



UNIT IV

PETROL ENGINE

Basic Civil and Mechanical Engineering

KARTHICK B

ASSISTANT PROFESSOR / MECHANICAL ENGG

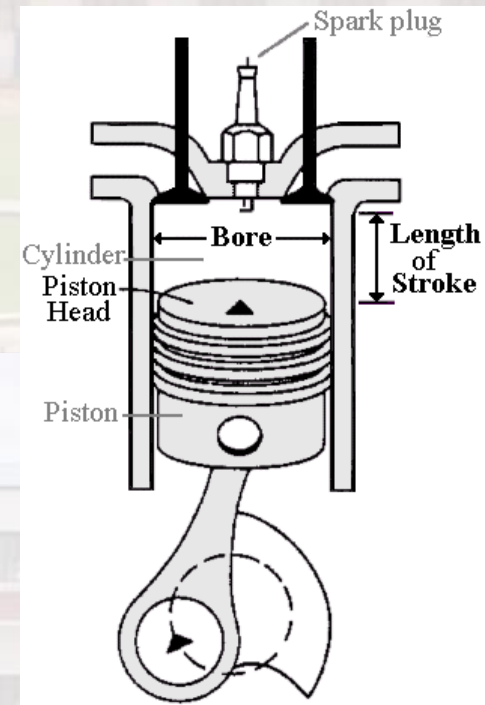


FOUR STROKE CYCLE PETROL ENGINES



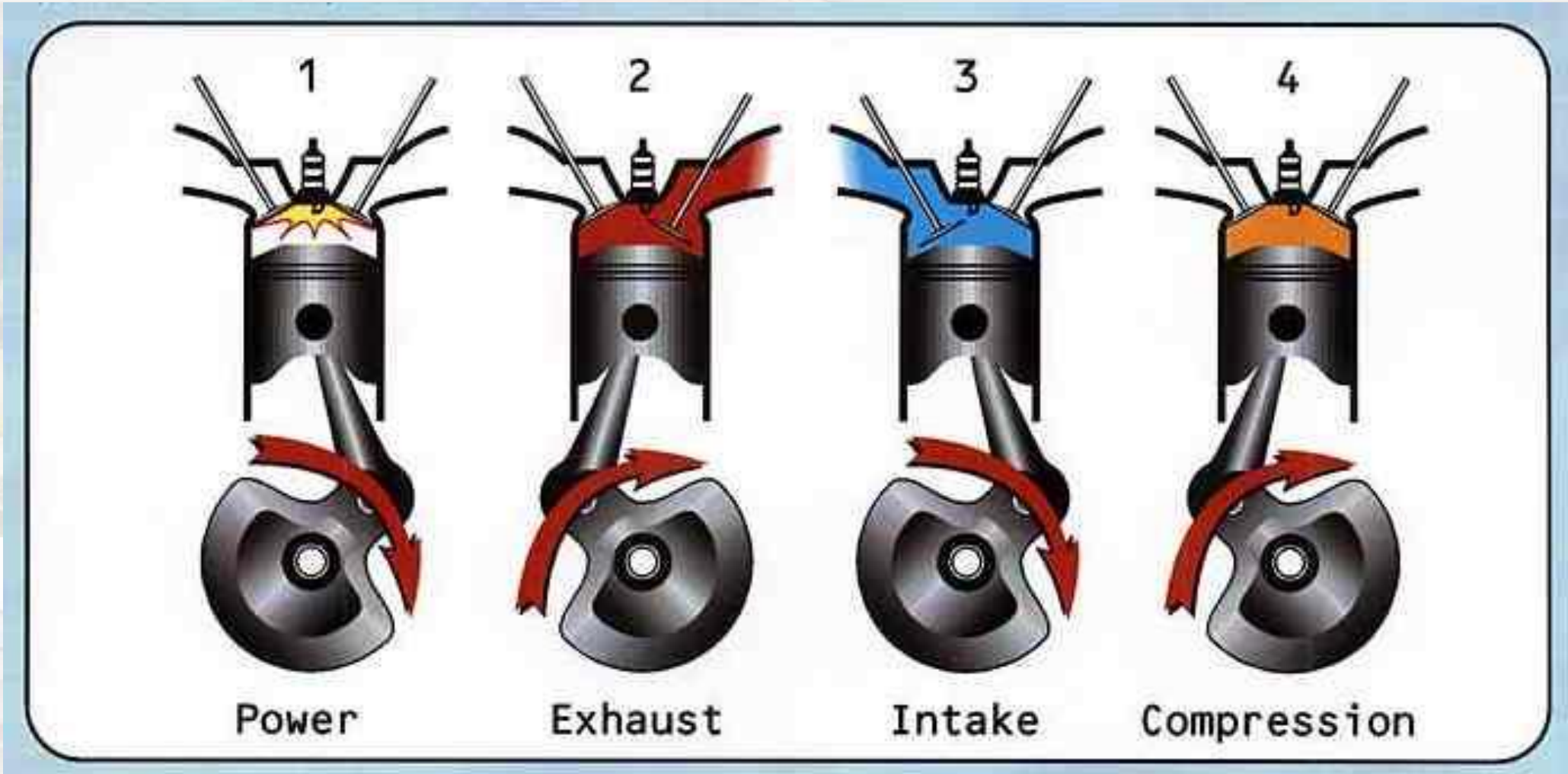
Construction :

