5.1 AUTO ENGINE-II

L	T	P
3	-	-

RATIONALE

This subject is in continuation to Auto Engine-I. It covers diesel engines and other types of engines. It also includes combustion, performance of engine. Engine pollutants and its control. Brief description of engines of modern vehicles has also been included in this subject.

DETAILED CONTENTS

1. High Speed Diesel Engine (10 hrs)

   - Theory of diesel engine operation. Difference between petrol & diesel engine. Advantages and disadvantages.
   - Fuel filters-primary and secondary, priming & fuel feed pumps. Fuel injection pumps- plunger and barrel type, distributor type. Fuel injectors and solid injection, CRDI (Common rail direct Injection). Type of nozzles. Governing and type of governors.

2. Combustion (8 hrs)

   Phenomenon of combustion in C.I engines and S.I engines, phases of combustion and after burning . Methods producing turbulence. Various type of combustion chambers for petrol and diesel engines. Detonation and knocking, octane and cetane number,, swirl and squish.

3. Different Types of Engine (8 hrs)

   - Super charged engines. Turbo charged engines, power absorbed by super charger. Location of super charger.
   - Wankel engine
   - Free piston engine
   - Gas turbines and jet propulsion
   - Alternate fuels operative engines like L.P.G, C.N.G operated.
   - Working principle of Hybrid car, fuel cell car/duel fuel operated engines.

4. Performance of Engine (6 hrs)

   Effect on engine performance due to atmospheric temperature, pressure, compression ratio, engine speed, working conditions, dirt, desert, hills, injection timing/spark timing. Air fuel ratio. Their remedial measures. Two stroke engine scavenging – definition and types

5. Engine Pollutants and its control (10 hrs)

   Sources of engine pollutants of S.I and C.I engine. Effect of pollutants on human and environment.

   Methods of Control – Crank case, fuel tank ventilation, carburetion and recirculation. Redesigning of various engine system, V.V.R. Exhaust gas recirculation systems. Catalytic converters. Close loop feed back electronic integrated engine management system. Emission rules and regulations. Euro – I, II, III

6. Modern Vehicles (6 hrs)

   Brief description of constructional features of engine used in automobiles such as Hero Honda, Maruti, Tata and Leyland and Volvo trucks.

RECOMMENDED BOOKS

1. Automobile Engineering by Dr. Kirpal Singh
2. Automobile Engineering by R.B. Gupta
3. I.C. Engines by M.L. Mathur and R.P Singh.

5.2 CHASSIS, BODY AND TRANSMISSION-II

L	T	P
3	-	-

RATIONALE

Chassis, body and transmission forms the core of automobile engineering. The subject aims at imparting knowledge and skills regarding chassis and body viz, clutch system, transmission system, drive system, steering mechanism, suspension system, braking system and safety of vehicles

DETAILED CONTENTS

1. Clutch (8 hrs)

   Constructional details and working of centrifugal, semi centrifugal clutches and fluid coupling.

2. Transmission (10 hrs)

   Necessity, functions. Epicyclic gear box and automatic transmission, free – wheel mechanism, auxiliary gear box torque converter, description and operation of transfer gear box, common faults and remedies.

3. Steering (8 hrs)

   Power steering - necessity, types, salient features of construction and working. Common steering system troubles and remedies.

4. Suspension System (12 hrs)

   Function, types- independent, rigid axle suspension springs, functions and types – coil, leaf and torsion bar, sprung and un-sprung weight. Characteristic of spring materials, leaf ends, spring eye, upturned and down turned bushes, variable rate spring, helper leaf, leaf section, rubber pads, pressure block, spring covers interleaf inserters pneumatic suspension system. Pneumatic suspension system. Function and construction of hydraulic dampers (shock absorbers). Diagnosis of common faults and their rectification, silent-bloc bushing.

5. Power Brakes (6 hrs)

   Air, air-hydraulic, hydro-vac brakes-their construction and working details. Brake tests, common faults and their rectification.

