

FLUID MACHINES

(ENGINEERING ECONOMICS & ACCOUNTANCY)

L T P
3 0 2

Curri. Ref. No.: ME410

Total Contact Hrs.: 75 Total Marks: 100

Theory: 45

Practical: 30

45 classes of 1hr. or

60 classes of 45 mins.

Prerequisite: ME403

Credit: 4

Theory:

End Exam : 70

P.A.: 30

Practical:

End Exam.: 25

P.A. : 25

RATIONALE:

Importance of fluids (i.e. liquids and gases) in mechanical engineering cannot be overstressed, and has been explained under the course named “Fluid Mechanics”. Water is the most important liquid, which is widely used by mankind starting from agriculture for production of food to various industrial as well as household purposes. Pressurised oil is used for transmitting power to various production machines as well as mechanised system. However, actual use of or action by various liquids like water & oil can be realised by a group of machines called fluid machines. It is, therefore, essential that mechanical engineers should be well conversant with design, operation and use of these hydraulic machines.

AIM.

Students to have a good working knowledge and skill about the principle of working, constructional features, uses and normal maintenance problems pertaining to common water hydraulic machines and oil hydraulic system.

DETAIL COURSE CONTENTS:

THEORY:

UNIT	TOPIC/SUB-TOPIC	Contact hrs.
1	IMPACT OF FLUID JET	1
	Force exerted by fluid jet on a stationary and moving flatplate and curved plate. Derive the expression for the force of a fluid jet on a stationary or moving plate. Deduce the expression for force of a fluid jet impinging on a curved plate.	
2	WATER TURBINES	12
	2.1 Classification of turbines: (a) impulse or velocity turbine, (b) pressure or reaction turbine.	
	2.2 Impulse turbine (Pelton wheel); principle of operation; velocity diagram and work done; efficiencies of an impulse turbine; simple problems.	
	2.3 Reaction turbine classifications: radial flow, axial or parallel flow, fixed flow; difference between impulse and reaction turbines	
	2.4 Inward flow reaction turbine (Francis turbine); velocity diagram and work done.	
	2.5 Axial flow reaction turbine (Kaplan turbine); work done.	
	2.6 Efficiencies of a reaction turbine: hydraulic, mechanical & overall efficiency; simple problems. Understand working principle of (i) impulse turbine and (ii) reaction turbine.	
3	PUMPS	2
	Various types of pumps, their principle of operation and uses: reciprocating pump, centrifugal pump, axial flow pump, and jet pump.	
4	RECIPROCATING PUMPS	6
	4.1 Types of reciprocating pumps; constructional details and parts of a reciprocating pump; discharge capacity; power required to drive a reciprocating pump	

4.2	Advantages and disadvantages of a reciprocating pump; normal problems of a reciprocating pumps; effect of air vessel in the line	
5	CENTRIFUGAL PUMPS	10
5.1	Constructional details and parts of a centrifugal pump; single stage and multistage pumps; applications of centrifugal pump	
5.2	Work done by a centrifugal pump; efficiency of a centrifugal pump; power required to drive a centrifugal pump; simple problems.	
5.3	Priming; suction head; delivery head; characteristic curves; normal problems in a centrifugal pump; cavitation.	
6	AUXILIARY FLUID MACHINES	5
6.1	Principle of operation and constructional details of hydraulic ram; and hydraulic press; mechanical advantage of a press.	
6.2	Air compressor classification; constructional features and use of reciprocating compressor-single stage and multi stage, rotary compressor, centrifugal blower.	
7	OIL HYDRAULICS	6
7.1	Definition of oil hydraulic system; various components and uses of an oil hydraulic system pump, storage tank, filter, flow and pressure control valve, direction control valve, hydraulic cylinder, accumulator, pipes & fittings; symbol used for these components, hydraulic oil.	
7.2	Principle of operation of rotary positive displacement pumps: gear pump, vane pump, variable delivery piston pumps; pressure range of hydraulic systems.	
7.3	Constructional features of a hydraulic cylinder.	
7.4	Hydraulic circuit drawing for a few typical applications like holding a job, hydraulic press etc.	
7.5	Seals-types and uses.	
8	FLUID MACHINES LABORATORY	30
8.1	To demonstrate actual working of a hydraulic ram	
8.2	To operate a reciprocating pump and calculate volumetric efficiency of the pump.	
8.3	To operate a centrifugal pump and note its normal head and discharge.	

8.4	To find out characteristic curve (H-Q Curve) of a centrifugal pump by throttling its output.
8.5	To demonstrate actual working of a Pelton wheel and Francis turbine.
8.6	Study hydraulic system of any machine, draw the hydraulic circuit and operate the system.

Total Hrs 60

TEXT / REFERENCE BOOKS:

1. Jagadish Lal : *Hydraulic Machines* – Metropolitan Book
2. TTTI, Madras : *Hydraulics and Hydraulic Machinery* - Tata Mc Graw Hill.
3. R. S. Khurmi : *Hydraulics and Hydraulic Machines* – S. Chand & Co. (Pvt.) Ltd.
4. S. R. Majumder : *Oil Hydraulics* – Tata Mc Graw Hill.
5. S. K. Likhi : *Hydraulics Laboratory Manual* – New Age International (P) Ltd.
6. S. Ramamrutham: *Hydraulics, Fluid Machines and Fluid Machines* – Dhanpat Rai and Sons, New Delhi.
7. K. Subramanya: *One thousand Solved Problems in Fluid Machines* – Tata Mc Graw Hill.
8. P. N Modi & S. M. Seth: *Hydraulics and Fluid Mechanics including Hydraulic Machines* -Standard Book House, Delhi.
9. Dr. R. K. Bansal: *A Textbook of Fluid Mechanics and Hydraulic Machines*
10. R. K. Rajput: *A Textbook of Hydraulic Machines* – S. Chand & Co. Ltd.
11. R. K. Rajput: *Fluid Mechanics & Hydraulic Machines* – S. Chand & Co. Ltd.
12. R. S. Khurmi: *A Textbook of Hydraulic Machines* – S. Chand & Co. Ltd.

