

**CURRICULUM**  
**for**  
**DIPLOMA PROGRAMME**  
**in**  
**AUTOMOBILE ENGINEERING**

**2nd Year (3rd & 4th Semester)**

**FOR THE STATE OF HIMACHAL PRADESH**



Prepared by  
National Institute of Technical Teachers Training & Research,  
Sector-26, Chandigarh-160019, India.

June, 2018

**STUDY & EVALUATION SCHEME  
THIRD SEMESTER AUTOMOBILE ENGINEERING**

S r. No.	SUBJECTS	STUDY S HEME Hrs/Week		MARKSINEVALUATIONScheme								Total Marks  Int.& Ext.
		INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT							
		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot			
3.1	*Applied Mechanics	4	2	30	20	50	100	3	50	3	150	<b>200</b>
3.2	Basics of Thermodynamics, Hydraulics and Pneumatics	5	2	30	20	50	100	3	50	3	150	<b>200</b>
3.3	Automotive Materials	4	-	50	-	50	100	3	-	-	100	<b>150</b>
3.4	Automobile Chassis, Body and Transmission - I	4	-	50	-	50	100	3	-	-	100	<b>150</b>
3.5	Production Processes	3	-	50	-	50	100	3	-	-	100	<b>150</b>
3.6	Auto Engineering Drawing - I	-	6	-	50	50	100	4	-	-	100	<b>150</b>
3.7	Auto Shop Practices - I	-	4	-	50	50	-	-	100	3	100	<b>150</b>
3.8	Mechanical Workshop Practices	-	4	-	50	50	-	-	100	3	100	<b>100</b>
	Student Centered Activities	-	2	-	25	25	-	-	-	-	-	<b>25</b>
<b>Total</b>		<b>20</b>	<b>20</b>	<b>210</b>	<b>215</b>	<b>425</b>	<b>600</b>	<b>-</b>	<b>300</b>	<b>-</b>	<b>900</b>	<b>1325</b>

\* Common with Diploma in Mechanical Engineering

**STUDY & EVALUATION SCHEME  
FOURTH SEMESTER AUTOMOBILE ENGINEERING**

S R. NO.	SUBJECTS	STUDY SCHEME <i>Hrs/Week</i>		MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr	Th	Pr	Tot	Th	Hrs	Pr	Hr	Tot	
4.1	Elements of SOM	4	2	30	20	50	100	3	50	3	150	<b>200</b>
4.2	*Electrical Technology	4	2	30	20	50	100	3	50	3	150	<b>200</b>
4.3	Garage Equipment	3	-	50	-	50	100	3	-	-	100	<b>150</b>
4.4	Automobile Engines – I	4	-	50	-	50	100	3	-	-	100	<b>150</b>
4.5	Automobile Chassis, body and Transmission – II	3	-	50	-	50	100	3	-	-	100	<b>150</b>
4.6	Computer Aided drafting	-	6	-	50	50	-	-	100	3	100	<b>150</b>
4.7	Autoshop Practices – II	-	4	-	50	50	-	-	100	3	100	<b>150</b>
4.8	Driving practice – I	-	6	-	50	50	-	-	100	3	100	<b>150</b>
6.8	Student Centred Activities	-	2	-	25	25	-	-	-	-	-	<b>25</b>
Total		<b>18</b>	<b>22</b>	<b>210</b>	<b>215</b>	<b>425</b>	<b>500</b>	<b>•</b>	<b>400</b>	<b>•</b>	<b>900</b>	<b>1325</b>

\* Common with diploma in mechanical engineering.

**Industrial Training** - After examination of 4<sup>th</sup> Semester, the students shall go for training in a relevant industry/field organisation for a minimum period of 6 weeks and shall prepare a diary. The students shall also prepare a report at the end of training and shall present it in a seminar, which will be evaluated during 5<sup>th</sup> semester.



### 3.1 APPLIED MECHANICS

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#### RATIONALE

The subject Applied Mechanics deals with basic concepts of mechanics like laws of forces, moments, friction, centre of gravity, laws of motion and simple machines which are required by the students for further understanding of other allied subjects. The subject enhances the analytical ability of the students.

#### Learning Outcomes

After undergoing this course, the students will be able to:

- Interpret various types of units and their conversion from one to another.
- Analyze different types of forces acting on a body and draw free body diagrams.
- Determine the resultant of coplanar concurrent forces.
- Calculate the co-efficient of friction for different types of surfaces.
- Calculate the least force required to maintain equilibrium on an inclined plane.
- Determine the centroid/centre of gravity of plain and composite laminar and solid bodies.
- Determine velocity ratio, mechanical advantage and efficiency of simple machines

#### DETAILED CONTENTS

1. Introduction (05 hrs)
  - 1.1 Concept of engineering mechanics definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields. Definition of Applied Mechanics.
  - 1.2 Definition, basic quantities and derived quantities of basic units and derived units
  - 1.3 Different systems of units (FPS, CGS, MKS and SI) and their conversion from one to another for density, force, pressure, work, power, velocity, acceleration
  - 1.4 Concept of rigid body, scalar and vector quantities

2. Laws of forces (10 hrs)
- 2.1 Definition of force, measurement of force in SI units, its representation, types of force: Point force/concentrated force & Uniformly distributed force, effects of force, characteristics of a force
  - 2.2 Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of super-position
  - 2.3 Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, triangle law of forces, polygon law of forces - graphically, analytically, resolution of forces, resolving a force into two rectangular components
  - 2.4 Free body diagram
  - 2.5 Equilibrant force and its determination
  - 2.6 Lami's theorem (concept only)  
[Simple problems on above topics]
3. Moment (14 hrs)
- 3.1 Concept of moment
  - 3.2 Moment of a force and units of moment
  - 3.3 Varignon's theorem (definition only)
  - 3.4 Principle of moment and its applications (Levers – simple and compound, steel yard, safety valve, reaction at support)
  - 3.5 Parallel forces (like and unlike parallel force), calculating their resultant
  - 3.6 Concept of couple, its properties and effects
  - 3.7 General conditions of equilibrium of bodies under coplanar forces
  - 3.8 Position of resultant force by moment  
[Simple problems on the above topics]
4. Friction (10 hrs)
- 4.1 Definition and concept of friction, types of friction, force of friction
  - 4.2 Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction
  - 4.3 Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane.
  - 4.4 Calculation of least force required to maintain equilibrium of a body on a

rough inclined plane subjected to a force:

- a) Acting along the inclined plane Horizontally
- b) At some angle with the inclined plane  
[Simple problems on above topics]

5. Centre of Gravity (10 hrs)

- 5.1 Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies
- 5.2 Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion
- 5.3 Determination of center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed  
*[Simple problems on the above topics]*

6. Simple Machines (15 hrs)

- 6.1. Definition of effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machines
- 6.2. Simple and compound machine (Examples)
- 6.3. Definition of ideal machine, reversible and self-locking machine
- 6.4. Effort lost in friction, Load lost in friction, determination of maximum mechanical advantage and maximum efficiency
- 6.5. System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency
- 6.6. Working principle and application of wheel and axle, Weston's Differential Pulley Block, simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application  
[Simple problems on the above topics]

### LIST OF PRACTICALS

- 1. Verification of the polygon law of forces using gravesend apparatus.
- 2. To verify the forces in different members of jib crane.
- 3. To verify the reaction at the supports of a simply supported beam.
- 4 To find the mechanical advantage, velocity ratio and efficiency in case of an inclined plane.
- 5. To find the mechanical advantage, velocity ratio and efficiency of a screw jack.
- 6. To find the mechanical advantage, velocity ratio and efficiency of worm and

worm wheel.

