



**MOTHERHOOD UNIVERSITY**

Roorkee-Dehradun Road, Village Karoundi Post Bhagwanpur, Tehsil-Roorkee, Uttarakhand, India

# **MOTHERHOOD UNIVERSITY, Roorkee**

**ENLIGHTENING WORLD**

**DIPLOMA IN ENGINEERING  
(MECHANICAL ENGINEERING)  
II Year/3<sup>RD</sup> SEMESTER**

[Academic Session 2022-2023 onwards]





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## EVALUATION SCHEME – SEMESTER III – Mechanical Engineering

Sr. No.	Subject Code	Subject Name	Effective Teaching			Credits	Evaluation Scheme		
			L	T	P		Internal Assessment	End Term	Total Marks
			Hours/Week						
<b>THEORY</b>									
1	MDEME22-301T	Fluid Mechanics & Hydraulic Machinery	2	1	0	3	30	70	100
2	MDEME22-302T	Manufacturing Engineering	3	0	0	3	30	70	100
3	MDEME22-303T	Thermal Engineering - I	3	0	0	3	30	70	100
4	MDEME22-304T	Basic Mechanical Engineering	2	1	0	3	30	70	100
5	MDEME22-305T	Material Science & Engineering	3	0	0	3	30	70	100
<b>TOTAL</b>			<b>13</b>	<b>2</b>	<b>-</b>	<b>15</b>	<b>150</b>	<b>350</b>	<b>500</b>
<b>PRACTICAL/PROJECT</b>									
6	MDEME22-351P	Fluid Mechanics & Hydraulic Machinery Lab	0	0	2	1	20	30	50
7	MDEME22-352P	Manufacturing Engineering Lab	0	0	2	1	20	30	50
8	MDEME22-353P	Thermal Engineering I - Lab	0	0	2	1	20	30	50
9	MDEME22-356P	Computer Aided Machine Drawing Practice	0	0	2	1	20	30	50
10	MDEME22-357I	Summer Internship-I	0	0	0	2	40	60	100
<b>TOTAL</b>			<b>-</b>	<b>-</b>	<b>10</b>	<b>6</b>	<b>120</b>	<b>180</b>	<b>300</b>



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<b>MDEME22-301T</b>	<b>Fluid Mechanics and Hydraulic Machinery</b>	<b>2L:1T:2P</b>	<b>3T + 1P Credits</b>
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## COURSE OBJECTIVES

The objectives of the course are:

- 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 ,students will be able to:		Blooms Level
<b>CO1</b>	Measure various properties such as pressure, velocity, and flow rate using various instruments.	<b>K1</b>
<b>CO2</b>	Calculate different parameters such as co-efficient of friction, power, and efficiency of various systems.	<b>K2</b>
<b>CO3</b>	Describe the construction and working of turbines and pumps.	<b>K2</b>
<b>CO4</b>	Test the performance of turbines and pumps.	<b>K2</b>
<b>CO5</b>	Plot characteristics curves of turbines and pumps.	<b>K2</b>

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5-Evaulate, K6- Create

## SYLLABUS

**UNIT-I: Properties of fluid:** Density, Specific gravity, Specific Weight, Specific Volume, Dynamic Vis-cosity, Kinematic Viscosity, Surface tension, Capillarity, Vapour Pressure, Compressibility.

**Fluid Pressure & Pressure Measurement:** Fluid pressure, Pressure head, Pressure intensity, Concept of vacuum and gauge pressures, atmospheric pressure, absolute pressure, Simple and differential manometers, Bourdan pressure gauge, Concept of Total pressure on immersed bodies, center of pressure, Simple problems on Manometers.

**Unit-II: Fluid Flow:** Types of fluid flows, Path line and Stream line, Continuity equation, Bernoulli's theorem, Principle of operation of Venturimeter, Orifice meter and Pitot tube, Derivations for dis- charge, coefficient of discharge and numerical problems.

**Flow Through Pipes:** Laminar and turbulent flows; Darcy's equation and Chezy's equation for fric- tional losses, Minor losses in pipes, Hydraulic gradient and total gradient line, Numerical problems to estimate major and minor losse.



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**Unit-III: Impact of jets:** Impact of jet on fixed vertical, moving vertical flat plates, Impact of jet on curved vanes with special reference to turbines & pumps, Simple Numericals on work done and efficiency.

