Standard Functions – Structures and Unions : Introduction – Features – Declaration and Initialization – Structure within Structure – Array of Structure – Structure and Function – Enumerated Data Type – Union.

UNIT – V POINTERS AND FILES 09 Hrs

Pointers: Introduction – Features – Declaration – Arithmetic Operations – Array of Pointers – Pointers to Functions – Pointer to Structures – Pointer to Pointer – Void Pointer – Files: Introduction – Types – Steps for File Operation – File I/O – Command Line Arguments – The Preprocessor Directives.

Total Hours: 45

Course Outcomes:

CO1 : Identify Basics of Computer.
CO2 : Write C Programs for solving simple scientific and statistical problems.
CO3 : Understand the introductory concepts of C Programming.
CO4 : Write C Programs using arrays and Functions
CO5 : Implement Simple C applications using pointers and Files.

Text Books :

1. Ashok.N.Kamthane,Computer Programming, Pearson Education – India,(2008).
2. B.L. Juneja and A. Seth, Computer Fundamentals and C Programming, Cengage Learning India,(2012).

References :

1. Pradip Dey, Manas Ghoush, Programming in C, Oxford University Press (2007).
2. Byron Gottfried, Programming with C, 2nd Edition, TMH publications, (2006).
3. Brian W.Kernighan and Dennis M.Ritchie, The C Programming Language, Pearson Education Inc., (2005).
4. Alexis Leon, Mathews Leon,Introduction to Computers, Leon Techworld,(2009).

K.S.R. COLLEGE OF ENGINEERING (Autonomous)

SEMESTER – I

12ME2106 **ENGINEERING DRAWING**
(Common To AU, CE & ME)

L	T	P	C
1	3	0	4

Objective(s): *To develop students' graphic skill for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.*

UNIT – I PLANE CURVES AND ORTHOGRAPHIC PROJECTION 15 Hrs

Introduction on drafting instruments, BIS conventions and specifications, Lettering and Dimensions Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes– Drawing of tangents and normal to the above curves. Representation of Three Dimensional objects – General principles of orthographic projection – First angle projection.

UNIT – II PROJECTION OF POINTS, LINES AND PLANE SURFACES 15 Hrs

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 any one reference plane.

UNIT – III PROJECTION OF SOLIDS 15 Hrs

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

UNIT – IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 15 Hrs

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. Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones.

UNIT – V ISOMETRIC AND PERSPECTIVE PROJECTIONS 15 Hrs

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones. Perspective projection of prisms, pyramids and cylinders by visual ray method.

Total hours : 75

Course Outcomes:

CO1 : Develop the knowledge about basic concepts and methodology to draw the special curves and find the procedure

CO2: Discussed about orthographic projection of points, straight lines and plane surfaces in first angle projection.

CO3 : Understand the position of the given condition of simple solids

CO4 : Explain the methodology for drawing the development of the truncated solids and how to make the cylindrical cut outs

CO5 : Improve the knowledge about how to draw the isometric projection of the truncated solids

Text Books:

1. K. V. Natarajan, A text book of Engineering Graphics, Dhanalakshmi Publishers, Chennai (2006).
2. M.S. Kumar, Engineering Graphics, D.D. Publications, (2007).

References:

1. Venugopal & V. Prabhu Raja, Engineering Graphics, New Age International (P)Limited (2008).
2. N.D. Bhatt, Engineering Drawing, Charotar Publishing House, 46 th Edition, (2003).
3. B. Shah and B.C. Rana, Engineering Drawing, Pearson Education (2005).
4. K. R. Gopalakrishna, Engineering Drawing, (Vol.I & II), Subhas Publications (1998).
5. Basant Agarwal and C.M. Agarwal, Engineering Drawing, Tata McGraw Hill Publishing Company Limited, New Delhi, (2008).

K.S.R. COLLEGE OF ENGINEERING (Autonomous)

SEMESTER – I

12GE1210 **PHYSICS AND CHEMISTRY LABORATORY**
(Common To All Branches)

L	T	P	C
0	0	3	3

Objective(s): *To gain practical knowledge in the following experiments*

List of Experiments in Physics Laboratory

1. Determination of wavelength of laser using grating and angle of divergence of the laser beam
2. Determination of acceptance angle and numerical aperture of an optical fiber
3. Determination of thickness of the material by air – wedge method
4. Determination of velocity of Ultrasonic waves and compressibility using ultrasonic interferometer
5. Determination of wavelength of mercury spectrum by Spectrometer grating
6. Determination of thermal conductivity of a bad conductor by Lee's disc method

List of Experiments in Chemistry Laboratory

1. Estimation of Hardness in Water by EDTA Method
2. Estimation of Copper in Brass by EDTA Method
3. Estimation of Dissolved Oxygen (DO) in Water by Winkler's Method
4. Estimation of Chloride in Water Sample by Argentometry
5. Estimation of Alkalinity of Water Sample
6. Determination of Molecular Weight and Degree of Polymerization using Viscometry

Total Hours: 45

Course Outcomes:

CO1 : Comprehend the different physical parameters of optics.
CO2: Perceive the production of ultrasonic waves through inverse piezoelectric effect and to determine the velocity of sound waves in the given liquid.
CO3 : Understand the principle of thermal conductivity thereby to calculate the thermal conductivity of various bad conductors like cardboard, mica, etc.
CO4 : To know the applicability of water in various fields.
CO5:- To know the composition of brass quantitatively and the molecular weight of the polymer.

References:

1. Dr.G.Senthilkumar, Physics Lab manual, VRB Publications Pvt. Ltd.,(2006).
2. J.B. Yadav , Advanced Practical Physical Chemistry, GOEL Publishing House.
3. Gurdeep Raj, Advanced Practical Inorganic Chemistry, GOEL Publishing House.

Note: A Minimum of FIVE experiments shall be offered in each Laboratory classes on alternate weeks for Physics and Chemistry

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SEMESTER - I

12CS1110 **COMPUTER PRACTICES LABORATORY - I**

(Common To All Branches)

L	T	P	C
0	0	3	3

Objective(s): *To gain practical knowledge in the following experiments.*

LIST OF EXPERIMENTS

1. Study Experiment

- Hardware Specification and PC Assembly
- Getting connected to Internet
-

2. Word processing

- Documentation Creation, Text Manipulation with Scientific Notation
- Table Creation, Table Formatting and Conversion
- Mail Merge
- Flow Chart Preparation.

3. Spread Sheet

- Charts – Bar Chart, Pie Chart, Line Chart, X,Y – Chart
- Object Inclusion, Picture and graphics
- Protecting the Document

4. Power Point Presentation and Access

- Creation of Presentation
- Generation of Report using Access

5. C Programming

- Simple C Program with Data Types, Expressions and Comment Lines
- Programming with Conditional Statements
- Programming with Branching and Looping Statements
- Programming with Arrays and Structures
- Programming with Functions and Pointers

Total Hours: 45

Course Outcomes:

CO1: Be familiar with creating a table, flow chart, mail merge and apply text manipulation in a word document
CO2: Design a spread sheet for creating the charts and apply formulas and functions.
CO3: Create power point presentation with animations and generate a report in MS access.
CO4: Apply good programming design methods for program development.
CO5: Design and implement C programs for simple applications.

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SEMESTER - I

12AU2111 **COMPUTER AIDED DRAWING LABORATORY**
(Common To AU & ME)

L	T	P	C
0	0	3	3

Objective(s): *To gain practical knowledge in the following experiments*

LIST OF EXPERIMENTS

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using B spline or cubic spline
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (e. g. V- block, Base of a mixie, Simple stool, Objects with hole and curves)
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Total Hours: 45

Note:

Plotting of drawings must be made for each exercise and attached to the records written by students

Course Outcomes:

CO1 : Construct special curves and conic sections using drafting software.

CO2 : Draw the projection of solids using drafting software.

CO3 : Draw the true shape of section of solids

CO4 : Covert the pictorial views into orthographic views using drafting software.

CO5 : Construct the isometric projections of objects using drafting software.

CO6 : Create the 3D models of simple objects from 2D multi view drawing

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SEMESTER - I

12HR1112 **CAREER DEVELOPMENT SKILLS – I**
(Common To All Branches)

L	T	P	C
0	2	0	1

Objective(s): *To make the students aware about their career and expose them to the concepts of communication and practice through interactive soft ware and to enable them understand about themselves and provide them with Experiential Learning.*

UNIT – I CAREER AWARENESS 3 Hrs

Career Planning – Career Options – Importance of Career Planning – General Awareness about the Course and Opportunities (Engineering Dept) – Basic Life Skills – Self introduction (Activity on Self Introduction)

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UNIT – II STORY TELLING AND ROLE PLAY 7 Hrs

Listening to Stories and Contextual Conversations – Narrative Techniques & Developing SituationsSummarizing Abilities – Tenses for Storytelling – Specific Vocabulary – Body Language. (Activity on Story Telling and Role Play).

UNIT – III SELF ESTEEM AND ATTITUDE 7 Hrs

Term Self Esteem – Signs of Self Esteem – Advantages – Do's and Don‘ts to Develop Positive Self esteem – Low Self-esteem – Symptoms – Positive and Negative Self-esteem. Building Positive Attitude – Importance – Measures of Attitude – Confidence Building Techniques.

UNIT – IV BASIC ETIQUETTES 3 Hrs

Dress Code – Behavioral Skills – Personal Etiquette (Cleanliness, Dining / Table Manners, Dressing / Grooming, etc.) – Social Etiquette (Polite Talk, Manners).

UNIT – V COMMUNICATION ESSENTIALS 10 Hrs

Listening Skills (Active Listening) – Voice and Accent – Body language (Non-Verbal Communication) – Pronunciation Practice (Activity – Using Interactive Software for Communication Skills in the Language Laboratory).

Total Hours: 30

Course Outcomes

CO1 : Have competency on planning the career and aware about the opportunities
CO2 : Communicate effectively and enhance interpersonal skills with renewed self confidence.
CO3 : Improve the Self Esteem and implement confidence building techniques.
CO4 : Exhibit behavioural skills and follow basic etiquettes
CO5 : Develop their LSRW skills

Text Book(s):

1. Jeff Butterfield, Soft Skills for Everyone, engage Learning India pvt ltd, New Delhi, (2011).

References:

1. Bhatnagar Nitin, Communicative English for Engineers and Professionals,ISBN 9788131732045, Pearson Publication, New Delhi (2010).
2. V.Sasikumar, P.Kiranmai Dutt & Geetha Rajeevan, Listening & Speaking , ISBN 9788175963344, Pearson Education, New Delhi, (2007).
3. V.Sasikumar Spoken English: A Self-Learning Guide to Conversation Practice, Tata McGraw Hill Publishing Company Limited, New Delhi. (2011).

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SEMESTER - II

12HS1201 **TECHNICAL ENGLISH – II**
(Common To All Branches)

L	T	P	C
3	0	0	3

Objective(s): *To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills through improvement of LSRW skills*

UNIT – I LANGUAGE FOCUS 10 Hrs

Technical Vocabulary – Adjectives (Comparatives) – Conjunction, Preposition- Clauses (Simple, Compound Complex) – SI Units – Abbreviation & Acronyms – Homophones- Idioms – Foreign Words and Phrases – Phrasal Verbs

UNIT – II LANGUAGE FOCUS 10 Hrs

Relative Clauses – Imperative – Adverbial Clauses of Time, Place and Manner – Intensifiers – Basic Patterns of Sentences – One Word Substitution - 'If' Conditionals – Correction of Errors – Concord – Reported Speech

UNIT – III READING 7 Hrs

Intensive Reading – Predicting Content – Interpretation – Inference from the Text (Implication) – Inferential Information – Implication – Critical Interpretation – Reading Brief Notices, Notices - Advertisement and The Implication

UNIT – IV WRITING 11 Hrs

Paragraph Writing – Letter Writing – Job Application and Resume, Business Correspondence - Instructions – E-mail Writing – Process Description – Transcoding of Information from Pie Chart, Bar Chart, etc.

UNIT – V SPEAKING 7 Hrs

Stress and Intonation – Introducing oneself – Introducing others – Oral Instructions

Total Hours: 45

Course Outcomes:

CO1 : Classify and categorize preposition, simple, compound and complex sentences and use them in language

CO2 : Employ idioms, foreign words and phrases indicating Time, Place, and Manner to enhance written and spoken form

CO3 : Make critical interpretation by reading a text

CO4 : Review brief notices, and advertisements and make implications and which help to write paragraphs having a concept or an idea effectively

CO5 : Tailor a resume effectively and speak the language with proper stress and intonation

Text Book:

Division of Humanities and Social Sciences Anna University, Chennai, English for Engineers and Technologists (Vols. I & II combined edition) Orient Longmans Rept.(2008).

Reference:

1. Dr. S. Sumant, Technical English I, Tata McGraw Hill, Chennai (2012).

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SEMESTER - II

12MA1202 **ENGINEERING MATHEMATICS - II**
(Common To All Branches)

L	T	P	C
3	1	0	4

Objective(s): *On completion of the course, the students are expected*

- *To familiarize with the applications of differential equations.*
- *To know the basics of vector calculus comprising of gradient, divergence, curl and line, surface & volume integrals along with classical theorems involving them.*
- *To grasp the basics of complex integration and the concept of contour integration which is important for evaluation of certain integrals encountered in practice.*
- *To study the Laplace transform techniques, then apply to solve second order linear differential equations with constant coefficients.*

UNIT – I ORDINARY DIFFERENTIAL EQUATIONS 12 Hrs

Linear differential equations of second and higher order with constant coefficients – Method of variation of parameters – Differential equations with variable coefficients -Cauchy‘s and Legendre‘s linear equations – Simultaneous first order linear differential equations with constant coefficients.

UNIT – II VECTOR CALCULUS 12 Hrs

Gradient Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green‘s theorem in a plane, Gauss divergence theorem and stokes‘theorem (excluding proof) – Simple applications involving cubes and rectangular parallelopipeds.

UNIT – III ANALYTIC FUNCTIONS 12 Hrs

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proof) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping : w = z+c, cz, 1/z, and bilinear transformations

UNIT – IV COMPLEX INTEGRATION 12 Hrs

Complex integration – Statement and applications of Cauchy‘s integral theorem and Cauchy‘s integral formula – Taylor and Laurent expansions – Singular points – Residues – Residue theorem – Application of residue theorem to evaluate real integrals – Unit circle and semi-circular contour.

UNIT – V LAPLACE TRANSFORMATION 12 Hrs

Laplace transforms – Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse functions – Initial and final value theorems - Transform of periodic functions.Inverse Laplace transforms – Convolution theorem (excluding proof) – Solution of linear ordinary differential equations of second order with constant coefficients

L:45 T:15 Total Hours:60

Course Outcomes:

CO1 -.Gain knowledge on the Linear Differential Equations
CO2 - Acquire the basics of vector calculus *and its applications.*
CO3 – Able to understand the concepts of Analytic functions
CO4 - Enable to evaluate the area of the surface and volume using double and triple integrations.
CO5 - Enable to understand the fundamentals of Laplace transform and its applications Understand and apply the concepts of analytic functions, conformal mapping and bilinear transformations

Text Book:

Ravish R Singh and Mukul Bhatt, Engineering Mathematics - II, Third Edition, Mcgraw Hill Publications, New Delhi, (2012).

References:

1. B.S.Grewal, Higher Engineering Mathematics, Tata Mcgraw Hill Publishing Company, New Delhi, (2007).
2. Erwin Kreyszig, Advanced Engineering Mathematics, 7th Edition, Wiley India, (2007).
3. N.P.Bali and Manish Goyal, Text book of Engineering Mathematics I & II, Third edition, Laxmi Publications(p) Ltd.,(2008).

K.S.R. COLLEGE OF ENGINEERING (Autonomous)

SEMESTER - II

12PH1203 **ENGINEERING PHYSICS - II**
(Common To All Branches)

L	T	P	C
3	0	0	3

Objective(s): *To enable the student to*

- *Describe the theory of conducting and semiconducting materials.*
- *Explain the properties of magnetic and dielectric materials.*
- *Discuss about the various module of elasticity and their relations.*
- *Understand some exciting prospects of modern engineering materials*

UNIT – I CONDUCTING MATERIALS 09 Hrs

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT – II SEMICONDUCTING MATERIALS 09 Hrs

Elemental & Compound semiconductors - Intrinsic semiconductor – Carrier concentration (derivation) - Fermi energy level – Variation of Fermi level with temperature - Electrical conductivity - Band gap determination - Extrinsic semiconductors – Carrier concentration in n - type and p – type semiconductors (Qualitative) - Hall effect - Determination of Hall effect - Determination of Hall coefficient – Applications.

UNIT – III MAGNETIC AND DIELECTRIC MATERIALS 09 Hrs

Origin of magnetic moment – Bohr magneton – Dia, Para, Ferro and Anti ferromagnetism and its properties - Domain theory– Hysteresis – soft and hard magnetic materials – applications. Dielectrics - Dielectric constant – Polarization in dielectrics – Electronic, Ionic, Orientational and Space charge polarizations (Derivation for polarizability) – Internal or local field- Clausius – Mosotti equation – Dielectric loss – Dielectric breakdown – Types of dielectric breakdowns - Applications

UNIT – IV ELASTICITY AND HYDRODYNAMICS 09 Hrs

Elasticity-Stress – Strain – Hooke‘s Law – Types of moduli of elasticity – Torsional pendulum – Determination of Rigidity modulus of a wire – Bending of beams – Expression for bending moment – Measurement of Young‘s modulus by uniform and non-uniform bending – I‘ Shaped girders Stream line flow – Turbulent flow- Poiseuille‘s equation for the flow of liquid through a tube.

UNIT – V MODERN ENGINEERING MATERIALS 09 Hrs

Metallic glasses: Preparation, properties and applications. Shape memory alloys (SMA): Characteristics,properties of NiTi alloy, application, advantages and disadvantages of SMA Nanomaterials: synthesis – solgels – electro deposition - properties of nanoparticles and applications Carbon nanotubes: fabrication – pulsed laser deposition – chemical vapour deposition - structure – properties and applications.

Total Hours: 45

Course Outcomes:

CO1 : Comprehend the basics of conducting, superconducting materials and their applications
CO2: Gain knowledge on the various Semi conducting materials
CO3 : Categorize the magnetic materials based on their properties and to enumerate different types of polarization in dielectrics and the theories of dielectrics
CO4: Grasp the knowledge about different types of elasticity, bending of beams, property of flow of liquids and its theory
CO5: Confer the properties, preparation and applications of metallic glasses, shape memory alloys and nano materials

Text boooks:

1. Dr.G.Senthil Kumar, Engineering Physics – II, VRB Publishers Pvt. Ltd.(2011).
2. William F. Smith, Foundations of Materials Science and Engineering, McGraw-Hill,(2003).

References:

1. G.Senthilkumar and N.Iyandurai, Engineering Physics – I,VRB Publications Ltd, Chennai,(2003).
2. T. Sivanesan & Ranjani, Engineering Physics – II, D.D. Publications, Chennai,(2011).
3. R. Murugesan, Properties of matter, S. Chand & Co, Delhi (2007).
4. Subramaniam & Brij Lal, Properties of Matter, S. Chand & Co, New Delhi (2005).
5. Dr.S.Muthukumaran, S.Masilamani and G.Balaji, Engineering Physics - II, Sri Krishna HI—Tech Publishing company Pvt. Ltd. (2011).

K.S.R. COLLEGE OF ENGINEERING (Autonomous)

SEMESTER - II

12CY1204 **ENVIRONMENTAL SCIENCE AND ENGINEERING**
(Common To All Branches)

L	T	P	C
3	0	0	3

Objective(s):

- *To make students understand the concepts of natural resources, ecosystem and biodiversity.*
- *To create awareness on pollution, value education, population growth and social issues.*
- *Students will be made aware of the concepts of the environment, its issues and possible solutions at the end of the semester.*

UNIT – I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURALRESOURCES 09 Hrs

Environment – definition, scope and importance, need for public awareness; Forest resources – use, over exploitation, deforestation, case studies, mining, dams and their effects on forests and tribal people; Water resources – use, over- utilization of surface and ground water, floods, drought, conflicts over water; Mineral resources – use, exploitation, environmental effects of extracting and using mineral resources and case studies; Food resources - world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity and 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.

UNIT – II ECOSYSTEMS AND BIODIVERSITY 09 Hrs

Concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids; Types of ecosystem – introduction, characteristic features, structure and function of the Forest ecosystem and Aquatic ecosystems; Biodiversity – introduction, definition of genetic, species and ecosystem diversity; Value of biodiversity; Hot-spots of biodiversity; Threats to biodiversity; Endangered and Endemic Species of India; Conservation of biodiversity – *In-situ* and *Ex-situ* conservation of biodiversity.

UNIT – III ENVIRONMENTAL POLLUTION 09 Hrs

Pollution – introduction and different types of pollution; Causes, effects and control measures of Air pollution, Water pollution – BOD and COD (definition and significance), DO and its determination by Winkler‘s method, Soil pollution and Noise pollution; Solid waste management – causes, effects and control measures of urban and industrial waste; Hazardous waste – nuclear and medical wastes.

UNIT – IV SOCIAL ISSUES AND ENVIRONMENT 09 Hrs

Urban problems related to energy; Water conservation – rain water harvesting and watershed management; Resettlement and rehabilitation of people – its problems and concerns; Environmental ethics – issues and possible solutions; Climate change – global warming and its effects on flora and fauna, acid rain, ozone layer depletion, nuclear accidents and nuclear holocaust; Wasteland reclamation; Consumerism and waste products; Environment Protection Act – Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act and Forest Conservation Act; Issues involved in enforcement of environmental legislation.

UNIT – V HUMAN POPULATION AND ENVIRONMENT 09 Hrs

Human population – population growth and variation among nations; Population explosion; Family welfare programme and family planning; Environment and human health; Human rights; Value education – HIV / AIDS; Women and child welfare; Role of information technology in environment and human health; Sustainable development – from Unsustainable to Sustainable development – Green Chemistry.

Total Hours: 45

Course Outcomes:

CO1: Play an important role in conservation of resources for future generation.
CO2: Paraphrase the importance of ecosystem and biodiversity
CO3: Analyze the impact of pollution and hazardous waste in a global and societal context
CO4: Understand contemporary issues that result in environmental degradation that would attempt to provide solutions to overcome the problems
CO5: Consider issues of environment and human population in their professional undertakings

Text Books:

1. T. G. Jr. Miller, Environmental Science, Wadsworth Publishing Co. (2004).
2. Anubha Kaushik and C. P. Kaushik, *Environmental Science and Engineering*, New Age International Publishers, New Delhi (2006).

References:

1. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad, India (2004).
2. Benny Joseph, Environmental Science and Engineering, Tata McGraw-Hill (2006).
3. S.S.Dara , A Text Book of Environmental Chemistry and Pollution Control, S. Chand & Co., New Delhi(2006).
4. Raman Sivakumar, Introduction to Environmental Science and Engineering, Tata McGraw Hill

Education Private Limited, New Delhi (2011).

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SEMESTER - II

12EE2205 **BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING**
(Common To AU, CE & ME)

L	T	P	C
3	1	0	4

Objective(s):

- *To study the basic concepts of electric circuits.*
- *To study the various measuring instruments and need for control system*
- *To familiarize the constructional details and operation of the electrical machines*
- *To study the characteristics of semiconductor devices and its application*
- *To study the simplification of mathematical expression, flip flops and converters*

UNIT – I ELECTRICAL CIRCUITS 12 Hrs

Basic Definitions – Ohm‘s Law – Kirchhoff‘s Laws – Faraday‘s Law – Lenz‘s Law – Introduction to AC Circuits – Waveforms, Average and RMS Value – Power and Power factor – Three Phase Balanced Circuits: Star and Delta Connections.

UNIT – II MEASURING INSTRUMENTS AND CONTROL SYSTEM 12 Hrs

Basic Methods of Measurements: Direct and Indirect – Analog and Digital Instruments – Basic Principle of Indicating Instruments – Moving Coil and Moving Iron Ammeter and Voltmeter – Dynamometer type Wattmeter – Induction type Energy Meter – Cathode Ray Oscilloscope.Fundamentals of Control Systems: Basic Definitions – Open Loop Systems – Closed Loop Systems – Effect of Feed Back

UNIT – III ELECTRICAL MACHINES 12 Hrs

DC Generators: Construction – Operation – EMF Equation – Types - Applications. DC Motors: Operation – Types – Applications. Single Phase Transformer: Construction – Operation – EMF Equation – Applications, Single Phase Induction Motor: Construction – Operation – Split Phase Induction Motor and Capacitor Start Induction Run Motor – Applications, Three Phase Induction Motor : Types - Applications.

UNIT – IV SEMICONDUCTOR DEVICES AND APPLICATIONS 12 Hrs

Characteristics of PN Junction Diode – Avalanche and Zener break down – Zener diode – Zener diode Characteristics – Construction and Operation of Half wave and Full wave Rectifiers. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Applications.

UNIT – V DIGITAL ELECTRONICS 12 Hrs

Logic Gates – Boolean Algebra – Boolean Laws – Half and Full Adders – RS and JK Flip-Flops – Registers – Asynchronous and Synchronous Counters – Digital to Analog converter: successive Approximation method – Analog to Digital Converter: Binary Weighted Resistor and R-2R ladder method.

L = 45 T = 15 Total Hours: 60

Course Outcomes:

CO1: Solve the electric circuits by applying basic circuital laws using various combinations of circuit elements.
CO2: Illustrate the function of various measuring instruments.
CO3: Explain the construction, operating principle and application of DC generator, DC motor, transformers.
CO4: Enlighten the construction, operating principle and application of Semi conductor Devices.
CO5: Discuss the characteristics of Diodes, Zener diode, BJT using CE configurations.

Text Books:

1. Smarajit Ghosh, Fundamentals of Electrical and Electronics Engineering, PHI Learning Private Limited, Second Edition (2009).
2. V.Jegathesan, K.VinothKumar and R.Saravanakumar, Basic Electrical and Electronics Engineering, Wiley India,(2011).

References:

1. R. Muthusubramanian,S. Salivahanan and K.A.Muraleedharan, Basic Electrical, Electronics and Computer Engineering,Tata McGraw Hill, Second Edition, (2006).
2. T.K .Nagsarkar and M.S.Sukhija, Basics of Electrical Engineering, Oxford press (2005).
3. V.K Mehta and Rohit Mehta, Principle of Electrical Engineering, S Chand & Company, (2008).
4. Mahmood Nahvi and Joseph A. Edminister, Electric Circuits, Schaum‘ Outline Series, McGraw Hill (2002).

