

School of Mechanical Engineering

Course Code : BAUT3055

Course Name: Two and three wheeled vehicles

UNIT 1

Port Timing diagrams

GALGOTIAS
UNIVERSITY

Name of the Faculty: Mr. Abdul Gani

Program Name: B.Tech(AE)

Port Timing diagrams

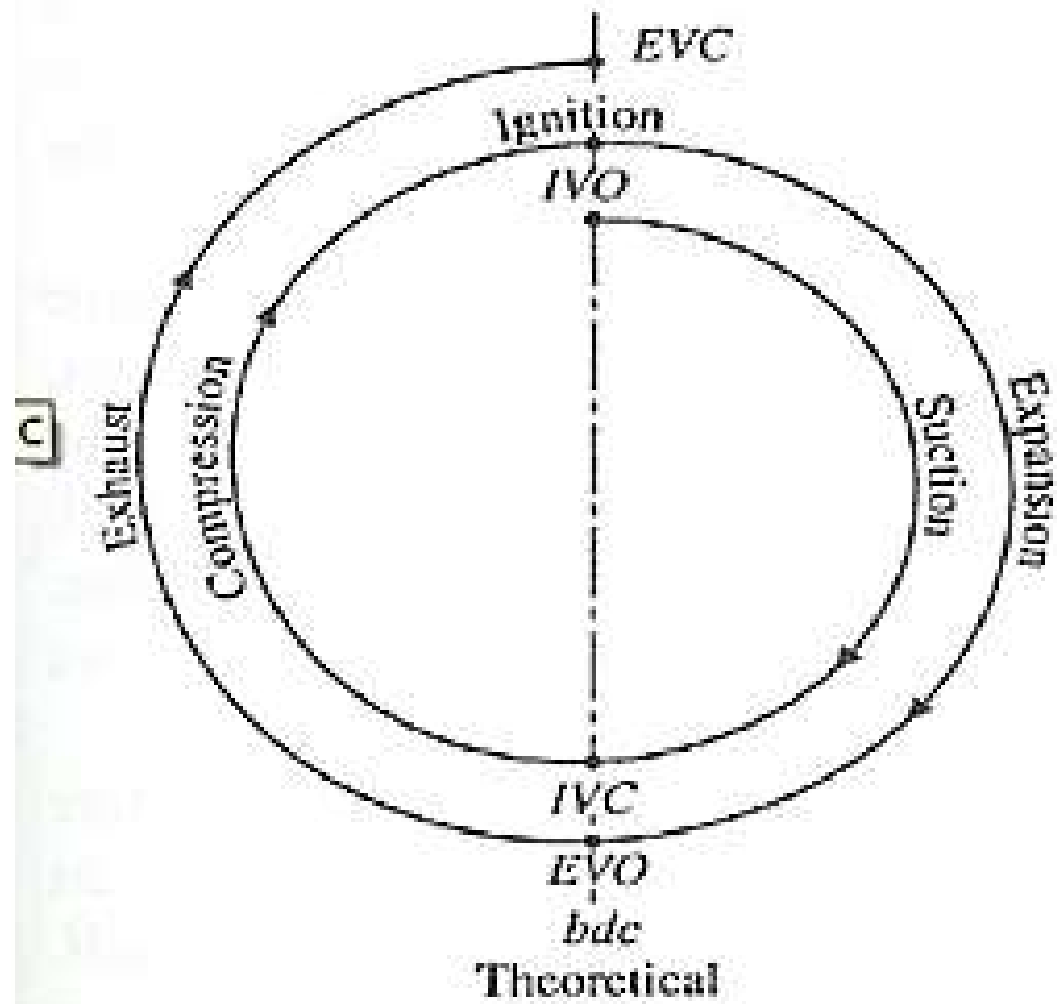
- In 2-stroke petrol engine as we all know the engine cycle completes in 2-strokes i.e expansion stroke and compression stroke, The fuel intake and combustion residual exhaust occurs respectively during these 2 strokes.
- A **Port/valve timing diagram** is a graphical representation of the opening and closing of the intake and exhaust valve of the engine with respect to crank position. The opening and closing of the valves of the engine depend upon the movement of piston from TDC to BDC, This relation between piston and valves is controlled by setting a graphical representation between these two, which is known as valve timing diagram.
- The valve timing diagram comprises of a 360 degree figure which represents the movement of the piston from TDC to BDC in all the strokes of the engine cycle, Which is measured in degrees and the opening and closing of the valves is controlled according to these degrees.

