

**BASIC MECHANICAL ENGINEERING**

Course Code	:	** ME 3001 (Same as MA/MP 3001)
Course Title	:	BASIC MECHANICAL ENGINEERING
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites (Course code)	:	NIL
Course Category	:	PC

**COURSE OBJECTIVES**

1. To understand General Principles of Mechanical Engineering.
2. To understand laws of thermodynamics, thermal and thermodynamic Processes.
3. To understand working principles of power developing and power absorbing devices.
4. To understand basic materials and manufacturing processes.

**COURSE OUTCOMES:**

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

CO1	Understand basics of thermodynamics and components of a thermal power plant
CO2	Understand basics of heat transfer, refrigeration and internal combustion engines
CO3	Understand mechanism of thermal power plant and boiler operation
CO4	Identify engineering materials, their properties, manufacturing methods encountered in engineering practice
CO5	Understand functions and operations of machine tools including milling, shaping, grinding and lathe machines

**COURSE CONTENTS:****1. INTRODUCTION TO THERMODYNAMICS**

- 1.1 Role of Thermodynamics in Engineering and Science.
- 1.2 Basic Concept of thermodynamic laws
  - 1.2.1 Types of system, Thermodynamic Equilibrium, properties (basic Concept only)
  - 1.2.2 Elementary introduction to Zeroth Law, First Law, Heat and work
  - 1.2.3 Second laws of thermodynamics Kelvin-Planck and Clausius Statements
  - 1.2.4 Concept of Heat Engine, Heat Pump & Refrigerator, Efficiency/COP
  - 1.2.5 Carnot Cycle, Carnot Efficiency, T-S and P-V Diagrams

**2. HEAT TRANSFER & THERMAL POWER PLANT**

- 2.1 Modes of Heat Transfer
- 2.2 Conduction:
  - 2.2.1 Composite Walls and Cylinders
- 2.3 Simple Numerical Problems
- 2.4 Thermal Power Plant Layout
- 2.5 Fire Tube and Water Tube boilers (only working principal and types)

**3. STEAM TURBINES**

- 3.1 Impulse and Reaction Turbines;
- 3.2 Condensers: Jet & Surface Condensers (only working principal of both type)
- 3.3 Cooling Towers(only working principal and types)

**4. MATERIAL AND MANUFACTURING PROCESSES`**

- 4.1 Engineering Materials
  - 4.1.1 Classification and their Properties
- 4.2 Metal Casting: Moulding, Patterns
- 4.3 Metal Working process: Hot and Cold working (Introduction only)
- 4.4 Metal Forming processes (Introduction Only)
- 4.5 Press Working process (Introduction and working)
  - 4.5.1 Press Working operations: - Cutting, bending, Drawing,

- 4.5.2 Punch, blanking, piercing, notching, lancing
- 4.5.3 effect of clearance.

## 5. SUPER FINISHING AND METAL COATING PROCESSES

- 5.1 Finishing by grinding: (basic concept only and no mathematical formulation)
  - 5.1.1 Honing,
  - 5.1.2 Lapping,
  - 5.1.3 Super finishing;
- 5.2 Electroplating: Basic principles and applications;
- 5.3 Hot dipping: Galvanizing, Tin coating
- 5.4 Metal spraying: (Basic Principle);
- 5.5 Finishing specifications.

## REFERENCES:

1. Basic Mechanical Engineering – M.P. Poonia & S.C. Sharma, Khanna Publishing House, Delhi
2. Elements of Mechanical Engineering – M. L. Mathur, F. S. Mehta and R. P. Tiwari, Jain Brothers, New Delhi
3. Engineering Heat Transfer – Gupta & Prakash, Nem Chand & Brothers, New Delhi
4. Workshop Technology (Vol. 1 and 2) – B. S. Raghuvanshi, Dhanpath Rai and Sons, New Delhi.
5. Basic Mechanical Engineering – J Benjamin
6. Elements of Mechanical Engineering – Roy and Choudhary
7. Engineering Thermodynamics – Spalding and Cole

\*\*\*\*\*

**MATERIAL SCIENCE & ENGINEERING**

Course Code	:	*ME 3002 (Same in MA 3002)
Course Title	:	MATERIAL SCIENCE & ENGINEERING
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	PC

**COURSE OBJECTIVES:**

- To understand crystal structures and atomic bonds.
- To understand the properties of different types of ferrous metals and alloys.
- To understand the properties of different types of non-ferrous metals and alloys.
- To understand various metallic failures and acquire the knowledge of testing of materials.
- To understand the concept of corrosion and its prevention.