K.S.R. COLLEGE OF ENGINEERING (Autonomous)

SEMESTER - II

12CE2206 **ENGINEERING MECHANICS**
(Common To AU, CE & ME)

L	T	P	C
3	1	0	4

Objective(s)*: 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 & STATICS OF PARTICLES 12 Hrs

Introduction – Units and Dimensions – Laws of Mechanics – Lame‘s theorem, Parallelogram and triangular Law of forces – Vectors –– 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 Hrs

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 Hrs

Determination of Areas and Volumes – First moment of area and the Centroid of sections – simple and compound sections by using standard formula – second and product moments of plane area – simple and compound sections 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

UNIT – IV DYNAMICS OF PARTICLES 12 Hrs

Displacements, Velocity and acceleration, their relationship – Rectilinear motion – Determination of motion of a particle – freely falling objects – relative motion- Curvilinear motion – projectile motion - Newton‘s law – D‘Alembert‘s principle – Work Energy Equation of particles – Conservative forces and principle of conservation of energy - Impulse and Momentum – Impact – Direct central impact and oblique central impact

UNIT – V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12 Hrs

Frictional force – Types of friction- Laws of Coulomb friction – Angle of repose – Simple Contact friction - Wedge friction, Screw friction, Rolling resistance, Ladder friction, Belt friction. Translation and Rotation of Rigid Bodies – Velocity and acceleration – Plane motion, Absolute motion - Relative motion.

L = 45 T = 15 Total Hours: 60

Course Outcomes:

CO1: Recall and acquire knowledge in the Law of mechanics, forces and equilibrium of particles.
CO2 : Analyze about moments, couples and equilibrium of rigid bodies in two dimensions and analyze the friction
CO3: Determine moments of Inertia and centroid using integration methods.
CO4 : Outline the concepts involved in rectilinear and curvilinear motion and summarize the different laws of motion.
CO5 : Analyze the translation and rotation of rigid bodies.

Text Books:

1. M.S.Palanichamy, S.Nagan,Engineering Mechanics-Statics and Dynamics, Tata McGraw-Hill, (2001).
2. S.C. Natesan, Engineering Mechanics Statics and Dynamics, Umesh Publications, Naisarak, Delhi (2005).

References:

1. Rajasekaran, S, Sankarasubramanian.G, Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., (2005).
2. R.C.Hibbelle, Engineering Mechanics, Vol.1 Statics, Vol.2 Dynamics,Pearson Education Asia Pvt. Ltd., (2000).
3. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition – Pearson Education Asia Pvt. Ltd., (2003).

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SEMESTER - II

12GE1210 **PHYSICS AND CHEMISTRY LABORATORY**
(Common To All Branches)

L	T	P	C
0	0	3	3

Objective(s): *To gain practical knowledge in the following experiments*

LIST OF EXPERIMENTS IN PHYSICS LABORATORY:

1. Determination of Young's modulus of the material of a uniform bar by non – uniform bending method.
2. Determination of Young's modulus of the material of a uniform bar by uniform bending method
3. Determination of Band gap energy of a semiconductor
4. Determination of Viscosity of liquid by Poiseuille's method.
5. etermination of rigidity modulus of a wire by torsional pendulum.
6. Determination of dispersive power of the given prism using spectrometer.

LIST OF EXPERIMENTS IN CHEMISTRY LABORATORY:

1. Conductometric Titration – Strong Acid vs. Strong Base
2. Conductometric Titration – Mixture of Weak and Strong Acids.
3. Conductometric Titration – Precipitation, $BaCl_2$ vs. Na_2SO_4
4. Estimation of Ferrous ion by Potentiometry – Fe^{2+} vs $K_2Cr_2O_7$
5. Estimation of Hydrochloric Acid by pH metry.
6. Estimation of Iron by Spectrophotometry
7. Estimation of water of crystallization of Copper Sulphate.

Total Hours: 45

Course Outcomes:

CO1: Confer the experimental counterparts of materials properties such as modulus, solar cell, and energy gap.
CO2: Imbibe the concept of capillary action in fluid dynamics and to compare the coefficient of viscosity of the given liquid.
CO3: To gain practical knowledge in determining the strength of a solution in a given solution by conductometric titration methods.
CO4: To get conceptual knowledge in estimating the concentration of Iron in solution by electrochemical methods.
CO5: To determine the role of pH in quantitative analysis of a solution.

Reference Books:

1. Dr.G.Senthilkumar, Physics Lab manual, VRB Publications Pvt. Ltd.,(2006).
2. J.B. Yadav, Advanced Practical Physical Chemistry, GOEL Publishing House.
3. Gurdeep Raj, Advanced Practical Inorganic Chemistry, GOEL Publishing House.

Note:

A Minimum of FIVE experiments shall be offered. Laboratory classes on alternate weeks for Physics and Chemistry.

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SEMESTER - II

12CS1211 **COMPUTER PRACTICES LABORATORY - II**
(Common To All Branches)

L	T	P	C
0	0	3	3

Objective(s): *To gain practical knowledge in the following experiments.*

LIST OF EXPERIMENTS

1. UNIX COMMANDS

- Study of Unix Operating Systems
- Unix Commands
- Unix Editor
- Basic Shell Commands

2. SHELL PROGRAMMING

- Simple Shell Program
- Conditional Statements
- Testing and Loops

3. C PROGRAMMING ON UNIX

- Dynamic Storage Allocation
- Pointers
- Functions
- File Handling

Hardware / Software Requirements for a Batch of 30 Students

Hardware

- 1 UNIX Clone Server
- 33 Nodes (Thin Clint or PCs)
- Printer – 3 Nos

Software

- Operating System – UNIX Clone (33 User License or License Free Linux)
- Compiler – C

Total Hours: 45

Course Outcomes:

CO1: Use the software packages for drafting and modeling.

CO2 : Create 2D and 3D models of engineering components.

CO3 : Create, render, and manipulate 3D AutoCAD drawings and convert 2D drawings to 3D drawings.

CO4 : Demonstrate graphical skills appropriate to the level of the course work.

CO5 : Become familiar to draw special curves

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SEMESTER - II

12GE1212 **ENGINEERING PRACTICES LABORATORY**
(Common To AU & ME)

L	T	P	C
0	0	3	3

Objective(s): *To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.*

GROUP A (CIVIL & MECHANICAL)

Plumbing: **4 Hrs**

a) Study of Plumbing tools and accessories.
b) Preparation of plumbing line sketches for water supply and sewage works.
c) Hands-on-exercise - Basic pipe connections – Mixed pipe material connection.

Carpentry: **5 Hrs**

a) Study of Carpentry tools.
b) Hands-on-exercise - Wood work, joints by sawing, planning and cutting.

Welding: **4 Hrs**

a) Preparation of arc welding of butt joints, lap joints and tee joints.
b) Gas welding practice.

Basic Machining: **4 Hrs**

a) Simple Turning and Taper turning.
b) Drilling Practice.

Sheet Metal Work: **4 Hrs**

a) Model making – Trays, funnel and Cone.

Demonstration on: **4 Hrs**

a) Smithy operations, upsetting, swaging, setting down and bending.
b) Foundry operations like mould preparation for gear and step cone pulley.
c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.
d) Centrifugal pump and Window Air Conditioner.

LIST OF EXPERIMENTS:

1. Study of Carpentry tools, Welding tools, Sheet metal tools, Plumbing tools and Basic Machining tools.
2. To make a Tee joint from the given wooden piece.
3. To make a Lap joint/dovetail joint from the given wooden piece.
4. To make a butt joint using arc welding.
5. To make a Lap joint/Tee joint using arc welding.
6. To prepare a tray (square/rectangular) from the given tin sheet metal.
7. To prepare cone/funnel from the given tin sheet metal.
8. To prepare the mixed pipe (GI&PVC) connections for shower set from the main water supply.
9. To make a thread on given (GI&PVC) pipe and prepare the connections for wash basin from the main water supply.
10. To make plain/step turning on a given MS rod by using Lathe.
11. Make drilling and tapping operation on a given MS plate by using drilling machine.
12. Demonstration – Draw a neat sketch and explain the working principle of
    a) Smithy Operation
    b) Mould Preparation
    c) Square and Vee fitting Operation
    d) Centrifugal Pump
    e) Window Air Conditioner

Course outcomes:

CO1: To acquire knowledge on plumbing works for water supply and basic pipe connections.
CO2: To learn about the carpentry work practices for planning, sawing and cutting.
CO3: Understand about welding operations like butt joints, lap joints and T – joints.
CO4: Gain the knowledge on basic machining operations in conventional machines.
CO5: Grasp the knowledge on metal forming operation and smithy operations
CO6 : Demonstrate on Smithy operations

(continued…)

GROUP B (ELECTRICAL AND ELECTRONICS)

LIST OF EXPERIMENTS

ELECTRICAL ENGINEERING: **10 Hrs**

1. Residential House Wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent Lamp Wiring.
3. Stair-Case Wiring
4. Measurement of Electrical Quantities – Voltage, Current, Power & Power Factor in RLC circuit.
5. Measurement of Energy using Single Phase Energy Meter.
6. Study of Ceiling Fan, Iron Box and Emergency Lamp

ELECTRONICS ENGINEERING: **10 Hrs**

1. Study of Electronic Components and Equipments – Resistor Colour Coding
2. Measurement of AC Signal Parameters (peak-peak, rms value, time period, frequency) using CRO.
3. Study of logic gates AND, OR, ExOR and NOT.
4. Soldering Practice – Components Devices and Circuits – Using general purpose PCB.
5. Construction of Half Wave and Full Wave Rectifier

Total Hours: 45

Course Outcomes:

CO1 : Construct different types of wiring used in house.
CO2:- Estimate the parameter of electrical quantity using different measuring devices.
CO3 : Discover peak-peak, RMS value, time period, frequency of AC Signal Parameters using CRO.
CO4: Infer different logic gates applications using truth tables.
CO5 : Organize different electronic components.

References:

1. K.Jeyachandran, S.Natarajan & S, Balasubramanian, A Primer on Engineering Practices laboratory, Anuradha Publications, (2007).
2. T.Jeyapoovan, M.Saravanapandian & S.Pranitha, Engineering Practices Lab Manual, Vikas Publishing House Pvt.Ltd, (2006).
3. H.S. Bawa, Workshop Practice, Tata McGraw – Hill Publishing Company Limited, (2007).
4. Rajendra Prasad & P.M.M.S. Sarma, Workshop Practice, Sree Sai Publication, (2002).
5. P.Kannaiah & K.L.Narayana, Manual on Workshop Practice, Scitech Publications, (1999).

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SEMESTER - II

12HR1213 **CARRER DEVELOPMENT SKILLS - II**
(Common To All Branches)

L	T	P	C
0	0	3	3

Objective(s): *To make the students aware the need of Communication and expose them to the concepts of communication skills. Also, enable them to have creativity and problem solving skills.*

UNIT – I COMMUNICATION SKILLS 04 Hrs

Tools of Communication (Oral, Written, One Way, Two Way, Vertical and Horizontal / Lateral) – Assertive Communication – Introduction on Public Speech – (Activity on Written/Oral Communication).

UNIT – II SELF INTRODUCTION 05 Hrs

Introductory Greetings – Essentials of Self Introduction – Needs of Self Introduction (Activity on Self Introduction).

UNIT – III PRESENTATION SKILLS 06 Hrs

Preparing and Structuring the Presentation – Using Visual Aids – Voice Culture – Body Language and the Art of Presentation – Audience Awareness – Question and Interruption Handling – Building and Maintaining Interest – Dealing with the Unexpected – (Activity on Presentation Skills.

UNIT – IV QUANTITATIVE APTITUDE 07 Hrs

Speed Maths – HCF and LCM – Ratio and Proportions – Simplifications and Approximations – Number System.

UNIT – V NON-VERBAL REASONING 08 Hrs

Odd Man Out – Coding and Decoding – Mathematical Operations – Arithmetic Reasoning – Direction Sense Test.

Total Hours: 30

Course Outcomes:

CO1 : Speak and write appropriately by understanding and applying the basic grammatical rules.
CO2 : Able to introduce in front of a group of people or in interview.
CO3 : Enhance their skill or Presentation.
CO4 : Enhance knowledge on various quantitative aptitude topics.
CO5 : Gain knowledge on various non verbal reasoning techniques

Text Book(s):

1. Jeff Butterfield, Soft Skills for Everyone, Cengage Learning India Pvt. Ltd., New Delhi- (2011).
2. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, 4th edition, TMH.

Reference(s):

1. Bhatnagar Nitin, Communicative English for Engineers and Professionals, ISBN 9788131732045, Pearson Publication, New Delhi (2010).
2. V.Sasikumar, P.Kiranmai Dutt & Geetha Rajeevan, Listening & Speaking, ISBN 9788175963344, Pearson Education, New Delhi (2007).
3. R.V.Praveen, Quantitative Aptitude and Reasoning, PHI
4. R.S.Agarwal, Quantitative Aptitude, 3rd Edition, TMH.

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SEMESTER - III

12MA2301 **ENGINEERING MATHEMATICS - III**
(Common to AU, CE, EC, EE, IT& ME)

L	T	P	C
3	1	0	4

Objective(s): *The course objective is to develop the skills of the students in the areas of Transforms and Partial Differential Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, Communication Systems, Electro- Optics and Electromagnetic Theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.*

UNIT – I FOURIER SERIES 12 Hrs

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

UNIT – II FOURIER TRANSFORMS 12 Hrs

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

UNIT – III PARTIAL DIFFERENTIAL EQUATIONS 12 Hrs

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

UNIT – IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12 Hrs

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded).

UNIT – V Z-TRANSFORMS AND DIFFERENCE EQUATIONS 12 Hrs

Z-transforms - Elementary properties – Inverse Z-transform – Convolution theorem – Formation of difference equations – Solution of difference equations using Z-transform.

L: 45, T: 15, Total Hours: 60

Course Outcomes:

CO1 : Apply the basics of Fourier series and its application in the field of engineering.
CO2 : Understand the concepts of Fourier Transforms.
CO3 :To develop the ability in solving partial differential equations.
CO4:- Develop their skills in applications of partial differential equations.
CO5 : Acquire knowledge in basics of Z–Transforms and solving difference equation by using Z – transform

Text Books:

1. Grewal, B.S, „Higher Engineering Mathematics' 40th Edition, Khanna publishers, Delhi, 2007.
2. Veerarjan, T „Transforms and Partial Differential Equations", 11th Reprint, Tata McGraw-Hill Publishing.Co.Ltd.

References:

1. Bali.N.P and Manish Goyal „A Textbook of Engineering Mathematics', Seventh Edition, Laxmi Publications (P) Ltd.
2. Ramana.B.V. „Higher Engineering Mathematics' Tata Mc-GrawHill Publishing Company limited, New Delhi 2007.
3. Glyn James, „Advanced Modern Engineering Mathematics', Third edition-Pearson Education 2007

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SEMESTER - III

12ME2322 **FLUID MECHANICS AND MACHINERY**
(Common To AU & ME)

L	T	P	C
3	0	0	3

Objective(s): *The student is introduced to the mechanics of fluids through a thorough understanding of the properties of the fluids. The dynamics of fluids is introduced through the control volume approach which gives an integrated understanding of the transport of mass, momentum and energy.The applications of the conservation laws to flow through pipes and hydraulics machines are studied.*

UNIT – I INTRODUCTION11 Hrs 11 Hrs

Units & Dimensions, Properties of fluids – Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws – capillarity and surface tension, Pressure measurement devices, Flow characteristics: Types of motion, stream line, path line, streak line, concepts of control volume, application of control volume to continuity equation, Energy equation, momentum equation and moment of momentum equation.

UNIT – II FLOW THROUGH CIRCULAR CONDUITS 07 Hrs

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

UNIT - III DIMENSIONAL ANALYSIS 07 Hrs

Dimension and units: Buckingham's Π theorem, Dimensionless parameters, Models and similitude, Applications of dimensionless parameters.

UNIT – IV ROTO DYNAMIC MACHINES 11 Hrs

Homologus units, Specific speed, Elementary cascade theory, Theory of turbo machines- Euler"s equation, Hydraulic efficiency, Velocity triangle for single stage radial flow and axial flow machines. Centrifugal pumps, turbines, performance curves for pumps and turbines.

UNIT V POSITIVE DISPLACEMENT PUMPS 09 Hrs

Recriprocating pumps, Indicator diagrams, Air vessels. Rotary pumps- Classification, Working principle and performance.

Total Hours: 45

Course Outcomes:

CO1: Recall about the properties of fluids and determine the pressure using measuring device ,with the application of Bernoulli's equation discharge can be Calculated.
CO2 : Understand the concept of boundary layer and study of fluid flow through pipes along with Analyze of energy loss in pipes.
CO3 : Apply mathematical techniques in research work for design and to conduct model test and to Design a models on dimensionless parameters.
CO4 : Formulate the performance and analysis of hydraulic turbines and Relate the behavior and performance for turbine under different working conditions.
CO5 : Demonstrate and examine performance about reciprocating and rotary pumps.

Text Books

1. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi.(IX Ed), 2013.
2. Rathakrishnan. E, Fluid Mechanics, Prentice Hall of India (II Ed.), 2007.

References:

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. Streeter. V. L., and Wylie, E.B., Fluid Mechanics, McGraw Hill, 1983.
4. G.K.Vijayaraghavan, S.Sundaravalli,"Fluid Mechanics and Machinery", Lakshmi Publications,2012

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SEMESTER - III

L	T	P	C
3	0	0	3

12ME3303 ENGINEERING THERMODYNAMICS

Objective(s):

- *To achieve an understanding of principles of thermodynamics and to be able to use it in accounting for the bulk behaviour of the simple physical systems.*
- *To provide in-depth study of thermodynamic principles, thermodynamics of state,basic thermodynamic relations, Principle of Psychrometry & Properties of pure substances*
- *To enlighten the basic concepts of vapour power cycles.*

UNIT I BASIC CONCEPT AND FIRST LAW 09 Hrs

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 09 Hrs

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 – availability.

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE 09 Hrs

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 nonflow and flow processes. Standard Rankine cycle, Reheat and regenerative cycle.

UNIT IV IDEAL AND REAL GASES AND THERMODYNAMIC RELATIONS 09 Hrs

Gas mixtures – properties of ideal and real gases, equation state, Avagadro"s Law, Vander Waal's equation of state, compressability factor, compressability chart – Dalton's law of partial pressure, exact differentials, T- D relations, Maxwell's relations, Clausius Clapeyron equations, Joule –Thomson coefficient.

UNIT V PSYCHROMETRY 09 Hrs

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

Total Hours: 45

Course Outcomes:

CO1 : Recognize the basic concepts of thermodynamic system, property and first law of thermodynamics.

CO2 : Apply the concepts of second law of thermodynamics and entropy concepts.

CO3 : Acquire the knowledge about the basic properties of pure substances and steam power cycles.

CO4 : Comprehend the applications of thermodynamic properties and their relationship.

CO5 : Realize the basic properties of Psychrometry and its processes.

Text Books

1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill,New Delhi, 1998.
2. R. K. Rajput,"Engineering Thermodynamics",Laxmi Publications, Fourth Edition – 2010 Delhi.

References:

1. *Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 1995.*
2. *Venwylen and Sontag, "Classical Thermodynamics", Wiley Eastern, 1987*
3. *Arora C.P, " Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.*
4. G.K.Vijayaraghavan, S.Sundaravalli, "Engineering Thermodynamics", Lakshmi Publications, 2010.
5. Cengel, „Thermodynamics – An Engineering Approach" Third Edition – 2003 – Tata McGraw Hill, New Delhi.

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SEMESTER - III

12EE3324 ELECTRICAL DRIVES AND CONTROLS

L	T	P	C
3	0	0	3

Objectives :

- *To understand the basic concepts of the electrical drives.*
- *To study the different methods of starting and braking of DC and AC motors.*
- *To study the conventional and solid-state DC and AC drives*.

UNIT – I INTRODUCTION 09 Hrs.

Electrical drives – Need – Advantage of electrical drives – Basic elements of electrical drives – Factors influencing the choice of electrical drives – Four quadrant operation of a motor driving a hoist load – Load torques – Heating and cooling curves – Classes of motor duty - Selection of power rating for drive motors with regard to thermal overloading and load variation factors.

UNIT – II CHARACTERISTICS OF ELECTRIC DRIVES 09 Hrs

DC Motors: DC shunt, DC series, DC compound and Permanent Magnet DC motors – AC Motors: Single phase and three phase Induction motors – Speed–Torque characteristics of various types of loads and drive motors – Introduction to Starting, braking and reversing operations.

UNIT – III STARTING AND BRAKING METHODS 09 Hrs

Starting and braking methods of DC Motors – DC motor starters – Starting and braking methods of single phase induction motor – Starting and braking methods of three phase induction motor.

UNIT – IV DC DRIVES 09 Hrs

Speed control of DC motors: Armature voltage control, Field flux control and Armature resistance control – Ward Leonard drives – single-phase and three-phase fully controlled converter fed DC drives – chopper controlled DC shunt and DC series motor drives.

UNIT - V AC DRIVES 09 Hrs

Speed control of induction motors: Pole Changing, Stator voltage control, Supply frequency control, V/f control and Rotor resistance control – slip power recovery: Static Scherbius drive, Static Kramer drive – VSI fed Induction motor drive.

Total Hours: 45

Course Outcomes:

CO1: Describe the structure of electric drive system and the basic requirements of mechanical systems.
CO2: Explain the characteristics of various types of DC Motors and Induction Motors.
CO3: Describe the different starting and braking methods used in the DC and AC Motor drives.
CO4: Explain the modeling of electrical and mechanical systems.
CO5: Implement the different types of controllers in the electrical drives system

Text Books:

1 Dubey G.K., “Fundamentals of Electrical Drives”, Narosa Publishing House, NewDelhi, 2003.
2 Nagrath .I.J. & Kothari .D.P, “Electrical Machines”, Tata McGraw-Hill, 2007.

References:

1. Vedam Subrahmaniam, “Electric Drives: Concepts and Applications”, Tata McGraw-Hill Pvt. Ltd, 2011.
2. Bose, B.K., “Modern Power Electronics and AC Drives”, Pearson Education Pvt. Ltd, New Delhi, 2003.
3. Krishnan.R, “Electric Motor Drives: Modeling, Analysis and Control”, Prentice Hall Pvt. Ltd Delhi, 2003.
4. M.D.Singh, K.B.Khanchandani, “Power Electronics”, Tata McGraw-Hill, 2008.

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SEMESTER - III

12ME3305 MANUFACTURING TECHNOLOGY – I

L	T	P	C
3	0	0	3

Objective(s): *To introduce the students the concepts of some basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and plastics component manufacture.*

UNIT I METAL CASTING PROCESSES 9 Hrs

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 – CO_2 process – Sand Casting defects – Inspection methods

UNIT II JOINING PROCESSES 9 Hrs

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 9 Hrs

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 9 Hrs

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 9 Hrs

Types of plastics - Characteristics of the forming and shaping processes – 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 Hours: 45

Course Outcomes:

CO1: Understand the making of patterns, sand moulding and special casting process
CO2 : Able to handle the welding equipments including Arc, Gas welding
CO3 : Gain the knowledge on forging operations
CO4: To know about applications of sheet metal processes
CO5 : Understand the basic principles of plastic components manufacturing

Text Books

1. Hajra Choudhury, "Elements of Workshop Technology, Vol. I and II", Media Promotors Pvt Ltd.Mumbai, 2001
2. S.Gowri, P.Hariharan, and A.Suresh Babu, "Manufacturing Technology 1", Pearson Education , 2008.
3. Rajput R.K, „A text book of Manufacturing Technology', Lakshmi Publications, 2007.

References:

1. B.S. Magendran Parashar & R.K. Mittal,"Elements of Manufacturing Processes", Prentice Hall of India, 2003.
2. P.N. Rao,"Manufacturing Technology",Tata McGraw-Hill Publishing Limited, II Edition, 2002.
3. P.C. Sharma, "A text book of production technology",S. Chand and Company, IV Edition, 2003.
4. Begman, „Manufacturing Process", John Wilely & Sons, VIII Edition, 2005.

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SEMESTER - III

L	T	P	C
3	0	0	3

12ME3306 MACHINE DRAWING

Objective(s): *To impart the knowledge in Machine Drawing fundamentals.*
To impart the knowledge to read, draw and to understand various machine elements.

UNIT I I.S CODE OF PRACTICE FOR ENGINEERING DRAWING 6 Hrs

Use of scales – Selection and designation of sizes – Types of lines – termination of leader line, hatching of sections – revolved and removed sections.

UNIT – II FASTENERS 6 Hrs

Conventional representation of threads - Internal and external types. Bolts and Nuts - Machine and cap screws, set screws, Grub screws, studs. Types of nuts - cap, castle, wile"s , lock nuts - Locking by set screw, grooved nut, plate and spring washer. Hexagonal square bolt and nut assembly.

UNIT – III BEARINGS 6 Hrs

Sliding contact bearings – Solid and bushed journal, Plummer block – foot step bearing with radial and thrust ball bearing - symbols of antifriction bearings

UNIT – IV PULLEYS 6 Hrs

Pulley with arms, pulley with web, step cone pulley for flat belt, Pulley for V-belt, fast and loose pulley.

UNIT – V ASSEMBLY DRAWING 36 Hrs

Sleeve and Cotter joint, Knuckle joint, Screw jack , Flexible coupling, Swivel bearing, Machine vice, Tail stock, Drilling Jig, Milling fixture, Steam stop valve.

Total Hours: 60

Course Outcomes:

CO1 : Gain the knowledge about basic concepts of I.S code for machine drawing.

CO2 : Acquire the knowledge about different types of fasteners for machine design.

CO3 : Demonstrate the bearing working methods.

CO4 : Ensure the principles about the stepped cone pulley for different types of belts.

CO5: Draw the given assembly drawings.

Text Book:

1. K.R. Gopalakrishna, “Machine Drawing”, Subhas publications, Bangalore, Eighteenth edition, 2004.

References:

1. Warren Hammer “Blueprint Reading Basics, III Edition, Industrial Press Inc, New York, 2003.
2. K.L.Narayana, P.Kannaiah and K.Venkata Reddy, “Machine Drawing”, 3rd reprint, New Age International Ltd., New Delhi, 2003.
3. Dhawan, “Machine Drawing”, First Edition, Sultan Chand and Sons, New Delhi, 1996.
4. P.S. Gill, “A Text Book of Machine Drawing” Seventh Edition Reprint, S. K. Kataria & Sons. New Delhi. 2004.
5. Narayana, P.Kannaiah and K.Venkata Reddy, “Production Drawing”, Ist Edition, New Age International Ltd., New Delhi, 1997.
6. N.D.Bhatt,” Machine Drawing”, Wiley Eastern Pvt.Ltd., 1998.
7. BIS Code 919

Question Paper Pattern:

1(a) or 1(b) – Unit – I – 10 Marks
2(a) or 2(b) – Unit – II – 10 Marks
3(a) or 3(b) – Unit – III – 10 Marks
4(a) or 4(b) – Unit – IV – 10 Marks
5(a) or 5(b) – Unit – V – 60 Marks

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SEMESTER - III

12ME3310 **FLUID MECHANICS AND MACHINERY LAB**

L	T	P	C
0	0	3	2

Objective(s) : *To gain practical knowledge in the following experiments*

LIST OF EXPERIMENTS

PART A

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Flow measurement using Pitot tube.

