CBCS SCHEME

USN | | | | | | | | | | |

21AU34

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.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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, $0.1m^3$ to 0.4MPa, $0.03m^3$. 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 300m^3/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)**

* * * * *