

# **E-Course on Internal Combustion Engine**

## **Subject code : 3171923**

**Chapter : Introduction**

# Comparison of SI and CI Engines

- Difference in thermodynamic and operating variables
- comparison of performance characteristics
- comparison of initial and maintenance costs
- application of SI and CI engine.

# Classification of I.C.ENGINES

I.C.ENGINES are may be classified according to

Type of fuel used as

- ✓(1)Petrol engine
- ✓(2)Diesel engine
- ✓(3)Gas engines

Nature of thermodynamic cycle as:

- (1)Otto cycle engine
- (2)Diesel engine cycle
- (3) Duel or mixed cycle engine

# Classification of I.C. ENGINES

Number of stroke per cycle as :

- (1) Four stroke engine
- (2) Two stroke engine



Method of ignition as :

- (1) Spark Ignition engines (S I)  
(Mixture of air and fuel is ignited by electric spark)
- (2) Compression Ignition engines (C I)  
(The fuel is ignited as it comes in contact with hot Compressed air)

# Classification of I.C. ENGINES

## Method of Cooling as:

- (1) Air cooled engines
- (2) Water cooled engines

ICE → heat

Combustion → heat  
↓  
engine

## Speed of the engines as:

- (1) Low speed engines
- (2) Medium speed engines
- (3) High speed engines

## Number of cylinder as:

- (1) Single cylinder engines
- (2) Multi cylinder engines

# Difference between Petrol <sup>(SI)</sup> and Diesel <sup>(CI)</sup> Engine

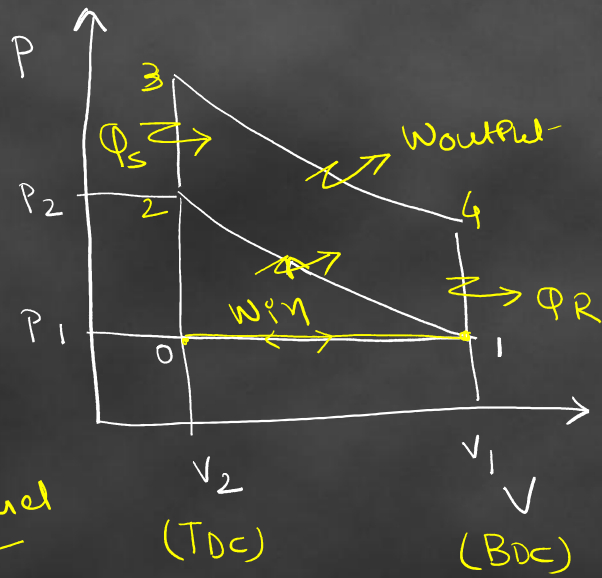
PETROL ENGINE	DIESEL ENGINE
Works on <u>Otto cycle</u> .	Works on <u>Diesel Cycle</u> .
Petrol is used as fuel .	Diesel is used as fuel .
Air and fuel mixture enters in cylinder during suction stroke .	<u>Only Air</u> is drawn during the suction stroke .
Low compression ratio ranging from <u>6 to 10</u> .	High compression ratio ranging from <u>14 to 20</u> .
The compressed charge is ignited by the <u>spark plug</u> .	The <u>fuel injector</u> is used in Diesel engine.
High engine speed of about <u>3000 RPM</u> .	Low to medium engine speed ranging from <u>500 to 1500 RPM</u> .
The Thermal efficiency is <u>lower</u> due to lower Compression ratio .	The Thermal efficiency is <u>higher</u> due to high Compression <u>ratio</u> .
Lighter in weight because maximum pressure and Temperature is less .	Heavier in Weight because maximum pressure and temperature is high .
Less Costlier .	More Costlier .
Maintenance cost is Less .	Maintenance cost is Slightly higher .
Easier starting even in cold weather .	Difficult to start in cold weather .
Running cost Higher because petrol is <u>Costlier</u> .	Running cost is Less because diesel is <u>Cheaper</u> .

