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Question Paper Code :23573

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Third Semester

Mechanical Engineering

ME 1201/ME 1202/070120006 — ENGINEERING THERMODYNAMICS

(Common to Production Engineering)

(Regulation 2004/2007)

(Common to B.E. (Part-Time) Second Semester — Mechanical Engineering — Regulation 2005)

Time : Three hours Maximum : 100 marks

(Use of standard steam table, Mollier diagram and psychometric chart permitted)

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Differentiate between characteristic gas constant and universal gas constant.

2. Define a quasi static process.

3. What is the significance of Clausius inequality?

4. How does the second law of thermodynamics overcome limitations of first law of thermodynamics?

5. What are the advantages of superheated steam?

6. Write the limitations of maximum and minimum temperatures in a steam power cycle.

7. What is the significance of Maxwell relations?

8. What is the fundamental property of gases with respect to the product pv?

9. Define relative humidity and specific humidity.

10. Define degree of saturation.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Prove that the difference between the two temperatures in Clesius scale is same as that in Kelvin scale. (8)

(ii) How is the first law of thermodynamics applied to a closed system undergoing a non-cyclic process? (8)

Or

(b) (i) Show that internal energy is property. (8)

(ii) A compressed air bottle of volume 0.15 m^3 contains air at 40 bar and27°C. It is used to drive a turbine which exhausts to atmosphere at 1 bar. If the pressure in the bottle is allowed to fall to 2 bar, determine the amount of work that could be delivered by the turbine. (8)

12. (a) (i) Show the equivalence of two statements of second law of thermodynamics. (8)

(ii) Why Carnot cycle is a theoretical cycle? Explain. (8)

Or

(b) (i) State Carnot theorem. Also prove it. (8)

(ii) Explain the entropy of universe is increasing. Calculate the change in entropy of air, if it is throttled from 5 bar, 27°C to 2 bar adiabatically. (8)

13. (a) Derive the expressions for the following:

(i) Work of evaporation or external work of evaporation. (4)

(ii) True latent heat. (4)

(iii) Internal energy of steam. (4)

(iv) Entropy of water. (4)

Or

(b) (i) Explain the throttling calorimeter for dryness fraction measurement. (8)

(ii) A steam power plant uses steam as working fluid and operates at a boiler pressure of 5 MPa, dry saturated and a condenser pressure of 5 kPa. Determine the cycle efficiency for (1) Carnot cycle (2) Rankine cycle. Also show the T-s representation for both the cycles. (8)

14. (a) Write short notes on the following:

(i) Clapeyron – Clausius equation. (6)

(ii) Dalton's law of partial pressure. (5)

(iii) Joule – Thomson coefficient. (5)

Or

(b) (i) Derive an expression for change in entropy of a as obeying Vander Waals equation of state. (8)

(ii) Show that for an ideal as the internal energy depends only on its temperature. (8)

15. (a) Two streams of moist air, one having flow rate of 3 kg/s at 30°C and 30% relative humidity, other having flow rate of 2 kg/s at 35°C and 85% relative humidity get mixed adiabatically. Determine specific humidity and partial pressure of water vaporafter mixing. Take Cp, stream = 1.86 kJ/kg.K. (16)

Or

(b) Determine partial pressure of vapour and relative humidity in the atmospheric air having specific humidity of 16 gm/k of air and 25°C DBT. (16)