5.1 AUTO DESIGN

	L	T	P
Periods/week	5	0	0

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 period)

- Design consideration and basics of design, design procedure
- Classification of design and principles of good economic design
- Standardization, interchange ability of automobile parts among industry and at global level
- Limits, fits and tolerances
- Material Properties: elasticity, plasticity, ductility, malleability, toughness, brittleness, hardness, strength, fatigue, creep
- Materials selection and ergonomics

2. Design of (20 period)

- Friction Clutch
- Flywheel
- Gears
- Brakes
- Coupling (flange coupling and its types)

3. Design of (12 period)

- Design of shaft subjected to torsion only, determination of shaft diameter (hollow and solid shaft) on the basis of strength criteria, rigidity criterion
- Types of keys, Functions of key, Failure of key, Design of key (determination of key dimensions)

4 Design of following Auto parts (20 period)

- Piston
- Cylinder
- Connecting rod
- Crankshaft

5. Design of Screw Jack (06 period)

6. Design of Knuckle and Cotter Joint (06 period)

7. Design of Flat belt and V-belt (04 period)

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 (Period)	Marks Allotted (%)
1	12	15
2	20	25
3	12	15
4	20	25
5	06	10
6	06	05
7	04	05
Total	**80**	**100**

5.2 GARAGE EQUIPMENT

	L	T	P
Periods/week	5	0	0

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. Hand Tools/Measuring Tools (13 period)

   Classification and Use of

   - Screw drivers
   - Spanners and wrenches
   - Pliers
   - Hammers
   - Chisels
   - Files
   - Hacksaw
   - Tools for tubes flaring
   - Taps and dies
   - Reamers
   - Feeler gauge
   - Cylinder dial gauge

2. General Equipment (13 period)

   Construction, working and application use of

   - Bench grinder
   - Air compressor
   - 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)
   - Fire extinguisher
   - Contents of First aid box

3. Turning and Testing Equipment (10 period)

   Construction, working and application use of

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

4. Engine Repair Tools/Measuring and Testing Equipment (13 period)

Construction and use of

- Torque wrench, pneumatic wrench
- Piston ring compressor, expander
- Valve lifter and valve spring tester
- Piston ring files, groove cleaner
- Scrappers
- Piston ring remover
- Smokemeter

5. Reconditioning/Testing Equipment for Chassis, Body (10 period)

Construction, working and use of

- Brake Efficiency Tester (Chassis Dynamometer) or brake testing equipment
- Jacks – mechanical, hydraulic, trolley type,
- Creeper
- Paint chamber
- Paint Spray Gun
- Paint Drying Equipment
- Spring tester

6. Special Tools (10 period)

Construction and use of

- Ridge cutter
- Crank shaft cutter
- Tools for tubes flaring
- Soldering tool
- Nipple forming tool
- Decarbonising kit

7. Body Repair Tools Kit (11 period)

Assorted hammers, asserted dollies, body spoons, sanders, pick tools, adjustable file, drip moulding pliers, assorted wrenches, assorted screw drivers, cold chisels, fender bleeding tool, sanders, power tools

INSTRUCTIONAL STRATEGY

Teacher should make use of audio visual aids to show features of chassis, body and transmission. Demonstration should be made in the automobile shop to explain various aspects of garage equipment.

RECOMMENDED BOOKS

1. Automotive Mechanics by WH Crouse and Donald Anglin; Tata McGraw 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
4. Garage Equipment by G.S. Aulakh, Eagle Prakashan, Jalandhar
5. Garage Equipment by Raj Kumar, Ishan Publication, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Periods allotted (Period)	Marks Allotted (%)
1	13	15
2	13	15
3	10	10
4	13	15
5	10	15
6	10	15
7	11	15
Total	**80**	**100**

5.3 EARTH MOVING EQUIPMENT

	L	T	P
Periods/week	5	0	0

RATIONALE

A diploma holder in Automobile Engineering has to deal with repair and maintenance of heavy earthmoving vehicles. The subject provides basic understanding of such special vehicles

DETAILED CONTENTS

1. Earth Moving Equipment (36 period)

   Function, classification, constructional features and applications of the following earth moving machinery: Excavator, scrapper, ripper, dragline, grader, shovel, trailer, loader, dozer. Equipment used - drill, ripper, crusher, feeder, compressor, snow remover. Tractor types. Difference in each type of engine used, features of clutch, power transmission, track chains, sprockets, springs and blades.

