5.1 COMPUTER AIDED DRAFTING IN AUTOMOBILE ENGINEERING

L	T	P
-	-	6

RATIONALE

Competency in computer-aided drafting is essential for diploma holders in Automobile Engineering. Hence this subject is required.

DETAILED CONTENTS

1. Introduction to AutoCAD

1.1. Introduction to AutoCAD. Setting the drawing environment: Limits, Grid, Snap, Axis, Units, Ortho, Co- Ordinates ON, OFF Units and Color.

1.2. 2D Drawing entities - Point - Line - Arc - circle, Ellipse, Polygon, and Trace. Object Selection using Object Snap (OSNAP).

1.3. Editing commands: Selection of entities by different methods - copy, Move, Scale, Rotate, Fillet, Chamfer, and Mirror, Array-Polar, Rectangular. Measure, Divide, and Erase.

1.4. Drawing Display Methods: Zoom, Pan, and View.

1.5 Adding Texts and Dimensions: Text, Dimension-linear, continued, angular

1.6. Pedit commands. Working on multiple layers, Layer concepts in Auto CAD -Various options with layer command - Hatch command - Creating line types, library and user made library.

1.7. Preparing the schematic drawing of a workshop building in one layer, the blocks of machines in another Layer and Electrical connection on another layer.

2. Drawing of 2D views of following automotive components using AutoCAD (Any Six sheets)
   - V – belt pulley
   - Stepped cone pulley
   - Ball bearing
   - Sectional front view of screw jack
   - Spur gear
   - Poppet valve
   - Wheel cylinder (sketch)
   - Valve tappet
   - Piston
   - Semi-elliptic leaf spring
   - Internal expanding shoes brake (sketch)

3. Introduction to 3D features of AutoCAD

INSTRUCTIONAL STATREGY

1. Teachers should demonstrate use of AutoCAD, while teaching..
2. Emphasis should be given on dimensioning and layout of sheet.
3. Teacher should ensure use of IS Codes related to drawing.

RECOMMENDED BOOKS

1. AutoCAD by Shyam Tickoo, Dream Tech. Publication, Delhi
2. Computer aided drafting – Auto CAD, ISTE Nomogram, Delhi

5.2 MECHANICS OF VEHICLES

L	T	P
4	-	-

RATIONALE

Understanding of the basic mechanism and motions, power transmission, vehicle braking, vibrations and balancing are essential for a diploma holder in automobile Engineering . Hence this subject.

DETAILED CONTENTS

1. Vehicle in motion (10 hrs)

   Air resistance, gradient resistances and rolling resistance.

   Tractive effort, traction, inertia load, draw bar pull, power required to propel a vehicle, calculations of acceleration and tractive effort required in case of front wheel drive, rear wheel drive and four wheel drive. Cenrifugal force and its effect on vehicle stability on banked and unbanked road.

2. Gyroscopic couple and stability of vehicles (10 hrs)

   Introduction to gyroscopic couple. Precessional angular motion. Simple problems based on above. Stability of a four wheel drive moving in a curved path. Stability of a two wheel drive taking a turn

   Simple problems based on above.

3. Turning moment diagrams and flywheels (10 hrs)

   Introduction to turning moment diagrams
   Turning moment diagram for a four stroke cycle internal combustion engine
   Fluctuation of energy
   Determination of maximum fluctuation of energy
   Flywheel, coefficient of fluctuating of speed. Energy stored in a flywheel
   Numericals based on above

4. Governors (10 hrs)

Introduction to governors
Types of Governors
Centrifugal governors
Terms used in governors
Watt governor
Porter governor
Sensitiveness of Governors
Stability of governors
Isochronous governors
Hunting

5. Brakes (12 hrs)

Introduction to braking,
Characteristics of materials used for braking,
Internal expanding brakes,
Braking of a vehicle when brakes are applied to rear wheels, when brakes are applied to front wheels, when brakes are applied to four wheels.
Numericals based on above

6. Vibrations (12 hrs)

Terms used in vibratory motion
Types of vibratory motion
Types of free vibrations
Natural frequency of free longitudinal vibrations
Natural frequency of free transverse vibrations
Effect of inertia of the constraint in longitudinal and transverse vibrations
Natural frequency of free transverse vibrations due to a point load acting over a simply supported beam
Frequency of free damped vibrations.
Damping factor or damping ratio, Logarithmic decrement

Numericals based on above.

