

Notes : The Charts and Tables are Allowed

Q1 - Answer one branch

a) For transparent surface show that with sketch and details the heat passing through glasses (q_{sg}) and for opaque surface show that the heat transfer through wall (q_w) as shown below respectively.

$$q_{sg} = A \times SHGF \times SC$$

$$q_w = U_w A [t_e - t_i]$$

b) For a heat pump show that with sketch and details the performance factor (PF) is greater than the coefficient of performance (COP) by unity (PF=COP+1).

(20 marks)

Q2- In a closed expansion tank the change in air volume between cold water condition (26 °C) and operation water condition (84 °C) is to be (1/5) one to fifth from the tank volume, if $P_i = 100$ k Pa , the hot Pressure $P_h =$ k Pa. What will be the cold Pressure (P_c)?

(20 marks)

Q3- Answer one branch

a) A single phase fan runs at 900 rpm delivers 3600 l/hr, the fan input power 1.5 kW and (imp%=.9, motor%=.95 and PF=.7) when the density is 1.2 kg/ m³. Assume that the air density is increase to 1.3 kg/ m³. Find the overall motor drive power and total pressure for the fan in the two cases.

b) when a water flow through a pipe at a rate of 300 l/min. at 90 °C. Find the pressure drop of a 60 m pipe length and 3 inch diameter, if there are 3 open gate valve and 2 standard elbow as a fitting.

(20 marks)

Q4- a) In an air-conditioning unit the compressor has two cylinders each has a bore and stroke 5.65 and 5 cm respectively, It is speed 1450 rpm, volumetric efficiency 100% and working fluid enters expansion valve at 40 °C and the temperature of its return suction -10 °C. Find the heat capacity of the unit and the mass flow rate of the refrigerant (Freon 134a).

b) find the mass flow rate of the refrigerant if the clearance factor is 4 %.

(20 marks)

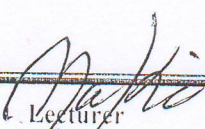
Q5- a) For Li Br-water absorption refrigeration system the following data are known, heat capacity of the evaporator is (2 kW), Generator temp.=78 °C, condenser temp.=38 °C evaporator temp.= 4 °C and Absorber temp.=34 °C. Find a- Properties (p, t, h, and x) b- The mass flow rates and heat rejected or added for all components , COP_{th} and COP_{act}.

b) Show that the coefficient of performance for absorption refrigeration system as shown below.

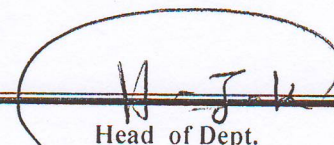
$$cop = \frac{Te(Tg - Ta)}{Tg(Ta - Te)}$$

(20 marks)

Good Luck


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