3.1 BASIC AUTOMOBILE ENGINEERING

L	T	P
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RATIONALE

A diploma holder in automobile engineering should have an overall view of automobiles before learning the detail aspects of various systems of automobile. This subject provides a broad knowledge about the power plant, electrical system, transmission, final drive, braking system, front axle, steering, frame and chassis. This knowledge will be helpful to the students in co-relating various systems with each other and understanding the individual systems in a better manner

DETAILED CONTENTS

1. Introduction (6 hrs)

   - Classification of vehicles on the basis of load, wheels, final drive, fuel used, axles, position of engine and steering transmission, body and load (definition only)

   - Layout of an automobile chassis, function of major components of a vehicle and introduction to their different systems such as frame, power plant, transmission (clutch and gear box), final drive, braking system, front axles, steering and suspension systems (just line diagrams and utility)

2. Thermodynamics (4 hrs)

   First and second law of thermodynamics (concept only), otto cycle, diesel cycle. Types of automotive fuels, properties of fuels, air requirement for complete combustion of fuel

3. Concept of Static Pressure (4 hrs)

   Definition of Pascal’s law, Pressure head

4. Flow of Liquid (6 hrs)

   Laminar and turbulent flow, law of continuity, velocity head, datum head, total head, Bernoulli's Theorem (definition only, no derivation, simple numericals)

5. Flow Through Pipes and Hydraulic Pumps (6 hrs)

   Friction losses in pipes, introduction to reciprocating and centrifugal hydraulic pump, gear pump

6. Power Plant (6 hrs)

Concept of two stroke and four stroke petrol and diesel engines and their applications to automobiles. Various terms, specification of automobile engines

7. Automotive Systems (6 hrs)

- Automobile fuel system: Fuel tank,, filters, carburettor, fuel injection
- Automobile cooling system: Air and water cooling, radiator, fan, water pump
- Auto lubrication system: Lubricants, necessity and desirable properties, oil additives

8. Suspension (4 hrs)

- Purpose and types of suspension – principle and components of rigit axle suspension
- Tyres – types of function, comparison

9. Auto Industry in India (6 hrs)

History, leading manufacturers, development in automobile industry, trends, new products

LIST OF BOOKS

1. Thermal Engineering by PL Ballaney, Khanna Publishers, New Delhi
2. Hydraulics and Hydraulics Machines by RS Khurmi, S Chand and Co., Delhi
3. Automobile Engineering by Dr. Kirpal Singh, Strandard Publishers, Delhi
4. Automobile Engineering by RB Gupta, Satya Parkashan, New Delhi

3.2 BASIC MECHANICAL ENGINEERING

L	T	P
3	1	2

RATIONALE

A diploma holder is supposed to select and analyze the reasons for failure of different components and select the required material for different applications. It is essential to teach the diploma holders about concepts, principles, applications and practices covering stresses and strain, beams, bending moment and shear force, springs and shafts. Knowledge in basic concepts of simple mechanism, flywheel and governor, balancing, vibrations and vehicle in motion is also very much required to understand the problems in the moving parts of automobile. It is expected that efforts will be made by the teachers to provide appropriate learning experiences to the students for developing necessary competencies related to this subject area.

DETAILED CONTENTS
SECTION - A

1. Stresses and strain (8 hrs)

- Introduction to stress and strain
- Mechanical properties of materials
- Tensile and compressive stress
- Shear stress and strain
- Hooke’s law and Young's Modulus of elasticity
- Modulus of Rigidity
- Poisson's ratio
- Bulk Modulus
- Deformation and stress in a uniform bar
- Deformation and stress in a non uniform bar
- Temperature stresses
- Longitudinal and hoop stress in thin and thick cylinders

2. Beams and Bending (6 hrs)

- Concept of beam, rod, shaft (different types of structure members)
- Different types of supports - Fixed support, Roller support, Hinged support
- Concept of a simply supported beam and cantilever
- Concept of bending moments and shear force
- B.M. and S.F. diagrams for Beams - for uniformly distributed loads, for concentrated loads
- Determination of position of maximum B.M. and S.F. in a beam
- Point of contraflexure