PART B

6. Performance test on centrifugal pump / submergible pump.
7. Performance test on reciprocating pump.
8. Performance test on Gear pump.
9. Performance test on Pelton wheel.
10. Performance test on Francis turbine.
11. Performance test on Kaplan turbine.

Note : End semester examination question paper shall consist of one question from part A and another from part B

LIST OF EQUIPMENT

(For a batch of 30 students)

1. Orifice meter setup
2. Venturi meter setup
3. Rotameter setup
4. Pipe Flow analysis setup
5. Pitot tube set up
6. Centrifugal pump/submergible pump setup
7. Reciprocating pump setup 8 Gear pump setup
8. Pelton wheel setup
9. Francis turbine setup
10. Kaplan turbine setup

Quantity : One Each

Total Hours : 45 Hrs

Course Outcomes:

CO1: Understand the concept to determine Coefficient of discharge of Orifice meter and Venturimeter.
CO2: Demonstrate and calculate the rate of flow using Rota meter.
CO3: Categorize friction factor for a given set of pipes.(Major and Minor Losses).
CO4: Determine measurement of flow using Pitot tube.
CO5: Experiment and conduct performance test on Various Pumps (Centrifugal pump, reciprocating pump, Gear pump, etc).
CO6: Discuss the working principle of various turbines and conduct the Performance test on Francis turbine, Kaplan turbine and Pelton wheel.

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SEMESTER - III

12ME3311 MANUFACTURING TECHNOLOGY LABORATORY – I

L	T	P	C
0	0	3	2

Objective(s): *To gain hands on experience on working of general purpose machine tools and on various manufacturing processes*.

LIST OF EXPERIMENTS

1. LATHE OPERATIONS

Facing, plain turning and step turning
Taper turning using compound rest, Tailstock set over, etc
Single and Multi-start V thread, cutting and knurling
Boring and internal thread cutting.

2. WELDING EXCERCISES

Horizontal, Vertical and Overhead welding.
Gas Cutting, Gas Welding
Brazing - for demonstration purpose

3. SHEET METAL WORK

Fabrication of sheet metal tray
Fabrication of a funnel

4. PREPARATION OF SAND MOULD

Mould with solid, split patterns
Mould with loose-piece pattern
Mould with Core

5. PLASTIC MOULDING

Injection Moulding- for demonstration purpose

Total Hours: 45

Note: End semester examination shall consist of one lathe exercise and one exercise from welding /sheet metal/ sand mould.

LIST OF EQUIPMENT

(For a batch of 30 students)

1	Centre Lathe with accessories	*15*
2	**Welding**	
2.1	Arc welding machine	4
2.2	Gas welding machine	1
2.3	Brazing machine	1
3	**Sheet Metal Work facility**	
3.1	Hand Shear 300mm	5
3.2	Bench vice	5
3.3	Standard tools and calipers for sheet metal work	5
4	**Sand moulding Facility**	
4.1	Moulding Table	5
4.2	Moulding boxes, tools and patterns	5
5	**Plastic Moulding**	
5.1	Injection Moulding Machine	1

Course Outcomes:

CO1: Acquire the knowledge of fabricating a sheet metal component by using necessary tools.
CO2: Able to choose the proper welding joint for the given metal plates for effective joining
CO3: Able to make a green sand mould for the given pattern by using foundry tools and equipments
CO4: Apply the knowledge of fabricating a cylindrical component with step turning and taper turning with the help of a lathe machine tool
CO5 : Able to make internal and external thread cutting on a cylindrical work piece by using lathe machine tool
CO6 : Able to make knurling operation in a cylindrical work piece

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SEMESTER - III

12EE3312 ELECTRICAL DRIVES AND CONTROLS LABORATORY

L	T	P	C
0	0	3	2

Objectives :

- *To develop the skill on the electrical and mechanical characteristics of various types of AC and DC motors.*
- *To develop the skill on the speed control of various types of AC and DC motors.*

LIST OF EXPERIMENTS

1. Load characteristics of DC shunt motor
2. Load characteristics of DC series motor
3. Load characteristics of DC compound motor
4. Load test on single-phase induction motor
5. Load test on three-phase squirrel cage induction motor
6. Load test on three-phase slip ring induction motor
7. Speed Control of DC shunt motor
8. Speed control of three phase squirrel cage induction motor using Stator Voltage Control
9. Speed control of DC motor using three-phase fully controlled converter
10. Speed control of three-phase induction motor using PWM inverter.
11. Speed Control of induction motor using FPGA
12. Study of DC motor starters

Total Hours: 45

Course Outcomes:

CO1: Analyze the performance of AC machines.
CO2: Examine the performance of DC machines.
CO3: Employ various speed control methods for DC machines.
CO4: Employ various speed control methods for AC machines.
CO5: Explain the functions of various DC motor starters
CO6: Speed Control methods for AC machines

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SEMESTER - III

12HR1313 **CAREER DEVELOPMENT SKILLS – III**
(Common to all branches)

L	T	P	C
0	2	0	1

Objective(s): *To improve reading, writing skills and personality development.*
To enhance arithmetical & logical ability.

UNIT – I **READING AND WRITING** **05 Hrs**

Reading Comprehension and Essay Writing ***(Activity on Reading & Writing)***

UNIT – II **CREATIVE THINKING** **05 Hrs**

Motivation - Creativity – Innovation –Learning Creativity – Presence of Mind –Brainstorming – Strategies for Developing Creativity –Overcoming myths about creativity - ***Activity (Extempore)***

UNIT – III **TIME MANAGEMENT AND GOAL SETTING** **06 Hrs**

Importance of time – Managing time – Time Wasters – The art of Prioritizing and Scheduling – ***Activity*** - Concept of goal-setting - Importance of goals - Dream Vs Goal – Reason for failure of Goals - SMART (Specific, Measurable, Achievable, Realistic, Time-bound) goals.

UNIT – IV **QUANTITATIVE APTITUDE III** **07 Hrs**

Chain Rule -Logarithms – Areas – Volumes - Partnerships and shares - Profit and loss.

UNIT – V **LOGICAL REASONING II** **07 Hrs**

Alphabet test & Series– Venn Diagrams-Series Completion - Number series

Total Hours: 30

Course Outcomes

CO1: Perform well in reading comprehension and essay writing.
CO2: Ability to enhance the creative thinking.
CO3: Understand the importance of Time management and Goal Setting.
CO4: Enhance the skill in various quantitative aptitude topics.
CO5: Enhance the skill on various Logical Reasoning skills

References:

1. R.V.Praveen, “Quantitative Aptitude and Reasoning”, PHI 2nd Edition, 2013.
2. Abhijit Guha, “Quantitative Aptitude for Competitive Examinations”, 4th edition, TMH, 2011.
3. Jeff Butterfield, “Soft Skills for Everyone”, Cengage Learning India pvt ltd, 2011, New Delhi.
4. R.S.Agarwal, ”Quantitative Aptitude”, 3rd edition, TMH, 2011.
5. Edgar Thorpe, “Test of reasoning”, 4th edition, TMH, 2011.

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SEMESTER - IV

12MA2401 **NUMERICAL METHODS**
(Common To CE,CS,ME,AU & EE)

L	T	P	C
3	1	0	4

Objective(s): *On completion of the course, the students learn, to apply Numerical techniques in the field of engineering. They study the concept and applications of polynomial and transcendental equations, simultaneous linear equations, Eigen values, solutions to interpolation techniques, solutions to numerical differentiation and integration, Numerical solutions to ordinary differential equations and numerical solutions to boundary value problems.*

UNIT – I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12 Hrs

Solutions to polynomial and transcendental equations - Newton's method, Regula falsi method – Solutions to simultaneous linear equations - Gaussian Elimination and Gauss-Jordon method– Iterative method - Gauss-Seidel method - Inverse of a matrix by Gauss Jordon method – Eigen value of a matrix by power method.

UNIT – II INTERPOLATION AND APPROXIMATION 12 Hrs

Newton's forward and backward difference interpolation techniques (equal interval) – Lagrange"s interpolation and Divided difference method for solving unequal intervals – Interpolating with a cubic spline.

UNIT - III NUMERICAL DIFFERENTIATION AND INTEGRATION 12 Hrs

Numerical Differentiation using Newton's forward and backward interpolation methods only – Numerical integration by trapezoidal and Simpson"s 1/3 and 3/8 rules – Romberg"s method –Double integrals using trapezoidal and Simpson"s rules.

UNIT – IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12 Hrs

Solving Ordinary Differential Equations by Taylor series method – Euler method and Modified Euler"s Method for first order equation – Fourth order Runge – Kutta method for solving first and second order equations – Milne's and Adam's predictor and corrector methods.

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

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

L: 45, T: 15, Total Hours: 60

Course Outcomes:

CO1: Enable to solve polynomial, transcendental equations and simultaneous linear equations numerically.
CO2: Able to apply the Interpolation techniques.
CO3: Developing their skills in numerical differentiation and integration
CO4: Enable to solve ordinary differential equations numerically
CO5: Understand and apply the concepts of numerical solutions to boundary value problems

Text Books:

1. Veerarajan, T and Ramachandran, T., "Numerical methods with programming in C", Second Editiion, Tata McGraw-Hill Publishing.Co.Ltd, 2007.
2. Sankara Rao K, "Numerical Methods for Scientisits and Engineers", 3rd Edition, Printice Hall of India Private Ltd, New Delhi, 2007

References:

1. Chapra, S. C and Canale, R. P., "Numerical Methods for engineers",5thEdition,TataMcGraw-Hill, New Delhi, 2007.
2. Gerald, C. F. and Wheatley, P.O., "Applied Numerical Analysis", 6th Edition, Pearson Education, Asia, New Delhi, 2006.
3. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, Delhi, 2004.

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SEMESTER - IV

12ME3402 THERMAL ENGINEERING

L	T	P	C
3	0	0	3

Objective(s):

- *To integrate the concepts, laws and methodologies from the first course in thermo dynamics 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 CYCLE 09 Hrs

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

UNIT II INTERNAL COMBUSTION ENGINES 09 Hrs

Classification - Components and their function - Valve timing diagram and port timing diagram - Comparison of two stroke and four stroke engines – Carburettor system, Diesel pump and injector system. Performance calculation - Comparison of petrol and diesel engine - Lubrication system and Cooling system - Battery and Magneto Ignition System – Formation of exhaust emission in SI and CI engines

UNIT III STEAM NOZZLES AND TURBINES 09 Hrs

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

UNIT IV AIR COMPRESSOR 09 Hrs

Classification and working principle of various types of compressors, work of compression with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency of reciprocating compressors, Multistage air compressor and inter cooling –work of multistage air compressor

UNIT V REFRIGERATION AND AIR CONDITIONING 09 Hrs

Vapour compression refrigeration cycle- super heat, sub cooling – Performance calculations – working principle of vapour absorption system, Ammonia –Water, Lithium bromide –water systems (Description only) - Alternate refrigerants – Comparison between vapour compression and absorption systems.Psychrometry, Psychrometric chart - Cooling Load calculations - Concept of RSHF, GSHF, ESHF, Types of Air conditioning systems.

Total Hours: 45

Course Outcomes:

CO1 : Understand the basic concepts of various gas power cycles.
CO2: Get an insight of various components and performance characteristics of an IC engines.
CO3: Demonstrate the knowledge on turbines.
CO4: Evaluate the performance of air compressor
CO5: Evaluate the energy sources applications

Text Books

1. Sarkar, B.K,"Thermal Engineering" Tata McGraw-Hill Publishers, 2007 Kothandaraman.C.P., Domkundwar. S,Domkundwar. A.V.,
2. "A course in thermal engineering,"Dhanpat Rai &sons ,Fifth edition, 2002 Rajput. R. K., "Thermal Engineering" S.Chand Publishers , 2010

References:

1. Arora.C.P,"Refrigeration and Air Conditioning ," Tata McGraw-Hill Publishers 1994
2. Ganesan V.." Internal Combustion Engines" , Third Edition, Tata Mcgraw-Hill 2007
3. Rudramoorthy, R, "Thermal Engineering ",Tata McGraw-Hill, New Delhi,2003
4. G.K.Vijayaraghavan and S.Vishnupriyan, "Thermal Engineering", Lakshmi Publications, 2005

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SEMESTER - IV

12ME3403 KINEMATICS OF MACHINERY

L	T	P	C
3	1	0	4

Objective(s):

- *To understand the concept of machines, mechanisms and related terminologies.*
- *To analyse a mechanism for displacement, velocity and acceleration at any point in a moving link*
- *To understand the theory of gears, gear trains and cams*
- *To understand the role of friction in drives and brakes.*

UNIT I BASICS OF MECHANISMS 7 Hrs

Definitions – Link, Kinematic pair, Kinematic chain, Mechanism, and Machine. –Degree of Freedom – Mobility - Kutzbach criterion (Gruebler‟s equation) -Grashoff's law Kinematic Inversions of four-bar chain and slider crank chain - Mechanical Advantage- Transmission angle. Description of common Mechanisms - Offset slider mechanism as quick return mechanisms, Pantograph, Straight line generators (Peaucellier and Watt mechanisms), Steering gear for automobile, Hooke‟s joint, Toggle mechanism, Ratchets and escapements - Indexing Mechanisms.

UNIT II KINEMATIC ANALYSIS 15 Hrs

Analysis of simple mechanisms (Single slider crank mechanism and four bar mechanism) - Graphical Methods for displacement, velocity and acceleration; Shaping machine mechanism - Coincident points – Coriolis acceleration - Analytical method of analysis of slider crank mechanism and four bar mechanism. Approximate analytical expression for displacement, velocity and acceleration of piston of reciprocating engine mechanism, case studies.

UNIT III KINEMATICS OF CAMS 11 Hrs

Classifications - Displacement diagrams - Parabolic, Simple harmonic and Cycloidal motions – Graphical construction of displacement diagrams and layout of plate cam profiles - circular arc and tangent cams - Pressure angle and undercutting.

UNIT IV GEARS 14 Hrs

Classification of gears – Gear tooth terminology - Fundamental Law of toothed gearing and involute gearing – Length of path of contact and contact ratio - Interference and undercutting - Gear trains – Simple, compound and Epicyclic gear trains - Differentials.

UNIT V FRICTION 13 Hrs

Dry friction – Friction in screw jack – Pivot and collar friction - Plate clutches - Belt and rope drives - Block brakes, band brakes.

L: 45, T: 15, Total Hours: 60

Course Outcomes:

CO1: Demonstrate an understanding of the concepts in various mechanisms and pairs.
CO2: Perform velocity and acceleration analysis of simple mechanisms.
CO3: Design a layout of cam for specified motion.
CO4: Demonstrate an understanding of principle of gears.
CO5: Evaluate the concepts on action of friction

Text Books:

1. Rattan S.S., “Theory of Machines”, 3rd edition, Tata McGraw-Hill Publishers.2012.
2. R. S. Khurmi, J. K. Gupta., “Theory of Machines”,S. Chand 2008.
3. Singh.V.P., “Theory of Machines”, 3rd Edition, 2012

References:

1. Thomas Bevan, “Theory of Machines”, CBS Publishers and Distributors.
2. Ramamurti,V.,“ Mechanism and Machine Theory”, Second Edition, Narosa Publishing House.
3. Ghosh A and A.K.Mallick, “Theory of Mechanisms and Machines”, Affiliated East- West Pvt. Ltd.,
4. Rao J.S and Dukkipati R.V, “Mechanism and Machine Theory”, Wiley-Eastern Ltd.,New Delhi.
5. John Hannah and Stephens R.C, “Mechanics of Machines”, Viva Low-Prices Student Edition.
6. Uicker J.J.,Pennock G.R., Shigley J.E., “Theory of Machines and Mechanisms”(Indian Edition), Oxford University Press, 2010.

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SEMESTER - IV

12ME3404 STRENGTH OF MATERIALS

L	T	P	C
3	0	0	3

Objective(s):

- To gain knowledge of simple stresses, strains and deformation in components due to external loads.
- To assess stresses and deformations through mathematical models of beams, twisting bars or combinations of both.
- Effect of component dimensions and shape on stresses and deformations are to be understood.

UNIT I STRESS STRAIN DEFORMATION OF SOLIDS 09 Hrs

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 09 Hrs

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 DEFLECTION OF BEAMS 09 Hrs

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 – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula for columns

UNIT IV TORSION 09 Hrs

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 – stresses in helical coil springs under torsion loads.

UNIT V ANALYSIS OF STRESSES IN TWO DIMENSIONS 09 Hrs

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 Hours: 45

Course Outcomes:

CO1: Develop the relationship between the loads applied to a non-rigid body and the internal stresses and deformations induced in the body.
CO2 : Study the general state of stresses and strains in a given loaded member and the magnitude and direction of the principal stresses.
CO3 : Understand the different approaches to calculate slope and deflection for various types of beams.
CO4 : Analyze the columns with different edge conditions by using different theories.
CO5 : Analyze the complex stress systems.

Text Books

1. S.Senthil, "Strength of Materials", Lakshmi Publications, Chennai,2004.
2. Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 1997
3. Bansal, R.K., "Strength of Materials",, Laxmi Publications (P) Ltd., New Delhi.(IV Ed), 2010.

References:

1. Nash W.A, "Theory and problems in Strength of Materials", Schaum Outline Series, McGraw-Hill Book Co, New York, 1995Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 1981.
2. Ryder G.H, "Strength of Materials, Macmillan India Ltd"., Third Edition, 2002
3. Ray Hulse, Keith Sherwin & Jack Cain, "Solid Mechanics", Palgrave ANE Books,2004.
4. Beer F. P. and Johnston R," Mechanics of Materials", McGraw-Hill Book Co, Third Edition, 2002

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SEMESTER - IV

12ME3405 MANUFACTURING TECHNOLOGY – II

L	T	P	C
3	0	0	3

Objective(s):

- *To understand the concept and basic mechanics of metal cutting, working of Standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching*
- *To understand the basic concepts of computer numerical control (CNC) machine tool and CNC programming.*

UNIT I THEORY OF METAL CUTTING 9 Hrs

Introduction: material removal processes, types of machine tools – theory of metal cutting: chip formation, orthogonal cutting, cutting tool materials, tool wear, tool life, surface finish, cutting fluids.

Unit II CENTRE LATHE AND SPECIAL PURPOSE LATHES 9 Hrs

Centre lathe, constructional features, cutting tool geometry, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes – automats – single spindle, Swiss type, automatic screw type, multi spindle - Turret Indexing mechanism, Bar feed mechanism.

UNIT III SPECIAL PURPOSE MACHINE TOOLS 9 Hrs

Reciprocating machine tools: shaper, planer, slotter - Milling : types, milling cutters, operations - Hole making : drilling - Quill mechanism , Reaming, Boring, Tapping - Sawing machine: hack saw, band saw, circular saw; broaching machines: broach construction – push, pull, surface and continuous broaching machines

UNIT IV ABRASIVE PROCESSES AND GEAR CUTTING 9 Hrs

Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding – honing, lapping, super finishing, polishing and buffing, abrasive jet machining - Gear cutting, forming, generation, shaping, hobbing.

UNIT V UNCONVENTIONAL MACHINES 9 Hrs

EDM,WIRE EDM,ECM, EBM,LASER MACIHING, WATER JET MACHINING. Numerical control (NC) machine tools – CNC: types, constructional details. Part programming fundamentals – manual programming – computer assisted part programming**.**

Total Hours: 45

Course Outcomes:

CO1 : Gain the knowledge about basic concepts of special purpose lathe.
CO2 : Build the knowledge about constructional features and types of reciprocating machine tools, milling and gear cutting machines.
CO3 : Develop the knowledge about utilizing the features of special purpose machines.
CO4 : Apply the knowledge on abrasive processes and super finishing methods.
CO5 : Reveal the knowledge of main aspects of the unconventional machining process and create the part program about how to make a component using CNC programming languages.

Text Books:

1. Hajra Choudry, “Elements of Work Shop Technology – Vol. II”, Media Promoters. 2002
2. G.K.Vijayaraghavan and S.Sundaravalli, “Manufacturing Technology-II”, Lakshmi Publications, Chennai,2009.
3. Rajput. R. K., Manufacturing Technology”, Laxmi Publications, 2007.

References:

1. Rao, P.N. “Manufacturing Technology”, Metal Cutting and Machine Tools, Tata McGraw–Hill, New Delhi, 2003.
2. P.C. Sharma, “A Text Book of Production Engineering”, S. Chand and Co. Ltd, IV edition, 1993.

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SEMESTER - IV

12ME3426 **ENGINEERING MATERIALS AND METALLURGY**
(Common To AU & ME)

L	T	P	C
3	0	0	3

Objective(s): *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.*

Review (Not for Exam):

Crystal structure – BCC, FCC and HCP structure – unit cell – crystallographic planes and directions, miller indices – crystal imperfections, point, line, planar and volume defects – Grain size, ASTM grain size number.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9 Hrs

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

UNIT II HEAT TREATMENT 9 Hrs

Definition – Full annealing, stress relief, recrystallisation and spheroidizing –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 - carburising, nitriding, cyaniding, carbonitriding, flame and induction hardening.

UNIT III MECHANICAL PROPERTIES AND TESTING 9 Hrs

Mechanism of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Impact test - Izod and Charpy, Fatigue and creep tests, fracture toughness tests.

UNIT-IV FERROUS AND NON FERROUS METALS 9 Hrs

Effect of alloying elements on steel (Mn, Si, Cr, Mo, V, Ti & W) - stainless and tool steels- . Titanium and titanium alloys – HSLA - maraging steels – Cast Irons - Grey, White malleable, spheroidal – Graphite, Alloy cast irons, Copper and Copper alloys - Brass, Bronze and Cupronickel – Aluminum and Al-Cu alloy – Titanium and titanium alloys - precipitation hardening– Bearing alloys.

UNIT- V NON-METALLIC MATERIALS 9 Hrs

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE. Polymers – Urea and Phenol Formaldehydes – Engineering Ceramics – Introduction to Fibre reinforced plastics.

Total Hours: 45

Course Outcomes:

CO1: Analyze the Structure of materials at different levels, basic concepts of crystalline materials like iron – carbon phase diagram and its significance

CO2 : Understand the metallurgical reactions that occur in heat treatment and T.T.T. and C.C.T. Diagrams and show how non-equilibrium.

CO3 : Explain the concept of various mechanical testing of materials-tensile, compression, shear, hardness, impact, fatigue and creep tests

CO4 : Understand the heat treating steps of precipitation hardening and of over asking principle effect on Properties of major alloying elements used in steels.

CO6 : Explain the features and typical engineering applications of composite materials and how to select an appropriate polymer for on application

Text Books:

1. Dr.V.Jayakumar, “Engineering materials and Metallurgy”, A. R. S Publications, Chennai, 2012
2. Kenneth G.Budinski and Michael K.Budinski “Engineering Materials” Prentice-Hall of India Private Limited, 4th Indian Reprint 2002.

References:

1. William D Callister “Material Science and Engineering”, John Wiley and Sons 2007.
2. Raghavan.V “Materials Science and Engineering”, Prentice Hall of India Pvt., Ltd., 2007.
3. Sydney H.Avner “Introduction to Physical Metallurgy” McGraw Hill Book Company, 2007.
4. Dieter G. E., Mechanical Metallurgy, Mc Graw Hill Book Company, 1988.
5. O.P. Khanna , A text book of Materials Science and Metallurgy, Khanna Publishers,2003.

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SEMESTER - IV

12ME3410 **THERMAL ENGINEERING LABARATORY**

L	T	P	C
0	0	3	2

Objective(s) : *To gain practical knowledge in the following experiments*

LIST OF EXPERIMENTS

PART A

1. Valve Timing Diagram.
2. Port Timing Diagram.
3. Determination of Viscosity – Red Wood Viscometer.
4. Determination of Flash Point and Fire Point.

PART B

1. Performance Test on 4-stroke Diesel Engine.
2. Heat Balance Test on 4-stroke Diesel Engine.
3. Morse Test on Multicylinder Petrol Engine.
4. Retardation Test to find Frictional Power of a Diesel Engine.
5. Performance and Energy Balance Test on a Steam Generator.
6. Performance and Energy Balance Test on Steam Turbine.

Note : End semester examination question paper shall consist of one question from part A and another from part B

LIST OF EQUIPMENT

(For a batch of 30 students)

1.	I.C Engine – 2 stroke and 4 stroke model	1 set
2.	Red Wood Viscometer	1 No.
3.	Apparatus for Flash and Fire Point	1 No.
4.	4-stroke Diesel Engine with mechanical loading.	1 No.
5.	4-stroke Diesel Engine with hydraulic loading.	1 No.
6.	4-stroke Diesel Engine with electrical loading.	1 No.
7.	Multi-cylinder Petrol Engine	1 No.
8.	Single cylinder Petrol Engine	1 No.
9.	Data Acquisition system with any one of the above engines	1 No.
10.	Steam Boiler with turbine setup	1 No.

Total Hours : 45

Course Outcomes :

CO1 : Understand the basic knowledge in relation to Valve timing and Port timing diagram.

CO2 : Perform the experiment to determine the properties of fuels and oils.

CO3 : Demonstrate the Performance on engines and draw its characteristics.

CO4 : Analyze the heat balance on four-stroke diesel engine.

CO5 : Predict and analyze the performance of multi cylinder petrol engine by energy balance test.

CO6 :- Evaluate the frictional power of a diesel engine using retardation test.

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SEMESTER - IV

12ME3411 STRENGTH OF MATERIALS LABORATORY

L	T	P	C
0	0	3	2

Objective(s) :

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 a mild steel rod
2. Double shear test on Mild steel and Aluminum rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
    (i) Unhardened specimen
    (ii) Quenched Specimen and
    (iii) Quenched and tempered specimen.
11. Microscopic Examination of Hardened samples and Hardened and tempered samples.

LIST OF EQUIPMENT

(For a batch of 30 students)

1.	Universal Tensile Testing machine with double shear attachment –(40 Ton Capacity)	1
2.	Torsion Testing Machine (60 NM Capacity)	1
3.	Impact Testing Machine (300 J Capacity)	1
4.	Brinell Hardness Testing Machine	1
5.	Rockwell Hardness Testing Machine	1
6.	Spring Testing Machine for tensile and compressive loads (2500 N)	1
7.	Metallurgical Microscopes	3
8.	Muffle Furnace (800 C)	

Total hours: 45

Course Outcomes:

CO1 : Demonstrate various tests on mechanical properties of materials

CO2 : Examine deflection test on various beam

CO3 : Predict the helical spring requirement

CO4 : Demonstrate various torsion tests on various materials

CO5 : Analyze the Tension test on mild steel

CO6 : Analyze compression test different types of materials

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SEMESTER - IV

12ME3412 MANUFACTURING TECHNOLOGY LABORATORY - II

L	T	P	C
0	0	3	2

Objective(s) : *To give practical hands on exposure to students in the various metal cutting operations using commonly used machine tools*

LIST OF EXPERIMENTS

1. Metal Cutting Experiment (Example: Shear Angle, Cutting Force, Tool Wear etc.)
2. Shaper, Slotter, Planner, Drilling, Milling Machines
   i. (Example: Round to Square, Dovetail in shaper, Internal keyway cutting in Slotter, Round to square in Planner, Drilling, reaming and tapping in Drilling machine, Gear Milling and Keyway milling in Milling machine.)
3. Two or More Exercises in Grinding / Abrasive machining (Example: Surface Grinding, Cylindrical Grinding.)
4. Two or More Exercises in Assembly of Machined Components for different fits.
   i. (Example: Parts machined using Lathes, Shapers, Drilling, Milling, and Grinding Machines etc.)
5. One or More Exercises in Capstan or Turret Lathes
6. One or More Exercises in Gear Machining (Example: Gear Milling, Gear Hobbing etc.)

