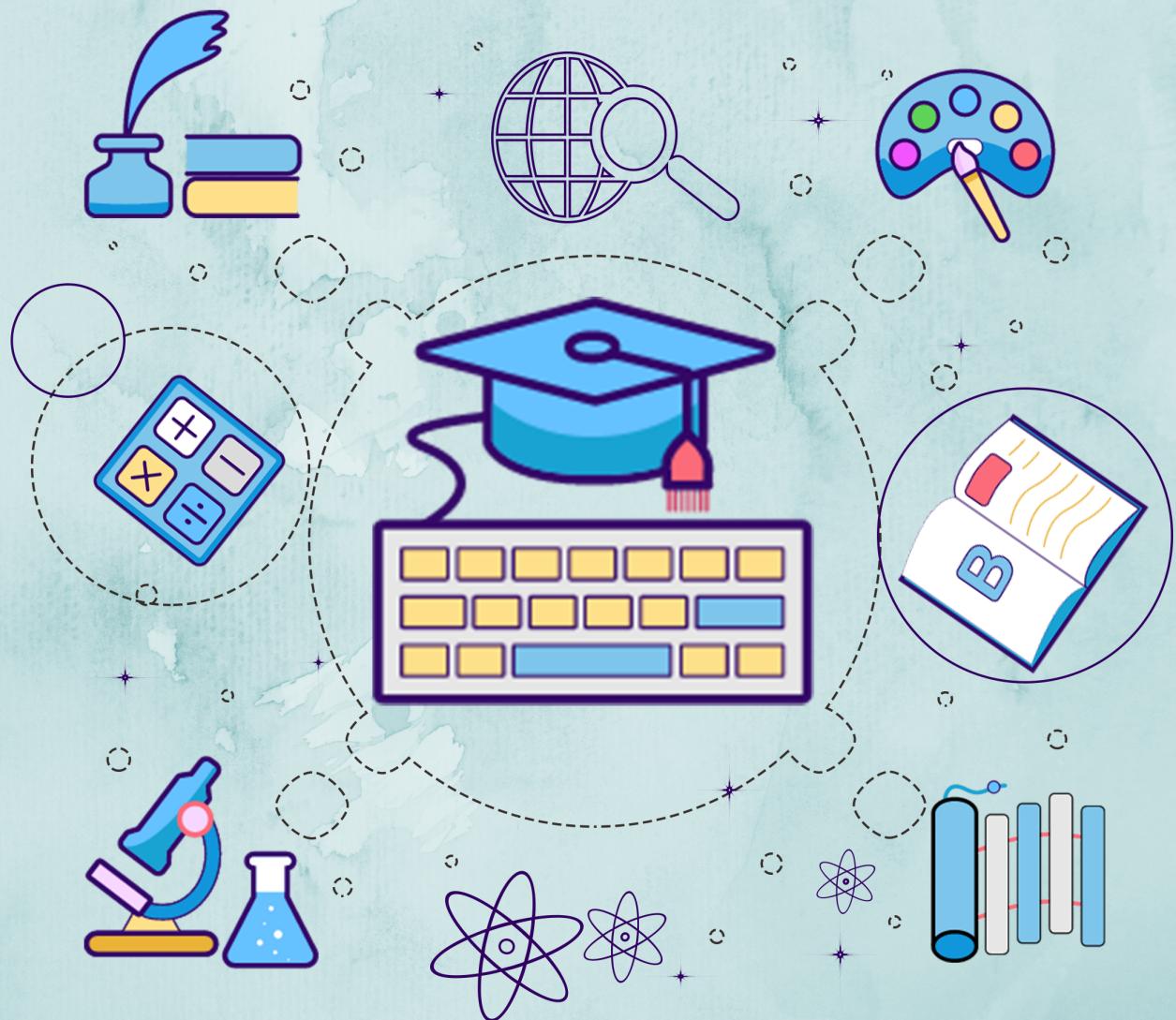


Kerala Notes



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KTU STUDY MATERIALS

BASICS OF MECHANICAL ENGINEERING

EST120

Module 1

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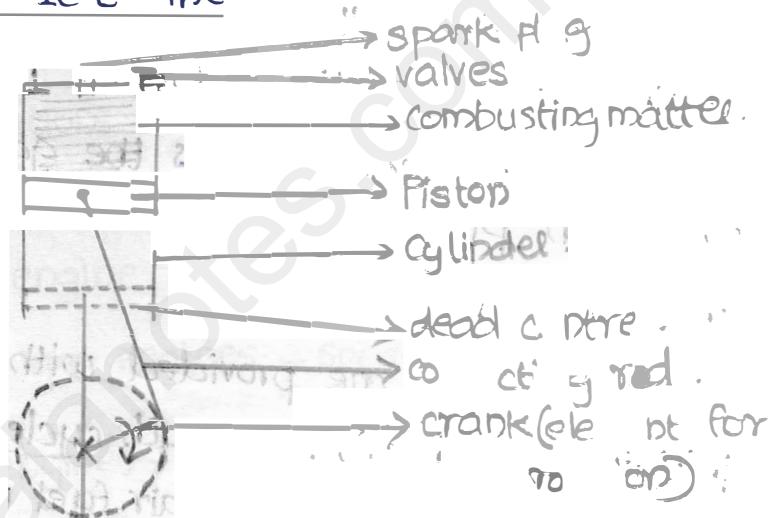
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INTERNAL COMBUSTION ENGINES

Engines)

An engine is a device which transforms the chemical energy of a fuel into thermal energy.

Components of ICE engine



1. Cylinder: It is a container fitted with piston, where the fuel is burnt and power is produced.
2. Cylinder head/cylinder cover: One end of the cylinder is closed by means of cylinder head. This consists of inlet valve and outlet valve.
3. Piston: Piston is used to reciprocate inside the cylinder. It transmits the energy to crankshaft through connecting rod.
4. Connecting rod: It transmits the reciprocatory motion

of piston to rotary crank.

5. Crank: It is a lever between connecting rod and crank shaft.

6. Crank Shaft: It transforms reciprocating motion into a rotary motion.

7. Inlet and Exhaust Valves

- Inlet valve - allows admission of air into the engine during suction stroke.
- Exhaust valve - removes the gases after doing work on piston.

8. Other components:

- Petrol engines are provided with spark plug for initiating combustion in each cycle.

- Carburettor - prepare air fuel mixture

- Diesel engines are provided with fuel injectors for injecting fuel oil into the cylinder and fuel pump for increasing the pressure of oil before injection.

According to the number of piston strokes per cycle, IC Engines are classified as follows:

