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# UNIT 1 INTRODUCTION TO AUTOMOBILE ENGINEERING

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## 1.1 INTRODUCTION

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Automobile engineering is the one of the stream of mechanical engineering. It deals with the various types of automobiles, their mechanism of transmission systems and its applications. Automobiles are the different types of vehicles used for transportation of passengers, goods, etc. Basically all the types of vehicles works on the principle of internal combustion processes or some times the engines are called as internal combustion engines. Different types of fuels are burnt inside the cylinder at higher temperature to get the transmission motion in the vehicles. Most of the automobiles are internal combustion engines vehicles only. Therefore, every mechanical and automobile engineers should have the knowledge of automobile engineering its mechanism and its various applications.

### Objectives

After studying this unit, you should be able to

- define automobile engineering,
- classify the vehicles,
- list the various components of automobile, and
- describes the function of components of automobile.

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## 1.2 DEFINITION

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Automobile engineering is a branch of engineering which deals with everything about automobiles and practices to propel them.

Automobile is a vehicle driven by an internal combustion engine and it is used for transportation of passengers and goods on the ground. Automobile can also be defined as a vehicle which can move by itself.

**Examples :** Car, jeep, bus, truck, scooter, etc.

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## 1.3 CLASSIFICATION OF VEHICLES

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Automobiles or vehicles can be classified on different bases as given below :

### On the Basis of Load

- (a) Heavy transport vehicle (HTV) or heavy motor vehicle (HMV), e.g. trucks, buses, etc.
- (b) Light transport vehicle (LTV), e.g. pickup, station wagon, etc.
- (c) Light motor vehicle (LMV), e.g. cars, jeeps, etc.

### Wheels

- (a) Two wheeler vehicle, for example : Scooter, motorcycle, scooty, etc.
- (b) Three wheeler vehicle, for example : Autorickshaw, three wheeler scooter for handicaps and tempo, etc.
- (c) Four wheeler vehicle, for example : Car, jeep, trucks, buses, etc.
- (d) Six wheeler vehicle, for example : Big trucks with two gear axles each having four wheels.

### Fuel Used

- (a) Petrol vehicle, e.g. motorcycle, scooter, cars, etc.
- (b) Diesel vehicle, e.g. trucks, buses, etc.
- (c) Electric vehicle which use battery to drive.
- (d) Steam vehicle, e.g. an engine which uses steam engine. These engines are now obsolete.
- (e) Gas vehicle, e.g. LPG and CNG vehicles, where LPG is liquefied petroleum gas and CNG is compressed natural gas.

### Body

On the basis of body, the vehicles are classified as :

- (a) Sedan with two doors
- (b) Sedan with four doors
- (c) Station wagon
- (d) Convertible, e.g. jeep, etc.
- (e) Van
- (f) Special purpose vehicle, e.g. ambulance, milk van, etc.

### Transmission

- (a) Conventional vehicles with manual transmission, e.g. car with 5 gears.
- (b) Semi-automatic
- (c) Automatic : In automatic transmission, gears are not required to be changed manually. It is automatically changes as per speed of the automobile.

### Position of Engine

#### *Engine in Front*

Most of the vehicles have engine in the front. Example : most of the cars, buses, trucks in India.

#### *Engine in the Rear Side*

Very few vehicles have engine located in the rear. Example : Nano car.

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## 1.4 LAYOUT OF AN AUTOMOBILE CHASIS

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Layout of an engine chasis is shown in the Figure 1.1 given below :

**Figure 1.1 : Chasis of a Passenger Car**

It contains the source of power, i.e. engine, the frame, which supports the engine, wheels, body, transmission, the braking system and the steering. It also gives support to suspension system and springs. Besides these parts

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## 1.5 COMPONENTS OF THE AUTOMOBILE

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The automobile can be considered to consist of five basic components :

- (a) **The Engine or Power Plant** : It is source of power.
- (b) **The Frame and Chasis** : It supports the engine, wheels, body, braking system, steering, etc.
- (c) The transmission which transmits power from the engine to the car wheels. It consists of clutch, transmission, shaft, axles and differential.
- (d) The body.
- (e) Accessories including light, air conditioner/hearer, stereo, wiper, etc.

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## 1.6 FUNCTIONS OF MAJOR COMPONENTS OF AN AUTOMOBILE

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### **Chasis and Frame**

The chasis is formed by the frame with the frame side members and cross members. The frame is usually made of box, tubular and channel members that are welded or riveted together. In addition to this, it comprises of the springs with the axles and wheels, the steering system and the brakes, the fuel tank, the exhaust system, the radiator, the battery and other accessories. Along with this the frame supports the body.

