4.1 AUTO ENGINE - I

L	T	P
3	-	3

RATIONALE

Engine forms the base of automobile engineering. Since the scope of automobile engines is very wide, it has been divided in two subjects i.e. Auto Engine-I and Auto Engine-II. Auto Engine-I mainly deals with constructional details and various systems of petrol engine like fuel, carburetor and MPFI ignition, cooling, lubrication system and manifolds.

DETAILED CONTENTS

1. Introduction (10 hrs)

   - Concept of internal and external combustion engine and their comparison, classification of IC engine as per stroke, cycle of operation. Types of fuels used, method of air charging, types of ignition, types of cooling, cylinder arrangement, engine location. Applications of IC engines, two stroke, four stroke of S.I. and C.I. engine

   - Engine performance parameters (definitions only), BHP, IHP, FHP, indicated thermal efficiency, mechanical efficiency, volumetric efficiency, relative efficiency, mean effective pressure and specific fuel consumption.

2. Construction Details (8 hrs)

   - Specifications, functions, working and materials of components – cylinder block, cylinder head, cylinder liner, piston, piston rings and wrist pin, connecting rod, crank-shaft, cam shaft, bearings, valves and valve actuating mechanism, fly wheel and dampers.

   - Nomenclature of cylinder bore, piston area, stroke, dead centres (top and bottom), swept volume, clearance volume, compression ratio

3. Fuel Supply System (6 hrs)

   Fuel supply circuits in petrol engine, function of various components in the circuit, gravity, vacuum and pump feed systems, AC mechanical and electrical fuel feed pump, fuel filters, fuel gauges – balanced coil and bi-metallic type.

4. Carburation (8 hrs)

   - Theory of carburation, air fuel ratio required under various conditions of operation of engine. Important circuits in carburetors – starting, idling, low speed accelerating, economy and full power circuits. Automatic chokes, description of solax and amal carburetors.

   - MPFI – Description and working of multipoint fuel injection. Advantages and disadvantages of M.P.F.I

5. Ignition System (4 hrs)

   Phenomenon of carburation in petrol engine, type of spark ignition system, battery/coil and magneto ignition system. Distributor: its function, layout and drive. Automatic spark advance methods. C.B. point gap, spark plug gap adjustment. Ignition timing. Electronic ignition system.

6. Cooling System (4 hrs)

   Necessity of cooling, types, direct and indirect, air cooling fins, blowers application, indirect or coolant cooling, pump circulation system, water jacket, water pump fan and its drive. Radiator and its types. Thermostat for temperature control, temperature gauges, pressurized cap, anti-freeze solutions, scale and corrosion.

7. Lubrication Systems (4 hrs)

   Various lubrication systems – splash, pressure and combined splash of pressure lubrication, oil pumps, oil lines, filters, coolers, crank case ventilation. Requirements of engine lubrication oils, their specifications, oil consumption and additives for lubricants.

8. Air Supply/Intake and Exhaust system (4 hrs)

   Inlet and exhaust manifold, consideration for good manifold design, materials. Various types of air cleaners – dry and wet, centrifugal. Exhaust silencers, different types, valve timing diagrams

LIST OF PRACTICALS

1. Servicing of lubrication system – flushing crankcase, cleaning and replacing oil, filter elements.

2. Servicing of fuel system – petrol feed system, cleaning, flushing fuel tank, changing of fuel filters.

3. Servicing of feed pump, mechanical, electrical pump and testing.

4. Servicing of air cleaning.

5. Servicing of carburetor, cleaning and adjustment.

6. Setting of fuel injection pump timing of a diesel engine.

7. Overhauling of fuel injector and pump.

8. Servicing of valves and vale mechanism – replacement of valve, valve seats and valve seats, checking and replacement of defective springs, facing of valves, tappet and rocker arm, adjusting valve tappets.

9. Dismantling and assembling water pumps. Back – flushing of cooling system/radiator.

10. Engine tune up

LIST OF BOOKS

1. Automobile Engineering by Dr. Kirpal Singh, Standard Publications.

2. Automobile Engineering by RB Gupta.

3. Automobile Engineering by Chitkara.

4.2 MATERIALS AND METALLURGY

L	T	P
3	-	2

RATIONALE

Materials play an important role in the construction and manufacturing of equipment/tools. Right selection of materials add to the economy, working and life of machinery. A diploma holder must be conversant with the properties, uses, availability and costs of materials used for construction/fabrication to enable him to perform his functions confidently. The subject of Materials and Metallurgy has been designed to cover the above aspects.

