Code No: 133BX **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, April/May - 2018

THERMODYNAMICS

(Common to ME, AE, 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) What are positive and negative work interactions? [2]
b) What is Quasi static process? [3]
c) Define enthalpy. How is it related to internal energy? [2]
d) Why is the performance of a heat pump or a refrigerator not measured in terms of thermal efficiency, but in terms of COP? [3]
e) What do you understand by triple point? [2]
f) Define an ideal gas. What is universal gas constant? [3]
g) What is Specific humidity and relative humidity? [2]
h) Explain Mole fraction, Volume fraction. [3]
i) What is a ton of refrigeration? [2]
j) What is an air standard cycle? Why are such cycles conceived? [3]

PART-B **(50 Marks)**

2.a) Why does free expansion has zero work transfer?
b) A new scale N of temperature is divided in such a way that the Freezing point of ice 100^0N and the boiling point is 400^0N. What is the temperature reading on this new scale when the temperature is 160^0C? At what temperature both the Celsius and the new temperature scale reading would be the same. [5+5]

OR

3.a) Explain the working of constant volume gas thermometer.
b) 2kg of gas at a pressure of 1.5 bar, Occupies a volume of 2.5 m^3. If this gas compresses isothermally to 1/3 times the initial volume. Find initial, Final temperature, work done, heat transfer. [5+5]

4.a) Discuss the significance of Gibbs and Helmholtz functions.
b) Two blocks of metal, each having a mass of 10 kg and having a specific heat of 0.4 kJ/kg.K, are at a temperature of 40^0C. A reversible refrigerator receives heat from one block and rejects heat to the other. Calculate the work required to cause a temperature difference of 100^0C between the two blocks. [5+5]

OR

5.a) State and prove Clausius theorem.
b) A reversible heat engine operates between two reservoirs at temperatures of 600^0C and 40^0C. The engine drives a reversible refrigerator which operators between reservoirs at temperatures 40^0C and -20^0C. The heat transfer to the heat engine is 2000kJ and the net work output of the combined engine refrigerator plant is 360 kJ. Evaluate the heat transfer to the refrigerator and the net heat transfer to the reservoir at 40^0C. [5+5]

6.a) What is critical state? Explain the terms critical pressure, critical volume and critical temperature of water?

b) A steam pressure of holding capacity 4 m^3 contains a mixture of saturated water and saturated steam at 250^{0}C. The mass of the liquid present is 1 ton. Determine (i) Quality; (ii) Specific Volume; (iii) Specific Enthalpy; (iv) Specific Entropy and (v) Specific Internal Energy of steam. [5+5]

OR

7.a) Write short notes on "Mollier diagram". Why do isobars on the Mollier diagram diverge from one another?

b) A pressure cooker holding 2 kg of steam at 5 bar and 90% dry is being cooled slowly. What quantity of heat has to be extracted so as to reduce the steam quality down to 60%? Also calculate the pressure and temperature of the steam that remains in the pressure cooker after the heat rejection. [5+5]

8.a) Compare and contrast the Gravimetric and volumetric analysis.

b) A sling psychrometer reads 39^{0}C dry bulb Temperature and 35^{0}C wet bulb Temperature. Find the humidity ratio, Relative humidity, dew point Temperature, specific volume, and enthalpy of air. [5+5]

OR

9.a) Explain the following:
i) Heating and dehumidification
ii) Cooling and dehumidification.

b) 100m^3 of air per min at 40^{0}C DBT and 15% relative humidity is passed through adiabatic humidifier. The air is coming out at 25^{0}C DBT and 20^{0}C WBT. Find:
i) Dew Point Temperature
ii) Relative Humidity
iii) Water carried by the air per min. [5+5]

10.a) Derive an expression for thermal efficiency of Otto cycle.

b) An engine works on a diesel cycle with an Inlet pressure and temperature of 1 bar and 17^{0}C. The pressure at the end of the adiabatic compression is 35 bar. The ratio of expansion, i.e. after constant pressure heat addition is 5. Calculate the heat addition, heat rejection and efficiency of the cycle. Assume r=1.4, C_p=1.005 kJ/kgk C_v=0.717 kJ/kgk. [5+5]

OR

11.a) Explain the working of Bell- Coleman cycle.

b) Explain the working of Atkinson Cycle. [5+5]

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