7. To find mechanical advantage, velocity ratio and efficiency of single purchase crab.
8. To find out center of gravity of regular lamina.
9. To determine coefficient of friction between three pairs of given surface.
10. To find mechanical advantage, velocity ratio and efficiency of (1) First system of pulleys and (2) second system of pulleys.

#### RECOMMENDED BOOKS

1. A Text Book of Applied Mechanics by S Ramamurtham, Dhanpat Rai Publishing Co. Ltd.
2. A Text Book of Engineering Mechanics (Applied Mechanics) by RK Khurmi; S Chand and Co. Ltd., New Delhi.
3. A Text Book of Applied Mechanics by RK Rajput; Laxmi Publications, New Delhi..
4. Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House, New Delhi.
5. Test Book of Applied Mechanics by AK Upadhya, SK Kataria & Sons, New Delhi

#### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	05	8
2	10	16
3	14	20
4	10	16
5	10	16
6	15	24
Total	64	100



## 3.2 BASICS OF THERMODYNAMICS, HYDRAULICS AND PNEUMATIC

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### RATIONALE

A diploma holder in Automobile Engineering is supposed to look after the I.C engines, air compressors and air conditioning of automobiles. Therefore, it is essential to teach concepts, principles, applications and practices covering laws of thermodynamics, basic air cycles, types of fuel used and their properties and components of air conditioners. Hence this subject has been included in this course.

Learning Outcome:

At the end of this course, the student will be able to

- Explain the basis principles of thermal engineering, gas laws, laws of thermodynamics, air cycles, air compressors.
- Identify, components of hydraulics and pneumatics system
- Comprehend different modes of heat transfer
- Explain the principles of air conditioning and refrigeration, their components and functions.

### DETAILED CONTENTS

1. Principles of Thermal Engineering (08 hrs)
  - 1.1 Introduction
  - 1.2 Thermodynamics properties – intensive and extensive
  - 1.3 Property, path, process, system, surroundings
  - 1.4 Heat and work
  - 1.5 Enthalpy and internal energy
2. Gas Laws (08hrs)

Boyle's law, Charle's law, Joule's law, Characteristic gas equation, gas constant, universal gas constant. Simple numerical problems
3. Law of Thermodynamics (10 hrs)
  - 3.1 Zeroth law of thermodynamics
  - 3.2 Irreversible process
  - 3.3 First law of thermodynamics (concept only)
  - 3.4 Second law of thermodynamics (concept only)
  - 3.5 Thermal efficiency and heat pump, heat engine and heat sink
  - 3.6 Concept of entropy
  - 3.7 Constant volume, constant pressure, isothermal, adiabatic, polytropic, throttling and free expansion processes (concept only).

4. Air Cycles (12 hrs)
- 4.1. Carnot cycle
  - 4.2. Otto cycle
  - 4.3. Diesel cycle
  - 4.4. Dual combustion cycle
5. Air Compressors (08 hrs)
- 5.1 Reciprocating air compressor
  - 5.2 Centrifugal compressor
  - 5.3 Working of single stage and double stage compressor and applications
  - 5.4 Rotary air compressor
  - 5.5 Working of fan, blower, booster, and super charger
- 6 Hydraulics (08 hrs)
- Types of fluid, Properties of fluid, Pascal Law, Components of hydraulic systems, Function of each component in hydraulic circuit, Oil reservoir, filters, Hydraulic Jack, Hydraulic Press
7. Pneumatics (05 Hrs)
- Basic components and their function, air cylinders – function, single acting and double acting, air filter, regulator, different types of control valves, concept of automation.
8. Heat Transfer (05 hrs)
- Modes of heat transfer, conduction, convection, radiation, Fourier's Law
9. Refrigeration and Air Conditioning (10 hrs)
- Refrigeration methods, unit of refrigeration, refrigerants, heat pump, coefficient of performance, rating of refrigeration machines
- Principles of air conditioning, Concept of human comfort, Introduction to air conditioning system. components of air conditioning system and their function

## LIST OF PRACTICALS

1. To find flash point and fire point of given fuel.
2. To find viscosity of given fuel.
3. To study air compressor.
4. To analyse exhaust gases by electronic gas analyzer
5. To conduct morse test of multicylinder petrol engines.
6. To prepare heat balance sheet of an IC engine.
7. Identification of components in air conditioning system.
8. Measurement of pressure head with the help of following instruments: - Manometer- U tube and inclined tube.
9. Study of a reciprocating pump.
10. Study of centrifugal pump.
11. Measurement of flow with - Venturi meter - Orifice meter
12. Verification of Bernoulli's theorem

## INSTRUCTIONAL STRATEGY

Teachers should provide simple exercises to students involving applications of various concepts and principles being covered in the subject. Tutorial sheets on various topics should be prepared and students should be asked to solve them. In practical work, students should independently perform practicals.

## 1. LIST OF BOOKS

1. Thermal Engineering by SK Kulshreshtha; Vikas Publishing House Pvt. Ltd., Delhi
2. Thermal Engineering by A.S. Sarao; Satya Prakashan, New Delhi
3. Engineering Thermodynamics by Valan A. Arasu, TMH, Delhi
4. Thermal Engineering by P.L. Ballaney; Khanna Publishers, Delhi
5. Thermal Engineering by R.K. Rajput; Laxmi Publications, New Delhi
6. Refrigeration and Air conditioning by G.S. Aulakh, Eagle Prakashan, Jalandhar.
7. Thermodynamics –I by Er. B.S. Ubhi, S.K. Kataria & Sons, Delhi.
8. Hydraulics & Pneumatics by Birinder Singh, Kaption Publishing house, New Delhi.
9. Hydraulic and Pneumatic Control by ShammugaSundram, S.Chand& Company Ltd., New Delhi.
10. Pneumatic controls by Festo Didactic, Bangalore

### **SUGGESTED DISTRIBUTION OF MARKS**

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	8	10
2	8	10
3	10	12
4	12	15
5	10	12
6	8	10
7	6	8
8	6	8
9	12	15
Total	80	100

### 3.3 AUTOMOTIVE MATERIALS

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## RATIONALE

Materials play an important role in the manufacturing of automobiles and the equipment/tools used in repair of automobiles. Proper selection of materials adds to the life of machinery. A diploma holder must be conversant with the properties, uses, and availability of materials used in manufacturing of different types of vehicles to enable him to perform his functions confidently. The subject of Automotive Materials has been designed to cover the above aspects.

