

3.1 ENGINEERING MATERIALS

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RATIONALE

Lot of development has taken place in the field of materials. New materials are being developed and it has become possible to change the properties of materials to suit the requirements. Diploma holders in this course are required to make use of different materials for various applications. For this purpose, it is necessary to teach them basics of metal structure, properties, usage and testing of various ferrous and non ferrous materials and various heat treatment processes. This subject aims at developing knowledge about the characteristics, testing and usage of various types of materials used in industries.

Learning Outcomes

After undergoing this course, the students will be able to:

- Distinguish between metals and non metals and ferrous and non ferrous materials.
- Analyze microstructure and changes in microstructure due to heat treatment.
- Carryout various heat treatment processes such as annealing, normalizing, tempering and hardening.
- Draw and interpret iron-carbon diagram.
- Classify various types of plastics and rubber.
- Explain properties and applications of composites, ceramics and smart materials.
- Select suitable material to be used for various engineering applications.

DETAILED CONTENTS

1. Introduction (07 hrs)

Material, History of Material Origin, Scope of Material Science, Overview of different engineering materials and applications, Classification of materials, Thermal, Chemical, Electrical, Mechanical properties of various materials, Present and future needs of materials, Overview of Biomaterials and semi-conducting materials, Various issues of Material Usage-Economical, Environment and Social.
2. Crystallography (07 hrs)

Fundamentals: Crystal, Unit Cell, Space Lattice, Arrangement of atoms in Simple Cubic Crystals, BCC, FCC and HCP Crystals, Number of atoms per unit Cell, Atomic Packing Factor.

Deformation: Overview of deformation behaviour and its mechanisms, behaviour of material under load and stress-strain.

Failure Mechanisms: Overview of failure modes, fracture, fatigue and creep.

3. Metals And Alloys (14 hrs)
- Ferrous Materials: Different iron ores, Raw materials in production of iron and steel, Basic process of iron-making and steel-making, Classification of iron and steel.
- Cast Iron: Different types of Cast Iron, manufacture and their use. Classification of Grey cast iron and S.G. iron
- Steels: Steels and alloy steel, Classification of plain carbon steels, Properties and usage of different types of Plain Carbon Steels, Effect of various alloys on properties of steel, Uses of alloy steels (high speed steel, stainless steel, spring steel, silicon steel)
- Non Ferrous Materials: Properties and uses of Aluminium, Copper and Zinc and their alloys
4. Heat Treatment (08 hrs)
- Purpose of heat treatment, Solid solutions and its types, Formation and decomposition of Austenite, Martensitic Transformation – Simplified Transformation Cooling Curves. Various heat treatment processes- hardening, tempering, annealing, normalizing, Case hardening and surface hardening, Hardenability of steels, Selection of case carburizing and induction hardening steels. Types of heat treatment furnaces (only basic idea)
5. Plastics (03 hrs)
- Important sources of plastics, Classification-thermoplastic and thermoset and their uses, Various trade names of plastics, Plastic coatings, food grade plastics. Applications of plastics in automobile and domestic use.
- Rubber classification - Natural and synthetic. Selection of rubber
6. Advanced Materials (03 hrs)
- Composites-Classification, properties, applications
 Ceramics-Classification, properties, applications
 Adhesives – Classification, properties and applications
 Smart materials - properties and applications.
7. Miscellaneous Materials (06 hrs)
- Overview of -Tool and Die materials, Materials for bearing metals, Materials for Nuclear Energy, Refractory materials.

LIST OF PRACTICALS

1. Classification of about 25 specimens of materials/machine parts into
 - (i) Metals and non metals
 - (ii) Metals and alloys
 - (iii) Ferrous and non ferrous metals
 - (iv) Ferrous and non ferrous alloys
2. Given a set of specimen of metals and alloys (copper, brass, aluminium, cast iron, HSS, Gun metal); identify and indicate the various properties possessed by them.
3.
 - a) Study of heat treatment furnace.
 - b) Study of a thermocouple/pyrometer.
4. Study of a metallurgical microscope and a specimen polishing machine.
5. To prepare specimens of following materials for microscopic examination and to Examine the microstructure of the specimens of following materials:
 - i) Brass ii)Copper iii)Grey iv)Malleable v)Low carbon steel vi)High carbon steel vii) HSS
6. To anneal a given specimen and find out difference in hardness as a result of annealing.
7. To normalize a given specimen and to find out the difference in hardness as a result of normalizing.
8. To harden and temper a specimen and to find out the difference in hardness due to tempering.

