

DIPLOMA IN MECHANICAL ENGINEERING

SEMESTER: THIRD SEMESTER

NAME OF THE COURSE: Materials Technology

PAPERCODE: DME- 301

RATIONAL

Materials technology is a relatively comprehensive discipline that begins with the production of goods from raw materials to processing of materials into the shapes and forms needed for specific applications. Materials - metals, plastics and ceramics composite material, which means that the technologies involved in their production are fundamentally different. Materials technology is a constantly evolving discipline, and new materials with interesting properties lead to new applications. For example, the combination of different materials into composites gives rise to entirely new material properties. Materials Science is closely related to materials technology. Materials Science is a multidisciplinary field that connects material properties to the material's chemical composition, micro-structure and crystal structure.

CO'S of Materials Technology

CO1: Understanding of basic of material properties.

CO2: Explain and to understand the Steel and Cast Iron and its properties.

CO3: Explain and to understand the non ferrous material and its properties

CO4: To understand various metallic failures and acquire the knowledge of testing of materials.

CO5: To understand the concept of corrosion and its prevention.

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Unit No	COURSE CONTENT
1	Basics of Engineering Materials, Classification of engineering materials, Crystal structure, Unit cell and space lattice, Microstructure, types of microscopes, Sample preparation, etching process, types of etchants., Properties of metals Physical Properties, Mechanical Properties., Concept of phase, pure metal, alloy and solid solutions., Iron Carbon Equilibrium diagram various phases. Critical temperatures and significance. Reactions on Iron carbon equilibrium diagram, Hardness testing procedure on Brinell and Rockwell tester.
2	Steel & Cast Iron: Broad Classification of steels. Plain carbon steels: Definition, Types and Properties, Compositions and applications of low, medium and high carbon steels. ii. Alloy Steels: Definition and Effects of alloying elements on properties of alloy steels. iii. Tool steels: Cold work tool steels. Hot work tool steels, High speed steels (HSS) iv. Stainless Steels: Types and Applications v. Spring Steels: Composition and Applications. vi. Specifications of steels and their equivalents. Steels for following components: Shafts, axles, Nuts, bolts, Levers, crank shafts, camshafts, Shear blades, agricultural equipments, household utensils, machine tool beds, car bodies, Antifriction bearings and Gears. Types of cast irons as white. Gray, nodular, malleable, Specifications of cast iron. Selection of appropriate cast iron for engineering applications. Designation and coding (as per BIS, ASME, EN, DIN, TIS) of cast iron.
3	Heat Treatment processes: Overview of heat treatment. Annealing: Purposes of annealing, Annealing temperature range, Types and applications, Normalizing: Purposes of Normalizing, temperature range. Broad applications of Normalizing. Hardening: Purposes of hardening, Hardening temperature range, applications Tempering: Purpose of tempering Types of tempering and its applications, Case hardening methods like Carburizing, Nitriding, and Cyaniding., Heat treatment Furnaces - Muffle, Box type.
4	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.
5	Unit-V: Corrosion & Surface Engineering: 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 finishing of surfaces; Organic coatings; Electroplating and Special metallic plating; Electro polishing and photo-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.

LIST OF EXPERIMENTS

- 1 Preparation of micro specimen.
- 2 To study micro structural characteristics of gray cast iron white cast iron and malleable cast iron.
- 3 Hardness testing on Brinell Hardness Tester of given sample material.
- 4 Hardness testing on Rockwell Hardness tester of given sample material.
- 5 Hardness testing on relevant hardness testers of given untreated and heat treated Mild Steels.
- 6 Hardness testing on relevant hardness testers of given untreated and heat treated Mild Steels.
- 7 Microstructure of cast iron using metallurgical microscope on standard specimens
- 8 Hardness testing on relevant hardness testers of given Copper and Brass specimens.
- 9 Hardness testing on relevant hardness testers of given Aluminum specimens.
- 10 To observe the micro structural characteristics and other properties of various cast irons and prepare a report there of, for industrial uses