## ★ Difference in thermodynamic and operating variables

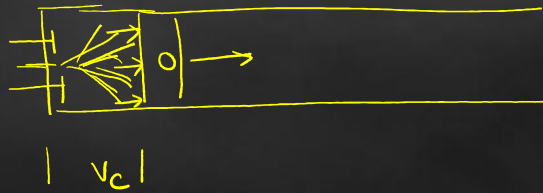
- ✓ 1. Thermodynamics Cycle
- ✓ 2. Combustion Phenomenon
- ✓ 3. Compression Ratio
- ✓ 4. Operating Pressure
- ✓ 5. Operating Speed
- ✓ 6. Distribution of Fuel between cylinder
- ✓ 7. Exhaust gas temperature
- ✓ 8. Starting

# 1. Thermodynamics Cycle

SI (Petrol engine)  
Otto cycle



air + fuel  
↓



⇒ Diesel CR → 14 to 22

- 1) Compression (CR) Ratio
- 2) heat supply ( $Q_s$ )

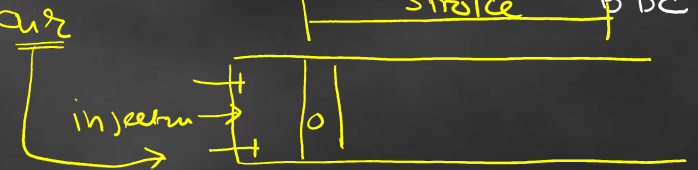
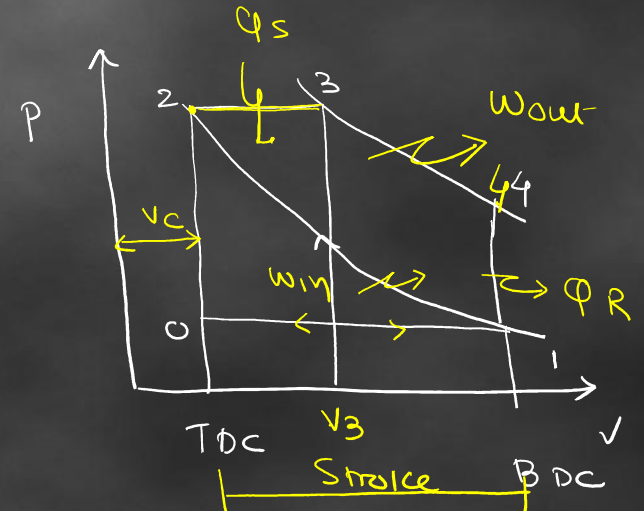
★ Same Comp Ratio  
and for same heat supply

$$\eta_{Otto} > \eta_{Diesel}$$

Perun 7 to 10  $\eta_D > \eta_P$

(Dual cycle)

CI Engine (Diesel Engine)



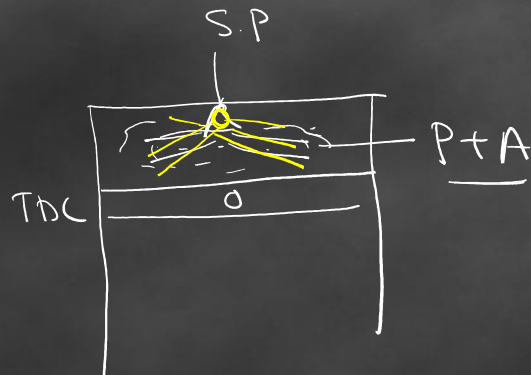


## 2. Combustion Phenomenon

(SI)

SPRUE INJECTION

Single flame

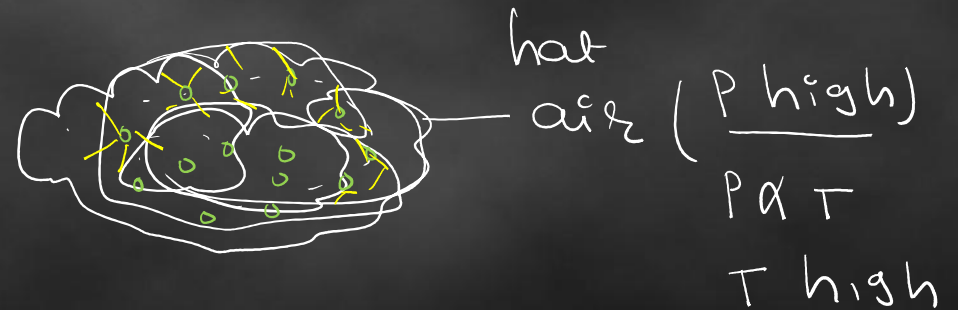
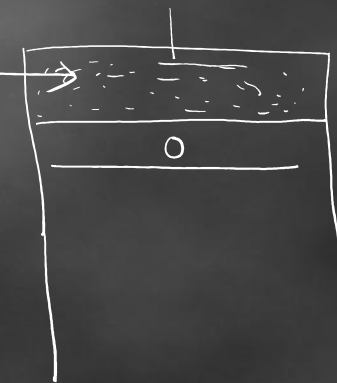