LIST OF EQUIPMENT

(For a batch of 30 students)

1.	Centre Lathes	-	2 Nos.
2.	Turret and Capstan Lathes	-	1 No
3.	Horizontal Milling Machine	-	1 No
4.	Vertical Milling Machine	-	1 No
5.	Surface Grinding Machine	-	1 No.
6.	Cylinderical Grinding Machine	-	1 No.
7.	Shaper	-	2 Nos.
8.	Slotter	-	1 No.
9.	Planner	-	1 No.
10.	Radial Drilling Machine	-	1 No.
11.	Tool Dynamometer	-	1 No
12.	Gear Hobbing Machine	-	1 No
13.	Tool Makers Microscope	-	1 No

Total Hours: 45

Course Outcomes:

CO1 : Measure of shear angle of a single point cutting tool in a lathe machine.
CO2 : Apply the knowledge in the manufacturing features using a centre and capstan lathe machines for producing verities of cylindrical jobs.
CO3 : Demonstrate the experiments in reciprocating machine tools like shaper, slotter and planner.
CO4 : Create the different types of jobs in machine tools like drilling and milling machine operations.
CO5: Develop the knowledge of making the surface grinding of a plate using surface and cylindrical grinding machine and also apply the knowledge of utilizing the gear hobbing machine to fabricate a spur and helical gear using gear hobbing machine
CO6 : Apply the knowledge of utilizing the gear hobbing machine to fabricate a spur and helical gears using gear hobbing machine.

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SEMESTER - IV

12HR1413 **CAREER DEVELOPMENT SKILLS – IV**
(Common to all branches)

L	T	P	C
0	2	0	1

Objective(s): *To inculcate people skills, time management and to enhance personality.*
To enhance arithmetical & analytical ability.

UNIT – I INTERPERSONAL SKILLS & SWOT ANALYSIS 04 Hrs

Assertiveness – conflict – Conversation starters –Influence – Negotiation – Networking – Relationships –Teamwork – Trust - Introduction to SWOT Analysis – SWOT Worksheet ***(Activity).***

UNIT – II STRESS MANAGEMENT 04 Hrs

Introduction to Stress – What are Stressors –Stress Prevention –Coping Skills –Stress at Home/ Outside –Overcoming Monetary Stress and Unhealthy Worry –Dealing With Frustration and Anger.

UNIT – III VOCABULARY PRACTICE 07 Hrs

Synonyms – Antonyms – Confusing Words/Homonyms– Prepositions - Conjunctions – Jumbled Sentences/Words – ***(Activity on all topics)***

UNIT – IV QUANTITATIVE APTITUDE IV 09 Hrs

Simple interest & Compound interest - Allegation & Mixtures - Time and Work & Pipes and cisterns- Heights and Distances.

UNIT – V REASONING (VERBAL & NON VERBAL) 06 Hrs

Blood Relations – Grammar (Tenses, Subject, and verb agreement) – Sentence formation and Correction.

Total Hours: 30

Course Outcomes

CO 1 :Ability to exhibit the interpersonal skills and perform SWOT Analysis
CO 2: Gain knowledge on the stress management techniques
CO 3: Enhance the Vocabulary by various activities
CO 4: Enhance the skill on various Quantitative techniques
CO 5: Enhance the skill on various verbal and non verbal reasoning techniques

References:

1. R.V.Praveen, “Quantitative Aptitude and Reasoning”, PHI 2nd Edition, 2013.
2. Abhijit Guha,”Quantitative Aptitude for Competitive Examinations”, 4th edition, TMH, 2011
3. Bhatnagar Nitin, “Communicative English for Engineers and Professionals”, ISBN 9788131732045, Pearson Publication, New Delhi, 2010.
4. Jeff Butterfield, “Soft Skills for Everyone”, Cengage Learning India pvt ltd, New Delhi, 2011.
5. R.S.Agarwal “Quantitative Aptitude”, 3rd edition, TMH, 2011.
6. Edgar Thorpe, “Test of reasoning”, 4th edition, TMH, 2011.

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SEMESTER - V

12ME4805 **OPERATIONS RESEARCH**

L	T	P	C
3	0	0	3

Objective(s):
- *To learn about the optimization techniques in utilization of resources.*
- *To understand and apply operations research techniques to industrial operations.*

UNIT - I LINEAR PROGRAMMING PROBLEM 09 Hrs.

Introduction - scope of OR and role of OR in science and technology - phases of OR - limitations of OR - linear programming problem - formulation of linear programming problem - optimum solution by graphical method - simplex method - artificial variables technique - Big-M method.

UNIT - II TRANSPORTATION AND ASSIGNMENT PROBLEM 09 Hrs.

Transportation problem - necessary and sufficient conditions for existence of solution - unbalanced TP - initial basic feasible solution by north-west corner rule, least cost method and VAM - degenerative solution - optimum solution by using MODI method - maximization of transportation problem. Assignment problems - unbalanced AP - optimum assignment by Hungarian method - maximization of assignment problems - travelling salesman problem.

UNIT - III NETWORK MODELS 09 Hrs.

Network - properties of network - construction of a network - total, independent and free floats - critical path method (CPM) - optimistic, pessimistic and most likely time - project scheduling by PERT analysis - difference between CPM and PERT - normal and crash cost - cost slope - crashing technique.

UNIT - IV INVENTORY MODEL 09 Hrs.

Types of Inventory - deterministic inventory models - EOQ and EBQ models with and without shortages - quantity discount model - price breaks - probabilistic inventory model.

UNIT - V REPLACEMENT MODELS AND SEQUENCING 09 Hrs.

Replacement of items that deteriorate with time - value of money changing with time - not changing with time - optimum replacement policy - individual and group replacement. Sequencing problem - assumptions - processing of 'n' jobs in 2 machines, 'n' jobs with 'm' machines.

Total hours: 45.

Course Outcomes:

CO1 : Develop the decision making during the uncertain situations by linear programming approach
CO2 : Indentify to minimize the transpiration and assignment cost and maximize the profit in industries
CO3 : Develop the network techniques in project scheduling
CO4 : Apply inventory control methods to stock controlling and maximizing the profit
CO5 : Understand and apply the replacement and sequencing methods in manufacturing engineering

Text Books:

Panneerselvam R, "Operations Research", Prentice Hall of India, Fourth Print 2008.
Natarajan AM, Balasubramani P and Tamilarasi A, "Operations Research", Pearson Education, First Indian Reprint, 2005.

References:

Frederick.S.Hiller and Gerald.J.Lieberman, "Operations research concepts and cases", TMH (SIE) 8th edition.2008.
Wayne.L.Winston, "Operations research applications and algorithms", Thomson learning, 4th edition 2007.
Taha H.A, "Operation Research", Pearson Education sixth edition, 2003
Hira and Gupta "Problems in Operations Research", S.Chand and Co,2002.

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SEMESTER - V

L	T	P	C
3	1	0	4

12ME3501 **DYNAMICS OF MACHINERY**

Objective(s):
- *To learn about the system of forces acting on bodies and balancing forces.*
- *To learn about the control mechanisms in automotive systems.*
- *To learn about the types of vibration and their effects on bodies.*

UNIT - I FORCE ANALYSIS 12 Hrs.

Introduction to static and dynamic equilibrium - D'Alemberts principle - principle of superposition - turning moment diagram - flywheel - coefficient of fluctuation of energy, speed and mass of flywheel.

UNIT - II BALANCING 12 Hrs.

Static and dynamic balancing - balancing of rotating masses - balancing of single and multi cylinder engines - balancing of reciprocating masses - partial balancing in locomotive engines - v type engines - balancing linkages.

UNIT - III CONTROL MECHANISMS 12 Hrs.

Governors - types - centrifugal governors - gravity controlled and spring controlled centrifugal governors. Characteristics - stability - sensitivity - effect of friction - controlling force. Gyroscopes - gyroscopic forces and torques - gyroscope stabilization - gyroscopic effects in automobiles, ships and airplanes.

UNIT - IV LONGITUDINAL VIBRATION 12 Hrs.

Undamped free vibration of single degree of freedom system - simple pendulum, compound pendulum - springs in series, springs in parallel and combinations. Damped free vibration of single degree of freedom system - types of damping - viscous damping, critically damped, under damped system. Logarithmic decrement. Forced vibration of single degree of freedom system - constant harmonic excitation, steady state vibration, magnification factor, vibration isolation and transmissibility - measurement of forced vibration.

UNIT - V TRANSVERSE AND TORSIONAL VIBRATIONS 12 Hrs.

Transverse vibrations of beams - natural frequency - energy method - Dunkerly's method. Critical speed - whirling of shafts. Torsional systems - natural frequency of two and three rotor systems, equivalent shafts, geared systems, Holzer's method and signature analysis.

Lecture: 45, Tutorial: 15, Total hours: 60.

Course Outcomes:

CO1: Demonstrate an understanding of turning moment diagrams in various applications & skills to design flywheel for an IC engine

CO2: Execute static and dynamic balancing of high speed rotary and reciprocating machines.

CO3: Apply concept of governors on automobiles, ships and airplanes.

CO4: Evaluate gyroscopic couple on various vehicles

CO5 : Analyze free and forced vibrations of machines, engines and structures

Text Books:

1. Gupta B.V.R, "Theory of Machines", International Publishing House Pvt. Ltd., New Delhi, 2011.
2. Rattan S.S, "Theory of Machines", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007.

References:

1. Khurmi R. S, and Gupta J.K, "Theory of Machines", PHI Publishers, New Delhi, 2007.
2. Rao J.S and Dukkipati R.V, "Mechanism and Machine Theory", New Age International, New Delhi, 2007.
3. Sadhu Singh, "Theory of Machines", Pearson Edition, 2002.
4. Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", McGraw-Hill, Inc., 1995.
5. Bevan T, "Theory of Machines", Pearson Edition, 2010

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SEMESTER - V

12ME3502 **HEAT AND MASS TRANSFER**

(Use of standard heat and mass transfer data book permitted)

L	T	P	C
3	0	0	3

Objective(s): *To learn about the basics of heat transfer and apply the concepts in real time problems*.

UNIT - I CONDUCTION **09 Hrs.**

Basic concepts - mechanism of heat transfer - conduction, convection and radiation - Fourier law of conduction - heat conduction equation - cartesian and cylindrical coordinates - one dimensional steady state heat conduction - conduction through plane wall, cylinders, spherical systems and composite systems - unsteady heat conduction - lumped analysis.

UNIT - II CONVECTION **09 Hrs.**

Basic concepts - heat transfer coefficients - boundary layer concept - types of convection - forced convection - dimensional analysis - external flow - flow over plates, cylinders and spheres - internal flow - laminar and turbulent flow - combined laminar and turbulent - flow over bank of tubes - free convection - dimensional analysis - flow over vertical plate, horizontal plate, inclined plate, cylinders and spheres.

UNIT - III RADIATION **09 Hrs.**

Basic concepts, laws of radiation - Stefan Boltzman law, Kirchoff's law - black body radiation - grey body radiation - shape factor algebra - electrical analogy - radiation shields - introduction to gas radiation.

UNIT - IV HEAT EXCHANGER **09 Hrs.**

Nusselts theory of condensation - pool boiling, flow boiling, correlations in boiling and condensation. Types of heat exchangers - heat exchanger analysis - LMTD method and NTU - effectiveness - overall heat transfer coefficient - fouling factors - extended surfaces.

UNIT - V MASS TRANSFER **09 Hrs.**

Basic concepts - diffusion mass transfer - Fick's law of diffusion - steady state molecular diffusion - convective mass transfer - momentum, heat and mass transfer analogy - convective mass transfer correlations.

Total hours: 45.

Course Outcomes:

CO1 : Apply the concepts of one dimensional steady state heat conduction to various co-ordinates system and the internal heat generation and lumped heat analysis.

CO2 : Understand the boundary layer concept, type of convection flow, dimensional analysis and type of plates.

CO3:- Investigate the black body, grey body radiation and electrical analogy, radiation shields, Stefan Boltzmann law.

CO4 : Scrutinize about the pool boiling, flow boiling, shape factor algebra, fouling factors, LMTD, NTU effective.

CO5: Apply the concept of heat exchanger, its application and diffusion mass transfer flick's law steady state molecular diffusion and Analyze laws of radiation and its application.

Text Books:

1. Holman J. P, "Fundamentals of Heat and Mass Transfer", McGraw-Hill, 2010.
2. Nag P.K, "Heat and Mass Transfer", Third Edition Tata McGraw-Hill New Delhi, 2011.

References:

1. Sachdeva R.C, "Fundamentals of Engineering Heat and Mass Transfer", New Age Science, Limited, Jan 1, 2009.
2. Rajput R.K, "Heat and Mass Transfer", S. Chand Second Edition, 2011.
3. Kothandaraman C.P, "Fundamentals of Heat and Mass Transfer" Revised Third Edition, New Age International Publishers, 2006.
4. Rudramoorthi R, and Mayilsamy K, "Heat and Mass Transfer" Second Edition, Pearson Education, 2011.

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SEMESTER - V

12ME3503 **DESIGN OF MACHINE ELEMENTS**
(Use of PSG Design Data Book permitted)

L	T	P	C
3	1	0	4

Objective(s):

- *To familiarize various steps involved in the Design Process.*
- *To understand the principles involved in evaluating the shapes and dimensions of a component to satisfy functional and strength requirements.*

UNIT - I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 12 Hrs.

Introduction to the design process - factors influencing machine design, selection of materials - preferred numbers, fits and tolerances - direct, bending and torsional stress equations - impact and shock loading - principal stresses - 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 - fracture mechanics.

UNIT - II DESIGN OF SHAFTS AND COUPLINGS 12 Hrs.

Design of solid and hollow shafts based on strength, rigidity and critical speed - design of keys, key ways and splines - design of crankshafts - design of connecting rod - design of rigid and flexible couplings.

UNIT - III DESIGN OF TEMPORARY AND PERMANENT JOINTS 12 Hrs.

Threaded fasteners - design of bolted joints including eccentric loading, knuckle joints, cotter joints - design of welded joints, riveted joints for structures - theory of bonded joints.

UNIT - IV DESIGN OF ENERGY STORING ELEMENTS 12 Hrs.

Design of various types of springs, optimization of helical springs - leaf springs - design of flywheels considering stresses in rims and arms, for engines and punching machines.

UNIT - V DESIGN OF BEARINGS 12 Hrs.

Sliding contact and rolling contact bearings - design of hydrodynamic journal bearings, Mckee's equation. Sommerfeld number, selection of rolling contact bearings.

Lecture: 45, Tutorial: 15, Total hours: 60.

Course Outcomes:

CO1 : Analyze the stress and strain on mechanical components and understand failure modes for their parts
CO2 : Design power transmission shafts carrying various elements with geometrical features.
CO3 : To design and analyze permanent joints under concentric and eccentric loading conditions
CO4 : To design and analyze coil springs under various loads.
CO5 : Design and analyze of machine components such as bearings including prediction of their life and failure.

Text Books:

1. Shigley J.E and Mischke C. R., "Mechanical Engineering Design", Sixth Edition, Tata McGraw-Hill , 2003.
2. Bhandari V.B, "Design of Machine Elements", Second Edition, Tata McGraw-Hill Book Co, 2007.

References:

1. Khurmi R.S & Guptha J.K, "Machine Design" S.Chand & Co, 2005.
2. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
3. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
4. Ugural A.C, "Mechanical Design - An Integral Approach, McGraw - Hill Book Co, 2004.
5. Robert L. Norton, "Machine Design an Integrated Approach", Prentice Hall, 1998.

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SEMESTER - V

12ME3504 ENGINEERING METROLOGY AND MEASUREMENTS

L	T	P	C
3	0	0	3

Objective(s): *To learn about the basic principles of measurements and measuring equipments, principles of operation, applications and various methods for measuring mechanical parameters.*

UNIT - I CONCEPTS OF MEASUREMENTS 09 Hrs.

General concepts - generalized measurement system - units and standards - measuring instruments- sensitivity, stability, range, accuracy and precision - static and dynamic response - repeatability - systematic and random errors - correction, calibration - calibration of instruments - vernier, micrometer, vernier height gauge - quality standards - introduction to dimensional and geometric tolerancing - interchangeability.

UNIT - II LINEAR AND ANGULAR MEASUREMENTS 09 Hrs.

Abbe's principle, linear measuring instruments - vernier, micrometer, slip gauges and classification, tool makers microscope - interferometry, optical flats - limit gauges, Taylor's principle of gauge design. Comparators- mechanical, pneumatic and electrical comparators - applications. Angular measurements- sine bar, sine center, bevels protractor and angle decker.

UNIT - III FORM MEASUREMENTS 09 Hrs.

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 roughness - equipment and parameters - straightness - flatness and roundness measurements.

UNIT - IV ADVANCES IN METROLOGY 09 Hrs.

Precision instruments based on laser - principles - laser interferometer - white light - photo grametry - applications in measurements - coordinate measuring machine (CMM) - need, construction, types, applications - computer aided inspection.

UNIT - V MEASUREMENT OF MECHANICAL PARAMETERS 09 Hrs.

Force - torque - power - mechanical, pneumatic, hydraulic and electrical type - pressure - flow - venturi, orifice, rotameter, pitot tube - temperature - bimetallic strip, pyrometer, thermocouple and PT100.

Total hours: 45.

Course Outcomes:

CO1 : Understand the Calibration of geometric tolerance of Vernier and Dial Gauge and Learn the Dimensions of part using slip gauges and Micrometer

CO2 : Apply Abbe's principle, Taylor's principles and its Measuring the Gear Tooth Dimensions and Summarize about Mechanical, electrical pneumatic and angle Decker measurements

CO3 : Appraise the use of screw thread and other gear testing and Build the Setting up of comparators for inspection in advanced metrology (Mechanical / Pneumatic / Electrical)

CO4 : Demonstrate the method of Measuring the dimension using advance CMM technology

CO5 : Recall, Analyzing and Measuring techniques using thermocouple/PT100 and Applied the Measuring of Thermocouple / Pyrometer, Force, Torque, Vibration / Shock

Text Books:

1. Anand K Bewoor and Vinay A Kulkarni, "Metrology and Measurement", Tata McGraw-Hill, 2009.
2. Jain R.K., "Engineering Metrology", Khanna Publishers, 2005.

References:

1. Gupta S.C, "Engineering Metrology", Dhanpat rai Publications, 2005.
2. Jayal A.K, "Instrumentation and Mechanical Measurements", Galgotia Publications 2000.
3. Beckwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education, 2006.
4. Khurmi R.S., "Metrology and Measurements", Schand Publications, 2009.

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SEMESTER - V

L	T	P	C
3	0	0	3

12ME3506 HYDRAULIC AND PNEUMATIC SYSTEMS

Objective(s): *To learn about the principles of fluid power systems and apply them in motion control, power transmission etc.*

UNIT - I FLUID POWER SYSTEMS AND FUNDAMENTALS 09 Hrs.

Fluids - compressible, incompressible - properties - introduction to fluid power systems - types, advantages, applications - fluid power symbols. Pascal's law - laminar and turbulent flow - Reynold's number - Darcy's equation - losses in pipes, valves and fittings.

UNIT - II PUMPS AND ACTUATORS 09 Hrs.

Pumping theory - positive, non positive displacement pumps - fixed, variable displacement pumps - gear pump, vane pump, piston pump - pump performance. Actuators - linear hydraulic actuators - types of hydraulic cylinders - single acting, double acting, special cylinders like tandem, rod less, telescopic, cushioning mechanism. Rotary actuators - fluid motors, gear, vane, piston motors.

UNIT - III DESIGN OF HYDRAULIC CIRCUITS 09 Hrs.

Types of valves - direction control - 3/2, 4/2 valves, shuttle valve, check valve. Pressure control - pressure reducing valve, sequence valve. Flow control - fixed, adjustable. Controls - manual, solenoid, pilot, relays. Accumulators - types, circuits, sizing. Intensifier - intensifier circuits - meter-in, meter-out circuits.

UNIT - IV PNEUMATIC SYSTEM AND CIRCUITS 09 Hrs.

Properties of air - pneumatic components - compressors, filters, regulators, lubricators, control valves, quick exhaust valves, pneumatic actuators. Fluid power circuit design - speed control circuit, synchronizing circuit, sequential circuit for simple applications using cascade method - pneumo-hydraulic circuit.

UNIT - V ADVANCED FLUID POWER SYSTEMS 09 Hrs.

Servo systems - hydro mechanical servo systems, electro hydraulic servo systems, proportional valves. Fluidics - introduction to fluidic devices, simple circuits, introduction to electro hydraulic pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Troubleshooting in fluid power circuits.

Total hours: 45.

Course Outcomes:

CO1 :. Understand and explain the fundamentals of fluid power systems.
CO2 : Explain the working of hydraulic control devices.
CO3 : Construct hydraulic circuits for industrial applications.
CO4 : Explain the working of pneumatic components.
CO5 :. Construct pneumatic circuits .

Text Books:

1. Srinivasan R, "Hydraulic and Pneumatic Controls",TMH, 2011.
2. Anthony Esposito, "Fluid Power with Applications", Pearson Education, 2005.

References:

1. Majumdar S.R.,"Pneumatic systems - Principles and Maintenance", Tata McGraw Hill, 1995.
2. Majumdar S.R., "Oil Hydraulics", Tata McGraw-Hill, 2000.
3. Shanmugasundaram K, "Hydraulic and Pneumatic Controls", Chand & Co, 2006.
4. Dudley A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 1987.

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SEMESTER - V

12ME3510 DYNAMICS OF MACHINERY LABORATORY

L	T	P	C
0	0	3	2

Objective(s): To experiment and learn the concepts and theories of machines.

LIST OF EXPERIMENTS

1. Kinematics of four bar mechanisms - slider crank and crank rocker mechanism - determination of velocity and acceleration.
2. Kinematics of universal joints - determination of velocity and acceleration.
3. Bifilar suspension system - determination of mass moment of inertia of an object.
4. Governors - determination of sensitivity, effort, etc. for watt, porter, proell.
5. Cam - determination of jump speed and profile of the cam.
6. Motorized gyroscope - verification of laws - determination of gyroscopic couple.
7. Whirling of shaft - determination of critical speed of shaft with concentrated loads.
8. Balancing of rotating masses.
9. Determination of moment of inertia by oscillation method for connecting rod and flywheel.
10. Vibrating system - spring mass system - determination of damping co-efficient of single degree of freedom system.
11. Determination of moment of inertia for compound pendulum.
12. Transverse vibration - free beam - determination of natural frequency and deflection of beam.

LIST OF EQUIPMENTS

(For a batch of 30 students)

1.	Whirling speed of shaft setup	1 No.
2.	Free beam setup	1 No.
3.	Cantilever beam apparatus	1 No.
4.	Vibrating table	1 No.
5.	Universal Governor	1 No.
6.	Gyroscope	1 No.
7.	Balancing of rotating masses setup	1 No.
8.	Cam Analyser	1 No.
9.	Spring mass system	1 No.
10.	Bifilar suspension	1 No.
11.	Compound pendulum	1 No.
12.	Axle setup	1 No.
13.	Turn table apparatus	1 No.

Total hours: 45.

Course Outcomes:

CO1 : Demonstrate an understanding of the concepts of various mechanisms and pairs.
CO2 : Attain basic knowledge about mass moment of inertia on different mechanical setup
CO3 : Understand dynamic balancing of rotating masses.
CO4 : Analysis the characteristics of different control mechanisms.
CO5 : Understand the free response of single degree of freedom systems.
CO6 : Ability to measure vibrations, vibration characteristics and understand various methods for vibration control for real life problem.

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SEMESTER - V

12ME3511 **HEAT AND MASS TRANSFER LABORATORY**

(Use of standard heat and mass transfer data book permitted)

L	T	P	C
0	0	3	2

Objective(s) :

- *To help the students to understand the 3 modes of heat transfer.*
- *To inculcate certain innovative skills among the students to use the experimental setups and do higher level studies.*

LIST OF EXPERIMENTS

1. Thermal conductivity measurement by guarded plate method.
2. Thermal conductivity of pipe insulation using lagged pipe apparatus.
3. Natural convection heat transfer from a vertical cylinder.
4. Forced convection inside tube.
5. Heat transfer from pin-fin (natural and forced convection modes).
6. Determination of Stefan-Boltzmann constant.
7. Determination of emissivity of a grey surface.
8. Effectiveness of parallel / counter flow heat exchanger.
9. Determination of COP of a refrigeration system.
10. Experiments on air-conditioning system.
11. Performance test on single stage reciprocating air compressor.
12. Performance test on two stage reciprocating air compressor.

Total hours: 45.

LIST OF EQUIPMENTS

(For a batch of 30 students)

1.	Guarded plate apparatus	1 No.
2.	Lagged pipe apparatus	1 No.
3.	Natural convection-vertical cylinder apparatus	1 No.
4.	Forced convection inside tube apparatus	1 No.
5.	Pin-fin apparatus	1 No.
6.	Stefan-Boltzmann apparatus	1 No.
7.	Emissivity measurement apparatus	1 No.
8.	Parallel / counter flow heat exchanger apparatus	1 No.
9.	Single / two stage reciprocating air compressor.	1 No.
10.	Refrigeration test rig	1 No.
11.	Air-conditioning test rig	1 No.

Course Outcomes:

CO1 : Understand the basic concepts of heat exchangers and applications.
CO2 : Find the thermal conductivity in different materials by using lagged pipe and guarded plate apparatus.
CO3 : Calculate the heat transfer coefficient in natural and forced convection apparatus
CO4 : Acquire the basic knowledge of compressors and their volumetric efficiency.
CO5: Understand the basics of refrigeration and air-conditioning and find their C.O.P
CO6: Troubleshoot existing engineering heat transfer systems and develop alternatives and more energy efficient systems.

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SEMESTER - V

12ME3512 ENGINEERING METROLOGY AND MEASUREMENTS LAB

L	T	P	C
0	0	3	2

Objective(s): *To facilitate the students to use measuring instruments in various mechanical quantities.*

LIST OF EXPERIMENTS

1. Checking dimensions of part using vernier, micrometer, slip gauges, height and depth gauge.
2. Measurement of gear tooth dimensions.
3. Measurement of angle using sine bar / sine center.
4. Measurement of gear tooth profile using profile projector.
5. Measurement of straightness and flatness using autocollimator.
6. Component inspection by electrical comparator and Go - No Go gauges.
7. Calibration of micrometer.
8. Calibration of thermocouple.
9. Tool geometry measurement using tool makers microscope.
10. Measurement of displacement and force.
11. Measurement of torque.
12. Measurement of vibration.