   Working principal and design considerations of different systems involved like power system, transmission system, final drive, lubrication system, electrical system, braking system, steering system and pneumatic and hydraulic control circuits of earth moving equipment

2. Hoisting Equipment (14 period)

   Description of hoist winch, part lines, hoisting chains, slings, fork-lift truck, cranes (hand operated type electric overhead travelling type), Jacks (hydraulic, mechanical), bucket elevators. Factors affecting the selection of hoisting equipment

3. Rollers (10 period)

   Types of rollers, type of engines used for rollers. Chassis, power transmission, steering, braking and other features

4. Pneumatic Equipment (12 period)

   Function and salient features of pneumatic tools-rock drill, hammer, chipper. Air operated grease gun and spray gun

5. Calculation of hire charges for various types of earth moving equipment (08 period)

INSTRUCTIONAL STRATEGY

Visits to construction sites should be organized for better understanding of concepts and principles. It is important to make use of audio-visual aids/video films to support the instructional material

RECOMMENDED BOOKS

1. Construction Equipment & its planning & applications by Mahesh Varma, Metropolitan Book Company, New Delhi

2. Hand Book of Earth Moving Machinery by Central Water and Power Commission

3. Construction Equipment Operation and Maintenance by Y Pokras and M Tushnyakov, Mir Publishers, Moscow

4. Heavy Construction Planning Equipment & Methods by Jagman Singh, Oxford & IBH Publishing Co., New Delhi

5. Construction Equipment Operation and Maintenance by Y Pokras and M Tushnyakov, Mir Publishers, Moscow

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Period)	Marks Allotted (%)
1	36	45
2	14	20
3	10	10
4	12	15
5	08	10
Total	**80**	**100**

5.4 PRODUCTION PLANNING AND COSTING

	L	T	P
Periods/week	5	0	0

RATIONALE

A diploma holder in Automobile Engineering is supposed to look after the planning, scheduling and production control activities in the industry. He is also required to have knowledge about cost estimation of new and repaired components, material management, quality aspects and productivity. Therefore it is essential to teach above topics.

DETAILED CONTENTS

I. Introduction to Production Planning and Control (06 period)

- 1.1 Necessity of planning and control
- 1.2 Functions of production, planning and control department Factors determining control procedure
- 1.3. Advantages of Production Planning & Control
- 1.4 Types of production.

2. Planning (10 period)

- 2.1 Forecasting
- 2.2 Material planning and allocation
- 2.3 Allocation for optimum utilization
- 2.4 Break even analysis
- 2.5 Procedure for process planning. Process planning sheet.
- 2.6 Calculation of man and machine hours

3. Production Control (10 period)

- 3.1 Objectives
- 3.2 Routing
- 3.3 Loading and scheduling
- 3.4 Dispatching
- 3.5 Follow up

4. Inspection and Quality Control (14 period)

- 4.1 Inspection - Need and Planning for Inspection
- 4.2 Types of Inspection
- 4.3 Role of Operator and Inspector in Inspection
- 4.4 Quality Control and Quality Assurance - Meaning and Need
- 4.5 Statistical Quality Control
- 4.6 Acceptance Sampling
- 4.7 Control Charts for variables and Attributes
- 4.8 QC tools
- 4.9 Introduction to 5S and Kaizan technique

5. Standards and Codes (06 period)

5.1 National and International Codes
5.2 Concept, elements, benefits and implementation of Quality Management System (ISO 9000) and environmental Management System (ISO 14000), Quality Circles

6. Introduction to Estimating and Costing (04 period)

6.1 Meaning and importance of estimating and costing
6.2 Difference between estimating and costing.
6.3 Importance of preparing realistic estimates.
6.4 Estimating procedures.