1. Four stroke engine

2. Two stroke engine

FOUR STROKE CYCLE ENGINE

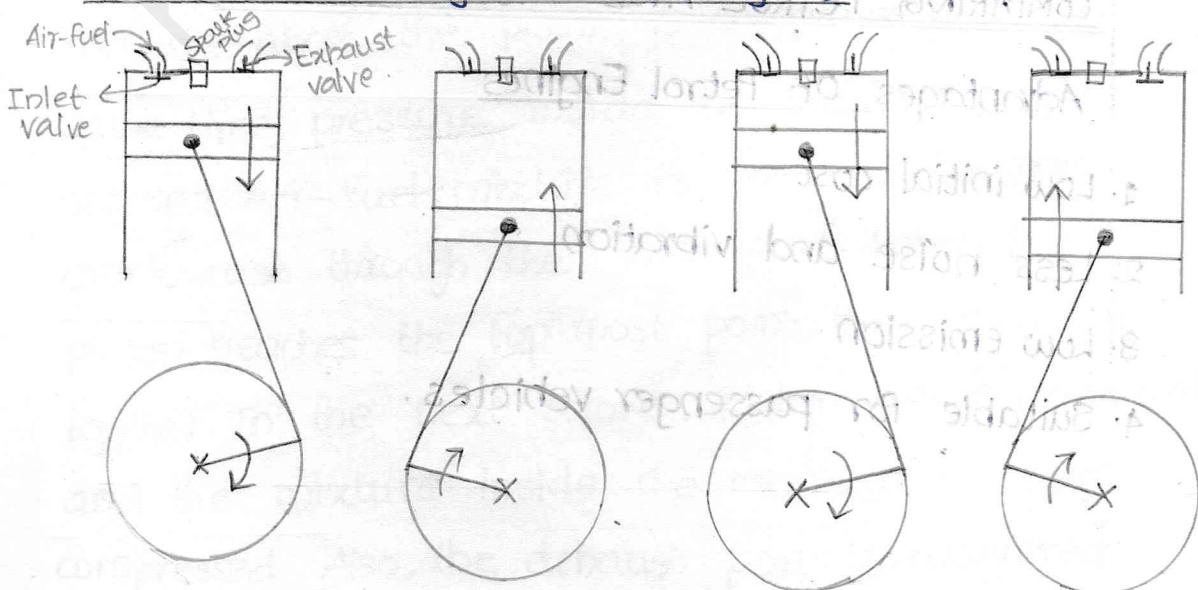
The travel of the piston from one dead centre to another is called stroke of the piston. When the piston executes two strokes, one forward (TDC to BDC) and one backward (BDC to TDC), the crankshaft completes one revolution.

When all the operations that are required to complete one thermodynamic cycle is carried out in two revolutions of the crankshaft, i.e., four strokes of the piston, then the engine is called a four stroke engine.

Note: • Petrol or gas engines - Spark Ignition Engines (SI Engines)

• Diesel engines - Compression Ignition Engines (CI Engines).

Four Stroke SI Engine (Petrol Engine)



In petrol engines, the fuel is mixed well with air before admission to the cylinder. The air fuel mixture (called charge) is prepared in a component called carburettor. From the carburettor, the charge enters the cylinder through the inlet manifold and inlet valve.

1. Suction stroke - suction valve opens and exhaust valve remains closed.
2. Compression stroke - both valves remains closed
3. Expansion stroke - both the valves closed during the start of the stroke. At the end of the stroke, the exhaust valve opens.
4. Exhaust stroke - inlet valve is closed and exhaust valve is opened.

COMPARING PETROL AND Diesel ENGINES

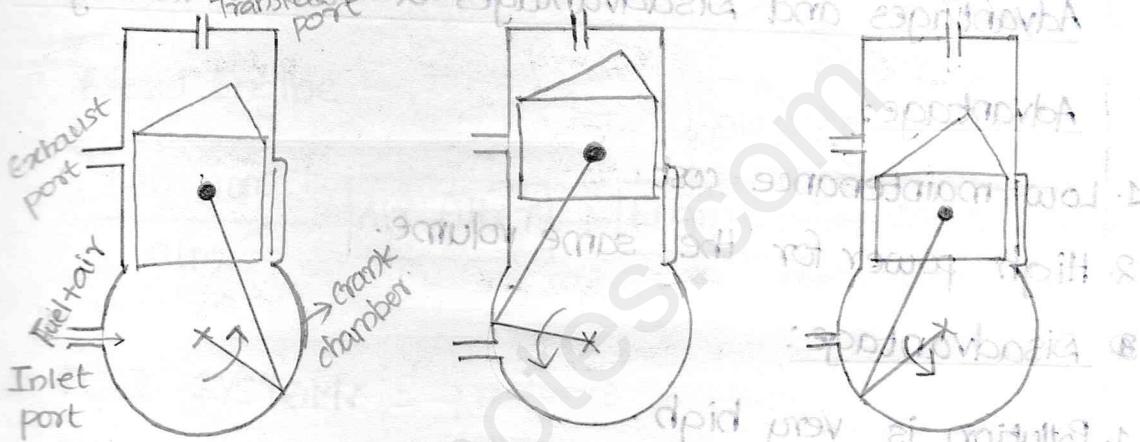
Advantages OF Petrol Engines

1. Low initial cost.
2. Less noise and vibration
3. Low emission.
4. Suitable for passenger vehicles.

Advantages of Diesel Engines

1. Low running cost.
2. Suitable for commercial vehicles.

Working of Two Stroke - Engine (Petrol)