3. Bending and Shear Stresses (7 hrs)

- Concept of Bending, bending equation and assumptions made in it
- Flexural formulae
- Concept of second moment of area for
  - Simple section
  - Rectangular cross section
  - Circular cross section
  - Triangular cross section
  - Hollow circular cross section
  - I-section
- Calculation of bending stresses for the above sections with given loading and span
- Section Modulus
- Average shear stress in Rectangular and I section

4. Springs (5 hrs)

- Strain energy and proof resilience. Castigliano's theorem
- Leaf Springs
- Maximum deflection in leaf springs
- Maximum stress in leaf springs
- Closed coiled and open coiled springs subjected to axial load and axial twist – maximum stress and deflection of free end
- Stiffness of a spring

5. Shafts (6 hrs)

- Concept of torque and angle of twist
- Torsion equation
- Torque developed by hollow and solid shafts of round sections
- Comparison of torque developed by hollow and solid shafts

SECTION - B

6. Simple Mechanism (4 hrs)

- Definition of link, kinematic pair, kinematic chain, mechanism, inversions and machines
- Simple examples of mechanism with lower pairs, four bar chain, slider crank chain, double slider crank chain and higher pairs

7. Flywheel and Governor (6 hrs)

- Flywheel, concept of moment of inertia and radius of gyration
- Fluctuation of energy for flywheel
- Concept of a governor, comparison between a flywheel and a governor
- Types of governors and their working principle (without derivation)

8. Balancing (3 hrs)

- Concept of static and dynamic balancing

9. Vibrations (3 hrs)

- Causes of vibrations in machines, their harmful effects and remedies

LIST OF PRACTICALS

1. To study tensile behaviour of three different metals.

2. To calculate shear strength of two different metals under single and double shear.

3. Test on a spring to study comparative effects of gradual, sudden and falling loads.

4. Calculation of impact strength of metals by
   - Charpy test
   - Izod test

5. To calculate bending strength by performing bending test on
   - a steel box and wooden beam
   - a steel flat

6. To calculate torsion strength of 3 different metals by torsion test.

7. To calculate hardness of metals by
   - Rockwell hardness test
   - Vickers hardness test

8. Study of various types of mechanisms through models

9. Study of governors through models

10. Wheel balancing

RECOMMENDED BOOKS

1. Mechanics of Materials by Kirpal Singh, Standard Publishers/Distributors, New Delhi
2. Strength of Materials by R.S. Khurmi; S Chand and Company, Delhi
3. Elements of Strength of Materials by D.R. Malhotra and H.C. Gupta; Satya Parkashan, New Delhi
4. Theory of Machines by DR Malhotra and HC Gupta, Satya Prakashan, Delhi
5. Theory of Machines by PL Ballaney, Khanna Publishers, New Delhi

3.3 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

L	T	P
3	-	2

RATIONALE

The objective of the course is to impart basic knowledge and skills regarding electrical engineering, which diploma holders will come across in their professional life

DETAILED CONTENTS

1. Application and Advantage of Electricity (4 hrs)

   Difference between AC and DC, various applications of electricity, advantages of electrical enginergy over other types of energy

2. Basic Quantities of Electricity (4 hrs)

   Definition of voltages, current, power and energy with their units, name of instruments used for measuring above quantities, connection of these instruments in an electric circuit

3. Electromagnetic Induction (4 hrs)

   Production of e.m.f., idea of a transformer and its working principle

4. Distribution System (8 hrs)

   Difference between high and low voltage distribution system, identification of three-phase wire, neutral wires 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

5. Domestic Installation (7 hrs)

   Distinction between light and fan circuits and single phase power circuit, sub-circuits, various accessories and parts of electrical installation. Identification of wiring systems. Common safety measures and earthing

6. Electric Motor (9 hrs)

   Definition and various 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

7. Electrical Safety (5 hrs)

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

8. Basic Electronics (7 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 application of a thyristor, characteristics and applications of servo motors.