REFERENCES

- 1 Engineering physical Metallurgy –By Prof. Y. Lakhtin MIR Publishers Mascow
- 2 A Text Book of Material Science and Metallurgy by O.P. Khanna.
- 3 Material Science and Process. By S. K. Hazra Choudhry
- 4 Mechanical Metallurgy by Dieter (Tata McGraw hill)
- 5 Materials For Engineers by M. H. A. Kempsty
- 6 Introduction to Material Science And Engineering by K.M. Ralls, T.H. Courtney, John Wuff (Wiley Eastern New Delhi)
- 7 Physical Metallurgy Principles by Read Hill (Affiliated East-West Press Pvt. Ltd. New Delhi.)
- 8 Engineering Metallurgy by R. Higgins (ENS).
- 9 Materials Science by B.S. Narang (Pub. C B Spub. & Distributions New Delhi)
- 10 Padarth Prodyogiki (Hindi) by P.N. Vijayvergiya (Deepak Prakashan, Gwalior).

DIPLOMA IN MECHANICAL ENGINEERING

SEMESTER: THIRD SEMESTER

NAME OF THE COURSE: Manufacturing Process

PAPERCODE: DME - 302

RATIONAL

Manufacturing processes are advancing very fast with the expansion of technology. This course will provide basic insight to the students regarding methods of manufacturing processes. The course gives the opportunity for exhaustive study of metal casting, Mechanical working of metals, press working and metal joining. The abilities developed by studying this course will be directly helpful to all the technicians; in whichever field they are employed.

CO'S of Manufacturing Process

- CO1: To understand the importance of cutting fluids & lubricants in machining.
- CO2: To study various types of basic production processes. To select, operate and control the appropriate processes for specific applications.
- CO3: To understand basic concepts of welding processes..
- CO4: To understand the importance of press tools and understand various die operations.
- CO5: To understand Grinding and finishing processes..

DIPLOMA IN MECHANICAL ENGINEERING

SEMESTER: THIRD SEMESTER

NAME OF THE COURSE: Manufacturing Process

PAPERCODE: DME - 302

Unit No	COURSE CONTENT
1	<p>UNIT-I: Cutting Fluids & Lubricants: Introduction; Types of cutting fluids, Fluids and coolants required in turning, drilling, shaping, sawing & broaching; Selection of cutting fluids, methods of application of cutting fluid; Classification of lubricants (solid, liquid, gaseous), Properties and applications of lubricants.</p> <p>Lathe Operations: Types of lathes – light duty, Medium duty and heavy duty geared lathe, Specifications; Basic parts and their functions; Operations and tools – Turning, parting off, Knurling, facing, Boring, drilling, threading, step turning, taper turning.</p>
2	<p>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.</p> <p>Drilling: Classification; Basic parts and their functions; Radial drilling machine; Types of operations, Specifications of drilling machine.</p>
3	<p>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, Welding defects; Brazing and soldering: Types, Principles, Applications.</p> <p>Milling: Introduction; Types of milling machines: plain, Universal, vertical; constructional details specifications, Milling operations:</p>
4	<p>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;</p> <p>Gear hobbing; Description of gear hob; Operation of gear hobbing machine; Gear finishing processes, Gear materials and specification. 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.</p>
5	<p>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 centreless 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.</p>

List of Experiment

- 1 Making a split/solid pattern from wood. Making a core box.
- 2 Tempering of and practice of green and dry sand making.
- 3 Practice of core making and baking
- 4 Practice of open moulding at woboxes, using split pattern and solid pattern, Locating the core .
- 5 Demonstration of metal melting in pit furnace& casting process.
- 6 Simple forming practice (Making as quarebarout of a given round bar, making of a chisel and bolt)
- 7 Study of Lathe, machine.
- 8 Study of Drilling machine.
- 9 Practice of Joining processes by Arc Welding
- 10 Practice of step turning, threading and knurling with the help of Lathe machine.