Total hours: 45.

LIST OF EQUIPMENTS

(For a batch of 30 students)

1. Micrometer	- 5 Nos.	11. Profile projector	- 01 No.
2. Vernier caliper	- 5 Nos.	12. Tool makers microscope	- 01 No.
3. Vernier height gauge	- 2 Nos.	13. Mechanical / electrical comparator	- 01 No.
4. Vernier depth gauge	- 2 Nos.	14. Autocollimator	- 01 No.
5. Slip gauge set	- 01 No.	15. Temperature measuring setup	- 01 No.
6. Gear tooth vernier	- 01 No.	16. Displacement measuring setup	- 01 No.
7. Sine bar	- 2 Nos.	17. Force measuring setup	- 01 No.
8. Sine center	- 01 No.	18. Torque measuring setup	- 01 No.
9. Bevel protractor	- 01 No.	19. Vibration measuring setup	- 01 No.
10. Floating carriage micrometer	- 01 No.		

Course Outcomes:

CO1 : Analyze the calibration of Vernier Caliper, Micrometer, thermocouple .
CO2 : Justify the dimensions of part using slip gauges, Angle using sine bar / sine center / tool makers microscope.
CO3 : Predict the Gear Tooth Dimensions, straightness, flatness and thread parameters.
CO4 : Understand the Setting up of comparators for inspection (Mechanical / Pneumatic / Electrical).
CO5 : Evaluate the gear tooth profile used profile projector and tool makers microscope.
CO6 : Investigation of the Measuring techniques of Force, Torque and Measuring of Vibration / Shock.

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SEMESTER - V

L	T	P	C
0	2	0	1

12 HR1513

CAREER DEVELOPMENT SKILLS - V

(Common to All Branches)

Objective(s):

- *To inculcate the skills to build resumes, prepare for and take part in group discussions and interviews.*
- *To enhance arithmetical & logical ability.*

UNIT - I RESUME WRITING 05 Hrs.

Introduction to resume writing - purpose - types of resumes - resume writing strategies and techniques - tips and techniques for resume formatting and designing - the power of words, structure and positioning - covering letter writing strategies and techniques. ***(Activity: Preparation of Resume and Covering letter)***

UNIT - II GROUP DISCUSSION 06 Hrs.

Concept - methodology - components - role players - how to generate ideas - evaluation techniques - Dos and Don'ts of GD. (***Activity: GD)***.

UNIT - III INTERVIEW SKILLS 04 Hrs.

Types of interviews - interpersonal skills - preparing for an interview - dress code for interview - overcoming nervousness/shyness - body language - interview tips - FAQs. ***(Activity: Mock Interview)***.

UNIT - IV QUANTITATIVE APTITUDE V 09 Hrs.

Averages and ages **-** time speed and distance - problems on trains - boats and streams - clocks and calendars.

UNIT - V NON-VERBAL REASONING V 06 Hrs.

Syllogisms - analogies - cubes and dice - seating arrangement.

Total hours: 30.

Course Outcome

CO 1 : Develop skills for Building a Resume & Drafting a Cover letter

CO 2 : Acquire knowledge about Group discussion and its evaluation through activity and developing skills to face interviews through mock interview

CO 3 : Perform well in Interview

CO 4 : Improve Analytical skills through Quantitative Aptitude Activities on Averages and ages, Time Speed and Distance, Problems on trains, Boats and streams, Clocks and calendars.

CO 5 : Develop Non Verbal Reasoning skills on Syllogisms- Analogies, Cubes and Dice & Seating arrangement

Reference(s):

1. Jeff Butterfield, "Soft Skills for Everyone" Cengage Learning India pvt. Ltd., 2011, New Delhi.
2. Hari Mohan Prasad & Rajinish Mohan, "How to Prepare for Group Discussion and Interview" Third Edition, TMH, 2012
3. Abhijit Guha, "Quantitative Aptitude for Competitive Examinations", 4th edition, TMH, 2011.
4. R.S.Agarwal, "Quantitative Aptitude", 3rd edition, TMH, 2011
5. R.V.Praveen, "Quantitative Aptitude and Reasoning", 2nd Edition, PHI, 2013

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SEMESTER - VI

12ME3601 **DESIGN OF TRANSMISSION SYSTEMS**
(use of standard design data book permitted)

L	T	P	C
3	0	0	3

Objective(s): *To learn about the principles and procedure for the design of power transmission components.*

UNIT - I TRANSMISSION SYSTEMS USING FLEXIBLE ELEMENTS 09 Hrs.

Introduction to transmission systems - design of flat belts, V- belts - design of pulleys - design of chains and sprockets.

UNIT - II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 09 Hrs.

Spur gear - terminology, speed ratios, number of teeth - force analysis - tooth stresses - dynamic effects - fatigue strength - factor of safety - gear materials - module, face width - power rating calculations based on strength, wear considerations - design of spur gears. Design of helical gears - pressure angle in the normal, transverse plane - equivalent number of teeth - forces, stresses - estimating the size of the helical gears.

UNIT - III BEVEL AND WORM GEARS 09 Hrs.

Design of straight, spiral bevel gear - Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight, spiral bevel gears. Design of worm gear - merits, demerits - terminology. Thermal capacity, materials - forces, stresses, efficiency, estimating the size of the worm gear pair.

UNIT - IV DESIGN OF GEAR BOXES 09 Hrs.

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 POWER SCREWS, CLUTCHES AND BRAKES 09 Hrs.

Design of power screws, ball screws for CNC machines - Design of plate clutches - axial clutches - cone clutches - internal expanding rim clutches - types of brakes, applications - design of internal, external shoe brakes.

Total hours: 45.

Course Outcomes:

CO 1 : Learn about the transmission elements and understanding the design and types of belt
CO 2 :Identification of the specification and to design the spur and helical gear
CO 3 :Design of worm and bevel gear by identifying the requirements.
CO 4 :Creation of gear boxes according to step ratio using ray diagrams.
CO 5 : Selection and design of clutches and brakes by identifying the requirements.

Text Books:

1. Shigley J.E and Mischke C. R., “Mechanical Engineering Design”, McGraw-Hill International Editions, 1989.
2. Sundararajamoorthy T.V. and Shanmugam N, “Machine Design”, Anuradha Publications, chennai, 2007.

References:

1. Khurmi R.S. and Guptha J.K, “Machine Design” S. Chand &Co, 2005.
2. Robert L. Mott, "Machine Elements in Mechanical Design”,4 Ed, Prentice Hall,2003.
3. Bhandari, V.B., “Design of Machine Elements”, Tata McGraw-Hill Publishing Company Ltd., 1994.
4. Stephen P. Radzevich, “Dudley's Handbook of practical Gear Design and Manufacture”, 2nd Edition, CRC Press, 2012.

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SEMESTER - VI

12ME3602 COMPUTER AIDED MANUFACTURING

L	T	P	C
3	0	0	3

Objective(s): *To understand the fundamentals of CNC machines, constructional features and Part Programming.*

UNIT - I CAD / CAM INTERFACE 09 Hrs

Current trends in manufacturing engineering - design for manufacturing, assembly - process planning techniques - total approach to product development - concurrent engineering - rapid prototyping - Introduction to CAD / CAM software packages.

UNIT - II FUNDAMENTALS OF CNC MACHINES 09 Hrs

CNC technology - functions of CNC control in machine tools - classification of CNC systems - contouring system - interpolators, open loop, closed loop CNC systems - CNC controllers, hardware features - direct numerical control (DNC Systems). Five axis CNC machines – horizontal / vertical machining center - cycle time reduction.

UNIT - III CONSTRUCTIONAL FEATURES OF CNC MACHINES 09 Hrs

Design considerations of CNC machines for improving machining accuracy - structural members - slide ways - side linear bearings - ball screws - spindle drives, feed drives - work holding devices, tool holding devices - automatic tool changers. Feedback devices - principles of operation - machining centres - tooling for CNC machines.

UNIT - IV PART PROGRAMMING FOR CNC MACHINES 09 Hrs

Numerical control codes - standards - manual programming - canned cycles, subroutines - computer assisted programming, CAD / CAM approach to NC part programming - APT language, machining from 3D models.

UNIT - V COMPUTER AIDED PROCESS PLANNING AND DATA BASE FOR CAM 09 Hrs

Process planning - role of process planning in CAD / CAM integration - approaches to computer aided process planning - variant approach, generative approaches - group technology. Development of databases - database terminology - architecture of database systems - data modeling and data associations - relational data bases - database operators - advantages of data base and relational database. Emerging challenges in CAD / CAM, product data management - product modeling - assembly modeling - tolerance modeling.

Total hours: 45.

Course Outcomes:

CO1 : *Understand various current trends in manufacturing process.*
CO2 : *Apply the concepts of CNC machine tools.*
CO3 : *Analyze the constructional features of CNC machines*
CO4 : *Understand the concepts of numerical codes , manual part programming*
CO5 : *Evaluate the concepts of PDM and Database management systems.*

Text Books:

1. Radhakrishnan P, "Computer Numerical Control ", New Central Book Agency, 1992.
2. Mikell.P.Groover, “Automation, Production Systems and computer integrated manufacturing”, Pearson Education, 2007.

References:

1. Yoram Koren, "Computer Control of Manufacturing Systems", McGraw-Hill Book Company, 2005.
2. Mahon and J. Browne, "CAD / CAM", Addison - Wesley, 2005.
3. Smith G.T, "CNC - Machining, Techniques - Vol. 1, 2 & 3", verlag, 1992.

4. Kant Vajpayee S, "Principles of Computer Integrated Manufacturing", Prentice Hall of India Ltd., 1999.

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SEMESTER - VI

12ME3603 GAS DYNAMICS AND JET PROPULSION

L	T	P	C
3	0	0	3

Objective(s):

- *To understand the differences between incompressible and compressible flow.*
- *To understand the phenomenon of shock waves and its effect on flow.*
- *To gain knowledge about jet propulsion and rocket propulsion.*

UNIT - I BASIC CONCEPTS OF COMPRESSIBLE FLOW 09 Hrs.

Energy and momentum equations - various regions of flows - reference velocities - stagnation state - velocity of sound - critical states - mach number - mach waves - mach cone - mach angle - effect of mach number on compressibility - flow through nozzle, diffuser.

UNIT - II FLOW THROUGH DUCTS 09 Hrs.

Flow through constant area ducts with heat transfer (Rayleigh flow) - Rayleigh line, Rayleigh flow equation. Flow through constant area ducts with friction (Fanno flow) - Fanno curves, Fanno flow equation - variation of flow properties - variation of mach number with duct length.

UNIT - III NORMAL AND OBLIQUE SHOCKS 09 Hrs.

Governing equations - variation of flow parameters - static pressure, static temperature, density, and stagnation pressure - entropy across the normal and oblique shocks - Prandtl-Meyer equation - use of tables, charts.

UNIT - IV JET PROPULSION 09 Hrs.

Theory of jet propulsion - thrust equation - thrust power - propulsive efficiency - operation principle - cycle analysis - performance of ram jet engine, turbojet, turbofan, turbo prop engines.

UNIT - V SPACE PROPULSION 09 Hrs.

Theory of rocket engines - propellants - feeding system - ignition and combustion - theory of rocket propulsion - performance study - applications.

Total hours: 45.

Course Outcomes:

CO1 : Learn about the basic concept and importance of Gas dynamics.
CO2 : Understand how the flow takes place in Fanno and Rayleigh line.
CO3 : Acquire the basic knowledge of the phenomena of normal and oblique shocks.
CO4 : Identify and analyze the basic principle of jet propulsion, types, comparison with rocket propulsion and its Applications.
CO5 : Estimate the various performance efficiencies of rocket engines.

Text Books:

1. Yahya.S.M., 'Fundamentals of Compressible flow" , New Age International (P) Ltd., New Delhi, 2010.
2. Anderson,J.D., "Modern Compressible flow", McGraw Hill, 3rd Edition, 2003.

References:

1. Ganesan .V., "Gas Turbines", Tata McGraw-Hill, New Delhi, 1999.
2. Hill P and Peterson C, "Mechanics and Thermodynamics of Propulsion", Addison - Weseley Publishing Company, 1992.
3. Zucrow N.J, "Principles of Jet Propulsion and Gas Turbines", John Wiley, New York, 1970.
4. Somasundaram PR.S.L, "Gas Dynamics and Jet Propulsion", New Age International Publishers, 1996.

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SEMESTER - VI

16ME3604 POWER PLANT ENGINEERING

L	T	P	C
3	0	0	3

Prerequisites : *Engineering Physics, Engineering Thermodynamics.*

Objectives :

- *Understand various components, operations, applications and site selection criteria of different types of power plants.*
- *Understanding of power plant economics and comparison of economics of various power plants.*

UNIT - I HYDEL POWER PLANT AND STEAM BOILERS [09]

Layout of Hydel power plants – Types – Standalone – Pumped Storage. Steam Boilers and cycles – High pressure and supercritical boilers – Fluidized bed boilers – Analysis of power plant cycles - Combined power cycles – comparison and selection

UNIT - II STEAM POWER PLANT [09]

Layout and types of Steam Power Plants - Fuel and Ash handling systems – combustion equipment for burning coal – Mechanical stokers – Pulverizers – Electrostatic precipitator – Draught – different types, Surface condenser types, Cooling towers, Pollution Controls.

UNIT - III NUCLEAR POWER PLANTS [09]

Nuclear energy - Fission, Fusion reaction - Layout of nuclear power plants - Types of reactors, pressurized water reactor - Boiling water reactor - Gas cooled reactor - Fast breeder reactor - Waste disposal and safety.

UNIT - IV DIESEL AND GAS TURBINE POWER PLANTS [09]

Layout and types of Diesel power plants and components, selection of engine type, applications. Gas Turbine power plant – Layout - Fuels, gas turbine material, types of combustion chambers - reheating, regeneration and inter - cooling.

UNIT - V POWER PLANT ECONOMICS [09]

Economics of power plant – Actual load curves-cost of electric energy-fixed and operating costs-energy rates – Types of Tariffs – Economics of load sharing – variable load operation - comparison of economics of various power plants.

Total = 45 Periods

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

CO1 :Select the suitability of site for a power plant.
CO2 : Calculate performance of thermal power plant and Propose ash handling, coal handling method in this plant.
CO3 : Explain working principle of different types of nuclear power plant.
CO4 : Calculate load factor, capacity factor, average load and peak load on a power plant.
CO5 : Cost analysis and comparison of economics of various plants.

Text Books :

1. Arora S.C. and Domkundwar.S, 'A Course in Power Plant Engineering', Dhanpatrai, 2001
2. Nag P.K., 'Power Plant Engineering', Tata-McGraw Hill, 1998.

Reference Books :

1. Frank D.Graham,'Power Plant Engineers Guide', D.B. Taraporevala Sons &Co., New Delhi, 1993.
2. T.Morse Frederick,'Power Plant Engineering', Prentice Hall of India, 1998.
3. R.K.Rajput,'Power Plant Engineering', Laxmi Publications,1995.
4. G.D.Rai,'Introduction to Power Plant Technology", Khanna Publishers, 1995.

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SEMESTER VI

12EC3625 ELECTRONICS AND MICROPROCESSOR

L	T	P	C
3	0	0	3

Objective(s):
- *To learn the fundamental concepts of semiconductor devices.*
- *To understand the fundamental concepts of Digital Electronics.*
- *To gain knowledge about 8085 Microprocessors and its applications.*

UNIT - I SEMICONDUCTORS AND RECTIFIERS 09 Hrs.

Classification of solids based on energy band theory - intrinsic semiconductors - extrinsic semiconductors - PN junction diode: characteristics - half wave and full wave rectifiers - Zener diode: Characteristics - voltage regulator.

UNIT – II TRANSISTORS AND AMPLIFIERS 09 Hrs.

Bipolar junction transistor: Construction and characteristics - CE configuration and characteristics - Transistor biasing: Fixed and voltage divider biasing - class A, B and C amplifiers - construction and characteristics: FET, SCR and UJT - concept of feedback: negative feedback - application in temperature and motor speed control.

UNIT - III DIGITAL ELECTRONICS 09 Hrs.

Number system: Binary, octal, hexadecimal - Boolean algebra - logic gates - half and full adders - flip flops - shift registers: SISO, SIPO, PISO, PIPO - counters: 3-bit synchronous up & down, 3-bit asynchronous up & down - A/D conversion: Single slope, successive approximation - D/A conversion: Binary weighted resistor type.

UNIT – IV 8085 MICROPROCESSOR 09 Hrs.

Block diagram of microcomputer - 8085: Architecture, pin configuration, addressing modes, instruction set and simple programs using arithmetic and logical operations.

UNIT - V INTERFACING AND APPLICATIONS OF MICROPROCESSOR 09 Hrs.

Basic interfacing concepts - interfacing of input and output devices - applications of microprocessor: Temperature control - stepper motor control - Traffic light control - case study: Mining problem -turbine monitor using 8085.

Total hours: 45.

Course Outcomes:

CO1 : Learn the fundamental concepts of semiconductor device.

CO2 : Understanding the various characteristics of amplifiers

CO3 : Understand the fundamental concepts of Digital Electronics

CO4 : Gain knowledge about 8085 microprocessors.

CO5 : Able to design and develop applications using microprocessor and microcontroller..

Text Books:

1. Milman and Halkias, “Integrated Electronics”, Tata McGraw-Hill publishers, 2nd Edition, 2011.
2. Ramesh Goankar, “Microprocessor Architecture”, Programming and Applications with 8085”, 5th Edition, Wiley Eastern, 2011.

References:

1. Malvino and Leach, “Digital Principles and Applications”, Tata McGraw-Hill, 5th Edition, 2006.
2. Mehta V.K, “Principles of Electronics”, S. Chand and Company Ltd., 2009.
3. Salivahanan S, Suresh Kumar N, Vallavaraj A, “Electronic Devices and Circuits”, Tata McGraw-Hill, 2nd Edition, 2008.
4. Krishna Kant, “Microprocessors and Microcontrollers”, PHI Learning Private Ltd., 2011.

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SEMESTER - VI

		L	T	P	C
12ME3610	**COMPUTER AIDED MANUFACTURING LABORATORY**	**0**	**0**	**3**	**2**

Objective(s):

- *To understand the concepts G and M codes and manual part programming.*
- *To expose students to modern control systems (Fanuc, Siemens etc)*

LIST OF EXPERIMENTS

1. Part programming for turning and facing using incremental positioning system.
2. Part programming for turning and facing using absolute positioning system.
3. Part programming using multiple turning cycle.
4. Part programming for threading and grooving.
5. Part programming using pattern repeating operation
6. Part programming for drilling and boring.
7. Part programming for contour milling.
8. Part programming using mirroring.
9. Part programming for peck drilling.
10. Part programming using rectangular pocketing.
11. Part programming using circular pocketing.
12. Part programming using rotation command

LIST OF EQUIPMENTS

(For a batch of 30 students)

1.	Computer server	1 No.
2.	CNC milling trainer type machine with standard accessories	1 No.
3.	CNC lathe trainer type machine with standard accessories	1 No.
4.	Computer system	30Nos.
5.	HP laser jet printer 1020	1 No.
6.	EDGE CAM software	30 LICENSES.

Total hours: 45.

Course Outcomes:

CO 1 : Learn the part programming for turning and facing operation
CO 2 : Implement the part programming for threading and grooving operation
CO 3 : Design the part programming using pattern repeating, drilling and boring operation
CO 4 : Perform the part programming for contour milling, mirroring and peck drilling operation
CO 5 : Develop the part programming using rectangular and circular pocketing
CO 6 : Study the part programming using rotation command operation

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SEMESTER – VI

12HS2611 **COMMUNICATION SKILLS LABORATORY**
(Common to CE and ME)

L	T	P	C
0	0	3	2

Objective(s):

- *To equip students of engineering and technology with effective speaking and listening skills in English.*
- *To help them develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their job.*
- *To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.*

A. ENGLISH LANGUAGE LAB

UNIT - I READING COMPREHENSION 09 Hrs.

Filling in the blanks - cloze exercises - vocabulary building - reading and answering questions

UNIT - II SPEAKING 09 Hrs.

Phonetics: Intonation - ear training - correct pronunciation - sound recognition exercises -common errors in English. Conversations: Face to face conversation - telephone conversation - role play activities (students take on roles and engage in conversation).

B. VIEWING AND DISCUSSING AUDIO-VISUAL MATERIALS

UNIT - III RESUME / E-MAIL WRITING 09 Hrs.

Structuring the resume / report - letter writing / e-mail communication – samples.

UNIT - IV GROUP DISCUSSION 09 Hrs.

Why is GD part of selection process? - Structure of GD - moderator - led and other GDs -strategies in GD - team work - body language - mock GD - video samples.

UNIT - V INTERVIEW SKILLS 09 Hrs.

Kinds of interviews - required key skills - corporate culture - mock interviews - video samples**.**

Total hours: 45.

Course Outcomes:

CO1 : To improve the reading skills of the students and to improve their vocabulary also.
CO2:- To improve the pronunciation of the students to make them speak English without errors.
CO3: To improve their writing skills and to make them familiar with resumes and reports.
CO4 : To make the students take part in Group Discussions effectively.
CO5: To make the students prepare for job interviews and to help them get rid of their fear about interview.

References:

1. John Seely, “The Oxford Guide to Writing and Speaking”, Oxford University Press, New Delhi, 2004.
2. Evans. D, “Decision maker”, 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”, Addision Wesley Longman Ltd., Indian reprint 1998.

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SEMESTER – VI

		L	T	P	C
12EC3612	**ELECTRONICS AND MICROPROCESSOR LABORATORY**	**0**	**0**	**3**	**2**

Objective(s):

- *To familiarize the characteristics of semiconductor devices.*
- *To perform the logical operations of logic circuits.*
- *To gain the programming knowledge of 8085 microprocessor.*

LIST OF EXPERIMENTS

ELECTRONICS

1. V-I Characteristics of PN Junction and Zener diode.
2. Transistor characteristics in common emitter mode.
3. Study of UJT characteristics.
4. Study of logic gates and verification of their truth tables.
5. Design and implementation of Half-adder and Full adder using logic gates.
6. Study of flip-flops.
   i. R-S Flip-flop.
   ii. D Flip-flop.
   iii. J-K Flip-flop.
   iv. T- Flip-flop.

MICROPROCESSOR

7. Programming with 8085 microprocessor for the following
   i. 8-bit Addition.
   ii. 8-bit Subtraction.
   iii. 8-bit Multiplication.
   iv. 8-bit Division.
8. Programming with 8085 microprocessor for finding Maximum and Minimum number in a block of data.
9. Programming with 8085 microprocessor for transferring a block of data from one block to another block.
10. Programming with 8085 microprocessor for sorting data.
11. Programming with 8085 microprocessor for Code Conversion.
12. Stepper motor interfacing in 8085 Microprocessor.

Total Hours: 45

Course Outcomes:

CO1: Understand the fundamentals of operation of the main semiconductor electronic devices.
CO2 : Study about different the characteristics of semiconductor electronic devices
CO3 : Understand the fundamental concepts of Digital Electronics
CO4 : Execution of various programs for arithmetic and logical as well as control application using 8051 microcontroller.
CO5 : Design and develop the programming for various interfacing devices like keyboard, peripheral and timer interfaces using processor.

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SEMESTER - VI

12ME3613 **COMPREHENSION**

L	T	P	C
0	2	0	1

Objective(s):

- *To provide an opportunity to revise the fundamental knowledge acquired. The student is expected to take up an objective and other types of testing processes and ensure his / her understanding of fundamentals.*
- *To enable the students to appear for GATE, GRE, IES, IRS, UPSC and all competitive exams.*

Mode of Assessment:

Internal Assessment Test No.	Topics / Area	Test Duration	Maximum Marks
1	Thermal Sciences	1 hour 30 minutes	30
2	Manufacturing, Design and Management	1 hour 30 minutes	30
3	All the above	2 hours	40
Total Marks			**100**

Total hours: 30.

Reference Books:

1. Jain R. K, “Mechanical engineering for competitions”, Khanna publications, 2012.
2. Bansal R.K, “Mechanical Engineering”, Laxmi Publications, 2005.
3. Anthony G. Atkins, Tony Atkins and Marcel Escudier, “Dictionary for Mechanical Engineering”, Oxford Press, 2013.
4. Vikas Slariya, “Mechanical Engineering for GATE (Graduate Aptitude Test in Engineering)”, Tata McGraw Hill, 2012.

Course Outcomes:

CO1 : Able to revise the knowledge gained
CO2: Able to have a recap on thermal sciences.
CO3 : Able to revise the concepts of Manufacturing
CO4 : Able to evaluate the knowledge gained in the field of design
CO5 : Acquire the knowledge on various management concepts

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SEMESTER - VII

12HS1701 **PROFESSIONAL ETHICS**
(Common to all branches)

L	T	P	C
3	0	0	3

Objective(s): *To inculcate the values of education and professional, ethical values.*

UNIT - I ENGINEERING ETHICS **09 Hrs.**

Senses of 'engineering ethics' - variety of moral issues - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy - models of professional roles - professional ideals and virtues - uses of ethical theories.

UNIT - II ENGINEERING AS SOCIAL EXPERIMENTATION **09 Hrs.**

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - industrial standards - a balanced outlook on law - the challenger case study.

UNIT - III ENGINEER'S RESPONSIBILITY FOR SAFETY **09 Hrs.**

Safety and risk - assessment of safety and risk - risk benefit analysis - reducing risk - the Chernobyl and Bhopal case studies.

UNIT - IV RESPONSIBILITIES AND RIGHTS **09 Hrs.**

Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - intellectual property rights (IPR) - discrimination.

UNIT - V GLOBAL ISSUES **09 Hrs.**

Multinational corporations - environmental ethics - computer ethics - weapons development - engineers as managers - consulting engineers - engineers as expert witnesses and advisors - honest - moral leadership - sample code of conduct.

Total hours: 45.

Course Outcomes:

CO1 : Understand basic perception of ethics, moral and values
CO2 : Aware the current industrial standards
CO3 : Identify and assess the risk and safety benefit in industry
CO4 : Aware of professional rights and responsibility of an engineer
CO5 : Acquire knowledge in global issues and able to apply in ethical principles in professional life

Text Books:

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York, 2005.
2. Govindarajan M, Natarajan S and Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

References:

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004.
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics - Concepts and Cases", Thompson Learning, 2000

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SEMESTER - VII

12ME3702 **MECHATRONICS**

L	T	P	C
3	0	0	3

Objective(s): *To understand the interdisciplinary application of electronics, electrical, mechanical and computer systems for the control of mechanical systems.*

UNIT - I MECHATRONIC SENSORS AND TRANSDUCERS 09 Hrs.

Introduction to mechatronics systems - measurement systems - control systems - microprocessor based controllers. Sensors, transducers - performance terminology - sensors for displacement, position, proximity, velocity, force, fluid pressure, liquid flow, liquid level, temperature, light sensor - selection of sensor.