Learning Outcome:

At the end of this course, the student will be able to

- Distinguish between metals and nonmetals, ferrous and nonferrous materials based on different laboratory tests.
- Analyze the composition and microstructure of specimen and change in microstructure due to various heat treatment processes
- Select suitable material to be used for various engineering applications on the basis of various factors such as environmental conditions, cost and desired properties.
- Interpret iron-carbon diagram

## DETAILED CONTENTS

1. Properties of Materials (08 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 Automobile Industry
  - Properties of metals and alloys
  - Physical properties - Appearance, luster, color, density and melting point
  - Mechanical Properties: Strength, stiffness, elasticity, plasticity, toughness, ductility, malleability, brittleness, hardness, fatigue and creep.
  - Thermal and electrical conductivity and corrosion resistance.
2. Ferrous Metals and Alloys (20 hrs)
  - 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 Phosphorus.
- Composition, properties, grades and uses of alloy steels such as High speed steel, Stainless steel, Silicon steel, Heat resistant steel, Spring steel

Heat Treatment : Iron-carbon diagram, objectives and practical aspects of heat treatment. Description and uses of principal heat treatment processes Annealing, Normalizing, Tempering, Hardening, Carburising, Nitriding and Cyaniding and applications. Case hardening and surface hardening, Hardenability of steels, Examples in heat treating automobile engineering components

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

- Copper: Properties and uses
- Composition, properties and uses of copper alloys.
- Brass: Cartridge brass, Nickel silver.
- Bronze: Phosphor bronze, Al-bronze, Mn-bronze, and Gun metal.
- Properties and uses of Aluminium and their grades
- 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 Metal: 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

4. Identification and Examination of Metals and Alloys (4 hrs)

Identification tests - Appearance, sound, filing, weight, magnetic, spark, bend and microstructure.

5. Other Important Materials (16 hrs)

- Plastics: Definition, classification of plastics, fibre glass, reinforced plastics. Major applications of various plastics with specific mention of their uses and grades
- Heat insulating materials: Properties and uses of asbestos, glass wool, thermocole, cork, mica.
- Sound insulating materials: Cork, fibre boards.

- Fabrication materials: Wood, plywood, Rubber - natural and synthetic, Glasses - plate glass, toughened glass, safety glass.
  - Insulating materials: Asbestos, mica
  - Electrical insulating materials, properties and uses of china clay, leather bakelite, ebonite, glasswool, rubber felt
  - Refractory materials: General characteristics and uses of dolomite, ceramics.
  - Protective coating materials: Auto paints, primers, varnishes, enamels, putti, electroplating materials, rubasil, teflon coating
  - Adhesive requirements types and advantages, thread locking special solution, antirust solution
6. Selection and Specifications of Materials (04 hrs)
- Practical considerations for selection of material for different Automobile Components.
  - ISO/Bureau of Indian standard specifications for metals, non-metals, auto components and other materials.

## 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 G. Narula, Tata McGraw Hill, Delhi
4. Material Science by RK Rajput; SK Kataria and Sons, Ludhiana

### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	08	14
2	20	28
3	12	18
4	04	08
5	16	24
6	04	08
Total	64	100



### 3.4 CHASSIS, BODY AND TRANSMISSION - I

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## RATIONALE

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

Learning Outcomes :

On completion of this course, a learner should be able to:

- Classify the vehicle
- Explain the function and working of clutch
- Explain the function and working of manual and automatic transmission
- Describe the functional and constructional features of final drive and its components and front axles.
- Comprehend steering geometry
- Explain the working and constructional features of steering system and their components

## DETAILED CONTENTS

### 1. Chassis and Body (10 hrs)

Classification of vehicles, types of chassis, 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., types of frame and body streamlining, cross members, brackets, materials of frame and body upholstery..

### 2. Clutch (14 hrs)

Necessity, function and requirements of clutch, types of clutch - single plate clutch, multi plate clutch, hydraulic power assisted and wet and dry plate clutch, clutch plate and lining material

Constructional details and working of centrifugal, semi centrifugal clutch, diaphragm clutch and fluid coupling.

### 3. Transmission (14 hrs)

Necessity, function and types of manual transmission- Sliding, constant mesh and synchromesh. Over drive, over running clutch, description and operation of transfer gear box. Common faults and remedies, transaxle construction.

- Types of automatic transmission and their main components

- Epicyclic gear box – construction, working and determination of speed ratio Torque converter  
- construction, principle of working. Continuously variable transmission, Automated Manual Transmission, hydrostatic transmission systems, direct shift gear box (DSG).

4. Final Drive (10 hrs)

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

5. Front Axle (06 hrs)

Types – Stub double drop, fully dropped, load distribution, effect of braking on axle shape, steering head, Elliot and reverse elliot, steering knuckle.

6. Steering (10 hrs)

Steering mechanism, function, Ackerman's Principle of steering. Working and constructional details of steering gear, steering linkages, sector arm, center arm, drag link and tie rod, steering ratio. Front wheel geometry-caster, camber, steering axis inclination, toe in and toe out. Cornering force, cornering power and self-righting torque. Over steering and under steering. Traction control system, Power steering – necessity, types, Construction features and working of hydraulic and electronic power steering systems ,four wheel steering, adjustable steering –rake and telescopic type, Common steering systems troubles and remedies.

### **Demonstration-**

1. Demonstration and sketching of Heavy and Light vehicle chassis.
2. Identification and servicing of single plate and multi plate clutch.
3. Servicing of centrifugal clutch.
4. Servicing and overhauling of constant mesh and synchromesh gear box
5. Servicing of universal joints, slip joint and propeller shaft
6. Servicing of differential, adjustment of crown and pinion backlash.
7. Checking and adjustment of steering geometry, camber, caster, Toe-in, Toe-out, kingpin inclination.

### **RECOMMENDED BOOKS**

1. Automobile Engineering, Vol. I- II by Dr. Kirpal Singh, Standard Publishers
2. Automobile Engineering by GBS Narang, Khanna Publishers, Delhi
3. Chassis, Body and Transmission-I by G.S.Aulakh, Eagle Prakashan, Jalandhar.
4. Automobile Engineering by R.B. Gupta, Satya Prakashan, New Delhi.
5. Chassis, Body and Transmission by Ishan Publications, Jalandhar.