REFERENCES

1. Process and Materials of Manufacture by Lindberg.
2. Workshop Technology by Hazara & Choudhary.
3. Materials and Manufacturing process by Dalela.
4. Manufacturing Processes by Yankee.
5. Manufacturing Process by S.E. Rusinof
6. Welding Engineering by B.E. Rossi.
7. Production Engineering –P.C. Sharma
8. ManufacturingTechnology-P.N. Rao
9. ProductionTechnology- R. K. Jain
10. Foundry Engineering by P.L. Jain.
11. Nirman Prakram (Hindi) by P. N. Vijayvargiya. (Deepak Prakashan, Morar, Gwalior)

DIPLOMA IN MECHANICAL ENGINEERING

SEMESTER: THIRD SEMESTER

NAME OF THE COURSE: Basics of CNC

PAPERCODE: DME - 303

RATIONAL

Computer Numerical Control (CNC) is an automated manufacturing process that controls and operates machinery such as lathes, drills, mills and more by way of a computer. It has evolved the manufacturing industry as we know it, streamlining the production process and allowing complex tasks to be done with precision and efficiency. In the field of manufacturing, CNC machining offers a cutting-edge career on the frontlines of innovation and technology.

CO'S of Basic of CNC

- CO1: Understanding of Basic of CNC Machine.
- CO2: Understanding of working principle of CNC Machine.
- CO3: Learning of CNC Programming.
- CO4: Learning of CNC Tools.
- CO5: Understanding of Industrial Automatism and its need.

SEMESTER: THIRD SEMESTER

NAME OF THE COURSE: Basic of CNC

PAPERCODE: DME - 303

Unit No	COURSE CONTENT
1.	Introduction to CNC Machines: Classification of CNC machines , Important terms related to CNC machining, Calibration of CNC machines, Axis standards and its identification Drives used in CNC system, Construction and working of CNC Machines Feedback, measurement & correction System
2.	Constructional features and working of CNC Machines: Bed and machine frame construction, Spindle constructional details, Constructional details and working of ball screw and L. M .guide ways, Various spindle drives used in CNC machines, working of machine control unit, Types of lubrication system, working of swarf removal arrangement, Working of hydraulic and pneumatic systems used for Chuck, tool and pallet changing in CNC machines.
3.	CNC Part Programming: NC words , G codes M codes, Programming format, word statement, block format, Tool offset and tool wears compensation, Part programming containing subroutines, Do-loops and canned cycle Introduction to Macro Programming
4.	Tooling for CNC machines: Types of CNC Cutting tools, Types of index able inserts with its geometry, Construction of tool holding assembly, Tool presetting procedure, Working of Automatic Tool Changing (ATC) device and types of tool magazine, Safety procedure, alarms, fool-proof procedures, cutting forces, Adaptive controls, communication with servers, Fixtures used in CNC machines
5.	Industrial Automation: Meaning of Automation, Need of Automation, Types of Automation, Advantages and Disadvantages of Automation, Components of Automated system , Introduction to Plant Automation & Introduction to Industry 4.0

List of Experiments

- 1 Study the constructional details of CNC lathe
- 2 Study the constructional details of CNC milling machine
- 3 Study the constructional details and working of
 - i) Automatic tool changer and tool setter
 - ii) Multiple pallets
 - iii) Swarf removal
 - iv) Safety Devices
- 4 Use of software for turning operations on CNC turning center
- 5 Use of software for milling operations on milling center
- 6 Develop a part programme for following lathe operations and make the job on CNC lathe
 - i) Plain turning & facing operation
 - ii) Taper turning operations
 - iii) Thread cutting operations
 - iv) Operation along contour using circular interpolation.
- 7 Develop a part programme for following milling operations and make the job on CNC milling machine
 - i) Plain milling
 - ii) Slot milling
 - iii) Pocket milling
- 8 Preparation of work instructions for machine operator while working on CNC machine
- 9 Study of CNC Cutting tools & Tool presetting procedure
- 10 Preparation of preventive maintenance schedule for CNC machines

REFERENCES

1. Mechatronics & Machine Tools by HMT, Bangalore, McGraw-Hill, International Ed, ISBN: 1998 978-0071-3463-44
2. CNC Machines by Pabla B.S.& M. Adithan, New age International Ltd., 2018 ISBN: 978-8122-4342-62
3. CAD/CAM (Computer Added Design & Manufacturing) by Groover, Zimmer, Pearson Education India, ISBN: 2006 978-8177-5841-65
4. CAD/CAM/CAE by Chougule N.K., SciTech publication Pvt Ltd., 2010 ISBN: 978-8183-7117-53
5. CNC Programming Made Easy by Binit Kumar Jha, Vikas Publication House Pvt.Ltd. New Delhi, Revised edition, 2010. 9

