Code No: R201254 **R20** SET - 1

I B. Tech II Semester Regular Examinations, September- 2021

THERMODYNAMICS

(Only ME)

Time: 3 hours Max. Marks: 70

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

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UNIT-I

1 a) What is a thermodynamic system? Explain different classes of systems with suitable examples. (7M)

b) A balloon is filled with air (200 kPa and 300K) such that it becomes as sphere of diameter 1m. It is then gradually heated till the pressure rises to 500 kPa. Determine the amount of work done during the process, assuming that the pressure inside the balloon is proportional to the diameter of the balloon. (7M)

Or

2 a) Discuss exact and inexact differentials. (7M)

b) Explain what do you understand by concept of continuum? How will you define density and pressure using this concept? (7M)

UNIT-II

3 a) State the first law of thermodynamics and prove that for a non-flow process, it leads to the energy equation. (7M)

b) Explain joule's Experiment. (7M)

Or

4 a) Define internal energy and prove that it is a property of the system. (7M)

b) A system executes a cyclic process during which there are four transfers of heat as given as follows: Q_{12} = 880 kJ; Q_{23} = 100 kJ; Q_{34} = -720 kJ; Q_{41} = 200 kJ. The work transfers during the processes are given as: W_{12} = 60 kJ; W_{23} = -40 kJ; W_{34} = 80 kJ. Find W_{41}. (7M)

UNIT-III

5 a) Given an expression for entropy changes for an open system. (5M)

b) An ice plant working on a reversed Carnot cycle heat pump produces 15 ton of ice per day. The ice is formed from water at 0^0C and the formed ice is maintained at 0^0C. The heat is rejected to the atmosphere at 25^0C. The heat pump used to run the ice plant is coupled to a Carnot engine which absorbs heat from a source which is maintained at 220^0C by burning liquid fuel of 44500 kJ/kg calorific value and rejects the heat to the atmosphere. Determine: (i) Power consumed by the engine. (ii) Fuel consumed per hour. Take enthalpy of fusion of ice = 334.5 kJ/kg. (9M)

Or

6 a) Two blocks of metal, each having a mass of 10 kg and having a specific heat of 0.4 kJ/kg.K, are at a temperature of 40^0C. A reversible refrigerator receives heat from one block and rejects heat to the other. Calculate the work required to cause a temperature difference of 100^0C between the two blocks. (7M)

b) Define Kelvin –Planck and Clausius statements. Prove that violation one Statement leads to a violation of the other Statement. (7M)
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UNIT-IV

7 a) Write the clapeyron equation and point out its utility. (7M)

b) Steam initially at 0.3 MPa, 250^0C is cooled at constant volume. (7M)
i) At what temperature will steam become superheated vapour?
ii) What is the quality of steam at 80^0C?
iii) What is the heat transferred per kg of steam in cooling from 250^0C to 80^0C.

Or

8 a) In a separating and throttling calorimeter the pressure of the steam before throttling is 10bar. The pressure and temperature of steam after throttling is 1.1 bar and 110^0C respectively. At the separator 0.6 kgs of water is trapped and 3.4 kgs of condensed water is collected from the condenser. Determine the dryness fraction of steam in the main pipeline. Take Cp for superheated steam as 2.1 kJ/kg k. (7M)

b) Discuss about triple point, critical temperature and critical pressure. (7M)

UNIT-V

9 a) Define the terms Specific humidity, Relative humidity and Degree of saturation. Draw the same on Psychometric chart. (7M)

b) Methane has a specific heat at constant pressure given by Cp=17.66 +0.06188T kJ/kg mol K when 1 kg of methane is heated at constant volume from 27°C to 500°C. If the initial pressure of the gas is 1 atm, calculate the final pressure, the heat transfer, the work done and the change in entropy. (7M)

Or

10 a) State and explain the importance of internal energy and enthalpy of gas mixtures. (7M)

b) A sling psychrometer reads 39^0C dry bulb Temperature and 35^0C wet bulb Temperature. Find the humidity ratio, Relative humidity, dew point Temperature, specific volume, and enthalpy of air. (7M)