### SUGGESTED DISTRIBUTION OF MARKS

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

### 3.5 PRODUCTION PROCESSES

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#### RATIONALE

Mechanical Workshop Practice contains only practicals in various workshops. There is need felt general idea about various production processes. Also requires is basic knowledge about CNC Machine.

#### DETAILED CONTENTS

##### 1. Manufacturing Processes (10 hrs)

General machine Tools, Description and functions of main parts, Cutting Parameters, Principles of Turning, Drilling, Boring, Shaping, Plaining, Slotting and Grinding, Milling and Superfinishing.

##### 2. Foundry Practice (10 hrs)

- Pattern Making
- Types of Pattern
- Pattern Materials
- Pattern Allowances
- Introduction to Core
- Moulding
- Introduction to Moulding
- Types of Moulding Sand and their properties
- Melting and pouring

- Defect in castings

(b) Simple Arc & Gas Welding, Metal forming processes- Die stamping, Metal Drawing, Spinning, Rolling, Extruding, Forging, Tube Drawing.

3. Modern Machining Processes (06 hrs)

Processes, Procedures, Advantages, Limitations and Applications of Electro discharge machining, Electro chemical Machining, USM, AJM and LBM.

4. Numerical Control of Machine Tools (12 hrs)

Introduction to Numerical control of machine tools, NC Machines, CNC machines, Direct numerical control, Advantages and disadvantages of CNC machines, Fundamentals of Part Programming, Manual part Programming, Computer aided part programming.

5. Powder Metallurgy (10 hrs)

Introduction, Production of Metal Powder-Atomization, Milling and grinding, Shooting. Main Characteristics of metal powder - particle shape, Size and Distribution, Apparent Density, Flowability, Compressibility, Purity and Sintering ability, Chemical Composition. Advantages and disadvantages of Power Metallurgy, Applications.

## INSTRUCTIONAL STATREGY

The teaching of the subject should be in the form of Lecture Cum demonstration so that the students are able to see the processes practically.

## RECOMMENDED BOOKS

1. Workshop Technology Vol-I & II by Hazara & Chowdery – Asia Publishing House.
2. Workshop Technology by B.K. Manchanda, H. Tata Publications, Delhi.
3. Production Technology by R.K. Jain
4. Manufacturing Technology by M Adithan and Gupta, New Age International Private Limited, Delhi.

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	22
2	10	22
3	06	10
4	12	24
5	10	22
Total	48	100

### 3.6 AUTOMOBILE ENGINEERING DRAWING - I

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#### 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 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 lay emphasis on showing automobile components to students..

#### Learning Outcomes:

At the end of this course, the students will be able to

- Prepare drawings of automotive components
- Interpret various drawing used in automobile engineering
- Compare hole basis system with shaft basis system and choose fits and tolerances for various mating parts.

#### DETAILED CONTENTS

##### 1. Assembly Drawings of the following automotive components:

Joints and Bearings (04 sheets)

- Universal joint,
- Slip joint
- Bush bearing
- Ball bearing
- Roller bearing- Straight and Needle type

- Stepped or cone pulley, V-belt pulley

2. Drawings of the following automotive components:

Engine Components

(06 sheets)

- Four Stroke Petrol Engine Piston
- Diesel Engine Piston
- Connecting rod
- Fuel injector
- Crank shaft – 4 cylinder Engine

3. Drawing of the following components:

4. Gears

- Nomenclature of gears (2 sheets)
- Profile of spur gear by 'Approximate method'
- Profile of spur gear by "Base Circle method"

5. Cam Profile

(3 sheets)

- Different types of cams and followers
- Drawing of cam profile for following motion of follower
  - (a) Uniform velocity motion
  - (b) Simple harmonic motion ( SHM)
  - (c) Uniformly accelerated and retarded motion.

6. Free hand sketching

(2 sheets)

- Battery ignition system
- Magneto ignition system
- Lighting system
- Leaf spring suspension
- Overhead and side valve mechanism



## **INSTRUCTIONAL STRATEGY**

Teacher should make use of models while explaining the details of drawing of various automobile parts and components. Emphasis should be laid on cleanliness and quality of drawings.

## **RECOMMENDED BOOKS**

1. Auto Engineering Drawing by RB Gupta; Satya Parkashan, New Delhi
2. Automobile Engg. Drawing by Raj Kumar, North Publication, Jalandhar
3. Machine Drawing by PS Gill; BD Kataria and Sons, Ludhiana
4. Machine Drawing by Lakshminarayan; Jain Brothers, New Delhi
5. Automobile Engineering- Vol. I and II by Dr. Kirpal Singh, Standard Publishers Distributors, Delhi

## **INSTRUCTIONAL STRATEGY**

1. Teachers should lay emphasis in making students conversant with concepts and principles of manufacturing processes.
2. Focus should be on preparing jobs using various machines in the workshop.
3. Foreman Instructor should conduct classes of each workshop explaining use of tools, jobs to be made and safety precautions related to each workshop prior to students being exposed to actual practicals.

## ***RECOMMENDED BOOKS***

1. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Sons; Delhi
2. Elements of Workshop Technology by SK Choudhry and Hajra; Asia Publishing House
3. A Text Book of Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi

### 3.7 AUTOSHOP PRACTICE-I

**L T P**  
**0 - 4**

#### RATIONALE

Automobile Technician/Foreman/Manager requires a thorough knowledge of Automobile Engineering theoretically as well as practically. Before the students of automobile engineering understand the theoretical aspects of automobile engineering chassis, body and transmission, it is essential to expose the student with the work study. This subject develops in the students, the skill and practical knowledge of automobile and also facilitates them to carry out the overhauling of different systems of automobile in the fifth and sixth semester of shop practice.

#### 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 such as cylinder dial gauge, inside & outside micrometer, telescopic gauge, compression gauge, Vernier caliper, height gauge of automobile workshop and practice to use them.
3. Identify and servicing of the components of single plate clutch and multiplate clutch, removal of worn out parts, adjustment of clutch pedal free play and release lever adjustment
4. Servicing and overhauling of gear boxes: sliding mesh, constant mesh and synchromesh gear box.
5. Servicing and overhauling of rear axle, differential units and adjustment of backlash.
6. Servicing and overhauling of brakes - mechanical, hydraulic brakes and power brakes adjustments - bleeding of brakes.
7. Servicing of steering system - steering gear boxes correction, adjustment of free play.
8. Checking and adjustment of camber, caster, toe in and toe out, king pin inclination in steering geometry.
9. Servicing of suspension system - leaf springs, independent suspension – coil spring - torsion bar, telescopic shock absorber
10. Identification of various denting and painting tools
11. Removing dents on body and minor body repairs - body trimming and painting.
12. Wheel balancing - static and dynamic.
13. Practice in brake shoe riveting and de riveting, aligning the shoes and adjustment of brakes.