LIST OF PRACTICAL

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 of a lead – acid battery
4. Troubleshooting in domestic wiring system
5. Connection and reading of an electric energy meter
6. Study of a distribution board for domestic installation
7. Use of ammeter, voltmeter, wattmeter, energy meter and multi-meter
8. Ohm's Law verification
9. Verification of law of resistance in series
10. Verification of law of resistance in parallel
11. Study of different types of fuses
12. Study of earthing pratices

RECOMMENDED BOOKS

1. Basic Electrical Engineering by PS Dhongal; 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

3.4 MANUFACTURING TECHNOLOGY - I

L	T	P
3	-	4

RATIONALE

The knowledge of manufacturing techniques in the area of foundry, machine shop (fitting shop, lathe machines and shaping), inspection and gauging and in coating both on metallic and non-metallic is essential at the first stage for understanding technology. Hence the following topics are included.

DETAILED CONTENTS

1. Fitting (10 hrs)

Fits, limits and tolerances and their applications, unilateral and bilateral tolelances, gauges, gauge tolerances, micrometer, vernier, height gauges, dial comparator, straight edge, surface plate. Metal cutting, metal shear, metal sawing, metal bending. Types of pipes, their materials and pipe standards. Types of pipe fittings and applications, pipe threads and thread cuttings.

2. Metallic and Non-metallic Coatings (6 hrs)

Necessity of metallic and non-metallic coatings, principles and processes of electroplating, galvanizing, vacuumizing, metal spraying, painting and their applications, preparation of base materials. Uses of primers, paints and finish coatings, powder coating and its advantages.

3. Foundry (10 hrs)

Introduction, types of patterns, pattern materials, cores and core boxes, core materials, preservation and storage of patterns,. Introduction to moulding, types of moulding sounds, types of moulds, preparation of cores, defects in moulds and their remedies, types of melting furnaces (pit furnace, tilting furnace, cupola, oil fired and induction furnaces), casting defects and their remedies.

4. Lathes (10 hrs)

Introduction, types of lathes, specifications, description and functions of lathe parts, feed mechanism, drives and transmission, work holding devices, turning tools

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Lathe operations – plain turning, facing, centring, parting off, undercutting, taper turning, eccentric turning, drilling, reaming, thread cutting and knuling, speeds and feeds of cut.

Introduction to capstan and turret lathes, copying lathe and their attachments, difference between capstan and turret lathes and heads, tool holders and tool layout, tool geometry and use of throwaway tips, brazed tools and HSS tools.

5. Shaper (2 hrs)

Operation and mechanism

6. Inspection Instruments and Gauges (10 hrs)

Height gauge, depth gauge, bore gauge, slip gauge, sine bar, measurement of taper by use of slip gauges, limits, fits and tolerances, interchangeability, Go and Not-Go gauges, screw thread micrometer, thread gauge, radius gauge, dial gauge, and gear tooth vernier, hardness checking instruments, coating thickness checking instruments, surface finish checking instruments, Tallyrand with computerized display of readings.

LIST OF PRACTICALS

1. Fitting shop

Bench work and fittings; simple male-female fitting (fitting of pulley, bearings, gears on shafts), scraping, pipe fittings with leakproof joints, checking alignment and centre distance

2. Pattern making and foundry shop

- To prepare pattern of rectangular block, 'V' block, step pulley with core box, split pattern
- Preparation of open floor mould of solid pattern, cope drag mould using split pattern
- Visit to foundry to see castings of cast iron, steel, non-ferrous materials, hand moulding, machine moulding and melting furnaces. Induction heating and gas fixed furnaces

3. Lathes

- Introduction to turning machine and allied services like cutting tool grinding, general shop layout including maintenance, oils, tools and gauge stores.
- Different exercises in turning like plain turning, step-turning, facing, chamfering, knurling, parting off and thread cutting, use of compound slide and tailstock, tool grinding, selection of coolant and lubricants and speed and feeds. Use of safety goggles.