## Engine or Power Plant

The engine is the power plant of the vehicle. In general, internal combustion engine with petrol or diesel fuel is used to run a vehicle. An engine may be either a two-stroke engine or a four-stroke engine.

An engine consists of a cylinder, piston, valves, valve operating mechanism, carburetor (or MPFI in modern cars), fan, fuel feed pump and oil pump, etc. Besides this, an engine requires ignition system for burning fuel in the engine cylinder.

## Transmission System (Clutch and Gear Box)

The power developed by the engine is transferred to the wheels by transmission system. Transmission system must do three jobs :

- (a) It must provide varying gear ratios. Number of gear ratios are equal to number of gears in a vehicle.
- (b) It must provide a reverse gear for moving vehicle in reverse direction.
- (c) It must provide a neutral or disconnecting arrangement so that the engine can be uncoupled from the wheels of the vehicle. In a conventional transmission system, there is a clutch, a manually operated transmission (gear box), a propeller shaft and a differential or final drive.

### Clutch

The purpose of the clutch is to allow the driver to couple or decouple the engine and transmission. When clutch is in engaged position, the engine power flows to the transmission through it (clutch). When gears are to be changed while vehicle is running, the clutch permits temporary decoupling of engine and wheels so that gears can be shifted. In a scooter, the clutch is operated by hand where as in a car the clutch is operated by foot. It is necessary to interrupt the flow of power before gears are changed. Without a clutch, it will be very difficult.

### Final Drive

Final drive is the last stage in transferring power from engine to wheels. It reduces the speed of the propeller shaft (drive shaft) to that of wheels. It also turns the drive of the propeller shaft by an angle of  $90^\circ$  to drive the wheels.

**Figure 1.2 : Final Drive**

The propeller shaft has a small bevel pinion which meshes with crown wheel. The crown wheel gives rotary motion to rear axles. The size of crown wheel is bigger than that of bevel pinion, therefore, the speed of rear axles (or crown wheel) is lower than the speed of pinion. Final drive is of two types, i.e. chain type and gear type.

### Braking System

Brakes are used to slow down or stop the vehicle. Hydraulic brakes are generally used in automobiles, where brakes are applied by pressure on a fluid. Mechanical brakes are also used in some vehicles. These brakes are operated by means of

leavers, linkages, pedals, cams, etc. Hand brake or parking brake is usually a mechanical brake. These are used for parking the vehicles on sloppy surfaces and also in case of emergency.

### **Gear Box**

Gear box contain gearing arrangement to get different speeds. Gears are used to get more than one speed ratios. When both mating gears have same number of teeth, both will rotate at same number speed. But when one gear has less teeth than other, the gear with less number of teeth will rotate faster than larger gear. In a typical car, there may be six gears including one reverse gear. First gear gives low speed but high torque. Higher gears give progressively increasing speeds. Gears are engaged and disengaged by a shift lever.

### **Steering System**

In front wheels can be turned to left and right by steering system so that the vehicle can be steered. The steering wheel is placed in front of driver. It is mechanically linked to the wheels to provide the steering control. The primary function of the steering system is to provide angular motion to front wheels so that vehicle can negotiate a turn. It also provides directional stability to vehicle when the vehicle moves ahead in straight line.

#### **Figure 1.3 : Simple Driving of a Steering System**

Now-a-days, many vehicles are equipped with power steering which uses pressure of a fluid to reduce steering effort. When driver turns the steering wheel, a hydraulic mechanism comes into play to provide most of the effort needed to turn the wheel.

### **Front Axle**

Front axles are mounted at the end of front axle. A part of the weight of vehicle is transmitted to the wheels through this axle. The front axle performs several functions.

It carries the weight of the front of the vehicle and also takes horizontal and vertical loads when vehicle moves on bumpy roads. When brakes are provided on front wheels, it endures bending stresses and torsional stresses. It is generally made from steel drop forging. It is robust in construction.

### **Suspension System**

Suspension system of an automobile separates the wheel and axle assembly of the automobile from its body. Main function of the suspension system is to isolate the body of the vehicle from shocks and vibrations generated due to irregularities on the surface of roads. Shock absorbers are provided in the vehicles for this purpose. It is in the form of spring and damper. The suspension system is provided both on front end and rear end of the vehicle.

A suspension system also maintains the stability of the vehicle in pitching or rolling when vehicle is in motion.

**SAQ 1**

- (a) Define automobile engineering.
- (b) Classify the vehicles on the basis of different aspects.
- (c) What are the various components of automobile?
- (d) Describe the functions of various components of automobile.
- (e) Describe the working of steering system mechanism

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**1.7 SUMMARY**

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**1.8 KEY WORDS**

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**1.9 ANSWERS TO SAQs**

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Refer the preceding text for all the Answers to SAQs.