INSTRUCTIONAL STRATEGY

While imparting instructions, teacher should show various types of engineering materials to the students. Students should be asked to collect samples of various materials available in the market. Visits to industry should be planned to demonstrate use of various types of materials or Heat Treatment Processes in the industry.

RECOMMENDED BOOKS

1. Text book of Material Science by R.K. Rajput; Katson Pubs, Ludhiana
2. Text book of Material Science by V.K. Manchanda; India Publishing House, Jalandhar.
3. Introduction to Material Science by A.R. Gupta, Satya Prakashan, New Delhi.
4. Material Science by Hazra, Chaudhary

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	07	15
2.	07	15
3.	14	30
4.	08	16
5.	03	06
6.	03	06
7.	06	12
Total	48	100

3.2 APPLIED MECHANICS

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RATIONALE

The subject Applied Mechanics deals with basic concepts of mechanics like laws of forces, moments, friction, centre of gravity, laws of motion and simple machines which are required by the students for further understanding of other allied subjects. The subject enhances the analytical ability of the students.

Learning Outcomes

After undergoing this course, the students will be able to:

- Interpret various types of units and their conversion from one to another.
- Analyze different types of forces acting on a body and draw free body diagrams.
- Determine the resultant of coplanar concurrent forces.
- Calculate the co-efficient of friction for different types of surfaces.
- Calculate the least force required to maintain equilibrium on an inclined plane.
- Determine the centroid/centre of gravity of plain and composite laminar and solid bodies.
- Determine velocity ratio, mechanical advantage and efficiency of simple machines

DETAILED CONTENTS

1. Introduction (04hrs)
 - 1.1 Concept of engineering mechanics definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields. Definition of Applied Mechanics.
 - 1.2 Definition, basic quantities and derived quantities of basic units and derived units
 - 1.3 Different systems of units (FPS, CGS, MKS and SI) and their conversion from one to another for density, force, pressure, work, power, velocity, acceleration
 - 1.4 Concept of rigid body, scalar and vector quantities

2. Laws of forces (9 hrs)
 - 2.1 Definition of force, measurement of force in SI units, its representation, types of force: Point force/concentrated force & Uniformly distributed force, effects of force, characteristics of a force

- 2.2 Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of super-position
- 2.3 Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, triangle law of forces, polygon law of forces - graphically, analytically, resolution of forces, resolving a force into two rectangular components
- 2.4 Free body diagram
- 2.5 Equilibrant force and its determination
- 2.6 Lami's theorem (concept only)
[Simple problems on above topics]
3. Moment (9 hrs)
- 3.1 Concept of moment
- 3.2 Moment of a force and units of moment
- 3.3 Varignon's theorem (definition only)
- 3.4 Principle of moment and its applications (Levers – simple and compound, steel yard, safety valve, reaction at support)
- 3.5 Parallel forces (like and unlike parallel force), calculating their resultant
- 3.6 Concept of couple, its properties and effects
- 3.7 General conditions of equilibrium of bodies under coplanar forces
- 3.8 Position of resultant force by moment
[Simple problems on the above topics]
4. Friction (9 hrs)
- 4.1 Definition and concept of friction, types of friction, force of friction
- 4.2 Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction
- 4.3 Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane.
- 4.4 Calculation of least force required to maintain equilibrium of a body on a rough inclined plane subjected to a force:
- a) Acting along the inclined plane Horizontally
 - b) At some angle with the inclined plane

5. Centre of Gravity (8 hrs)
- 5.1 Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies
- 5.2 Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion
- 5.3 Determination of center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed
[Simple problems on the above topics]
6. Simple Machines (9 hrs)
- 6.1. Definition of effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machines
- 6.2. Simple and compound machine (Examples)
- 6.3. Definition of ideal machine, reversible and self locking machine
- 6.4. Effort lost in friction, Load lost in friction, determination of maximum mechanical advantage and maximum efficiency
- 6.5. System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency
- 6.6. Working principle and application of wheel and axle, Weston's Differential Pulley Block, simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application
[Simple problems on the above topics]

LIST OF PRACTICALS

1. Verification of the polygon law of forces using gravesend apparatus.
2. To verify the forces in different members of jib crane.
3. To verify the reaction at the supports of a simply supported beam.
4. To find the mechanical advantage, velocity ratio and efficiency in case of an inclined plane.
5. To find the mechanical advantage, velocity ratio and efficiency of a screw jack.
6. To find the mechanical advantage, velocity ratio and efficiency of worm and worm wheel.
7. To find mechanical advantage, velocity ratio and efficiency of single purchase crab.