DIPLOMA IN MECHANICAL ENGINEERING

SEMESTER: THIRD SEMESTER

NAME OF THE COURSE: Material Handling System

PAPERCODE: DME - 304

RATIONAL

Mechatronic is to create more efficient, intelligent, and cost-effective systems by integrating mechanical, electronic, and computer engineering. This interdisciplinary approach allows for automation, precision control, and advanced functionality in products and processes, leading to improved performance, adaptability, and reliability across many industries like automotive, manufacturing.

CO'S of Material Handling System

Course Objectives:

CO1- Understand constructional & operational features of various materials handling systems.

CO2- Identify, compare & select proper material handling equipment for specified applications.

CO3- Know the controls & safety measures incorporated on material handling equipment.

CO4- Appreciate the role of material handling devices in mechanization & automation of industrial process.

CO5- Understand & appreciate safety instrumentation for equipment

DIPLOMA IN MECHANICAL ENGINEERING

SEMESTER: THIRD SEMESTER

NAME OF THE COURSE: Material Handling System

PAPERCODE: DME - 304

Unit No	COURSE CONTENT
1	Introduction to Material Handling System: Main types of Material handling equipments & their applications; Types of load to be handled; Types of Movements; Methods of stacking, loading & unloading systems; Principles of Material Handling Systems; Modern trends in Materials handling.
2	Hoisting Machinery & Equipments: Construction, Working & Maintenance of different types of hoists such as Lever operated hoist, Portable hand chain hoist, Differential hoists, Worm geared and Spur geared hoists, Electric & Pneumatic hoists, Jumper; Construction, Working & Maintenance of different types of cranes such as Rotary cranes, Trackless cranes, Mobile cranes, Bridge cranes, Cable cranes, Floating cranes & Cranes traveling on guide rails; Construction, Working & Maintenance of Elevating equipments such as Stackers, Industrial lifts, Freight elevators, Passenger lifts.
3	Conveying Machinery: Construction, Working & Maintenance of Traction type conveyors such as Belt conveyors, Chain conveyors, Bucket elevators, Escalators; Construction, Working & Maintenance of Traction less type conveyors such as Gravity type conveyors, Vibrating & Oscillating conveyors, Screw conveyors, Pneumatic & Hydraulic conveyors, Hoppers gates & Feeders.
4	Components of Material Handling Systems: Flexible hoisting appliances such as Welded load chains, Roller chains, Hemp ropes, Steel wire ropes, Fastening methods of wire & chains, Eye bolts, Lifting tackles, Lifting & Rigging practices; Load handling attachments: a) Various types of hooks-Forged, Triangular eye hooks, Appliances for suspending hooks b) Crane grab for unit & piece loads c) Electric lifting magnet, vacuum lifter. d) Grabbing attachment for loose materials e) Crane attachment for handling liquids/molten metals.
5	Mechanism used in Material Handling Equipment: Steady state motion; Starting & stopping of motion in following mechanisms: Hoisting mechanism, Lifting Mechanism, Traveling Mechanism, Slewing Mechanism, Rope & chain operated Cross- Traverse Mechanism.

References Books:

1. Material handling (Principles & Practice) – Allegri T. H., CBS Publisher, New Delhi.
2. Plant Layout & Materials Handling – Apple J. M., JohnWiley Publishers.
3. Material Handling Equipment – N. Rundenko, Peace Publisher, Moscow.
4. Material Handling Equipment – M. P. Alexandrov, MIR Publisher, Moscow.
5. Material Handling Equipment – Y. I. Oberman, MIR Publisher, Moscow.

DIPLOMA IN MECHANICAL ENGINEERING

SEMESTER: THIRD SEMESTER

NAME OF THE COURSE: Strength of Materials

PAPERCODE: DME - 305

RATIONAL

Strength of materials, also known as mechanics of materials, is focused on analysing stresses and deflections in materials under load. Knowledge of stresses and deflections allows for the safe design of structures that are capable of supporting their intended loads.