THERMAL ENGINEERING -II

L T P
3 0 2

Total Contact Hrs.: 75 Total Marks: 100

Theory:45

Practical: 30

Pre-requisite: ME401

Credit : 3

Curri. Ref. No.: ME402

Theory:

End Term Exam : 70

P.A.: 30

Practical:

End Term Exam: 25

P.A.: 25

RATIONALE

Amount of useful energy produced and spent is the most important factor by which a country's technical advancement is measured. Useful mechanical and electrical energy is produced from heat energy. It is of paramount importance to an engineer to know the basic principles by which heat energy can be converted into mechanical energy, which in turn can be converted into electrical energy.

Thermodynamics is the field of applied science which deals with the energy possessed by heated gases and vapours and the laws which govern the conversion of this energy into mechanical energy and vice versa. This is the fundamental subject for understanding the process of producing vast amount of mechanical energy from heat energy and therefore necessary to be learned by the engineering students. Understanding the working principles and features of the various machines and plants in which either such heated gas/vapours are produced or conversion of heat to mechanical energy takes place is of great importance to a mechanical engineer.

AIM:

To have a clear understanding of use, working principle, constructional features and operational details of various Heat Engines like steam engine, steam turbine, internal combustion engine and gas turbine. Students should also have an overview of a total power generating plant.

DETAIL COURSE CONTENT

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	STREAM ENGINE	8
	1.1 Importance of steam engine in ushering industrial revolution.	
	1.2 Classification of steam engines; important parts/ components and their functions.	
	1.3 Working principle of a single cylinder double acting engine.	
	1.4 Indicator diagram; mean effective pressure; diagram factor; indicated horsepower; mechanical efficiency and thermal efficiency.	
2.0	STREAM TURBINE	10
	2.1 Function and use of steam turbines	
	2.2 Working principle; difference between steam engine and steam turbine.	
	2.3 Classification: impulse and reaction; simple and compound; single and multistage.	
	2.4 Constructional parts : Shaft (rotor), casing, nozzles, blades, diaphragm, glands	
	2.5 Velocity diagram of a turbine – work done on a moving blade, blade efficiency, stage efficiency.	
	2.6 Simple impulse turbine; analysis of a single stage impulse turbine; maximum efficiency conditions; simple problems.	
	2.7 Reaction turbine; degree of reaction; maximum efficiency conditions.	
	Compounding: velocity compounded, pressure compounded;	
	2.8 multistage turbine. Justify that efficiency of a turbine is more than that of a steam engine.	
3.0	STREAM CONDENSER	6
	3.1 Function of a steam condenser; elements of a condensing plant.	
	3.2 Classification: jet condensers, surface condensers.	
	3.3 Condenser vacuum; vacuum efficiency; condenser efficiency; simple problems.	

4.0 INTERNAL COMBUSTION (IC) ENGINE	10
4.1 Function and use of IC engines;	
4.2 Air Standard Cycles- Otto Cycle, Diesel cycle, Dual-combustion cycle	
4.3 Classification of IC engines; working principle of 2-stroke and 4-stroke cycles IC engines; SI. engine and CI engine; Otto cycle; Diesel cycle	
4.4 Construction of an IC engine - cylinder block, cylinder head, piston, piston ring, connecting rod, crankshaft, crank case, valve mechanism, manifold.	
4.5 Accessories: Carburetor, ignition system, fuel injection system, cooling system, exhaust system, lubrication system.	
4.6 Firing order of multi cylinder engine	
4.7 Fuels; additives; knocking; compression ratio; octaverating; cetane rating.	
4.8 Governing of S. I. And C.I. engines.	
4.9 Super-changing and turbo-changing of IC engine	
5.0 GAS TURBINE	5
5.1 Function and use of gas turbines	
5.2 Principle of operation; closed cycle and open cycle; constant pressure and constant volume gas turbine.	
5.3 Constructional components: Compressor, combustion chamber, and turbine.	
6.0 STEAM POWER PLANT	6
Definition; type and size of a power plant; essential equipment of a steam power plant; coal handling system; pulverized coal firing system; ash handling and disposal system; cooling towers; principles and factors of a power plant design; site selection; plant layout.	
List functions of various equipment and systems in a power plant.	

7.0 PRACTICAL	30
7.1 Study of C.I. engine and to draw the valve timing diagram.	
7.2 Determination of power, efficiency and fuel consumption of a C.I. engine.	
7.3 Study of a S.I. engine and to draw its valve setting diagram.	
7.4 Determination of power, efficiency and fuel consumption of a S.I. engine.	
7.5 Determination of calorific value of an engine fuel by Bomb Calorimeter.	
7.6 Calculation of fuel consumption and heat balance of an I.C. engine.	
7.7 Study of cut section of steam engine, steam turbine, gas turbine.	
7.8 Tracing the flue gas path and water-steam circuit with the help of boiler model.	
7.9 Study of various heat exchangers such as radiators, evaporators, condensers, plate heat exchangers.	

Total Hrs: 45

NOTE: Arrangement should be made for the students to make an industrial visit to a power plant.