6. Automotive safety systems (4 hrs)

   Preventive design, designing for minimum injury in accident, seat belts, air bags, electronic vehicle stability and occupant protection systems.

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

5.3 GARAGE EQUIPMENT

L	T	P
4	-	-

RATIONALE

Management of garages forms an important function of automobile technicians. To perform such functions, knowledge of service station equipment, tuning equipment, engine repair tools, electrical repair equipment and reconditioning and fabrication of equipment is very essential. Hence the subject.

DETAILED CONTENTS

1. General Tools (6 hrs)

   Specifications and applications of

   - Screw drivers
   - Spanners and wrenches
   - Pliers
   - Hammers
   - Chisels
   - Files
   - Hacksaw
   - Tools for tubes flaring
   - Taps and dies
   - Reamers
   - Soldering tools
   - Measuring tools- vernier calipers, inside and outside micrometers

2. General Equipment (12 hrs)

   Specifications and applications of

   - Drilling machine
   - Bench grinder
   - Air compressor
   - Hydraulic and electric hoists
   - Car washer
   - Oil sprayers
   - Grease Guns-manual and bucket type, pneumatic
   - Tyre inflation gauge (Manual and Digital type automatic)
   - Tyre Changer (Manual and Automatic)
   - Creepers
   - Electric and gas welding equipment
   - Fire extinguisher
   - First aid box

3. Turning and Testing Equipment (10 hrs)

Specifications and applications of

- Vacuum Gauge
- Compression Gauge (Pressure Gauge)
- Distributor Tester cam (dwell) angle tester, r.p.m. tester.
- Battery Tester
- Spark lug cleaner and tester
- Ignition timing light
- Fuel injector tester
- Fuel consumption tester

4. Engine Repair Tools/Measuring and Testing Equipment (12 hrs)

Specifications and applications of

- Torque wrench, pneumatic wrench
- Piston ring compressor
- Valve lifter and valve spring tester
- Piston ring files, groove cleaner
- Scrappers
- Piston ring remover
- Cylinder Dial gauge
- Smokemeter
- Exhaust gas analyzer
- Engine Analyser/Scanner

5. Electrical Repair Equipment (6 hrs)

Specifications and uses of

- Electrical Test Bench
- Battery Charger
- Head Lights Beam Aligner and Tester (Electronic and Digital type)
- Growler

6. Chassis, Body of Reconditioning/Testing Equipment (6 hrs)

Use of

- Brake Efficiency Tester (Chassis Dynamometer)
- Clutch Fixtures and Brake Line Rivetters, pop riveting gun
- Crane and Chain Pulley Block
- Jacks – mechanical, hydraulic, trolley type
- Paint chamber
- Paint Spray Gun
- Paint Drying Equipment

- Computerized wheel balancer- Static and Dynamic
- Computerized wheel alignment Equipment

7. Engine Reconditioning and Testing Equipment (12 hrs)

   Specifications and use of

   - Cylinder Boring Machine and Honing Machine
   - Crankshaft Machine and Camshaft Grinding Machine
   - Connecting Rod Aligner
   - Line Boring Machine and Arbor Press
   - Nozzle Grinding and Lapping Machine
   - Fuel Injection Pump Calibrating Machine
   - Valve Refacer, Valve Seat Cutting and Grinding
   - Radiator Tester

RECOMMENDED BOOKS

1. Automotive Mechanics by WH Crouse and Donald Anglin; and Tata Mc Graw Hill Publishing Co. Ltd., Delhi.
2. Auto Mechanics Fundamentals by MW Stockel, Goodheart Wilcox Publishers.
3. Automobile Engineering Vol. I and II by Dr. Kirpal Singh; Standard Publishers, Delhi.

5.4 INDUSTRIAL ENGINEERING

L	T	P
4	-	-

RATIONALE

A diploma holder will have to conduct time and motion study to improve the methods/system. This subject impart valuable skills to plan and understand plant layout, and production planning and control.