#### RECOMMENDED BOOKS

1. Car maintenance and Repair by W. Judge
2. Carburetors and fuel Injection System by Arthur W. Judge.

## 3.8 MECHANICAL WORKSHOP PRACTICE

L T P

- - 4

### RATIONALE

Development of manual and machining skills are important aspects of technician training development. Skills in turning welding machining and fabrication are very essential for an automobile technician. Hence this mechanical workshop is introduced in the syllabus.

### DETAILED CONTENTS

#### 1. Turning Shop:

- Demonstration of functioning of lathe machine. Names of different parts of machine. Lathe operations, safety measure and practice of starting and stopping of the machine.
- Practical demonstration by instructor: Holding the round bar, facing at one end, centring and rough turning.
- Simple exercise of plain and step turning.
- Taper turning by various methods.
- Cutting simple threads and knurling.

#### 2. Welding Shop:

- One exercise on lap and butt joint each with arc welding.
- One exercise of vertical and overhead arc welding.
- One exercise of welding and cutting.
- One exercise of spot welding.
- One exercise of TIG welding.
- One utility article.

#### 3. Machine Shop:

- Shaping machine: simple exercise of shaping machine.
- Milling machine: simple exercise as gear cutting and rack cutting.
- Drilling: Simple exercise of drilling machine.
- Grinding: Face grinding and surface grinding.

#### 4. CNC Shop:

- One utility job in each machine and develop a part programming in
- Drilling
- Turning
- Thread cutting operation
- Use of software for milling operation on machine centre.

## RECOMMENDED BOOKS

1. Elements of Workshop Technology by S.K Chandwary and Hazre, Asia Publishing House, New Delhi
2. Workshop Technology by B.S Ragubanshi, Dhanpat Rai & Sons, New Delhi.

## **ECOLOGY AND ENVIRONMENTAL AWARENESS CAMP**

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the ecosystem and controlling pollution by pollution control measures. He should also be aware of environmental laws related to the control of pollution. This is to be organized at a stretch for 3 to 4 days. Lectures will be delivered on following broad topics. There will be no examination for this subject.

1. Basics of ecology, eco system and sustainable development
2. Conservation of land reforms, preservation of species, prevention of advancement of deserts and lowering of water table
3. Sources of pollution - natural and man made, their effects on living and non-living organisms
4. Pollution of water - causes, effects of domestic wastes and industrial effluent on living and non-living organisms
5. Pollution of air-causes and effects of man, animal, vegetation and nonliving organisms
6. Sources of noise pollution and its effects
7. Solid waste management; classification of refuse material, types, sources and properties of solid wastes, abatement methods
8. Mining, blasting, deforestation and their effects
9. Legislation to control environment
10. Environmental Impact Assessment (EIA), Elements for preparing EIA Statements
11. Current issues in environmental pollution and its control
12. Role of non-conventional sources of energy in environmental protection

## 4.1 ELEMENTS OF STRENGTH OF MATERIALS

L T P  
4 - 2

### RATIONALE

A diploma holder in automobile engineering is supposed to select and analyze the reasons for failure of different components and select the required material for different applications. Therefore, it is essential to teach him concepts, principles, applications and practices covering stresses and strains, beams, bending moment and shear force, springs, shaft etc. It is expected that efforts will be made by the teacher to provide appropriate learning experience to the students for developing necessary competencies related to this subject area.

### DETAILED CONTENTS

#### 1. Stresses and strains: (14 hrs)

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

#### 2. Beam and Bending: (10 hrs)

- Concept of Beam and their types (simply supported, overhanging, cantilever)
- Different types of supports.
- Concept of bending moments and shear force.
- B.M and S.F. diagram for Beams; for uniformly distributed and concentrated loads.
- Determination of position of maximum B.M and S.F. in beam. Point of contraflexure.

#### 3. Bending and Shear Stresses: (12 hrs)

- Concept of simple bending, assumptions made in it and derivation of bending equation
- Flexural formulae.
- Concept of Second Moment of Area and Section Modulus for simple sections:

- Rectangle cross section.
- Circular cross section.
- Triangular cross section.
- Hollow circular cross section.
- Calculation of bending stresses for the above section with given loading and span.
- Average shear stress in Rectangular and I-section.

#### **4. Springs:**

**(08 hrs)**

- Leaf Springs.
- Maximum deflection in leaf springs.
- Maximum stress in leaf springs.
- Close coiled and open coiled springs subjected to axial load and axial twist.
- Stiffness of a spring.
- Strain energy and proof resistance

#### **5. Shafts and Shaft Design**

**(14 hrs)**

- Concept of torque and angle of twist.
- Derivation of Torsion equation.
- Calculation of Torque transmitted by hollow and solid shafts of round sections
- Stresses in shaft
- Shaft coupling and various types (concept only)
- Design of shafts (Solid and hollow)
- Shaft under torsion
- Combined bending and torsion
- Keys (Types of keys, saddle, sunk, woodruff, taper tangent) & flanged coupling (concept only)

#### **6. Columns and Struts**

**(06 hrs)**

- Long and short columns
- Buckling of columns
- Euler, Rankine and Gordon formulae

#### **PRACTICAL EXERCISES**

1. To study tensile behavior of three different metals.
2. To calculate shear strength of two different metal under single and double shear.
3. Test on a spring to find out spring constant of the spring.
4. Calculation of impact strength of metals by
  - Charpy test
  - Izod test
5. To calculate bending strength by performing bending test of

- 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
- Brinell's hardness test

#### RECOMMENDED BOOKS

1. Mechanics of Materials by Kirpal Singh

2. Strength of Material by R.S Khurmi, S Chand & Co., Delhi

3. Elements of Strength of Materials by D.R Malhotra and H.C Gupta, Satya Parkashan, New Delhi.

4. Mechanics of Solids by Virender Singh

#### SUGGESTED DISTRIBUTION OF MARKS

<b>Topic No.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	14	22
2	10	16
3	12	18
4	08	12
5	14	22
6	06	10
<b>Total</b>	<b>64</b>	<b>100</b>



## 4.2 ELECTRICAL TECHNOLOGY

L T P  
4 - 2

### RATIONALE

*Basic knowledge of Electrical and Electronics Engineering is essential for diploma holders in Mechanical Engineering for the purpose of understanding applications of these subject areas on the shop floor and in handling machines and equipment. This subject imparts basic concepts, principles and applications to enable students to apply these principles in real live situations, may it be production, quality control or repair and maintenance.*

### DETAILED CONTENTS

- 1. General Introduction (05 hrs)**
  - 1.1 Types of elect. Engg. materials; conducting semi-conducting & insulating materials and their application.
  - 1.2 Applications for electricity and Advantages of Elect. Energy over other types of energy.
  - 1.3 Concept of voltage current power and energy and their units
  
- 2. DC Circuits (05 hrs)**
  - 2.1 Resistance factors affecting the resistance of conducting metals resistivity and their units.
  - 2.2 Resistances in series & parallel.
  - 2.3 Ohm's Law,
  - 2.4 Faraday's Laws,
  - 2.5 Len's Law.
  