Need for port timing diagram

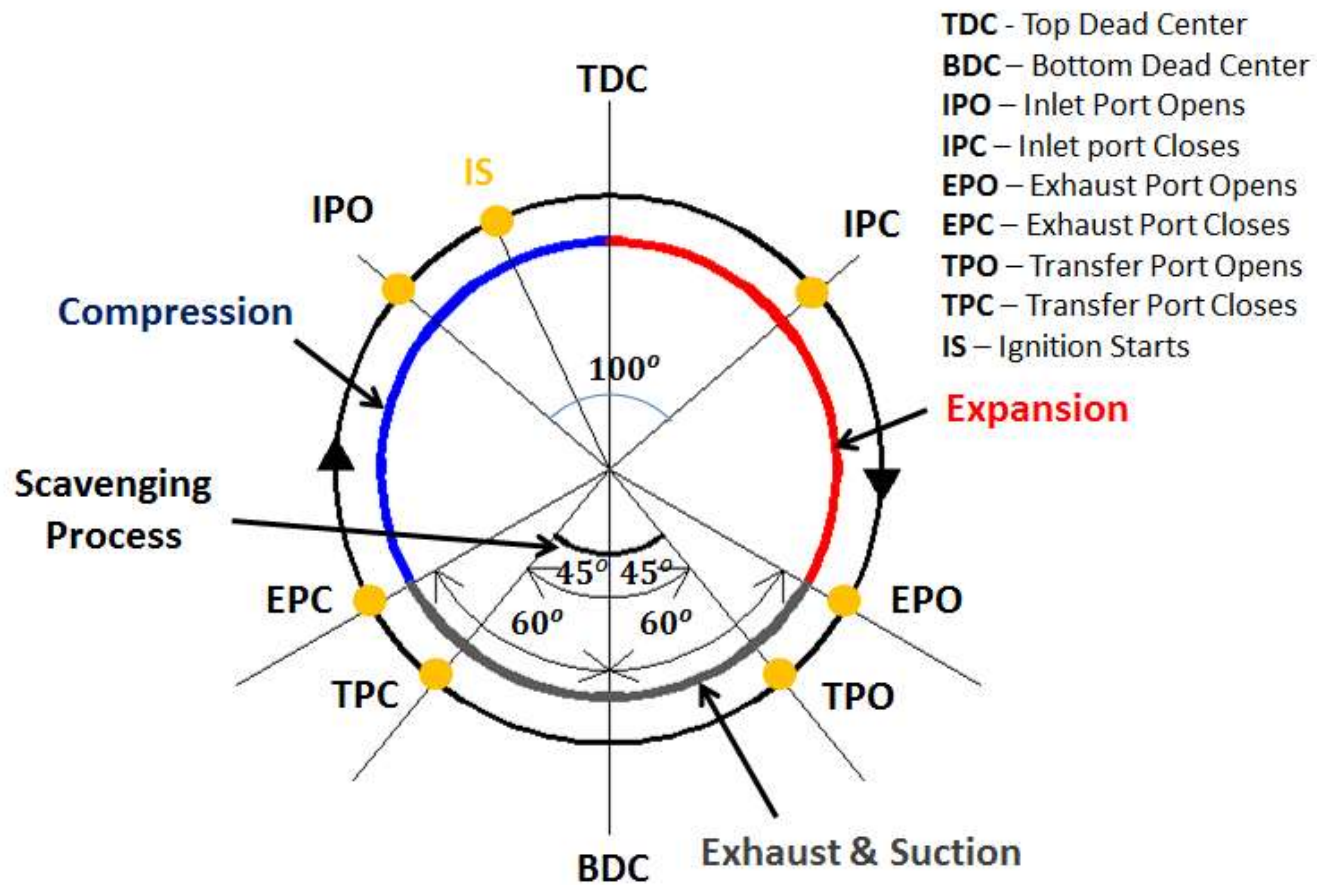
- Synchronization between the steps of a cycle of the engine from intake of air-fuel ratio to the exhaust of combustion residual.
- Complete seizure of the combustion chamber at the instant at which the combustion of air-fuel mixture takes place as the leakage can cause damage to the engine and can be hazardous.
- Provide engine with a mixed air and fuel or air in case of diesel engine when required (at the time of suction) which is the necessity of the engine.
- Provide the exit for the combustion residual so that the next cycle of the engine can take place.
- Ideal timing for the opening and closing of the inlet and outlet valve which in turn protect the engine from defects like knocking or detonation.
- A high compression ratio required to combust the fuel especially in case of diesel engine by overlapping the closing of the valve.
- The cleaning of engine cylinder which in turn maintain the quality of combustion and decreases wear and tear inside the cylinder.
- The study of the details of the combustion that is required for the modification of the power of the engine.