REFERENCE BOOKS:

1. V. P. Vasandani & D. S. Kumar : *Heat Engineering* - Metropolitan Book Co. (P) Ltd.
2. S. L. Somasundaram : *Thermal Engineering* - New Age International (P) Ltd.
3. Pandya & Shah : *Elements of Heat Engines* – Charotar Publishing House
4. Mukherjee & Basu : *Heat Engine* – M. Dutta & Co.
5. Nagpal : *Power Plant Engineering* – Khanna Publishers
6. Skrotzki and Vopat : *Power Station Engineering* – McGraw Hill.
7. R. S. Khurmi : *A Textbook of Engineering Thermodynamics* – S. Chand & Co. Ltd.
8. B. K. Sarker : *Thermal Engineering* – Tata McGraw Hill.
9. P. L. Ballaney : *Thermal Engineering* - Khanna Publishers
10. A. S. Sarao : *Thermal Engineering* – Satya Prakash.
11. K. C. Pal : *Heat Power* - Orient Longman
12. P. K. Nag : *Engineering Thermodynamics* - Tata McGraw Hill, New Delhi, 2008
13. A. R. Basu : *Thermal Engineering and Heat Power* – Dhanpat Rai.
14. Domkundwar, Kothandaram and Domkundwar : *A Course in Thermal Engineering* - Dhanpat Rai Publishing Company New Delhi
15. Mahesh M. Rathore : *Thermal Engineering* - Tata McGraw Hill Education Private Ltd.
16. R. Rudramoorthy : *Thermal Engineering* - Tata McGraw Hill Published New Delhi, 2003
17. R. K. Rajput : *Thermodynamics* - Laxmi Publications, New Delhi, 2007
18. M. M. Rathore : *Essential Engineering Thermodynamics* - Dhanpat Rai Publishing Co, New Delhi, 2005
19. R.S. Khurmi and S.K. Kataria: *A Textbook of Thermal Engineering* – S. Chand & Co.
20. K. Soman: *Thermal Engineering* – PHI Learning Pvt. Ltd.
21. R. S. Khurmi and J. K. Gupta: *A Textbook of Thermal Engineering* – S. Chand & Co. Ltd.

MANUFACTURING PROCESS-II

L T P
3 0 0

Curri. Ref. No.: ME405

Total Contact Hrs.: Total Marks: 100

Theory: 45

Practical: 0

Theory:

End Exam : 70

P.A.: 30

Practical:

End Exam.: 0

P.A. : 0

Pre-requisite: NIL

Credit : 3

RATIONALE

Manufacturing is the backbone of any industrial nation. The level of manufacturing activity is directly related to the economic health of a country. Generally, the higher the level of manufacturing activity in a country, the higher is the standard of living of the people. Manufacturing is generally a complex activity, involving people who have a broad range of disciplines and skills and a wide variety of machinery, equipment, and tooling with various levels of automation, including computers, robots, and material handling equipment.

AIM:

To develop basic concepts and working principles of different fabrication processes, welding, forging and non-conventional machining.

COURSE CONTENTS

THEORY:

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	GENERAL INTRODUCTION Classification of manufacturing processes, selection of Manufacturing Processes, selection of materials.	1
2.0	INTRODUCTION TO FABRICATION PROCESSES	2
	2.1 Mechanical joining: Bolts, screws and Rivets	
	2.2 Adhesive bonding: Epoxy resins	
	2.3 Welding, brazing and soldering	

3.0 BRAZING, BRAZE WELDING AND SOLDERING	4
3.1 Brazing: Definition, fluxes used in brazing, properties of filler metal	
3.2 Braze welding: Definition, necessity, design of joint	
3.3 Soldering: Definition, joint design, types of fluxes, filler metals, applications	
4.0 GAS WELDING AND CUTTING	4
4.1 Filler metal Types of Gas welding, oxy-acetylene welding, principle of operation, process, and equipment, flame types and safety.	
4.2 Flame cutting: Operation, equipment, safety, techniques.	
5.0 GAS AND WELDING CUTTING	4
5.1 Principle, arc welding equipment, electrodes	
5.2 Manual metal arc welding	
5.3 Carbon arc welding	
5.4 Metal inert gas welding (MIG).	
5.5 Submerged arc welding	
6.0 FORGING AND OTHER MECHANICAL WORKS	8
6.1 Introduction to metal working processes, nature of plastic deformation, hot working and cold working	
6.2 Rolling: Principle, rolling stand arrangement, roll passes, breakdown passes, roll pass sequences.	
6.3 Forging :Forging operation, smith forging, drop forging, press forging machine forging, forging design, drop forging die design	
7.0 NON-CONVENTIONAL MACHINING	8
Basic processes, applications, advantages and disadvantages and economics of the following process: Chemical Machining, Electrochemical Machining, Electro Discharge Machining (EDM), Laser Beam Machining, Electron Beam Machining, Water Jet Machining, Abrasive Jet Machining.	
8.0 PLASTICS AND THEIR PROCESSING	7
8.1 Introduction, types of plastics	
8.2 Types of plastic, plastic processing, moulding, reinforcing Thermoforming, casting, laminating and formed plastics, fastening and machining plastic.	