- 3.Principles of AC Circuits (12 hrs)**
  - 3.1 Concept of voltage generation advantages of three phase generation over single phase generation. Three phase star & delta connections voltage & current relationship (no derivation)
  - 3.2 Definition of cycle, frequency time period instantaneous value rms& max value of sinusoidal wave (relation between rms & max value), form factor & peak factor.
  - 3.3 Concept of phase & phase difference.
  - 3.4 Concept of resistance, inductance, capacitance and impedance in ac circuits.
  - 3.5 Power factor(concept of lead, lag & unity p.f.),its importance and improvement.
  - 3.6 Measurement of three phase power using two voltmeter method.
  - 3.7 Determination of true power, current & p. f. in simple ac series circuits (simple problems)
  
- 4. DC Machines (08 hrs)**
  - 1.1 Construction & principle of working of dc motor & generator.
  - 1.2 Flaming's Rules
  - 1.3 Starting of dc motors ( three-point starter) & speed control.
  - 1.4 Reversing the direction of rotation of dc motors.

## **5.AC Machines**

**(10 hrs)**

- 5.1 Types of AC motors and their applications
- 5.2 Construction of three phase induction motors, comparison of squirrel cage and slip-ring induction motors
- 5.3 Working principle of single phase & three-phase induction motors.
- 5.4 Reversing the direction of rotation of single phase & three phase induction motors.
- 5.5 Starting of three phase induction motors using star/delta & DO1, starters, starting single phase split phase motors.

## **6. Transformer**

**(06 hrs)**

- 6.1 Construction & working principle.
- 6.2 Transformation ratio, emf equation, losses & efficiency.
- 6.3 Auto transformer,
- 6.4 Cooling of transformers.

## **7. Electrical Safety**

**(04hrs)**

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**

**(06 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 applications of a thyristor, characteristics and applications of stepper motors and servo motors in process control.

## **LIST OF PRACTICALS**

1. Use of multimeter for measurement of voltage & current (ac & dc).
2. Measurement of voltage, current, power and power factor of a motor at various loads.
3. Measurement of transformation ratio of a single phase transformer.
4. Measurement of a copper & iron losses of transformer and to determine its efficiency by direct loading method.
5. Starting of three-phase squirrel cage induction motor using star/delta starter and DOL starter and reversing the direction of three phase induction motor
6. Measurement of terminal voltage of dc shunt generator as a function of load current and plot the load-characteristic curve.
7. To draw V-I characteristics of a (i) NPN transistor (ii) thyristor (SCR)
8. Study of different types of fuses, MCBs and ELCBs
9. Study of zener diode as a constant voltage source and to draw its V-I characteristics
10. Study and testing of workshop equipment for earthing.
11. Troubleshooting in domestic wiring and distribution board.

## INSTRUCTIONAL STRATEGY

- . *Students may be given an assignment to prepare a chart of various electrical gadgets, their specification, rates and applications including the motors.*
- . *Arrange visit to some Electrical distribution/control room.*

## RECOMMENDED BOOKS

1. *Electrical Technology by B.L Theraja, S Chand and Co. New Delhi.*
2. *Basic Electrical and Electrical Engineering by S.K Sahadev, Dhanpat Rai and Sons.*
3. *Principles of Electrical Engineering by B.R Gupta, S Chand and Co.*
4. *Basic Electrical Engineering by JB Gupta, SK Kataria and Sons.*
5. *Basic Electricity by B.R. Sharma, Satya Prakashan, New Delhi.*

<b>SUGGESTED DISTRIBUTION OF MARKS</b>		
<b>Topic No.</b>	<b>Time Allotted (hrs)</b>	<b>Marks Allotted (%)</b>
1.	06	08
2.	06	08
3.	15	24
4.	08	14
5.	12	18
6.	07	12
7.	10	16
<b>Total</b>	<b>64</b>	<b>100</b>

### 4.3 GARAGE EQUIPMENT

L T P  
3 - -

#### 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.

#### Learning Outcomes :

On completion of this course, a learner should be able to:

- Use general tools for required application.
- Use appropriate tuning and testing equipment for given situation.
- Use engine repair tools.
- Use Electrical Repair equipment.
- Use reconditioning/testing equipment for chassis and body.

#### DETAILED CONTENTS

#### 1. General Equipment Specifications and applications of (8 hrs)

- 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, Car vacuum cleaner, Buffing tool)
- Oil sprayers
- Grease Guns-manual and bucket type, pneumatic
- Tyre inflation gauge (Manual and Digital type automatic)
- Tyre Changer (Manual and Automatic)
- Creepers
- Fire extinguisher
- First aid box

#### 2. Tuning and Testing Equipment Specifications and applications of (8 hrs)

- 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

3. Engine Repair Tools/Measuring and Testing Equipment **(8 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
- Smoke meter
- Engine Analyser/ Scanner
- Part degreasing tank

4. Electrical Repair Equipment **(4 hrs)**  
Specifications and uses of

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

5. Reconditioning/Testing Equipment for Chassis and Body **(8 hrs)**

Use of

- Brake Efficiency Tester (Chassis Dynamometer) or brake testing equipment
- 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
- Tools for tyres, automatic tyre remover
- Trolleys
- Axle/chassis stands
- Steering work stands
- Jib crane
- Spring tester
- Frame strengthening equipment

- Chassis alignment equipment
- Computerized wheel balancer –static and dynamic
- Computerized wheel alignment equipment

6. Engine Reconditioning and Testing Equipment  
Specifications and use of

(12 hrs)

- 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

**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

<b>Topic No.</b>	<b>Time allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	8	16
2	8	16
3	8	16
4	4	12
5	8	16
6	12	24
<b>Total</b>	<b>48</b>	<b>100</b>

## 4.4 AUTOMOBILE ENGINE · I

**L+D T P**  
**3+1 · 0**

### RATIONALE

Engine forms the base of Automobile Engineering. As the scope of auto engines is very wide, it has been divided into two subjects, Auto Engine -I and Auto Engine-II. This subject deals with engine terminology basic concept of 2 stroke and 4 stroke engine, classification of engines, constructional details of petrol engine, fuel system, cooling system, lubrication system and ignition system

### Learning Outcomes :

On completion of this course, a learner should be able to:

- Explain the principles of operation of an internal combustion engine
- classify various types of engine
- Explain the principles of operation of fuel supply systems
- Explain the principles of operation of engine cooling and lubrication systems
- Carryout servicing of lubrication and cooling system
- Test I.C engine.

