Code No: 133BX

R16

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, November/December - 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 is an ideal gas? [2]
b) What is the difference between the work transfer and heat transfer? [3]
c) What is PMM-I. Justify with reason whether it is feasible or not? [2]
d) A heat pump takes up heat from cold outdoors and transfers it to warmer indoor space. Is this a violation of second law of thermodynamics? Explain. [3]
e) What is the difference between critical point and triple point? [2]
f) Is it true that water boils at higher temperatures at higher pressures? Explain. [3]
g) Define the degree of saturation. What are its limiting values? [2]
h) Distinguish between wet bulb temperature and thermodynamic wet bulb temperature. [3]
i) Draw the P-V and T-S diagram of Lenoir cycle. [2]
j) Compare Otto and Dual cycle for the same maximum pressure and Temperature. [3]

PART-B

(50 Marks)

2.a) Explain the concept of ideal gas temperature scale.
b) A milk chilling unit can remove heat from the milk at a rate of 41.87 MJ/H. Heat leaking into milk from surroundings at an average rate of 4.187 MJ/h. Find the time required for cooling a batch of 500 kg of milk from 45^0C to 5^0C. Take the C_P of milk to be 4.187 kJ/kg K. [5+5]

OR

3.a) Explain what do you understand by concept of continuum? How will you define density and pressure using this concept?
b) A balloon is filled with air (200kPa and 300K) such that it becomes as sphere of diameter 1m. It is then gradually heated till the pressure rises to 500 kPa. Determine the amount of work done during the process, assuming that the pressure inside the balloon is proportional to the diameter of the balloon. [5+5]

4.a) Is the Third law of thermodynamics, an extension of second law? Is it an independent law of nature? Explain.
b) Two bodies of equal heat capacities C and temperatures T_1 and T_2 form an adiabatically closed system. What will be the final temperature be if one lets this system come to equilibrium (i) freely; (ii) reversibly. [5+5]

OR

5.a) Discuss about Clausius Inequality.

b) One kg of ice at -5^0C is exposed to the atmosphere which is at 20^0C. Ice melts and comes into thermal equilibrium with the atmosphere. Determine the entropy increase of the universe. [5+5]

6.a) Steam initially at 0.3 MPa, 250^0C is cooled at constant volume.
i) At what temperature will steam become superheated vapour?
ii) What is the quality of steam at 80^0C?
iii) What is the heat transferred per kg of steam in cooling from 250^0C to 80^0C.

b) Discuss about triple point, critical temperature and critical pressure. [5+5]

OR

7.a) Write the clapeyron equation and point out its utility.

b) In a separating and throttling calorimeter the pressure of the steam before throttling is 10bar. The pressure and temperature of steam after throttling is 1.1 bar and 110^0C respectively. At the separator 0.6 kgs of water is trapped and 3.4 kgs of condensed water is collected from the condenser. Determine the dryness fraction of steam in the main pipeline. Take C_p for superheated steam 2.1 kJ/kg k. [5+5]

8.a) State Avagadro's Hypothesis.

b) A gas mixture contains 1 Kg of O_2 and 3 Kg of N_2. The pressure and temperature of the mixture are 1 bar and 27^0C.
Determine:
i) Mass fraction amd mole fraction of each constituent
ii) Average molecular weight of mixture
iii) Partial Pressure of constituents
iv) Specific gas constant
v) Mixture volume
vi) Mixture density. [5+5]

OR

9.a) A reversible adiabatic process begins at P_1= 10 bar, T_1 = 300^0C and ends with P_2= 2 bar. Find the specific volume and the work done per kg of fluid if (i) the fluid is air and (ii) the fluid is steam.

b) Discuss about sensible heating, cooling and dehumidification processes. [5+5]

10.a) Draw the variation of thermal efficiency against compression ratio of an Otto-cycle.

b) An air standard diesel cycle has a compression ratio of 17. The Pressure at the beginning of compression stroke is 1bar and the temperature is 23^0C. The maximum temperature is 1430^0C. Determine the thermal efficiency and the mean effective pressure for this cycle.Take γ = 1.4. [5+5]

OR

11.a) With a neat sketch explain the working of simple vapour compressing refrigeration cycle and derive the expression for COP.

b) Define mean effective pressure and thermal efficiency of an air standard cycle. [5+5]

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