

Subject: Automobile Engineering (PE-ME 701A)

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INTRODUCTION:

Heat engine is a machine for converting heat, developed by burning fuel into useful work. It can be said that heat engine is equipment which generates thermal energy and transforms it into mechanical energy.

CLASSIFICATION OF HEAT ENGINES:

1. Based on combustion of fuel:

- (i) External combustion engine
- (ii) Internal combustion engine.

External combustion engine

Here, the working medium, the steam, is generated in a boiler, located outside the engine and allowed in to the cylinder to operate the piston to do mechanical work.

Internal combustion engine

In internal combustion engine, the combustion of fuel takes place inside the engine cylinder and heat is generated within the cylinder. This heat is added to the air inside the cylinder and thus the pressure of the air is increased tremendously. This high pressure air moves the piston which rotates the crank shaft and thus mechanical work is done

2. Based on fuel used:

1. Diesel engine 2. Petrol engine 3. Gas engine

Diesel engine – Diesel is used as fuel

Petrol engine – Petrol is used as fuel

Gas engines – propane, butane or methane gases are used

3. Based on ignition of fuel:

1. Spark ignition engine (Carburetor type engines)

2. Compression ignition engine (injector type engines)

Spark ignition engine – a mixture of air and fuel is drawn in to the engine cylinder. Ignition of fuel is done by using a spark plug. The spark plug produces a spark and ignites the air-fuel mixture. Such combustion is called constant volume combustion (C.V.C.).

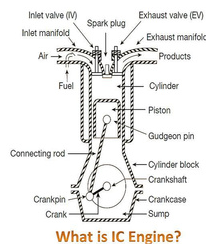
Compression ignition engine – In compression ignition engines air is compressed in to the engine cylinder,. Due to this the temperature of the compressed air rises to 700-900 C. At this stage diesel is sprayed in to the cylinder in fine particles. Due to a very high temperature, the fuel gets ignited. This type of combustion is called constant pressure combustion (C.P.C.) because the pressure inside the cylinder is almost constant when combustion is taking place.

4. Based on working cycle:

1. Four stroke cycle engine - When the cycle is completed in two revolutions of the crankshaft, it is called a four stroke cycle engine.
2. Two stroke cycle engine. - When the cycle is completed in one revolution of the crankshaft, it is called two stroke cycle engine

CONSTRUCTION OF AN IC ENGINE:

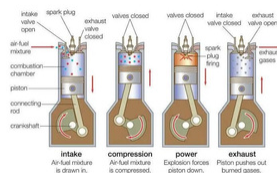
I.C. engine converts the reciprocating motion of piston into rotary motion of the crankshaft by means of a connecting rod. The piston which is reciprocating in the cylinder is very close fit in the cylinder. Rings are inserted in the circumferential grooves of the piston to prevent leakage of gasses from sides of the piston. Usually a cylinder is bored in a cylinder block and a gasket, made of copper sheet or asbestos is inserted between the cylinder and the cylinder head to avoid any leakage. The combustion space is provided at the top of the cylinder head where combustion takes place.



The connecting rod connects the piston and the crankshaft. The end of the connecting rod connecting the piston is called small end. A pin called gudgeon pin or wrist pin is provided for connecting the piston and the connecting rod at the small end. . The other end of the connecting rod connecting the crankshaft is called the big end. When piston is moved up and down, the motion is transmitted to the crankshaft by the connecting FOUR STROKE ENGINE rod and the crank shaft makes rotary motion. The crankshaft rotates in main bearings which are fitted to the crankcase. A flywheel is provided at one end of the crankshaft for smoothing the uneven torque produced by the engine. There is an oil sump at the bottom of the engine which contains lubricating oil for lubricating different parts of the engine.

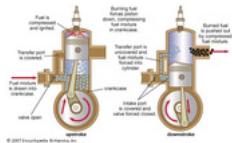
Four Stroke Engine:

A four-stroke engine (also known as four-cycle) is an internal combustion engine in which the piston completes four separate strokes which comprise a single thermodynamic cycle. A stroke refers to the full travel of the piston along the cylinder, in either direction. While it is quite slang among some automotive enthusiasts names these respectively the "suck," "squeeze," "bang" and "blow" strokes, they are more commonly termed



