



SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME : 19OE120 AUTOMOTIVE ELECTRONICS

III YEAR /IV SEMESTER MECHATRONICS

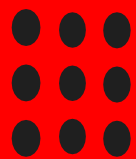
Unit 1 – INTRODUCTION TO ECU

Topic 1 : INTRODUCTION TO SI AND CI ENGINE





INTRODUCTION TO SI & CI ENGINES



PETROL ENGINE

DIESEL ENGINE



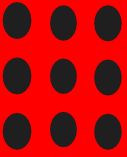


The purpose and function of an engine

- The purpose and function of an engine is to convert the heat energy of burning fuel into mechanical energy.
- In a typical vehicle, mechanical energy is then used to perform the following:
 - Propel the vehicle
 - Power the air-conditioning system and power steering
 - Produce electrical power for use throughout the vehicle
 - Engines use energy to produce power. The chemical energy in fuel is converted to heat energy by the burning of the fuel at a controlled rate. This process is called **combustion**



Working Principle of SI Engine



Type of SI Engines

1. Two Stroke

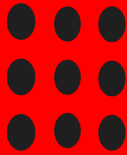
2. Four Stroke

- **TWO** stroke engine produce power in **360 deg** of crank shaft rotation
- **FOUR** stroke cycle produce power in **720 deg** of crankshaft rotation,





Working Principle of SI Engine - 4stroke



All SI Engine working under the following process

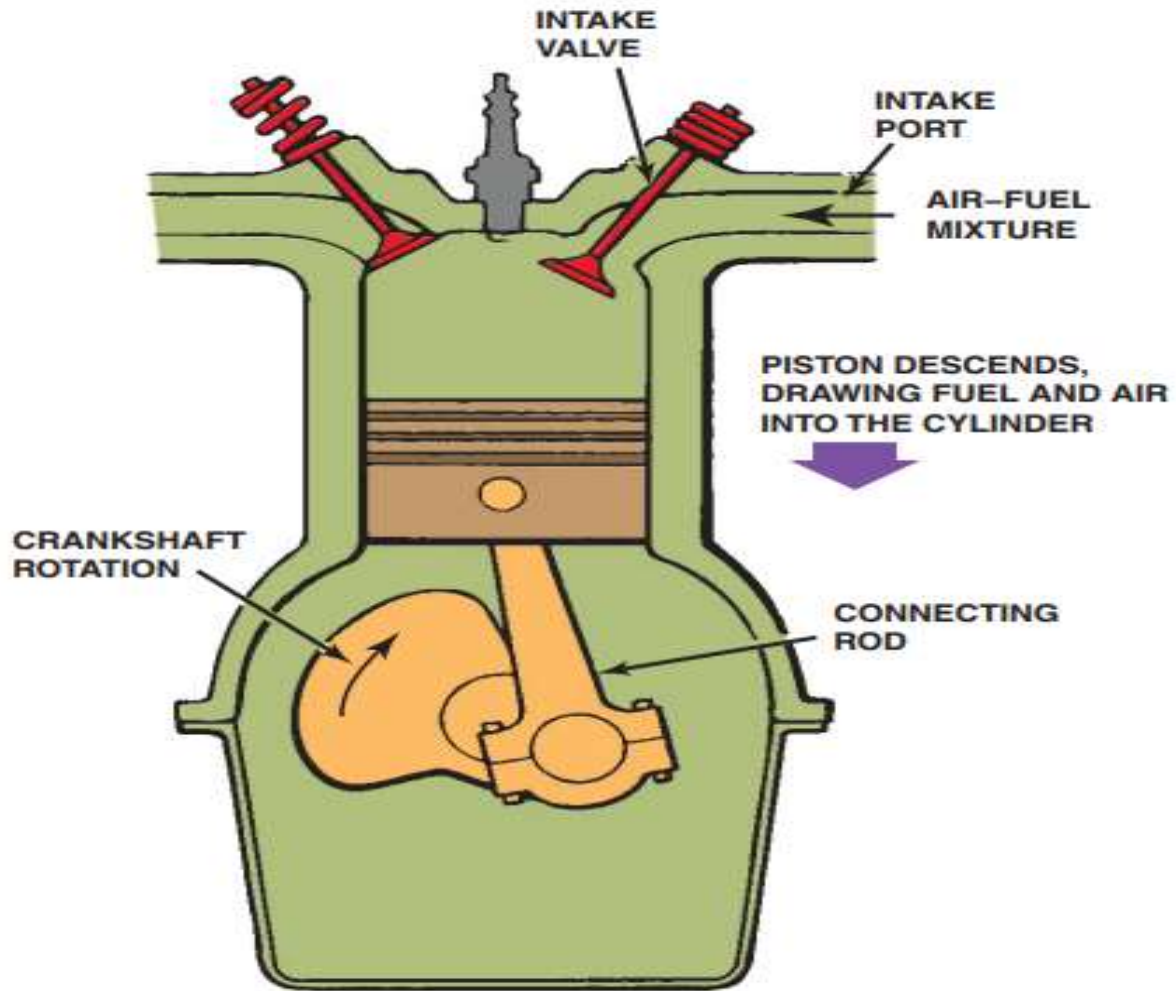
The first four-stroke cycle engine was developed by a German engineer, Nickolaus Otto, in 1876. Most automotive engines use the four-stroke cycle of events. The process begins by the starter motor rotating the engine until combustion takes place. The four-stroke cycle is repeated for each cylinder of the engine.