Theoretical valve timing

- **Expansion stroke-** At the beginning of the expansion stroke the piston which is at TDC starts moving towards BDC due to the combustion of compressed air-fuel (petrol engine) and (diesel sprayed charge in diesel engine) during compression stroke and the power output is obtained.
- The air-fuel (petrol engine) and air (diesel diesel) enters through the inlet port during the expansion strokes as the piston moves from TDC to BDC during this stroke.
- The expansion stroke continuous till the piston reaches BDC.

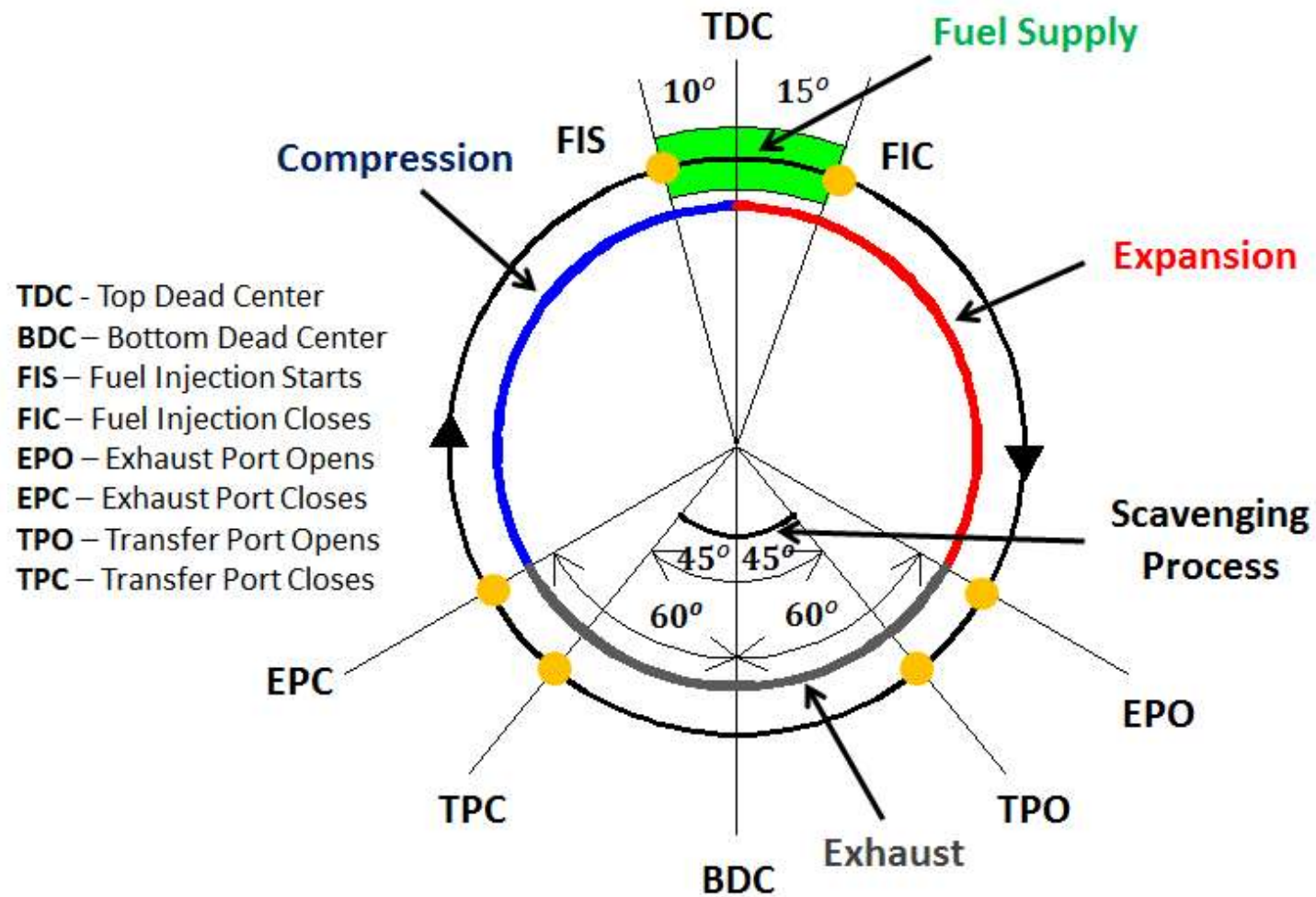


- **Compression Stroke-** At the end of the expansion stroke the piston which is at BDC starts moving towards TDC and the compression of air-fuel (petrol engine) and diesel sprayed charge (diesel engine) starts along with the exhaust of combustion residual through exhaust port due to the movement of piston from BDC to TDC.
- The piston closes both inlet port and exhaust port due to its movement from BDC to TDC which in turn raises the pressure inside the combustion chamber.
- At the end of the compression stroke i.e. when the piston reaches TDC combustion of the air-fuel (petrol engine) due to spark and diesel sprayed charge (diesel engine) due to the high pressure takes place, And the cycle repeats again.



©2017mechanicalbooster.com

Valve Timing Diagram of 2 Stroke Petrol Engine