1. **INTAKE:** this stroke of the piston begins at top dead center. The piston descends from the top of the cylinder to the bottom of the cylinder, increasing the volume of the cylinder. A mixture of fuel and air is forced by atmospheric (or greater) pressure into the cylinder through the intake port.
2. **COMPRESSION:** with both intake and exhaust valves closed, the piston returns to the top of the cylinder compressing the air or fuel-air mixture into the cylinder head.
3. **POWER:** this is the start of the second revolution of the cycle. While the piston is close to Top Dead Centre, the compressed air–fuel mixture in a gasoline engine is ignited, by a spark plug in gasoline engines, or which ignites due to the heat generated by compression in a diesel engine. The resulting pressure from the combustion of the compressed fuel-air mixture forces the piston back down toward the bottom dead center.
4. **EXHAUST:** during the exhaust stroke, the piston once again returns to top dead center while the exhaust valve is open. This action expels the spent fuel-air mixture through the exhaust valve(s).

Two Stroke Engine:



In two stroke cycle engines, the whole sequence of events i.e., suction, compression, power and exhaust are completed in two strokes of the piston i.e.

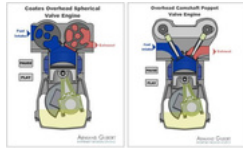
One revolution of the crankshaft. There is no valve in this type of engine. Gas movement takes place through holes called ports in the cylinder. The crankcase

The engine is air tight in which the crankshaft rotates. Upward stroke of the piston (Suction + Compression) When the piston moves upward it covers two of the ports, the exhaust port and transfer port, which are normally almost opposite to each other. This traps the charge of air- fuel mixture drawn already into the cylinder. Further upward movement of the piston compresses the charge and also uncovers the suction port. Now fresh mixture is drawn through this port into the crankcase.

Just before the end of this stroke, the mixture in the cylinder is ignited by a spark plug. Thus, during this stroke both suction and compression events are completed. Downward stroke (Power + Exhaust) Burning of the fuel rises the temperature and pressure of the gases which forces the piston to move down the cylinder. When the piston moves down, it closes the suction port, trapping the fresh charge drawn into the crankcase during the previous upward stroke. Further downward movement of the piston uncovers first the exhaust port and then the transfer port. Now fresh charge in the crankcase moves in to the cylinder through the transfer port driving out the burnt gasses through the exhaust port. Special shaped piston crown deflect the incoming mixture up around the cylinder so that it can help in driving out the exhaust gasses . During the downward stroke of the piston power and exhaust events are completed.

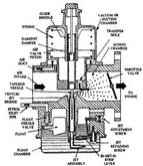
Rotary Valve Engine:

A rotary valve engine is always a two stroke engine. Most rotary valve engines are rotax engines. Although other rotary engines such as suzuki and Kawasaki has been made.



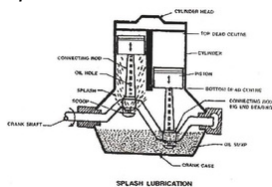
Rotax engines are used in snowmobiles, jet-skis and motorcycles and aircraft engines. A rotary valve refers to the intake of a two stroke engine. There are three types of intake designs for two stroke engines. Simplistic two strokes are piston ports, meaning that the piston movement past the port controls the incoming air timing. The piston port engine doesn't do a very good job of keeping the airflow to stay in the engine. The air can simply travel back out of the engine. The most popular intake air induction is the reed port engine. It uses reed petals to allow the intake air in the engine and traps it there. The tension of the reed petals can change with the use of different petals and can provide some power improvement at certain rpm ranges. A rotary valve engine has the best intake air control.

Constant Vacuum Carburetor:



A vacuum actuated valve for a constant vacuum type carburetor is formed with a first guide hole, a jet needle engaging step portion and a jet needle insertion hole therein. A spring seat has an outer cylindrical portion in an upper portion thereof, and an inner cylindrical portion and a jet needle supporting cylindrical portion therein. The outer cylindrical portion of the spring seat is arranged on the outer circumference of a diaphragm plate. The jet needle supporting cylindrical portion is inserted within a first guide hole. A lower end of a vacuum actuated valve return spring engages with a spring seating flange of the spring seat. A flange portion of a jet needle is restricted by the jet needle engaging step portion and the jet needle supporting the cylindrical portion.

Splash Lubrication System:



The splash system is no longer used in automotive engines. It is widely used in small four-cycle engines for lawn mowers, outboard marine operation, and so on.

In the splash lubrication system, oil is splashed up from the oil pan or oil trays in the lower part of the crankcase. The oil is thrown upward as droplets or fine mist and provides adequate lubrication to valve mechanisms, piston pins, cylinder walls, and piston rings.