- 1.Suction**
- 2.Compression**
- 3.Expansion / Power and**
- 4.Exhaust**





SI ENGINE PARTS

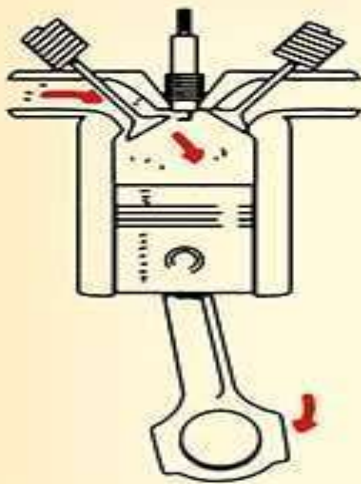


THE INTAKE STROKE

4-Stroke Spark Ignition (SI)

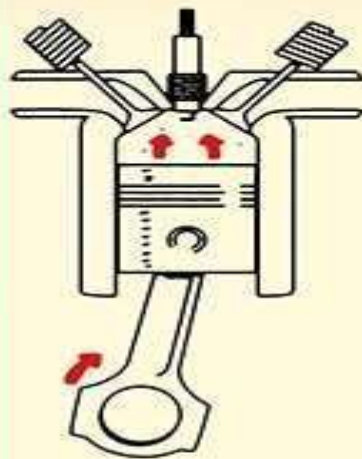
Engine

Four-Stroke Cycle



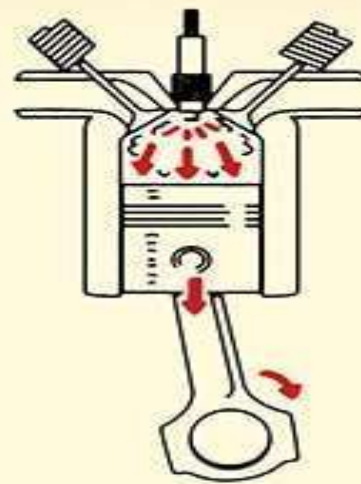
Intake Stroke

The piston lowers in the cylinder, sucking air into the cylinder through the intake valve while the fuel injector simultaneously sprays fuel into the cylinder.



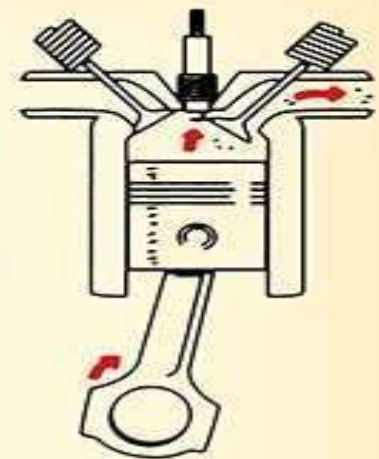
Compression Stroke

The valves close, and crankshaft moves the piston up, compressing the air-fuel mixture.



**Combustion Stroke
(Power Stroke)**

When the piston reaches the top, the spark plug sparks, igniting the fuel-air mixture. The resulting combustion forces the piston to the bottom of the cylinder again.



Exhaust Stroke

When the piston reaches the bottom, the exhaust valve opens up. The piston comes back up, forcing the exhaust out of the cylinder.