8. To find out center of gravity of regular lamina.
9. To find out center of gravity of irregular lamina.
10. To determine coefficient of friction between three pairs of given surface.

RECOMMENDED BOOKS

1. A Text Book of Applied Mechanics by S Ramamurtham, Dhanpat Rai Publishing Co. Ltd.
2. A Text Book of Engineering Mechanics (Applied Mechanics) by RK Khurmi; S Chand and Co. Ltd., New Delhi.
3. A Text Book of Applied Mechanics by RK Rajput; Laxmi Publications, New Delhi..
4. Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House, New Delhi.
5. Test Book of Applied Mechanics by AK Upadhya, SK Kataria & Sons, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	4	8
2	9	20
3	9	20
4	9	18
5	8	16
6	9	18
Total	48	100

3.3 ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING

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RATIONALE

The objective of this subject is to impart fundamental knowledge and skills regarding basic electrical and electronics engineering, which diploma holders will come across in their professional life. This course will provide the students to understand the basic concepts and principles of d.c. and a.c. fundamentals, electromagnetic induction, batteries, transformers, motors, distribution system, domestic installation, electrical safety etc. The students will also learn basic electronics including diodes and transistors and their applications.

Learning Outcomes

After undergoing this course, the students will be able to:

- Measure basic electrical quantities.
- Measure and improve power factor in a given circuit.
- Explain the construction, working principle, performance and applications of transformers.
- Identify different wires of distribution system.
- Select and operate single phase and three phase motors.
- Follow electrical safety measures.
- Describe the characteristics and applications of diodes, transistors and thyristor.

DETAILED CONTENTS

1. Application and Advantage of Electricity (03 hrs)
Difference between ac and dc, various applications of electricity, advantages of electrical energy over other types of energy
2. Basic Electrical Quantities (04 hrs)
Definition of voltage, current, power and energy with their units, name of instruments used for measuring above quantities, connection of these instruments in an electric circuit
3. AC Fundamentals (08 hrs)
Electromagnetic induction-Faraday's Laws, Lenz's Law; Fleming's rules, Principles of a.c. Circuits; Alternating emf, Definition of cycle, frequency, amplitude and time period. Instantaneous, average, r.m.s and maximum value of sinusoidal wave; form factor and Peak Factor. Concept of phase and phase difference. Concept of resistance, inductance and capacitance in simple a.c. circuit. Power factor and improvement of power factor by use of capacitors. Concept of three phase system; star and delta connections; voltage and current relationship (no derivation)

4. Transformers (06 hrs)
Working principle and construction of single phase transformer, transformer ratio, emf equation, losses and efficiency, cooling of transformers, isolation transformer, CVT, auto transformer (brief idea), applications.
5. Distribution System (06 hrs)
Difference between high and low voltage distribution system, identification of three-phase wires, neutral wire and earth wire in a low voltage distribution system. Identification of voltages between phases and between one phase and neutral. Difference between three-phase and single-phase supply
6. Electric Motor (08 hrs)
Description and applications of single-phase and three-phase motors. Connection and starting of three-phase induction motors by star-delta starter. Changing direction of rotation of a given 3 phase induction motor. Motors used for driving pumps, compressors, centrifuge, dyers etc. Totally enclosed submersible and flame proof motors
7. Domestic Installation (04 hrs)
Distinction between light-fan circuit and single phase power circuit, sub-circuits, various accessories and parts of domestic electrical installation. Identification of wiring systems. Common safety measures and earthing
8. Electrical Safety (04hrs)
Electrical shock and precautions against shock, treatment of electric shock, concept of fuses and their classification, selection and application, concept of earthing and various types of earthing, applications of MCBs and ELCBs
9. Basic Electronics (05 hrs)
Basic idea of semiconductors – P and N type; diodes, zener diodes and their applications, transistor – PNP and NPN, their characteristics and uses. Characteristics and applications of a thyristor, characteristics and applications of stepper motors and servo motors in process control.

