DETAILED SYLLABUS

Semester III

Sl. No.	Category	Code No.	Course Title	Hours per week			Total Contact Hrs/Week	Credit
				L	T	P		
1	Programme core course-1	MEPC301	Basic Mechanical Engineering	2	1	0	3	3
2	Programme core course-2	MEPC302	Thermal Engineering - I	2	1	0	3	3
3	Programme core course-3	MEPC303	Fluid Mechanics & Hydraulic Machinery	2	1	0	3	3
4	Programme core course-4	MEPC304	Manufacturing Engineering	2	0	0	2	2
5	Programme core course-5	MEPC305	Material Science & Engineering	2	0	0	2	2
6	Programme core course-6	MEPC306	Computer Aided Machine Drawing Practice	0	0	4	4	2
7	Programme core course-7	MEPC307	Fluid Mechanics & Hydraulic Machinery Lab	0	0	2	2	1
8	Programme core course-8	MEPC308	Thermal Engineering Lab-I	0	0	2	2	1
9	Programme core course-9	MEPC309	Manufacturing Engineering Lab-I	0	0	2	2	1
10	Summer Internship-I (3 to 4 weeks) after IInd Semester	MESI310	Internship	0	0	0	0	2
			Total	10	3	10	23	20

BASIC MECHANICAL ENGINEERING

Course Code	MEPC301
Course Title	Basic Mechanical Engineering
Number of Credits	3(L: 2, T: 1, P: 0)
Prerequisites	NIL
Course Category	Programme core course

Course Outcomes: - By the end of the course, the students are expected to

CO1: Understand laws of thermodynamics, thermal and thermodynamic Processes and cycles and refrigeration. (K2)
CO2: Explain basics of heat transfer and components of a thermal power plant and boiler operation. (K2)
CO3:Summarize theSteam Turbines and internal combustion engines (K2)
CO4: Identify engineering materials, their properties, manufacturing methods encountered in engineering practice (k2)
CO5: Understand functions and operations of machine tools including milling, shaping, grinding And lathe machines. (k2)

Course Content:-

Module- 1: Introduction to Thermodynamics
Number of class hours:6 hrs.

Suggestive Learning Outcomes:
1) Describe basic concepts of Thermodynamics.
2) State different laws of Thermodynamics
3) Explain different types of Thermodynamics processes and cycles.
4) Distinguish between Heat Pump & Refrigerator.

Detailed content of the unit: -
Introduction to Thermodynamics - Role of Thermodynamics in Engineering and Science,Types of Systems, Thermodynamic Equilibrium, Properties, State, Process and Cycle, Elementaryintroduction to Zeroth, First and Second laws of thermodynamics, Heat and Work Interactions forvarious non-flow and flow processes; Concept of Heat Engine, Heat Pump & Refrigerator, Efficiency/ COP; Kelvin-Planck and Clausius Statements, Carnot Cycle, Carnot Efficiency, T-S and P-V Diagrams,Concept of Entropy (Definition only).

Module- 2: Heat transfer & Thermal Power Plant:
Number of class hours:6 hrs

Suggestive Learning Outcomes:
1) Identify various modes of heat transfer.
2) Estimate Overall Heat Transfer Co-efficient.
3) Compare different types of boilers.

Detailed content of the unit: - 6 hrs
Modes of Heat Transfer; Conduction: CompositeWalls and Cylinders, Combined Conduction and Convection: Overall Heat Transfer Co-efficient, Simple Numerical Problems:
Thermal Power Plant Layout; Rankine Cycle; Fire Tube and Water Tubeboilers, Babcock & Wilcox, Cochran Boilers;

Module-3:Steam Turbines and Internal Combustion Engines
Number of class hours:6 hrs

Suggestive Learning Outcomes:
1) Distinguish between Impulse and Reaction Turbines.
2) Compare Otto, Diesel and Dual cycles.
3) Classify Internal Combustion Engine.

Steam Turbines: Impulse and Reaction Turbines; Condensers: Jet & Surface Condensers,Cooling Towers;

Internal Combustion Engines: Otto, Diesel and Dual cycles; P-V and T-S Diagrams; IC Engines: 2 - Stroke and 4 - Stroke I.C. Engines, S.I. and C.I. Engines.

Module-4: Materials and Manufacturing Processes
Number of class hours:6 hrs

Suggestive Learning Outcomes:
1)Illustrate Engineering Materials, Classification and theirProperties.
2) Describe metal working processes.
3) Discuss joining processes.