- A piston reciprocates inside the cylinder
- The piston is connected to the crank shaft by means of a connecting rod and crank.
- The inlet and exhaust valves are Mounted on the cylinder head.
- A spark is provided on the cylinder Head.
- The fuel used is petrol





FOUR STROKE PETROL ENGINE- WORKING





FOUR STROKE PETROL ENGINE - WORKING



(a) Suction Stroke (First Stroke of the Engine)

- Piston moves down from TDC to BDC
- Inlet valve is opened and the exhaust valve is closed.
- Pressure inside the cylinder is reduced below the atmospheric pressure.
- The mixture of air fuel is sucked into the cylinder through the inlet valve

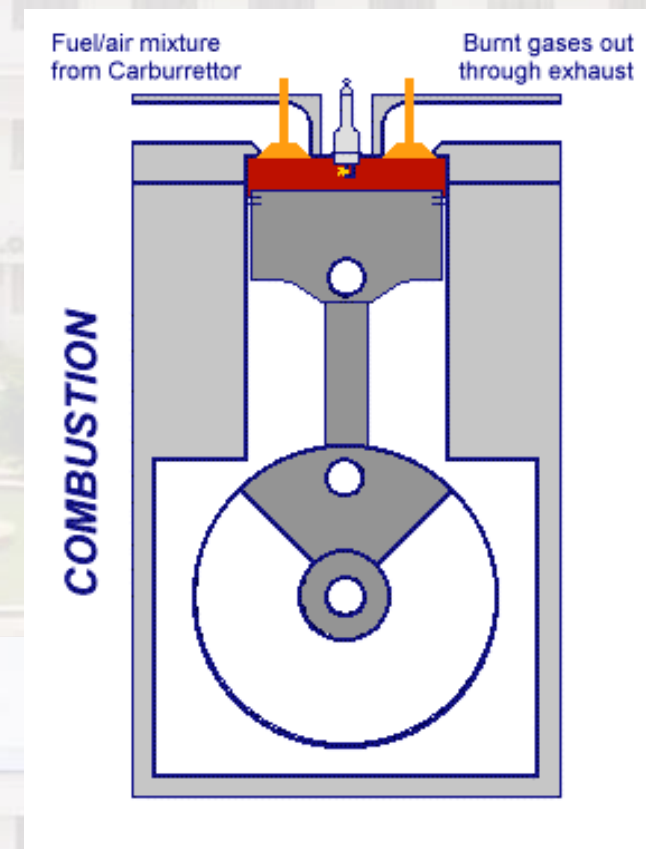


FOUR STROKE PETROL ENGINE - WORKING



Compression Stroke : (Second Stroke of the piston)

- Piston moves up from BDC to TDC
- Both inlet and exhaust valves are closed.
- The air fuel mixture in the cylinder is compressed.