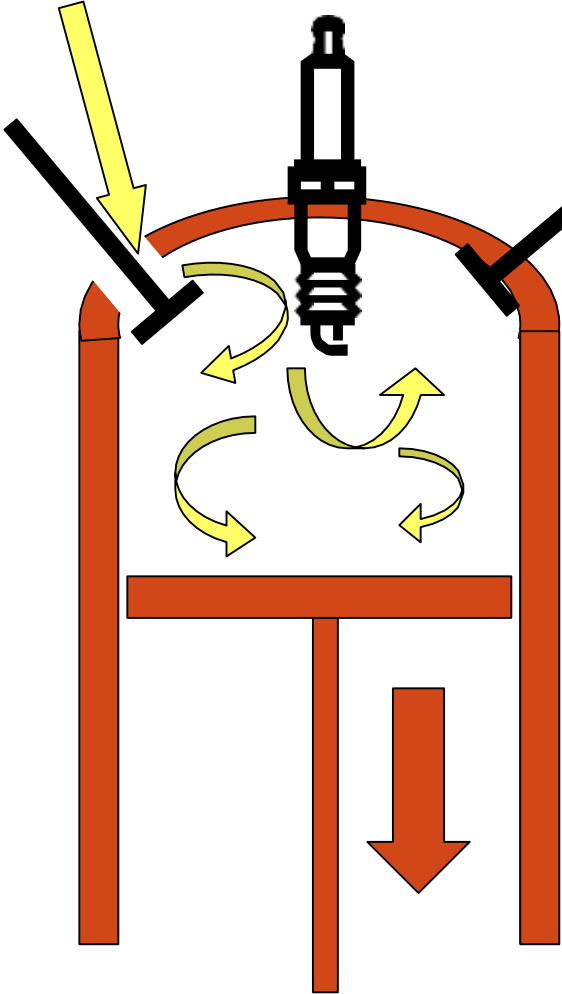


Four-stroke SI Engine

Air/Fuel Mixture In

Inlet valve open

Exhaust Valve closed



1

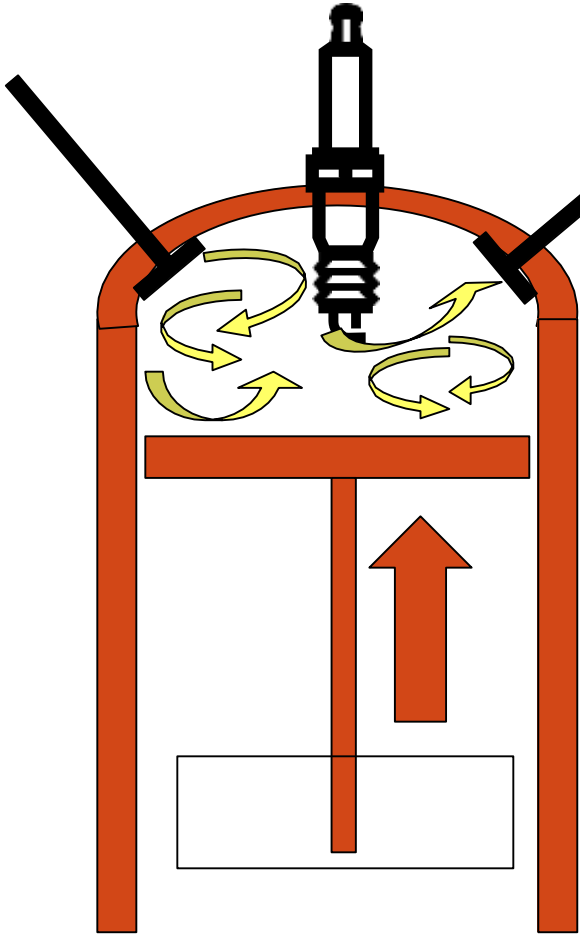
**INDUCTION
STROKE**

Piston down

Four-stroke SI Engine

Inlet valve closed

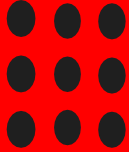
Exhaust valve closed



**COMPRESSION
STROKE**

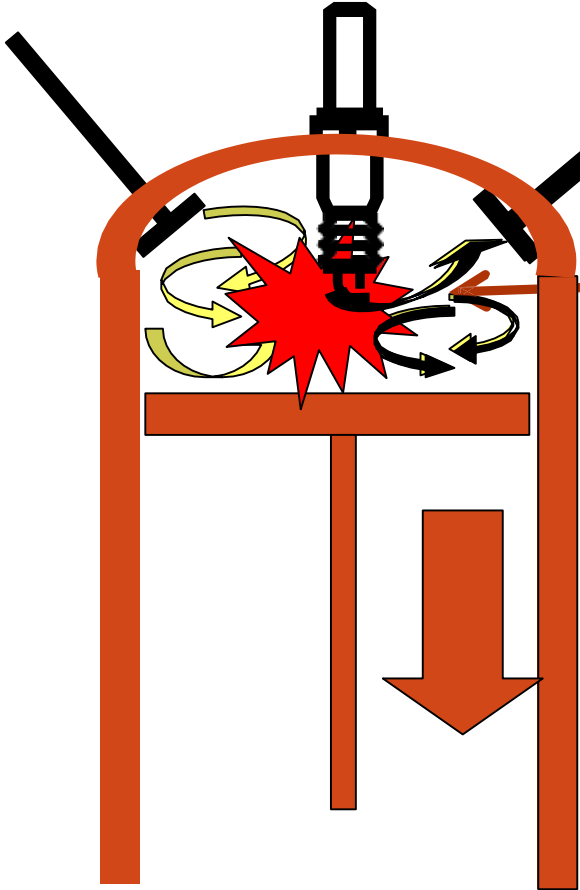


Four-stroke SI Engine



Inlet valve closed

Exhaust valve closed



Combustion

3

**POWER
STROKE**

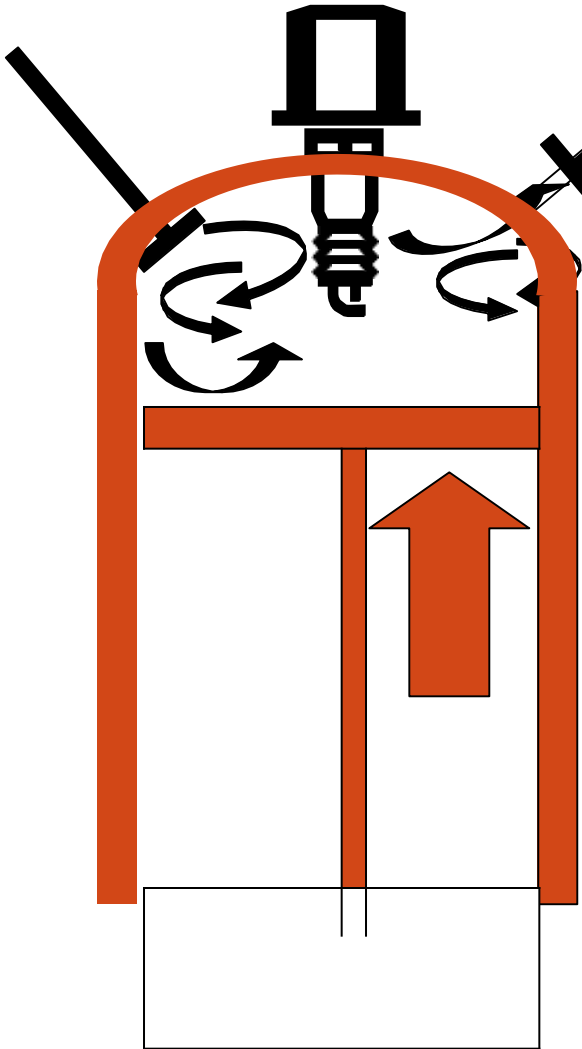




Four-stroke SI Engine

Inlet valve closed

Exhaust valve Open



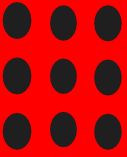
