CODE NO OR 210352 OR

2005 JAWAHARLAL NEHRU TECHNOLOGY UNIVERSITY

II B.TECH I SEMESTER SUPPLYMENTARY EXAMINATIONS

THERMO DYNAMICS

(MECHANICAL ENGINEERING)

MAY 2005

TIME: 3 HOUR
MARK: 80

ANSWER ANY FIVE QUESTIONS ALL QUESTIONS CARRY EQUAL MARKS

MARK [5*16=80]

1. (a) Define the terms 'system' , 'surrounding' and 'boundary' of a system.

(b) Define and differentiate between the following cycles:

i. Closed cycle

ii. Open cycle.

2. (a) Define thermodynamic work and prove that work is a path function.

(b) Define and explain the concept of Zeroth law of thermodynamics.

3. (a) Prove that Kelvin-Planck statement and Clausius statement of Second law of thermodynamics are equivalent.

(b) Air is cooled reversibly at constant pressure of 120 kPa in a cylinder-piston arrangement from a temperature of 2400C to a temperature of 400C. Calculate the work done, heat transfer and change in entropy per kg of air. Consider for air R=0.287 kJ/kgK and = 1.4.

4. (a) Obtain expressions to find entropy change for a system of ideal gas in terms of pressure, temperature and volume during any process.

(b) One kg of water is heated at a constant pressure of 0.7 MPa. The boiling point is 164.97 0C and the latent heat of evaporation is 2066.3 kJ/kg. If the initial temperature of water is 00C, find the increase in entropy of the water if the final state is dry saturated steam. Assume for liquid water Cp= 4.2kJ/kgK.

5. (a) Define the following terms:

i. Internal energy

ii. Enthalphy

(b) A gas mixture in an engine cylinder has 12% CO_2, 11.2% O_2 and76.5%N_2 by volume. The mixture at 1000 0C expands reversibly, according to $PV^{1.2}$=constant to 7 times its initial volume. Determine the work done and heat transfer per unit mass of the mixture. The average cp values for CO_2,O_2andN_2 are 1.27

kJ/kgK, 1.11 kJ/kgK and 1.196 kJ/kgK respectively.

6. (a) Derive an expression for the thermal efficiency of air standard Otto cycle.

(b) In an air standard Otto cycle engine, the temperatures at the start and end of the adiabatic expansion are 3260 K and 1420 K. The heat added per cycle is 1850 kJ/kg of air. Determine the compression ration and the cycle work per kilogram of air.

7. (a) Show a schematic diagram and explain the working of the vapor absorption refrigeration system.

(b) Consider a 300 kJ/min refrigeration system which operates on an ideal vapor compression

refrigeration cycle with refrigerant-12 as the working fluid. The refrigerant enters the compressor as saturated vapor at 140kPa and is compressed to 800 kPa. Show the cycle on a T-S diagram with respect to saturation lines, and determine the quality of the refrigerant at the end of the throttling process, the coefficient of performance and the power input to the compressor.

8. Write short notes on the following:

(a) Maxwell's relations

(b) Bell coleman cycle

(c) Mollier chart.