©2017mechanicalbooster.com

Valve Timing Diagram of 2 Stroke diesel Engine

- Before the expansion stroke i.e. completion of the compression stroke, the inlet port open 10-20 degree before the piston reaches the TDC which in turn starts the expansion stroke due to the combustion of air-fuel (petrol engine) from the crankcase and air (diesel engine) entered from the inlet port which in turn pushes the piston towards BDC.
- The inlet port closes 15-20 degree after TDC during the expansion stroke of the 2-stroke engine.
- Due to the movement of piston from TDC to BDC during expansion stroke exhaust port opens 35-60 degree before the piston reaches BDC which in turn starts the exhaust of the combustion residual..

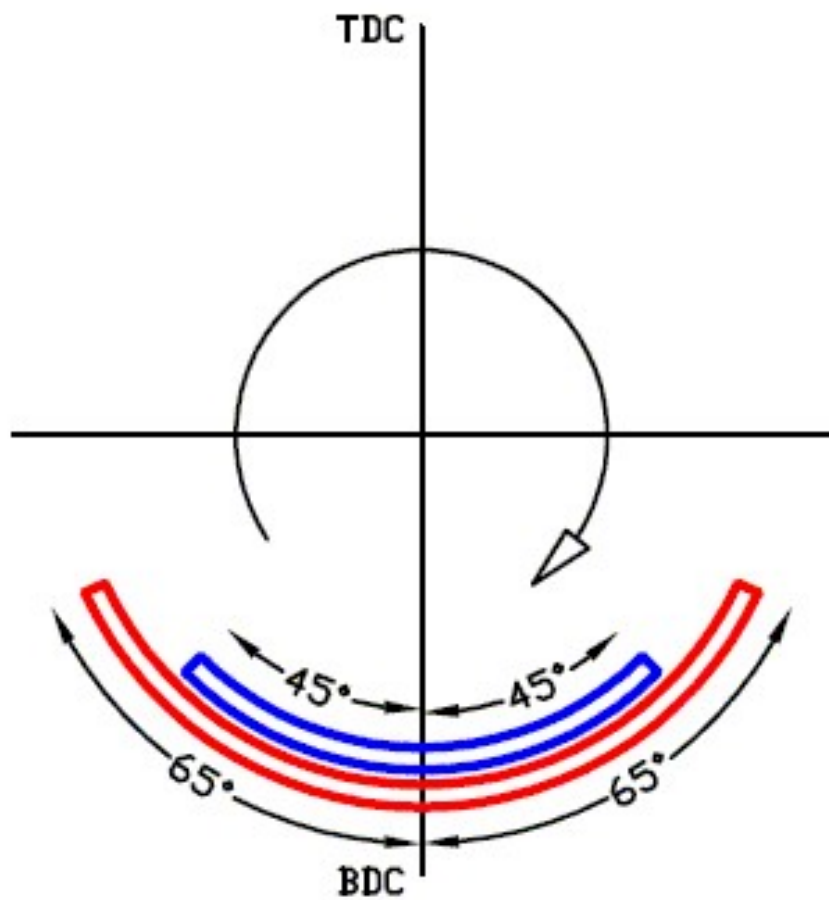
- Transfer port open 30-45 degree before BDC for scavenging process.
- When the piston moves towards TDC from BDC the transfer port closes 30-45 degree after BDC which in turn stops the scavenging process.
- During the movement of piston from BDC to TDC exhaust valve closes 35-60 degree after BDC which seizes the combustion chamber and pressure inside the combustion chamber increases due to the start of compression stroke. and the cycle starts again.
- The air fuel mixture (petrol engine) and air (diesel engine) is transported to the cylinder during the opening of the transfer port.