One cycle is completed in two strokes. In two stroke engine, valves are replaced by ports. The cylinder is connected to a closed crank chamber. During the upward motion of the piston, the mixture above the piston is compressed. At the same time, pressure inside the crank case is reduced. Air-Fuel mixture is injected to the crank case through the inlet port. When the piston reaches the top most point, the mixture is ignited. In the next stroke, piston moves downward and the mixture inside the crank case is compressed. Also, the exhaust port is uncovered.

and then the transfer port also uncovered.
The product of compression is removed by the
freshly admitted air-fuel mixture. This process
is called scavenging.

Advantages and Disadvantages of Two Stroke Engine

Advantage:

1. Low maintenance cost.
2. High power for the same volume.

Disadvantage:

1. Pollution is very high.
2. More noise and vibration.

Efficiencies of IC Engines

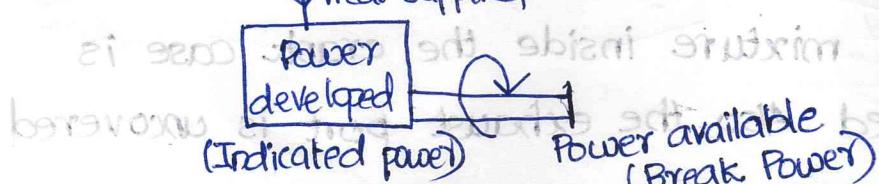
1. Thermal efficiency - ITE and BTE

$$\text{ITE (Indicated Thermal Efficiency)} = \frac{\text{Indicated Power (IP)}}{\text{Heat supplied (IP)}} \quad (20-30\%)$$

$$\text{BTE (Break Thermal Efficiency)} = \frac{\text{Break Power (BP)}}{\text{Heat supplied (IP)}}$$

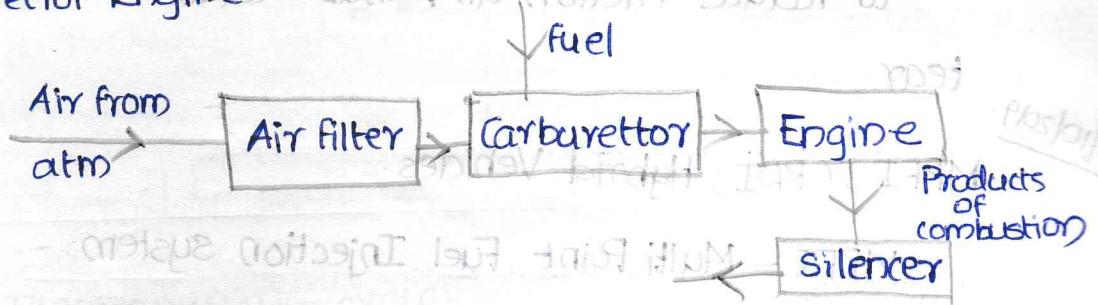
$$2. \text{Mechanical Efficiency} = \frac{\text{BP}}{\text{IP}}$$