### DETAILED CONTENTS

#### 1. Introduction

**(8 hrs)**

- Engines, internal and external combustion Engines, Engine terminology including Bore, Stroke, dead centres, Compression Ratio, Swept volume, clearance volume, compression ratio, Engine capacity, Engine torque, Indicated power, Brake power, Friction power
- Classification of engines as per stroke, cycle, fuel, ignition, cooling, speed, number and arrangement of cylinders, governing, reciprocating and rotary,
- Concept of 2-stroke and 4- stroke engines and their comparison.

#### 2. Engine Components

**(12 hrs.)**

Construction details, specification, function and working of components, cylinder block, head, cylinder liner, piston, piston rings, wrist pin, connecting rod, crankshaft bearing, camshaft, valves and valves mechanisms. flywheel and dampers.

#### 3. IC Engine Testing

**(12 hrs)**



Testing of I.C. engine and determination of Indicated Power and Brake Power. Mechanical Efficiency, Volumetric efficiency, Thermal Efficiency, Relative Efficiency, Mean Effective Pressure and Specific fuel consumption. Heat balance sheet, Morse Test. Simple numerical problems.

4. Fuel System in spark Ignition Engine **(10 hrs)**

Fuel System: types of fuel feed system, gravity and pump feed. Fuel injection system, Fuel tank, fuel lines, fuel filters, carburetion, working of simple carburetor and its limitation.

Circuits of complete carburetor: Float circuit, starting and choke circuit, idling, low speed, high speed part load and full load circuits. Construction and working of solex carburetor, dry and wet air cleaners. Intake and exhaust manifold, mufflers.

Petrol Injection: - Introduction, Comparison with Carburetor method, Description and working of multipoint fuel injection (M.P.F.I.), Advantages and disadvantages of M.P.F.I., Sensors and construction of ECU.

5. Ignition system **(12 hrs)**

Concept of ignition system, types of ignition systems, Battery/coil and magneto ignition system, Function and working of ignition coil, distributors, condenser, advance mechanisms, C.B. Point and gap, spark plugs and gaps pertaining to Indian vehicles., Distributor less Ignition System, transistorized ignition system.

6. Cooling System **(05 hrs)**

Cooling system, necessity, types(air, water), pump circulation cooling., Advantages & Disadvantages of Air cooling & water cooling, Components of Water cooling system- Radiators, thermostat, water pump, Fan, Pressure cap, Water jackets, anti-freeze solution, trouble shooting and remedies.

7. Lubrication System **(05 hrs)**

Necessity and types of Lubrication system (Splash System, Pressure system), wet and dry sump, Components used, oil pump, oil lines, oil filters, oil coolers, crankcase ventilation, characteristics, classification and service ratings of lubricating oil, additives for lubricants.

### **Content for Demonstrations:**

1. Sketching and working of basic components of an automobile engine such as cylinder block, cylinder head, piston, connecting rod and crankshaft.
2. Testing of mechanical fuel pump.
3. Servicing of water-cooling system, radiator, fan, and pump, thermostat.
4. Identification of each part and working of two-wheeler carburetor
5. Servicing of lubrication system.
6. Find IP ,BP ,Mechanical efficiency of multi-cylinder petrol engine by using Morse test.
7. Testing and cleaning of Fuel injector (Petrol Engine).

### **RECOMMENDED BOOKS**

1. Automobile Engineering – Vol. 2 by Dr. Kirpal Singh; Standard Publishers Distributors.
2. Automobile Engineering by R.B. Gupta; Satya Prakashan, New Delhi
3. Automotive Engines by Srinivasan, TMH, Delhi
4. Automobile Engineering by Chikara, Dhanpat Rai and Sons, New Delhi
5. Automobile Engineering by KM Gupta, Umesh Publishers, Delhi
6. Auto Engine –I by G.S. Aulakh, Eagle Prakashan, Jalandhar.

### ***SUGGESTED DISTRIBUTION OF MARKS***

<b>Topic No.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	8	12
2	12	18
3	12	18
4	10	16
5	12	20
6	5	08
7	5	08
<b>Total</b>	<b>64</b>	<b>100</b>

## 4.5 CHASSIS, BODY AND TRANSMISSION · II

**L+D T P**  
**2+1 · 0**

### RATIONALE

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

Learning Outcomes:

On completion of this course, a learner should be able to:

- Explain the function and working of suspension system
- Explain the function and working of different types of brakes.
- Describe the functional and constructional features of wheels and tyres.
- Comprehend vehicle safety systems.
- To get awareness about recent trends in automobile industry.

### DETAILED CONTENTS

#### 1. Suspension System

**(8 hrs)**

Function type - independent, rigid axle. Springs, functions, and types (coil, leaf and torsion bar), sprung and un-sprung weight, Characteristics of springs, material, spring eye, bushes, variable rate spring, helper leafs, leaf sections. Camber grading and nippling spring seats, rubber pads, pressure blocks, spring covers, interleaf inserters, pneumatic suspension system. Function and construction of hydraulic dampers (shock absorbers), active suspension system, diagnosis of common faults and their rectifications.

#### 2.. Braking System

**(10 hrs)**

- Purpose of brakes, lay out of braking system, components.  
- Types of brakes- mechanical, hydraulic, power.  
- Principle of hydraulic brakes, braking action, master cylinder, wheel cylinder, leading and trailing shoes, self adjusting brakes, self applying and self releasing action, anti-skid devices, pedal travel, brake enclosures, heat generation and operating temperature. Drum brakes - construction and working details. Disc brakes - constructional and working details.

### **3. Power Brakes**

(12 hrs)

Air, air hydraulic, hydraulic vacuum their construction and working details. Brake fluid and characteristics, brake liner, hand brake, engine exhaust brake system and its importance, brake tests, antilock braking system with electronic brake distribution, common faults and their rectification.

### **4. Wheel and Tyres**

(10 hrs)

Wheels, types, hub attachment, wheel specification, tyres classification and purpose, types and construction of pneumatic tyre, composition of covers, tread breaker, bead and casing, causes of excessive tyre wear, effects of different condition of vehicles stability. Care and maintenance of tyres, tubes, static and dynamic balance, retreading of tyres, tubeless tyres, Run flat tyres, concept of green tyres, tweel.

### **5. Automotive Safety Systems**

(4 hrs)

Preventive design, designing for minimum injury in accident, seat belts, seat belt pretensioner with load limiter, airbags, electronic vehicle stability and occupants protection system, pedestrian protection, iso car seat fix, child lock.

