

II B.Tech I Semester Supplementary Examinations, November 2005
THERMODYNAMICS

(Common to Mechanical Engineering and Aeronautical Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Explain the terms state, path, process and cyclic process.
 (b) Discuss the macroscopic and microscopic point of view of thermodynamics.
[8+8]

2. Air at 1.06 bar and 7°C is heated at constant volume to a temperature of 847°C. It is then expanded adiabatically until the pressure falls to 1.06bar, following which heat is rejected at constant pressure until the temperature is brought back to 7°C. Show that the heat input is equal to work output of the cycle. [16]

3. Ten grammes of water at 20°C is converted to ice at -10°C at constant atmospheric pressure. Assuming the specific heat of liquid water to remain constant at 4.2J/g°C and that of ice to be half of this value, and taking the latent heat of fusion of ice at 0°C to be 335J/g, calculate the total entropy change of the system. [16]

4. (a) Deduce an expression for the non-flow availability for a system.
 (b) A 2-kg piece of iron is heated from room temperature of 25°C to 400°C by a heat source at 600°C. What is the irreversibility in the process? Assume for iron $C_p=0.450\text{kJ/kgK}$. [6+10]

5. (a) Describe the process of formation of steam and give its graphical representation.
 (b) Find the specific volume, enthalpy and internal energy of wet steam at 18 bar dryness fraction 0.9.
 (c) What is the triple point? [8+6+2]

6. (a) A gas mixture consists of 5 kmol of hydrogen and 5 kmol of nitrogen. Determine the mass of each gas and the gas constant of the mixture.
 (b) Air is considered to be a mixture of 78% nitrogen and 22% oxygen by volume if the small amounts of argon and carbon oxide present in the mixture are neglected. Treating nitrogen and oxygen in air are to be the ideal gases, find the gas constant C_P and C_V for air at 25°C. [6+10]

7. The gravimetric composition of a liquid fuel is 0.86 kg carbon, 0.163 kg hydrogen and 0.01 kg ash. What is the mass ratio of air to liquid fuel required?
 The fuel is burnt with air and the products of combustion are sampled to determine the volumetric composition of carbon monoxide and carbon dioxide present, the result being 1% CO and 10% CO_2 . assume that the hydrogen has burned completely and the remaining undetermined products are water vapour, excess oxygen

and nitrogen. Calculate the actual air fuel mass ratio. Also find the mean isobaric specific heat capacity of the product. [16]

8. (a) Plot the thermal efficiency of Diesel cycle against compression ratio for different cut off ratios and explain its importance?
- (b) Calculate the thermal efficiency of a Diesel cycle with compression ratio 14 and cut off takes place at 6% of the stroke? [8+8]