LIST OF BOOKS

1. Workshop Technology by BS Raghuwanshi, Dhanpat Rai & Sons, Delhi
2. Manufacturing Technology by M Adithan and Gupta, New Age International (P) Ltd., Delhi
3. Elements of Workshop Technology by SK Choudhary & Hazara, Asia Publishing House
4. Principles of Foundry Technology by Jain, Tata McGrawHill, New Delhi
5. Workshop Technology, Vol-I, II & III by Chapman, Standard Publishers Distributors, New Delhi

3.5 AUTO ENGINEERING DRAWING - I

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 production drawings and maintenance 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 give more emphasis to the students by showing them automobile components.

DETAILED CONTENTS

Drawing of the following components:
All drawings to be made to the scale:

1. Joints and Pulleys (1 sheet)

   - Universal joint, slip joint
   - Stepped or cone pulley, V-belt pulley

2. Engine Bearings (1 sheet)

   - Bush bearing
   - Split bearing
   - Thrust bearing,
   - Ball bearing
   - Roller bearing – straight and needle

3. Engine Components (7 sheets)

   - Four stroke petrol engine piston
   - Two stroke petrol engine piston
   - Four stroke diesel engine piston
   - Connecting rod
   - Crank shaft of 4 cylinder engines
   - Crank shaft of single cylinder engines

4. Screw Jack (1 sheet)

5. Spark Plug (1 sheet)
6. Gears (2 sheets)

Drawing of gear tooth profile for spur gear, nomenclature and profiles by Approximate and Unwin's method

7. Cam Profile (3 sheets)

- Different types of cams and followers
- Types of motion of follower
- Uniform velocity motion
- Simple harmonic motion
- Uniformally accelerated and retarded motion
- Drawing of cam profiles for the above motions

Note: 25% of drawings to be made using AutoCAD

RECOMMENDED BOOKS

1. Engineering Drawing by RB Gupta; Satya Parkashan, New Delhi

2. Machine Drawing by PS Gill; BD Kataria and Sons, Ludhiana

3. Machine Drawing by Lakshminarayan; Jain Brothers, New Delhi

3.6 AUTO WORKSHOP

L	T	P
-	-	6

RATIONALE

The automobile workshop practice inducts practical attitudes amongst the automobile engineering technician, supervisor/manager in transport undertaking/private sector has to deal with fabrication, repair and maintenance of vehicle such as patching, painting etc. Therefore, for a automobile technician, it is necessary to develop the skills of handling and use of tools and maintenance of the vehicle. As a proprietor of a service station, the knowledge of car washer, hydraulic hoist is essential as lot of repair work of light commercial vehicles has to be carried out on hydraulic hoist.

DETAILED CONTENTS

1. Identification and sketching of general tools of automobile workshop and practice to use them
2. Identification and sketching of special tools and gauges of automobile workshop and practice to use them
3. Identification and function of each component of air-compressor, car washer and hydraulic hoist.
4. Identification, dismantling and assembling of AC fuel pump
5. Identification and sketching of major components in the layout of chassis of a scooter/motor cycle/3 wheeler
6. Identification and sketching of major components in layout of chassis of a car/jeep, truck/bus
7. Removal and fitting of wheels and tyres of car/jeep and rotation of tyres, tyre pressure, use of gauges
8. Removal and fitting of wheels and tyres of a two wheeler and repairing of punctures.
9. Soldering of defective radiator and brazing of a fuel tank
10. Cleaning, greasing, checking as per maintenance schedule of two wheelers
11. Cleaning, greasing, checking as per maintenance schedule for washing, wiping and polishing of jeep/car
12. Flushing out water jackets, cleaning of radiator and refitting in vehicle, adjustment of fan belt tension.

RECOMMENDED BOOKS

1. Car maintenance and repair by Arthur W. Judge
2. Carburettors and Fuel Injection System by Arthur W. Judge