TUTORIAL-8 (16 Apr 2019)
Thermodynamics for Aerospace Engineers (AS1300)

1. A process had Nitrogen gas entering a device at 220K and leaving at 2500K. The pressure was maintained at 1 bar throughout. Find the amount of heat added to this gas per kg of gas.

2. Find the heat of formation of CO2 gas at 500K, without using the direct table entry at that temperature. Check your result with the data in the table.

3. An ideal Otto cycle has compression ratio of 8. At the beginning of the compression process, air is at 100 kPa and 17°C, and 800 kJ/kg of heat is transferred to air the constant volume heat addition process. Assuming cold air standard assumption, determine (a) the maximum pressure and temperature that occur during the cycle, (b) the net work done, (c) thermal efficiency and (d) mean effective pressure for the cycle.

4. An ideal Diesel cycle with air as the working fluid has a compression ratio of 18 and a cut-off ratio of '2'. At the beginning of the compression process, the working fluid is at 100 kPa, 27°C, and 1917 cm^3. Utilising the cold standard assumptions, determine (a) the temperature and pressure of air at the end of each process, (b) net work output, (c) thermal efficiency and (d) the mean effective pressure.

Problems to be solved in class

1. Find the standard heat of formation of H2O at 500K without directly using the data from the tables.

2. Find the final temperature if N2 at -40 deg C, O2 at 100 deg C and CO2 at 150 deg C are mixed in the proportions 1:2:3 by mass at 1 bar pressure. Assume there is no reaction happening between the gases. Find the net entropy change.