4

**EXHAUST
STROKE**





Working Principle of CI Engine- 4stroke



All CI Engine working under the following process

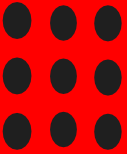
- 1.Suction**
- 2.Compression**
- 3.Expansion / Power and**
- 4.Exhaust**





MCQ

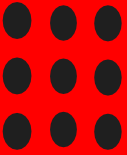
- What is the combustion in spark ignition engine?
 - a) heterogeneous
 - b) laminar
 - c) homogeneous
 - d) none of the mentioned



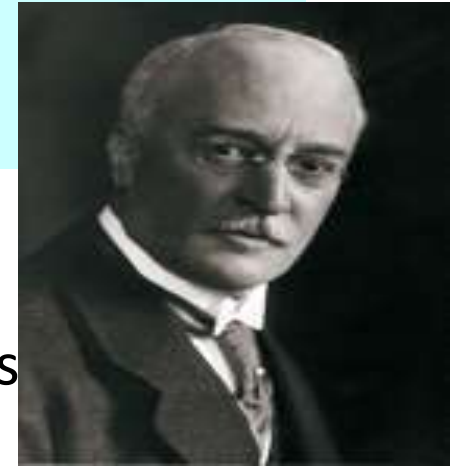


MCQ

- What is the combustion in spark ignition engine?
 - a) heterogeneous
 - b) laminar
 - c) homogeneous
 - d) none of the mentioned
- ANSWER - **HOMOGENENOUS**



