

INTERNAL COMBUSTION ENGINE

Module - I

INTRODUCTION

Heat engine:

A heat engine is a device which transforms the chemical energy of a fuel into thermal energy and uses this energy to produce mechanical work. It is classified into two types-

- (a) External combustion engine
- (b) Internal combustion engine

External combustion engine:

In this engine, the products of combustion of air and fuel transfer heat to a second fluid which is the working fluid of the cycle.

Examples:

*In the steam engine or a steam turbine plant, the heat of combustion is employed to generate steam which is used in a piston engine (reciprocating type engine) or a turbine (rotary type engine) for useful work.

*In a closed cycle gas turbine, the heat of combustion in an external furnace is transferred to gas, usually air which the working fluid of the cycle.

Internal combustion engine:

In this engine, the combustion of air and fuels take place inside the cylinder and are used as the direct motive force. It can be classified into the following types:

1. According to the basic engine design- (a) Reciprocating engine (Use of cylinder piston arrangement), (b) Rotary engine (Use of turbine)
2. According to the type of fuel used- (a) Petrol engine, (b) diesel engine, (c) gas engine (CNG, LPG), (d) Alcohol engine (ethanol, methanol etc)
3. According to the number of strokes per cycle- (a) Four stroke and (b) Two stroke engine
4. According to the method of igniting the fuel- (a) Spark ignition engine, (b) compression ignition engine and (c) hot spot ignition engine
5. According to the working cycle- (a) Otto cycle (constant volume cycle) engine, (b) diesel cycle (constant pressure cycle) engine, (c) dual combustion cycle (semi diesel cycle) engine.
6. According to the fuel supply and mixture preparation- (a) Carburetted type (fuel supplied through the carburettor), (b) Injection type (fuel injected into inlet ports or inlet manifold, fuel injected into the cylinder just before ignition).
7. According to the number of cylinder- (a) Single cylinder and (b) multi-cylinder engine
8. Method of cooling- water cooled or air cooled
9. Speed of the engine- Slow speed, medium speed and high speed engine
10. Cylinder arrangement-Vertical, horizontal, inline, V-type, radial, opposed cylinder or piston engines.
11. Valve or port design and location- Overhead (I head), side valve (L head); in two stroke engines: cross scavenging, loop scavenging, uniflow scavenging.

12. Method governing- Hit and miss governed engines, quantitatively governed engines and qualitatively governed engine

13. Application- Automotive engines for land transport, marine engines for propulsion of ships, aircraft engines for aircraft propulsion, industrial engines, prime movers for electrical generators.

Comparison between external combustion engine and internal combustion engine:

External combustion engine	Internal combustion engine
*Combustion of air-fuel is outside the engine cylinder (in a boiler)	* Combustion of air-fuel is inside the engine cylinder (in a boiler)
*The engines are running smoothly and silently due to outside combustion	* Very noisy operated engine
*Higher ratio of weight and bulk to output due to presence of auxiliary apparatus like boiler and condenser. Hence it is heavy and cumbersome.	* It is light and compact due to lower ratio of weight and bulk to output.
*Working pressure and temperature inside the engine cylinder is low; hence ordinary alloys are used for the manufacture of engine cylinder and its parts.	* Working pressure and temperature inside the engine cylinder is very much high; hence special alloys are used
*It can use cheaper fuels including solid fuels	*High grade fuels are used with proper filtration
*Lower efficiency about 15-20%	*Higher efficiency about 35-40%
* Higher requirement of water for dissipation of energy through cooling system	*Lesser requirement of water
*High starting torque	*IC engines are not self-starting