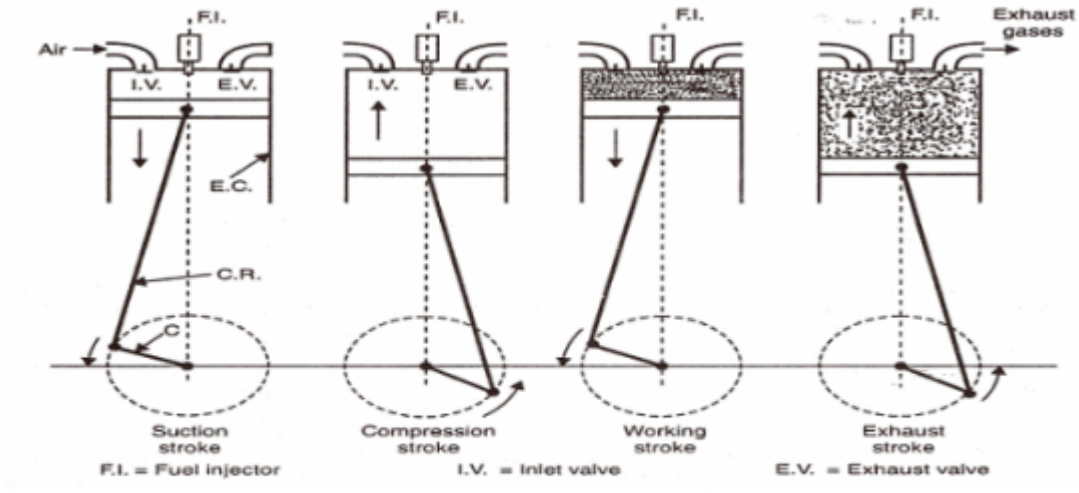
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Explain with neat sketch working principle of four stroke petrol engine.

Working of four stroke petrol engine



1.**Intake Stroke**: As the name suggests in this stroke the intake of fuel takes place. When the engine starts, the piston descends to the cylinder's bottom from the top. Thus the pressure inside the cylinder reduces. Now the intake valve opens and the fuel and air mixture enters the cylinder. The valve then closes.

2.**Compression Stroke**: This stroke is known as compression stroke because the compression of the fuel mixture takes place at this stage. When the intake valve closes (exhaust valve is already closed), the piston forced back to the top of the cylinder and the fuel mixture gets compressed.

3.**Combustion/Power Stroke**: Now in case of petrol engine when the fuel mixture compresses to the maximum value the spark plug produces spark which ignites the fuel mixture. The combustion leads to the production of high pressure gases. Due to this tremendous force the piston is driven back to the bottom of the cylinder. As the piston moves downwards, the crankshaft rotates which rotates the wheels of the vehicle.

4.**Exhaust Stroke**: As the wheel moves to the bottom the exhaust valve opens up and due to the momentum gained by the wheel the piston is pushed back to the top of the cylinder. The gases due to combustion are hence expelled out of the cylinder into the atmosphere through the exhaust valve.
The exhaust valve closes after the exhaust stroke and again the intake valve opens and the four strokes are repeated.

What are the effects of detonation in I.C. engine ?

Effects of detonation (1) Noise – As intensity of detonation increases, the sound intensity increases & it is harmful. (2) Mechanical damage –

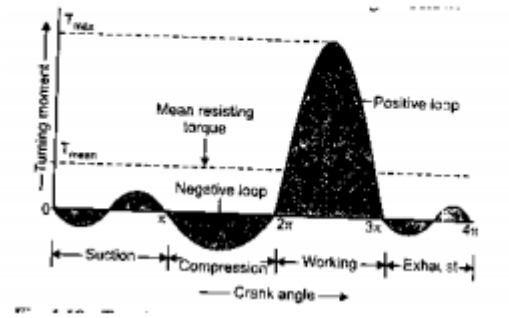
shock waves are so violent that it may cause mechanical damage like breaking of piston. It increases the rate of wear erosion of piston. (3) Pre-ignition – Due to local overheating of spark plug & this pre-ignition increases detonation. (4) Power output & efficiency decreases - Power output & thermal efficiency decreases due to abnormal combustion.

What is supercharging ? State advantages of supercharging.

Superchargers are pressure boosting devices (compressors) which increase the pressure of the air before inletting it get into cylinder of the internal combustion engine, and the process of increasing the pressure OR forcing more air to get into engine is called as supercharging. This gives each intake cycle of the engine more oxygen, letting it burn more fuel and do more work, thus increasing power.

Draw turning moment diagram for four stroke petrol engine and explain it in brief.