Four Stroke Diesel / CI Engine

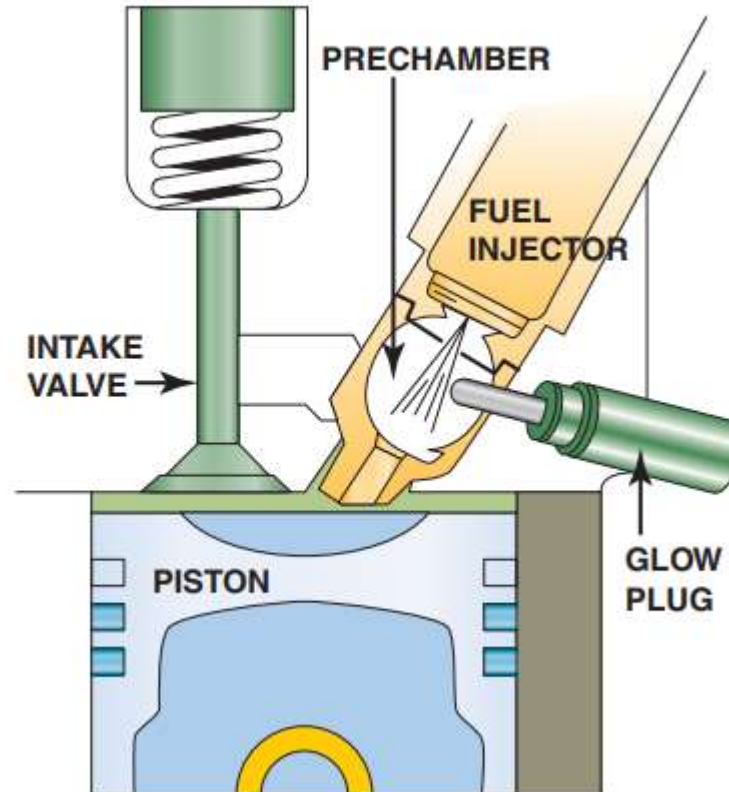


- Diesel Engine was invented by **Rudolph Diesel**. It is ignited by compression of charge, so it's also **compression ignition (CI)** engine.
- It is similar to four stroke petrol engine but operates at a much higher compression ratio. The compression ratio of an SI engine is between **6 and 10:1** while for a CI engine it is from **16 to 20:1**.
- A high pressure **fuel injector** is used to inject the fuel into the combustion chamber.