**COURSE OUTCOMES:**

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

CO1	Explain about crystal structures and atomic bonds.
CO2	Describe about classification of ferrous metals and their properties.
CO3	Explain about non-ferrous metals, cutting tool materials and composites along with their properties.
CO4	Describe about the various metallic failures and knowledge in testing of materials.
CO5	Explain the principle of corrosion, their types and its prevention methods along with the various surface engineering processes.

**COURSE CONTENTS:****1. CRYSTAL STRUCTURES AND BONDS**

- 1.1 Unit cell and space lattice:
- 1.2 Crystal system:
  - 1.2.1 The seven basic crystal systems
  - 1.2.2 Atomic radius and atomic radius for Simple Cubic, BCC and FCC;
  - 1.2.3 Atomic Packing Factor for Simple Cubic, BCC, FCC and HCP;
- 1.3 Simple problems on finding number of atoms for a unit cell.
  - 1.3.1 Bonds in solids: Primary and secondary bond (Introduction)
  - 1.3.2 Types of primary bonds: Ionic, Covalent and Metallic Bonds
  - 1.3.3 Types of secondary bonds: Dispersion bond, Dipole bond and Hydrogen bond.

**2. PHASE DIAGRAMS, FERROUS METALS AND ITS ALLOYS**

- 2.1 Isomorphs, eutectic and eutectoid systems;
- 2.2 Iron-Carbon binary diagram;
- 2.3 Iron and Carbon Steels;
- 2.4 Flow sheet for production of iron and steel
- 2.5 Iron ores
- 2.6 Pig iron:
  - 2.6.1 classification
  - 2.6.2 composition and effects of impurities on iron;
- 2.7 Cast Iron:
  - 2.7.1 Classification
  - 2.7.2 Composition, properties and uses;
- 2.8 Wrought Iron
  - 2.8.1 properties, uses/applications of wrought Iron;
- 2.9 Comparison of cast iron, wrought iron and mild steel and high carbon steel;
- 2.10 standard commercial grades of steel as per BIS and AISI;
- 2.11 Alloy Steels – Types and uses;
  - 2.11.1 Stainless Steels – Types and uses

**3. NON-FERROUS METALS AND ITS ALLOYS**

- 3.1 Properties of Non-Ferrous metals

- 3.2 Copper alloys: Brasses, bronzes – composition, properties and uses;
- 3.3 Aluminium alloys: properties and uses;
- 3.4 Nickel alloys: properties and uses.
- 3.5 Types of Anti-friction/Bearing alloys:
  - 3.5.1 Standard commercial grades as per BIS/ASME.

#### 4. FAILURE ANALYSIS & TESTING OF MATERIALS

- 4.1 Introduction to failure analysis
- 4.2 Fatigue,
  - 4.2.1 endurance limit
  - 4.2.2 characteristics of fatigue fracture
  - 4.2.3 variables affecting fatigue life
- 4.3 creep
  - 4.3.1 creep curve;
  - 4.3.2 creep fracture;
- 4.4 Destructive testing (Introduction only)
  - 4.4.1 Tensile testing
  - 4.4.2 compression testing
  - 4.4.3 bend test;
  - 4.4.4 torsion test;
  - 4.4.5 fatigue test;
  - 4.4.6 creep test.
  - 4.4.7 Hardness testing
  - 4.4.8 Brinell
  - 4.4.9 Rockwell
- 4.5 Non-destructive testing:
  - 4.5.1 Visual Inspection;
  - 4.5.2 magnetic particle inspection;
  - 4.5.3 liquid penetrant test;
  - 4.5.4 ultrasonic inspection;
  - 4.5.5 radiography.