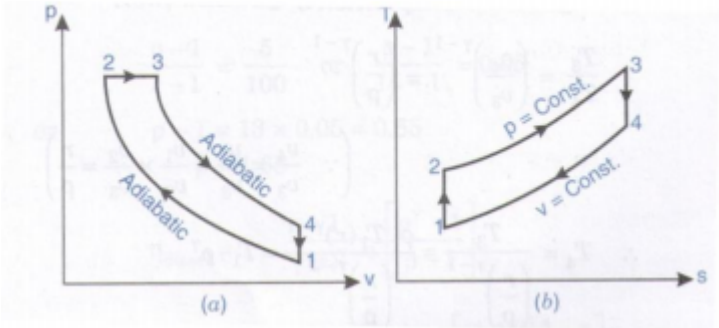
Turning moment diagram of four stroke engine:



During suction stroke, negative loop is formed as pressure inside engine cylinder is less than atmospheric pressure. During compression stroke, work is done on gases therefore higher negative loop is formed. During expansion or power stroke, fuel burn & gases expand therefore large positive loop is formed & during this stroke we get work output. During exhaust stroke, work is done on the gas to expel it out of cylinder, hence negative loop is formed.

Draw P-V and T-S diagram for Diesel cycle. Name the processes involved in it.

Diesel Cycle on P-V and T-S diagram :



Processes :

1-2 : Isentropic compression

2-3 : Heat addition at constant pressure

3-3 Isentropic expansion

4-1 Heat rejection at constant volume

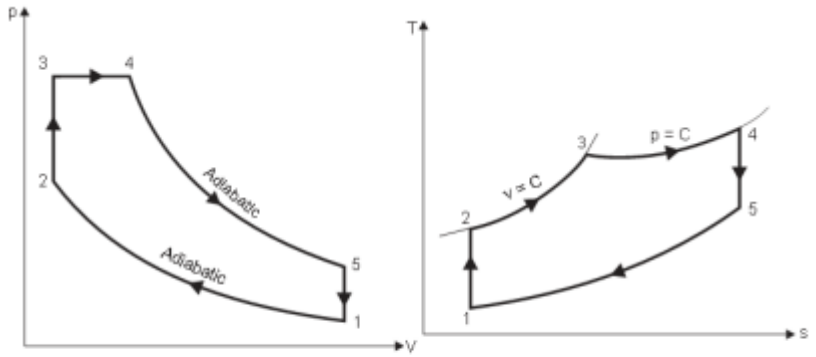
Draw superimposed p-v diagram of Otto cycle, Diesel cycle

and Dual cycle to compare their efficiencies for same compression ratio (R c) and heat rejection (Q r).

Superimposed P-V Diagram of Otto, Diesel & Duel Cycle: A comparison of the cycles (Otto, Diesel and Dual) on the p-v and T-s diagrams for the same compression ratio and heat supplied is shown in the Fig. Since all the cycles reject their heat at the same specific volume, process line from state 4 to 1, the quantity of heat rejected from each cycle is represented by the appropriate area under the line 4 to 1 on the T-s diagram. As is evident from the cycle which has the least heat rejected will have the highest efficiency.

Explain w.r.to. dual cycle i) cutoff ratio ii) pressure ratio.

Duel cycle:



(i) Cut off ratio w.r.t. Duel Cycle: $\rho = V_4/V_3$

(ii) Pressure ratio w.r.t. Duel Cycle: $\alpha = P_3/P_2$

Differentiate supercharging and turbocharging in I.C. engine.

Difference between Turbocharger and Supercharger

S.no	Turbocharging	Supercharging
1.	Turbocharger is a forced induction system that compresses the atmospheric gases and sends it to the engine cylinder.	Super charger is also a forced induction system. It compresses the atmospheric air and sends it to the engine cylinder.
2.	It uses exhaust gases for its energy.	It is connected to the crankshaft of the engine for its energy.
3.	It is not directly connected to the engine.	It is directly connected to the engine through belt.
4.	It has smog altering equipment which helps in lowering the carbon emission.	It doesn't have waste gate, so the smog emits from the supercharger.
5.	It spins with a speed up to 150000 rpm.	It spins with a speed upto 50000 rpm.
6.	It is much quieter than supercharger.	It is not so quieter.
7.	It is less reliable.	It is more reliable.
8.	Maintenance is not easy.	Maintenance is easy.
9.	Turbocharger delivers their boost better at high rpm.	Supercharger can deliver their boost at lower rpm.
10.	It is more efficient.	It is less efficient.
11.	The compressed air in turbocharger has high temperature.	The compressed air in supercharger has less temperature.
12.	It requires intercooler for the compressed air to lower its temperature.	It may or may not require intercooler. Bu in some types, it requires intercooler.
13.	It is more complex.	It is less complex.
14.	It has lag problem due to discontinuous supply of energy.	It has negligible lag problem because of continuous supply of energy by crankshaft.
15.	The compressor is rotated by the turbine.	The compressor is rotated by the engine crankshaft through a belt.

