3.1 AUTOMOTIVE MATERIALS

L	T	P
3	-	2

RATIONALE

Materials play an important role in the manufacturing of automobiles and the equipment/tools used in repair of automobiles. Proper selection of materials adds to the life of machinery. A diploma holder must be conversant with the properties, uses, and availability of materials used in manufacturing of different types of vehicles to enable him to perform his functions confidently. The subject of Automotive Materials has been designed to cover the above aspects.

Learning Outcome:

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

- Distinguish between metals and non metals, ferrous and non ferrous materials based on different laboratory tests.
- Analyse the composition and microstructure of specimen and change in microstructure due to various heat treatment processes
- Select suitable material to be used for various engineering applications on the basis of various factors such as environmental conditions, cost and desired properties.
- Interpret iron-carbon diagram

DETAILED CONTENTS

1. Properties of Materials (08 hrs)

   - Classification: Metals and non-metals, Ferrous and non-ferrous metals and their alloys
   - Names of common metals, their alloys and non-metals used in Automobile Industry
   - Properties of metals and alloys
   - Physical properties - Appearance, luster, colour, density and melting point
   - Mechanical Properties: Strength, stiffness, elasticity, plasticity, toughness, ductility, malleability, brittleness, hardness, fatigue and creep.
   - Thermal and electrical conductivity and corrosion resistance.

2. Ferrous Metals and Alloys (16 hrs)

   - Classification, composition and uses of cast iron and plain carbon steels. IS, BS and SAE Grades

- Effect of alloying elements such as Aluminium, chromium, Nickel, Cobalt, Manganese, Molybdenum, tungsten, Vanadium, Silicon, Sulphur and Phosphorus.
- Composition, properties, grades and uses of alloy steels such as High speed steel, Stainless steel, Silicon steel, Heat resistant steel, Spring steel

Heat Treatment : Iron-carbon diagram, objectives and practical aspects of heat treatment. Description and uses of principal heat treatment processes Annealing, Normalizing, Tempering, Hardening, Carburising, Nitriding and Cyaniding and applications. Case hardening and surface hardening, Hardenability of steels, Examples in heat treating automobile engineering components

3. Non-ferrous Metals and Alloys (10 hrs)

- Copper: Properties and uses
- Composition, properties and uses of copper alloys.
- Brass: Cartridge brass, Nickel silver.
- Bronze: Phosphor bronze, Al-bronze, Mn-bronze, and Gun metal.
- Properties and uses of Aluminium and their grades
- Composition, properties and uses of Al-alloys e.g., Duralumin, Yellow metal, Magnalium and Hindalium
- Properties and uses of alloys of lead, tin and magnesium.
- Bearing Metal: Requisite qualities. Composition, properties and uses of white metal bearing. Copper based bearing metals. Aluminium based bearing metals. Use of nylon/PTFE for bushes/bearings, bi-metallic and tri-metallic bushes

4. Identification and Examination of Metals and Alloys (2 hrs)

Identification tests - Appearance, sound, filing, weight, magnetic, spark, bend and microstructure.

5. Other Important Materials (08 hrs)

- Plastics: Definition, classification of plastics, fibre glass, reinforced plastics. Major applications of various plastics with specific mention of their uses and grades
- Heat insulating materials: Properties and uses of asbestos, glass wool, thermocole, cork, mica.
- Sound insulating materials: Cork, fibre boards.

- Fabrication materials: Wood, plywood, Rubber - natural and synthetic, Glasses – plate glass, toughened glass, safety glass.
- Insulating materials: Asbestos, mica
- Electrical insulating materials, properties and uses of china clay, leather baklite, ebonite, glasswool, rubber felt
- Refractory materials: General characteristics and uses of dolomite, ceramics.
- Protective coating materials: Auto paints, primers, varnishes, enamels, putti, electroplating materials, rubasil, teflon coating
- Adhesive requirements types and advantages, thread locking special solution, antirust solution

6. Selection and Specifications of Materials (04 hrs)

- Practical considerations for selection of material for different Automobile Components.
- ISO/Bureau of Indian standard specifications for metals, non-metals, auto components and other materials.