CI ENGINE

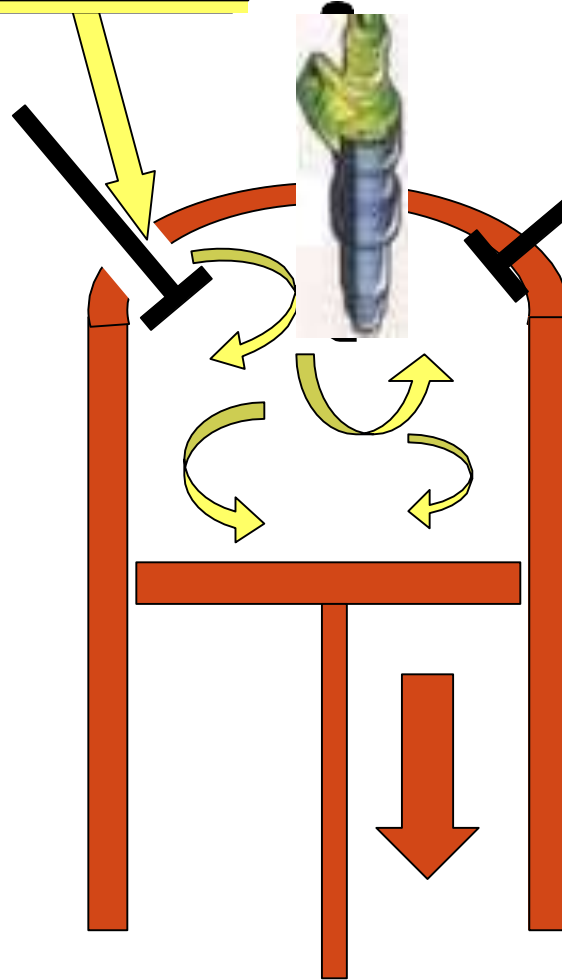


Four-stroke CI Engine

Air ONLY In

Inlet valve open

Exhaust valve Closed



1

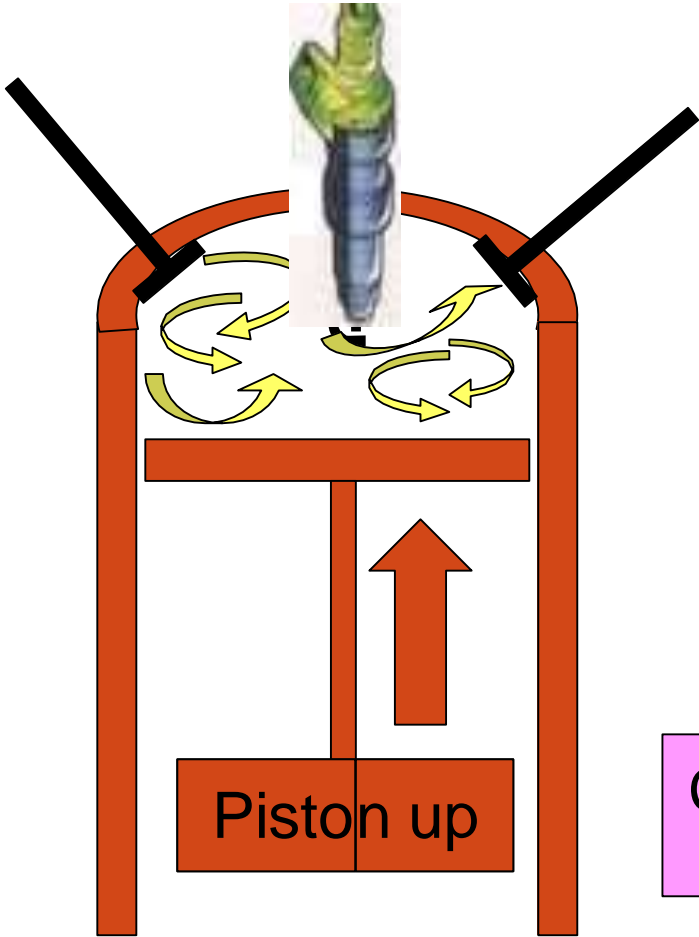
INDUCTION
STROKE

Piston down

Four-stroke CI Engine

Inlet valve closed

Exhaust valve Closed



2

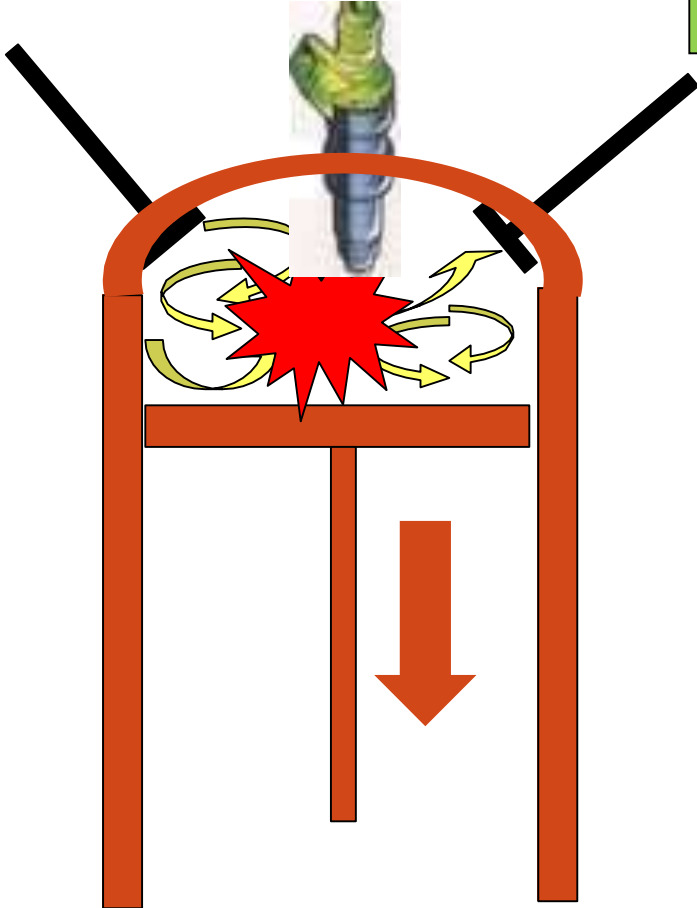
COMPRESSION
STROKE



Four-stroke CI Engine

Inlet valve closed

Exhaust valve/Port Closed



FIRING

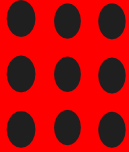
3

POWER STROKE



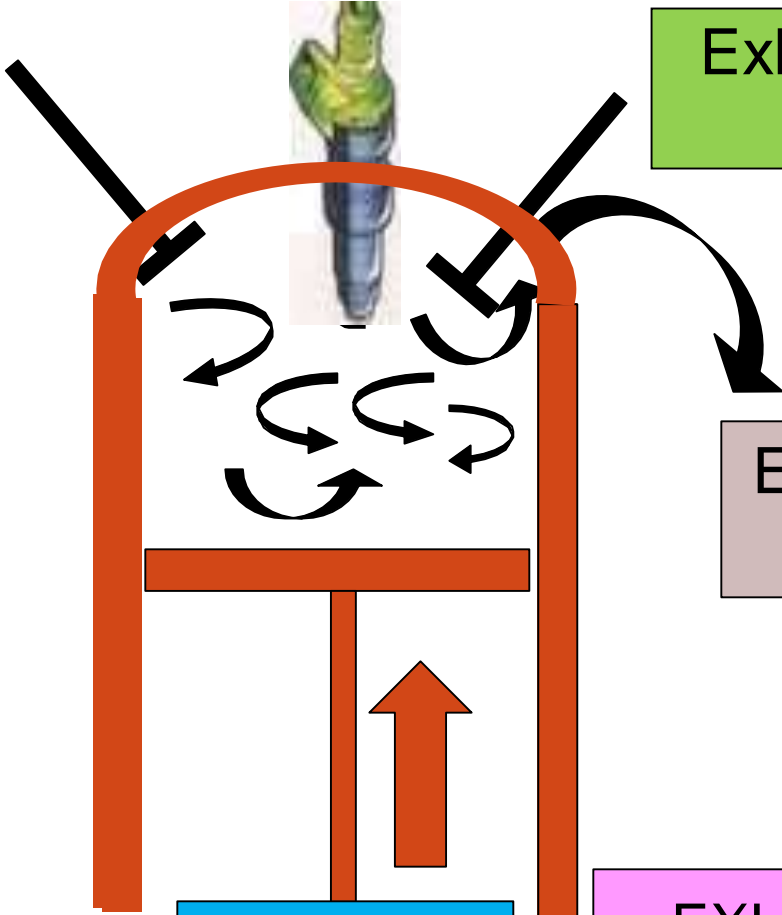


Four-stroke CI Engine



Inlet valve closed

Exhaust valve opens



Exhaust gases out

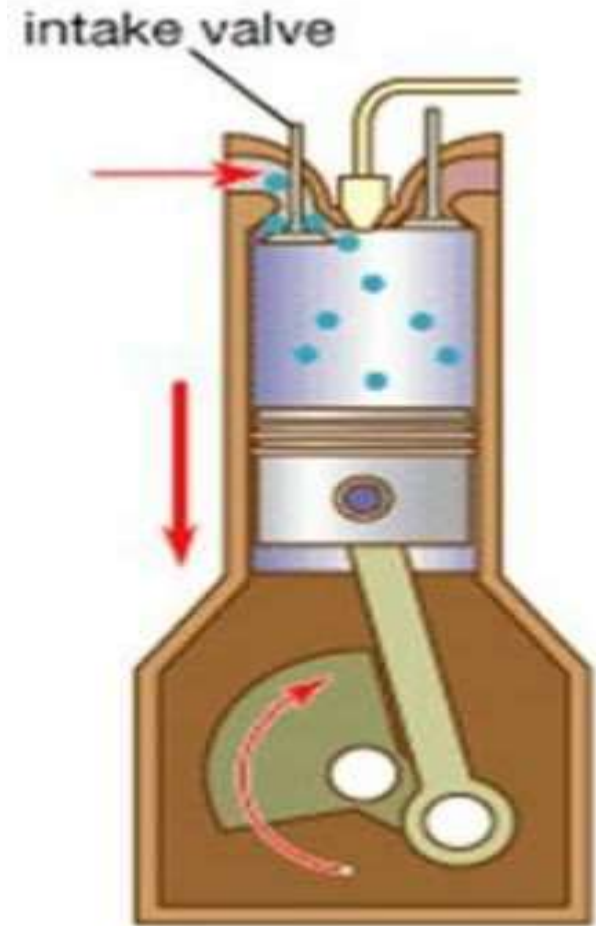
Piston up

EXHAUST STROKE



