

3.1 BASICS OF THERMAL AND HYDRAULICS ENGINEERING

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.

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

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| 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 | |
| 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. Demonstration of heat transfer through heat conduction, convection and radiation.
4. To study circuit of hydraulic jack.
5. To study hydraulic circuit of automotive brake

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, Bangalore

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

3.2 APPLIED MECHANICS

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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.

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. Applied Mechanics By, Col. Harbhajan Singh, TL Singha and Parmod Kumar Singla Published By Abhishek Publication, 57-59, Sector-17, Chandigarh
3. A Text Book of Engineering Mechanics (Applied Mechanics) by RK Khurmi; S Chand and Co. Ltd., New Delhi.
4. A Text Book of Applied Mechanics by RK Rajput; Laxmi Publications, New Delhi..
5. Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House, 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.

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 (04 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 (06 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. Batteries (02 hrs)
- Construction, charging and maintenance of lead and batteries, maintenance free batteries
10. 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. Charging and testing of a lead – acid battery
4. Troubleshooting in domestic wiring system, including distribution board
5. Connection and reading of an electric energy meter
6. Use of ammeter, voltmeter, wattmeter, and multi-meter
7. Measurement of power and power factor in a given single phase ac circuit
8. Study of different types of fuses, MCBs and ELCBs
9. Study of zener as a constant voltage source and to draw its V-I characteristics
10. Study of earthing practices
11. To draw V-I characteristics of a (i) NPN transistor (ii) thyristor (SCR)
12. 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	04	10
4	06	12
5	06	12
6	08	16
7	06	12
8	04	10
9	02	04
10	05	10
Total	48	100

3.4 WORKSHOP TECHNOLOGY-1

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4 - 6

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.

DETAILED CONTENTS

1. Welding (22 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.
 - 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
 - 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.
 - 1.5 Modern Welding Methods

Methods, Principle of operation, advantages, disadvantages and applications of, Tungsten inert gas (TIG) welding, Metal inert gas (MIG) welding, Thermit welding, Electro slag welding, Electron beam welding, Ultrasonic welding, Laser beam welding, Robotic welding

2. Pattern Making (05 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 (22 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.
- 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 (10 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 (05 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 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

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.

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. Manufacturing Technology by M Adithan and A.B. Gupta; Wiley Eastern India Ltd. New Delhi.
4. Welding Engineering by RL Aggarwal and T Manghnani; Khanna Publishers, Delhi
5. A Text Book of Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi
6. Foundry Technology by KP Sinha and DB Goel; Roorkee Publishing House, Roorkee.
7. 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	22	34
2	05	08
3	22	34
4	10	16
5	05	08
Total	64	100

3.5 AUTO ENGINE - I

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3 - 2

RATIONALE

Engine forms the base of Automobile Engineering. As the scope of auto engines is very wide, it has been divided into two subjects, Auto Engine –I and Auto Engine-II. This subject deals with engine terminology basic concept of 2 stroke and 4 stroke engine, classification of engines, constructional details of petrol engine, fuel system, cooling system, lubrication system and ignition system,.

DETAILED CONTENTS

1. Introduction (8 hrs)
 - Engines, internal and external combustion Engines, Engine terminology including Bore, Stroke, dead centres, Compression Ratio, Swept volume, clearance volume, compression ratio, Engine capacity, Engine torque, Indicated power, Brake power, Friction power
 - Classification of engines as per stroke, cycle, fuel, ignition, cooling, speed, number and arrangement of cylinders, governing, reciprocating and rotary,
 - Concept of 2-stroke and 4- stroke engines and their comparison.

2. Engine Components (08 hrs.)

Construction details, specification, function and working of components, cylinder block, head, cylinder liner, piston, piston rings, wrist pin, connecting rod, crankshaft bearing, camshaft, valves and valves mechanisms. flywheel and dampers.

3. IC Engine Testing (06 hrs)

Testing of I.C. engine and determination of Indicated Power and Brake Power. Mechanical Efficiency, Volumetric efficiency, Thermal Efficiency, Relative Efficiency, Mean Effective Pressure and Specific fuel consumption. Heat balance sheet, Morse Test.

4. Fuel System in spark Ignition Engine (10 hrs)

Fuel System: types of fuel feed system, gravity and pump feed. Fuel tank, fuel lines, fuel filters, carburetion.

Circuits of carburetor: Float circuit, starting and choke circuit, idling, low speed, high speed part load and full load circuits. Construction and working of solex, and amal carburetors, dry and wet air cleaners. Intake and exhaust manifold, mufflers.

Petrol Injection: - Introduction, Comparison with Carburetor method, Description and working of multipoint fuel injection (M.P.F.I.), Advantages and disadvantages of M.P.F.I., Sensors.