Materials and Manufacturing Processes: Engineering Materials, Classification and theirProperties; Metal Casting, Moulding, Patterns, Metal Working: Hot Working and Cold Working, Metal Forming: Extrusion, Forging, Rolling, Drawing, Gas Welding, Arc Welding, Soldering, and Brazing.

Module- 5 Machine Tools and Machining Processes:
Number of class hours:6 hrs

Suggestive Learning Outcomes:
1) Demonstrate Different types of Machine Tools and operations.
2) Differentiate Shaper and Planer Machines.

Machine Tools and Machining Processes: Machine Tools: Lathe Machine and types, LatheOperations, Milling Machine and types, Milling Operations, Shaper and Planer Machines: Differences, Quick-Return Motion Mechanism, Drilling Machine: Operations, Grinding Machine: Operations

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
225 Mechanical Engineering Curriculum Structure
6. Elements of Mechanical Engineering – Roy and Choudhary
7. Engineering Thermodynamics – Spalding and Cole ...
8. Online Swayam Moocs Courses

THERMAL ENGINEERING - I

Course Code	MEPC302
Course Title	Thermal Engineering – I
Number of Credits	3(L: 2, T: 1, P: 0)
Prerequisites	NIL
Course Category	Programme core course

Course Outcomes: - By the end of the course, the students are expected to

CO1: Explain various sources of Energy and their applications. (K2)
CO2: Classify I.C. engines and understand their working and constructional features. (K2)
CO3: Sketch the energy flow diagram of an I.C. engine and evaluate its performance. (K3)
CO4: Evaluatethe performance f an I.C. engine (K4)
CO5: Describe different types of air compressors and demonstrate the applications of refrigeration and air-conditioning systems. (K2)

Course Content:-

Module- 1: Sources of Energy

Number of class hours: 6 Hrs.

Suggestive Learning Outcomes:
1) Classify different types of energy.
2) Describe Solar Energy,WindEnergy andGeothermal Energy
3) Explain Bio-diesel; HydraulicEnergy, Nuclear Energy; Fuel cell.

Detailed content of the unit: -
Brief description of energy Sources: Classification of energy sources- Renewable, Non-Renewable; Fossil fuels, including CNG, LPG; Solar Energy: Flat plate and concentratingcollectors & its applications (Solar Water Heater, Photovoltaic Cell, Solar Distillation); WindEnergy; Tidal Energy; Ocean Thermal Energy; Geothermal Energy; Biogas, Biomass, Bio-diesel; HydraulicEnergy, Nuclear Energy; Fuel cell.

Module- 2: Internal Combustion Engines:

Number of class hours: 6 Hrs.

Suggestive Learning Outcomes:
1) Discuss various air standard cycle used in I. C. Engine.
2) Express the working and constructional features of I. C. Engine.
3) Compare Working of four-stroke andtwo-stroke petrol and diesel engines.

Detailed content of the unit: -
Assumptions made in air standard cycle analysis; Brief descriptionof Carnot, Otto and Diesel cycles with P-V and T-S diagrams; Internal and external combustionengines; advantages of I.C. engines over external combustion engines; classification of I.C.engines; neat sketch of I.C. engine indicating component parts; Function of each part and materialsused for the component parts - Cylinder, crank case, crank pin, crank, crank shaft, connecting rod,wrist pin, piston, cooling pins cylinder heads, exhaust valve, inlet valve; Working of four-stroke andtwo-stroke petrol and diesel engines; Comparison of two stroke and four stroke engines; Comparisonof C.I. and S.I. engines; Valve timing and port timing diagrams for four stroke and two strokeengines.

Module- 3: I.C. Engine Systems:

Number of class hours:6 Hrs.

Suggestive Learning Outcomes:
1) Illustrate the construction and working of Fuel system and Cooling system.
2) Describe Ignition systems and lubricating systems.
3) List various types of governing of I.C. engines.

Detailed content of the unit: -

Fuel system of Petrol engines; Principle of operation of simple and Zenithcarburettors; Fuel system of Diesel engines; Types of injectors and fuel pumps; Cooling system- air cooling, water cooling system with thermo siphon method of circulation and water cooling systemwith radiator and forced circulation (description with line diagram). Comparison of air coolingand water cooling system; Ignition systems – Battery coil ignition and magneto ignition (description and working) Comparison of two systems; Types of lubricating systems used in I.C. engines withline diagram; Types of governing of I.C. engines – hit and miss method, quantitative method, qualitativemethod and combination methods of governing; their applications; Objective of super charging.