FOUR STROKE PETROL ENGINE - WORKING

Working or Power or Expansion Stroke: (Third Stroke of the Engine)

- The burning gases expand rapidly. They exert an impulse (thrust or force) on the piston.
- The piston is pushed from TDC to BDC
- This movement of the piston is converted into rotary motion of the crankshaft through connecting rod.
- Both inlet and exhaust valves are closed.



FOUR STROKE PETROL ENGINE - WORKING

Exhaust Stroke (Fourth stroke of the Piston)

- Piston moves upward from BDC
- Exhaust valve is opened and the inlet valve is closed.
- The burnt gases are forced out to the atmosphere through the exhaust valve (Some of the burnt gases stay in the clearance volume of the cylinder)
- The exhaust valve closes shortly after TDC
- The inlet valve opens slightly before TDC and the cylinder is ready to receive fresh charge to start a new cycle.



FOUR STROKE PETROL ENGINE - WORKING

Summary :

- Compression ratio varies from 5 to 8
- The pressure at the end of compression is about 6 to 12 bar.
- The temperature at the end of the compression reaches 250°C to 350°C



COMPARISON BETWEEN SI AND CI ENGINES (GENERAL COMPARISON)



S.No.	Spark Ignition Engines (SI)	Compression Ignition Engines (CI)
1	It draws air fuel mixture into the cylinder during suction stroke	It draws only air into the cylinder during suction stroke.
2	Petrol engines operate with low pressure and temperature	Diesel engines operate with high pressure and temperature
3.	Pressure ranges from 6 to 12 bar Temperature ranges from 250° to 300° C	Pressure ranges from 35 to 40 bar Temperature ranges from 600° to 700° C



COMPARISON BETWEEN SI AND CI ENGINES (GENERAL COMPARISON)



S.No.	Spark Ignition Engines (SI)	Compression Ignition Engines (CI)
4	It is fitted with carburettor and spark plugs	It is fitted with fuel injection pump and injectors
5	The burning of fuel takes place at constant volume	The burning of fuel takes place at constant pressure
6.	Ignition of air fuel mixture takes place by an electric spark produced by spark plug	Ignition of air fuel takes place by a injection of fuel into the hot compressed air.



COMPARISON BETWEEN SI AND CI ENGINES (GENERAL COMPARISON)



S.No.	Spark Ignition Engines (SI)	Compression Ignition Engines (CI)
7	Petrol engines are quality governed engines. The speed of petrol engines are controlled by varying the quantity of air fuel mixture.	Diesel engines are quantity governed engines. The speed of diesel engines are controlled by varying quality of air fuel mixture. (rich or weak mixture)
8	Petrol engines are widely used in automobiles and aeroplanes etc.,	Diesel engines are widely used in heavy vehicles, such as buses, lorries, trucks etc.,



COMPARISON BETWEEN SI AND CI ENGINES (MERITS AND DEMERITS)



S.No.	Spark Ignition Engines (SI)	Compression Ignition Engines (CI)
1	<p><u>Merits:</u> Otto cycle is employed in petrol engine. Otto cycle is more efficient for a given compression ratio.</p>	<p><u>Demerits:</u> Diesel engines works on diesel cycle. Diesel cycle is less efficient than Otto cycle for a given compression ratio.</p>
2	<p>Operating speed is more. Speed range is 3000 to 6000 rpm</p>	<p>Operating speed is less. Speed range is 400 to 3500 rpm.</p>
3.	<p>Starting is easy, since cranking effort required is less</p>	<p>Starting is difficult since more cranking effort is required.</p>



COMPARISON BETWEEN SI AND CI ENGINES (MERITS AND DEMERITS)



S.No.	Spark Ignition Engines (SI)	Compression Ignition Engines (CI)
4	<u>Merits:</u> Initial cost and maintenance cost are less	<u>Demerits:</u> More initial and maintenance costs since the construction is heavy and sturdy.
5	Produces less noise.	Produces more noise.
6	Weight per unit power is less	Weight per unit power is more.