Suction / Intake Stroke

- Suction stroke starts when piston is at top dead center and about to move downwards.
- The inlet **valve** is **open** at this time and the exhaust valve is closed.
- Due to the suction created by the motion of the piston towards the BDC, **Air alone** is inducted during the suction stroke.

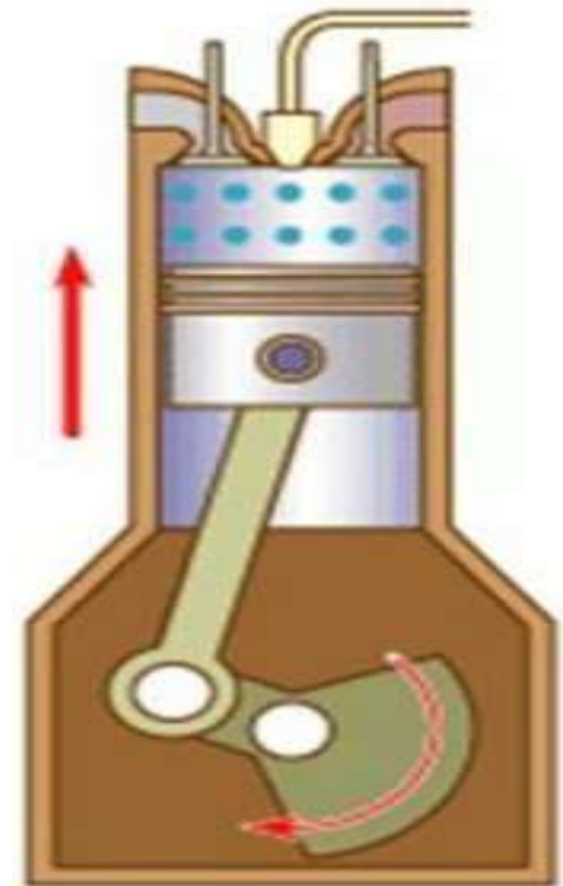


**intake/
Suction**

Compression Stroke

- Air inducted during the suction stroke is **compressed** into the clearance volume due to return stroke of piston.
- Both valves remain closed during this stroke.
- The air in the combustion chamber is at **high temperature and high pressure** with a decrease in volume.