LIST OF PRACTICALS

1. Connection of a three-phase motor and starter with fuses and reversing of direction of rotation
2. Connection of a single-phase induction motor with supply and reversing of its direction of rotation
3. Troubleshooting in domestic wiring system, including distribution board
4. Connection and reading of an electric energy meter

5. Use of ammeter, voltmeter, wattmeter, and multi-meter
6. Measurement of power and power factor in a given single phase ac circuit
7. Study of different types of fuses, MCBs and ELCBs
8. Study of zener diode as a constant voltage source and to draw its V-I characteristics
9. Study of earthing practices
10. To draw V-I characteristics of a (i) NPN transistor (ii) thyristor (SCR)
11. Study of construction and working of a (i) stepper motor and (ii) servo motor

INSTRUCTIONAL STRATEGY

The teacher should give emphasis on understanding of concept and various terms used in the subject. Practical exercises will reinforce various concepts.

RECOMMENDED BOOKS

1. Basic Electrical Engineering by PS Dhogal; Tata McGraw Hill Publishers, New Delhi
2. A Text Book of Electrical Technology, Vol. I and II by BL Thareja; S Chand and Co., New Delhi
3. Basic Electricity by BR Sharma; Satya Prakashan, New Delhi
4. Basic Electrical Engineering by JB Gupta, S Kataria and Sons, Delhi
5. Experiments in Basic Electrical Engineering by SK Bhattacharya and KM Rastogi, New Age International Publishers Ltd., New Delhi
6. Basic Electronics by VK Mehta; S Chand and Co., New Delhi
7. Electrical Machines by SK Bhattacharya; Tata McGraw Hill, New Delhi
8. Basic electronics and Linear circuits by NN Bhargava and Kulshreshta, Tata Mc Graw Hill New Delhi.
9. Electronic principles by SK Sahdev, Dhanpat Rai and Sons, New Delhi.
10. Electronic Devices and circuits by Rama Raddy Narora Publishing House Pvt. Ltd. New Delhi.
11. Principles of electrical and electronics Engineering by VK Mehta; S Chand and Co. New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	03	06
2	04	08
3	08	16
4	06	12
5	06	12
6	08	16
7	04	10
8	04	10
9	05	10
Total	48	100

3.4 METROLOGY AND INSTRUMENTATION

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RATIONALE

Metrology is the science of measurement, Diploma holders in this course are responsible for ensuring process and quality control by making measurements and carrying out inspection of various parameters. For this purpose, knowledge and skills about various measuring instruments are required. The aim of this subject is to develop knowledge and skills regarding various measuring instruments amongst the students.

LEARNING OUTCOME

After undergoing the subject, students will be able to :

- Use vernier calliper, micrometer, Height gauge for linear internal and external measurement.
- Use bore gauge, radius gauge, taper gauge, plug gauge, ring gauge, snap gauge for measurements.
- Use bevel protector, sine bar, slip gauge, dial indicator, angle deckor, poppy dial for angular measurements.
- Measure spur gear characteristics using gear tooth vernier, outside diameter over dovel pins.
- Use tool makers microscope
- Measure surface roughness parameters.
- Use profile projector, auto collimeter, angle deckor.
- Select and measure variables using electrical and electronics comparators and measuring instrument, sensors, transducers.
- Select and use non destructive testing methods.
- Explain the use of coordinate measuring machine.

DETAILED CONTENTS

1. Introduction (06 hrs)
 - 1.1 Definition of metrology
 - 1.2 Standard of measurement
 - 1.3 Types of Errors - Controllable and random errors
 - 1.4 Precision, accuracy, sensitivity, hysteresis, response time, repeatability, calibration, uncertainty of measurement, interchangeability.
 - 1.5 Standardization and standardizing organizations

2. Linear and Angular Measurement (18 hrs)
 - 2.1 Construction features and use of instruments for non precision linear measurement: steel rule, callipers, surface plate, angle plate, V-block.