LIST OF PRACTICALS

1. Classification of about 25 specimen of materials/parts in material lab
2. Identification of various type of materials with respect to their properties
3. To prepare microscopic structure for examination and to examine the micro structure of specimens of following materials (i) Brass (ii) Copper (iii) Grey CI (iv) Malleable CI (v) Low carbon Steel (vi) High carbon steel (vii) HSS
4. To anneal a given specimen
5. To normalize a given specimen
6. To temper a given specimen

INSTRUCTIONAL STRATEGY

Teacher should show various types of automotive components and parts to students while imparting instructions. Visits to industry should be planned to demonstrate the use of various types of materials in the automobile industry. Students should be asked to collect samples of various materials available in the market

RECOMMENDED BOOKS

1. Material Science by GBS Narang; Khanna Publishers, New Delhi
2. Material Science and Metallurgy by RB Choudary; Khanna Publishers, New Delhi
3. Material Science by G. Narula, Tata McGraw Hill, Delhi
4. Material Science by RK Rajput; SK Kataria and Sons, Ludhiana

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	08	16
2	16	32
3	10	20
4	02	06
5	08	16
6	04	10
Total	**48**	**100**

3.2 APPLIED MECHANICS

L	T	P
3	-	2

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 (04 hrs)

   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

L	T	P
3	-	2

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 BASICS OF THERMODYMICS, HYDRAULICS AND PNEUMATICS

L	T	P
4	-	2

RATIONALE

A diploma holder in Automobile Engineering is supposed to look after the I.C engines, air compressors and air conditioning of automobiles. Therefore, it is essential to teach concepts, principles, applications and practices covering laws of thermodynamics, basic air cycles, types of fuel used and their properties and components of air conditioners. Hence this subject has been included in this course.

Learning Outcome:

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

- Explain the basis principles of thermal engineering, gas laws, laws of thermodynamics, air cycles, air compressors.
- Identify, components of hydraulics and pneumatics system
- Comprehend different modes of heat transfer
- Explain the principles of air conditioning and refrigeration, their components and functions.

DETAILED CONTENTS

1. Principles of Thermal Engineering (06 hrs)

   1.1 Introduction
   1.2 Thermodynamics properties – intensive and extensive
   1.3 Property, path, process, system, surroundings
   1.4 Heat and work
   1.5 Enthalpy and internal energy

2. Gas Laws (08hrs)

   Boyle's law, Charle's law, Joule's law, Characteristic gas equation, gas constant, universal gas constant. Simple numerical problems

3. Law of Thermodynamics (10 hrs)

   3.1 Zeroth law of thermodynamics
   3.2 Irreversible process
   3.3 First law of thermodynamics (concept only)
   3.4 Second law of thermodynamics (concept only)
   3.5 Thermal efficiency and heat pump, heat engine and heat sink
   3.6 Concept of entropy
   3.7 Constant volume, constant pressure, isothermal, adiabatic, polytropic, throttling and free expansion processes (concept only).

4. Air Cycles (08 hrs)

4.1. Carnot cycle
4.2. Otto cycle
4.3. Diesel cycle
4.4. Dual combustion cycle

5. Air Compressors (08 hrs)

5.1 Reciprocating air compressor
5.2 Centrifugal compressor
5.3 Working of single stage and double stage compressor and applications
5.4 Rotary air compressor
5.5 Working of fan, blower, booster, and super charger

6 Hydraulics (06 hrs)

Types of fluid, Properties of fluid, Pascal Law, Components of hydraulic systems, Function of each component in hydraulic circuit, Oil reservoir, filters, seals and packings, Hydraulic Jack, Hydraulic Press

7. Pneumatics (04 Hrs)

Basic components and their function, air cylinders – function, single acting and double acting, air filter, regulator, different types of control valves, concept of automation.

8. Heat Transfer (04 hrs)

Modes of heat transfer, conduction, convection, radiation, Fourier's Law

9. Refrigeration and Air Conditioning (10 hrs)

Refrigeration methods, unit of refrigeration, refrigerants, heat pump, coefficient of performance, rating of refrigeration machines

Principles of air conditioning, Concept of human comfort, Introduction to air conditioning system. components of air conditioning system and their function

LIST OF PRACTICALS

1. Determination of temperature by using: thermocouple, pyrometer.
2. Identification of components in air conditioning system.
3. To find thermal conductivity of given specimen
4. Servicing and repair of hydraulic jack
5. Servicing and repair of air compressor
6. To prepare the basic pneumatic circuit.

INSTRUCTIONAL STRATEGY

Teachers should provide simple exercises to students involving applications of various concepts and principles being covered in the subject. Tutorial sheets on various topics should be prepared and students should be asked to solve them. In practical work, students should independently perform practicals.