UNIT - II ACTUATION SYSTEMS 09 Hrs.

Pneumatic hydraulic systems - directional control valves - rotary actuators. Mechanical actuation systems - cams - gear train - ratchet and pawl - belt and chain drives - bearing electrical actuation systems - mechanical switches - solid state switches - solenoids - construction and working principle of AC and DC motors - speed control of AC and DC drives, stepper motors - switching circuitries for stepper motor - AC and DC servo motors.

UNIT - III SYSTEM MODELS AND CONTROLLERS 09 Hrs.

Building blocks of mechanical, electrical, fluid, thermal systems, rotational - translational 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.

UNIT - IV PROGRAMMABLE LOGIC CONTROLLERS 09 Hrs.

Basic structure - input/output processing - programming - mnemonics - timers, internal relays, counters - shift registers - master and jump controls - data handling - analog input/output - selection of a PLC.

UNIT - V DESIGN OF MECHATRONICS SYSTEMS 09 Hrs.

Stages in designing mechatronics systems – traditional, mechatronics systems – traditional, mechatronics design - possible design solutions. Case studies of mechatronics systems - pick and place robot - autonomous mobile robot - wireless surveillance balloon - engine management systems**.**

Total hours: 45.

Course Outcomes:

CO1 : Remember about mechatronic sensors and transducers.
CO2 : Understand the Actuation Systems
CO3 : Apply the system models & controllers
CO4 : Create the programming in PLC
CO5 : Analyze the Design of mechatronic systems

Text Books:

1. Bolton.W, ”Mechatronics”,pearson education, second Edition, fifth Indian print,2013.
2. Rajput.R.K. ”A text book of mechatronics”, s chand and co, 2010.

References:

1. Nitaigor Premch and Mahadik, “Mechatronics”, Tata McGraw-hill publishing company Ltd, 2007.
2. David G, Alciatore Michael B and Histand, “Intorduction to mechatronics and measurement system”, Tata McGraw-hill publishing company Ltd, 2007.
3. Michael.B.histand and David G. Alciatore, “Introduction to mechatronics systems”, McGraw-Hill International editions, 2005.
4. Dan necsulesu, “Mechatronics”, Pearson education Asia, 2002.

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SEMESTER - VII

L	T	P	C
3	0	0	3

12ME4604 **FINITE ELEMENT ANALYSIS**

Objective(s): *To learn about the fundamentals of Finite Element models and its procedure.*

UNIT - I INTRODUCTION 09 Hrs.

Historical background - relevance of FEA to design problems, application to the continuum - discretisation - meshing methods - matrix approach, matrix algebra - Gaussian elimination - governing equations for continuum - classical techniques in FEM - weighted residual method - Ritz method, Galerkin method

UNIT - II ONE DIMENSIONAL PROBLEMS 09 Hrs.

Finite element modeling - coordinates, shape functions - potential energy approach - element matrices, vectors - assembly for global equations - boundary conditions - higher order elements - shapes functions - applications to axial loadings of rods - extension to plane trusses - bending of beams - finite element formulation of stiffness matrix, load vectors - assembly to global equations - boundary conditions - solutions and post processing - example problems.

UNIT - III TWO DIMENSIONAL PROBLEMS - SCALAR VARIABLE PROBLEMS 09 Hrs.

Finite element modeling - CST element - element equations, load vectors, boundary conditions - assembly - application to heat transfer - examples.

UNIT - IV TWO DIMENSIONAL PROBLEMS - VECTOR VARIABLE PROBLEMS 09 Hrs.

Vector variable problems **-** elasticity equations **-** plane stress, plane strain, axisymmetric problems **-** formulation **-** element matrices **-** assembly **-** boundary conditions and solutions **-** examples.

UNIT - V ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL PROBLEMS 09 Hrs.

Natural coordinates, iso parametric elements, four node quadrilateral element - shape functions - element stiffness matrix and force vector - numerical integration - stiffness integration - displacement and stress calculations - examples.

Total hours: 45.

Course outcomes:

CO1 : Acquire knowledge about FEA design procedure and types of classical techniques in FEM

CO2 : Analyses stresses, strains and displacements of one dimensional elements

CO3 : Making finite element modeling of constant triangular elements and to determine the stresses, strains and displacements of CST element

CO4 : Recap finite element modeling of two dimensional element and to formulate the stresses, strains and displacements of two dimensional elements

CO5 : Interpret the finite element modeling of isoparametric elements and to assess the stress, strains and displacements of isoparametric elements

Text Books:

1. Chennakesava. R. Alavala., “Finite Element Methods-Basic Concepts and Applications”, PHI Learning (P) Limited, New Delhi, 2013.
2. David V Hutton “Fundamentals of Finite Element Analysis”. McGraw-Hill Int. Ed, 2004.

References:

1. Klaus-Jurgen Bathe, “Finite Element Procedures”, PHI Learning (P) Limited, New Delhi, 2010.
2. Chandrupatla T.R., and Belegundu A.D., “Introduction to Finite Elements in Engineering”, Pearson Education 2002, 3rd Edition.
3. Logan D.L., “A First course in the Finite Element Method”, Third Edition, Thomson Learning, 2002
4. Robert D.Cook., David.S, Malkucs Michael E Plesha, “Concepts and Applications of Finite Element Analysis” 4 Ed. Wiley, 2003.

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SEMESTER - VII

12ME3706 QUALITY, RELIABILITY AND MAINTENANCE ENGINEERING

L	T	P	C
3	0	0	3

Objective(s): *To learn about the quality, reliability, principles and practices of maintenance planning, maintenance policies, repair methods*

UNIT - I PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING 09 Hrs.

Basic principles of maintenance planning - objectives and principles of planned maintenance activity - importance and benefits of sound maintenance systems - reliability, machine availability - MTBF, MTTR and MWT - factors of availability - maintenance organization - maintenance economics.

UNIT - II MAINTENANCE POLICIES - PREVENTIVE MAINTENANCE 09 Hrs.

Maintenance categories - comparative merits of each category - preventive maintenance, maintenance schedules, repairs cycle - principles, methods of lubrication - TPM.

UNIT - III CONDITION MONITORING 09 Hrs.

Condition monitoring - cost comparison with, without CM - on-load testing, off - load testing - methods, instruments for CM - temperature sensitive tapes - pistol thermometers - wear - debris analysis.

UNIT - IV REPAIR METHODS FOR BASIC MACHINE ELEMENTS 09 Hrs.

Repair methods for beds, sideways, spindles, gears, lead screws and bearings - failure analysis - failures and its development - logical fault location methods - sequential fault location.

UNIT - V REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT 09 Hrs.

Repair methods for material handling equipment - equipment records - job order systems - use of computers in maintenance.

Total hours: 45.

Course Outcomes:

CO1 : Illustrate the principles of maintenance planning and activity in industries.
CO2 : Analyze maintenance categories and preventive maintenance.
CO3 : Understand condition monitoring techniques and temperature measuring devices.
CO4 : Analyze failure methods for machine elements and models.
CO5 : Analyze repair methods for material handling equipments and maintenance in computers.

Text Books:

1. Srivastava S.K, “Industrial Maintenance Management”, S. Chand and Co., 2002.
2. Bhattacharya S.N, “Installation, Servicing and Maintenance”, S. Chand and Co., 2006.

References:

1. Mishra R.C and Pathak K, “Maintenance Engineering and Management” Prentice Hall of India Pvt. Ltd. 2007.
2. Higgins L.R, “Maintenance Engineering Hand book”, McGraw Hill, 5th Edition, 2001.
3. Garg M.R,“Industrial Maintenance”, S. Chand & Co., 1986.
4. White E.N, “Maintenance Planning”, I Documentation, Gower Press, 1979.

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SEMESTER - VII

12ME3710 **MECHATRONICS LABORATORY**

L	T	P	C
0	0	3	2

Objective(s): *To make use of electrical, electronics, mechanical and computer systems for the control of mechanical systems.*

LIST OF EXPERIMENTS

1. Design and testing of fluid power circuit to control (i) velocity, (2) direction and (iii) force of single and double acting actuators.
2. Design of pneumatic circuit for a sequential operation of two cylinders using basic trainer kit.
3. Design of circuits with logic sequence using electro pneumatic trainer kit.
4. Design of pneumatic circuit for a sequential operation of two cylinders using PLC trainer kit.
5. Study the characteristics of servo controller interfacing for open loop and closed loop.
6. Study on the characteristics of speed control when PID controller interfaced with AC and DC motor.
7. Writing the opcode for 8051microcontroller to control the stepping action of a stepper motor.
8. Design of a hydraulic circuit for sequential operation of multiple cylinders using simulation software.
9. Design of a pneumatic circuit for sequential operation of multiple cylinders using simulation software.
10. Design of an electro-pneumatic circuit for sequential operation of multiple cylinders using simulation software.
11. Compare the analog process variables such as pressure, flow, and temperature with digital outputs obtained through data logging with computer.
12. Modeling & analysis of basic electrical, hydraulic and pneumatic systems using Lab view.

Total: 45 Hrs.

LIST OF EQUIPMENTS

(For a batch of 30 students)

1. Basic pneumatic trainer kit -1No.
2. Electro pneumatic trainer kit -1No.
3. Electro pneumatic trainer kit with PLC control -1No.
4. Hydraulic Trainer kit -1No.
5. PID Controller Interfacing -1No.
6. Speed Control of AC and DC Drives -1No.
7. Hydraulic / pneumatic systems simulation software -10 users.
8. 8031/51 Microcontroller Trainer Kit & Stepper motor interface -1No.

Course Outcomes:

CO1 : Understand the Design and testing of fluid power circuit to control velocity, direction and force of single and double acting actuators.

CO2 : Create the Design of pneumatic circuit for a continuous & sequential operation of two cylinders using basic, electro pneumatic trainer kit & using software

CO3 : Apply the Design of circuits with logic sequence using electro pneumatic trainer kit.

CO4 : Evaluate the Design of pneumatic circuit for a sequential operation of two cylinders using PLC trainer kit.

CO5 : Recall the characteristics of servo controller interfacing for open loop and closed loop. & speed control when PID controller interfaced with AC and DC motor.

CO6 : Compare the analog process variables such as pressure, flow, and temperature with digital outputs obtained through data logging with computer.

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SEMESTER - VII

12ME3711 **COMPUTER AIDED SIMULATION AND ANALYSIS LABORATORY**

L	T	P	C
0	0	3	2

Objective(s): *To acquire knowledge about simulation and analysis of the stress, vibration and heat transfer on the mechanical components using suitable software packages.*

LIST OF EXPERIMENTS

1. Stress analysis of a bar element.
2. Stress analysis of a plate with a circular hole.
3. Stress analysis of a rectangular L bracket.
4. Stress analysis of beams (cantilever, simply supported, fixed).
5. Modal analysis of beams (cantilever, simply supported, fixed).
6. Harmonic analysis of a 2D component.
7. Thermal stress analysis of a 2D component.
8. Conductive, convective, insulated heat transfer analysis of a 2D component.
9. Simulation of spring mass damper system control.
10. Simulation of air conditioning system with condenser and evaporator temperatures as input to estimate COPs.
11. Flow analysis in duct using CFD / CFX.
12. Simulation of hydraulic / pneumatic cylinder circuit.

LIST OF EQUIPMENTS

(For a batch of 30 students)

1. Computer system - 30 Nos.
2. Printer - 01 No.
3. Software

   ANSYS / SOLIDWORKS / C / MATLAB / NXNASTRAN / MATHCAD / AUTOMATION STUDIO - 30 licenses.

Total hours: 45.

Course Outcomes:

CO1 : Predict the stress, strain and displacement for the simple specimen in ANSYS software.
CO2 : Analysis the structure of different types of Beams with the help of ANSYS software.
CO3:- Understand the Simple Harmonic and Modal analysis in various beams by using ANSYS software.
CO4 : Demonstrate the thermal analysis problems by using ANSYS software.
CO5 : Simulation and analysis of vibration problems by using MAT Lab software.
CO6 : Apply the concept of air conditioning system for various applications using MAT Lab software.

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SEMESTER - VII

12ME3712 REPAIR AND MAINTENANCE LABORATORY

L	T	P	C
0	0	3	2

Objective(s): *To understand the procedure involved in repair and maintenance of mechanical components.*

LIST OF EXPERIMENTS

1. Preparation of preventive maintenance schedule for institution machine shop.
2. Inspection, removal, cleaning, lubrication and refitting of bearings.
3. Maintenance, repair and replacement of couplings and alignment of shafts.
4. Belt drives - mounting of belts and checking of slip.
5. Chain drives - tightening and replacement of chains.
6. Servicing of tailstock.
7. Servicing of lathe chuck.
8. Dismantling and assembling of pumps.
9. Dismantling and assembling of an internal combustion engine.
10. Dismantling and assembling of an air conditioning system.
11. Test for Level of installation of machine tool in longitudinal and transverse direction.
12. Test for flatness of machine tool and true running of the main spindle.

EVALUATION PROCEDURE

1. The students should maintain a laboratory record and submit during end semester examination.
2. During the end semester examination, students should give a presentation based on their learning.
3. The evaluation will be based on the record of work, presentation and defense.
4. The performance of the students should be evaluated jointly by the external and internal examiners.

Total hours: 45.

Course Outcomes:

CO 1 : Identify and select appropriate tools to preparation of preventive maintenance schedule for machine shop

CO 2 : Understand complete methodology of evaluation and maintenance of machine parts such as bearings

CO 3 : Analyze dismantling and assembling of an I.C engines using instruments and special tools.

CO 4 : Identify the various fundamental disciplines of an evaluation and maintenance concepts for coupling assembly.

CO 5 : Understand the functions of machine tool alignment tests

CO 6 : Conduct True running of main spindle with dial indicator to check run out

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SEMESTER - VIII

12HS2821 **TOTAL QUALITY MANAGEMENT**

(Common to AU, CE, CS, EE, IT & ME)

L	T	P	C
3	0	0	3

Objective(s): *To understand the total quality management concept, tools available to achieve TQM and the ISO certification process.*

UNIT - I INTRODUCTION 09 Hrs.

Introduction - need for quality - evolution of quality - definition of quality - dimensions of manufacturing and service quality - basic concepts of TQM - definition of TQM - TQM implementation steps - quality council - importance of leadership and motivation in TQM - contributions of Deming, Juran and Crosby - barriers to TQM.

UNIT - II TQM PRINCIPLES 09 Hrs.

Quality statements - customer perception of quality - customer complaints, customer retention. Employee involvement, empowerment, team and teamwork, recognition and reward - continuous process improvement - Juran trilogy, PDSA cycle, 5s, Kaizen - Supplier partnership - partnering, supplier selection, supplier Rating.

UNIT - III STATISTICAL PROCESS CONTROL 09 Hrs.

The seven traditional tools of quality - measurement of central tendency and dispersion, population and sample, normal curve, control chart for variable and attributes- X,R, P charts, process capability - seven new management tools - six-sigma concepts..

UNIT - IV TQM TOOLS 09 Hrs.

Bench marking - reason, process - Quality circles concepts - FMEA - stages, types - quality function deployment (QFD) - Taguchi quality loss function - TPM - concepts, improvement needs - performance measures - criteria.

UNIT - V QUALITY SYSTEMS 09 Hrs.

Need for ISO 9000 - ISO 9001-2008, ISO 14000 quality system - elements, implementation, and documentation. Quality auditing - concepts, requirements and benefits, non conformance report - case studies of TQM implementation in manufacturing and service sectors.

Total hours: 45.

Course Outcome:

CO1: Explore TQM framework to improve the quality of the products and services
CO2 : Apply TQM principles for continuous process improvement
CO3 : Interpret statistical tools to control and improve the quality of the product and services
CO4 : Implement the tools and techniques to improve the quality concept
CO5 : Understand the quality system in manufacturing and service sector

Text Books:

1. Jayakumar V and Raju R, “Total Quality Management”, Lakshmi publications, Chennai, 2012.
2. Dale H.Besterfiled, et at., “Total Quality Management”, Pearson Education Asia, Third Edition, Indian Reprint, 2006.

References:

1. Janakiraman B and Gopal, R.K, “Total Quality Management - Text and Cases”, Prentice Hall (India) Pvt. Ltd., 2006.
2. Suganthi L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd., 2006.
3. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, 6th Edition, South-Western (Thomson Learning), 2005.
4. Subburaj R, Total Quality Management, Tata McGraw Hill, New Delhi 2005.

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SEMESTER - VIII

12ME3810 **PROJECT WORK**

L	T	P	C
0	0	12	6

Objective(s): *To make sure students to get confidence in solving real time engineering problems.*

1. The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study.

2. Every project work shall have a guide who is the member of the faculty of the institution.

3. Twelve periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

4. The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

5. The progress of the project is evaluated based on a minimum of three reviews.

6. The review committee may be constituted by the head of the department.

7. The students shall be encouraged to apply for funded projects, patents, publish in journals, conferences and symposiums.

8. Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion.

9. The final report shall be in type written form as specified in the guidelines.

10. The project report should be evaluated jointly by external and internal examiners.

Total hours: 180.

Course Outcomes:

CO1 : Able to identify real time problems.

CO2 : Acquire knowledge on the industrial oriented projects.

CO3 : Collect the data from the literature surveys and able to find out the solutions.

CO4 : Select the topic based on the critical problems and hazards identified.

CO5 : Summarize the problems identified and can be compared with the legal requirements.

CO6 : Apply the solutions for the problems identified.

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SEMESTER - VI

12MA4621 **PROBABILITY AND STATISTICS (Elective)**
(Common to CE and ME)

L	T	P	C
3	0	0	3

Objective(s): *To study and understand the concepts of Probability and Statistical methods and its applications in the field of Engineering Sciences.*

UNIT - I ONE DIMENSIONAL RANDOM VARIABLE 09 Hrs.

Random variables - probability function - moments - moment generating functions and their properties - binomial, poisson, exponential and normal distributions (based on problems only).

UNIT - II CORRELATION AND REGRESSION ANALYSIS 09 Hrs.

Karl-Pearson's coefficient of correlation - spearman's rank correlation - concurrent correlation - regression lines - angle between two regression lines.

UNIT - III TESTING OF HYPOTHESIS 09 Hrs.

Sampling distributions - type i and type ii errors - tests based on proportions, t, $\chi 2$ - distributions for independence of attributes and Fdistributions for testing of variance.

UNIT - IV NON - PARAMETRIC TESTS 09 Hrs.

Sign test: one sample and paired tests - rank sum test: Mann-Whitney U test - one sample run test - Kruskal Wallis H test.

UNIT - V DESIGN OF EXPERIMENTS 09 Hrs.

Analysis of variance - one-way and two-way classifications - completely randomized design - randomized block design - Latin square design.

Total hours: 45.

Course Outcomes:

CO1 : Understand the concept of one dimensional random variable and distributions
CO2 : Apply the concepts of correlation and regression analysis
CO3 : Determine the inference of the samples by using various methods in testing of hypothesis
CO4 : Evaluate the samples by non parametric tests and finding the inferences
CO5 : Interpret variances by design of experiments to obtain inferences

Text Books:

1. Gupta S.P, "Statistical Methods", Sultan Chand & Sons, New Delhi, thirty first edition, 2002.
2. Venkataraman M.K, "Numerical methods in Science and Engineering", National publishing Co.,Fifth edition, 2003.

References:

1. Jay L. Devore, "Probability and Statistics for Engineers", CENGAGE Learning, Indian Edition, Singapore, 2008.
2. Montgomery D. C and Runger G. C, "Applied Statistics and Probability for Engineers", Third Edition, John Wiley and Sons, 2007.
3. Walpole, R.E, Myer, R.H, Myer S.L and Ye, K, "Probability and Statistics for Engineers and Scientists", 7th edition, Pearson Education, Delhi, 2002.
4. Gupta S. C and Kapoor V. K, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, New Delhi, 2001.

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SEMESTER - VI

12ME4602 FUNDAMENTALS OF NANO SCIENCE (Elective)

L	T	P	C
3	0	0	3

Objective(s): *To gain the basic knowledge of nano science and technology*

UNIT - I INTRODUCTION 09 Hrs.

Nano science and technology - implications on physics, chemistry, biology and engineering - classifications of nano structured materials - nano particles - quantum dots, wells and wires. Ultra-thin films - multilayered material. Properties - mechanical, electronic, optical, magnetic and motivation for study (qualitative only).

UNIT - II PREPARATION METHODS 09 Hrs.

Bottom-up and top-down approach - mechanical milling, colloidal routes, self assembly, vapour phase deposition, MOCVD, sputtering, evaporation, molecular beam epitaxy, atomic layer epitaxy, MOMBE, Sol-gel technique**.**

UNIT - III PATTERNING AND LITHOGRAPHY 09 Hrs.

Introduction to optical /UV electron beam and X RAY lithography systems and processes, wet etching, dry (plasma/reactive ion) etching, etch resists - dip pen lithography, nano imprint lithography and soft lithography.

UNIT - IV PREPARATION ENVIRONMENT AND HAZARDS 09 Hrs.

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 contamination, safety issues, flammable and toxic hazards and bio-hazards.

UNIT - V CHARACTERISATION TECHNIQUES 09 Hrs.

Introduction to mechanical characterization. Optical microscopy - AFM, SPM, STM, SNOM, ESCA, SIMS, XRD, SEM, TEM.

Total hours: 45.

Course Outcomes:

CO1 : Describe the impact of engineering solutions in the Nano science and technology.
CO2 : Categorize the preparation methods.
CO3 :Explain about the patterning and lithography techniques.
CO4 : Develop the preparation environment and hazards.
CO5 : Improve the characterization techniques.

Text Books:

1. Narlikar A.V and Fu Y.Y, “The Oxford hand book of Nano science and technology”, Oxford University Press, 2010.
2. Elwood D. Carlson, “Encyclopedia of Nano technology”, Nova Science Publishers, 2009.

References:

1. Akhlesh Lakhtakia, “The Hand Book of Nano-technology”, New Delhi, 2007.
2. John Dinardo N, “Nano-scale Characterization of Surfaces And Interfaces”, 2nd Edition, Weinheim Cambridge, Willey-VCH, 2000.
3. Gregory L. Timp, “Nano-technology”, AIP Press, Springer, 1999.
4. Edelstein A.S and Cammaratra R.C, “Nanomaterials - Synthesis, Properties and Applications”, Institute of physics publishing, Bristol and Philadelphia, 1996.
5. Muralidaran V.S. and Subramania A., “Nanoscience & Technology”, Ane books Pvt. Ltd., 2009.

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SEMESTER - VI

12ME4603 VALUE AND RE-ENGINEERING (Elective)

L	T	P	C
3	0	0	3

Objective(s):
- *To understand the evolving modern techniques in design field.*
- *To learn the Re-Engineering techniques and case studies in industry.*

UNIT - I INTRODUCTION TO VALUE ENGINEERING 09 Hrs.

Introduction - life cycle of a product - definition – objectives, methodology of value engineering - comparison with other cost reduction techniques - unnecessary cost. Quantitative definition of values - alternatives to increase value - types of values - estimation of product quality/performance.

UNIT - II PHASES AND APPROACHES IN VALUE ENGINEERING 09 Hrs.

Functions - definition, types, relationship between different functions in design of a product - functional cost - functional worth - test for poor value - aim of value engineering. Systematic approach - phases of value engineering in job plan - general phase, information phase, function phase creation / speculation phase, evaluation phase, investigation phase, recommendation, implementation phase.

UNIT - III DECISIONS AND VALUE STREAM MATRIX 09 Hrs.

Decision / evaluation matrix - quantitative comparison of alternatives, estimation of weight factors and efficiency. FAST diagramming - critical path of function, how, why, when logic, supporting and all time functions, ground rule for FAST diagram.

UNIT - IV CONCEPTS AND TECHNIQUES IN RE-ENGINEERING 09 Hrs.

Basic concept - digitization techniques - model reconstruction - data processing for rapid prototyping - data formats - data interfacing, part orientation, support generation, support structure design, model slicing, contour data organization, direct, adaptive slicing, tool path generation.

UNIT - V CASE STUDIES 09 Hrs.

Applications case studies - automotive, aerospace and electronic industries.

Total hours: 45.

Course outcomes:

CO1: Understand the knowledge on value Engineering.
CO2: Choose the phases and approaches in value Engineering.
CO3: Implement the decisions and value stream matrix.
CO4: Analyze the concepts and techniques in Re-Engineering.
CO5: Evaluate the case studies.

Text Books:

1. Del L.Younker, “Value Engineering analysis and methodology”, 2003
2. Chua C.K, Leong K.F, and Lim C.S, “Rapid prototyping - Principles and applications”, second edition, World Scientific Publishers, 2003.

References:

1. Liou W.Liou and Frank W.Liou, “Rapid Prototyping and Engineering applications - A tool box for prototype development”, CRC Press, 2007.
2. Peter D.Hilton, Hilton/Jacobs and Paul F.Jacobs, “Rapid Tooling - Technologies and Industrial Applications”, CRC press, 2000.
3. Miles L.D, “Techniques of value analysis and value engineering”,1989.
4. Mittal H S, “Value engineering for cost reduction and product improvement”,1986.

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SEMESTER - VI

12ME3703 **DESIGN OF JIGS, FIXTURES AND PRESS TOOLS (Elective)**
(use of standard design data book permitted)

L	T	P	C
3	0	0	3

Objectives : *To learn about the functions and design principles of Jigs, fixtures and press tools.*

UNIT - I LOCATING AND CLAMPING PRINCIPLES 09 Hrs.

Objectives of tool design - function, advantages of jigs, fixtures - basic elements - principles of location - degrees of freedom - degrees of mobility - locating methods, devices - redundant location - principles of clamping - mechanical actuation – pneumatic, hydraulic actuation standard parts - drill bushes, jig buttons - tolerances, materials used.

UNIT - II JIGS 09 Hrs.

Design, development of jigs, fixtures for given component - types of jigs - post, turnover, channel, latch, box, pot, angular post jigs, indexing jigs.

UNIT - III FIXTURES 09 Hrs.

General principles of milling, lathe, boring, broaching and grinding fixtures - assembly, inspection and welding fixtures - modular fixturing systems - quick change fixtures.

UNIT - IV PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES 09 Hrs.

Press working terminologies - operations - types of presses - press accessories - computation of press capacity - strip layout - material utilization - shearing action - clearances - press work materials - center of pressure- design of various elements of dies - die block - punch holder, die set, guide plates - stops - strippers - pilots - selection of standard parts - design, preparation of four standard views of simple blanking, piercing, compound, progressive dies - design of molds for plastic injection.

UNIT - V BENDING FORMING AND DRAWING DIES 09 Hrs.

Difference between bending, forming, drawing - blank development for above operations - types of bending dies - press capacity - spring back - knockouts - direct, indirect - pressure pads - ejectors - variables affecting metal flow in drawing operations - draw die inserts - draw beads - ironing - design, development of bending, forming, drawing reverse re-drawing, combination dies - blank development for axi-symmetric, rectangular and elliptic parts - single, double action dies - forging.