#### 5. SURFACE ENGINEERING

- 5.1 Surface engineering processes:
  - 5.1.1 Coatings and surface treatments; Cleaning and mechanical finishing of surfaces;
  - 5.1.2 Organic coatings;
  - 5.1.3 Electroplating and
  - 5.1.4 Special metallic plating;
  - 5.1.5 Electro polishing and photo-etching ;

#### REFERENCES:

1. A Text Book of Material Science & Metallurgy – O.P. Khanna, Dhanpath Rai and Sons, New Delhi. 2003.
2. Material Science & Engineering – R.K. Rajput, S.K. Kataria & Sons, New Delhi, 2004.
3. Material Science – R.S. Khurmi, S. Chand & Co. Ltd., New Delhi, 2005.

\*\*\*\*\*

**FLUID MECHANICS & HYDRAULIC MACHINERY**

Course Code	:	**ME 3003(Same as MA/MP 3003)
Course Title	:	FLUID MECHANICS & HYDRAULIC MACHINERY
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	NIL
Course Category	:	PC

**COURSE OBJECTIVES:**

- To understand fluid flow & related machinery for power generation, water supply and irrigation.
- To Select and use appropriate flow measuring device.
- To Select and use appropriate pressure measuring device.
- To understand and analyze the performance of pumps and turbines.

**COURSE OUTCOMES:**

**At the end of the course, the student will be able to:**

CO1	Measure various properties such as pressure, velocity, flow rate using various instruments.
CO2	Calculate different parameters such as co-efficient of friction, power, efficiency etc of various Systems.
CO3	Describe the construction and working of turbines and pumps.
CO4	Test the performance of turbines and pumps.
CO5	Plot characteristics curves of turbines and pumps.

**COURSE CONTENT:****1. Introduction of basic Properties of fluid**

1.1 Surface tension, Capillarity,

**1.2 Fluid Pressure & Pressure Measurement:**

1.2.1 Fluid pressure, Pressure head, Pressure intensity

1.2.2 Concept of vacuum and gauge pressures, atmospheric pressure, absolute pressure,

1.2.3 Simple and differential manometers,

1.2.4 Bourdan pressure gauge,

1.2.5 Concept of Total pressure on immersed bodies, center of pressure,

1.2.6 Simple problems on Manometers.

**2. FLUID FLOW:**

2.1 Types of fluid flows,

2.2 Continuity equation,

2.3 Bernoulli's theorem,

2.4 Principle of operation of Venturimeter,

2.5 Orifice meter

2.6 Pitot tube

2.7 Numerical problems.

2.8 Minor and major losses in pipes, Hydraulic gradient and total gradient line,

2.9 Numerical problems to estimate major and minor losses

**3. IMPACT OF JETS**

3.1 Impact of jet on fixed and vertical flat plates,

3.2 Impact of jet on curved vanes,

3.3 Simple Numericals on work done and efficiency.

**4. HYDRAULIC TURBINES**

4.1 Layout of hydroelectric power plant (Basic Concept)

4.2 Classification and selection of hydraulic turbines,

4.3 Construction and working principle of Pelton wheel,

4.4 Francis and Kaplan turbines (Derivation for work and efficiency)

4.5 Draft tubes – types and construction,

4.6 Concept of cavitation in turbines,

4.7 Simple problem related to Calculation of Work done, Power, efficiency of turbines,

4.8 Unit quantities

**5. CENTRIFUGAL PUMPS**

- 5.1 Principle working and applications of centrifugal pump (with Derivation for work done and efficiency),
- 5.2 Numericals on calculations of overall efficiency and power required to drive pumps
- 5.3 Reciprocating Pumps:
  - 5.3.1 working principle and applications of reciprocating pumps,
- 5.4 Concept of Slip,
- 5.5 Cavitation and separation.

**REFERENCES:**

1. Fluid Mechanics & Hydraulic Machines, S.S. Rattan, Khanna Publishing House, New Delhi
2. Hydraulic, fluid mechanics & fluid machines – Ramamrutham S, Dhanpath Rai and Sons, New Delhi.
3. Hydraulics and fluid mechanics including Hydraulic machines – Modi P.N. and Seth S.M., Standard Book House. New Delhi
4. One Thousand Solved Problems in Fluid Mechanics – K. Subramanya, Tata McGraw Hill.
5. Hydraulic, fluid mechanics & fluid machines – S. Ramamrutham, Dhanpat Rai and Sons, New Delhi
6. Fluid Mechanics and Hydraulic Machines – R. K. Bansal, Laxmi Publications, New Delhi

\*\*\*\*\*

(SEMESTER SCHEME-2020-21)

**MANUFACTURING ENGINEERING-I**

Course Code	:	*ME 3004 (Same in MA 3004)
Course Title	:	MANUFACTURING ENGINEERING-I
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	Basic Mechanical Engineering
Course Category	:	PC

**COURSE OBJECTIVES:**

- To understand the importance of cutting fluids & lubricants in machining.
- To study various types of basic production processes. To select, operate and control the appropriate processes for specific applications.
- To understand the concept of gear making and list various gear materials.
- To understand the importance of press tools and understand various die operations.
- To understand Grinding and finishing processes.