Module- 4: Performance of I.C. Engines:
Number of class hours:6 Hrs.

Suggestive Learning Outcomes:
1) Evaluate Brake power; Indicated power; Frictional power.
2) Calculate different types of efficiency.
3) Demonstrate Performance test and Morse test.
Detailed content of the unit: -
Brake power; Indicated power; Frictional power; Brake andIndicated mean effective pressures; Brake and Indicated thermal efficiencies; Mechanical efficiency;Relative efficiency; Performance test; Morse test; Heat balance sheet; Methods of determination ofB,P., I.P. and F.P.; Simple numerical problems on performance of I.C. engines.

Module- 5: Air Compressors and Refrigeration & Air-conditioning:

Number of class hours:6 Hrs.

Suggestive Learning Outcomes:
1) Classify various types of air compressor.
2) Estimate COP of Refrigeration system.
3) Distinguish various types of Air-Conditioning system.

Detailed content of the unit: -
Functions of air compressor; Uses of compressed air; Types of air compressors;Single stage reciprocating air compressor - its construction and working (with line diagram) using P-V diagram; Multi stage compressors – Advantages over single stage compressors; Rotarycompressors: Centrifugal compressor, axial flow type compressor and vane type compressors.
Refrigeration; Refrigerant; COP; Air Refrigeration system: components, working & applications; Vapour Compression system: components, working & applications; Air conditioning; Classification of Air-conditioning systems; Comfort and Industrial Air-Conditioning; Window Air-Conditioner; Summer Air-Conditioning system, Winter Air-Conditioning system,Year-round Air-Conditioning system.

Reference Books:
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, NewDelhi.
5. Thermal Engineering – R. K. Rajput,8th Edition, Laxmi publications Pvt Ltd, New Delhi.

FLUID MECHANICS & HYDRAULIC MACHINERY

Course Code	MEPC303
Course Title	Fluid Mechanics & Hydraulic Machinery
Number of Credits	3(L: 2, T: 1, P: 0)
Prerequisites	NIL
Course Category	Programme core course

Course Outcomes: - By the end of the course, the students are expected to

CO1: Analyse various properties such as pressure, velocity, flow rate using various instruments. (K4)
CO2: Calculate different parameters such as co-efficient of friction, power, efficiency etc of various systems. (K4)
CO3:Explain the working principle of Impact of Jet. (K3).
CO4: Test the performance of turbines. (K4)
CO5: Sketch the characteristics curves of turbines and pumps. (K3)

Course Content:-

Module- 1: Properties of fluid, Fluid Pressure & Pressure Measurement
Number of class hours: 5 hrs.

Suggestive Learning Outcomes:
1) Analyze various properties of fluid.
2) CalculateFluid pressure, Pressure head, Pressure intensity.

Detailed content of the unit: -
Properties of fluid: Density, Specific gravity, Specific Weight, Specific Volume, Dynamic Viscosity,Kinematic Viscosity, Surface tension, Capillarity, Vapour Pressure, Compressibility.**Fluid Pressure & Pressure Measurement:** Fluid pressure, Pressure head, Pressure intensity, Conceptof vacuum and gauge pressures, atmospheric pressure, absolute pressure, Simple and differentialmanometers, Bourdon pressure gauge, Concept of Total pressure on immersed bodies, centre pressure, Simple problems on Manometers.

Module-2: Fluid Flow, Flow through Pipes:
Number of class hours: 6 hrs.

Suggestive Learning Outcomes:
1) Discuss various types of fluid flows.
2) State and apply Bernoulli'stheorem.
3) State and analyze Darcy's equation and Chezy's equation for frictionallosses
Detailed content of the unit: -
Types of fluid flows, Path line and Stream line, Continuity equation, Bernoulli'stheorem, Principle of operation of Venturimeter, Orifice meter and Pitot tube, Derivations for discharge,coefficient of discharge and numerical problems.

Flow Through Pipes: Laminar and turbulent flows; Darcy's equation and Chezy's equation for frictionallosses, Minor losses in pipes, Hydraulic gradient and total gradient line, Numerical problemsto estimate major and minor losses

Module-3: Impact of jets:
Number of class hours: 5 hrs

Suggestive Learning Outcomes:
1) Explain the working principle of Impact of Jet.
2) Calculate on work done and efficiency.

Detailed content of the unit: -
Impact of jet on fixed vertical, moving vertical flat plates, Impact of jet oncurved vanes with special reference to turbines & pumps, Simple Numerical on work done and efficiency.