↓ Heat supplied

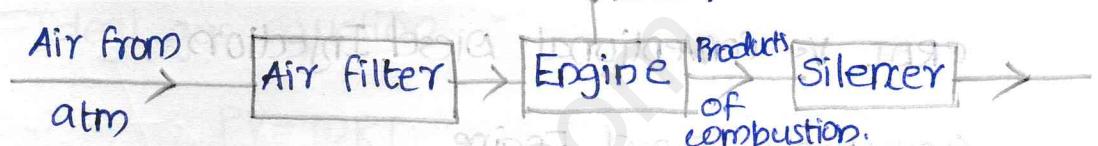


1. AIR SYSTEM

Petrol Engine

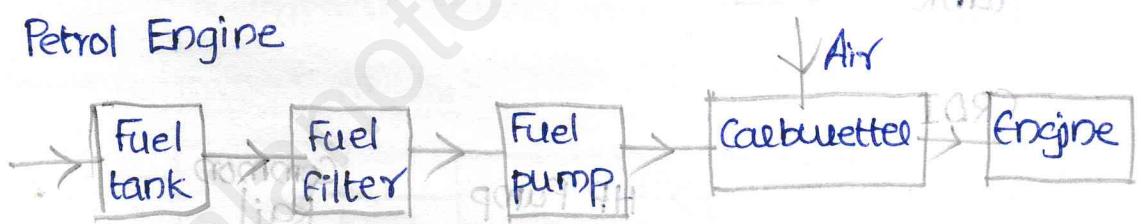


Diesel Engine

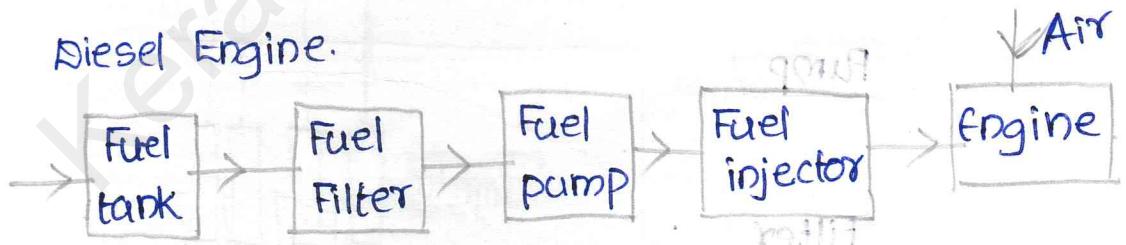


2. FUEL SYSTEM:

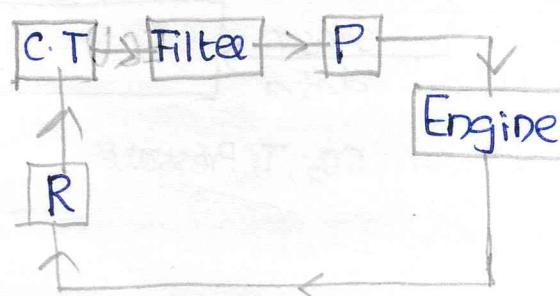
Petrol Engine



Diesel Engine.



3. COOLING SYSTEM:



C.T - Coolant tank

P - Pump

R - Radiator.

4. LUBRICATION SYSTEM

-to reduce friction and thus reduce wear and
age.

11/10/2019

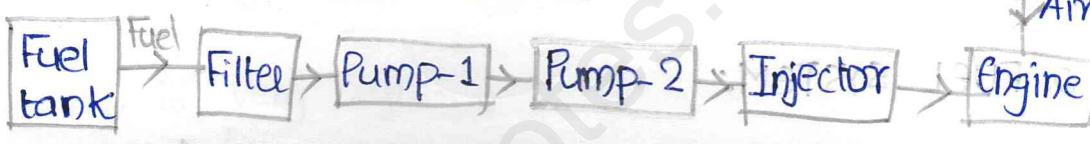
MPFI, CRDI, Hybrid Vehicles.

MPFI - Multi Point Fuel Injection system.

