Roll No. | | | | | | | | | | | | **Total No. of Pages : 02**

Total No. of Questions : 09

B.Tech. (AE) (Sem.–5th)

HEAT EXCHANGE & AIR CONDITIONING

Subject Code : AE-307

Paper ID : [A0716]

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students has to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.**

SECTION-A

l. Answer briefly :

a) What are the limitations of reversed Carnot cycle?

b) Explain the difference between comfort air conditioning and industrial air conditioning.

c) What do you mean by Fouling factor? How it is calculated?

d) Explain how a refrigerant produces cooling effect?

e) Explain the terms Effectiveness ($\in$) and capacity ration (C) with respect to a heat exchanger.

f) How heat exchangers are classified on the basis of nature of heat exchange process?

g) What do you mean by overall heat transfer coefficient (U)?

h) Sketch :

i) Cooling and dehumidification

ii) Heating and humidification processes on *Ph* chart.

i) How do you classify refrigerant evaporators?

j) Differentiate between primary and secondary refrigerants.

SECTION-B

2. Derive an expression for calculating effectiveness for a counter flow heat exchanger. Discuss the application of resulting expression on boiling and condensation process as well as gas turbine recuperator.
3. After a long time in service, a counter flow cooler is checked to ascertain if its performance has deteriorated due to fouling. In the test, SAE 50 oil (C_p = 2.33 kJ/kg – K) flowing at 2.0 kg/s is cooled from 420 K to 380 K by a water supply of 1.0 kg/s at 300 K. If the heat transfer surface is 3.33 m^2 and the design value of overall heat transfer coefficient is 930 W/m^2 – K , how much has it been reduced by fouling?
4. Discuss the criteria used for selection of an air conditioning system.
5. Explain the effect of presence of non-condensable gases on condenser performance.
6. What is the required wattage of an electrical heater that heats 0.1 m^3/s of air from 15°C and 80%.RH to 15°C? The barometric pressure is 101.325 kPa.

SECTION-C

7. Cold water at 1495 kg/h enters at 25°C through a parallel flow heat exchanger to cool 605 kg/h of water entering at 70°C and leaving at 50°C. Find the area of heat exchanger. The individual heat transfer coefficients on both sides are 1590 W/m^2 – K. Use LMTD and NTU methods. Find also the exit temperatures of cold and hot fluid streams in this heat exchanger, if the hot water flow rate is doubled. Assume that the heat transfer rate is proportional to 0.8^{th} power of flow rate.
8. Air at dry bulb temperature of 30°C and 60% relative humidity enters a cooling coil at the rate of 250 m^3/min.
   (a) Determine the refrigeration in *ton* needed to bring the temperature of air to the coil temperature of 23°C and also the relative humidity at that condition.
   (b) If the effective surface temperature of the cooling coil or ADP is 12°C and the by-pass factor is 0.1, determine the refrigeration in *ton* needed and the mass of water condensed out at the cooling coil per minute. Determine also the sensible heat factor for the process through the coil.
9. Write short notes on the following :
   (a) Plate type heat exchangers
   (b) Automatic expansion valve
   (c) Estimation of cooling capacity of system