BASIC MECHANICAL ENGINEERING

Course Code	:	**MA 3001 (Same as ME/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

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MATERIAL SCIENCE & ENGINEERING

Course Code	:	*MA 3002 (Same in ME 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.

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FLUID MECHANICS & HYDRAULIC MACHINERY

Course Code	:	**MA 3003(Same as ME/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

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MANUFACTURING ENGINEERING-I

Course Code	:	*MA 3004 (Same in ME 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, Nomenclatureand 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 Classificationof 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. **MILLINGAND 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 classificationand 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. HajraChaudary, 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

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AUTO THERMODYNAMICS - I

Course Code	MA 3005
Course Title	AUTO THERMODYNAMICS - I
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Basic Mechanical Engineering (MA 3001)
Course Category	PC

COURSE OBJECTIVES:

- To understand the significance of different types of energy sources and its suitability for using in I.C. engines.
- To understand the basic working principle of the I.C. engines.
- To understand fuel supply, cooling, lubrication, governing and supercharging system of I.C. engines.
- To understand the performance of the I.C. engines.
- To understand the properties of the steam and performance of the boilers.

COURSE OUTCOMES:

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

CO1	know the significance of different types of energy sources and its suitability for I.C. engines
CO2	understand the basic working principle of the I.C. engines
CO3	explain fuel supply, cooling, lubrication, governing and supercharging system of I.C. engines
CO4	evaluate the performance of the I.C. engines
CO5	know the properties of the steam and evaluate performance of the boilers

COURSE CONTENT:

1. ENERGY SOURCES OF INTERNAL COMBUSTION ENGINES

1.1 Brief description of renewable and non-renewable energy sources
1.2 Petroleum based liquid fuels
1.3 Non petroleum based liquid fuels
1.4 Gaseous fuels including CNG, LPG
1.5 Biogas, biomass and biodiesel;
1.6 Chemical structure of Petroleum fuels
1.7 Heating value of fuels (concept only)
1.8 Flash point & fire point
1.9 Complete and partial combustion of the fules
1.10 Basic required properties of fuels for I.C. engines

2. BASICS OF I.C. ENGINES

2.1 Air standard cycle and its efficiency
2.2 Compression ratio and its effect on engine efficiency
2.3 Brief description of otto, diesel and dual cycle with PV and TS diagrams
2.4 Classification of internal combustion engines
2.5 Working of 2 stroke petrol and diesel engines
2.6 Working of 4 stroke petrol and diesel engines
2.7 PV & port timing diagrams of 2 stroke Petrol and diesel engines (theoretical & actual)
2.8 PV & valve timing diagrams of 4 stroke petrol and diesel engines (theoretical & actual)
2.9 Comparison between two stroke and four stroke engines
2.10 Comparison between petrol and diesel engines

3. I.C. ENGINE SYSTEMS

3.1 Fuel system of petrol engine
3.1.1 Mechanical and electrical feed pumps

3.1.2 Concept of carburetion and air fuel ratio
3.1.3 Simple carburettor and its limitations
3.1.4 M.P.F.I. systems
3.2 Fuel system of diesel engine
3.2.1 Working of fuel pumps
3.2.2 Air and airless fuel injection
3.2.3 Types of fuel injectors
3.3 Cooling system
3.3.1 Necessity of engine cooling
3.3.2 Methods of cooling
3.3.3 Properties of coolants
3.4 Lubrication system
3.4.1 Objectives of lubrication
3.4.2 Methods of lubrication with line diagrams
3.4.3 Properties of lubricant
3.5 Governing methods of I.C. engines
3.6 Objectives of supercharging

4. I.C. ENGINES PERFORMANCE

4.1 Engine powers
4.1.1 Brake power
4.1.2 Indicated power
4.1.3 Frictional power
4.2 Measurement of brake power by dynamometer
4.3 Measurement of indicated power by
4.3.1 Engine indicator
4.3.2 Morse test
4.4 Brake and indicated mean effective pressure
4.5 Engine efficiency-
4.5.1 Volumetric efficiency
4.5.2 Brake thermal efficiency
4.5.3 Indicated thermal efficiency
4.5.4 Mechanical efficiency
4.5.5 Relative efficiency
4.6 Heat balance sheet
4.7 Simple numerical problems