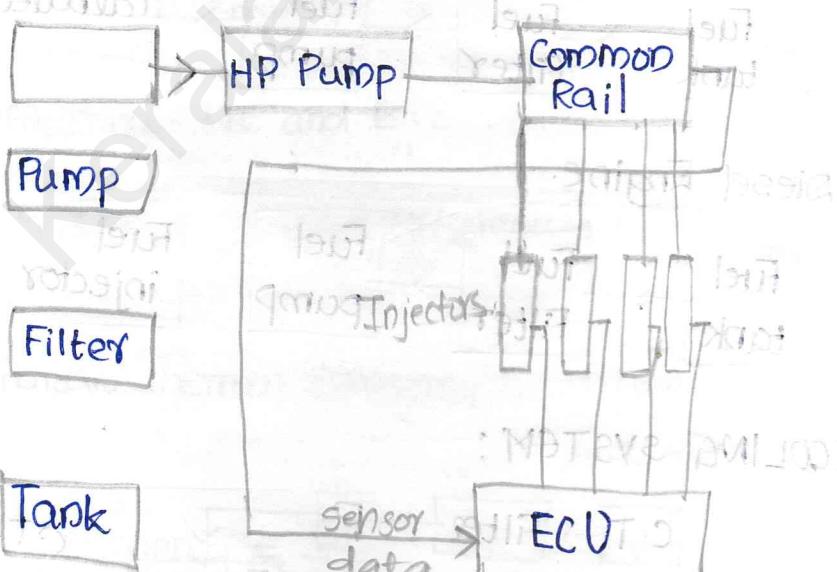
CRDI - Common Rail Direct Injection.

CRAI Vs Conventional Diesel Injection

Conventional Diesel Engine

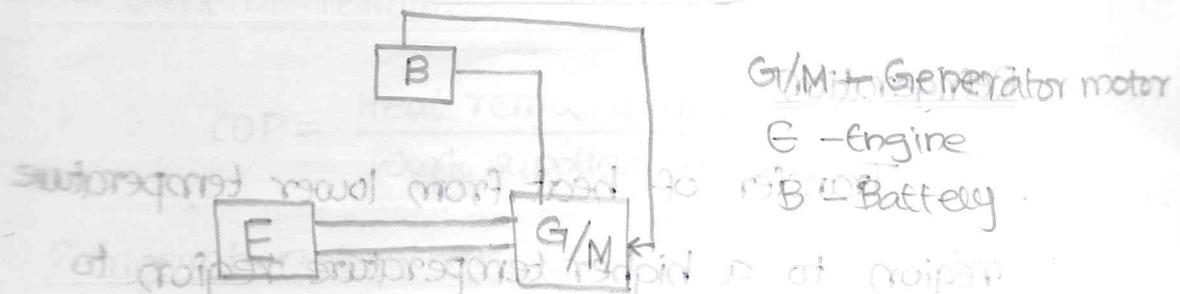


CRDI



Hybrid Vehicle.

GENERATION



G/M + Generator motor

E - Engine

F - Flywheel

B - Battery

THERMODYNAMIC CYCLES

Ideal gas equation

$$PV = mRT$$

R - characteristic gas coefficient.



• Air enters the cylinder and is compressed by the piston.

• Heat is transferred to the air during compression, causing its temperature to rise.

• The compressed air is then ignited by a spark plug.

• The resulting expansion drives the piston down, turning the crankshaft.

• The spent gases are then exhausted through the exhaust port.

• The cycle then repeats as the piston returns to the top of the cylinder.

• The heat transfer during compression is called compression heat transfer.

• The heat transfer during ignition is called ignition heat transfer.

• The heat transfer during expansion is called expansion heat transfer.

• The heat transfer during exhaust is called exhaust heat transfer.

• The heat transfer during intake is called intake heat transfer.

• The heat transfer during compression is called compression heat transfer.

• The heat transfer during ignition is called ignition heat transfer.

• The heat transfer during expansion is called expansion heat transfer.

• The heat transfer during exhaust is called exhaust heat transfer.