Explain MPFI with neat sketch.

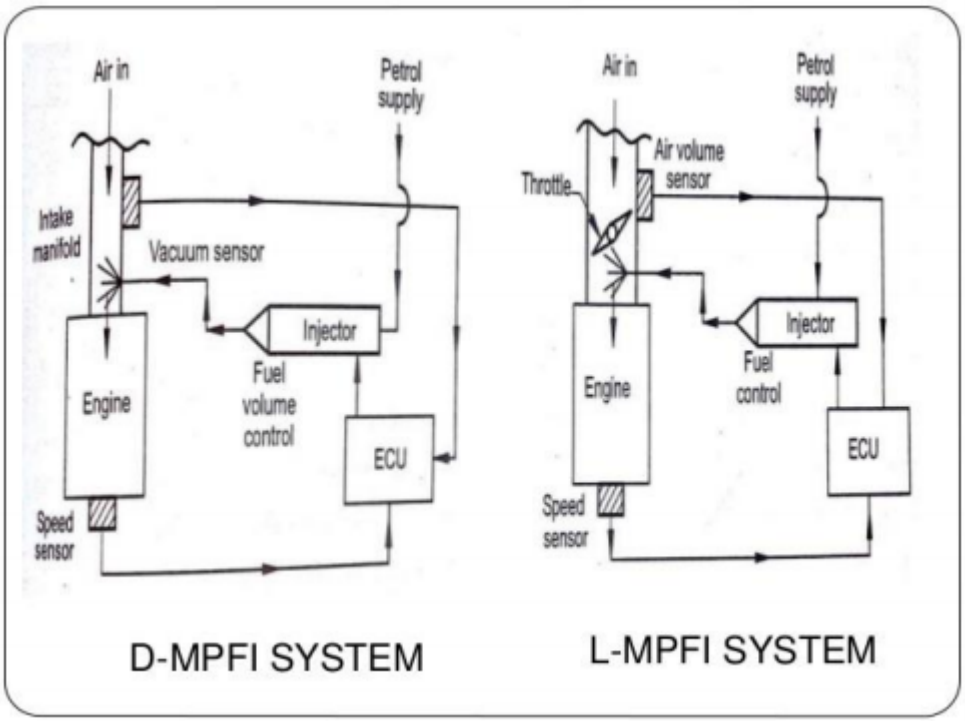
Attempt any FOUR MPFI : MPFI means Multipoint Injection System in which each cylinder has number of injector to supply / spray the fuel in cylinders.

- The MPFI electronic system is also classified as

1) D-MPFI system: The main input signal are the intake manifold pressure, Engine speed and flow volume of air which are sent to ECU to control the A/F ratio.
2) L-MPFI system: The main input signal are air flow rate and engine speed to regulate fuel quantity injected.

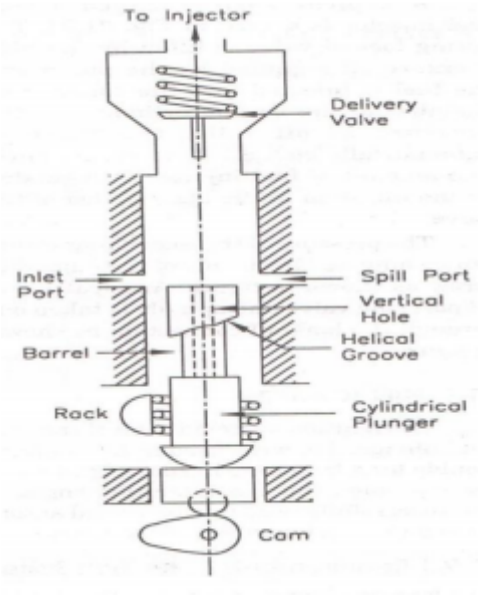
- The both system mentioned above, sends the information of respective sensors to ECU and then ECU processes the information and sends commend to fuel injector to regulate fuel injected. Then the mixture formed enters into the engine.

MPFI result in 1. Superior fuel consumption, 2.Better fuel management, 3.Better engine performance, 4. Reduce pollution.



Draw a neat labelled sketch of fuel injection pump. Give its function.

Fuel injection pump : Fuel injection pump is used widely for the supply of fuel under high pressure in diesel engines



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