Module-4: Hydraulic Turbines:
Number of class hours: 7hrs

Suggestive Learning Outcomes:
1) Distinguish different types of hydraulic turbines.
2) Calculate Work done, Power,efficiency of turbines.

Detailed content of the unit: -
Layout of hydroelectric power plant, Features of Hydroelectric powerplant, Classification of hydraulic turbines, Selection of turbine on the basis of head and dischargeavailable, Construction and working principle of Pelton wheel, Francis and Kaplan turbines, Drafttubes – types and construction, Concept of Cavitation in turbines, Calculation of Work done, Power,efficiency of turbines, Unit quantities and simple numerical.

Module-5: Centrifugal Pumps:,Reciprocating Pumps:
Number of class hours:**7hrs**

Suggestive Learning Outcomes:
1) Explain working and applications of Centrifugal Pumps and Reciprocating Pumps.
2) Compute Manometric efficiency and Overall efficiency.
3) Differentiate between Centrifugal Pumps and Reciprocating Pumps.

Detailed content of the unit: -
Centrifugal Pumps: Principle of working and applications, Types of casings and impellers, Concept of multistage, Priming and its methods, Cavitation, Manometric head, Work done, Manometricefficiency, Overall efficiency. Numerical on calculations of overall efficiency and power required to drive pumps.
Reciprocating Pumps: Construction and working principle and applications of single and double acting reciprocating pumps
Concept of Slip, negative slip, Cavitationand separation

Reference Books:
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., StandardBook 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

MANUFACTURING ENGINEERING

Course Code	MEPC304
Course Title	Manufacturing Engineering
Number of Credits	2(L: 2, T: 0 P: 0)
Prerequisites	NIL
Course Category	Programme core course

Course Outcomes: - By the end of the course, the students are expected to

CO1: Know and identify basic manufacturing processes for manufacturing different components.[K2]
CO2: Operate& control different machines and equipment.[K3]
CO3: Produce jobs as per specified dimensions and inspect the job for specified dimensions.[K3]
CO4: Select the specific manufacturing process for getting the desired type of output.[K1]
CO5: Employ safety practices while working on various machines.[K3]

Course Content:-

Module- 1: Cutting Fluids & Lubricants, Lathe Operations:

Number of class hours: 5hrs.

Suggestive Learning Outcomes:
1) Identify basic manufacturing processes.
2) Indicate Properties and applicationsof lubricants.
3) Demonstrate various operations of Lathe.

Detailed content of the unit: -
Introduction; Types of cutting fluids, Fluids and coolants requiredin turning, drilling, shaping, sawing & broaching; Selection of cutting fluids, methods of applicationof cutting fluid; Classification of lubricants (solid, liquid, gaseous), Properties and applicationsof lubricants.

Lathe Operations: Types of lathes – light duty, Medium duty and heavy duty geared lathe, CNC lathe;Specifications; Basic parts and their functions; Operations and tools – Turning, parting off, Knurling , facing, Boring, drilling, threading, step turning, taper turning.

Module- 2: Broaching Machines:
Number of class hours:5hrs.

Suggestive Learning Outcomes:
1) Operate different types of broaching machines.
2)Operate and Control of drilling machine

Detailed content of the unit: -
Introduction to broaching; Types of broaching machines – Horizontaltype (Single ram & duplex ram), Vertical type, Pull up, pull down, and push down; Elements of broachtool; broach teeth details; Nomenclature; Tool materials.
Drilling: Classification, Basic parts and their functions, Radial drilling machine, types of operations;Specifications of drilling machine, Types of drills and reamers

Module- 3: Welding&Milling
Number of class hours:5hrs.

Suggestive Learning Outcomes:
1) Explain different types of welding techniques.
2) Describe different types ofmilling operations

Detailed content of the unit: -
Classification; Gas welding techniques; Types of welding flames; Arc Welding –Principle, Equipment, Applications; Shielded metal arc welding; Submerged arc welding; TIG / MIGwelding; Resistance welding - Spot welding, Seam welding, Projection welding; Welding defects;Brazing and soldering: Types, Principles, Applications.
Milling: Introduction; Types of milling machines: plain, Universal, vertical; constructional details– specifications; Milling operations: simple, compound and differential indexing; Milling cutters –types; Nomenclature of teeth; Teeth materials; Tool signature of milling cutter; Tool & work holdingdevices.

Module- 4: Gear Making and Press working
Number of class hours:5hrs.

Suggestive Learning Outcomes:
1) Describe different types of gear manufacturing processes.
2) Define various Press working operations.