Course Outcomes:

CO1 : Understand tool engineering concepts, purpose and characteristics with their properties
CO2 : Identify various locating ,clamping devices, principles used in jigs and fixtures
CO3 : Discussed purpose and principles of jigs &fixtures
CO4 : Understand press working terminologies & elements of cutting dies
CO5 : Analyze bending, forming, drawing dies on various components

Total hours: 45.

Text Books:

1. Joshi, P.H, “Jigs and Fixtures”, Second Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2004.
2. Donaldson, Lecain and Goold, “Tool Design”, III rd Edition, Tata McGraw Hill, 2000.

References:

1. Hoffman, “Jigs and Fixture Design” - Thomson Delmar Learning, Singapore, 2004.
2. Venkataraman K, “Design of Jigs Fixtures & Press Tools”, Tata McGraw Hill, New Delhi, 2005.
3. ASTME, “Fundamentals of Tool Design”, Prentice Hall of India, 2010.

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SEMESTER - VI

12ME4605 COMPOSITE MATERIALS (Elective)

L	T	P	C
3	0	0	3

Objective(s): *To learn about the different types of composite materials, their properties and applications.*

UNIT - I INTRODUCTION TO COMPOSITES 09 Hrs.

Fundamentals of composites - need for composites - enhancement of properties - classification of composites - matrix - polymer matrix composites (PMC), metal matrix composites (MMC), ceramic matrix composites (CMC) - reinforcement - particle reinforced composites, fibre reinforced composites. Application of various types of composites.

UNIT - II POLYMER MATRIX COMPOSITES 09 Hrs.

Polymer matrix resins - thermosetting resins, thermoplastic resins - reinforcement fibres - rovings - woven fibres - non-woven random mats - various types of fibres. PMC processes - hand lay-up processes - spray up processes - compound moulding - reinforcement reaction - injection moulding - resin transfer moulding - pultrusion - filament winding. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GRP).

UNIT - III METAL MATRIX COMPOSITES 09 Hrs.

Characteristics of MMC, various types of metal matrix composites alloy Vs MMC, advantages of MMC, limitations of MMC, metal matrix, reinforcement – particles, fibres - effect of reinforcement - volume fraction - rule of mixture - processing of MMC - powder metallurgy process - diffusion bonding - stir casting - squeeze casting.

UNIT - IV CERAMIC MATRIX COMPOSITES 09 Hrs.

Engineering ceramic materials - properties - advantages - limitations - monolithic ceramics - need for CMC - various types of ceramic matrix composites - oxide ceramics - non-oxide cermics - aluminium oxide - silicon nitride - reinforcement - particle and fibres - whiskers. Sintering - hot pressing - cold isostatic pressing (CL ping) - hot isostatic pressing (HI ping).

UNIT - V ADVANCES IN COMPOSITES 09 Hrs.

Carbon / carbon composites - advantage of carbon matrix - limitations of carbon matrix, carbon fibre - chemical vapour deposition of carbon on carbon fibre. Composites for aerospace applications.

Total hours: 45.

Course Outcomes:

CO1 : Build the knowledge about theory of Composite Materials.
CO2 : Develop the skills on Polymer matrix composite fibers.
CO3 : Gain the knowledge about metal matrix composite.
CO4 : Build the knowledge on ceramic matrix composite.
CO5 : Gain the knowledge on Advances in composites.

Text Books:

1. Mallick, P.K., “Fiber Reinforced Composites - Materials, Manufacturing and Design”, Third Edition, Marcel Dekker Inc, 2007.
2. Srinivasan K, “Composites Materials-Production, Properties, Testing and Applications”, Published by N.K. Mehra for Narosa Publishing House Pvt. Ltd, 2009.

References:

1. Ronald Gibson, “Principles of Composite Material Mechanics", Tata McGraw Hill, 2007.
2. Agarwal, B.D., and Broutman L.J., “Analysis and Performance of Fiber Composites”, John Wiley and Sons, 2006.
3. Autar K. Kaw, “Mechanics of Composite Materials” CRC Press, 2006
4. Robert M. Jones, “Mechanics of Composite Materials” Taylor and Francis, 1999.

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SEMESTER - VII

12ME4701 THERMAL TURBO MACHINES (Elective)

L	T	P	C
3	0	0	3

Objective(s): *To understand the fundamentals of thermal turbo machines.*

UNIT - I INTRODUCTION TO TURBO MACHINES 09 Hrs.

Turbo machines - fans, blowers, compressors - stages, energy transfer between fluid and rotor - stage velocity triangles - general energy equation - modified to turbo machines - compression, expansion process - velocity triangles - work - T-S and H-S diagram - total-to-total and total-to-static efficiencies.

UNIT - II CENTRIFUGAL FANS AND COMPRESSORS 09 Hrs.

Definition - selection and classifications - types of blading design - velocity triangles - stage parameters - flow analysis in impeller blades - design parameters - volute and diffusers - efficiencies and losses - fan noises - causes and remedial measures. Centrifugal compressors - constructional details - stage velocity triangles - stage work - stage pressure rise - stage efficiency - degree of reaction - slip factor - H-S diagram - performance characteristics.

UNIT - III AXIAL FANS AND COMPRESSORS 09 Hrs.

Definition, classifications - stage parameters - types of fan stages - performance characteristics - cascade of blades - cascade tunnel - blade geometry - cascade variables - energy transfer, loss. Axial flow compressors - definition, classification - constructional details - stage velocity triangles - stage work - stage pressure rise - H-S diagram - stage efficiencies, losses - degree of reaction - radial equilibrium – surging, stalling - performance characteristics.

UNIT - IV AXIAL FLOW TURBINES 09 Hrs.

Construction details - 90° IFR turbine - stage work - stage velocity triangles - stage pressure rise - impulse, reaction stage - effect of degree of reaction - H-S diagram – efficiencies, losses - performance characteristics.

UNIT - V RADIAL FLOW TURBINES AND WIND TURBINES 09 Hrs.

Constructional details - stage velocity triangles - H-S diagram - stage efficiencies, losses - performance characteristics - wind turbines - definition, classifications - constructional details - horizontal axis wind turbine - power developed - axial thrust - efficiency.

Total hours: 45.

Course outcomes:

CO1: Recognize the turbo machines.
CO2 : Describe the centrifugal fans and compressors.
CO3 : Categorize the axial fans and compressors.
CO4 : Construct the axial flow turbines.
CO5 : Perform the radial flow turbines and wind turbines.

Text Books:

1. Yahya, S.M., “Turbines, Compressors and Fans”, Tata McGraw-Hill Publishing Company, 2010.
2. Dixon, S.L., “Fluid Mechanics, Thermodynamics of Turbo-machines”, 2nd Edition, Pergamon Press, 2005.

References:

1. Kadambi, V. and Manohar Prasad, “An Introduction to energy conversion- Turbomachinery”, Vol. III, , New Age International Pvt. Ltd., 2005.
2. Shepherd, D.H., “Principles of Turbomachinery”, The Macmillan Company, 1975.

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SEMESTER - VII

12ME4702 NUCLEAR ENGINEERING (Elective)

L	T	P	C
3	0	0	3

Objective(s): *To gain fundamental knowledge about nuclear physics, nuclear fuels, reactors and safe disposal of nuclear wastes.*

UNIT - I NUCLEAR PHYSICS 09 Hrs.

Nuclear model of an atom - equivalence of mass, energy - binding - radio activity - half life - neutron interactions - cross sections.

UNIT - II NUCLEAR REACTIONS AND REACTION MATERIALS 09 Hrs.

Mechanism of nuclear fission and fusion - radio activity - chain reactions - critical mass and composition - nuclear fuel cycles and its characteristics - uranium production and purification - zirconium, thorium, beryllium.

UNIT - III REPROCESSING 09 Hrs.

Reprocessing - nuclear fuel cycles - spent fuel characteristics - role of solvent extraction in reprocessing - solvent extraction equipment - global status of reprocessing.

UNIT - IV NUCLEAR REACTOR 09 Hrs.

Nuclear reactors - principle - classification - types of fast breeding reactors - design and construction of fast breeding reactors - heat transfer techniques in nuclear reactors - reactor shielding - fusion reactors.

UNIT - V SAFETY AND DISPOSAL 09 Hrs.

Safety and disposal - nuclear plant safety - safety systems - changes and consequences of accident - criteria for safety - nuclear waste - types of waste and its disposal - radiation hazards and its prevention.

Total hours: 45.

Course Outcomes:

CO1 : Remembering the knowledge about nuclear physics
CO2 : Recognize the nuclear reactions and reaction materials.
CO3 : Analyze the reprocessing.
CO4: Categorize the nuclear reactor.
CO5 : Organize the disposal of nuclear waste.

Text Books:

1. John R. Lamarsh and Anthony J. Baratta, “Introduction to Nuclear Engineering”, Pearson Edition, 2001.
2. Stacey W. M., “Nuclear Reactor Physics”, John Wiley & Sons, 2007.

References:

1. Kenneth Shutting J., and Richard E.Faw.,”Fundamentals of Nuclear Science And Engineering”, 2011.
2. Kakani S.L, “Nuclear and Particle Physics” - ANSHAN Publication, 2008.
3. Collier J.G., and Hewitt G.F, “Introduction to Nuclear power”, Hemisphere publishing, New York, 2000.
4. WakilM.M.El., “Power Plant Technology” - McGraw-Hill International, 1984.

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SEMESTER - VII

12ME3604 **REFRIGERATION AND AIR CONDITIONING (Elective)**

(Use of psychrometric chart, steam, refrigeration and air conditioning tables permitted)

L	T	P	C
3	0	0	3

Objective(s): *To learn about the basics of refrigeration and air conditioning which can be applied in the real world problems.*

UNIT - I REFRIGERATION CYCLE 09 Hrs.

Thermodynamic principles of refrigeration. Concept of aircraft refrigeration system - vapour compression refrigeration cycle - use of p-h charts - cascade system - COP comparison. Vapor absorption refrigeration system. Ammonia water and lithium bromide water systems. Steam jet, solar refrigeration systems.

UNIT - II REFRIGERANTS AND SYSTEM COMPONENTS 09 Hrs.

Compressors - reciprocating & rotary (elementary treatment.) - condensers - evaporators - cooling towers. Refrigerants - properties - selection of refrigerants - eco friendly refrigerants - refrigeration plant controls - testing and charging of refrigeration units - balancing of system components. Applications to refrigeration systems - ice plant - food storage plants - milk - chilling plants - refrigerated cargo transports.

UNIT - III PSYCHROMETRY 09 Hrs.

Psychrometric processes - use of psychrometric charts - grand and room sensible heat factors - bypass factor - requirements of comfort air conditioning - comfort charts - factors governing optimum effective temperature, recommended design conditions, ventilation standards.

UNIT - IV AIR CONDITIONING 09 Hrs.

Air conditioning equipments - air cleaning and air filters - humidifiers - dehumidifiers - air washers condenser - cooling tower and spray ponds - elementary treatment of duct design - air distribution system. Thermal insulation of air conditioning systems – applications - car, industry, stores, public buildings.

UNIT - V COOLING LOAD CALCULATIONS 09 Hrs.

Types of load - design of space cooling load - heat transmission through building. Solar radiation infiltration - internal heat sources (sensible and latent) - outside air and fresh air load - estimation of total load - domestic, commercial, industrial systems - central air conditioning systems.

Total hours: 45.

Course Outcomes:

CO1 : Learn about the basic concepts of cryogenic refrigeration system.
CO2 : Understand the various refrigeration cycles and their applications.
CO3 : Acquire the basic knowledge of types of refrigerants and refrigeration system components.
CO4 : Study about the air conditioning equipments and their applications.
CO5 : Estimate the cooling load by using various parameters and using the psychrometric chart.

Text Books:

1. Arora. C.P., "Refrigeration and Air Conditioning", Tata McGraw-Hill New Delhi, 2009.
2. Manohar Prasad, "Refrigeration and Air Conditioning", Wiley Eastern Ltd., 2008.

References:

1. Roy.J Dossat, “Principles of Refrigeration”, Pearson Education 2011.
2. Stocker W.F, and J.W.Jones, “Refrigeration and Air Conditioning", McGraw-Hill, 2003.
3. Sapali S.N., "Refrigeration and Air Conditioning", PHI Learning Private Ltd, 2009.
4. Jordon and Prister, “Refrigeration and Air Conditioning”, Prentice Hall of India PVT Ltd., New Delhi, 1985.

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SEMESTER - VII

12ME4704 **AUTOMOBILE ENGINEERING (Elective)**

L	T	P	C
3	0	0	3

Objective(s): *To understand the construction and working principle of various parts of an automobile*.

UNIT - I VEHICLE STRUCTURE AND ENGINES

Types of automobiles - vehicle construction - chassis - frame and body. Engine - classification, components, functions and materials - cooling and lubrication systems - turbo charger and super charger.

UNIT - II ENGINE AUXILIARY SYSTEMS

Carburetor - basic type and working principle only - electronic fuel injection system - single point and MPFI system - diesel injection - CRDI system - construction, operation and maintenance of lead acid battery - electrical systems - generator, starting motor and drives, lighting and ignition (magneto coil and electronic type), regulators, cut outs.

UNIT - III TRANSMISSION SYSTEMS

Clutch - types, construction, linkages - gear boxes - manual, automatic - simple floor mounted shift mechanism - over drives - transfer box - fluid flywheel - torque converters - propeller shaft - slip joint - differential and rear axle - Hotchkiss drive and torque tube drive.

UNIT - IV STEERING, BRAKES, SUSPENSION SYSTEMS AND SAFETY DEVICES

Steering geometry - power steering - types of steering gear box - types of front axle - braking systems - types and construction - diagonal braking system. Suspension systems - front, rear, conventional, air suspension - wheels - tyres - wheel alignment parameters - casher, camber, toe, king pin alignment. Anti lock braking system - airbags - stabilizers.

UNIT - V ALTERNATE FUELS AND POLLUTION CONTROL METHODS

Natural gas, LPG, bio-diesel, alcohol and hydrogen in automobiles - concepts of electric and hybrid vehicles - fuel cells - engine emission standards - pollution control methods - emission control by 3-way catalytic controller - electronic engine management system.

Course Outcomes:

CO1 : Develop chassis and identify suitable engine for different applications.
CO2 : Understand the functions of Engine Auxiliary System.
CO3 : Select a suitable conventional and automatic transmission system.
CO4 : Formulate steering, braking and suspension systems.
CO5 : Identify the usage of Electrical vehicles / Hybrid vehicles & various pollution control methods.

Text Books:

Kirpal Singh “Automobile Engineering Vol. 1 & 2”, Standard Publishers, New Delhi, 2011.
Sethi H.M, “Automobile Technology”, Tata McGraw-Hill-2003.

References:

Crouse and Anglin, “Automotive Mechanism”, 9th Edition. Tata McGraw-Hill, 2003.
Jain,K.K.,and Asthana .R.B, “Automobile Engineering” Tata McGraw Hill Publishers,New Delhi, 2002.
Bob Henderson and John Harold Haynes, “Haynes Tech book OBD – II Manual, Haynes Publication, 2006.
Ganesan V., “Internal Combustion Engines”, Third Edition, Tata Mcgraw-Hill , 2007.

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SEMESTER - VII

12ME4705 RENEWABLE SOURCES OF ENERGY (Elective)

L	T	P	C
3	0	0	3

Objective(s): *To educate the significance of renewable energy sources, energy consumption, energy needs and also environmental aspects.*

UNIT - I SOLAR ENERGY 09 Hrs.

Solar radiation and its measurements, solar energy conversion, solar energy collectors - flat plate collector, concentrating collector, advantages and disadvantages, storage systems, applications, solar thermal power plants.

UNIT - II WIND ENERGY 09 Hrs.

Introduction, classifications, energy conversion principles, advantages and disadvantages. Wind energy generators, forces acting on the blades, storage systems, applications, safety systems.

UNIT - III BIO ENERGY 09 Hrs.

Bio mass - conversion techniques, thermal gasification, photosynthesis. bio gas - types of plants, materials, site selection, design consideration, properties, utilization, pyrolysis, thermo chemical process, liquid fuels.

UNIT - IV GEO THERMAL AND TIDEL ENERGY 09 Hrs.

Geo thermal energy - introduction, hydrothermal resources and geo pressured resources, hot dry rock resources, magma resources and prime movers, materials selection, advantages and disadvantages. tidel energy - introduction, ocean thermal electric conversion (OTEC), energy from tides, mini and micro hydel plants.

UNIT - V ADDITIONAL ALTERNATE ENERGY SOURCES 09 Hrs.

Magneto hydro dynamic (MHD) power generation - principles, design and developments, materials. Thermo nuclear fusion energy - nuclear fusions, reactions, requirements, types, advantages and disadvantages, fusion hybrids.

Total hours: 45.

Course Outcomes:

CO1 : Understand the solar energy.
CO2 : Identify the wind energy
CO3 : Build the knowledge on Bio energy.
CO4 : Categorize the Geo thermal and tidal energy.
CO5 : Assess the alternate energy sources.

Text Books:

1. Chetan Singh Solanki, “Renewable Energy Technologies”, PHI Learning Private Limited., New Delhi, 2011.
2. Rai G.D., “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 1999.

References:

1. Twidell, J.W. & Weir, A., “Renewable Energy Sources”, EFN Spon Ltd., UK, 1986
2. Khan B.H., “Non Conventional Energy Resources”, Tata McGraw Hill Publishing Company Ltd., New Delhi, Second Edition, 2006.
3. Sawhney G.S., “Non Conventional Energy Resources”, PHI Learning Private Limited., New Delhi, 2012.
4. Chauhan D.S., and Srivastava S.K., “Non Conventional Energy Resources”, New Age International (P) Ltd. New Delhi, 2009

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SEMESTER - VII

12ME4706 **OPTIMIZATION IN DESIGN (Elective)**

L	T	P	C
3	0	0	3

Objective(s): *To learn the optimization techniques and apply for the design of loaded members.*

UNIT - I UNCONSTRAINED OPTIMIZATION TECHNIQUES 09 Hrs.

Introduction to optimum design - general principles of optimization - problem formulation & their classifications - single variable and multivariable optimization, techniques of unconstrained minimization - golden section, random, pattern and gradient search methods - interpolation methods.

UNIT - II CONSTRAINED OPTIMIZATION TECHNIQUES 09 Hrs.

Optimization with equality and inequality constraints - direct methods - indirect methods using penalty functions, Lagrange multipliers - sensitivity analysis - KKT condition - geometric programming.

UNIT - III DYNAMIC PROGRAMMING 09 Hrs.

Introduction - multi stage optimization - dynamic programming methods - stochastic programming- multi objective optimization.

UNIT - IV UNCONVENTIONAL OPTIMIZATION TECHNIQUES 09 Hrs.

Genetic algorithms, Simulated Annealing and Ant Colony techniques; Neural network & Fuzzy logic principles in optimization.

UNIT - V APPLICATIONS 09 Hrs.

Structural applications - design applications - design of simple truss members - design of simple axial, transverse loaded members for minimum cost and weight - design of shafts and torsionally loaded members - design of springs.

Total hours: 45.

Course Outcomes:

CO1 : Understand the unconstrained optimization techniques.
CO2: Remember the constrained optimization techniques.
CO3 : Apply the dynamic programming.
CO4 : Formulate the unconventional optimization techniques.
CO5 : Assess the design applications.

Text Books:

1. Rao, Singaresu, S., “Engineering Optimization - Theory & Practice”, New Age International (P) Limited,3rd Edition, New Delhi, 2007.
2. Ravindran A., Ragsdell K.M. and Reklaitis G.V., “Engineering Optimization, Methods and applications” John Wiley Puplications, 2nd Edition, 2006

References:

1. Johnson Ray, C., “Optimum design of mechanical elements”, Wiley, John & Sons, Re printed 2003.
2. Goldberg, D.E., “Genetic algorithms in search, optimization and machine”, Barnen, Addison- Wesley, New York, re printed 2003.
3. Kalyanamoy Deb, “Optimization for Engineering design algorithms and Examples”, Prentice Hall of India Pvt. Ltd. 2006.
4. Purna Chandra Biswal, “Optimization in Engineering”, SCITECH publications, 2009.

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SEMESTER - VII

12ME4707 **INDUSTRIAL TRIBOLOGY (Elective)**

L	T	P	C
3	0	0	3

Objective(s): *To attain the basic knowledge of surfaces, wear and lubrication theory.*

UNIT - I SURFACES AND FRICTION 09 Hrs.

Topography of engineering surfaces - contact between surfaces - sources of sliding friction - adhesion - ploughing - energy dissipation mechanisms. Friction characteristics of metals, ceramic materials and polymers - friction of lamellar solids - rolling friction - sources of rolling friction - measurement of friction.

UNIT - II WEAR 09 Hrs.

Types of wear - mechanisms of sliding wear - abrasive wear - materials for adhesive and abrasive wear situations - corrosive wear - surface fatigue wear situations - brittle fracture - wear of ceramics and polymers - wear measurements.

UNIT - III LUBRICANTS AND LUBRICATION TYPES 09 Hrs.

Types, properties of lubricants - testing methods - concepts of hydrodynamic, hydrostatic, elasto-hydrodynamic, boundary lubrication. Thin film, thick film lubrication - methods of lubrication - semi solid, solid lubricants.

UNIT - IV FILM LUBRICATION THEORY 09 Hrs.

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 co-efficient of friction - Sommerfeld diagram.

UNIT- V SURFACE ENGINEERING AND MATERIALS FOR BEARINGS 09 Hrs.

Surface modifications - transformation hardening, surface fusion - thermo chemical processes - surface coatings – plating, anodizing - fusion processes - vapour phase processes - materials for rolling element bearings - materials for fluid film bearings - materials for marginally lubricated and dry bearings.

Total hours: 45.

Course Outcomes:

CO1 : Build the knowledge about friction.
CO2 : Understanding the different types of wear.
CO3 : Gain the knowledge about lubricants and types.
CO4 : Recognize the knowledge on film lubrication theory
CO5 : Design the materials for bearing.

Text Books:

1. Harnoy A., “Bearing Design in Machinery” Marcel Dekker Inc, New York, 2003
2. Basu S.K. et. Al., “Fundamentals of Tribology” PHI Learning Private Limited, 2009.

References:

1. Khonsari M.M and Booser E.R., “Applied Tribology”,John Willey &Sons,New York, 2001
2. Neale M.J., “Tribology Handbook", Newnes. Butter worth, Heinemann, U.K., 1995.
3. Cameron A., “Basic Lubrication theory", Longman, U.K.., 1981.
4. Bowden E.P. and Tabor.D., "Friction and Lubrication", Heinemann Educational Books Ltd.,1974.

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SEMESTER - VII

12ME4708 VIBRATION AND NOISE CONTROL (Elective)

L	T	P	C
3	0	0	3

Objective(s): *learn about the concept of vibration isolation and noise control.*

UNIT - I BASICS OF VIBRATION 09 Hrs.

Introduction, classification - free and forced vibration - undamped and damped vibration - linear and non linear vibration - response of damped and undamped systems under harmonic force - analysis of single degree and two degree of freedom systems - torsional vibration - determination of natural frequencies.

UNIT - II VIBRATION OF CONTINUOUS SYSTEMS 09 Hrs.

Methods - boundary value problem - Eigen value problem - axial vibration of rods - transverse vibration of beams - response of system by modal analysis - general elastic waves - approximate methods to analyze system - different methods like Rayleigh's energy method, Rayleigh-Ritz method, Dunkerleys method.

UNIT - III CONTROL TECHNIQUES 09 Hrs.

Vibration isolation - tuned absorbers - untuned viscous dampers - damping treatments - application dynamic forces generated by IC engines - engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

UNIT - IV BASICS OF NOISE 09 Hrs.

Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise level, legislation, measurement and analysis of noise, measurement environment and equipment, frequency analysis, tracking analysis, sound quality analysis.

UNIT - V INDUSTRIAL NOISE AND CONTROL 09 Hrs.

Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise and assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise. Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers

Total hours: 45.

Course outcomes:

CO1 : Build the basic knowledge of vibration.
CO2: Understand the vibration of continuous system.
CO3: Categorize the control techniques.
CO4 : Identify the basics of noise.
CO5 : Analyze the industrial noise and control.

Text Books:

1. Ambekar A.G. “Mechanical Vibrations and Noise Engineering” Prentice Hall of India Pvt. Ltd,2010.
2. Singiresu S.Rao - “Mechanical Vibrations” - Pearson Education, - 2010.

References:

1. Rao V. Dukkipati and Srinivas J., “Mechanical Vibrations” - Prentice Hall of India Pvt. Ltd, 2008.
2. Kewal Pujara., “Vibrations and Noise for Engineers, Dhanpat Rai & Sons, 1992.
3. Rao, J.S., and Gupta, K., “Ind. Course on Theory and Practice Mechanical Vibration”, New Age International (P) Ltd., 1984.
4. Thomson W. T., “Theory of Vibrations with applications” - CBS Publishers, 1980.

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SEMESTER - VII

12ME4709 PRESSURE VESSEL AND PIPING DESIGN (Elective)

L	T	P	C
3	0	0	3

Objective(s): *To learn about the principles of pressure vessels and piping design.*

UNIT - I INTRODUCTION 09 Hrs.

Development of pressure vessel construction codes - pressure vessel design overview - methods for determining stresses - terminology - applications - standard safety norms - selection of materials (ISI norms).

UNIT - II STRESSES IN PRESSURE VESSELS 09 Hrs.

Stresses in a circular ring, cylinder - membrane stress analysis of vessel shell - components - cylindrical shells, spherical shells, torispherical heads, conical heads - thermal stresses - discontinuity of stresses in pressure vessels.

UNIT - III DESIGN OF VESSELS 09 Hrs.

Design of tall cylindrical self supporting process columns - supports for short vertical vessels - stress concentration at a variable thickness transition section in a cylindrical vessel, circular hole, elliptical openings. Theory of reinforcement - pressure vessel design.

UNIT - IV BUCKLING AND FRACTURE ANALYSIS IN VESSELS 09 Hrs.

Buckling phenomenon - elastic Buckling of circular ring and cylinders under external pressure - collapse of thick walled cylinders or tubes under external pressure - effect of supports - elastic buckling of cylinders - buckling under combined external pressure and axial loading.

UNIT - V PIPING 09 Hrs.

Introduction - design procedure - flow diagram - piping layout and piping stress analysis.

Total hours: 45.

Course outcomes:

CO1 : Understand the knowledge about pressure vessel.
CO2 : Categorize the stresses acting in pressure vessels.
CO3: Creating the design of vessels.
CO4 : Analysis the Buckling and fracture in vessels.
CO5 : Implement the design procedure for piping layout.

Text Books:

1. John F. Harvey, “Pressure Vessel Design”, CBS publishers, 2007.
2. Henry H. Bedner, “Pressure Vessels”, Design Hand Book, CBS publishers, 2007.