- 2.2 Construction features and use of instruments for precision measurements : vernier calipers, vernier height and depth gauges, micrometers.
 - 2.3 Slip gauges, Indian standards of slip gauges, sets of slip gauges, use of slip gauges.
 - 2.4 Cylinder bore gauges, feeler and wire gauges. Checking flatness, roundness and squareness
 - 2.5 Comparators – Characteristics, uses, working principles of different types of comparators: mechanical, electrical, electronics and pneumatic .
 - 2.6. Construction and use of instruments for angular measurements: bevel protector, sine bar, angle gauges, clinometer, angle dekker. Optical instruments for angular measurement, auto collimator.
3. Measurement of Surface Finish (06 hrs)
- 3.1 Terminology of surface roughness.
 - 3.2 Concept of primary texture and secondary texture.
 - 3.3 Factors affecting surface finish.
 - 3.4 CLA, RMS and RA value.
 - 3.5 Principle and operation of stylus probe instruments. Tomlinson surface meter and Taylor surface talysurf.
4. Measurements of Screw threads and Gauges (08 hrs)
- 4.1 Measurement of screw threads- Introduction, measurements of external and core diameters, checking of pitch and angle of threads with gauges.
 - 4.2 Measurements of gears (spur) – Measurement of tooth thickness, pitch, Gear Ball tester, Lead and Profile Testers.
 - 4.3 Profile projector, Coordinate Measuring Machine (CMM), Tool maker's microscope.
5. Instrumentation (08 hrs)
- 5.1 Various types of instruments used for mechanical quantities such as displacement, velocity, acceleration, speed and torque. Use of transducers and electronic counters, stroboscope, vibrating reeds and tachometers.
 - 5.2 Strain gauge – use of strain gauge and load cells

Note: There should be a visit to established metrology lab to familiarize students with purpose and need of metrology.

LIST OF PRACTICALS

1. Internal and external measurements with vernier calliper and microscope
2. Measurement of linear dimensions with height gauge and depth gauge.
3. Measurement of flatness, concentricity with dial indicator
4. Use of feeler gauge, wire gauge, radius gauge and fillet gauges for checking of standard parameters.
5. Use of plain plug and ring gauge, taper plug and ring gauge, thread plug and ring gauge and snap gauges.
6. Measurement of Angle using;
 - i) Cylindrical rollers and spherical balls and slip gauges
 - ii) Bevel protector
 - iii) Sine Bar/Sine Table , Slip Gauges, Height Gauge and dial indicator.
 - iv) Angle deckor.
7. Measurement of spur gear characteristics;
 - i) Measurement over teeth (M.O.T) by using flange/Disc micrometer.
 - ii) P.C.D run-out using bench centre, mandrel, cylindrical pin and dial indicator.
 - iii) Composite error using Gear Roller Tester and Master Gear.
8. Measurement of thread parameters by using tool maker's microscope.
9. Measurement of effective diameter of external threads by 2-wire and 3-wire method.
10. Measurement of cylindrical bore using cylinder bore gauge for bore diameter, ovality and taper.
11. Measurement of worn out IC engine piston clearance between cylinder and piston.
12. Measurement of surface roughness using surface roughness tester.
13. Measurement of co-ordinates of two or more than two holes using surface plate, angle plate, Height Gauge, dial indicator and slip gauges.
14. Measurement of a profile using profile projector.
15. Study and use of Auto-Collimator.

INSTRUCTIONAL STRATEGY

1. Demonstrate use of various measuring instruments while imparting theoretical instructions.
2. Stress should be laid on correct use of various instruments.

RECOMMENDED BOOKS

1. Engineering Metrology by RK Jain; Khanna Publishers, New Delhi.
2. A Text Book of Production Engineering by RC Sharma; S Chand and Company, New Delhi.
3. Metrology Laboratory Manual by M Adithan and R Bahl; NITTTR, Chandigarh.
4. Engineering Metrology by RK Rajput; SK Kataria and Sons, Ludhiana.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	10
2	18	26
3	06	10
4	08	12
5	08	12
6	18	30
Total	64	100

3.5 MECHANICAL ENGINEERING DRAWING-I

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RATIONALE

Diploma holders in Mechanical Engineering are required to interpret drawings and therefore it is essential that they have skills of preparing drawings and sketches of mechanical components. This subject aims at development of drawing skills in the students.