COMPARISON BETWEEN SI AND CI ENGINES (MERITS AND DEMERITS)



S.No.	Spark Ignition Engines (SI)	Compression Ignition Engines (CI)
4	<u>Demerits:</u> Thermal efficiency is less, since compression ratio is limited. 5 – 8	<u>Merits:</u> Thermal efficiency is high since compression ratio is high. 12 to 18.
5	Specific fuel consumption is more.	Specific fuel consumption is less
6	The fuel used is petrol. It is costlier than diesel. It is volatile and fire hazard is more	The fuel used is diesel. It is cheaper than petrol. It is less volatile and fire hazard is less.



COMPARISON BETWEEN SI AND CI ENGINES (MERITS AND DEMERITS)



S.No.	Two Stroke Cycle Engine	Four Stroke Cycle Engine
1	<u>Merits:</u> One power stroke in one revolution of the crankshaft	<u>Demerits:</u> One power stroke in two revolutions of the crank shaft
2	Power developed for the same engine speed theoretically twice that of a four stroke engine	Power developed for the same engine speed is theoretically half that of two stroke engine.
3	Simple design and lighter in construction for the same power	For the same power complicated design and heavier in construction



COMPARISON BETWEEN SI AND CI ENGINES (MERITS AND DEMERITS)



S.No.	Two Stroke Cycle Engine	Four Stroke Cycle Engine
4	<p><u>Merits:</u> Uniform torque is obtained. Hence a lighter fly wheel can be used</p>	<p><u>Demerits:</u> Non uniform torque on the crankshaft. Hence a heavier flywheel is required for balancing.</p>
5	<p>Design of ports is simpler. Hence initial cost is less</p>	<p>Design valve mechanism is difficult. Hence initial cost is more.</p>
6	<p>Mechanical efficiency is high. No moving parts like cam, follower, rocker arm valves etc.,</p>	<p>Mechanical efficiency is less. Power is lost due to friction caused by valve mechanism</p>



COMPARISON BETWEEN SI AND CI ENGINES (MERITS AND DEMERITS)



S.No.	Two Stroke Cycle Engine	Four Stroke Cycle Engine
7	<u>Merits:</u> Starting is easy	<u>Demerits:</u> Starting is not so easy
8	These engines are generally air cooled	These engines are generally water cooled.



COMPARISON BETWEEN FOUR STROKE CYCLE AND TWO STROKE CYCLE ENGINE (MERITS AND DEMERITS)



S.No.	Two Stroke Cycle Engine	Four Stroke Cycle Engine
1	<p><u>DeMerits:</u></p> <p>Consumption of lubricating oil is more, because less time is available to remove the heat</p>	<p><u>Merits:</u></p> <p>Consumption of lubricating oil is less, because more time is allowed for removing heat from the cylinder.</p>
2	<p>More wear and tear of moving parts.</p>	<p>Less wear and tear of parts is less</p>
3	<p>Some of the fresh air fuel mixture may escape with exhaust gases. Hence fuel consumption is more</p>	<p>Fuel cannot escape with exhaust gases. Hence fuel consumption is less.</p>



COMPARISON BETWEEN FOUR STROKE CYCLE AND TWO STROKE CYCLE ENGINE (MERITS AND DEMERITS)



S.No.	Two Stroke Cycle Engine	Four Stroke Cycle Engine
4	<u>DeMerits:</u> Thermal efficiency is less.	<u>Merits:</u> Thermal efficiency is more.
5	It produces more noise due to sudden release of exhaust gases	Noise is less is less. Exhaust gases are released in separate stroke.
6	Scavenging is poor, since exhaust port is open only for a short time	Scavenging is better, since there is a separate exhaust stroke for the removal of exhaust gases



COMPARISON BETWEEN FOUR STROKE CYCLE AND TWO STROKE CYCLE ENGINE (MERITS AND DEMERITS)



S.No.	Two Stroke Cycle Engine	Four Stroke Cycle Engine
7	<p><u>Merits:</u></p> <p>Poor scavenging leads to mixing of fresh charge with exhaust gases. This results in poor performance, slow running</p>	<p><u>Demerits:</u></p> <p>Better performance and efficiency is more</p>
8	<p>Used in light vehicles, like bikes, scooters, mopeds, etc.,</p>	<p>Used in heavy vehicles, like buses, lorries, trucks etc.,</p>



THANK YOU