**COURSE OUTCOMES:**

**At the end of the course, the student will be able to:**

CO1	Know and identify basic manufacturing processes for manufacturing different components.
CO2	Operate & control different machines and equipments.
CO3	Produce jobs as per specified dimensions and inspect the job for specified dimensions.
CO4	Select the specific manufacturing process for getting the desired type of output.
CO5	Adopt safety practices while working on various machines.

**COURSE CONTENT:****1. Cutting Fluids & Lubricants:**

- 1.1 Introduction;
- 1.2 Types of cutting fluids and coolants,
- 1.3 Classification, properties and applications of lubricants

**Lathe Operations:**

- 1.4 Basic parts and their functions
- 1.5 Types of lathes,
- 1.6 Lathe Operations– Facing,Turning, step turning, taper turning, parting off, Knurling, Boring, drilling, threading,

**2. BROACHING MACHINES:**

- 2.1 Introduction and Types of broaching machines;
- 2.2 Elements of broach tool, Nomenclature and Tool materials

**Drilling:**

- 2.3 Basic study of Drill machine with specification;
- 2.4 Types of operations;
- 2.5 Types of drills and reamers.

**3. WELDING:**

- 3.1 Classification of Gas welding techniques and Types of welding flames;
- 3.2 Introduction of different types of ARC welding
- 3.3 Resistance welding -
  - 3.3.1 Spot welding,
  - 3.3.2 Seam welding,
  - 3.3.3 Projection welding;
- 3.4 Welding defects;
- 3.5 Brazing and soldering: Principles and Applications.

**1. MILLING AND GEAR MAKING:**

- 4.1 Introduction and Types of milling machines
  - 4.1.1 constructional details, specifications of milling machine
  - 4.1.2 Milling operations: simple, compound and differential indexing
  - 4.1.3 Milling cutters
  - 4.1.4 Tool & work holding devices
- 4.2 Manufacture of gears by – (Basic concept of process Only)

- 4.2.1 Casting,
- 4.2.2 Moulding,
- 4.2.3 Stamping,
- 4.2.4 Coining
- 4.2.5 Extruding,
- 4.2.6 Rolling,
- 4.2.7 Machining;
- 4.3 Gear generating methods:
  - 4.3.1 Gear Shaping with pinion cutter & rack cutter;
  - 4.3.2 Gear hobbing;

## 5 GRINDING PROCESSES:

- 5.1 Principles of metal removal by Grinding;
- 5.2 Factors affecting the selection of grind wheels:
- 5.3 Standard marking systems
- 5.4 Grinding machines classification and Construction details;
- 5.5

## REFERENCES:

1. Manufacturing technology – P N Rao, Tata McGraw-Hill Publications
2. Elements of workshop Technology (Volume I & II) – S. K. Hajra Chaudary, Bose & Roy, Media Promoters and Publishers Limited.
3. Production Technology (Volume I & II) – O. P. Khanna & Lal, Dhanpat Rai Publications.
4. Fundamental of metal cutting and machine tools– B. L. Juneja, New age international limited.
5. Manufacturing Technology, Metal Cutting & Machine tools– P. N. Rao, Tata McGraw-Hill Publications
6. Production Technology – R.B. Gupta, Satya Prakashan, New Delhi

\*\*\*\*\*



**THERMAL ENGINEERING - I**

Course Code	:	ME 3005
Course Title	:	THERMAL ENGINEERING - I
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	Basic Mechanical Engineering
Course Category	:	PC

**COURSE OBJECTIVES:**

- To give a good understanding of and thorough insight into all important aspects of thermal systems, energy control and the general issue of energy.
- To understand the principles & working of various power producing & power absorbing devices.
- To study, analyze and evaluate the operation and the performance of I.C. engines, compressors and refrigerators, to apply pinch technology and to critically analyze and describe the global behavior of integrated thermal systems.