Detailed content of the unit: -
Manufacture of gears – by Casting, Moulding, Stamping, Coining Extruding,Rolling, Machining; Gear generating methods: Gear Shaping with pinion cutter & rack cutter;Gear hobbing; Description of gear hob; Operation of gear hobbing machine; Gear finishing processes;

Gear materials and specification; Heat treatment processes applied to gears.
Press working: Types of presses and Specifications, Press working operations - Cutting, bending,drawing, punching, blanking, notching, lancing; Die set components- punch and die shoe, guide pin,bolster plate, stripper, stock guide, feed stock, pilot; Punch and die clearances for blanking and piercing,effect of clearance.

Module- 5: Grinding and finishing processes:
Number of class hours:5hrs.

Suggestive Learning Outcomes:
1) Select suitable grinding wheels for different operations.
2) Describe different finishing operations.

Detailed content of the unit: -
Principles of metal removal by Grinding; Abrasives –Natural & Artificial; Bonds and binding processes: Vitrified, silicate, shellac, rubber, Bakelite; Factorsaffecting the selection of grind wheels: size and shape of wheel, kind of abrasive, grain size, gradeand strength of bond, structure of grain, spacing, kinds of bind material; Standard marking systems:Meaning of letters & numbers sequence of marking, Grades of letters; Grinding machines classification:Cylindrical, Surface, Tool & Cutter grinding machines; Construction details; Principle of centre-lessgrinding; Advantages & limitations of centre less grinding; Finishing by grinding: Honing,Lapping, Super finishing; Electroplating: Basic principles, Plating metals, applications; Hot dipping:Galvanizing, Tin coating, Parkerising, Anodizing; Metal spraying: wire process, powder process and applications; Organic coatings: Oil base Paint, Lacquer base, Enamels, Bituminous paints, rubberbased coating; Finishing specifications.

Reference Books:
1. Manufacturing technology – P N Rao, Tata McGraw-Hill Publications
2. Elements of workshop Technology (Volume I & II) – S. K. Hajra Chaudary, Bose & Roy, MediaPromoters 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

MATERIAL SCIENCE & ENGINEERING

Course Code	MEPC305
Course Title	Material Science & Engineering
Number of Credits	2(L: 2, T: 0, P: 0)
Prerequisites	NIL
Course Category	Programme core course

Course Outcomes: - By the end of the course, the students are expected to

CO1 Explain about crystal structures and atomic bonds. (K2)
CO2 Describe about classification of ferrous metals and their properties.(K2)
CO3 Explain about non-ferrous metals, cutting tool materials and composites alongwith their properties.(K2)
CO4 Describe about the various metallic failures and knowledge in testing ofmaterials. (K2)
CO5 Explain the principle of corrosion, their types and its prevention methods alongwith the various surface engineering processes.(K2)

Course Content:-

Module- 1: Crystal structures and Bonds:
Number of class hours: 5 Hrs.

Suggestive Learning Outcomes:
1) Explain basic crystal systems.
2) Describe different types of bonding.

Detailed content of the unit: -
Unit cell and space lattice: Crystal system: The seven basic crystal systems; Crystal structure for metallic elements: BCC, FCC and HCP; Coordination number for Simple Cubic, BCC and FCC; Atomic radius: definition, atomic radius for Simple Cubic, BCC and FCC;Atomic Packing Factor for Simple Cubic, BCC, FCC and HCP; Simple problems on finding number ofatoms for a unit cell.
Bonds in solids: Classification - primary or chemical bond, secondary or molecular bond; Types of primary bonds: Ionic, Covalent and Metallic Bonds; Types of secondary bonds: Dispersion bond,Dipole bond and Hydrogen bond.

Module- 2: Phase diagrams, ferrous metals and its Alloys:
Number of class hours:5 Hrs.

Suggestive Learning Outcomes:
1) Interpret Iron-Carbon binary diagram.
2) Classify different type ferrous metals and its alloys.
3) Understand standard commercial grades of steel as per BIS and AISI.

Detailed content of the unit: -
Isomorphs, eutectic and eutectoid systems;
Iron-Carbon binary diagram; Iron and Carbon Steels; flow sheet for production of iron and steel; Iron ores – Pig iron: classification, composition and effects of impurities on iron; Cast Iron: classification,composition, properties and uses; Wrought Iron: properties, uses/applications of wroughtIron; comparison of cast iron, wrought iron and mild steel and high carbon steel; standard commercialgrades of steel as per BIS and AISI; Alloy Steels – purpose of alloying; effects of alloying elements– Important alloy steels: Silicon steel, High Speed Steel (HSS), heat resisting steel, spring steel,Stainless Steel (SS): types of SS, applications of SS – magnet steel – composition, properties and uses

Module-3: Non-ferrous metals and its Alloys:
Number of class hours:5 Hrs.