DETAILED CONTENTS

1. Importance of Materials (4 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 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
   - Corrosion, causes, effects and prevention.

2. Metallurgical Considerations (6 hrs)

   Solidification of metals form liquid to solid state of pure metals, cooling curves of pure metals, dendritic solidification, crystal formation, types of crystal structure. Phase diagram of:

   (i) Solid-state solubility.
   (ii) Partial solubility.
   (iii) Nil solubility i.e. eutectic solution (Binary only). Effects of all alloying elements on engineering materials. Effect of grain size on mechanical properties.

3. Ferrous Metals and Alloys (12 hrs)

- Flow diagram for the production of ferrous metals from their ores, constituents of iron, iron carbon diagram.
- 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 Phosphorous on steels.
- Composition, properties, grades and uses of special steels such as High speed steel, Stainless steels, Silicon steels, Heat resistant steels, Spring steel.
- Heat Treatment: Iron-carbon diagram, objectives and practical aspects of heat treatment. Brief description and uses with examples of principal heat treatment processes, Annealing, Normalizing, Tempering, Hardening, Carburising, Nitriding and Cyaniding and applications. Examples in heat-treating engineering components time, temperature transformation curve.

4. Non-ferrous Metals and Alloys (12 hrs)

- Copper: Properties and uses
- Composition, properties and uses of copper alloys.
- Brasses: Cartridge brass, Nickel silver.
- Bronzes: Phosphor bronze, Al-bronze, Mn-bronze, and Gun metal.
- Properties and uses of Aluminium.
- 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 Metals: 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

5. Identification and Examination of Metals and Alloys (1 hrs)

   Identification tests - Appearance, sound, filing, weight, magnetic, spark, bend and microstructure. Different types of etchants for preparation of surface structure.

6. Other Important Materials (10 hrs)

   - Plastics: Definition, classification of plastics, fibre glass, reinforced plastics. Major applications of various plastics and their uses and grades.
   - Composite materials.
   - Heat insulating materials: Properties and uses of asbestos, glass wool, thermocole, cork, mica.
   - Electrical insulating materials. Properties and uses of china clay, leather, bakelite, ebonite, glass wool, rubber, felt.
   - Sound insulating materials: Cork, fibre boards.
   - Fabrication materials: Wood, plywood, rubber – natural and synthetic, Glass – plate glass, toughened glass, safety glass.
   - Refractory materials: General characteristics and uses of dolomite, ceramics.
   - Protective coating materials: Paints, primers, varnishes, enamels, putti, electroplating materials, rubasil, teflon coating.
   - Sealant and adhesives – Application and availability of sealant and adhesives for industrial user.

7. Selection, specifications and commercial availability of materials (3 hrs)

   - Practical considerations for selection of material for different purposes
   - ISO/Bureau of Indian standard specifications for metals, non-metals, various components and materials.

LIST OF PRACTICALS

1. Classification of about 25 specimen of materials/parts in material lab, identify and indicate the type of materials with respect to their properties

2. Study of metallurgical microscope.

3. To prepare microscopic structure for examination and to examine the micro structure of specimens of various metals and alloys.

4. Study of heat treatment furnaces.

5. To study the effects of heat treatments processes on the following materials:

   (i) Low carbon steel
   (ii) Mild steel
   (iii) High Carbon Steel

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 RK Rajput; SK Kataria and Sons, Delhi.
4. Materials and Matallurgy by D.S. Nutt. SK Kataria and Sons, Delhi.

4.3 CHASSIS, BODY AND TRANSMISSION - I

L	T	P
3	-	3

RATIONALE

Chassis, body and transmission forms the core of automobile engineering. The subject focuses at imparting knowledge and skills regarding chassis and body, viz. clutch system, transmission system, drive system, steering mechanism, braking system, wheels and tyres.

DETAILED CONTENTS

1. Chassis and Body (6 hrs)

   Classification of vehicles, layout of conventional type of chassis, function and arrangement of major assemblies. Alternating arrangement used such as engine position, drive types, their merits and demerits. Constructional details of car body. Materials used for chassis frames, body components, interior body dressing components, body upholstery, body streamlining, protective coatings and body air-conditioning, types of frame and body, cross members, brackets, materials for frame.