CI

Injector

air

TDC



### 3. Compression Ratio

SI low CR 7 to 10

CI high CR 14 to 22 → T high (Diesel)  
↑  
P pressure

CI high Thermal  $\eta$  because of high CR

## 4. Operating Pressure

CI      30 to 50 bar  
SI      7 to 15 bar

→ Material strength high

CR of CI = 3 to 4 CR of SI

$P_{max} \text{ CI} = 1.3 \text{ to } 1.4 P_{max} \text{ of SI}$

## 5. Operating speed

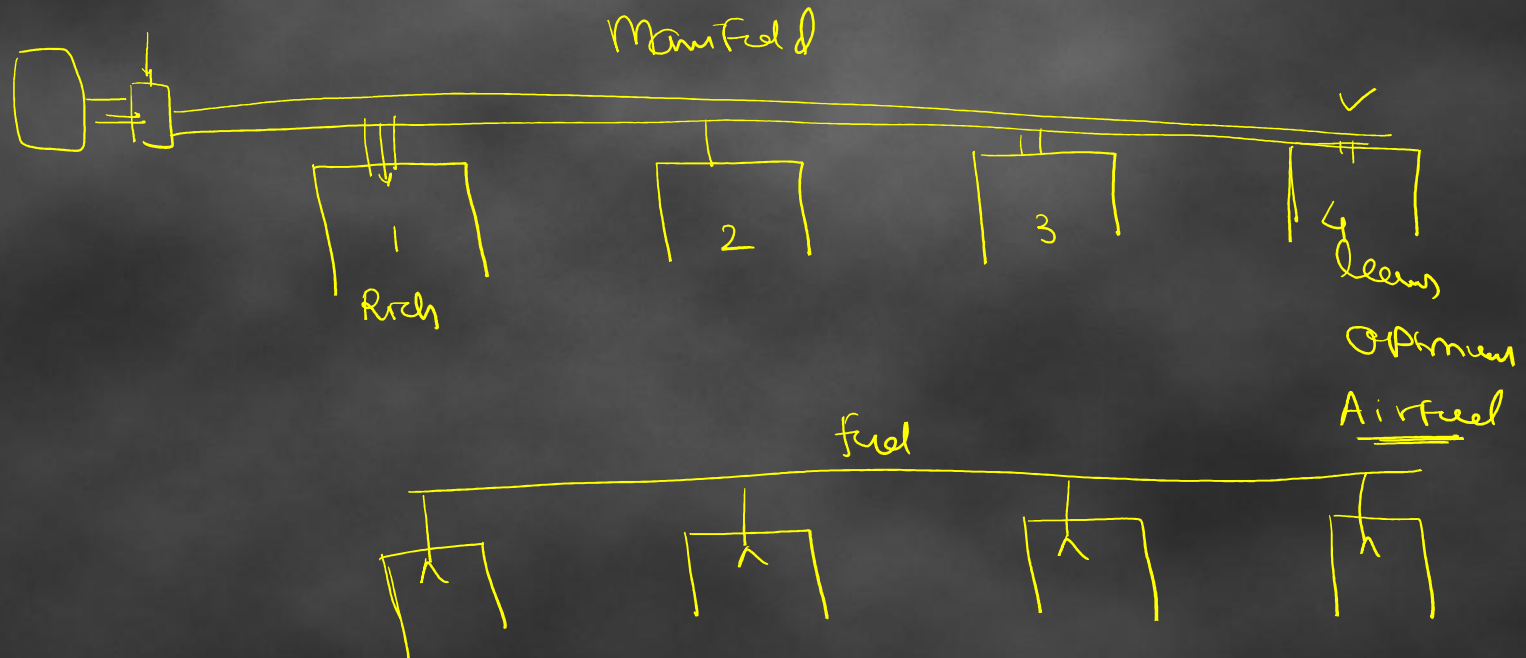
bhp (brake horse power)

bhp  $\rightarrow$  f(N)

max bhp  $\rightarrow$  max N (speed)

SI engine is higher speed compare to CI

## 6. Distribution of Fuel between cylinder



## 7. Exhaust gas temperature

$$\eta_{CI} > \eta_{SI}$$

$Q_s \rightarrow$  CI  $\rightarrow$  lower exhaust      excess CI  
SI  $\rightarrow$  high      "

## 8. Starting

SI Starting Easy

CI Difficulty to start (Cold)