5. STEAM AND STEAM GENERATORS

5.1 Difference between evaporation and boiling
5.2 Showing phase and phase change of water from -30 degree Celsius to superheated steam on temperature- enthalpy (t-h) diagram
5.3 Define and show on steam property diagrams- Saturated liquid line, saturated vapour line, liquid region, two phase (liquid - vapour) region, superheat region, critical point, triple point, saturated liquid, saturation temperature, sensible heat, latent heat, wet steam, dryness fraction, wetness fraction, dry saturated steam, superheated steam, degree of superheat, enthalpy of evaporation and enthalpy of superheat
5.4 At constant pressure determine thermodynamic properties of steam
5.4.1 Specific volume
5.4.2 Specific enthalpy
5.4.3 Specific internal energy
5.4.4 Specific entropy
5.5 Heating and expansion of steam during-
5.5.1 Hyperbolic process
5.5.2 Isothermal process
5.5.3 Polytropic process
5.6 Classification of boilers
5.7 Define boiler mountings and accessories
5.8 Special characteristics of high pressure boilers
5.9 Boiler performance-
5.9.1 Actual evaporation

5.9.2 Equivalent evaporation
5.9.3 Factor of evaporation
5.9.4 Boiler efficiency
5.9.5 Boiler power
5.9.6 Energy balance sheet

5.10 Simple numerical problems with use of steam tables and mollier chart

REFERENCE BOOKS:

1. Thermal Engineering (Hindi) - Verma & Gulecha
2. Introduction to Renewable Energy – Vaughn Nelson, CRC Press
3. Internal Combustion Engine - Mathur & Sharma
4. Thermal Engineering – R.S. Khurmi and J.K. Gupta, 18th Edition, S. Chand & Co, NewDelhi.
5. Thermal Engineering – R. K. Rajput,8th Edition, Laxmi publications Pvt Ltd, New Delhi

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MANUFACTURING ENGINEERING-I LAB

Course Code	:	*MA 3006 (Same in ME 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) – HajraChowdry&Bhattacharaya, Media Promoters, 11th Edition, 2007
2. Introduction of Basic Manufacturing Processes and Workshop Technology – Rajendersingh, New age International (P) Ltd. NewDelhi, 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, 18th edition, Tata McGraw Hill, New Delhi
6. Manufacturing process –Myro N Begman, 5th 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.

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FLUID MECHANICS & HYDRAULIC MACHINERY LAB

Course Code	:	*MA 3007 (Same in ME 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.

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AUTO THERMODYNAMICS - I LAB

Course Code	MA 3008
Course Title	AUTO THERMODYNAMICS - I LAB
Number of Credits	1(L:0 , T: 0, P: 2)
Prerequisites	Auto Thermodynamics - I (MA 3005)
Course Category	PC

COURSE OBJECTIVES:

- To understand the various properties of I.C. engine fuels.
- To understand the working of two stroke and four stroke engines
- To understand the fuel supply, cooling, lubrication, supercharging and governing systems of engines
- To understand the working of the fuel pumps
- To understand the working of boilers.

COURSE OUTCOMES:

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

CO1	Know suitable properties of the fuels for particular type of engine
CO2	know the working of two stroke and four stroke I.C. engines
CO3	Know fuel supply, cooling, lubrication, supercharging and governing systems of engines
CO4	know the working of the fuel pumps
CO5	understand the working of boilers and identify the mountings & accessories of boilers

COURSE CONTENT:

1. Find Flash & Fire point tests using Able's/ Cleveland/ Pensky Martin Apparatus and Viscosity measurement using Saybolt viscometer
2. Study of two stroke petrol and diesel engine and port timing diagram
3. Study of four stroke petrol and diesel engine and valve timing diagram
4. Study of fuel supply, supercharging/ turbocharging, and exhaust system of the I.C. engines
5. Study of cooling and lubrication system of the I.C. engines
6. To find Brake Power and prepare heat balance sheet of the engine
7. Study of carburetors and MPFI system of petrol engine
8. Study of the mechanical/ electrical fuel feed pumps of a petrol engine and fuel pump/ Testing of injector of a diesel engine
9. Study of low & high pressure boilers with the help of models
10. Identification of boiler mountings and boiler accessories of a given boiler

REFERENCE BOOKS:

1. Thermal Engineering (Hindi) - Verma & Gulecha
2. Introduction to Renewable Energy – Vaughn Nelson, CRC Press
3. Internal Combustion Engine - Mathur & Sharma
4. Thermal Engineering – R.S. Khurmi and J.K. Gupta, 18th Edition, S. Chand & Co, NewDelhi.
5. Thermal Engineering – R. K. Rajput,8th Edition, Laxmi publications Pvt Ltd, New Delhi

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COMPUTER AIDED MACHINE DRAWING PRACTICE

Course Code	:	*MA 3009 (Same in ME 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.

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

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