2. Clutch (5 hrs)

   Necessity, function and requirements of clutch, types of clutch - single plate, multiplate clutch, wet and dry clutch, clutch plate and lining material

3. Transmission (6 hrs)

   Necessity, function, types and working of transmission – sliding, constant mesh, synchromesh

4. Driveline (8 hrs)

   Propeller shaft - function, construction details. Universal joints - functions and types. Constant velocity joints. Types of final drive – hotchkiss drive, torque tube drive. Differential – principle, functions and its working, rear axles – semi floating, fully floating, three quarter floating. Common faults and remedies

5. Steering (8 hrs)

Types of front axles and their constructional details. Steering mechanism, function Ackerman's Principle of steering , working and constructional details of steering gear, steering linkages, front and geometry-castor, camber, steering axis inclination, toe in and toe out. Cornering force, cornering power and self-righting torque, over steering and under steering.

6. Braking System (8 hrs)

Purpose of brakes, layout of hydraulic and mechanical braking system, components. Principle of hydraulic brakes, braking action, master cylinder, wheel cylinder, leading and trailing shoes, self adjusting and self releasing action, its dissipation, antilock and antiskid devices, pedal travel, brake enclosures, heat generation, its dissipation, and operating temperature, brake drum and their material, lining materials, lining thickness and lining area, brake shoes, shoe clearance, split brakes, hand brakes, brake fluids, disc brakes, brake adjusters

7. Wheel and Tyres (7 hrs)

Wheels – types, constructional details, specifications. Tyres - classification and purpose. Types, construction of pneumatic tyres, details of carcass of various types, comparison of cross-ply and radial-ply tyres, causes of excessive tyre wear, effects of different conditions of vehicle stability. Tyre care and maintenance, tubes and their types. Static and dynamic balance, retreading of tyres, tubeless tyres.

LIST OF PRACTICALS

1. Identify and service single and multiplate clutch.
2. Servicing of steering system – steering gear boxes, correction and adjustment of free play.
3. Servicing/overhauling of brakes – mechanical, hydraulic, brake adjustment and bleeding.
4. Checking and adjustment of Camber, Caster, toe-in, toe-out, king pin inclination.
5. Removing dents and minor repair, body trimming and painting.
6. Wheel balancing – static and dynamic.
7. Practice in brake shoe riveting, de-riveting, aligning the shoes and adjustment of brakes.
8. Servicing/overhauling of gear box.

RECOMMENDED BOOKS

1. Automobile Engineering, Vol. I by Dr. Kirpal Singh, Standard Publishers
2. Automotive Chassis and Body by PL Kohli
3. Automobile Engineering by GBS Narang, Khanna Publishers, Delhi
4. Automobile Engineering by CP Nakra

4.4 MANUFACTURING TECHNOLOGY - II

L	T	P
3	-	4

RATIONALE

Knowledge in various machining operations viz. drilling, boring, milling, planning and grindin processes, finishing operations, gear production, CNC machining, bending forming and welding processes is very essential for the diploma holders. Hence this subject.

DETAILED CONTENTS

1. Drilling and Boring (8 hrs)

   Introduction, Types of drills, types of drilling machines i.e. portable, bench type, piller and radial, drilling speeds and feeds, drill chucks and other accessories (jigs etc.) used in drilling machines, reaming, introduction to boring, types of boring machines – horizontal and vertical, specifications, boring bar and boring heads

2. Machining Processes (12 hrs)

   - Milling – Types of milling machines and their operations, speeds and feeds, indexing (simple and compound), types of milling cutters
   - Planing machines and their operation
   - Grinding – cylindrical, centreless and surface grinding machines, types of grinding wheels, specifications, grades and their selection, balancing of grinding wheels and their storage

3. Finishing Operations (4 hrs)

   Lapping, honing, superfinishing operations and their applications, types of abrasives used and their selection

4. Gear Production (4 hrs)

   Gear cutting and gear shaving machines, gear cutters and coolants

5. CNC Machines (4 hrs)

   Introduction to CNC control systems, advantages, productivity, accuracy and cost

6. Bending and Forming (4 hrs)

   Description of press brakes, bending dies, forming machines

7. Welding (10 hrs)

   - Introduction, types of welding (gauge welding, arc welding, resistance welding), butt welding, flash, projection, seam and spot welding. Selection of electrodes, filter metals, types of welding defects and their remedies, soldering and brazing – processes and applications
   - Special welding processes for stainless steel and aluminium