Note – The opening and closing of valves few degrees before TDC and BDC is required for normal working of the engine as this degree gaps provides proper completion of the operation of strokes and prevents the engine from defects like knocking, and also causes less emission.

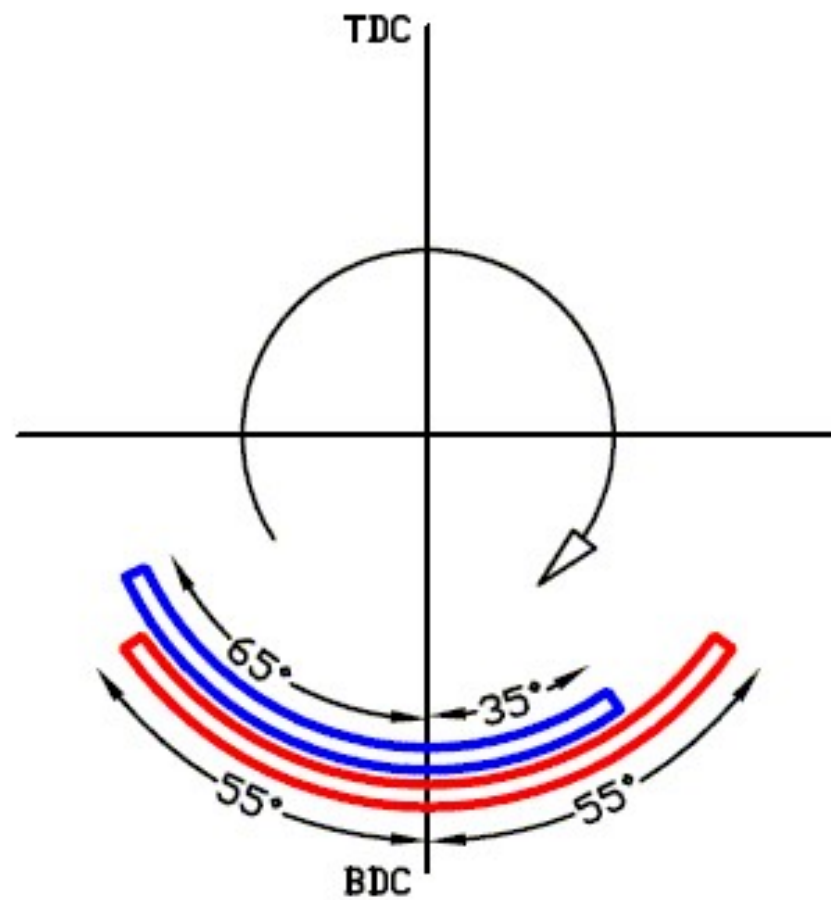
- For power modification this valve timing is adjusted which in turn increases the power and torque of the engine but decreases the economy.

- In the conventional two-stroke engine the exhaust port and the transfer port are controlled by the piston making inevitable the symmetric timing (for instance as shown in the following plot at left, wherein: the exhaust port opens 65 degrees before the BDC and closes 65 degrees after the BDC, while the transfer port opens 20 degrees after the exhaust port and closes 20 degrees before the exhaust port).
- With symmetric timing, the transfer port opens after the exhaust port and closes before the exhaust port.
- Time is required to pass from the opening of the exhaust port till the opening of the transfer port (translated into crankshaft degrees) in order the pressure inside the combustion chamber to fall substantially.

The same time passes from the closing of the transfer port till the closing of the exhaust port (case of zero offset), giving the chance to a good part of the fresh air or mixture to escape from the open exhaust port under the action of the upwardly moving piston, reducing the torque and increasing the emissions.



Conventional Symmetric Timing



PatAT Asymmetric Timing

- In asymmetric timing (as shown in fig), the exhaust port opens 55 degrees before the BDC and closes 55 degrees after the BDC, while the transfer starts 35 degrees before the BDC and ends 65 degrees after the BDC).

References

- Irving P E (1992), Motor cycle engineering, Temple Press Book, London.
- Dhruv U. Panchal (2015), Two And Three Wheeler Technology, PHI Learning; 1 edition
- Newton Steed (2000), “The Motor Vehicle”, McGraw Hill Book Co. Ltd., New Delhi.

GALGOTIAS
UNIVERSITY



Thank You

GALGOTIAS
UNIVERSITY