3.0 CLASSIFICATIONS OF AUTOMOTIVES

Automotive classifications can be done based on the following:-

- **Arrangement of Cylinders**

  - **In-line:** in this arrangement, the cylinders are positioned in a straight line, one behind the other along the length of the crankshaft. This type of engine could have cylinders ranging from 2 to 11 cylinders or more. For automobile engines, the in-line four-cylinder engines are more common. They are sometimes called STRAIGHT (four, six or eight).

  - **V-engine:** this configuration has two-banks of cylinder at angle with each other, all connected to a single crankshaft. The angle between the banks of cylinder ranges from 15˚ to 120˚, with 60˚ to 90˚ being common. V6s and V8s are common automobile engines used while V12s and V16s are found in some luxury and high-performance vehicles.

  - **Opposed piston:** In this arrangement, two pistons are found in a single cylinder with the combustion chamber in-between them. A single combustion process causes two power strokes at the same time, with each piston being pushed away from the center and delivering power to a separate crankshaft at each end of the cylinder. Engine output is either on two rotating crankshafts or on one crankshaft incorporating complex mechanical linkages.

  - **Opposed cylinder:** In this arrangement, two banks of cylinders opposite each, other are connected to a single crankshaft (it is also a V engine with 180˚V). This type of engine is common in small aircrafts and some automobiles, with an even number of cylinder from two to eight or more. They are mainly called flat engines.

  - **Radial type:** in this arrangement, the engine pistons are positioned in a circular plane around a central crankshaft. The connecting rods are connected to a master rod which, in turn, is connected to the crankshaft. A bank of cylinders on a radial engine always has an odd number of cylinders ranging from 3 to 13 or more. Operating on a four-stroke cycle implies that every other cylinder fires as the crankshaft rotates, giving a smooth operation. A lot of medium and large-size

propeller-driven aircraft use the radial engine. In large aircrafts, two or more banks of cylinders are mounted together (one behind the other on a single crankshaft, given a more powerful and smooth engine operation. Very large ship engines exist with up to 54 cylinders, six (6) banks of nine (9) cylinders each.

- **W type:** this arrangement is similar to the V engine except that it has three cylinder banks connected to a single crankshaft. This design is not common but has been developed for some racing automobiles in the past and present. Usually such engines have 12 cylinders with 60˚ in between them.

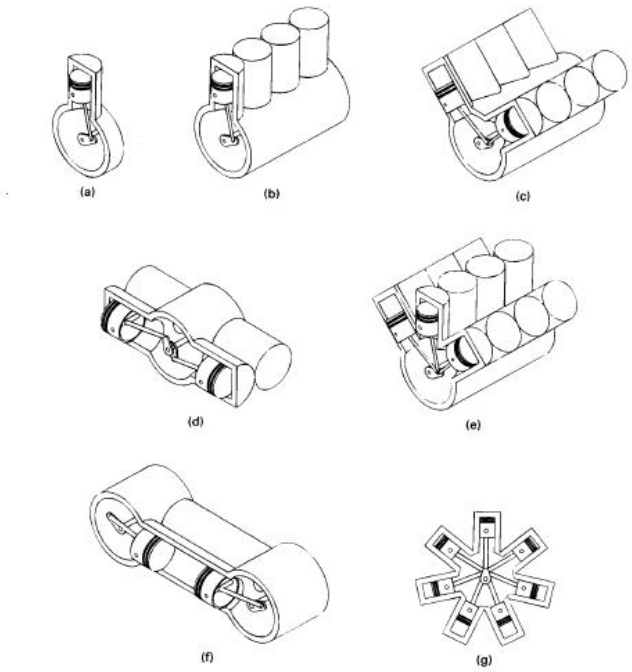

Figure 3.1: Engine configurations (a) Single Cylinder (b) Straight or In-line (c) V Engine (d) Opposed Cylinder (e) W Engine (f) Opposed Piston (g) Radial

• Type of fuel burned

- Diesel
- Petrol
- CNG / LPG
- Dual fuel engine

• Type of aspiration

– Naturally aspirated engine

– Turbo / super charged engine

• **Number of valve / cylinder**

– 2 valves per cylinder

– 3 valves per cylinder

– 4 valves per cylinder

– 5 valves per cylinder

• **Mode of ignition**

– Compression ignition

– Spark ignition

• **Valve location**

Four stroke engines employ the opening and closing of valves for the purpose of gas exchange in its combustion chamber by the various valve arrangements.