Both Valves Closed

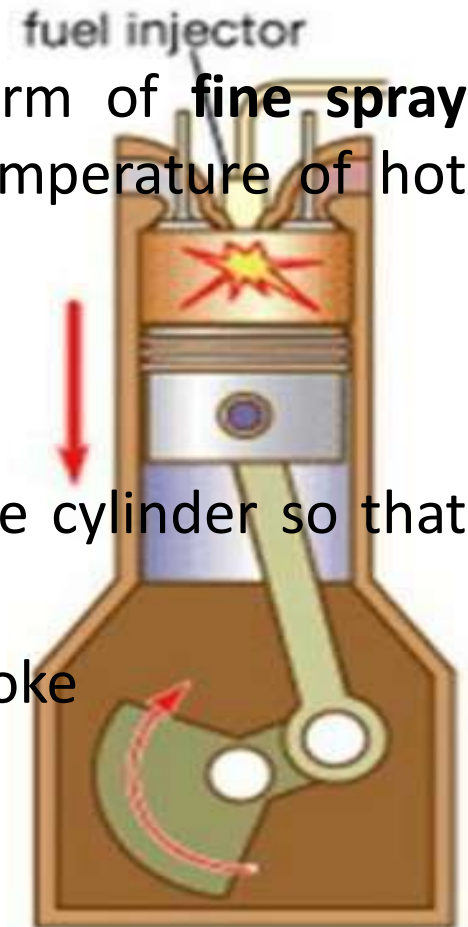


compression

Stroke

- At the **end of compression** stroke, the **fuel is injected** into the cylinder in the form of **fine spray** through the **nozzle** and is ignited by the temperature of hot compressed air in the chamber.
- So that combustion process is **started** at the end of compression **stroke**.
- The combustion of gases expands inside the cylinder so that piston start to move towards BDC.
- Both the valves remain closed during this stroke

Both Valves Closed

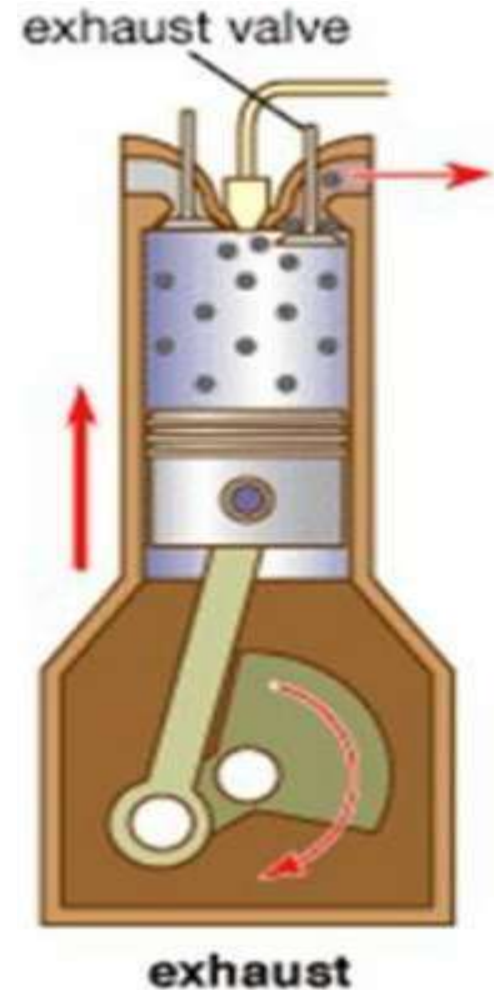


power /
Expansion

Exhaust

Stroke

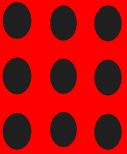
- The piston traveling from BDC to TDC **pushes** out the product of combustion.
- The exhaust valve is open and the intake valve is closed during this stroke.





MCQ

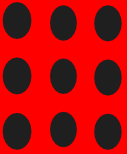
- What is the combustion in spark ignition engine?
 - a) heterogeneous
 - b) laminar
 - c) homogeneous
 - d) none of the mentioned





MCQ

- What is the combustion in COMPRESSION ignition engine?
 - a) heterogeneous
 - b) laminar
 - c) homogeneous
 - d) none of the mentioned
- ANSWER- **HETEROGENEOUS**





Difference between Petrol and Diesel Engine

Petrol Engine

1. Operates on the principle of Otto cycle.
2. Fuel is ignited by spark plug.
3. Low compression ratio
4. Operates at high speed.
5. Fuel used (petrol) is costly.
6. Lighter in weight.
7. Fuel is sent to cylinder through Carburetor.
8. Fuel consumption is more.
9. Less vibration.
10. Petrol is highly volatile, so handling is at more risk.

Diesel Engine

1. Operates on the principle of diesel cycle.
2. Fuel is ignited by hot compressed air.
3. High compression ratio
4. Operates at low speed.
5. Fuel used (diesel) is cheap.
6. Heavier in weight.
7. Fuel is sent to cylinder through Fuel Injector.
8. Fuel consumption is less.
9. More vibration.
10. Diesel is less volatile, so handling is not risky.



REFERENCES

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- Robert Bosch, “ Bosch Automotive Electrics and Automotive Electronics”, Springer View, 5th Edition, 2013.
- Tom Denton, “Automobile Electrical and Electronic Systems”, Elsevier, 3rd Edition, 2003.