Suggestive Learning Outcomes:
1) Summarised properties and uses ofNon-ferrous metals and its Alloys.
2) Discuss various types of bearingalloys

Detailed content of the unit: -

Properties and uses of aluminium, copper, tin, lead,zinc, magnesium and nickel; Copper alloys: Brasses, bronzes – composition, properties and uses;Aluminium alloys: Duralumin, hindalium, magnelium – composition, properties and uses; Nickel alloys:Inconel, Monel metal, nichcrome – composition, properties and uses. Anti-friction/Bearing alloys:Various types of bearing bronzes - Standard commercial grades as per BIS/ASME.

Module-4: Failure analysis & Testing of Materials:
Number of class hours:5 Hrs.

Suggestive Learning Outcomes:
1) Describe about the various metallic failures in metals.
2) Demonstrate different types Destructive testing andNon-destructive testing.
3) Compute the Brinell and Rockwell hardness number.

Detailed content of the unit: -
Introduction to failure analysis; Fracture: ductilefracture, brittle fracture; cleavage; notch sensitivity; fatigue; endurance limit; characteristics of fatiguefracture; variables affecting fatigue life; creep; creep curve; creep fracture; Destructive testing:Tensile testing; compression testing; Hardness testing: Brinell, Rockwell; bend test; torsion test; fatiguetest; creep test. Non-destructive testing: Visual Inspection; magnetic particle inspection; liquidpenetrate test; ultrasonic inspection; radiography.

Module-5: Corrosion & Surface Engineering:
Number of class hours:5 Hrs.

Suggestive Learning Outcomes:
1) Explain the principle of corrosion.
2) Describe various surface engineering processes
3) UnderstandPollution norms for treating effluents as per standards.

Detailed content of the unit: -

Nature of corrosion and its causes; Electrochemical reactions;Electrolytes; Factors affecting corrosion: Environment, Material properties and physical conditions;Types of corrosion; Corrosion control: Material selection, environment control and design;
Surface engineering processes: Coatings and surface treatments; Cleaning and mechanical finishingof surfaces; Organic coatings; Electroplating and Special metallic plating; Electro polishing and photo-etching; – Conversion coatings: Oxide, phosphate and chromate coatings; Thin film coatings: PVDand CVD; Surface analysis; Hard-facing, thermal spraying and high-energy processes; Process/materials election. Pollution norms for treating effluents as per standards

Reference Books:
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.

COMPUTER AIDED MACHINE DRAWING PRACTICE

Course Code	MEPC306
Course Title	Computer Aided Machine Drawing Practice
Number of Credits	2 (L: 0, T: 0, P: 4)
Prerequisites	Engineering Graphics
Course Category	Programme core course

Course Outcomes: - By the end of the course, the students are expected to
CO1: Understand the representation of materials used in machine drawing. (K2)
CO2: Draw the development of surfaces for sheet metal working applications. (K3)
CO3: Draw the machine elements including keys, couplings, cotters, riveted, bolted and welded Joints. (K3)

CO4: Construct an assembly drawing using part drawings of machine components. (K5)
CO5: Able to create 3-D modelling of an article and show the intricate parts of the components. (K3)

Course Content:-

List of Practical's/Activities (To perform minimum 6 practical)

Introduction to CAD software
Drawing aids and editing commands
Basic dimensioning, hatching, blocks and views
Isometric drawing, printing and plotting
Machine drawing practice using Auto CAD: (Detailed drawings of following machine partsare to be given to the students to assemble and draw the sectional or plain elevations, plansand side views with dimensioning and bill of materials using cad software.)

1. Sleeve & Cotter Joint
2. Spigot & Cotter Joint
3. Knuckle Joint
4. Stuffing Box
5. ScrewJack
6. Foot Step Bearing
7. Universal Coupling
8. Plummer Block
9. Machine Vice
10. Connecting Rod
11. Protected Type Flanged Coupling.