**COURSE OUTCOMES:**

**At the end of the course, the student will be able to:**

CO1	Know various sources of Energy and their applications.
CO2	Classify I.C. engines and understand their working and constructional features.
CO3	Draw the energy flow diagram of an I.C. engine and evaluate its performance.
CO4	Describe the constructional features of air compressor and working of different air compressors.
CO5	Know the applications of refrigeration and Classify air-conditioning systems.

**COURSE CONTENT:****1. SOURCES OF ENERGY:**

- 1.1 Brief description and classification of energy Sources;
- 1.2 Solar Energy applications (Basic introduction for concept only)
- 1.3 Wind Energy (Basic introduction for concept only)
- 1.4 Tidal Energy, Ocean Thermal Energy, Geothermal Energy (Basic introduction for concept only);
- 1.5 Biogas, Biomass, Bio-diesel (Basic introduction for concept only)
- 1.6 Hydraulic Energy, Nuclear Energy (Basic introduction for concept only)
- 1.7 Fuel cell. (Basic introduction for concept only)

**2. INTERNAL COMBUSTION ENGINES:**

- 2.1 Assumptions made in air standard cycle analysis;
- 2.2 Brief description of Carnot, Otto and Diesel cycles with P-V and T-S diagrams;
- 2.3 Difference between Internal and external combustion engines;
- 2.4 advantages of I.C. engines over external combustion engines;
- 2.5 classification of I.C. engines;
- 2.6 Working with neat sketch of I.C. engine indicating component part and function of parts
- 2.7 Working of four-stroke and two-stroke petrol and diesel engines;
- 2.8 Comparison of two stroke and four stroke engines;
- 2.9 Comparison of C.I. and S.I. engines;
- 2.10 Valve timing and port timing diagrams for four stroke and two stroke engines.

**3. I.C. ENGINE SYSTEMS:**

- 3.1 Fuel system of Petrol engines;
- 3.2 Fuel system of Diesel engines;
- 3.3 Cooling system -
- 3.4 Ignition systems -
- 3.5 Types of lubricating systems used in I.C. engines;
- 3.6 Types of governing of I.C. engines;
- 3.7 Objective of super charging.

**4. PERFORMANCE OF I.C. ENGINES:**

- 4.1 Performance parameters in IC Engine
- 4.2 Performance test;
- 4.3 Morse test;

- 4.4 Heat balance sheet;
- 4.5 Methods of determination of B.P., I.P. and F.P.
- 4.6 Simple numerical problems on performance of I.C. engines.
- 5. **AIR COMPRESSORS:**
  - 5.1 Functions of air compressor;
  - 5.2 Uses of compressed air;
  - 5.3 Types of air compressors;
  - 5.4 Single stage reciprocating air compressor - its construction and working (with line diagram) using P-V diagram;
  - 5.5 Multi stage compressors – Advantages over single stage compressors;
  - 5.6 Rotary compressors:
    - 5.6.1 Centrifugal compressor,
    - 5.6.2 axial flow type compressor and
    - 5.6.3 vane type compressors

**REFERENCES:**

1. Introduction to Renewable Energy – Vaughn Nelson, CRC Press
2. Thermal Engineering – P.L. Ballaney, Khanna Publishers, 2002
3. A Course in Thermal Engineering – S. Domkundwar & C.P. Kothandaraman, Dhanpat Rai.
4. Thermal Engineering – R.S. Khurmi and J.K. Gupta, 18th Edition, S. Chand & Co, New Delhi.
5. Thermal Engineering – R. K. Rajput, 8th Edition, Laxmi publications Pvt Ltd, New Delhi.

\*\*\*\*\*

**MANUFACTURING ENGINEERING-ILAB**

Course Code	:	* ME 3006 (Same in MA 3006)
Course Title	:	MANUFACTURING ENGINEERING-I LAB
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Nil
Course Category	:	PC

**COURSE OBJECTIVES:**

- To Practice the casting principles and operations in foundry.
- To Practice the operation of Lathe.
- To Practice the joining of metals using different Welding techniques.