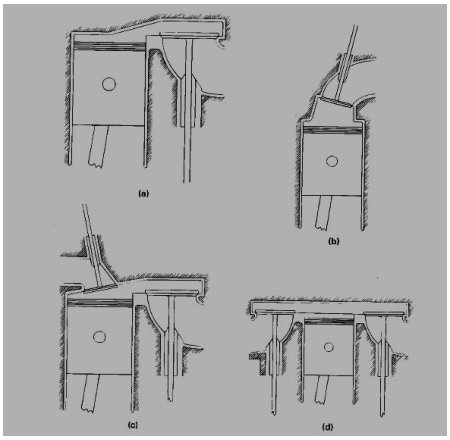

Figure 3.2: Four-stroke engine classification based on valve location (a) Valve in block, L head (b) Valve in head, I head (c) One valve in head and one valve in block, F head. (d) Valve in block on opposite sides of cylinder, T head.

- **Valve in block, L head:** this type of valve arrangement was used in older automobiles and is still being used in some smaller engines.

- **Valve in head, I head:** This valve arrangement is the standard used in modern automobile engines.
- **One valve in head and one valve in block, F head:** this arrangement was used in older automobile engines and their usage was not so common.
- **Valve in block on opposite sides of cylinder, T head:** this arrangement was used in some historic automobile engines.

• **Camshaft location**

- Overhead cam engine
- Cam in the block engine

• **Number of strokes / cycle**

- 4 – stroke cycle
- 2 – stroke cycle

• Cooling system type

– Water cooled engine

– Air cooled engine

• Combustion chamber design

Shapes:

- Pancake
- Wedge
- Hemispherical
- Pent roof
- Pre-combustion chamber

- **On load basis:**
  - Heavy transport vehicle (HTV) or heavy motor vehicle (HMV) e.g. trucks, buses, etc.
  - Light transport vehicle (LTV) e.g. pickup, station wagon, etc.
  - Light motor vehicle (LMV) e.g. cars, jeeps, etc.

- **On the Basis of Wheels :**
    - Two wheeler vehicle e.g. Scooter, motorcycle, scooty, etc.
    - Three wheeler vehicle e.g. Auto rickshaw, three wheeler scooter and tempo, etc.
    - Four wheeler vehicle e.g. Car, jeep, trucks, buses, etc.
    - Six wheeler vehicle e.g. Big trucks with two gear axles each having four wheels.
- **On the Basis of Body**
    - On the basis of body, the vehicles are classified as :
    - Sedan with two doors
    - Sedan with four doors
    - Station wagon
    - Convertible, e.g. jeep, etc.
    - Van
    - Special purpose vehicle e.g. ambulance, milk van, etc.
- **Transmission**
    - Conventional vehicles with manual transmission, e.g. car with 5 gears.
    - Semi-automatic
    - Automatic: In automatic transmission, gears are not required to be changed manually. It is automatically changes as per speed of the automobile.
- **Engine Position**
    - Engine in Front: Most of the vehicles have engine in the front e.g. most of the cars, buses and trucks.

- Engine in the Rear Side: Very few vehicles have engine located in the rear.

3.1 COMPONENTS OF THE AUTOMOBILE

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 Chassis: 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 fitted on chassis.

(e) Accessories including light, air conditioner/hearer, stereo, wiper, etc.