

Unit 1

Introduction of IC engine

What is an engine ?

An engine is an device which is use to convert chemical energy into mechanical energy or work.

Engine

Chemical energy -> mechanical energy

Types of Engine

On the basis where combustion takes place, there are two types of engine-

1. External combustion engine (E.C. engine)
2. Internal combustion engine (I.C. engine)

External Combustion Engine

E.C. Engine - In external combustion engine the fuel is burn outside from the engine cylinder and the heat generated then transferred to the main working fluid to vaporises it, and a high pressure is generated which helps to move the piston.

Example - steam engine



Internal Combustion Engine

I.C. Engine - In internal combustion engine working fluid burns inside the cylinder and the heat generated due to burning is then help to move the piston

Example - Petrol engine,
Diesel engine



Difference between E.C and I.C

E.C. Engine

1. two working fluid in this type of engine.
2. combustion of the fluid take place out side the cylinder.
3. Large in size due to many accessories.
4. As we know that heat transfer take place from one fluid to the another so, heat losses in this type of engine is more.
5. example of such types of engines are
- steam engine, steam turbine.

I.C. Engine

1. one working fluid in this type of engine
2. combustion of the fluid take place out side the cylinder
3. small and simple in size as compare to E.C. engine.
4. In this type of engine no heat transfer occurs, so the heat losses are less.
5. example of such type of engines are –
S.I. engine, CI engine.

Engine's Main Parts

1. Cylinder block
2. Cylinder
3. Piston
4. Combustion chamber
5. Inlet manifold
6. Exhaust manifold
7. Inlet valve
8. Exhaust valve
9. Spark plug
10. Connecting rod
11. Crank shaft
12. Cam shaft
13. Piston rings
14. Gudgeon pins
15. Fly wheel

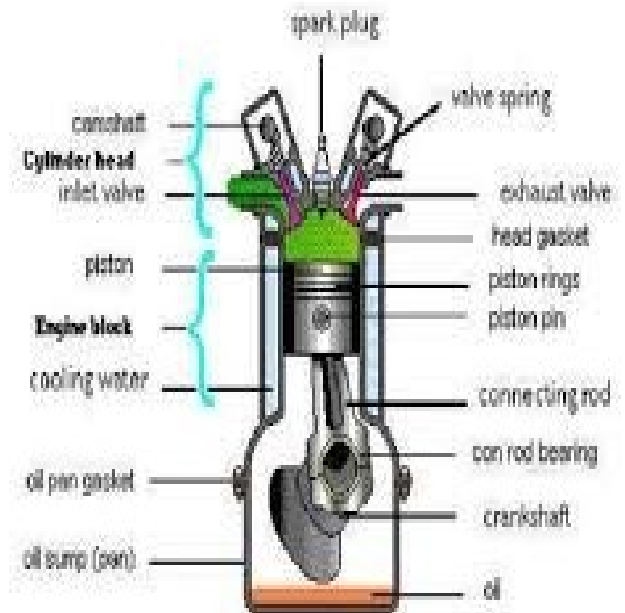


Figure 11

Classification of Heat Engine

1. **On the basis of operating cycle** – (i) SI Engine (Otto cycle engine)
(ii) CI engine (Diesel cycle engine)
2. **On the basis of ignition method** - (i) SI engine (ii) CI engine
3. **On the basis of working strokes** - (i) Four stroke engine (ii) Two stroke engine
4. **On the basis of fuel used** - (i) petrol or gasoline engine (ii) Diesel engine
5. **On the basis of cooling system** - (i) Air cooled engine (ii) Water cooled engine
6. **On the Basis of Cylinder Arrangement** - (i) Line Arrangement (ii) V-Engine
(iii) Radial engine (iv) Opposed cylinder engine
7. **On the Basis of Ignition System** - (i) Magneto ignition system engines (ii) Battery ignition system engine

Important terms used in Engine

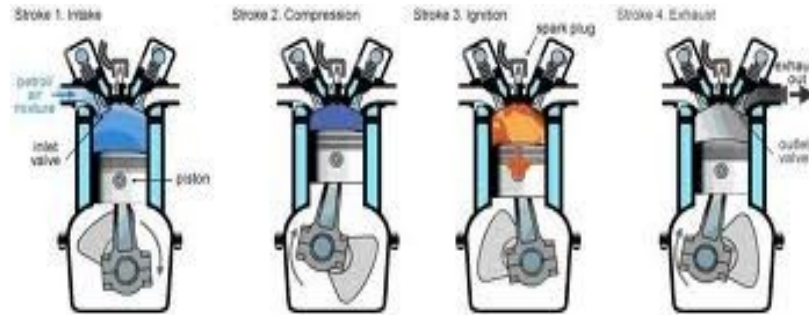
- 1. Cylinder bore (D)** - it is the nominal inner diameter of the working cylinder.
- 2. piston area (A)** - it is the area of the circle of diameter equal to cylinder bore.
- 3. stroke length (L)** - the nominal distance through which a working piston moves between two successive reversals of its direction of motion.
- 4. Dead centre** - the position of the working piston and the moving parts which are mechanically connected to it at the moment when the direction of the piston motion is reversed (at either end point of the stroke).

Top dead centre - when the piston held at its top position in the cylinder then this top position is called top dead centre.

