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18AU32

Third Semester B.E. Degree Examination, Dec.2024/Jan.2025
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 tables, Psychrometry chart are allowed.

Module-1

1   a.   Define a thermodynamics system, cycle, process, property and thermal equilibrium.
(10 Marks)
   b.   Using zeroth law of thermodynamics, explain the temperature concept.   **(10 Marks)**

OR

2   a.   Define work and heat. Mention the sign convention for both. Also give the comparison between them.   **(10 Marks)**
   b.   Explain the following with sketch
      (i)   electrical work
      (ii) paddle wheel work   **(10 Marks)**

Module-2

3   a.   Explain unsteady flow process namely tank filling and tank emptying process with relation.
(10 Marks)
   b.   50Kg/min enters the control volume of a steady flow system at 2 bars and 100°C and at elevation of 100m above the datum. The same mass leaves the control volume at 150m elevation with a pressure of 10 bars and temperature of 300°C. The entrance velocity is 2400m/min and exit velocity is 1200m/min. During the process 50000 kJ/hr of heat is transferred to the control volume and the rise in enthalpy is 8kJ/kg. Calculate the power developed. Also find the ratio of inlet to outlet diameter of pipe.   **(10 Marks)**

OR

4   a.   State Kelvin – Planck's and Clausius statement of second law of Thermodynamics and prove that they are equivalent.   **(08 Marks)**
   b.   The minimum power required to drive a heat pump which maintains a house of 20°C is 3kW. If the outside temperature is 3°C, estimate the amount of heat which the house loses per minute.   **(08 Marks)**
   c.   Briefly explain PMM II and PMM I.   **(04 Marks)**

Module-3

5   a.   Sketch and explain working of Carnot engine.   **(10 Marks)**
   b.   A heat engine absorbs 200 kJ/s of heat at 227°C and rejects heat at 27°C. Three separate cases of heat rejection are reported. (i) 180 kJ/s heat rejected   (ii) 120 kJ/s heat rejected (iii) 60 kJ/s heat rejected. Classify each cycle.   **(10 Marks)**

OR

6 a. With a neat diagram, explain P-V-T surface. (06 Marks)
   b. With a neat diagram, explain the working of throttling calorimeter. (06 Marks)
   c. The following data were recorded in a test on a combined separating and throttling calorimeter. Pressure of steam sample = 15 bar ; Pressure of steam at exit = 1 bar ; Temperature of steam at exit = 150°C ; Discharge from separating calorimeter = 0.5 kg/min ; Discharge from throttling calorimeter = 0.5 kg/min . Determine the dryness fraction of steam sampled. (08 Marks)

Module-4

7 a. With neat sketches (including T-S and p-h diagrams), explain vapour compression refrigeration system. (10 Marks)
   b. What is a refrigerant? Explain the desirable properties of refrigerants. (10 Marks)

OR

8 a. The conditions of atmospheric air is 40°C DBT and 40% RH. The air is cooled to 25°C DBT. If the air supply to the system is 200 m³/min, find :
   (i) Heat removed from air per minute
   (ii) RH of air
   Take air pressure to be 1.01325 bar. (10 Marks)
   b. With the help of schematic diagram and appropriate psychrometric chart, explain winter air conditioning system. (10 Marks)

Module-5

9 a. Derive the expression for the isothermal work done by a single state reciprocating compressor with and without clearance volume. (12 Marks)
   b. Explain Multi-stage compression with sketch. Mention its advantages. (08 Marks)

OR

10 a. Explain with neat sketch, types of gas turbines. (10 Marks)
    b. Write short notes on :
       i) Turbojet engine
       ii) Rocket propulsion. (10 Marks)

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