8. Types of Coolants and Lubricants for various machining processes (2 hrs)

LIST OF PRACTICALS

1. Introduction to drilling and boring machines, an exercise of simple drilling and boring operation, selection of speeds and feeds, use of jigs and fixtures and coolant.
2. Simple exercises on shaper
3. Practice on horizontal and vertical milling machines, work holding devices and types of milling cutters
4. Practice on cylindrical and centreless grinding machine, selection, dressing and storage of grinding machines. Use of lubricants
5. Practice on honing machines with selection of honing sticks, honing and finish pattern in the bore. Bore geometry measurement
6. Observe working of CNC machines including setting of cutting parameters and dimensions and loading of tools, repeatability of operation and adjustment for wear allowances
7. Visit to industry (sheet metal shoos) to observe bending and forming operation and use of dies
8. Use of appropriate coolant and lubricants for all machining operation in the workshop and during Industrial visits.

RECOMMENDED BOOKS

1. Workshop Technology by BS Raghuwanshi, Dhanpat Rai & Sons, Delhi.
2. Workshop Technology Vol. – I, II & III by Chapman, Standard Publishers Distributors, New Delhi.
3. Workshop Practice by RK Singhal, SK Kataria & Sons, New Delhi.
4. Production Technology by HMT, Tata McGraw Hill, New Delhi.
5. Elements of Workshop Technology by SK Chaudhary & Hazra, Asia Publishing House.

4.5 AUTO ENGINEERING DRAWING - II

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/she 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. Hence this subject. The teachers are recommended to give more emphasis to the students by showing them automobile components.

Note:

- All assembly drawings to be made to scale except wherever mentioned otherwise specifically
- Candidates may be asked to show specific sections of the component/assembly
- 50% of the drawings shall also be made by AutoCAD for which no question shall be set in the written paper
- AutoCAD component shall be included in the practical/viva voce examination

DETAILED CONTENTS

1. Engine Components (24 hrs)

    - AC fuel feed pumps (assembly)
    - Fuel injection pump (jerk type) (assembly)
    - Fuel injector (assembly
    - Overhead and side valve mechanism (free hand)
    - Water cooling system (free hand)

2. Chassis Components (33 hrs)

    - Leaf spring suspension (assembly)
    - Shock absorber (assembly)
    - Internal expanding shoe brake (assembly)
    - Master cylinder (assembly)
    - Wheel cylinder (assembly)
    - Independent suspension system (free hand)
    - Brake drum (assembly)
    - Air assisted hydraulic brake system (free hand)

3. Auto Electrical Circuits (free hand sketches) (12 hrs)

   - Electrical circuit of battery and magneto ignition system
   - Automobile gauges and meters circuit diagram
   - Automobile lighting and signaling circuits
   - Complete wiring diagram of a car

4. Transmission (18 hrs)

   - Single plate clutch (assembly)
   - Gear box (free hand sketch)
   - Rear axle (fully floating) (free hand)

5. Garage (9 hrs)

   - Free hand sketch of a bus
   - Free hand layout of a garage having a fleet of 100 vehicles

Note: 50% of drawings to be made using AutoCAD

RECOMMENDED BOOKS

1. Automobile Engineering Drawings by RB Gupta.
2. Machine drawings by PS Gill.
3. Machine Drawings by Laxmi Narayan and Mathur.

4.6 COMPUTER APPLICATIONS IN MECHANICAL ENGINEERING

L	T	P
-	-	4

RATIONALE

Today age is computer age. Most of our daily activities are being influenced by the use of computers. While in areas like science and technology, improvements cannot be achieved without computers. It has become necessary for each and everyone of us to have a basic knowledge of application of computers. PowerPoint is a feature packed presentation programme whereas access is database management systems. Programming is backbone for preparing various technological projects, which can be achieved by C^{++} language – most versatile one in today's scenario. This subject is being offered to acquaint the students about MS PowerPoint, MS Access and Programming using C^{++} language.

