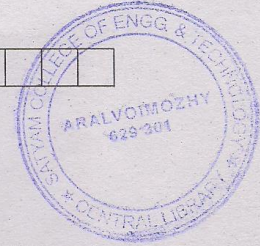


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**Question Paper Code : 31558**



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  $870^{\circ}\text{K}$  and rejects to a reservoir at  $T$ . B receives heat rejected by the first engine and in turn rejects to a sink at  $300^{\circ}\text{K}$ . 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)  $3\text{kg}$  of air at  $500\text{kPa}$ ,  $90^{\circ}\text{C}$  expands adiabatically in a closed system until its volume is doubled and its temperature becomes equal to that of the surroundings at  $100\text{kPa}$  and  $10^{\circ}\text{C}$ . Find maximum work, change in availability and the irreversibility. (12)
- (ii) Briefly discuss about the concept of entropy. (4)
13. (a) Steam at  $480^{\circ}\text{C}$ ,  $90\text{ bar}$  is supplied to a Rankine cycle. It is reheated to  $12\text{ bar}$  and  $480^{\circ}\text{C}$ . The minimum pressure is  $0.07\text{ bar}$ . Find the work output and cycle efficiency using steam tables with and without considering pump work.

Or

- (b) (i) Steam initially at  $0.3\text{ MPa}$ ,  $250^{\circ}\text{C}$  is cooled at constant volume. At what temperature will the steam become saturated vapour? What is the steam quality at  $80^{\circ}\text{C}$ . Also find what is the heat transferred per  $\text{kg}$  of steam in cooling from  $250^{\circ}\text{C}$  to  $80^{\circ}\text{C}$ . (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  $20^{\circ}\text{C}$ ,  $40\%$  R.H is mixed with air at  $40^{\circ}\text{C}$ ,  $40\%$  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)