Code No: 123AB **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, November/December - 2016

THERMODYNAMICS

(Common to ME, AE, AME, MSNT)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) Explain the process of irreversibility. [2]
b) What is the principle of Thermometry? [3]
c) Define two statements of second law of thermodynamics. [2]
d) Mention all Maxwell relations. [3]
e) Explain the non flow process. [2]
f) Write the Clausius Clapeyron equation and its significance. [3]
g) What is meant by molecular internal energy? [2]
h) Write the Carrier's equation and its significance. [3]
i) Draw p-v and T-s diagrams of Lenoir cycle. [2]
j) Draw the Bell Coleman cycle in operation. [3]

PART-B

(50 Marks)

2.a) What is meant by thermodynamic equilibrium? Explain with the help of examples.
b) What is meant by SFEE and derive it and reduce it for the turbine. [5+5]

OR

3.a) Write about constant volume gas Thermometer? Why it is preferred over a constant pressure gas Thermometer.

b) A blower handles 1kg/s of air at 20^0C and consuming a power of 15 kw. The inlet and outlet velocities of air are 100 m/s and 150 m/s respectively. Find the exit air temperature, assuming adiabatic conditions. Take C*p* of air as 1.005 kJ/kgk. [5+5]

4.a) Discuss the significance of Third law of thermodynamics.
b) A heat pump working on a reversed Carnot cycle takes in energy from a reservoir maintained at 3^0C and delivers it to another reservoir where temperature is 77^0C. The heat pump drives power for its operation from a reversible engine operating within the higher and lower temperature limits of 1077^0C and 77^0C. For 100 kJ/sec of energy supplied to the reservoir at 77^0C, estimate the energy taken from the reservoir at 1077^0C. [5+5]

OR

5.a) Explain the concept of irreversibility and its significance.
b) 0.5 kg of air executes a Carnot power cycle having a thermal efficiency of 50%. The heat transfer to the air during isothermal expansion is 40 kJ. At the beginning of the isothermal expansion the pressure is 7 bar and the volume is 0.12 m^3. Determine the maximum and minimum temperatures for the cycle in Kelvin, the volume at the end of isothermal expansion in m^3 and the work, heat transfer for each of the four processes in kJ. c_p=1.008 kJ/kgK and c_v=0.721 kJ/kgK for air. [5+5]

6.a) What do you understand by triple point? Give the pressure and Temperature of water at its triple point.

b) Water at 40^0C is continuously sprayed into a pipeline carrying 5 tonnes of steam at 5 bar, 300^0C per hour. At a section downstream where the pressure is 3 bar, the quality is to be 95%. Find the rate of water spray in kg/hr. [5+5]

OR

7.a) Write about Vander Waals equation for real gases.

b) Explain the steps involved in the construction of Psychrometric chart at 2 bar pressure and also explain the process of adiabatic saturation. [5+5]

8.a) What are the Daltons Law of partial pressures? How it is different from Avagadro's law?

b) A sling psychrometer reads 40^0C dry bulb Temperature and 36^0C wet bulb Temperature. Find the humidity ratio, Relative humidity, dew point Temperature, specific volume, and enthalpy of air. [5+5]

OR

9.a) What is an adiabatic saturation? When does the wet bulb temperature equal the saturation temperature?

b) At steady state, $100m^3$/min of dry air at 32^0C and 1 bar is mixed adiabatically with a stream of oxygen (O_2) at 127^0C and 1 bar to form a mixed stream at 47^0C and 1 bar. The kinetic an potential energy effects are negligible. Determine (i) Mass flow rates of dry air and oxygen in kg/min, (ii) The mole of fraction of dry air and oxygen in the existing mixture, and (iii) Time rate of entropy production, in kJ/K.min. [5+5]

10.a) Write about Dual combustion cycles and the significance of the same.

b) An Ericsson cycle operating with an ideal regenerator works between 1100 K and 288 K. the pressure at the beginning of isothermal compression is 1.013 bar. Determine:
i) The compressor and turbine work per kg of air, and
ii) The cycle efficiency. [5+5]

OR

11.a) How is a reversed Carnot cycle used for refrigeration? Explain the processes.

b) An engine working on the Otto cycle is supplied with air at 0.1 MPa, 35^0C. 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 kJ/kgK. [5+5]