DETAILED CONTENT

1. **Production and Productivity** (6 hrs)

   Production, production functions, productivity, factors affecting productivity, measurement of productivity, causes of decrease in productivity, difference between production and productivity.

2. **Plant Location, Layout and Material Handling** (8 hrs)

   Plant location, factors affecting plant location, concept of plant layout, types of layout, their characteristics, factors affecting plant layout, work station design, factors considered while designing a work station, introduction, need and objective of material handling, factors considered while selecting a material handling device, safety concept of material handling equipment.

3. **Work Study** (12 hrs)

   Definition and scope of work study; areas of application of work study in industry, Role of work study in improving productivity, Objectives, needs and methods of method study, information collection, recording techniques, process symbols, charts and diagrams, critical examination, development, installation and maintenance of improved methods, work measurement objectives, needs and methods of work measurement, time study, various allowances, calculation of time, work sampling, standard data and its use. Application of engineered time standards and work sampling Ergonomics, concept and advantages.

4. **Job Evaluation and Incentives** (12 hrs)

   Introduction, objectives, needs of job evaluation, job definition, job analysis, data source, job evaluation methods such as ranking method, grade description method, point system and factor comparison method, hybrid system.

Incentive-definition and concept, incentive and productivity relation, types of incentives such as financial, non financial. Individual and group incentives, pre requisites for incentives, characteristics of a good incentives plan

5. **Production Planning and Control** (14 hrs)

Introduction, objectives and components (functions) of P.P.C, Advantages of production planning and Production Control, stages of P.P.C, process planning, routing, scheduling, dispatching and follow up, routing purpose, route sheets, scheduling – purpose, machine loading chart, Gantt chart, dispatching – purpose, and procedure, follow up – purpose and procedure. CPM/PERT technique, drawing of simple networks and critical time calculation. Production Control in job order, batch type and continuous type of productions. Difference between these controls.

6. **Estimation and Costing** (12 hrs)

Introduction, purpose/functions of estimating, costing concept, ladder and elements of cost, difference between estimation and costing. Overheads and their types, estimation of material cost, estimation of cost for machining processes, numerical problems.

RECOMMENDED BOOKS

1. Industrial Engineering by O.P. Khanna; Dhanpat Rai and Sons, New Delhi.
2. Industrial Engineering by S.C. Sharma; Khanna Publisher.
3. Industrial Engineering and Management by T.R. Banga.
4. Elements of work study by Suresh Dalela.
5. Production Management by Jain and Aggarwal.

5.5 AUTO ELECTRICAL AND ELECTRONICS EQUIPMENT

L	T	P
4	-	-

RATIONALE

Diploma holders in Automobile Engineering have to deal with different types of batteries, their changing and testing and electronic regulators, ignition system, lighting system and various other electrical accessories used in Automobile Engineering. Hence the subject of automotive electrical & electronic equipment is very essential for these technicians.

DETAILED CONTENTSS

1 Introduction (6 hrs)

Various electrical and electronics circuit components and their symbols as used and their functions. HT & LT, their specifications, wiring harness.

2. Lead Acid and other Batteries (12 hrs)

Construction, working, material used, electrolyte and its strength, effect of added plate area and temperature, rating, capacity, efficiency, temperature characteristics, terminal voltages, charging & discharging, maintenance- free batteries.

Battery testing

Electrolyte testing hydrometer, voltage test, high discharge and cadmium test.

Battery charging: Constant potential and constant current, Initial charging, normal charging, trickle charging, intermittent charging, Boost charging.

Battery Defects: Sulphation, plates decay, erosion, cracking, sedimentation, separator defects, short circuits, over charging.

Alkaline Batteries: Principles of working, merits and demerits of Ni-Fe, Ni-Cd, Ag-Zn cells.

Fuel cells: Types, principles of working and use of fuel cells.

3. Charging system (8 hrs)

Circuits, function of various components, Dynamo, Alternator-types, construction, working, advantages and disadvantages. Cut out relay.
Regulation: Necessity of regulation, construction and working of regulators for dynamos and alternators.

