

CBCS SCHEME

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18AU32

Third Semester B.E. Degree Examination, June/July 2023 Engineering Thermodynamics

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of thermodynamics data hand book, steam table, psychrometry chart allowed.

Module-1

- 1 a. Distinguish between :
- Open System and Closed System
 - Mechanical and Chemical Equilibrium
 - Intensive and Extensive Properties
 - Macroscopic and Microscopic Approach. (08 Marks)
- b. State and explain Zeroth law of thermodynamics. (04 Marks)
- c. The reading t_A and t_B of two Celsius thermometers A and B agree at the ice point and the steam point and are related by the equation $t_A = \ell + m t_B + n t_B^2$. Between these two points ℓ , m , n are constants. When both are immersed in an oil both, A indicates 55°C and B indicates 50°C . Determine the values of ℓ , m and n and also find the reading on A if B reads 25°C . (08 Marks)

OR

- 2 a. Derive an expression for work done during quasistatic process. (06 Marks)
- b. Define work and heat, mention similarities and dissimilarities between them. (06 Marks)
- c. Explain constant volume gas thermometer with neat sketch. (08 Marks)

Module-2

- 3 a. Derive Steady Flow Energy Equation (SFEE) state assumptions mode. (08 Marks)
- b. Prove that internal energy a property of a system. (08 Marks)
- c. What are PMM – I and PMM – II? (04 Marks)

OR

- 4 a. State Kelvin – Planck and Clausius statements of second law of thermodynamics and show that violation of Clausius statement leads to violation of Kelvin Planck's statement. (08 Marks)
- b. One kg of air at 15°C and 98.1KPa is compressed isentropically to 588.6KPa . Determine the final temperature and the work done. If the air is now cooled to 15°C at constant pressure, find the heat exchanged. (06 Marks)
- c. A 1m^3 container is filled with air at 0.20MPa and 70°C . Calculate the final pressure in the container if 10kJ of heat are added. Assume ideal gas behavior with constant specific heats. (06 Marks)

Module-3

- 5 a. Prove that entropy a property of a system. (08 Marks)
- b. State and prove Clausius inequality. (08 Marks)
- c. What is available and unavailable energy? (04 Marks)

OR

- 6 a. Define following terms :
- Heat of fusion
 - Wet steam
 - Triple point
 - Sensible heat
 - Saturation temperature
 - Dryness fraction.
- (06 Marks)
- b. Sketch and explain the PT diagram of water. (06 Marks)
- c. Explain with neat sketch, the method of estimating quality of steam by throttling Calorimeter. (08 Marks)

Module-4

- 7 a. Explain vapor absorption refrigeration system with a neat sketch. (08 Marks)
- b. Explain steam jet refrigeration with sketch. (08 Marks)
- c. Explain desirable properties of refrigerants. (04 Marks)

OR

- 8 a. Explain summer air conditioning system for :
- Hot and dry outdoor condition
 - Hot and wet outdoor condition.
- (10 Marks)
- b. A hall is to be air conditioned for 100 persons requiring $0.5\text{m}^3/\text{min}/\text{person}$. Outdoor condition = 35°C DBT, 65% RH, Required conditions = 15°C DBT, 40% RH. The required conditions are achieved first by cooling and dehumidification and then by heating, find :
- Capacity of the humidifier
 - Cooling coil capacity
 - Heating coil capacity.
- (10 Marks)

Module-5

- 9 a. Derive an expression for work done in a single stage compressor by neglecting clearance volume. (10 Marks)
- b. Derive the condition for maximum work input to a two-stage compressor with perfect inter cooling between stages. (06 Marks)
- c. Explain the necessity of multi-stage compression using P-V diagram. (04 Marks)

OR

- 10 a. Explain open and closed cycle gas turbine cycles. (10 Marks)
- b. Explain with a neat sketch :
- Turbo – jet engine
 - Rocket propulsion.
- (10 Marks)
