

**BACHELOR OF ENGINEERING (MECHANICAL ENGINEERING) THIRD
YEAR FIRST SEMESTER-2025**

INTERNAL COMBUSTION ENGINE

TIME: THREE HOURS

FULL MARKS: 100

Answer any FIVE questions. All questions carry equal marks.

Assume any data suitably, if necessary.

- 1) (a) Draw the Valve Timing diagram for a four-stroke vertical spark-ignition engine showing the positions of the opening and closing of each valve and also the point of sparking. Also show the valve opening and closing positions on a P-v diagram of the cycle. 10
(b) Why the suction valve closes after the BDC? 5
(c) Why the exhaust valve opens before the BDC? 5
- 2) (a) Derive the expression of Thermal Efficiency of an air-standard Dual Cycle showing the cycle on the (P-v) and the (T-s) planes. 10
(b) In an Otto cycle air at 27 °C and 1.1 bar is compressed isentropically to 20 bar. 2000 kJ/kg of heat is added at constant volume until the pressure rises to 40 bar. Calculate the air standard efficiency, the compression ratio for the cycle. Take $C_v = 0.717$ kJ/kg K and $\gamma = 1.4$. 10
- 3) (a) Why a high fuel air ratio is necessary during the Idling mode and the High-Power mode of working in a Carburetor. 10
(b) With a neat sketch, derive the expression of Air-Fuel ratio of a carburetor in terms of the atmospheric pressure and the throat pressure considering air as a compressible fluid. 10

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- 4) (a) Compare between the Otto cycle, Diesel cycle and Dual cycle based on same compression ratio and same heat addition. 10
 (b) A simple float type carburetor is required to supply 4.5 kg of air and 0.45 kg of fuel per minute. The air is initially at 1 bar and 300 K. The fuel has a specific gravity of 0.75. Calculate the throat diameter of the venturi for a flow velocity of 100 m/s. If the pressure drop across the fuel metering orifice is 0.80 of that of the venturi throat, calculate the orifice diameter. 10
- 5) (a) What are the basic requirements of a fuel injection system in a C I engine? Explain the different types of solid injection system for a CI engine. 10
 (b) Calculate the diameter of the fuel orifice of a four-stroke engine which develops 20 kW per cylinder at 2000 rpm. The specific fuel consumption is 0.3 kg/kWh for fuel with a specific gravity of 0.876. The fuel is injected at a pressure of 150 bar over a crank travel of 25°. The pressure in the combustion chamber is 40 bar. Coefficient of velocity is 0.875. 10
- 6) With a neat sketch explain the Battery-Ignition system used in a S.I engine. Also discuss the fundamental requirements of a spark ignition system. What is the purpose of using the condenser? 20
- 7) Write short notes on (any two): 10+10
 (a) Comparison between a 2 Stroke engine and a 4 Stroke engine.
 (b) Crank case scavenged 2 Strike engine.
 (c) Auto ignition in an SI engine and Knocking in a CI engine.