4. Starting systems (8 hrs)

Starting requirements of an S.I. engines, principle, types and construction details of starter motor, starter switches, starter drives - their types and working.

5. Ignition system (8 hrs)

Working of point type electrical coil ignition system and function of its various components.
Working of point less inductive type systems, pulse generator, Hall switch optical switch. Electronic ignition advance, distributorless ignition system, testing of ignition circuits and various system components.

6. Lighting system (8 hrs)

Various lighting terms, lighting circuits, head lamp type and constructional details. Sealed beam, double filaments, asymmetric and dual units., vertical and side control of lamps, fog light, sidelight, brake light, instrument light, indicator light, reversing light, ultraviolet head light, LED lighting.

Wiring: Cable colour code, cable connectors, wiring diagram of cars and two-wheelers, fuses, faults and rectification. Multiplexed wiring system.

7. Electrical Accessories (14 hrs)

Fuel gauges:- Bimetallic and balancing coil type, Air pressure gauges, temperature gauges, warning lights, spedometer, wind Screen wipers, horns, horn-relay, electrical fuel pump, heaters, defrastors, power locks, window controllers, faults and rectification.

RECOMMENDED BOOKS

1. Automobile Engineering. Vol II - by Dr. Kirpal Singh, Standard Publishers, Delhi.
2. Automotive Electrical Equipment by P.L. Kohli, Tata McGraw Hill, Delhi
3. Automotive Electronics and Electrical equipment by William H. Crouse and DL. Anglin, McGraw Hill company.
4. Automobile Engineering by R.B. Gupta, Satya Prakash, New Delhi
5. Automobile Electric and Electronic Systems by Tom Denton, Arnold London.

5.6 AUTO WORKSHOP AND DRIVING PRACTICE

L	T	P
-	-	18

RATIONALE

Testing and trouble shooting of various electrical components and systems of automotive vehicle is an area where a diploma holder must have proficiency. He should be fully aware about the procedures of overhauling of engines, gearbox, differential. He should be trained in using various components while driving on road, in plains and hilly areas. That is why, this subject has been introduced.

LIST OF PRACTICALS

1. Testing of battery with hydrometer, high rate discharge tester, charging of Batteries.
2. Testing and setting of ignition timing with timing light, cam angle tester, and dwell angle tester.
3. Testing and Cleaning of spark plug.
4.
   - Testing of field winding, testing of armature winding and comutator for short-circuit.
   - For alternator.
5. Testing of voltage and current regulator.
6. Head light and beam setting.
7. Testing and setting of horn, relay, dipper switch, flasher unit and indicator circuits.
8. Diagnosing electronic ignition systems, magneto ignition system.
9. Colour codes and sketching of complete wiring circuits of an Indian automobile.
10. Overhauling of petrol engine.
11. Overhauling of diesel engine.
12. Overhauling of gearbox.
13. Overhauling of differencial.
14. Inside and out inspection/checking of vehicle, checking of engine oil, horn, starter, coolant before starting of engine.
15. Starting of engine and warming up.
16. Fuel injection pump calibration on calibration machine.
17. Clutch operation of engaging and disengaging on the road.
18. Gear changing from low to high and high to low speed on the road.
19. Braking and use of brakes on ground/road.
20. Practice on general road safety, road and traffic signals and driving regulations.
21. Driving practice on road for steering control.

22. Reversing practice on vehicle on the ground.
23. Driving on gradient.
24. Driving practice on a scooter/motor cycle.
25. Painting practice on vehicles to change colour from base.
26. Servicing of suspension system, lead springs, independent suspension, coil spring, torsion bar, telescopic shock absorber.

RECOMMENDED BOOKS

1. Automobile Engineering by Kirpal Singh.
2. Automobile Electrical and Electronic System by Tom Denton; Arnold, London,
3. Automotive Electrical Equipment by P.L. Kohli.
4. Automotive Electrical Equipment by William H. Crouse.
5. Automobile Engineering by R.B. Gupta.