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Question Paper Code : 31558

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Third Semester

Mechanical Engineering

ME 2202/ME 33/10122 ME 303/ME 1201/080190005 – ENGINEERING THERMODYNAMICS

(Regulation 2008/2010)

(Common to PTME 2202 Engineering Thermodynamics for B.E. (Part – Time) Third Semester Mechanical Engineering – Regulation 2009)

Time : Three hours Maximum : 100 marks

(Use of approved thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables permitted in the Examination)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is microscopic approach in thermodynamics?
2. Define extensive property.
3. State Clausius statement of II law of thermodynamics.
4. Draw a schematic of an heat pump.
5. Define a pure substance.
6. How is Triple point represented in the P–v diagram?
7. Define Avagadro's law.
8. What is a real gas? Give example.
9. Why do wet clothes dry in the sun faster?
10. Define Degree of saturation.

PART B — (5 × 16 = 80 marks)

11. (a) Derive the steady flow energy equation and reduce it for a turbine, pump nozzle and a heat exchanger.

Or

(b) Briefly explain the following :

(i) Point and path function. (4)

(ii) Property, state, process and path (8)

(iii) Quasi-static process. (4)

12. (a) (i) Two Carnot engines A and B are operated in series. The first one receives heat at 870°K and rejects to a reservoir at T. B receives heat rejected by the first engine and in turn rejects to a sink at 300°K. Find the temperature T for

(1) Equal work outputs of both engines (6)

(2) Same Efficiencies (6)

(ii) Mention the Clausius inequality for open, closed and isolated systems. (4)

Or

(b) (i) 3kg of air at 500kPa, 90°C expands adiabatically in a closed system until its volume is doubled and its temperature becomes equal to that of the surroundings at 100kPa and 10°C. Find maximum work, change in availability and the irreversibility. (12)

(ii) Briefly discuss about the concept of entropy. (4)

13. (a) Steam at 480°C, 90 bar is supplied to a Rankine cycle. It is reheated to 12 bar and 480°C. The minimum pressure is 0.07 bar. Find the work output and cycle efficiency using steam tables with and without considering pump work.

Or

(b) (i) Steam initially at 0.3 MPa, 250°C is cooled at constant volume. At what temperature will the steam become saturated vapour? What is the steam quality at 80°C. Also find what is the heat transferred per kg of steam in cooling from 250°C to 80°C. (12)

(ii) When will you call a vapour superheated? Give example. Also when will you call a liquid as compressed liquid? Give example. (4)

14. (a) (i) Derive the Clausius- Clapeyron equation and discuss its significance. (12)

(ii) Write down two Tds relations. (4)

Or

(b) (i) Derive any two Maxwell's relation. (10)

(ii) Draw a neat schematic of a compressibility chart and indicate its salient features. (6)

15. (a) (i) Air at 20°C, 40% R.H is mixed with air at 40°C, 40% R.H in the ratio of (former) 1 :2(later) on dry basis. Determine the final condition of air. (10)

(ii) Briefly discuss about evaporative cooling process. (6)

Or

(b) (i) Define the terms — Relative humidity and Specific humidity. (2 + 2)

(ii) Explain the adiabatic saturation process with a schematic. (8)

(iii) Represent — heating and humidification, cooling and dehumidification processes on a psychrometric chart. (4)

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