Reference Books:

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

FLUID MECHANICS & HYDRAULIC MACHINERY LAB

Course Code	MEPC307
Course Title	Fluid Mechanics & Hydraulic Machinery Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Fluid Mechanics & Hydraulic Machinery
Course Category	Programme core course

Course Outcomes: - By the end of the course, the students are expected to

CO1:Measure various properties such as pressure, velocity, flow rate using various instruments. (K5)

CO2: Calculate different parameters such as co-efficient of friction, power, efficiency etc. of varioussystems. (K4)

CO3: Understand the need and importance of calibration of pressure gauges. (K2)

CO4: Describe the construction and working of turbines and pumps.(K2)

CO5: Test the performance of turbines and pumps and Plot characteristics curves. (K5)

List of Practical /Activities (To perform minimum 6 practical)

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 Orifice meter
1. Determination of coefficient of friction of flow through pipes.
2. Determination of force exerted by the jet of water on the given vane.
3. Determination of minor losses of flow through pipes.
4. Calibration of pressure gauge using dead weight pressure gauge tester.
5. Trial on centrifugal pump to determine overall efficiency.
6. Trial on reciprocating pump to determine overall efficiency.
7. Trial on Pelton wheel to determine overall efficiency.
8. Trial on Francis turbine to determine overall efficiency.
9. Trial on Kaplan turbine to determine overall efficiency.

THERMAL ENGINEERING LAB-I

Course Code	MEPC308
Course Title	Thermal Engineering Lab-I
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Thermal Engineering – I
Course Category	Programme core course

Course Outcomes: - By the end of the course, the students are expected to

CO1: Understand the determination of flash and fire point of a given sample of fuel using given Apparatus(Abels, Cleveland &Penesky martin) (K2)

CO2: Understand the determination of Viscosity of a given sample of oil using given apparatus. (K2)

CO3: Understand the determination of Calorific value of a given sample of fuel using given apparatus. (K2)

CO4:Understand the determination of amount of carbon residue of a given sample of petroleum product.(K2)

CO5: Understand the functions of various parts of IC engines and the working of IC engines.(K2)

List of Practical/Activities (To perform minimum 6 practical)

1. Flash & Fire point tests using Able's/Cleveland/Pensky Martin Apparatus
2. Viscosity measurement, 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

Reference Books:

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, New Delhi

MANUFACTURING ENGINEERING LAB-I

Course Code	MEPC309
Course Title	Manufacturing Engineering Lab-I
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Manufacturing Engineering
Course Category	Programme core course

Course Outcomes: - By the end of the course, the students are expected to

CO1: Prepare a mould sand mix and molten metal and calculate the amount of metal to bepoured in the mould. (K3)
CO2: Centre the job and select the proper tool to perform the job on lathe machine. (K5)
CO3: Calculate the taper angle and practice different taper turning methods on lathe. (K4)
CO4: Prepare the edges for welding and select the suitable electrode, voltage and current. (K3)
CO5: Operate the welding transformer and generator to perform various weld joint operations. (K3)

List of Practical's/Activities(To perform minimum 6 practical)

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
6. (i) Step Turning & Groove Cutting (ii) Step Turning && Knurling (iii) Step Turning &
7. (i) Thread Cutting (ii) Turning and Drilling
8. Grinding the Lathe Cutting tools to the required angles
9. Study of Lathe, Drilling machine, shaping machine and slotting machine
10. The dismantling some of the components of lathe and then assemble the same
11. List the faults associated with lathe and its remedies
12. The routine and preventive maintenance procedure for lathe

Reference Books:

1. Elements of Workshop Technology (Volume I & II) – Hajra Choudhary& Bhattacharaya, Media
Promoters, 11th Edition, 2007
2. Introduction of Basic Manufacturing Processes and Workshop Technology – Rajender Singh, 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, 5 th edition, Tata McGraw Hill, New Delhi -

Summer Internship-I

Course Code	MESI-310
Course Title	Summer Internship-I
Number of Credits	2 (L: 0, T: 0, P: 0)
Prerequisites	Nil
Course Category	Internship

Internships may be full-time or part-time; they are full-time in the summer vacation and part-time during the academic session.

Sl. no.	Schedule	Duration	Activities	Credits	Hours of Work
1	Summer Vacation after 2nd Semester	3-4 Weeks	Inter/ Intra Institutional Activities **	2	80 Hours

(** Students are required to be involved in Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the respective Institutions; contribution at incubation/ innovation /entrepreneurship cell of the Institute; participation in conferences/ workshops/ competitions etc.; Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop; Working for consultancy/ research project within the Institutes and Participation in all the activities of Institute's Innovation Council for e.g.: IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.)

