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Code No: 123AB

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, May/June - 2019

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) Discuss the similarities and dissimilarities between heat and work. [2]
b) What are intensive and extensive properties? [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) What is pure substance? Draw PV diagram for a pure substance. [3]
g) Define the degree of saturation. What are its limiting values? [2]
h) List the six psychrometric processes? [3]
i) State the four processes of Diesel Cycle? [2]
j) What are cyclic and noncyclic heat engines? Give examples. [3]

PART-B

(50 Marks)

2.a) Explain Joules experiment and state the first law of thermodynamics applied to a closed system undergone by a cyclic process.
b) A mass of gas is compressed in a quasi-static process from 80 kPa, 0.1 m^3 to 0.4 MPa, 0.03 m^3. Assuming that the pressures volume are related by PV^n=constant, find network done by gas system. [5+5]

OR

3.a) Show that internal energy is a property of the system.
b) Calculate the amount of heat required to convert 100 kg of ice at -10^0C into steam at 100^0C at normal pressure. Specific heat capacity of ice=2100 J/Kg K, latent heat of fusion of ice =3.36 × 105 J/Kg, specific heat capacity of water=4.2 kg K/kg-K and latent heat of vaporization of water = 2.25×10^6 J/kg. [5+5]

4.a) Write the steady flow energy equation for a single stream entering and a single stream leaving a control volume and explain the various terms in it.
b) Define Claussius inequality and prove it. [5+5]

OR

5.a) Show that the enthalpy of a fluid before throttling is equal to that after throttling.

b) A room for four persons has two fans, each consuming 0.18 kW power, and three 100W lams. Ventilation air at the rate of 80 kg/h enters with an enthalpy of 84kJ/kg and leaves with an enthalpy of 59 kJ/kg. If each person puts out heat at therate of 630 kJ/hr. Determine the rate at which heat is to be removed by a roomcooler, so that a steady state is maintained in the room. [5+5]

6.a) Discuss about dryness fraction of steam.

b) Steam at 0.8 MPa, 250 ^{0}C and flowing at a rate of 1 kg/s passes into a pipe carrying wet steam at 0.8 MPa, 0.9 dry. After adiabatic mixing the flow rate is 2.3 kg/s. Determine the condition of steam after mixing. The mixture is now extended in a frictionless nozzle isentropically to a pressure of 0.4 MPa. Determine the velocity of steam leaving the nozzle. Neglect the velocity of steam in the pipe. [5+5]

OR

7.a) Explain the working of throttling calorimeter.

b) Steam initially at 0.3 MPa, 250^{0}C is cooled at constant volume.
i) At what temperature will steam become superheated vapour?
ii) What is the quality of steam at 80^{0}C?
iii) What is the heat transferred per kg of steam in cooling from 250^{0}C to 80^{0}C. [5+5]

8.a) Derive the expression for change of enthalpy of an ideal gas in a reversible adiabatic process in terms of pressure ratio.

b) Two streams of air 25 ^{0}C, 50% RH and 25 ^{0}C, 60% RH are mixed adiabatically to obtain 0.3 kg/s of dry air at 30 ^{0}C. Calculate the amount of air drawn from both the streams and the humidity ratio of mixed air. [5+5]

OR

9.a) Express the changes in internal energy and enthalpy of an ideal gas in a reversible adiabatic process in terms of the pressure ratio.

b) Atmospheric air at 1 bar and is at 25^{0}C DBT and 15^{0}C WBT. Calculate (i) relative humidity (ii) specific humidity (iii) vapour density in air (iv) DPT(v) enthalpy of mixture. [5+5]

10.a) Mention the merits and demerits of the Stirling and Ericsson cycles.

b) With the help of p-v and T-s diagrams, show that for the same maximum pressure and temperature of the cycle and the same heat rejection, $\eta_{Diesel} > \eta_{Dual} > \eta_{Otto}$ [5+5]

OR

11. In an air standard Diesel cycle, the compression ratio is 16, and at the beginning of isentropic compression, the temperature is 15^{0}C and the pressure is 0.1 M Pa. Heat is added until the temperature at the end of the constant pressure process is 1480 ^{0}C. Calculate:
a) the cut-off ratio,
b) the heat supplied per kg of air,
c) the cycle efficiency and
d) the m.e.p. [10]

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