9.0 ADVANCED MANUFACTURING TECHNOLOGIES	7
Basic concepts about the following	
9.1 Introduction, types of plastics	
9.2 Group Technology and flexible manufacturing systems	
9.3 CAD / CAM / CIM	
9.4 Robotics	

Total Hrs: 45

REFERENCE BOOKS :

1. R. K. Jain : Production Technology – Khanna Publishers.
2. L. E. Doyle : Manufacturing Process and Materials for Engineers – Prentice Hall.
3. B. H. Amstead, Phillippe. F. Ostwald & Myron L. Begeman : Manufacturing Process – John Wiley & Sons.
4. J. S. Campbell : Principles of Manufacturing Materials and Processes - Tata Mc. Graw – Hill Publishing Company.
5. George E. Dieter : Mechanical Metallurgy – Mc. Graw Hill International Book Company.
6. Donal S. Clark and Wilbur R. Varney : Physical Metallurgy for Engineers - Affiliated East – West Press Private Limited.
7. B. S. Raghuwanshi : A Course in Workshop Technology Vol. I and II - Dhanpat Rai & Sons.
8. John A. Schey : Introduction to Manufacturing Process - Mc. Graw – Hill Book Company.
9. P. N. Rao : Manufacturing Technology : Foundry, Forming and Welding - Tata Mc. Graw - Hill Publishing Company Limited.
10. Serope Kalpakjian : Manufacturing Engineering and Technology - Addison Wesley Publishing Company.
11. Mikell P. Groover: Introduction to Manufacturing Processes – Wiley.
12. Robert C. Creese: Introduction to Manufacturing Processes and Materials – Marcel Dekkar Inc.

MANUFACTURING PROCESS-II

L T P
3 0 0

Curri. Ref. No.: ME503

Total Contact Hrs.: Total Marks: 100

Theory:

Theory: 45

End Exam : 70

Practical: 0

P.A.: 30

Pre-requisite: NIL

Credit : 3

RATIONALE:

The Mechanical measurement is primarily concerned with methods of measurement based on agreed units and standards. The practice of mechanical measurement involves precise measurements requiring the use of apparatus and equipment to permit the degree of accuracy required to be obtained. In the broader sense the subject is not limited to length measurement but is also concerned with the industrial inspection and its various techniques. Thus technicians working in production and maintenance units should be thorough in this subject.

AIM:

The students will be exposed to the instruments and methods of their use in linear measurement, machine tool metrology, gear and screw thread measurement.

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	INTRODUCTION	5
	1.1 Definition of metrology, need of inspection	
	1.2 Measuring instruments – measuring range, sensitivity, scale interval, discrimination, hysteresis, response time, repeatability, bias, inaccuracy, precision and accuracy, magnification, calibration, uncertainty of measurement.	
	1.3 Types of errors – controllable errors, random errors	
	1.4 General care of measuring instruments	
	1.5 Standardization and standardising organizations- ISO, ISA, IEC, OIML, NPL	

2.0 INTRODUCTION TO LINEAR MEASUREMENT 9

- 2.1 Construction use and care of instruments for non-precision linear measurement: steel rule, calipers, surface plate, angle plate, V-block, straight edges.
- 2.2 Slip gauges: Indian standards on slip gauges, standard terminology, wringing and enforced adhesion, measuring faces, grades of slip gauges, sets of gauges, selecting slip gauges for required dimension, calibration of slip gauges.
- 2.3 Comparators – Characteristics, uses, working principles of different types of comparators: mechanical, mechanical optical, electrical and electronic, pneumatic, fluid displacement comparator.

3.0 ANGULAR MEASUREMENT 8

- 3.1 Construction and use of instruments for angular measurement – vernier and optical level protractor, sine bars, sine table, angle gauges, spirit level, clinometers.
- 3.2 Optical instruments for angular measurement – auto-collimator, microptic auto-collimator, constant deviation prism.
- 3.3 Circular division – dividing heads and circular tables, circular division by polygon, angle gauge dividing head.

4.0 MEASUREMENT OF FORM AND POSITION 7

- 4.1 Surface roughness standard form of representation, checking surface, roughness (introduction).
- 4.2 Use of straight edges and surface plate “Wedge” Method, “Level” Method.
- 4.3 Squareness Testing by Try square, dial gauge, Optical square
- 4.4 Testing of parallelism with scribing block, clock indicator
- 4.5 Use of dial gauge for squareness of hole axes.
- 4.6 Test for roundness and concentricity
- 4.7 Checking the relative position of holes (jig plate fitted with drill bushes).

5.0	MACHINE TOOL METROLOGY	6
5.1	Definition and its importance.	
5.2	Typical geometrical tests for machine tools: straightness, flatness, parallelism, squareness, roundness, cylindricity and runout.	
5.3	Acceptance Tests for machine tools: lathe, drilling and milling.	
6.0	MEASUREMENT OF SCREW THREADS AND GEARS	7
6.1	Measurement of screw threads – Introduction, measurement of external and core diameters, measurement of flank diameter, testing the lead, testing of thread angle and thread profile. Testing of threads with gauges.	
6.2	Measurement of gears (spur) – Introduction, measurement of the tooth thickness, measurement of the pitch, chordal measurement over several teeth, testing of alignment of teeth, testing of concentricity, shape of tooth and pitch.	
7.0	MEASUREMENT EXAMPLES	9
7.1	Measuring the diameter of a spigot (using slip gauges).	
7.2	Checking the size of a groove, dovetail slides; gauging large bores with point gauge and by four ball method.	
7.3	Small bore measurement with 2 spheres and 3 spheres	
7.4	Measuring a Taper plug gauge, Tape Ring gauge, internal and external template radius.	
7.5	Measurement of surface roughness.	
8.0	COORDINATE MEASURING MACHINES	3
8.1	Structure: cantilever, bridge, column, horizontal arm, gantry.	
8.2	Modes of operation: manual, semi-automatic, computer controlled.	
8.3	Probe assembly: probe head, probe, stylus, probe calibration.	
8.4	Operation and major applications.	