**Unit-IV: Hydraulic Turbines:** Layout of hydroelectric power plant, Features of Hydroelectric powerplant, Classification of hydraulic turbines, Selection of turbine on the basis of head and discharge available, Construction and working principle of Pelton wheel, Francis and Kaplan turbines, Draft tubes – types and construction, Concept of cavitation in turbines, Calculation of Work done, Power, efficiency of turbines, Unit quantities and simple numerical.

**Unit-V: Centrifugal Pumps:** Principle of working and applications, Types of casings and impellers, Concept of multistage, Priming and its methods, Cavitation, Manometric head, Work done, Manometric efficiency, Overall efficiency. Numerical on calculations of overall efficiency and power required to drive pumps.

**Reciprocating Pumps:** Construction, working principle and applications of single and double acting reciprocating pumps, Concept of Slip, Negative slip, Cavitation and separation.

## RECOMMENDED 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., 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

List of Practical's	
I	Verification of Bernoulli's theorem.
II	Determination of Coefficient of Discharge of Venturimeter.
III	Determination of Coefficient of Discharge, coefficient of contraction and coefficient of velocity of Orificemeter.
IV	Determination of coefficient of friction of flow through pipes.
V	Determination of force exerted by the jet of water on the given vane.
VI	Determination of minor losses of flow through pipes.
VII	Calibration of pressure gauge using dead weight pressure gauge tester.
VIII	Trial on centrifugal pump to determine overall efficiency.



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<b>MDEME22-302T</b>	<b>Manufacturing Engineering</b>	<b>3L:0T:2P</b>	<b>3T + 1P Credits</b>
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## COURSE OBJECTIVES

### The objectives of the course are:

- 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, students will be able to:		Blooms Level
<b>CO1</b>	Know and identify basic manufacturing processes for manufacturing different components.	<b>K1</b>
<b>CO2</b>	Operate & control different machines and equipment's.	<b>K2</b>
<b>CO3</b>	Produce jobs as per specified dimensions and inspect the job for specified dimensions.	<b>K2</b>
<b>CO4</b>	Select the specific manufacturing process for getting the desired type of output.	<b>K2</b>
<b>CO5</b>	Adopt safety practices while working on various machines.	<b>K2</b>

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5-Evaluate, K6- Create

## SYLLABUS

**UNIT-I: Cutting Fluids & Lubricants:** Introduction; Types of cutting fluids, Fluids and coolants re- quired in turning, drilling, shaping, sawing & broaching; Selection of cutting fluids, methods of appli- cation of cutting fluid; Classification of lubricants (solid, liquid, gaseous), Properties and applications of 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

**Unit-II: Broaching Machines:** Introduction to broaching; Types of broaching machines – Horizontal type (Single ram & duplex ram), Vertical type, Pull up, pull down, and push down; Elements of broach tool; broach teeth details; Nomenclature; Tool materials.

**Drilling:** Classification; Basic parts and their functions; Radial drilling machine; Types of operations;



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Specifications of drilling machine; Types of drills and reamers.

**Unit-III: Welding:** Classification; Gas welding techniques; Types of welding flames; Arc Welding – Principle, Equipment, Applications; Shielded metal arc welding; Submerged arc welding; TIG / MIG welding; 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 holding devices.

**Unit-IV: Gear Making:** 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 hobbling 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.

**Unit-V: Grinding and finishing processes:** Principles of metal removal by Grinding; Abrasives – Natural & Artificial; Bonds and binding processes: Vitrified, silicate, shellac, rubber, Bakelite; Factors affecting the selection of grind wheels: size and shape of wheel, kind of abrasive, grain size, grade and 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 centerless grinding; 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, rubber base coating; Finishing specifications.

## RECOMMENDED 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, 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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<b>List Of Practical's</b>	
I	Molding & casting of (i) Connecting rod (ii) Solid bearing (iii) V-Pulley/Gear Pulley
II	Arc welding (i) Lap Joint (ii) Butt Joint (iii) T- Joint
III	Gas welding (i) Lap Joint (ii) Butt Joint
IV	Spot welding (i) Lap Joint
V	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
VI	Grinding the Lathe Cutting tools to the required angles
VII	Study of Lathe, Drilling machine, shaping machine and slotting machine
VIII	The dismantling some of the components of lathe and then assemble the same
IX	List the faults associated with lathe and its remedies
X	The routine and preventive maintenance procedure for lathe



