ME 306
IC Engines Tutorial Sheet

Q1. In an Otto cycle with a compression ratio of 7, the suction temperature and pressure are 300 K and 1 bar. Heat supplied during the constant volume process is 700 kJ/kg. The air flow rate is 90 kg/hr. Determine (a) power output, (b) mean effective pressure, and (c) efficiency.

Q2. An air-standard Diesel cycle has a compression ratio of 16 and a cutoff ratio of 2. At the beginning of the compression process, air is at 95 kPa and 27°C. Determine (a) the temperature after the heat-addition process, (b) the thermal efficiency.

Q3. The compression ratio of an air-standard Otto cycle is 9.5. Prior to the isentropic compression process, the air is at 100 kPa, 35°C, and 600 cm^3. The temperature at the end of the isentropic expansion process is 800 K. Determine (a) the highest temperature and pressure in the cycle; (b) the amount of heat addition and rejection in kJ; (c) the thermal efficiency; and (d) the mean effective pressure.

Q4. The inlet state in a dual combustion cycle is 1 bar and 300 K. Its compression ratio is 10. The maximum pressure and temperature in the cycle are 45 bar and 1800 K. Determine the cycle efficiency.

Q5. The inlet of a dual combustion cycle is 1 bar and 300 K. Its compression ratio is 8 and expansion ratio is 5.3. If the isobaric heat absorbed is twice the isochoric heat absorbed, determine (a) cycle efficiency and (b) MEP.

Q6. The inlet conditions for an Otto cycle are 1 bar, 290 K. The pressures at the beginning and end of combustion are 15 bar and 40 bar respectively. Determine (a) compression ratio (b) standard efficiency and (c) MEP.

Q7. The fuel cut-off in a Diesel Cycle takes place at 5% of the stroke. If the compression ratio is 20, determine the standard efficiency.

Q8. An ideal Diesel cycle has a maximum cycle temperature of 2000°C. The state of the air at the beginning of the compression is P1 = 95 kPa and T1 = 15°C. This cycle is executed in a four-stroke, eight-cylinder engine with a cylinder bore of 10 cm and a piston stroke of 12 cm. The minimum volume enclosed in the cylinder is 5% of the maximum cylinder volume. Determine the power produced by this engine when it is operated at 1600 rpm. Use constant specific heats at room temperature.