Total Hrs: 45

1. R. K. Jain : *Engineering Metrology* – Khanna Publishers
2. D. S. Kumar: *Mechanical Measurements and Control Engineering* - Metropolitan Book Co. Pvt. Ltd.
3. I.C. Gupta: *Engineering Metrology* - Dhanpat Rai & Sons, New Delhi
4. Greeve J. and Wilson F.: *Handbook of Industrial Metrology* - Prentice Hall Publishers, New Delhi
5. Manish J.Kadam: *Metrology and Quality Control* - Everest Publishing House
6. N. V. Raghavendra and L. Krishna murthy: *Engineering Metrology and Measurements* – Oxford University Press.
7. K. L. Narayana: *Engineering Metrology* – Scitech Publications (India) Pvt. Ltd.

3 0 2

Total Contact Hrs.: **Total Marks: 150**

Theory: 45

Practical: 30

Theory Class Duration

Pre-requisite: Nil

Credit : 4

Theory:

End Exam : 70

P.A.: 30

Practical:

End Term Exam: 0

P.A.: 50

RATIONALE:

Mechanics of Materials deals with the internal behavior of variously loaded solid bodies, such as; shafts, bars, beams, plates, and columns, as well as structures and machines that are assemblies of these components. Mechanics of materials focuses primarily on mechanical properties of materials, analysis of stress, strain and evaluation of deformations. The subjects like structural analysis, design of structures as well as machines are based on adequate knowledge and understanding of Mechanics of Materials. Therefore, it is an important basic subject for Diploma students in Civil and Mechanical Engineering.

AIM:

The aim of the subject Mechanics of Materials is to develop background preparation of students for taking up Engineering subjects like Theory and Design of Structures, Design of Machines mostly through the followings:

- Describe the Mechanical properties of important Engineering materials
- Determine stresses, strains and deformations in elastic bodies of different shapes under different loading conditions for engineering applications.
- Determine load carrying capacity of different types of members.

DETAILED COURSE CONTENTS

THEORY: 45 Hrs.

UNIT	TOPIC / SUB TOPIC	Contact Hrs.
1.0	INTRODUCTION	2
	1.1 Scope of the subject: Uses of structures, Importance of knowledge of: stress, strain, deformation in a structure, permissible stresses in a material, Safety and Economy. Contents and importance of the subject.	
	1.2 Engineering Materials: Elastic material, linearly elastic material, ductile material, brittle material, composite material, isotropic material, orthotropic material. (Definition, examples, and application).	
2.0	STRESS AND STRAIN	12
	2.1 Introduction: Definitions of stress; types of stress-tensile, compressive and shear.	
	2.2 Stress Strain Diagram: Principle of tensile testing in Universal Testing Machine, dimensions of a tensile test specimen, tensile test, elastic limit, elastic range, proportional limit, point of fracture, plastic range, strain hardening, ultimate stress, necking, ductility, yield strength, 0.2% proof stress, allowable stress of ductile and brittle materials, factor of safety.	
	2.3 Stress Strain Relations: Hooke's law, Young's modulus, Shear modulus of rigidity, Poisson's ratio, generalized Hooke's law for two dimensional stress, relation among the elastic constants for an isotropic material.	
	2.4 Riveted or Bolted Joints: Single riveted/bolted lap joint, double riveted/bolted lap joint, triple riveted/bolted lap joint, single riveted/bolted double cover butt joint, double riveted/bolted double cover butt joint (no design).	
	2.5 Stresses in Welded Joints: butt weld, fillet weld.	

2.6	Stresses, strains, and Deformations of Axially Loaded Members: Bars of varying section, taper rod, bars of composite section, rod and tube connected by bolted joint, temperature stresses.		
2.7	Principal Stresses and Strains: Plane stress - definition and expressions; stresses on inclined planes; Principal Stresses (no theoretical derivation) - principal planes, maximum/major principal stress, minimum/minor principal stress, maximum shear stress; Mohr's Circle – construction and interpretation.		
2.8	Thin walled Cylindrical and Spherical Pressure Vessels: Circumferential or hoop stress, axial stress, difference between thick cylinder and thin cylinder (no derivation).		
3.0	STRESSES IN BEAMS	10	
3.1	Beam: definition, types of beams – Simply supported and cantilever beams, propped cantilever, fixed-ended and continuous beams.		
3.2	Shearing force and Bending Moment in Beams : Sign conventions and relationships among load, shearing force and bending moment.		
3.3	Shear Force and Bending Moment Diagrams : Cantilever beam with concentrated and uniformly distributed load, simply supported beam with uniformly distributed and varying loads.		
4.0	SIMPLE BENDING OF BEAMS	5	
4.1	Centroid of an area, moment of inertia of beam cross-sections, parallel axis theorem, principal moments of inertia		
4.2	Assumptions in simple bending, neutral surface, neutral axis determination of bending stresses in beams with simple cross sections and standard sections used in industry.		
5.0	TORSION	4	
5.1	Basic assumptions for pure torsion, torsion of circular shafts (hollow and solid, no proof) – polar moment of inertia, torsional shearing stress, angle of twist, torsional rigidity.		
5.2	Applications: Horse power transmitted by a shaft, moment transmitted by a key, horse power transmitted by a flange coupling with bolts, stiffness of closed coil helical spring (no proof).		
6.0	COLUMNS AND STRUTS	5	
6.1	Definition of columns and struts; Buckling load (critical or crippling load); Slenderness ratio, Classification of columns as long and short columns.		
6.2	Euler's Theory – Basic assumptions made in Euler's theory for column buckling, Effective lengths for different end conditions-- both ends pinned, one end fixed and the other end free, both ends fixed, one end fixed and other end pinned.		
6.3	Other Formulae – Practical deviations from ideal column, Rankine's formula, factor of safety for different column materials, IS - 800-code formula for column design.		
7.0	SLOPE AND DEFLECTION OF BEAMS	4	
	Introduction: Shape and Nature of Elastic Curve (Deflection Curve). Importance of Slope and Deflection.		
	Class Test:	3	
	TOTAL HRS:	45	