LIST OF BOOKS

1. Thermal Engineering by SK Kulshreshtha; Vikas Publishing House Pvt. Ltd., Delhi
2. Thermal Engineering by A.S. Sarao; Satya Prakashan, New Delhi
3. Engineering Thermodynamics by Valan A. Arasu, TMH, Delhi
4. Thermal Engineering by P.L. Ballaney; Khanna Publishers, Delhi
5. Thermal Engineering by R.K. Rajput; Laxmi Publications, New Delhi
6. Refrigeration and Air conditioning by G.S. Aulakh, Eagle Prakashan, Jalandhar.
7. Thermodynamics –I by Er. B.S. Ubhi, S.K. Kataria & Sons, Delhi.
8. Hydraulics & Pneumatics by Birinder Singh, Kaption Publishing house, New Delhi.
9. Hydraulic and Pneumatic Control by Shammuga Sundram, S.Chand & Company Ltd., New Delhi.
10. Pneumatic controls by Festo Didactic, Banglore

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	6	10
2	8	12
3	10	16
4	8	12
5	8	12
6	6	10
7	4	6
8	4	6
9	10	16
Total	**64**	**100**

3.5 AUTOMOBILE ENGINEERING DRAWING

L	T	P
-	-	6

RATIONALE

An Automobile Engineering diploma holder, irrespective of his field of operation in an industry or transport undertaking, is expected to possess a thorough understanding of engineering drawing, which includes clear spatial visualization of the subject and the proficiency in reading and interpreting a wide variety of drawings. Besides this, he is also expected to have a certain degree of drafting skills depending upon his job functions to perform his day-to-day activities e.g. communicating and discussing the ideas with his superiors and passing on instructions to his subordinates in an unambiguous way. The teachers are recommended to lay emphasis on showing automobile components to students..

Learning Outcomes:

At the end of this course, the students will be able to

- Prepare drawings of automotive components
- Interpret various drawing used in automobile engineering
- Compare hole basis system with shaft basis system and choose fits and tolerances for various mating parts.

DETAILED CONTENTS

1. Limits and Fits (01 sheet)
   Limit, tolerance, Geometrical Tolerance, deviation, allowance, fits: clearance, interference, transition fit, Hole and shaft basis system.

2. Assembly Drawings of the following automotive components:

   Joints and Bearings (04 sheets)

   - Universal joint,
   - Slip joint
   - Bush bearing
   - Plummer block or pedestal bearing
   - Ball bearing
   - Roller bearing- Straight and Needle type

3. Drawings of the following automotive components:

   Engine Components (06 sheets)

   - Four Stroke Petrol Engine Piston
   - Diesel Engine Piston

- Connecting rod
- Fuel injector
- Crank shaft – 4 cylinder Engine
- Cam shaft
- Spark Plug

4. Drawing of the following components:

4.1 Chassis components (05 sheets)

- Shock absorber
- Wheel cylinder
- Master Cylinder
- Brake drum (assembly)
- Singe plate clutch

4.2 Gears

- Nomenclature of gears (2 sheets)
- Profile of spur gear by 'Approximate method'
- Profile of spur gear by "Unwin's Method'

4.3 Cam Profile (3 sheets)

- Different types of cams and followers
- Drawing of cam profile for following motion of follower
  (a) Uniform velocity motion
  (b) Simple harmonic motion (SHM)
  (c) Uniformly accelerated and retarded motion.

5. Free hand sketching (2 sheet)

- Battery ignition system
- Magneto ignition system
- Lighting system
- Leaf spring suspension
- Overhead and side valve mechanism

INSTRUCTIONAL STRATEGY

Teacher should make use of models while explaining the details of drawing of various automobile parts and components. Emphasis should be laid on cleanliness and quality of drawings.

RECOMMENDED BOOKS

1. Auto Engineering Drawing by RB Gupta; Satya Parkashan, New Delhi
2. Automobile Engg. Drawing by Raj Kumar, North Publication, Jalandhar
3. Machine Drawing by PS Gill; BD Kataria and Sons, Ludhiana
4. Machine Drawing by Lakshminarayan; Jain Brothers, New Delhi
5. Automobile Engineerig- Vol. I and II by Dr. Kirpal Singh, Standard Publishers Distributors, Delhi

3.6 WORKSHOP TECHNOLOGY-1

L	T	P
3	-	7

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 Risering 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 moudling 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 RECOMMEMDED 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 Publishng 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: Tabacco, 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