INSTRUCTIONAL STRATEGY

Teacher should lay emphasis on conceptual understanding of working of various mechanisms used in the automobiles. Teacher should demonstrate various models in the class to explain various mechanisms. Simple problems and tutorial exercises should be provided so that the students can comprehend the subject.

RECOMMENDED BOOKS

1. Theory of Ground Vehicles by J.Y. Wong, John Willey & Sons, New Delhi
2. Mechanics of Road Vehicles by W Stead, Kefe Books Ltd. London

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	10	16
2	10	16
3	10	16
4	10	16
5	12	18
6	12	18
Total	**64**	**100**

5.3 AUTO ELECTRICAL EQUIPMENT

L	T	P
4	-	2

RATIONALE

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

DETAILED CONTENTS

1. Introduction (04 hrs)

   Various Electrical components/systems in Automobile. Their functions and demands, earth return system, types of earthing, 6V, 12V system.

2. Batteries (16 hrs)

   2.1. Lead Acid Batteries: Construction, working, elements, types, materials used, electrolyte and its strength, effect of added plate area and temperature, rating, capacity, efficiency, temperature characteristics, terminal voltages, charging and discharging.

   2.2. Battery Testing: Electrolyte testing by hydrometer, voltage test, high discharge and cadmium test. (voltage)

   2.3. Battery Charging: Constant potential and constant current, initial charging, normal charging, trickle charging, intermittent charging, boost charging.

   2.4. Battery Defects: Stipulation, plates decay, working, erosion, cracking, sedimentation, separator defects, short circuits, overcharging

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

   2.6 Lithium ion battery: Construction and working

3. Charging System (12 hrs)

   3.1. Circuits, function and various components, dynamo and alternator, types, construction, working, advantages and disadvantages of dynamo and alternators, drives, cut out relay.

   3.2. Regulation: Functions of various components of two unit, three unit and heavy duty Regulators, Regulator adjustments, Regulators for alternators.

4. Starting System (10 hrs)

- Function of various components, torque terms, principle and constructional details of starter motor, switches, types, starter to engine drive and their types.

5. Lighting System (09 hrs)

5.1. Various lighting circuits, head lamp, type and constructional details, sealed beam, double filaments, asymmetric and dual units, vertical and side control of lamps, fog light, side light, brake light, instrument light, indicator lights, reversing light, lamp mounting.

5.2. Wiring: HT and LT, their specifications, cable colour codes, wiring Harness, Cable connections, Wiring diagrams of cars and two wheeler, Fuses, faults and rectification.

6. Electrical Accessories (09 hrs)

- Fuel gauges - bimetallic and balancing coil type, Air pressure gauges, temperature gauges, Ammeter, warning light, speedometer, wind screen wipers, horns, horn relay, electric fuel pump, Faults and rectification.

7. Miscellaneous Electrical Equipment (04 hrs)

- Impulse Speedometer, tachometer, heaters, defrosters, Air conditioner, and Electric door locks, window actuation, Seat adjusters.

LIST OF PRACTICALS

1. Testing of alternator rotor and stator winding for short circuit, ground and broken circuit.
2. Head light beam setting.
3. Testing and setting of horn and relay.
4. Testing and fault tracing of field winding, armature and magnetic switch for short circuit, grounding of a starter.
5. Testing dipper switch, flasher unit and indicator circuits and fault tracing.
6. Testing and fault tracing of different components of transistorized ignition system.
7. Identification of colour codes for continuity test in a wiring harness.
8. Study and sketching of complete wiring circuit of an Indian vehicle.