Learning Outcomes

After undergoing this course, the students will be able to:

- Interpret different limits and fits of components
- Draw intersection of cylinders and their profile
- Draw different kind of machine components like bearings, brackets, pulleys, pipe joints and lathe tool holder.
- Draw electrical circuit diagram of simple household electrical circuits and home appliances
- Read and interpret drawings of mechanical components

DETAILED CONTENTS

1. Limits and fits (03 sheets)

Maximum limit of size, minimum limit of size, tolerance, allowance, deviation, upper deviation, lower deviation, fundamental deviation, clearance, maximum clearance, minimum clearance. Fits – clearance fit, interference fit, transition fit. Hole basis system, shaft basis system, tolerance grades, calculating values of clearance, interference, hole tolerance, shaft tolerance with given basic size for common assemblies like H₇/g₆, H₇/m₆, H₈/p₆. Basic terminology and symbols of geometrical dimensioning and tolerances.
2. Intersection of following solids:- (02 sheets)
 - (a) Cylinder with cylinder (equal and different diameters; axis at right angles)
 - (b) Cylinder with cylinder (axis inclined)
3. Drawing of the following with complete dimensions, tolerances, materials and surface finish marks.
 - 3.1 Universal coupling (Assembly) (01 Sheets)
 - 3.2 Bearings (05 sheets)
 - 3.2.1 Bushed Bearing (Assembled Drawing)
 - 3.2.2 Ball Bearing and Roller Bearing (Assembled Drawing)
 - 3.2.3 Plummer Block (Detailed Drawing)
 - 3.2.4 Plummer Block (Assembled Drawing)
 - 3.2.5 Foot step Bearing (Assembled Drawing)

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|-----|---|-------------|
| 3.3 | Bracket | (01 sheets) |
| | 3.3.1 Wall bracket (orthographic views) | |
| 3.4 | Pulleys | (03 sheets) |
| | 3.4.1 Stepped Pulley | |
| | 3.4.2 V. Belt Pulley | |
| | 3.4.3 Fast and loose pulley (Assembled Drawing) | |
| 3.5 | Pipe Joints | (02 sheets) |
| | 3.5.1 Expansion pipe joint (Assembly drawing) | |
| | 3.5.2 Flanged pipe and right angled bend joint (Assembly Drawing) | |
| 3.6 | Lathe Tool Holder (Assembly Drawing) | (01 sheets) |
| 3.7 | Reading of mechanical component drawing | (01 sheets) |
| 3.8 | Sketching practice of bearings, bracket and pulleys. | (02 sheets) |
| 4. | Electrical Circuit Diagram | (01 sheet) |
| | 4.1 Electrical circuit diagrams for house hold appliances (bulb, fan, tube, provision for plug and switch with voltmeter and energy meter connected in the circuit. | |
| | 4.2 Electrical connections for lathe machine | |

- Note:-** (1) First angle projection should be followed, 20% of drawings may be prepared in third angle projection.
- (2) SP-46-1988 should be followed
- (3) The drawing should include discussion with tolerances, whenever necessary and material list as per BIS / ISO specifications.

INSTRUCTIONAL STRATEGY

1. Teachers should show model or realia of the components/part whose drawing is to be made
2. Emphasis should be given to cleanliness, dimensioning, layout of sheet
3. Teachers should ensure use of IS codes related to drawing
4. Focus should be on the proper selection of drawing instrument and its proper use

LIST OF RECOMMENDED BOOKS

1. Machine Drawing by P.S. Gill; S.K. Kataria and Sons; Ludhiana
2. A Text Book of Machine Drawing by R.K.Dhawan; S. Chand and Co. Ltd New Delhi.
3. Machine Drawing by N.D. Bhatt; Charotar Book Depot. Anand.

3.6 WORKSHOP TECHNOLOGY-1

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RATIOANELE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about various manufacturing processes is required to be imparted. Hence the subject of workshop technology.

LEARNING OUTCOME

After undergoing the subject, students will be able to:

- Fabricate welding joints using gas welding arc welding, TIG, MIG/MAG welding of mild steel and stainless steel materials.
- Select suitable (most appropriate) process electrodes, various parameters of process for given job.
- Explain principle of operations of modern welding processes.
- Inspect various welding joints, castings, forgings.
- Prepare pattern for given job.
- Select material and type of patterns, cores.
- Prepare sand moulds manually and on machine.
- Select type of moulding sand, adhesives, compact, strength and parameters of sand for given job.
- Cast a mould.
- Identify a suitable furnace, alloying elements
- Carry out deburring of castings.
- Test the properties of moulding sand (permeability, Strength, refractoriness, adhesiveness, cohesiveness).
- Operate forging machine, press, spinning machine.
- Explain the principle of rolling, extrusion and drawing process.