**COURSE CONTENT:**

S.No.	Topics for Practice
1	Moulding & casting of (i) Connecting rod (ii) Solid bearing (iii) V-Pulley/Gear Pulley
2	Arc welding (i) Lap Joint (ii) Butt Joint (iii) T- Joint
3	Gas welding (i) Lap Joint (ii) Butt Joint
4	Spot welding (i) Lap Joint
5	Turning Exercise (i) Facing, Step Turning & Chamfering (ii) Step Turning & Taper Turning (iii) Step Turning & Groove Cutting (iv) Step Turning & Knurling (v) Step Turning & Thread Cutting (vi) Turning and Drilling
6	Grinding the Lathe Cutting tools to the required angles
7	Study of Lathe, Drilling machine, shaping machine and slotting machine
8	The dismantling some of the components of lathe and then assemble the same
9	List the faults associated with lathe and its remedies
10	The routine and preventive maintenance procedure for lathe

**REFERENCE BOOKS:**

1. Elements of Workshop Technology (Volume I & II) – Hajra Chowdry & Bhattacharaya, Media Promoters, 11th Edition, 2007
2. Introduction of Basic Manufacturing Processes and Workshop Technology – Rajendersingh, New age International (P) Ltd. New Delhi, 2006
3. Workshop Technology – Raghuwanshi, Khanna Publishers. Jain & Gupta, New Delhi, 2002
4. Production Technology – Jain & Gupta, Khanna Publishers, New Delhi, 2006.
5. Production Technology – HMT, 18<sup>th</sup> edition, Tata McGraw Hill, New Delhi
6. Manufacturing process – Myro N Begman, 5<sup>th</sup> edition, Tata McGraw Hill, New Delhi

**COURSE OUTCOMES:**

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

CO1	Prepare a mould sand mix and molten metal and calculate the amount of metal to be poured in the mould
CO2	Centre the job and select the proper tool to perform the job on lathe machine.
CO3	Calculate the taper angle and practice different taper turning methods on lathe.
CO4	Prepare the edges for welding and select the suitable electrode, voltage and current.
CO5	Operate the welding transformer and generator to perform various weld joint operations.

\*\*\*\*\*

**FLUID MECHANICS & HYDRAULIC MACHINERY LAB**

Course Code	:	*ME 3007 (Same in MA 3007)
Course Title	:	FLUID MECHANICS & HYDRAULIC MACHINERY LAB
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Fluid Mechanics & Hydraulic Machinery
Course Category	:	PC

**COURSE OBJECTIVES:**

- To calibrate the given flow measuring device.
- To apply the knowledge acquired in theory subject.
- To analyse the performance of turbines and pumps.

**COURSE CONTENT:**

S.No.	Topics for practice
1	Verification of Bernoulli's theorem.
2	Determination of Coefficient of Discharge of Venturimeter.
3	Determination of Coefficient of Discharge, coefficient of contraction and coefficient of velocity of Orificemeter.
4	Determination of coefficient of friction of flow through pipes.
5	Determination of force exerted by the jet of water on the given vane.
6	Determination of minor losses of flow through pipes.
7	Calibration of pressure gauge using dead weight pressure gauge tester.
8	Trial on centrifugal pump to determine overall efficiency.
9	Trial on reciprocating pump to determine overall efficiency.
10	Trial on Pelton wheel to determine overall efficiency.
11	Trial on Francis/Kaplan turbine to determine overall efficiency.

**REFERENCES:**

N. Kumara Swamy, Fluid Mechanics and Machinery Laboratory Manual, Charotar Publishing House Pvt. Ltd., ANAND 388 001, Ed. 2008

**COURSE OUTCOMES:**

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

CO1	Measure various properties such as pressure, velocity, flow rate using various instruments.
CO2	Calculate different parameters such as co-efficient of friction, power, efficiency etc. of various systems.
CO3	Understand the need and importance of calibration of pressure gauges.
CO4	Describe the construction and working of turbines and pumps.
CO5	Test the performance of turbines and pumps and Plot characteristics curves.

\*\*\*\*\*

**THERMAL ENGINEERING-I LAB**

Course Code	:	ME 3008
Course Title	:	THERMAL ENGINEERING-I LAB
Number of Credits	:	1 (L:0; T:0; P:2)
Prerequisites	:	Thermal Engineering – I
Course Category	:	PC

**COURSE OBJECTIVES:**

- To understand the importance of fuel properties and learn the methods of determination of various properties of fuels.
- To understand the working principles of various methods used in determination of properties of fuels.
- To observe different parts of I.C. engine and understand their working.
- To identify the physical differences between S.I. and C.I. engines and 2-S and 4-S engines.

