Name: **Roll No.:**

Indian Institute of Technology Kanpur

Thermodynamics (ESO201A)

Semester: 2022-23-I

Quiz#2 (Set B)

Time Limit: 30 min   **Full Marks: 15**

1. The refrigerant R-134a is used as the working fluid in a refrigerator. The mass flow rate through each component is 0.1 kg/s, and the power input to the compressor is 5 kW. Determine (i) the quality at the evaporator inlet, (ii) the magnitude of the rate of heat transfer to the evaporator, and (iii) The magnitude of the rate of heat transfer from the compressor. State all assumptions; draw a schematic diagram of the vapour compression refrigeration system indicating the direction of the refrigerant flow and the locations of the inlet and exit points, 1, 2, 3, 4; and show the control volume for the throttle, the evaporator and the compressor, respectively. Note that:1 $\rightarrow$ Exit of the evaporator, 2 $\rightarrow$ Inlet to the condenser, 3 $\rightarrow$ Inlet to the throttle, 4 $\rightarrow$ Inlet to the evaporator. Data: P_1 = 100 kPa, T_1 = -20°C; P_2 = 800 kPa, T_2 = 50°C; T_3 = 30°C, x_3 = 0.0; T_4 = -20°C, h_4 = 241.8 kJ/kg, $h_{f@4}$ = 167.4 kJ/kg, $h_{fg@4}$ = 215.6 kJ/kg, h_1 = 387.2 kJ/kg, h_2 = 435.1 kJ/kg. Use the front and the reverse of this sheet to write your solution.

(2 + 4 + 3 + 6 = 15)