CO'S of Strength of Materials

CO1: To understand the concept of Simple Stresses and Strains.

CO2: To understand the concept of Strain Energy.

CO3: To understand the concept of Shear Force and Bending Moment Diagrams.

CO4: To understand the concept of Theory of Simple Bending and Thin Cylindrical Shells.

CO5: To understand the concept of Torsion in Shafts and Springs.

DIPLOMA IN MECHANICAL ENGINEERING

SEMESTER: THIRD SEMESTER

NAME OF THE COURSE: Strength of Materials

PAPERCODE: DME - 305

Unit No	COURSE CONTENT
1	<p>Simple Stress and Strains: Types of stresses and strain, stress strain diagram for ferrous and non ferrous materials, Hooke's law, modulus of elasticity, rigidity and bulk modulus of materials. Stress in bars of varying cross sections, composite sections and compound sections Thermal stresses in bodies of uniform section, Poisson's ratio, volumetric strain, relation between different modulus. Mechanical properties and their testing: Mechanical properties of materials, destructive including Tensile test, compression test, hardness test, torsion test, impact test fatigue test, bending test, shear test and non- destructive testing methods.</p>
2	<p>Strain Energy: Strain energy or resilience, proof resilience and modulus of resilience; Derivation of strain energy for the following cases: i) Gradually applied load, ii) Suddenly applied load, iii) Impact/ shock load; Related numerical problems.</p> <p>Thin Cylindrical Shells: Explanation of longitudinal and hoop stresses in the light of circumferential and longitudinal failure of shell; Derivation of expressions for the longitudinal and hoop stress for seamless and seam shells; Related numerical Problems for safe thickness and safe working pressure.</p>
3	<p>Shear Force & Bending Moment: Types of beams, types of supports, concept and definition of Shear force (S.F) and bending moment (B.M).S.F and B.M diagrams for simply supported, overhang beams subjected to point load & UDL. Location of point of contraflexure and maximum bending moment calculations (if any). (No problem to be set for External moment or couple), S.F and B.M diagrams for cantilever subjected to point load & UDL. Location of point of contraflexure and maximum bending moment calculations (if any).(No problem to be for External moment or couple)</p>
4	<p>Bending stresses: Explanation of terms: Neutral layer, Neutral Axis, Modulus of Section, Moment of Resistance, Bending stress, Radius of curvature; Assumptions in theory of simple bending; Bending Equation $M/I = \sigma/Y = E/R$ with derivation; Problems involving calculations of bending stress, modulus of section and moment of resistance.</p>
5	<p>Torsion in Shafts and Springs: Definition and function of shaft; Calculation of polar M.I. for solid and hollow shafts; Assumptions in simple torsion; Derivation of the equation $T/J = \tau/R = G\theta/L$; Problems on design of shaft based on strength and rigidity.</p> <p>Classification of springs; Nomenclature of closed coil helical spring; Deflection formula for closed coil helical spring (without derivation); stiffness of spring; Numerical problems on closed coil helical spring to find safe load, deflection, size of coil and number of coils.</p>

List of Experiments

- 1 Study and demonstration of Universal Testing Machine & its attachments
- 2 Tensile test on Mild steel specimen, plotting of stress strain curve and indicating significant point as per I.S. requirement
- 3 Compression testing on metal/timber.
- 4 Shear test–Single and double shear for mild steel bar
- 5 Izod impact test on M.S. steel specimen
- 6 Charpy impact test on M.S. steel specimen
- 7 Bending test on mild steel.
- 8 Torsion test on metal bar
- 9 Hardness test (Brinell Hardness) on various metals.
- 10 Rockwell hardness Test on Hardened Steel.

References Books:

- 1 . Strength of Materials S. Timoshenko, D. Van Nostr and Company Inc.
2. Strength of Materials R. K. Bansal, Laxmi Publication Pvt Ltd.
3. Strength of Materials R.K. Rajput, S. Chand & Company Ltd.,
4. Strength of Materials S. Ramamrutham, Dhanpat Rai and sons Publishing House,
5. Text Book of Strength of Materials R.S. Khurmi, S. Chand & Company Ltd.
6. Study of Materials Ferdinand L.Singer, Harper & Row Publisher