**COURSE OUTCOMES:**

**At the end of the course, the student will be able to:**

CO1	Understand the determination of flash and fire point of a given sample of fuel using given apparatus(Abels, Cleveland &Penesky martin)
CO2	Understand the determination of Viscosity of a given sample of oil using given apparatus .
CO3	Understand the determination of Calorific value of a given sample of fuel using given apparatus.
CO4	Understand the determination of amount of carbon residue of a given sample of petroleum product.
CO5	Draw VTD /PTD of given I.C. Engine and understand how the processes are controlled during its operation.
CO6	Understand the functions of various parts of IC engines and the working of IC engines.

**COURSE CONTENT:**

S.No.	Topics for practice
1	Flash & Fire point tests using Able's/Cleveland/Pensky Martin Apparatus
2	Viscosity measurement usi/Saybolt viscometer
3	Calorific value tests using Bomb Calorimeter (Solid and Liquid fuels) and Junkers Gas Calorimeter (Gaseous fuels)
4	Carbon residue test using Conradson's apparatus.
5	Assembling and disassembling of I.C. Engines
6	Port timing diagram of Petrol engine
7	Port timing diagram of Diesel engine
8	Valve timing diagram of Petrol engine
9	Valve timing diagram of Diesel engine
10	Study of petrol and diesel engine components and Models

**REFERENCES:**

1. Thermal Engineering – P.L. Ballaney, Khanna Publishers, 2002
2. A Course in Thermal Engineering – S. Domkundwar& C.P. Kothandaraman, Dhanpat Rai & Publication New Delhi
3. Thermal Engineering – R.S. Khurmi and J.K. Gupta, 18th Edition, S. Chand & Co, NewDelhi

\*\*\*\*\*

**COMPUTER AIDED MACHINE DRAWING PRACTICE**

Course Code	:	*ME 3009 (Same in MA 3009)
Course Title	:	COMPUTER AIDED MACHINE DRAWING PRACTICE
Number of Credits	:	2 (L: 0, T: 0, P: 4)
Prerequisites (Course code)	:	Engineering Graphics
Course Category	:	PC

**COURSE OBJECTIVES:**

- To use computer aided drafting,
- To prepare geometrical model of various machine elements
- To draw the different views of machine elements
- To interpret the drawing in engineering field and illustrate three dimensional objects.

**COURSE OUTCOMES:**

**At the end of the course, the student will be able to:**

CO1	Understand the representation of materials used in machine drawing
CO2	Draw the development of surfaces for sheet metal working applications.
CO3	Draw the machine elements including keys, couplings, cotters, riveted, bolted and welded joints.
CO4	Construct an assembly drawing using part drawings of machine components
CO5	Represent tolerances and the levels of surface finish of machine elements.

**COURSE CONTENTS:**

1. Introduction to CAD software.
2. Drawing aids and editing commands.
3. Basic dimensioning, hatching, blocks and views.
4. Isometric drawing, printing and plotting
5. Machine Drawing practice using Auto CAD:  
Detailed drawings of following machine parts are to be given to the students to assemble and draw the sectional or plain elevations, plans and side views with dimensioning and bill of materials using cad software (**12 exercises**).
  - 5.1 Sleeve & Cotter Joint
  - 5.2 Spigot & Cotter Joint
  - 5.3 Knuckle Joint
  - 5.4 Stuffing Box
  - 5.5 Screw Jack
  - 5.6 Foot Step Bearing
  - 5.7 Universal Coupling
  - 5.8 Plummer Block
  - 5.9 Simple Eccentric
  - 5.10 Machine Vice
  - 5.11 Connecting Rod
  - 5.12 Protected Type Flanged Coupling.

**REFERENCES:**

2. Bhatt, N.D., Machine Drawing, Charotar Publishing House, 2003.
3. Sidheswar, N., Kannaiyah, P. and Sastry, V.V.S., Machine Drawing, Tata McGraw Hill Book Company, New Delhi, 2000.
4. Kannaiyah, P., Production Drawing, New Age International, 2009

\*\*\*\*\*