### **6. Miscellaneous**

(4 hrs)

SHSV system, lane departure warning, adaptive cruise control, automatic emergency braking system, 360° degree camera.

## **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 chassis, body and transmission.

## **RECOMMENDED BOOKS**

1. Automobile Engineering, Vol. I- II by Dr. Kirpal Singh, Standard Publishers
2. Automobile Engineering by GBS Narang, Khanna Publishers, Delhi
3. Chassis, Body and Transmission-I by G.S.Aulakh, Eagle Prakashan, Jalandhar.
4. Automobile Engineering by R.B. Gupta, Satya Prakashan, New Delhi.
5. Chassis, Body and Transmission by Ishan Publications, Jalandhar.

### **SUGGESTED DISTRIBUTION OF MARKS**

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	8	16
2	10	20
3	12	24
4	10	20
5	4	10
6	4	10
Total	48	100

## 4.6 COMPUTER AIDED DRAFTING

L T P  
.. 6

### RATIONALE

The diploma holders are required to integrate the drawings through a soft copy to the machines during production. Thus competency in computer aided drafting is essential. Hence this subject is required.

### DETAILED CONTENTS

#### 1. Introduction to CAD

- Introduction to Cad: - Advantages and applications, setting the drawing environment: Limits, Grid, Snap, Axis, Units, Ortho, Coordinates ON, OFF Units and Color.
- 2D Drawing entities - Point - Line - Arc - circle, Ellipse, Polygon, and Trace. Object Selection using Object Snap (OSNAP).
- 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.
- Adding Texts and Dimensions: Text, Dimension-linear, continued, angular

#### 2. More Learning for Productivity of Drawing

- Pedit commands. Working on multiple layers Layer concepts in CAD
- Various options with layer command - Hatch command - Creating line types library and user made library.
- Preparing the schematic drawing of a workshop building in one layer, the blocks of machines in another Layer and Electrical connection on another layer.

#### 3. Advanced Cad Features

- Drawing 2D figure of complex shape
- Extruding it into a 3D drawing
- Understanding 3D Co-ordinate values, Creating and viewing a drawing in 3D.
- Rotating the drawings- Meshing 3D drawing.
- Turning a 3D into 2D Ortho Graphic projection.

#### 4. Advanced 3DFeatures

- Understanding model space and paper space.
- Drawing and working in UCS.
- UCS icon, 3D editing-Union, Subtraction, 3 D Orbit.
- Basic 3D entities command, Box, Cylinder, Cone, Chamfer, Revolve.

## 5. LISP Programming

- Develop an LISP program that acts as a simple calculator having addition, subtraction, multiplication and division operations.
- Develop an LISP program that abbreviates some of the CAD commands (E.g.: e for erase, C for copy etc.)
- Develop an LISP program to parametrize certain 2D shapes such as bolt, pulley, gear etc.

## 6. CAD Setup and Presentation

- Developing CAD slides and presenting it.
- Configuring the CAD package with the following settings.
  - One User
  - 1SM SVGA monitor
  - Microsoft Serial Mouse at COM
  - DMP 52 plotter at COM2

## INSTRUCTIONAL STRATEGY

1. Teachers should demonstrate himself doing it.
2. Emphasis should be given on dimensioning and layout of sheet.
3. Teacher should ensure use of IS Codes related to drawing

## 4.7 AUTOSHOP PRACTICE - II

L T P

- - 4

### RATIONALE

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

### DETAILED CONTENTS

1. . Cleaning, greasing, checking as per maintenance schedule, washing, wiping and polishing of jeep/car and two wheeler.
2. Identification dismantling and assembling of AC fuel pump.
3. Overhauling of wheels, tyre's and suspension system of car/jeep.
4. Removal and fitting of wheels and tyres of a two wheelers and repairing of punctures., and rotation of tyres tyre pressure, use of gauges.
5. Soldering of defective radiator and brazing of a fuel tank
6. Flushing out water jackets, cleaning of radiator and refitting in vehicle, adjustment of fan belt tension by self-adjusting and automatic adjusting.
7. Dismantling and assembly of a carburetors.
8. Dismantling and assembly of water pump.
9. Dismantling and assembly of injectors.
10. Dismantling and assembly of oil pumps.
11. Dismantling and assembly of distributor.
12. Setting of engine timing, valve clearance and adjustment of tappet clearance.
13. Dismantling and assembly of fuel injection pump.
14. Demonstration of MPFI System used in modern vehicle using engine scanner.
15. Demonstration of CRDI system used in modern vehicles using engine scanner.

### INSTRUCTIONAL STRATEGY

Emphasis may be given on practical applications and practice on fitting of wheels and rotation of tyres.

### RECOMMENDED BOOKS

1. Car Maintenance and Repair by W. Judge
2. Carburetors and fuel Injection system by Arthur W. Judge



## 4.8 DRIVING PRACTICE - I

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### RATIONALE

Driving is an essential part of learning of an Automobile Engineering Diploma holder. Testing of vehicles is not possible unless driving is known. Driving is learnt only by practice on the vehicle. The driving involves knowledge of motor vehicle act provisions and traffic rules. Practical skills in application of the act. Provision is learnt only by actual practice.

### DETAILED CONTENTS

1. **Know your vehicles**- Different elements and their functions.
2. **Vehicles controls**- Hand controls, Foot controls, other controls, Major/Minor Controls.
3. **Pre driving checks**- before sitting on the driver seats, after sitting on the driver's seat.
4. **Beginning to Drive**
  - Setting of mirror for blind spot reduction.
  - Road users characteristics
  - Road sense
  - Traffic sense
  - Anticipation, Judgment
  - Gear changing (high to low and low to high)
  - Holding steering for controlling
  - Road signs & signals
  - Road marking
  - Traffic Signals (hand signal, traffic signs, Automatic lights).
  - Starting the engine
  - Precautions before moving the vehicles.
  - Precautions after moving the vehicles.
  - Positioning on road
  - Parking
  - Stopping distance
  - Following Distance
  - Passing
  - Turning
  - Stopping
  - Reversing
  - Driver's responsibility on road
  - Driving techniques
5. **Driving practice on driving simulator, driving in abnormal condition namely hilly, night, rain and heavy traffic.**

**6. Driving Practice with vehicle:**

Simple (in the ground or within the institution about 30 K.M. per students per semester).

**7. Important Provisions of Motor Vehicles Act, Accidents & Safety:**

Learning License, Display of learning sign on the vehicle, Regular Driving license, General Insurance, Vehicle Registration, Pollution test standards/certificates., log book and other documents. Causes of accidents and precaution to avoid accidents

**8. Routine Maintenance:** Engine lubrication and cooling system, Battery top up and charge, Tyre wear and wear, Washing, cleaning, greasing and polishing etc.