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<b>MDEME22-303T</b>	<b>Thermal Engineering - I</b>	<b>3L:0T:2P</b>	<b>3T + 1P Credits</b>
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## COURSE OBJECTIVES

The objectives of the course are:

- 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 ,students will be able to:		Blooms Level
<b>CO1</b>	Know various sources of Energy and their applications.	<b>K1</b>
<b>CO2</b>	Classify I.C. engines and understand their working and constructional features.	<b>K2</b>
<b>CO3</b>	Draw the energy flow diagram of an I.C. engine and evaluate its performance.	<b>K2</b>
<b>CO4</b>	Describe the constructional features of air compressor and working of different air compressors.	<b>K2</b>
<b>CO5</b>	Know the applications of refrigeration and Classify air-conditioning systems.	<b>K2</b>

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5-Evaluate, K6- Create

## SYLLABUS

**UNIT-I: Sources of Energy:** Brief description of energy Sources: Classification of energy sources Renewable, non-Renewable; Fossil fuels, including CNG, LPG; Solar Energy: Flat plate and concentrating collectors & its applications (Solar Water Heater, Photovoltaic Cell, Solar Distillation); Wind Energy; Tidal Energy; Ocean Thermal Energy; Geothermal Energy; Biogas, Biomass, Bio-diesel; Hydraulic Energy, Nuclear Energy; Fuel cell.

**Unit-II: Internal Combustion Engines:** Assumptions made in air standard cycle analysis; Brief description of Carnot, Otto and Diesel cycles with P-V and T-S diagrams; Internal and external combustion engines; 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 materials used 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 and two-stroke petrol and diesel engines; Comparison of two stroke and four stroke





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engines; Comparison of C.I. and S.I. engines; Valve timing and port timing diagrams for four stroke and two stroke engines.

**Unit-III: I.C. Engine Systems:** Fuel system of Petrol engines; Principle of operation of simple and Zenith carburetors; 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 system with radiator and forced circulation (description with line diagram). Comparison of air cooling and 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 with line diagram; Types of governing of I.C. engines – hit and miss method, quantitative method, qualitative method and combination methods of governing; their applications; Objective of super charging.

**Unit-IV: Performance of I.C. Engines:** Brake power; Indicated power; Frictional power; Brake and Indicated mean effective pressures; Brake and Indicated thermal efficiencies; Mechanical efficiency; Relative efficiency; Performance test; Morse test; Heat balance sheet; Methods of determination of B.P., I.P. and F.P.; Simple numerical problems on performance of I.C. engines.

**Unit-V: Air Compressors:** 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; Rotary compressors: Centrifugal compressor, axial flow type compressor and vane type compressors. Refrigeration & Air-conditioning: Refrigeration; Refrigerant; COP; Air Refrigeration system: components, working & applications; Vapor 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.

## RECOMMENDED 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.



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<b>List Of Practical's</b>	
I	Assembling and disassembling of I.C. Engines
II	Port timing diagram of Petrol engine
III	Port timing diagram of Diesel engine
IV	Valve timing diagram of Petrol engine
V	Valve timing diagram of Diesel engine
VI	Study of petrol and diesel engine components and Models
VII	Flash & Fire point tests using Able's/Cleveland/Pensky Martin Apparatus
VIII	Calorific value tests using Bomb Calorimeter (Solid and Liquid fuels) and Junkers Gas Calorimeter (Gaseous fuels)



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<b>MDEME22-304T</b>	<b>Basic Mechanical Engineering</b>	<b>2L:1T:0P</b>	<b>3T Credits</b>
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## COURSE OBJECTIVES

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

## COURSE OUTCOMES

<b>At the end of the course ,students will be able to:</b>		<b>Blooms Level</b>
<b>CO1</b>	Understand basics of thermodynamics and components of a thermal power plant.	<b>K1</b>
<b>CO2</b>	Understand basics of heat transfer, refrigeration and internal combustion engines.	<b>K2</b>
<b>CO3</b>	Understand mechanism of thermal power plant and boiler operation.	<b>K2</b>
<b>CO4</b>	Identify engineering materials, their properties, manufacturing methods encountered in engineering practice.	<b>K2</b>
<b>CO5</b>	Understand functions and operations of machine tools including milling, shaping, grinding and lathe machines.	<b>K2</b>

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5-Evaluate, K6- Create

## SYLLABUS

**Unit-I: Introduction to Thermodynamics:** Role of Thermodynamics in Engineering and Science, Types of Systems, Thermodynamic Equilibrium, Properties, State, Process and Cycle, Elementary introduction to Zeroth, First and Second laws of thermodynamics, Heat and Work Interactions for various 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).