7. Elements of Cost and Estimation (22 period)

7.1 Terms used in costing
7.2 Direct materials - components
7.3 Direct costs e.g. labour, raw material, hired equipment, machines and equipment, components indirect materials such as lubricants, cotton waste and indirect labour
7.4 Overhead expenses - rent of building, office expenses, depreciation and service charges
7.5 Profits – Concepts and requirements
7.6 Variable and fixed cost, production cost
7.7 Perception of job/work order
7.8 Different units of work (Bifurcation as per type, section)
7.9 Analysis of time – Handling time, preparation time, production cycle time, inspection and dispatch time
7.10 Computation of charges
7.11 Operator charges, supervisory charges, storage charges, components charges, material charges, consumable stores charges, Total charges. Estimation of service charges, overhauling
7.12 Estimation for machining, casting, forging, welding and fabrication

8. Productivity (08 period)

8.1 Production, productivity,
8.2 Factors affecting productivity,
8.3 Measurement of productivity
8.4 Causes of decrease in productivity

INSTRUCTIONAL STRATEGY

Efforts should be made to relate process of teaching with direct experiences in the industry. Students should be taken to various industrial enterprises for better conceptualization of specific topics such as production planning, inspection and quality control. Simple problems on costing should be given to students for comprehension.

RECOMMENDED BOOKS

1. Production Estimating and Costing by M. Adithan and B.S. Pabla, Konark Publishers, Delhi

2. Industrial Engineering and Management by T.R Banga, and S.C. Sharma, Khanna Publishers, Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Period)	Marks Allotted (%)
1	06	10
2	10	15
3	10	15
4	14	15
5	06	05
6	04	05
7	22	25
8	08	10
Total	**80**	**100**

5.5 FAULT DIAGNOSIS AND DRIVING PRACTICE

	L	T	P
Periods/week	0	0	12

RATIONALE

Now, as the students have learnt about the engines, chassis, body, transmission, auto electrical and electronics systems and garage equipments, they should be able to test the various automotive parts and accessories as well as diagnosis the various problems relating to them. So emphasis is given to familiarize and practice about fault diagnosis and testing.

DETAILED CONTENTS

1. Basic electrical checks – Battery connections, electrical bulbs and units, circuit protection devices and wiring connections
2. Testing of battery – Specific gravity test, high rate discharge test, open circuit voltage test, charging of battery
3. Testing and setting of ignition timing, cam angle
4. Testing of field winding of alternator and armature of starter motor for open circuit, short circuit and earthing
5. Engine testing and finding out fuel consumption
6. Diagnosing battery ignition system
7. Diagnosing and rectifying high oil consumption
8. Diagnosing and rectifying high fuel consumption
9. Diagnosing and rectifying engine noises and knocks
10. Diagnosing and rectifying engine starting troubles
11. Diagnosing and rectifying engine running faults
12. Diagnosing and rectifying engine overhauling
13. Measuring of bore for wear, ovality and taperness
14. Inspection of crankshaft – bearing replacement and setting of journal bearings, crank pin bearings and crank shaft bearings, measuring bearing clearances by gauges
15. Demonstration of body repair techniques

RECOMMENDED BOOKS

1. Automobile Engineering by Dr. Kirpal Singh; Standard Publisher, Delhi
2. Automobile Engineering by Sh. R. B Gupta; Satya Prakashan, New Delhi
3. Maintenance and Repair of Motor Vehicle by H.O Geneva; Dialogue, R-686, New Rajinder Nagar, New Delhi
4. Automotive Mechanics by William H. Crouse, Tata McGraw Hill, Delhi
5. Auto Mechanics – Theory and Service by W.J Dekryger, ET Hall

5.6 CAD IN AUTOMOBILE ENGINEERING

	L	T	P
Periods/week	0	0	12

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, Mirror, Array-Polar, Rectangular. Measure, Divide, and Erase. Drawing Display Methods: Zoom, Pan, and View

   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