DETAILED CONTENT

1. **Computer Application Overview** (3 hrs)

- Commercial and business data processing applications
- Engineering computation

2. **MS PowerPoint** (15 hrs)

2.1 Introduction

- Elements of power point package- templates, wizards, views, color schemes
- Starting PowerPoint
- Exploring PowerPoint menus
- Starting a new slide
- Adding title, text and art
- Moving text area and resizing text box
- Starting a slide show
- Saving a presentation
- Printing slides
- Inserting and deleting slides
- Closing a presentation
- Exercise for making a presentation and slide show

2.2 Views

- PowerPoint views – slide view, outline view, slide sorter view, notes view, slide show view, slide setup
- Zoom in, zoom out
- Exercises on various views of presentation

2.3 Formatting and Enhancing text

- Formatting
- Changing format with a new layout
- Alignment of text and text spacing
- Enhancing text formatting – use of bullets, changing text font and size
- Selecting text style and color
- Applying design template
- Closing and applying the transition
- Spell checking
- To set header and footer
- Exercise on formatting text and applying design template.

2.4 Slide with graphs

- Creating a graph
- Adding graphic objects
- Adding clipart pictures
- Adding movies and sounds
- Adding multimedia to presentation
- Inserting excel worksheet or word table
- Exercise on inserting graphs, tables, movies and clipart.

3 **MS - Access** (16 hrs)

3.1 Introduction to Microsoft access

- Components of access

3.2 Table creating

- Starting access, creating tables, tool bars and views of tables
- Editing the design and contents of the table
- Creating relationship between tables
- Adding OLE objects to a table
- Use of import and export facility
- Exercise on table creating

3.3 Query Handling

- Creating a new query, use of criteria, expressions and operation
- Editing a query, print a query
- Exercise on creating and editing query

3.4 Form designing

- Introduction, creating a form, modify a form design, designing a form using design view.
- Sub – forms, printing the forms, exercise on form designing.

3.5 Report designing

- Creating a report, managing the different controls of the records, saving and printing the report, use of graphs in reports
- Exercise on report designing

4 Programming fundamentals (6 hrs)

- Algorithm, pseudo language, flow charts: advantages and disadvantages
- Decision table – type, advantages and disadvantages
- Structured programming: structuring the control flow, modular programming
- Exercise on making algorithm and flow charts.

5 **C^{++} programming** (24 hrs)

5.1 Fundamentals

- Introduction, oop, character set, C^{++} tokens, keywords, identifiers, constants, basic data type, declaration of variables, defining symbolic constants, assignment statement, comments in a programme, structure of C^{++} programme, output using COUT, output using CIN, manipulators.

5.2 Operators and Expressions

- Arithmetic operators, relational operators, logical operators, shorthand assignment operator, increment and decrement operators, conditional operators, bit wise operators, precedence in C^{++} operators, casting of data, standard mathematical functions.

5.3 Control structures

- IF statements, IF---ELSE statements, nested IF statements, switch statements, Go To statements, repetitive structures, while statements, do statement, for loop, break statement, continue statement, nested loops.

5.4 Programs

- Write a program to check if a number is even or odd.
- Write a program to find the smallest of 3 numbers.
- Write a program to find largest of 4 numbers
- Write a program to find the roots of quadratic equation.
- Write a program to find the sum of the first N natural numbers using a for - do loops.
- Write a program that reads in N numbers and finds the smallest number among them.
- Write a program to find the sum of squares of the digits of a number.

6. Demonstration of CNC machine

RECOMMENDED BOOKS

1. MS Office 2000 for everyone by Sanjay Saxena; Vikas Publishing House Pvt. Ltd.
2. MS Office 2000 by Steve Hill; BPB Publications.
3. Programming in C++ by B. Subharamanayam.
4. Programming in C by Abdul Khader; Ajanata Publications

INDUSTRIAL TRAINING

Industrial Training aims at exposing the students to field practices, size and scale of operations and work culture at practical sites. For this purpose, students at the end of fourth semester, are required to be sent for a period of 4 weeks at different work sites**.**

Each student is supposed to study the material and technology used at site and prepares a detailed project report of the observation of processes seen by him/her. These students should be supervised and guided by respective subject teachers. Each teacher may guide a group of four to five students.

The teacher along with field supervisors will conduct performance assessment of students. The components of evaluation will include the following.

- Punctuality and regularity 15%
- Initiative in learning new things 15%
- Relationship with workers 15%
- Industrial training report 55%