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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 tables, Psychometric chart allowed.

Module-1

1　a.　Distinguish between :
　　　i)　　Macroscopic and microscopic approaches
　　　ii)　　Intensive and extensive properties
　　　iii)　Thermal and mechanical equilibrium
　　　iv)　Cyclic and non-cyclic process
　　　v)　　Diathermic and adiabatic walls. 　　　　　　　　　　　**(10 Marks)**
　　b.　A certain thermometer using pressure as a thermometric property gives values of P of 1.86 and 6.81 at ice point and steam point respectively. If ice point and steam point are assigned the numbers 10 and 120 respectively, determine the temperature corresponding to P = 2.3. The temperature is given by $t = a + b \ln P$. 　　　　　　　**(10 Marks)**

OR

2　a.　Define work and heat, write the similarities and dissimilarities between them. 　**(06 Marks)**
　　b.　Derive an expression for displacement work is a quasistatic process. 　　**(06 Marks)**
　　c.　A mass of gas is compressed in a quasistatic process from 80KPa, 0.1m³ to 0.4MPa, 0.03m³. Assuming that the pressure and volume are related by $PV^n =$ constant, find the work interaction during the process. 　　　　　　　　　　　　　　　**(08 Marks)**

Module-2

3　a.　Explain Joule's experiment. 　　　　　　　　　　　　　　　**(06 Marks)**
　　b.　Explain unsteady flow process namely tank filling and tank emptying process with relation 　　　　　　　　　　　　　　　　　　　　　　　　　　　　**(06 Marks)**
　　c.　Steam having a specific enthalpy of 2930kJ/kg flows through a turbine nozzle and after expansion leaves the nozzle with an enthalpy 2260 kJ/kg. If the flow is adiabatic, determine the exit velocity. Initial velocity is 3600m/min. 　　　　　　　　**(08 Marks)**

OR

4　a.　State Kelvin-Planck's and Clausius statement of second law of thermodynamic and prove that they are equivalent. 　　　　　　　　　　　　　　　　　**(08 Marks)**
　　b.　What are PMM I and PMM II? 　　　　　　　　　　　　　　**(04 Marks)**
　　c.　A series combination of two Carnot engines operate between the temperatures of 180°C and 20°C. Calculate the intermediate temperature, if the engines produce equal amounts of work. 　　　　　　　　　　　　　　　　　　　　　　　　**(08 Marks)**

Module-3

5　a.　Prove that entropy a property of a system. 　　　　　　　　　**(06 Marks)**
　　b.　Define available and unavailable energy. Explain. 　　　　　　**(08 Marks)**
　　c.　Explain the principle of increase of entropy. 　　　　　　　　**(06 Marks)**

OR

6 a. Draw a P-T diagram for pure substance and explain all necessary points on it. (06 Marks)
   b. Determine the amount of heat, which should be supplied to 2kg of water of 25°C to convert it into steam at 5 bar and 0.9 dry. (04 Marks)
   c. A pressure cooker contains 1.5kg of steam at 5 bar 0.9 dryness. When the gas was switched off, determine the quantity of heat rejected by the pressure cooker when the pressure in the cooker fall to 1 bar. (10 Marks)

Module-4

7 a. What is refrigeration? Explain with the neat sketch the working principle of vapour compression refrigeration system. (08 Marks)
   b. With neat sketch, explain vapour absorption refrigeration system. (06 Marks)
   c. What are the desirable properties of good refrigerant? (06 Marks)

OR

8 a. Define :
      i) Dry bulb temperature (DBT)
      ii) Wet bulb temperature (WBT)
      iii) Relative humidity
      iv) Specific humidity. (04 Marks)
   b. Explain the following psychrometric process
      i) Sensible cooling
      ii) Sensible heating
      iii) Humidification
      iv) Dehumidification
      v) Heating and humidification. (10 Marks)
   c. Air at 30°C DBT and 25°C WBT is heated to 40°C. If the air is 300m³/min, find the amount of heat added/min and RH and WBT of air. Take air pressure to be 1 bar. (06 Marks)

Module-5

9 a. Derive an expression for mean effective pressure in an air standard otto cycle. (10 Marks)
   b. Derive the expression for thermal efficiency and mean effective pressure for diesel cycle. (10 Marks)

OR

10 a. Describe how the IP of a multicylinder engine is measured through monse test. (05 Marks)
   b. Explain Rope brake dynamometer, with neat sketch. (05 Marks)
   c. From the following data draw on heat balance for a two-stroke diesel engine run for 20 minutes at full load.
      Speed = 350rpm, MEP = 3bar, Net brake load = 640N, Fuel consumption = 1.5kg, Cooling water = 160kg, water inlet temperature = 35°C, water outlet temperature = 60°C, Air used per kg of fuel = 30kg, Room temperature = 20°C, Exhaust temperature = 300°C, cylinder bore = 200mm, cylinder stroke = 300mm, brake diameter = 1000mm, calorific value of fuel = 44000kJ/kg, specific heat of dry exhaust gases = 1.01kJ/kg k. (10 Marks)

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