PRACTICAL: 30 Hours

UNIT	TOPIC / SUB TOPIC	Contact Hrs.
8.0	SHEAR TEST Determination of Shear Modulus (Modulus of Rigidity) of a material	3
9.0	TENSILE TEST Determination of Young's Modulus of a material in a tensile testing machine.	3
10.0	COMPRESSIVE TEST Determination of Compressive strength of brick and standard concrete cube.	3
11.0	HARDNESS TEST Determination of hardness of a material by a Brinell or Rockwell testing machine.	3
12.0	IMPACT TEST Testing of Cast Iron (C.I.) and Mild Steel (M.S.) test pieces by Impact testing machine.	3
13.0	FATIGUE TEST Testing of a Mild Steel (M.S.) test piece for fatigue.	3
14.0	TORSION Determination of spring constant of helical spring.	3
15.0	DEFLECTION OF BEAMS a) Deflection of simple supported beams with concentrated load at the middle. b) Determination of modulus of elasticity for the material of a beam by load deflection method.	3
16.0	VIVA - VOCE:	6
TOTAL HOURS:		30

1. S. P. Timoshenko, D. H. Young: Elements of Strength of materials - Affiliated East – West Press Private Limited.
2. R. K. Bansal: Engineering Mechanics and Strength of materials - Laxmi Publications, New Delhi
3. Surendra Singh: Strength of Materials - Vikas Publishing House Pvt. Ltd.
4. Ferdinand L. Singer: Strength of materials - Harper & Row and John Weatherbill.
5. William A. Nash: Theory and Problems of Strength of Materials - Shaum's outline of - Shaum's Outline Series, Mc. Graw Hill. Inc.
6. Egor P. Popov: Engineering Mechanics of Solids - Prentice Hall of India Private Limited, New Delhi.
7. R.S. Khurmi: Strength of Materials – S. Chand & Co. Ltd.
8. Dr. Sadhu Singh: Strength of Materials - Khanna Publishers, Delhi-110 006.
9. S. Ramamrutham: Engineering Mechanics & Strength of Materials - Dhanpat Rai Publishing Co., Delhi – 110 006.
10. A. C. Ugural: Mechanics of Materials - Mc. Graw Hill. Inc
11. D.R. Malhotra and H.C. Gupta: Strength of Materials - Satya Prakashan, New Delhi – 110 005.
12. B. K. Sarkar: Strength of Materials Through Problems - Allied Publishers Limite New Delhi – 110 002.
13. R. K. Rajput: Strength of Materials – S. Chand & Co. Ltd.

REFERENCE BOOKS:

ELEMENTS OF ELECTRICAL ENGINEERING

L T P
3 0 0

Total Contact Hrs.: 45 Total Marks: 100

Theory: 45

Practical: 0

Prerequisite: Nil

Credit: 3

Curri. Ref. No.: ME412

Theory:

End Exam : 70

P.A.: 30

Practical:

End Exam.: Nil

P.A. : Nil

DETAIL COURSE CONTENTS:

THEORY:

UNIT	TOPIC/SUB-TOPIC	Total hrs.
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1.0 CURRENT ELECTRICITY 4

Definition of e.m.f. and p.d. electric current and resistance Ohm's

Law, resistivity and calculation of resistance

1.1 Kirchoff's Law and ample network problems.

1.2 Power and Energy:

Definition and units of electrical power and energy heating

effect of electric current; relation between electrical

mechanical and heat units, problems.

1.4 Shear stress in beams—calculate shear stresses at different layers of a given beam, draw the distribution of shear stress for different structural sections (only application of formula).

Class Test: 1

2.0 A.C. FUNDAMENTALS 4

2.1 Definition – cycle-time period, frequency amplitude, generation of A.C. voltage and current and their interpretation

2.2 Phase, phase difference, R.M.S and average value with definitions and mathematical equation, form factor and ripple factor

2.3 Vector representation of alternating quantities concept of active apparent power and p.f.

3.0 A.C.CIRCUITS 4

A. C. circuits with pure resistance pure inductance and pure capacitance. Voltage current relationship and phase diagram power and p.f.. Series and parallel circuits including simple problems (Using vector Diagram), computation of power and p.f. in simple R.L.C. circuits

4.0 THREE PHASE CIRCUIT 4

4.1 Interconnection of three phase, voltage and current in delta and Star connection 3-phase power

5.0 MEASURING INSTRUMENTS 4

Principle and construction of simple moving iron and moving coil ammeter and voltmeter

5.1 Principle and construction of dynamometer type wattmeter

5.2 Measurement of three phase power by two wattmeter method

6.0 STORAGE CELLS 4

Lead acid accumulations its construction and uses

Maintenance free battery

Charging and discharging of cells, characteristics and a lead acid battery, maintenance of lead acid battery, problems.

7.0 D.C. MACHINES 8

7.1 D.C. Generator description, working principle, type e.m.f equation OCC and load characteristics.

7.2 D.C. motor : description, working principle, types, back e.m.f. starting and speed control of C.C. motor

8.0 A.C. MACHINES 8

8.1 Transformer construction, types, principles, e.m.f. equation, transformer on no load, transformer on load. Single phase and 3 phase transformers, connection of Transformers (star-star, star delta, delta-star). Principles and uses of auto transformer, losses and efficiency of transformer.