INSTRUCTIONAL STATREGY

Teachers should lay emphasis on concepts and principles while imparting instructions. As far possible, subject teaching should be supplemented by demonstrations in the laboratory. During practical work, individual students should be given opportunities to perform practicals independently.

RECOMMENDED BOOKS

1. Automobile Engineering by Dr. Kirpal Singh, Standard Publishers, Delhi
2. Automotive Electrical Equipment by P.L. Kohli, Tata McGraw Hill, Delhi
3. Automotive Electrical Equipment by William H. Crouse, Tata McGraw Hill, Delhi
4. Automobile Engineering by Dr. R.B. Gupta, Satya Prakashan, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	04	06
2	16	24
3	12	20
4	10	16
5	09	14
6	09	14
7	04	06
Total	**64**	**100**

5.4 GARAGE EQUIPMENT

L	T	P
4	-	-

RATIONALE

Management of garage 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
   - Feeler gauge
   - Tommy bar
   - Nut runner
   - Cleaning tools
   - Nipple forming tools

2. General Equipment (12 hrs)
   Specifications and applications of

   - Drilling machine (portable) along with set of drills
   - Bench grinder
   - Air compressor and pneumatic gun
   - Hydraulic and electric hoists
   - High pressure washing equipment (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. Tuning and Testing Equipment (6 hrs)
   Specifications and applications of

   - Vacuum Gauge
   - Compression Gauge (Pressure Gauge)
   - Distributor Tester, cam (dwell) angle tester, r.p.m. tester.
   - Battery Tester
   - Spark plug 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. Reconditioning/Testing Equipment for Chassis and Body (6 hrs)

   Use of

   - Brake Efficiency Tester (Chassis Dynamometer) or brake testing equipment
   - Crane and Chain Pulley Block
   - Jacks – mechanical, hydraulic, trolley type
   - Paint chamber
   - Paint Spray Gun
   - Paint Drying Equipment
   - Tools for tyres, automatic tyre remover

- Trolleys
- Axle/chassis stands
- Steering work stands
- Jib crane
- Spring tester
- Computerized wheel balancer –static and dynamic
- Computerized wheel alignment equipment

7. Engine Reconditioning and Testing Equipment (16 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
   - Cylinder head leakage testing fixture
   - Fuel injector tester
   - Nozzle cleaning equipment

INSTRUCTIONAL STRATEGY

Teacher should lay emphasis on proper handling and use of garage equipment Demonstration should be made in the workshop for clarity of ideas. Visits to garage should also be planned.

RECOMMENDED BOOKS

1. Automotive Mechanics by Srinivasan; TMH, Delhi
2. Automobile Engineering Vol. I and II by Dr. Kirpal Singh; Standard Publishers, Delhi.
3. Automotive Mechanics by WH Crouse and Donald Anglin; Tata Mc Graw Hill Publishing Co. Ltd., Delhi.
4. Garage Equipment by G.S. Aulakh, Eagle Prakashan, Jalandhar.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	6	10
2	12	20
3	6	10
4	12	20
5	6	10
6	6	10
7	16	20
Total	**64**	**100**