DETAILED CONTENTS

1. Welding (18 hrs)

1.1 Welding Process

Principle of welding, Classification of welding processes, Advantages and limitations of welding, Industrial applications of welding, Welding positions and techniques, symbols. Safety precautions in welding.

- 1.2 Gas Welding
- Principle of operation, Types of gas welding flames and their applications, Gas welding equipment - Gas welding torch, Oxy acetylene cutting torch, Blow pipe, Pressure regulators, Filler rods and fluxes
- 1.3 Arc Welding
- Principle of operation, Arc welding machines and equipment, A.C. and D.C. arc welding, Effect of polarity, current regulation and voltage regulation, Electrodes: Classification, B.I.S. specification and selection, Flux for arc welding. Requirements of pre heating, post heating of electrodes and work piece. Welding defects and their testing methods.
- 1.4 Other Welding Processes
- Resistance welding: Principle, advantages, limitations, working and applications of spot welding, seam welding, projection welding and percussion welding, Atomic hydrogen welding, Shielded metal arc welding, submerged arc welding, Welding distortion, welding defects, methods of controlling welding defects and inspection of welded joints. Welding defects and inspection.
- 1.5 Modern Welding Methods
- Methods, Principle of operation, advantages, disadvantages and applications of, Tungsten inert gas (TIG) welding, other welding process, Metal inert gas (MIG) welding, Thermit welding, Electro slag welding, Electron beam welding, Ultrasonic welding, Laser beam welding, Robotic welding
2. Pattern Making (03 hrs)
- Types of pattern, Pattern material, Pattern allowances, Pattern codes as per B.I.S., Introduction to cores, core boxes and core materials, Core making procedure, Core prints, positioning of cores
3. Moulding and Casting (18 hrs)
- 3.1 Moulding Sand
- Properties of moulding sand, their impact and control of properties viz. permeability, refractoriness, adhesiveness, cohesiveness, strength, flow ability, collapsibility, Various types of moulding sand, Testing of moulding sand. Safety precautions in foundry.

- 3.2 Mould Making
- Types of moulds, Step involved in making a mould, Molding boxes, hand tools used for mould making, Molding processes: Bench molding, floor molding, pit molding and machine molding, Molding machines squeeze machine, jolt squeeze machine and sand slinger.
- 3.3 Casting Processes
- Charging a furnace, melting and pouring both ferrous and non ferrous metals, cleaning of castings, Principle, working and applications of Die casting: hot chamber and cold chamber, Investment and lost wax process, Centrifugal casting
- 3.4 Gating and Riser System
- Elements of gating system, Pouring basin, sprue, runner, gates, Types of risers, location of risers, Directional solidification
- 3.5 Melting Furnaces
- Construction and working of Pit furnace, Cupola furnace, Crucible furnace – tilting type, Electric furnace
- 3.6 Casting Defects
- Different types of casting defects, Testing of defects: radiography, magnetic particle inspection and ultrasonic inspection.
4. Metal Forming Processes (6 hrs)
- 4.1 Press Working - Types of presses, type of dies, selection of press die, die material. Press Operations-Shearing, piercing, trimming, punching, notching, shaving, gearing, embossing, stamping
- 4.2 Forging - Open die forging, closed die forging, Press forging, upset forging, swaging, up setters, roll forging, Cold and hot forging
- 4.3 Rolling - Elementary theory of rolling, Types of rolling mills, Thread rolling, roll passes, Rolling defects and remedies
- 4.4 Extrusion and Drawing - Type of extrusion- Hot and Cold, Direct and indirect. Pipe drawing, tube drawing, wire drawing
5. Plastic Processing (3 hrs)
- 5.1 Industrial use of plastics, situation where used.
- 5.2 Injection moulding-principle, working of injection moulding machine.

- 5.3 Compression moulding-principle, and working of compression moulding machine.
- 5.4 Potential and limitations in the use of plastics

LIST OF PRACTICALS

General introduction to hand tools used in foundry, welding and pattern making and smithy shop.

Welding Shop

- Job 1. Preparing gas welding joint in vertical/Horizontal position joining M.S. Plates
- Job 2. Exercise on gas cutting of mild steel plate with oxy-acetylene gas torch.
- Job 3. Exercise on gas welding of cast iron and brass part or component.
- Job 4. Exercise on preparation of T Joint by arc welding
- Job 5. Exercise on spot welding/seam welding
- Job 6. Exercise on MIG and TIG welding
- Job 7. Exercise on arc welding pipe joint MS.