**Unit-II: Heat transfer & Thermal Power Plant:** Modes of Heat Transfer; Conduction: Composite Walls and Cylinders, Combined Conduction and Convection: Overall Heat Transfer Co-efficient, Simple Numerical Problems: Thermal Power Plant Layout; Rankine Cycle; Fire Tube and Water Tube boilers, Babcock & Wilcox, Cochran Boilers;



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**Unit-III: Steam Turbines:** Impulse and Reaction Turbines; Condensers: Jet & Surface Condensers, Cooling Towers; Internal Combustion Engines and Refrigeration: 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.

**Unit-IV: Materials and Manufacturing Processes:** Engineering Materials, Classification and their Properties; Metal Casting, Molding, Patterns, Metal Working: Hot Working and Cold Working, Metal Forming: Extrusion, Forging, Rolling, Drawing, Gas Welding, Arc Welding, Soldering, and Brazing.

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

## RECOMMENDED BOOKS

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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<b>MDEME22-305T</b>	<b>Material Science &amp; Engineering</b>	<b>3L:0T:0P</b>	<b>3T Credits</b>
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## COURSE OBJECTIVES

The objectives of the course are:

- 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 ,students will be able to:		Blooms Level
<b>CO1</b>	Explain about crystal structures and atomic bonds.	<b>K1</b>
<b>CO2</b>	Describe about classification of ferrous metals and their properties.	<b>K2</b>
<b>CO3</b>	Explain about non-ferrous metals, cutting tool materials and composites alongwith their properties.	<b>K2</b>
<b>CO4</b>	Describe about the various metallic failures and knowledge in testing of materials.	<b>K2</b>
<b>CO5</b>	Explain the principle of corrosion, their types and its prevention methods alongwith the various surface engineering processes.	<b>K2</b>

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5-Evaluate, K6- Create

## SYLLABUS

**Unit I : Crystal structures and Bonds:** 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 of atoms 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.



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**Unit-II: Phase diagrams, Ferrous metals and its Alloys:** 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 wrought Iron; comparison of cast iron, wrought iron and mild steel and high carbon steel; standard commercial grades 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

**Unit-III: Non-ferrous metals and its Alloys:** Properties and uses of aluminum, copper, tin, lead, zinc, magnesium and nickel; Copper alloys: Brasses, bronzes – composition, properties and uses; Aluminum alloys: Duralumin, hinalium, magnelium – composition, properties and uses; Nickel alloys: Inconel, monel, nicPerome – composition, properties and uses. Anti-friction/Bearing alloys: Various types of bearing bronzes - Standard commercial grades as per BIS/ASME.

**Unit-IV: Failure analysis & Testing of Materials:** Introduction to failure analysis; Fracture: ductile fracture, brittle fracture; cleavage; notch sensitivity; fatigue; endurance limit; characteristics of fatigue fracture; variables affecting fatigue life; creep; creep curve; creep fracture; Destructive testing: Tensile testing; compression testing; Hardness testing: Brinell, Rockwell; bend test; torsion test; fatigue test; creep test. Non-destructive testing: Visual Inspection; magnetic particle inspection; liquid penetrant test; ultrasonic inspection; radiography.

**Unit-V: Corrosion & Surface Engineering:** Nature of corrosion and its causes; Electrochemical re-actions; 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 finishing of surfaces; Organic coatings; Electroplating and Special metallic plating; Electro polishing and pho-to-etching ;– Conversion coatings: Oxide, phosphate and chromate coatings; Thin film coatings: PVD and CVD; Surface analysis; Hard-facing, thermal spraying and high-energy processes; Process/material selection. Pollution norms for treating effluents as per standards.

## RECOMMENDED 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.



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<b>MDEME22-356P</b>	<b>Computer Aided Machine Drawing Practice</b>	<b>0L:0T:1P</b>	<b>1P Credits</b>
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<b>List Of Practical's</b>	
I	Represent the materials used in machine drawing
II	Draw the development of surfaces for sheet metal working applications.
III	Draw the machine elements including keys, couplings, and cotters, riveted, bolted and welded joints.
IV	Construct an assembly drawing using part drawings of machine components
V	Represent tolerances and the levels of surface finish of machine elements.