5.5 AUTO REPAIR, MAINTENANCE AND DRIVING PRACTICE – I

L	T	P
-	-	12

RATIONALE

Testing and trouble shooting of various systems and components of automotive vehicle is an area where a diploma holder must have proficiency. He should be fully aware of the procedures of overhauling of engine, gearbox, and differential. He should be trained in using various controls while driving. 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. Diagnosing electronic ignition system, magneto ignition system.
5. Colour codes and sketching of complete wiring circuits of an Indian automobile.
6. Inside and outside inspection/checking of vehicle, checking of engine oil, horn, starter, coolant before starting of engine.
7. Adjusting Clutch free play and cleaning clutch plate and assembly
8. Setting brake pedal free play and carry out bleeding.
9. Gear changing from low to high and high to low speed on the road.
10. Practice on general road safety, road and traffic signals and driving regulations.
11. Driving practice on road for steering control.
12. Starting of engine and warming up.
13. Overhauling of petrol engine.
14. Overhauling of gearbox.
15. Overhauling of differential.
16. Servicing of suspension system, leaf springs, independent suspension, coil spring, torsion bar, telescopic shock absorber.
17. Removal and fitting of wheels and tyres of a two wheeler and repairing of punctures
18. Cleaning, greasing, checking as per maintenance schedule of two wheelers
19 Cleaning, greasing, checking as per maintenance schedule for washing, wiping and polishing of jeep/car
20 Use of Orsat Apparatus or smoke meter to measure emission

21 Inspection of Turbo charger

22 Checking of rail pressure using pressure guage

23 Checking return and resistance in injectors

24 Inspection of boost pressure (in the turbo charger)

RECOMMENDED BOOKS

1. Automobile Engineering by Kirpal Singh, Standard Publishers, Delhi
2. Auto Workshop & Driving Practice by G.S. Aulakh, Eagle Prakashan, Jalandhar.
3. Automotive Electrical Equipment by P.L. Kohli., TMH, Delhi
4. Automobile Engineering by R.B. Gupta, Satya Parkashan, New Delhi

5 Automobile Engineering, Vol.III by Anil Chikara, Satya Parkashan, Delhi

5.6 ELEMENTS OF AUTOMOBILE DESIGN

L	T	P
4	-	-

RATIONALE

Understanding of basic principles of components like cylinder liner, piston, crank shaft, connecting rod, simple mechanisms are essential for diploma holders in Automobile Engineering, hence this subject.

DETAILED CONTENTS

1. Introduction (12 hrs)

- Design consideration, design procedure
- Basic requirements, classification of design and principles of good economic design
- Standardization, interchangeability of automobile parts among industry and at global level.
- Limits, fits and tolerances
- Material Properties: elasticity, plasticity, ductility, malleability, toughness, hardness, fatigue, creep.
- Materials selection and ergonomics
- Designing for strength

2. Design of **:** (20 hrs)

- Friction Clutch.
- Flywheel
- Gears
- Brakes

3. Design of **:** (12 hrs)

(i) Design of shaft subjected to torsion only, determination of shaft diameter (hollow and solid shaft) on the basis of strength criteria, rigidity criterion

(ii) Types of keys, Functions of key, Failure of key, Design of key (determination of key dimensions)

4 Design of following Auto parts (20 hrs)

(i) Piston (ii) Cylinder (iii) Connecting rod (iv) Crankshaft

INSTRUCTIONAL STRATEGY

Teacher should lay emphasis on conceptual understanding and design aspects of various parts/components. Various models should be demonstrated in the class to explain mechanism

RECOMMENDED BOOKS

1. A Text Book of Machine Design by RS Khurmi & JKGupta, Eurasia Publishing House, Pvt. Ltd.., New Delhi
2. Introduction to Machine Design by VB Bhandari, TMH, Delhi
3. Theory of Machines by PL Ballaney, Khanna Publishers, New Delhi
4. Theory of Machines by DR Malhotra & HC Gupta, Satya Prakashan, Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	12	18
2	20	32
3	12	18
4	20	32
Total	**64**	**100**

PERSONALITY DEVELOPMENT CAMP

This is to be organized at a stretch for two to three days during fifth or sixth semester. Extension Lectures by experts or teachers from the polytechnic will be delivered on the following broad topics. There will be no examination for this subject.

1. Communication Skills

2. Correspondence and job finding/applying/thanks and follow-up

3. Resume Writing

4. Interview Techniques: In-Person Interviews; Telephonic Interview' Panel interviews; Group interviews and Video Conferencing etc.

5. Presentation Techniques

6. Group Discussions Techniques

7. Aspects of Personality Development

8. Motivation

9. Leadership

10. Stress Management

11. Time Management

12. Interpersonal Relationship

13. Health and Hygiene