Pattern making

- Job 1. Preparation of solid/single piece pattern.
- Job 2. Preparation of two piece/split pattern
- Job 3. Preparation of a pattern on wooden lathe
- Job 4. Preparation of a self cored pattern
- Job 5. Preparation of a core box.

Foundry Shop

- Job 1. Preparation of mould with solid pattern on floor.
- Job 2. Preparation of floor mould of solid pattern using cope.
- Job 3. Preparation of floor mould of split pattern in cope and drag of moulding box.
- Job 4. Moulding and casting of a solid pattern of aluminum
- Job 5. Preparing a mould of step pulley and also preparing core for the same.
- Job 6. A visit to cast iron foundry should be arranged to have first hand knowledge of cast iron melting pouring and casting.
- Job 7. Testing of moisture contents and strength of moulding sand.

Forging Shop/Fitting Shop/Sheet Metal Shop

- Job 1. Preparation of single ended spanner by hand/machine forging.
- Job 2. Preparation of simple die
- Job 3. Demonstration of spinning process on lathe and spinning a bowl on a lathe machine.
- Job 4. Demonstration of grinding process on lathe machine and grinding a job on a lathe machine
- Job 5. Preparation of utility item out of G.I. sheet.
- Job 6. Preparation of drilling Jig.

INSTRUCTIONAL STRATEGY

1. Teachers should lay special emphasis in making the students conversant with concepts, principles, procedures and practices related to various manufacturing processes.
2. Focus should be laid in preparing jobs using various machines/equipment in the workshop.
3. Use of audio-visual aids/video films should be made to show specialized operations.
4. Foreman Instructor should conduct classes of each Workshop explaining use of tools, jobs to be made and safety precautions related to each workshop prior to students being exposed to actual practicals.

LIST OF RECOMMENDED BOOKS

1. Workshop Technology by BS Raghuvanshi : Dhanpat Rai and Sons Delhi
2. Elements of Workshop Technology by SK Choudhry and Hajra : Asia Publishing House
3. Welding Engineering by RL Aggarwal and T Manghnani; Khanna Publishers, Delhi
4. A Text Book of Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi
5. Foundry Technology by KP Sinha and DB Goel; Roorkee Publishing House, Roorkee.
6. A Text Book of Manufacturing Science and Technology by A Manna, Prentice Hall of India, Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	18	36
2	03	08
3	18	36
4	06	14
5	03	06
Total	48	100

ENERGY CONSERVATION AWARENESS CAMP

A diploma holder must have knowledge of various tips of energy conservation. Energy conservation has attained priority as it is regarded as additional energy resource. Energy saved is energy produced. This camp covers the basic concepts of energy management and its conservation. It gives the insight to energy conservation opportunities in household appliances and star rating. Lectures will be delivered on following broad topics. There will be no exam for this camp.

1. Classification of energy- primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy with special reference to solar energy
2. Introduction to energy management, energy conservation, energy efficiency and its need
3. Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance
4. Standards and Labeling
 - Concept of star rating and its importance
 - Types of product available for star rating
5. Salient Features of Punjab Energy Conservation Building Code (ECBC)
6. General Energy Saving Tips in:
 - Lighting System
 - Room Air Conditioners
 - Refrigerators
 - Water Heater
 - Computers
 - Fans, Heaters, Blowers and Washing Machines
 - Colour Television
 - Water Pumps
 - Kitchens
 - Transport

DRUGS USE AND ABUSE AWARENESS CAMP

Unit 1 Drugs Use and Abuse in Society

- a. Concept and overview
- b. Extent of the problem
- c. Drug use as a social problem
- d. Causes of Drug Use: Biological, Socio-cultural, psychological

Unit 2 Types of Dugs and identification of Abuse

- a. Familiar drugs: Tobacco, Caffeine, over the counter drugs
- b. Restricted Drugs: Opiates, Hallucinogens, Marijuana
- c. Reformance enhancing the drugs
- d. Uppers and Downers: Stimulants and Depressants

Unit 3 Impact of drug Abuse

- a. Individual level biological and psychological
- b. Family social, National

Unit 4 Management and prevention of Drug Abuse

- a. Medical and psychological
- b. Role of family School , Media and Legislation