References:

1. Broek D., “Elementary Engineering Fracture Mechanics”, Sijthoff and Noordhoff International publishers, 1986.
2. Cook R. D., Malkus D. S., Plesha M. E. and Witt R. J., “Concepts & Applications of Finite Element Analysis”, John Wiley & Sons Scheme, 2007.
3. William. J., and Bees, “Approximate Methods in the Design and Analysis of Pressure Vessels and Piping”, Presented at ASME Pressure Vessels and Piping Conference, 1997.

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SEMESTER - VII

12ME4710 PRODUCT DESIGN AND DEVELOPMEN (Elective)

L	T	P	C
3	0	0	3

Objective(s): *To provide knowledge on design of product and their specifications.*

UNIT- I Introduction 0 9 Hrs.

Introduction - characteristics of successful product development - who designs and develops product - duration and cost of product development - challenges of product development. Development process and organization - a generic development process - concept development - product development process flow - product development organizations. Product planning - product planning process - identifying customer needs - product specifications.

UNIT - II Concept Development 09 Hrs.

Concept generation - activity of concept generation. Concept selection - method for choosing a concept. Concept screening - concept scoring - concept testing - steps of concept testing.

UNIT - III Product Architecture and Industrial Design 09 Hrs.

Product architecture - introduction of product architecture - implications of product architecture - establishing product architecture - platform planning - related system level design issues. Industrial design - introduction - need - management of Industrial design process - quality of industrial design.

UNIT - IV Design for Manufacturing , Prototyping and Robust Design 09 Hrs.

Design for manufacturing - definition - estimation of manufacturing costs - methods of reducing costs and other supporting production cost. Prototyping - principles of prototyping - prototyping technologies - planning for prototyping. Robust design – introduction - steps for robust design - concurrent engineering.

UNIT - V Patents and Intellectual Property, Product Development Economics 09 Hrs.

Patents and intellectual property - what is intellectual property - steps for patents and intellectual property. Product development economics - introduction - elements of economic analysis.

Total hours: 45.

Course outcomes:

CO1: Remember the theory of design .
CO2 : Describe the product specifications.
CO3 : Categorize the product architecture.
CO4 : Synthesis the industrial design.
CO5 : Analyse the principles of prototyping and economic.

Text Books:

1. Karl, T.Ulrich, Steven D.Eppinger, and Anita Goyal, “Product Design and Development”, McGraw Hill, International Editions, 2009.
2. George Dietor, “A Material and Processing Approach”, McGraw Hill, 2000.

References:

1. Kevin Otto, Kristin Wood, “Product Design”, Pearson Education, 2008.
2. Imad Moustapha, “Concurrent Engineering in Product Design and Development”, New Age International, 2003.
3. A. K. Chitale, R. C. Gupta, “Product Design and Manufacturing”, PHI Private Ltd., 2007.
4. Pahl and Pitz, “Engineering Design Process”, Springer, 2007.

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SEMESTER - VIII

12ME4801 PROCESS PLANNING AND COST ESTIMATION (Elective)

L	T	P	C
3	0	0	3

Objective(s):

- *To learn about the process planning concepts.*
- *To evaluate cost estimation for various products after process planning.*

UNIT - I WORK STUDY AND ERGONOMICS 09 Hrs.

Method study - definition - objectives-motion economy - principles - tools and techniques - applications - work measurements - purpose - use - procedure - tools and techniques - standard time - ergonomics - principles - applications.

UNIT - II PROCESS PLANNING 09 Hrs.

Definition - objective - scope - approaches to process planning- process planning activities - finished part requirements - operating sequences - machine selection - material selection parameters - set of documents for process planning - developing manufacturing logic and knowledge - production time calculation - selection of cost optimal processes.

UNIT - III COST ESTIMATION AND COST ACCOUNTING 09 Hrs.

Objective of cost estimation - costing - cost accounting - difference between cost estimation and cost accounting - classification of cost -difference between financial accounting and cost accounting-methods of costing- Elements of cost.

UNIT - IV TYPES OF ESTIMATION, STANDARD DATA AND ALLOWANCES 09 Hrs.

Types of estimates - materials available to develop estimate-methods of estimates - realistic estimates - data requirements and sources - collection of cost - estimating procedure -allowances in estimation.

UNIT - V PRODUCTION COST ESTIMATION 09 Hrs.

Estimation of material cost, labour cost and overheads, allocation of overheads - estimation for different types of jobs - estimation of machining time.

Total hours: 45.

Course outcomes:

CO1 : Understanding the work study and ergonomics.
CO2 : Evaluate the process planning
CO3 : Applying the cost estimation and cost accounting.
CO4 : Assess the types of estimation, standard data and allowances.
CO5 : Choose the production cost estimation.

Text Books:

1. Narang G.B.S and Kumar V., “Production and Costing”, Khanna Publishers, 2005.
2. Sinha.B.P., "Mechanical Estimating and Costing", Tata McGraw-Hill, Publishing Co., 1995.

References:

1. Russell.R.S and Tailor, B.W, "Operations Management", PHI, 4th Edition, 2003.
2. Chitale.A.V. and Gupta.R.C., "Product Design and Manufacturing", PHI, 2nd Edition, 2002.
3. Phillip.F Ostwalal and Jairo Munez, "Manufacturing Processes and systems", John Wiley, 9th Edition, 1998.

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SEMESTER - VIII

12ME4802 UNCONVENTIONAL MACHINING PROCESSES (Elective)

L	T	P	C
3	0	0	3

Objective(s):
- *To learn about the functions and principles of unconventional machining processes.*
- *To gain proficiency of views in machining processes.*

UNIT - I INTRODUCTION 08 Hrs.

Need for unconventional machining methods - classification of unconventional machining processes - considerations in process selection - materials, economic considerations - applications and limitations - recent developments.

UNIT - II MECHANICAL METAL REMOVAL PROCESSES 09 Hrs.

Abrasive jet machining, water jet machining and abrasive water jet machining - basic principles, equipments used, process variables, mechanics of metal removal, MRR, application and limitations. ultrasonic machining - working principles - equipments used - process parameters - MRR - application and limitations.

UNIT - III ELECTRO - CHEMICAL METAL REMOVAL PROCESSES 09 Hrs.

Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and de burring process, metal removal rate in ECM, tool design, surface finish, accuracy economic aspects of ECM - simple problems for estimation of metal removal rate. Fundamentals of chemical, machining, advantages, applications. Maskants – etchants.

UNIT - IV THERMO- ELECTRIC METAL REMOVAL PROCESSES 09 Hrs.

General principle and applications of electric discharge machining, electric discharge grinding and electric discharge wire cutting processes - power circuits for EDM, mechanics of metal removal, process parameters, selection of tool electrode and dielectric fluids, surface finish, machining accuracy and other characteristics of spark eroded surface. . magnetic abrasive finishing, abrasive flow finishing.

UNIT - V THERMAL METAL REMOVAL PROCESSES 10 Hrs.

Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes - general principle and application of laser beam machining - thermal features, cutting speed and accuracy of cut. Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries

Total hours: 45.

Course outcomes:

CO1 : Gain the knowledge on unconventional machining process
CO2 : Acquire the various mechanical machining processes
CO3 : Build the electro chemical metal removal processes
CO4 : Illustrate the thermal electric metal removal processes
CO5 : Understand the thermal metal removal processes

Text Books:

1. Vijay Kumar Jain,"Advanced Machining Processes" Allied Publishers, 2009 ISBN 8177642944, 9788177642940.
2. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill, New Delhi (1980).

References:

1. Benedict. G.F. "Nontraditional Manufacturing Processes" Marcel Dekker Inc., New York (1987)
2. Mc Geough, "Advanced Methods of Machining" Chapman and Hall, London (1998).
3. Paul De Garmo., Black J T and Ronold.A Kohser., "Material and Processes in Manufacturing" Prentice hall of India pvt., New Delhi (8th edition), 2001.
4 Assan Abdel-Gawad El-Hofy, "Fundamentals of Machining Process-Conventional and Non-conventional process", CRC Press, 2006.

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SEMESTER - VIII

12ME4803 FLEXIBLE MANUFACTURING SYSTEMS (Elective)

L	T	P	C
3	0	0	3

Objective(s): *To learn about basic concepts, components, automated material handling systems and control using computers.*

UNIT - I INTRODUCTION 09 Hrs.

Definition, need, types and configuration of FMS - types of flexibilities and performance measures. Economic justification of FMS - development and implementation of FMS- planning phases, integration, system configuration, FMS layouts, simulation.

UNIT - II AUTOMATED MATERIAL HANDLING AND STORAGE 09 Hrs.

Functions - types - analysis of material handling systems, primary and secondary material handling systems-conveyors, automated guided vehicles - working principle, types, and traffic control of AGVS. Role of robots in material handling. Automated storage systems - storage system performance - AS/RS - carousel storage system, WIP storage systems, interfacing handling and storage with manufacturing.

UNIT - III COMPUTER CONTROL OF FMS 09 Hrs.

Planning, scheduling and computer control of FMS, Hierarchy of computer control, supervisory computer. Features of DNC systems - communication between DNC computer and machine control unit.

UNIT - IV COMPUTER SOFTWARE, SIMULATION AND DATA BASE OF FMS 09 Hrs.

System issues, types of software - specification and selection - trends application of simulation and its software, manufacturing data systems planning - FMS data base. Modeling of FMS- analytical, heuristics, queuing, simulation and petrinets modeling techniques.

UNIT - V SCHEDULING OF FMS 09 Hrs.

Scheduling of operations on a single machine - two machine flow shop scheduling, two machine job shop scheduling - three machine flow shop scheduling - scheduling 'm' operations on 'n' machines, knowledge based scheduling, scheduling rules, tool management of FMS, material handling system schedule.

Total hours : 45.

Course outcomes:

CO1 : Gain the knowledge about basic concepts of FMS.
CO2 : Build the knowledge about Automated Material handling and storage.
CO3 : Develop the knowledge about Computer control of FMS.
CO4 : Apply the knowledge on computer software and simulation and database.
CO5 : Evaluate the scheduling of FMS.

Text Books:

1. Groover M. P., 'Automation production systems and computer integrated manufacturing', Prentice hall of India pvt.Ltd, 2007.
2. Jha, N.K. "Handbook of Flexible Manufacturing Systems ", Academic Press Inc., 2007.

References:

1. Radhakrishnan P. and Subramanyan S., "CAD/CAM/CIM", Wiley Eastern Ltd.,New Age International Ltd., 2008.
2. Raouf, A. and Ben-Daya, M., Editors, "Flexible manufacturing systems recent development", Elsevier Science, 1995.
3. Buffa .E.S. and Sarin, "Modern Production and Operations Management", Wiley Eastern, 1987.

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SEMESTER - VIII

12ME4804 INDUSTRIAL ROBOTICS (Elective)

L	T	P	C
3	0	0	3

Objective(s): *To learn about the principle of robotics and application in industry.*

UNIT - I FUNDAMENTALS OF ROBOTICS 09 Hrs.

Robot - definition - robot anatomy - co-ordinate systems, work envelope, types and classification - specifications - pitch, yaw, roll, joint notations, speed of motion, pay load - robot parts and their functions - need for robots - different applications.

UNIT - II ROBOT DRIVE SYSTEMS AND END EFFECTORS 09 Hrs.

Pneumatic drives - hydraulic drives - mechanical drives - electrical drives - D.C. servo motors, stepper motor, A.C. servo motors - salient features, applications and comparison of all these drives. End effectors - grippers - mechanical grippers, pneumatic and hydraulic grippers, magnetic grippers, vacuum grippers - two fingered and three fingered grippers - internal grippers and external grippers - selection and design considerations.

UNIT - III SENSORS AND MACHINE VISION 09 Hrs.

Requirements of a sensor, principles and applications of the following types of sensors - position sensors (Piezo electric sensor, LVDT, resolvers, optical encoders, pneumatic position sensors), range sensors (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, segmentation, feature extraction, object recognition, other algorithms. Applications - inspection, identification, visual serving and navigation.

UNIT - IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 09 Hrs.

Forward kinematics, inverse kinematics and differences - forward kinematics and reverse kinematics of manipulators with two, three degrees of freedom (in 2 dimensional), four degrees of freedom (in 3 dimensional) - DH matrices - deviations and problems. Teach pendant programming, lead through programming, robot programming languages - VAL programming - motion commands, sensor commands, end effecter commands and simple programs.

UNIT - V IMPLEMENTATION AND ROBOT ECONOMICS 09 Hrs.

RGV, AGV - implementation of robots in industries - various steps - safety considerations for robot operations - economic analysis of robots - pay back method, EUAC method, rate of return method.

Total hours: 45.

Course Outcomes:

CO1: Understand the fundamentals of robotics.
CO2 : Apply the concepts of Robot drive systems and end effectors.
CO3 : Knowledge the sensors and machine vision.
CO4 : Construct the robot kinematics and robot programming.
CO5 : Apply the implementation and robot kinematics.

Text Books:

1. Groover M.P., “Industrial Robotics - Technology, Programming and Applications”, McGraw-Hill, 2001.
2. Yoram Koren, “Robotics for Engineers”, McGraw-Hill Book Co., 1992.

References:

1. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”,McGraw-Hill Book Co., 1987..
2. Janakiraman.P.A., “Robotics and Image Processing”, Tata McGraw-Hill, 1995.

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SEMESTER - VIII

12ME4805 WELDING TECHNOLOGY (Elective)

L	T	P	C
3	0	0	3

Objectives :

- *To learn basic welding principles.*
- *To build on the fundamental skills in Welding.*

UNIT - I INTRODUCTION [09]

Gas welding: gases - setup of equipment - flame characteristics - different kinds of flame and their areas of application - weld quality - applications - variants of oxy-gas welding.
Manual metal arc welding: process - power sources - function of flux covering - different type of electrodes and their application - electrode designations - defects in welding.

UNIT - II SUBMERGED ARC WELDING [09]

The process - power sources - advantages – limitations - process variables and their effects - SAW consumables significance of flux-metal combination - modern developments - applications - defects.

UNIT - III GAS TUNGSTEN ARC WELDING [09]

Electrode polarity - shielding gas - use of D.C. suppressors - arc starting and stopping - choice of filler metal composition - use of pulsed arc and GTA spot welding - other recent developments - applications.

UNIT - IV GAS METAL ARC WELDING [09]

Considerations of electrodes polarity - shield gas and filler composition. Nature of conditions of spray transfer - difficulties for thin sheet. Dip transfer and CO2 welding. Flux cored and pulsed MIG welding - other recent developments - applications.

UNIT - V ADVANCED WELDING PROCESSES [09]

Solid state welding processes - high energy beam welding - electro slag welding - plasma arc welding principles of operation - advantages - limitations - applications.

Total = 45 Periods

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

CO1 : Remember the Gas welding equipment.
CO2 : Understand about the submerge arc welding
CO3 : Construct the gas tungsten arc welding
CO4 : Categorize the gas metal arc welding
CO5 : Implement the advanced welding processes.

Text Books:

1. Parmer R.S., “Welding Processes and Technology”, Khanna Publishers, 2010.
2. AWS - Welding Hand Book, 8th Edition, Volume-1 “Welding Process”, 1998.

Reference Books:

1. Schwartz M.M. “Metals Joining Manual”, McGraw Hill Books. 1979.
2. Tylecote R.F., “The Solid Phase Welding of Metals”, Edward Arnold Publishers Ltd. London, 1968.
3. Nadkarni S.V., “Modern Arc Welding Technology”, Oxford IBH Publishers. 1996.
4. Christopher Davis, “Laser Welding - Practical Guide”, Jaico Publishing House, 1994.

SEMESTER - VIII

12ME4806 HUMAN RESOURCES MANAGEMENT (Elective)

L	T	P	C
3	0	0	3

Objective(s):
- *To learn about the management towards in all aspects like man power, material, money, time etc.,*
- *To learn about various aspects of training and development.*

UNIT - I INTRODUCTION 09 Hrs.

Introduction, importance and evolution, functions of HRM, difference between personnel management and HRM, role of HR manager - duties and responsibilities of HR manager, structure of HR department.

UNIT - II MAN POWER PLANNING 09 Hrs.

Definition of manpower planning - estimating manpower requirement - main sources - selection tools - recruitment and selection process.

UNIT - III TRAINING AND DEVELOPMENT 09 Hrs.

Definition of training and development, training need analysis, training process and methodology, methods of training, evolution of training programmes, challenges in training.

UNIT - IV PERFORMANCE MANAGEMENT SYSTEM 09 Hrs.

Introduction to competencies, PMS and performance appraisal - objectives of performance appraisal, methods of performance appraisal, performance review.

UNIT - V COMPENSATION MANAGEMENT, GLOBALIZATION AND HRM 09 Hrs.

Meaning of compensation management, components of remuneration, compensation policy, internal mobility- promotion, demotion, transfer. Challenges of HR manager in 21st century, managing HR for competitive advantage in a multicultural workforce.

Total hours: 45.

Course Outcome :

CO1 : Ability to differentiate HRM and personal management
CO2 : Know about the recruitment and selection processes
CO3 : Acquire basic knowledge about training
CO4 : Recall the performance management system
CO5 : Understand the concept behind the globalization

Text Books:

1. Ashwathhapa, “Human Resource Management”, Tata McGraw Hill, 2010.
2. Dwiwedi R.S., “Managing Human Resource”, Vikas Publishing House Pvt. (L), 2010.

References:

1 Garry Dessler, “Human Resource Management”, Pearson Education Inc.,2011.
2 Rao TV, “Human Resource Management”, Oxford &IBH- 2006.
3 Arun monappa, “Managing Human Resource”, Macmillan India Limited, 2001.
4 Mirza and Saiyadin, “Human Resource Management”, Tata McGraw Hill, 2000.

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SEMESTER - VII

12ME4704 INTERNAL COMBUSTION ENGINES (Elective)

L	T	P	C
3	0	0	3

Objective(s): *To attain the basic knowledge of Internal combustion engines and various methods to control the pollution.*

UNIT - I SPARK IGNITION ENGINES 09 Hrs.

Introduction - mixture requirements - carburetors - fuel injection systems - single point and multi point injection - stages of combustion - normal, abnormal combustion - factors affecting knock - measurement of knock - anti knock agent - types of combustion chambers.

UNIT - II COMPRESSION IGNITION ENGINES 09 Hrs.

Introduction - states of combustion - direct, indirect injection systems - combustion chambers - fuel spray behaviors - spray structure, spray penetration, evaporation - air motion.

UNIT - III ALTERNATIVE FUELS 09 Hrs.

Methanol, ethanol, hydrogen, natural gas, biogas, bio diesel, liquefied petroleum gas - properties, suitability, engine modifications, merits and demerits as fuels.

UNIT - IV EMERGING ENGINE TECHNOLOGIES 09 Hrs.

Lean burn engines - stratified charge engines - gasoline direct injection engine - homogeneous charge compression ignition - plasma ignition - zero emission vehicle, variable compression ratio engines, turbocharged engines.

UNIT - V POLLUTANT FORMATION AND CONTROL 09 Hrs.

Pollutant - sources and types - formation of NOx - hydrocarbon emission mechanism - carbon monoxide formation - particulate emissions - effect of pollutant, emission standards - methods of controlling emissions - catalytic converters, particulate traps.

Total hours: 45.

Course Outcomes:

CO1 : Determine performance and combustion characteristics of SI engines.
CO2 : Understand performance and combustion characteristics of CI engines.
CO3 : Identify the usage of alternate fuels and power plants for automobiles.
CO4 : Demonstrate the ability to enhance the efficiency and performance of IC engines.
CO5 : Determine the emissions from SI and CI engines and its controlling techniques.

Text Books:

1. Ganesan V., “Internal combustion Engines”, 3rd edn., Tata McGraw Hill Pub. Co. Ltd., 2007.
2. Gupta H. N., “Internal Combustion Engines”, PHI Learning Private Limited, 2009.

References:

1. Willard W. Pulkrabek. “Engineering fundamentals of the internal combustion engine”, PHI Learning Private Limited, 2008.
2. John B.Heywood, “Internal combustion engines fundamentals”, McGraw Hill, 1988.
3. Mathur R.B and Sharmal R.P., “Internal combustion engines”, 2011.
4. Mohanty R.K., “A text book of internal combustion engines”, standard book House, 2007.

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SEMESTER - VIII

12ME4808 ENTREPRENEURSHIP DEVELOPMENT (Elective)

L	T	P	C
3	0	0	3

Objective(s): *To understand the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc.*

UNIT - I ENTREPRENEURSHIP 09 Hrs.

Entrepreneur - types of entrepreneurs - difference between entrepreneur and intrapreneur - entrepreneurship in economic growth, factors affecting entrepreneurial growth. Case studies of successful entrepreneurs.

UNIT - II MOTIVATION 09 Hrs.

Major motives influencing an entrepreneur - achievement motivation training, self rating, business game, thematic apperception test - stress management, entrepreneurship development programs - need, objectives.

UNIT - III BUSINESS 09 Hrs.

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 09 Hrs.

Need - sources of finance, term loans, capital structure, financial institution, management of working capital, costing, break even analysis, network analysis techniques of PERT/CPM - taxation - income tax, excise duty - sales tax.

UNIT - V SUPPORT TO ENTREPRENEURS 09 Hrs.

Sickness in small business - concept, magnitude, causes and consequences, corrective measures - government policy for small scale enterprises - growth strategies in small industry - expansion, diversification, joint venture, merger and sub contracting.

Total hours: 45.

Course outcomes:

CO1 : Identify the Entrepreneurship growth.
CO2 : Motivates to become an Entrepreneur.
CO3 : Discusses the Business concepts.
CO4 : Understand about financing and accounting.
CO5 : Plan to support Entrepreneurs.

Text Books:

1. Khanka S.S, “Entrepreneurial Development” S.Chand & Co. Ltd., Ram Nagar New Delhi, 2009.
2. Hisrich R D and Peters M P, “Entrepreneurship” 6th Edition, Tata McGraw-Hill, 2011.

References:

1. Kuratko and Hodgetts, “Enterprenuership - Theory, process and practices”, Thomson Learning, 6th edition, 1999.
2. Mathew J Manimala, “Enterprenuership theory at cross roads - paradigms and praxis” Dream tech, 2nd edition, 2006.
3. Rabindra N. Kanungo “Entrepreneurship and innovation”, Sage Publications, New Delhi, 1998.

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SEMESTER VIII

12ME4809 **BUSINESS CONCEPTS (Elective)**

L	T	P	C
3	0	0	3

Objective(s): *To learn to survive in today's global business and to help students to manage their personal business affairs.*

UNIT - I BUSINESS ENVIRONMENT 09 Hrs.

Nature and purpose of business, classification of business activities - industry, commerce and trade, objective of business and essential of successful business, economic environment - basic problems of scarcity and choice, allocation of resources, opportunity cost, Business growth and measurement of size, international environment - balance of trade, the trade gap and balance of payments, role and methods of trade protectionism, business ethics.

UNIT - II BUSINESS STRUCTURE AND ORGANIZATION 09 Hrs.

Historical view of business development forms of business organization - sole proprietorship, partnership, join stock companies, co-operative societies, public enterprise - definition, meaning, characteristics, advantages and disadvantages, role of government in business activity, organization charts.

UNIT - III ELEMENTS OF BUSINESS ACTIVITY 09 Hrs.

Purchasing - choosing suppliers, overview of stock control, production - scale of production, main features of job, mass, and batch production systems, marketing - concept and role of marketing, marketing mix, channels of distribution, finance - sources of finance, assessing business performance.

UNIT - IV HUMAN RESOURCES 09 Hrs.

Demographic trends and their impact on business concerns, local trends in employment in various sectors, selection, recruitment, training of workers, motivation, basic knowledge of working age, contract of work, minimum wage, statutory hours of work, statutory benefits.

UNIT - V FOREIGN TRADE AND BANKING 09 Hrs.

Foreign trade - meaning, nature, importance, procedure of export and import, globalization, MNC and MNE, introductory idea about commercial banks - functions and services, insurance -meaning, types, principles, benefits.

Total hours: 45.

Course Outcome :

CO1 : Ability to analysis the business environment
CO2 : Develop the business structure
CO3 : Knowledge on marketing and other business activity
CO4 : Acquire knowledge on human resources
CO5 : Understand the concept of import and export

Text Books:

1. Joel Dean, "Managerial Economics", Prentice Hall/Pearson, 2007.
2. Rangarajan, "Principles of Macro Economics", Tata McGraw Hill, 2012.

References:

1. Bhalla V.K., and Shivaramu S., "International business environment and management", Anmol publication, Delhi, 2006.
2. Philip Kotler, "Marketing Management", Pearson Education - Millennium Edition, 2004.
3. Gary Dessler, "Human Resource Management", Seventh edition, Prentice-Hall of India Pvt. Ltd., Pearson, 2000.
4. Karunakaran B., "Business strategy - Concepts and cases", ICFAI University press, 2006.

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SEMESTER - VIII

12ME4810 ENTERPRISES RESOURCE PLANNING (Elective)

L	T	P	C
3	0	0	3

Objective(s): *To learn about the implementation of ERP in business system. To focus on the cross functional processes and integration of events and transactions across different functional areas.*

UNIT - I INTRODUCTION TO ERP SYSTEMS 09 Hrs.

Principle - ERP framework - business blue print - business engineering vs business process re-engineering - tools - languages - value chain - supply and demand chain - extended supply chain management - dynamic models - process models.

UNIT - II CUSTOMER RELATIONSHIP MANAGEMENT 09 Hrs.

Client / server architecture - technology choices - internet direction - evaluation framework - CRM - CRM pricing - chain safety - evaluation framework.

UNIT - III ARCHITECTURE OF ERP 09 Hrs.

Overview - applications - integration of different ERP applications - ERP as sales force automation - integration of ERP and Internet - ERP Implementation strategies -organizational and social issues.

UNIT - IV ERP TOOLS 09 Hrs.

System Application and Product (SAP), people soft, Baan and Oracle ERP - comparison - Oracle SCM applications - before and after Y2K - critical issues - training on various modules of IBCS ERP package - MAXIMO, including ERP on the NET.

UNIT - V PROCUREMENT ISSUES 09 Hrs.

Market trends - outsourcing ERP - economics - hidden cost issues - ROI - analysis of cases from automotive, steel, sugar and paper sectors.

Total hours: 45.

Course Outcomes:

CO1 : To improve the knowledge on ERP systems
CO2 : Can able to understand Customer Relationship Management
CO3 : Acquire knowledge on Architecture of ERP
CO4 : Ability to handle ERP tools
CO5 : To analyze hidden issues of ERP

Text Books:

1. Vinod Kumar Garg and Venkitakrishnan N.K. “Enterprise Resource Planning - Concepts and Practice”, Prentice Hall of India Pvt. Ltd. 2008.
2. Sadagopan.S , “ERP- A Managerial Perspective”, Tata Mcgraw Hill, 1999.

References:

1. Jose Antonio Fernandez, “The SAP R/3 Handbook”, Tata Mcgraw Hill, 2011.
2. Garg and Venkitakrishnan, ERPWARE , “ERP Implementation Framework”, Prentice Hall,1999.
3. Thomas E Vollmann and Bery Whybark, “Manufacturing and Control Systems”, Galgothia Publications, 1998.