Benefits to Students:

1. An opportunity to get hired by the Industry/ organization.
2. Practical experience in an organizational setting.
3. Excellent opportunity to see how the theoretical aspects learned in classes are integrated into the practical world. On-floor experience provides much more professional experience which is often worth more than classroom teaching.
4. Helps them decide if the industry and the profession is the best career option to pursue.
5. Opportunity to learn new skills and supplement knowledge.
6. Opportunity to practice communication and teamwork skills.
7. Opportunity to learn strategies like time management, multi-tasking etc. in an industrial setup.
8. Opportunity to meet new people and learn networking skills.
9. Makes a valuable addition to their resume.
10. Enhances their candidacy for higher education.

11. Creating network and social circle and developing relationships with industry people.
12. Provides opportunity to evaluate the organization before committing to a full-time position.

Course Outcome:-

After completion of the course, students will be able to:

C.O.1: Explain the real life organizational and industrial environment situations (K2).

C.O.2: Develop organizational dynamics in terms of organizational behaviour, culture and professional ethics (K1).

C.O.3: Understand the importance of Team work (K2).

C.O.4: Explain invaluable knowledge and networking experience (K2).

C.O.5: Develop skill to build a relationship with a prospective employer (K3).

Course Content:-

Internships are educational and career development opportunities, providing practical experience in a field or discipline. The Summer Internship-I is a student centric activity that would expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry. They are structured, short-term, supervised placements often focused around particular tasks or projects with defined timescales. An internship may be compensated, non-compensated or some time may be paid. The internship has to be meaningful and mutually beneficial to the intern and the organization. It is important that the objectives and the activities of the internship program are clearly defined and understood. Following are the intended objectives of internship training:

1. Will expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
2. Provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required at the job.
3. Exposure to the current technological developments relevant to the subject area of training.
4. Experience gained from the 'Industrial Internship' in classroom will be used in classroom discussions.
5. Create conditions conducive to quest for knowledge and its applicability on the job.
6. Learn to apply the Technical knowledge in real industrial situations.
7. Gain experience in writing Technical reports/projects.
8. Expose students to the engineer's responsibilities and ethics.
9. Familiarize with various materials, processes, products and their applications along with relevant aspects of quality control.

10. Promote academic, professional and/or personal development.
11. Expose the students to future employers.
12. Understand the social, economic and administrative considerations that influence the working environment of industrial organizations
13. Understand the psychology of the workers and their habits, attitudes and approach to problem solving.

Overall compilation of Internship Activities / Credit Framework:

Major Head of Activity	Credit	Schedule	Total Duration	Sub Activity Head	Proposed Document as Evidence	Evaluated by	Performance appraisal/ Maximum points/ activity
Inter/ Intra Institutional Activities	2	Summer Vacation after 2nd Semester	3-4 Weeks	Inter/ Intra Institutional Workshop/ Training	Certificate	Programme Head	Satisfactory/ Good/ Excellent
				Working for consultancy/ research project	Certificate	Programme Head	Satisfactory/ Good/ Excellent
				Festival (Technical / Business / Others) Events	Certificate	Programme Head	Satisfactory/ Good/ Excellent
				Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation Council	Certificate	Cell In-charge	Satisfactory/ Good/ Excellent
				Learning at Departmental Lab/Tinkering Lab/ Institutional workshop	Certificate	Cell In-charge	Satisfactory/ Good/ Excellent

STUDENT'S DIARY/ DAILY LOG

The main purpose of writing daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the students' thought process and reasoning abilities. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students.

The daily training diary should be signed at the end of each day by the supervisor/ in charge of the section where the student has been working. The diary should also be shown to the Faculty Mentor visiting the industry from time to time and get ratified on the day of his visit.

Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training. It will be evaluated on the basis of the following criteria:

a) Regularity in maintenance of the diary.
b) Adequacy & quality of information recorded.
c) Drawings, sketches and data recorded.
d) Thought process and recording techniques used.
e) Organization of the information.

INTERNSHIP REPORT

After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period. The student may contact Industrial Supervisor/ Faculty Mentor/TPO for assigning special topics and problems and should prepare the final report on the assigned topics. Daily diary will also help to a great extent in writing the industrial report since much of the information has already been incorporated by the student into the daily diary. The training report should be signed by the Internship Supervisor, TPO and Faculty Mentor. The Internship report will be evaluated on the basis of following criteria:

a) Originality.
b) Adequacy and purposeful write-up.
c) Organization, format, drawings, sketches, style, language etc.
d) Variety and relevance of learning experience.
e) Practical applications, relationships with basic theory and concepts taught in the course.

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