- 8.2 A.C. motors Induction motor, construction, working principles, concept of rotating magnetic field, slip, torque equation, starting torque and maximum torque, efficiency, starting of induction motor, different types of starter
- 8.3 Synchronous Machine as alternator and motor, working principle, frequency e.m.f equation, distribution factor and breadth factor as alternators working principle and starting when used as synchronous motor)
- 8.4 Choice of motors for different industries and for traction purpose (comparative Study of A.C. and D.C. machines)

9.0 INDUSTRIAL HEATING 8

Induction and dielectric heating, different standard formulae regarding selection of voltage and frequency of power supply for both induction and dielectric heating, description and application.

10.0 GENERATION AND TRANSMISSION 8

- 10.1 Lay out of thermal generating station and hydro-electric generation station
- 10.2 A.C. and D.C. transmission and distribution system

Total Hours: 45

REFERENCE BOOKS:

1. H.Cotton : Applied Electricity
2. H. Pradip: Utilisation of Electric Power
3. A.T. Star/ H Cotton: Transmission, Distribution and Utilisation of Electric Power.
4. S.K. Bhattacharya & K.B. Raina: Electrical Installation - Tata Mc Graw Hill.
5. Mothershed: Electronic Devices & Currents – PHI.
6. H. Kalsi: Electronic Instrumentation - Tata Mc Graw Hill.
7. C. L. Wadhwa: Basic Electrical Engineering

WORKSHOP PRACTICE - IV

L T P
0 0 4

Total Contact Hrs.: **Total Marks: 50**

Theory: 0
Practical: 60
Pre-requisite: Nil
Credit : 2

Curri. Ref. No.: ME409

Theory:
End Exam : 0
P.A. : 0
Practical:0
P.A.:50

RATIONALE:

The wealth of a community is measured by the variety and quality of the articles it possesses for its use and consumption. All the materials we possess are made from substances won from the earth, or from nature. Our property depends upon our ability to convert these raw materials into useful articles for consumption, and to distribute these articles equitably amongst the various members of our community. The production of our engineering workshops is important since a large proportion of our industries is of an engineering nature. Our ability, therefore, to maintain a high standard of skill in our engineering workshops is an important factor

AIM:

To use and describe the tools, materials and working principles of various processes for pattern making shops, foundry shops, and electric shops.

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
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1.0 MACHINE SHOP

- | | | |
|-------|--|---|
| 1.1 | SHOP TALK | 8 |
| 1.1.1 | Introduction to Machine Shop: Role of machine shop and its importance in Manufacturing, difference between machine and machine tool, discussion on different types of machine. | |
| 1.1.2 | Safety precautions to be observed in machine shop: Safety measures in construction work, Protection in storage and manual handling of material, causes and common sources of accident, common precautions against electric shocks, damages and fires etc. | |
| 1.1.3 | Study of a centre lathe: Types of lathe, parts of the lathe, lathe accessories lathe turning, thread cutting, specifications of a lathe, running and routine maintenance of a centre lathe. | |
| 1.1.4 | Study of a single point cutting tool: Classification of cutting tool, materials of cutting tool, various angles of cutting tool, nomenclature of cutting tool. | |
| 1.1.5 | Study of planner, shaper and slotter: Functions of planning machine, Planner tools, cutting speed feed and depth of cut, Functions of shaper, Shaper tools, cutting speeds and speeds. Functions of a slotting machine, Slotter tools, cutting speed, feed and depth of cut. | |
| 1.1.6 | Demonstration of job and test setting on a shaper, planner and slotter. | |
| 1.1.7 | Adjustment of stroke length and study of quick return, mechanism of a shaper and planner. | |
| 1.1.8 | Study of Capstan and Turret: Introduction to semi-automatic lathe, functions of capstan and turret lathe. | |
| 1.1.9 | Study of a CNC Lathe | |

1.2 MACHINE SHOP PRACTICE 21

- 1.2.1 Tool grinding practice on M. S. square bar
- 1.2.2 Job setting for centering, facing and counter boring on a 3-jaw and a 4-jaw chuck
- 1.2.3 Practical on plain turning, step turning and taper turning process using 4-jaw chuck and tail stock.
- 1.2.4 Practical on knurling, chamfering, drilling and parting off operations.
- 1.2.5 Practical on external and internal thread cutting on a capstan lathe
- 1.2.6 Practical on Horizontal, Vertical and Angular surface and slot cutting using shaping machine.

1.3 Uses of Portable Hand machine: Portable Saw Mills.

2.0 WELDING SHOP:

2.1 SHOP TALK 8

- 2.1.1 Introduction to welding processes.
- 2.1.2 Gas welding processes: Oxy-acetylene welding, Relative advantages over other processes, Methods of welding, Composition of the Gas. Metal Inert Gas welding (MIG): Relative advantages over other processes stating specific applications. Methods of MIG welding, Composition of shielder & gases.
- 2.1.3 Arc welding processes: Types of arc welding processes, arc welding principle, Setting of various parameters for welding, Arc welding equipment, Electrode holder, welding Helmet, Safety goggles, welder's chipping hammer, Earthing clamps, Hand gloves Approus and sleeves, wire brush.