5. Ignition system (06 hrs)

Concept of ignition system, types of ignition systems, Battery/coil and magneto ignition system, Function and working of ignition coil, distributors, condenser, advance mechanisms, C.B. Point and gap, spark plugs and gaps pertaining to Indian vehicles., Distributor less Ignition System.

6. Cooling System (05 hrs)

Cooling system, necessity, types(air, water), pump circulation cooling., Advantages & Disadvantages of Air cooling & water cooling, Components of Water cooling system- Radiators, thermostat, water pump, Fan, Pressure cap, Water jackets, anti-freeze solution, trouble shooting and remedies.

7. Lubrication System (05 hrs)

Necessity and types of Lubrication system (Splash System, Pressure system), wet and dry sump, Components used, oil pump, oil lines, oil filters, oil coolers, crankcase ventilation, characteristics, classification and service ratings of lubricating oil, additives for lubricants.

LIST OF PRACTICALS

1. Study, sketching and working of basic components of an automobile engine such as cylinder block, cylinder head, piston, connecting rod and crankshaft.
2. Study, sketching and working of mechanical fuel pump.
3. Study, sketching and working of electrical fuel pump.
4. Servicing of water-cooling system, radiator, fan, and pump.
5. Identification of each part and working of solex carburetor
6. Identification of each part and working of Maruti carburetor
7. Identification of each part and working of scooter carburetor
8. Servicing of lubrication system.

INSTRUCTIONAL STRATEGY

The Teacher should lay emphasis in making the students conversant with the principles and practices related to various types of engines. Audio visual aids should be used to show engine features and working. Demonstrations should be made in automobile shop to explain various engine components.

RECOMMENDED BOOKS

1. Automobile Engineering – Vol. II by Dr. Kirpal Singh; Standard Publishers Distributors.
2. Automobile Engineering by R.B. Gupta; Satya Prakashan, New Delhi
3. Automotive Engines by Srinivasan, TMH, Delhi
4. Automobile Engineering by Chikara, Dhanpat Rai and Sons, New Delhi
5. Automobile Engineering by KM Gupta, Umesh Publishers, Delhi
6. Auto Engine –I by G.S. Aulakh, Eagle Prakashan, Jalandhar.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	8	18
2	8	18
3	6	12
4	10	20
5	6	12
6	5	10
7	5	10
Total	48	100

3.6 AUTOMOTIVE MATERIALS

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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.

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. 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 bakelite, 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
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

ECOLOGY AND ENVIRONMENTAL AWARENESS CAMP

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the eco system and controlling pollution by pollution control measures. He should also be aware of environmental laws related to the control of pollution.

This is to be organized at a stretch for 3 to 4 days. Lectures will be delivered on following broad topics. There will be no examination for this subject.

1. Basics of ecology, eco system and sustainable development
2. Conservation of land reforms, preservation of species, prevention of advancement of deserts and lowering of water table
3. Sources of pollution - natural and man made, their effects on living and non-living organisms
4. Pollution of water - causes, effects of domestic wastes and industrial effluent on living and non-living organisms
5. Pollution of air-causes and effects of man, animal, vegetation and non-living organisms
6. Sources of noise pollution and its effects
7. Solid waste management; classification of refuse material, types, sources and properties of solid wastes, abatement methods
8. Mining, blasting, deforestation and their effects
9. Legislation to control environment
10. Environmental Impact Assessment (EIA), Elements for preparing EIA statements
11. Current issues in environmental pollution and its control
12. Role of non-conventional sources of energy in environmental protection

ENVIRONMENTAL STUDIES

RATIONALE

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the eco system and controlling pollution by pollution control measures. He should also be aware of environmental laws related to the control of pollution.

Lectures will be delivered on following broad topics.

DETAILED CONTENTS		
1	Basics of ecology, eco system and sustainable development.	
2	Conservation of land reforms, preservation of species, prevention of advancement of deserts and lowering of water table	
3	Sources of pollution - natural and man made, their effects on living and non-living organisms	
4	Pollution of water - causes, effects of domestic wastes and industrial effluent on living and non-living organisms	
5	Pollution of air-causes and effects of man, animal, vegetation and non-living organisms	
6	Sources of noise pollution and its effects	
7	Solid waste management; classification of refuse material, types, sources and properties of solid wastes, abatement methods	
8	Mining, blasting, deforestation and their effects	
9	Legislation to control environment	
10	Environmental Impact Assessment (EIA), Elements for preparing EIA statements	
11	Current issues in environmental pollution and its control, Global warming, Green house gases, non-conventional sources of energy, introduction to clean technology.	
12	Introduction to Green buildings, site selection, material efficiency, energy efficiency, water efficiency, building form.	
13	Role of non-conventional sources of energy in environmental protection	

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Marks Allotted (%)
1	5
2	7
3	7
4	10
5	10
6	6
7	10
8	6
9	6
10	8
11	10
12	5
13	10
Total	100