Bottom dead centre - when the piston position occurs at the lowest position of the motion then this lowest position is called bottom dead centre.
- 5. Swept volume (Vs)** - the volume swept by piston while moving from top dead centre to bottom dead centre is called "swept volume".
- 6. Clearance volume (Vc)** - The volume of the cylinder from its top most surface to top dead centre (T.D.C.) is called "clearance volume".
- 7. Compression ratio (r)** - It is the ratio of total volume of the cylinder to the clearance volume.

4-stroke spark ignition engine

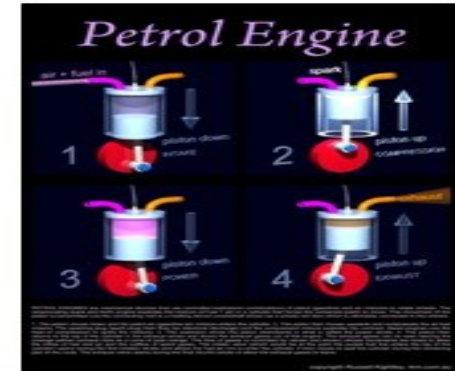
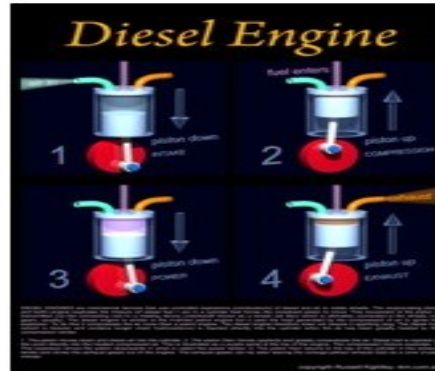
In four stroke cycle engine –
revolutions of the crankshaft - 2
crank rotation - 720 degree



- 1. Suction stroke** - In this stroke the fresh charge come into the cylinder and the piston moves from top to bottom dead centre.
- 2. Compression stroke** - in this stroke the movement of the piston from bottom dead centre to the top dead centre and thus the fresh charge get compressed. Both valves remain closed during this stroke.
- 3. Expansion or power stroke** – In this stroke both valves remains closed and ignition of compressed charge takes place and power for wheels and for completion of rest of three stroke takes place. Piston moves from bottom to top dead centre.
- 4. Exhaust stroke** - In this stroke the piston moves from bottom dead centre to top dead centre. Thus the burnt charge sweeps out from cylinder to atmosphere.

Four Stroke Compression Ignition Engine

In four stroke cycle engine –
revolutions of the crankshaft - 2
crank rotation - 720 degree

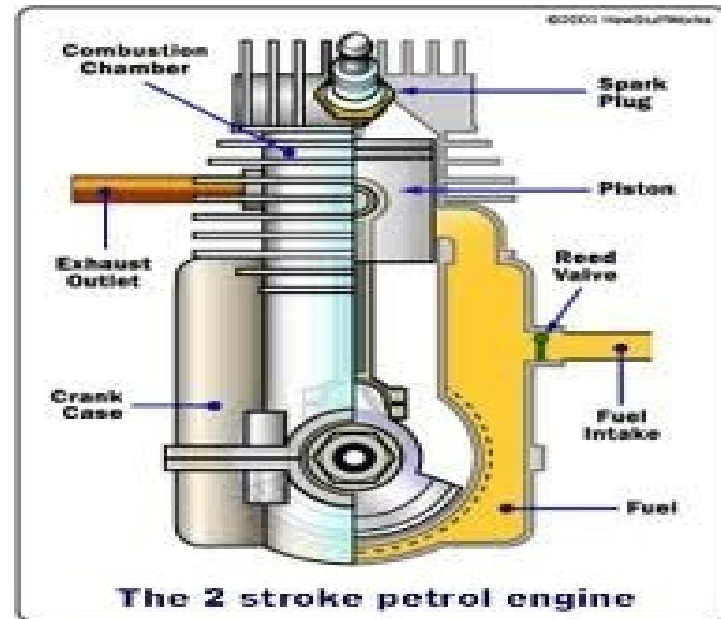


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- 1. Suction stroke** - in this stroke the fresh charge (air) come into the cylinder and the piston movement takes place from top to bottom dead centre. Only inlet valve opened in this stroke.
- 2. Compression stroke** - in this stroke the movement of the piston from bottom dead centre to the top dead centre and thus the air get compressed. Both valve remains closed during this stroke.
- 3. Expansion or power stroke** – In this stroke at the end of compression stroke the injector inject diesel into the cylinder and thus ignition of the diesel takes place and power is obtained. Both valve remain closed in this stroke.
- 4. Exhaust stroke** - In this stroke the piston moves from bottom dead centre to top dead centre. Thus the burnt charge sweeps out from cylinder to atmosphere. Only outlet valve opened in this stroke.

2-STROKE ENGINE

Revolution of the Crankshaft - one
Crank rotation - 360 degree



In two stroke engine suction and compression stroke occurs together and expansion and exhaust strokes occurs together. when the piston is at its bottom dead centre then fuel comes in the cylinder through the port, when piston moves upward the fuel get compressed and thus we obtain high pressure and temperature. After the ignition of the fuel a high pressure will occurs on the piston head and piston moves downward, this stroke is known as power stroke. With this stroke the exhaust stroke also occurs.

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