

## UCH305 (Chemical Engineering Thermodynamics I)

### Tutorial Sheet No. 8 (Power cycles)

1. An engine working on the Otto cycle is supplied with air at 0.1 MPa pressure and 35 °C temperature. The compression ratio is 8. Heat supplied is 2100 kJ/kg. Calculate the maximum pressure and temperature of the cycle, the cycle efficiency and the mean effective pressure. (For air  $C_p = 1.005$ ,  $C_v = 0.718$  and  $R = 0.287 \frac{\text{kJ}}{\text{kg-K}}$ )
2. Consider an air standard Otto cycle that has a heat addition of 3000 KJ/kg of air, a compression ratio of 8 and a pressure and temperature at the beginning of compression process of 1 bar, 320 K. Determine:
  - a) The maximum pressure and temperature in the cycle
  - b) The thermal efficiency and
  - c) The mean effective pressure.
3. A Diesel engine has a compression ratio of 14 and cut-off takes place at 6% of the stroke. Find the air standard efficiency.
4. In an air standard Diesel Cycle, the compression ratio is 16 and the fluid properties at the beginning of compression are 100kPa and 300K. For a peak temperature of 1500K, calculate (a) the percentage of stroke at which cut off occurs (b) the cycle efficiency and (c) the work output per kg of air.
5. In an air standard diesel cycle with compression ratio 14, the conditions of air at the start of the compression stroke are 1 bar and 300 K. After addition of heat at constant pressure, the temperature rises to 2775K. Determine the thermal efficiency of the cycle, net work done per kg of air and the mean effective pressure.
6. In a Diesel Cycle, air at 0.1 MPa and 300K is compressed adiabatically until the pressure rises to 5 MPa. If 700 kJ/kg of energy in the form of heat is supplied at constant pressure, determine the compression ratio, cut off ratio, thermal efficiency and mean effective pressure.
7. An Otto cycle takes in air at 1 bar and 15°C. The compression ratio is 6:1 and 2000 kJ/kg of energy is released to air in each cycle. To what value must the compression ratio be raised to increase the net work per cycle by 20 percent?