R20

SET - 1

I B. Tech II Semester Supplementary Examinations, March- 2022
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) Explain in detail the working of constant volume gas thermometer.   (7M)

   b) Show that work is a path function and not a property.   (7M)

Or

2 a) Explain what you understand by (i) Macroscopic and Microscopic view points;   (7M)
       (ii) Thermodynamic Equilibrium.

   b) A fluid contained in a horizontal cylinder fitted with a frictionless leak proof   (7M)
       piston, is continuously agitated by means of a stirrer passing through the cylinder
       cover. The cylinder diameter is 0.4 m. During the stirring process lasting 10
       minutes, the piston slowly moves out a distance of 0.485 m against the
       atmosphere. The net work done by the fluid during the process is 2 kJ. The speed
       of the electric motor driving the stirrer is 840 rpm. Determine the torque in the
       shaft and power output of the motor.

UNIT-II

3   A fluid system, contained in a piston and cylinder machine, passes through a   (14M)
    complete cycle of four processes. The sum of all heat transferred during a cycle
    is -170 kJ. The system completes 100 cycles per minute. Complete the following
    table showing the method for each item and compute the net rate of work output
    in kW.

Process	Q (kJ/min)	W (kJ/min)	ΔE (kJ/min)
1-2	0	2170	--
2-3	21000	0	--
3-4	-2100	--	-36600
4-1	--	--	--

Or

4 a) Show that energy is a property of a system.   (7M)

   b) A fluid contained in a cylinder receives 150 kJ of mechanical energy by means of   (7M)
       a paddle wheel, together with 50 kJ in the form of heat. At the same time, the
       piston in the cylinder moves in such a way that the pressure remains constant at
       200 kN/m^2 during the fluid expansion from 2 m^3 to 5 m^3. What is the change in
       internal energy and in enthalpy?

UNIT-III

5 a) 1.2 m^3 of air is heated reversibly at constant pressure from 300 K to 600 K and is   (7M)
       then cooled reversibly at constant volume back to initial temperature. If the initial
       pressure is 1 bar, calculate the net heat flow and overall change in entropy. Take
       Cp = 1.005 kJ/kgK and R = 0.287 kJ/kgK.

   b) State and prove Clausius theorem.   (7M)

Or

6   a)   Define Carnot efficiency and which is the more effective way to increase the efficiency of a Carnot cycle: to increase T_1 keeping T_2 constant; or to decrease T_2, keeping T_1 constant? Where T_1 is upper temperature and T_2 is lower temperature.   (8M)

    b)   Discuss the significance of Gibbs and Helmholtz functions.   (6M)

UNIT-IV

7   a)   Write short notes on "Mollier diagram". Why do isobars on the Mollier Diagram diverge from one another?   (7M)

    b)   Sample of steam from a boiler drum at 3 MPa is put through a throttling calorimeter in which pressure and temperature are found to be 0.1 MPa, 120^0C. Find the quality of a sample taken from the boiler.   (7M)

Or

8   a)   Why cannot a throttling calorimeter measure the quality if the steam is very wet? How is the quality measured then?   (7M)

    b)   A pressure cooker holding 2 kg of steam at 5 bar and 90% dry is being cooled slowly. What quantity of heat has to be extracted so as to reduce the steam quality down to 60%? Also calculate the pressure and temperature of the steam that remains in the pressure cooker after the heat rejection.   (7M)

UNIT-V

9   a)   Explain Dalton's law of partial pressures.   (7M)

    b) $100m^3$ of air per min at 40^0C DBT and 15% relative humidity is passed through adiabatic humidifier. The air is coming out at 25^0C DBT and 20^0C WBT. Find: i) Dew Point Temperature ii) Relative Humidity iii) Water carried by the air per min.   (7M)

Or

10   a)   Explain the following: (7M)
        i) Heating and dehumidification
        ii) Cooling and dehumidification.

    b)   Air at 20^0C, 40% RH is mixed adiabatically with air at 40^0C, 40% RH in the ratio of 1 kg of former with 2 kg of the latter (on dry basis). Find the final condition of air.   (7M)

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