2.2	WELDING SHOP PRACTICE	21
2.2.1	Leftward and Right ward welding.	
2.2.2	Buts-joints practice on M.S. sheet at horizontal Position by gas welding.	
2.2.3	Arc welding practice on M.S. flat bar, 4-6 mm thick both left and right ward for hand balancing.	
2.2.4	Making a double Vee-Butt joint on M.S. flat of 6 mm thick with minimum 2 runs on each side by Arc welding.	
2.2.5	Making Tee Fillet with joint on flat position using M.S. flat of 4 mm. thick by arc welding.	
2.2.6	Making small grill or window frame etc. by Arc welding.	
3.0	TEST AND VIVA VOCE	2
	TOTAL HRS:	60

1. Machinist – Trade Practicals (1st year and 2nd year), Central Instructional Media Institute, Madras, Directorate General of Employment & Training, Ministry of Labour, Govt. of India.
2. R. S. Khurmi Gupta & J. K. Gupta: A Textbook of Workshop Technology (Manufacturing Process) – S. Chand & Company Limited.
3. P, Kannaiah & K. L. Narayana: Workshop Manual – Scitech Publications (India) Pvt. Ltd.
4. Turner – Trade practical (1st year and 2nd year), Central Instructional Media Institute, Madras Directorate of Employment & training, Ministry of Labour, Govt. of India.
5. S. K. Hazra Choudhury and A. K. Hazra Choudhury: Elements of Workshop Technology Vol. I & II - Media Promoters & Publishers Pvt. Ltd.
6. R. N. Dutta: Machine Tools Vol. I, - S. Charel & Company Ltd.
7. B. S. Raghuwanshi: A course in Workshop Technology Vol. I & II - Dhanpat Rai & Sons.
8. O.P. Khanna: Workshop Technology - Dhanpat Rai & Sons Publications
9. Chapman: Workshop Technology Parts 1 & 2, 4th Edition - Viva Books P. Ltd., New Delhi
10. Kenyon Pitman: Basic Fabrication & Welding - Pitman Pub. Ltd.
11. P. N. Rao: Manufacturing Technology - Tata Mcgraw Hill.

PROFFESIONAL PRACTICE – III

REFERENCE BOOKS:

L T P
0 0 3

Curri. Ref. No.: ME513

Total Contact Hrs.: 45

Total Marks: 50

Practical:

Practical:45

P.A. : 50

Credit : 2

RATIONAL :

To develop general confidence, ability to communicate and attitude, in addition to basic technological concepts through Industrial visits, expert lectures, seminars on technical topics and group discussion.

AIM:

Student will be able to:

- Acquire information from different sources
- Prepare notes for given topic
- Present given topic in a seminar
- Interact with peers to share thoughts
- Prepare a report on industrial visit, expert lecture

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
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1. INDUSTRIAL VISIT 12

Structured industrial visits be arranged and report of the same shall be submitted by the individual student, to form a part of the term work. The industrial visits may be arranged in the following areas / industries: Sugar Factory / Dairy / Chemical Industry / Thermal Power Plant.

- i) Machine shop having CNC machines.
- ii) ST workshop / Auto service station
- iii) City water supply pumping station
- iv) Manufacturing unit to observe finishing and super finishing processes.

2.0 LECTURES BY PROFESSIONAL/INDUSTRIAL EXPERT TO BE ORGANIZED FROM ANY TWO OF THE FOLLOWING AREAS: 10

- 1) Interview Techniques.
- 2) Modern Boilers - Provisions in IBR
- 3) Applications of Sensors and Transducers
- 4) Alternate fuels - CNG / LPG, Biodiesel, Ethanol, hydrogen
- 5) Piping technology

3.0 INFORMATION SEARCH: 10

Information search can be done through manufacturer's catalogue, websites, magazines, books etc. and submit a report any one topic. Following topics are suggested:

- i. Engine lubricants & additives
- ii. Automotive gaskets and sealants
- iii. Engine coolants and additives
- iv. Two and Four wheeler carburetor.
- v. Power steering
- vi. Filters
- vii. Different drives/Transmission systems in two wheelers.
- viii. Types of bearings - applications and suppliers.
- ix. Heat Exchangers
- x. Maintenance procedure for solar equipment.
- xi. Tools holder on general purpose machines and drilling machines

4.0 SEMINAR: 13

Seminar topic shall be related to the subjects of fourth semester. Each student shall submit a report of at least 10 pages and deliver a seminar (Presentation time - 10 minutes)

Mini Project / Activities: (any one)

- a) Prepare one model out of card board paper / acrylic / wood / thermocol / metal such as: i) Elliptical Trammel ii) Pantograph iii) Coupling iv) Cams and Followers v) Geneva mechanism
- b) Dismantling of assembly (e.g. jig / fixtures, tool post, valves etc.) Take measurement and prepare drawings / sketches of different parts.
- c) Make a small decorative water fountain unit.
- d) Toy making with simple operating mechanisms.

Sample path for Term IV in Mechanical Engineering.

S l. N o	Code	Course	Study Scheme				Evaluation Scheme							Total Marks	Cred it
			Pre-requisite	Contact Hours / Week			Theory			Practical					
				L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
								Class Test	Assign ment	Attend ance		Sessi onal	Viva voce		
1	ME410	Fluid Machinmes	ME403	3	0	2	70	15	10	5	25	25	-	150	4
2	ME402	Thermal Engineering – II	ME401	3	0	2	70	15	10	5	25	25	-	150	4
3	ME405	Manufacturing Process- II	ME404	3	0	0	70	15	15	5	-	-	-	100	3
4	ME503	Mechanixal Measurement		3	0	0	70	15	10	5	-	-	-	100	3
5	ME411	Mechanics of Materials		3	0	2	70	15	10	5	-	25	25	150	4
6	ME412	Elements of Electrical Engineering		3	0	0	70	15	10	5	-	-	-	100	3
7	ME409	Workshop Practice – IV		0	0	4	-	-	-	-	-	25	25	50	2
8	ME513	Professional Practice – III		0	0	3	-	-	-	-	-	50	-	50	2
TOTAL				18	0	13	420	90	60	30	75	150	25	850	25

Sample path for Term III in Civil Engineering.