

B. TECH.

THEORY EXAMINATION (SEM-VIII) 2016-17

DESIGN OF THERMAL SYSTEM

Time : 3 Hours

Max. Marks : 100

Note : Be precise in your answer. In case of numerical problem assume data wherever not provided.

SECTION – A

1. Attempt all parts of the following questions:

10 x 2 = 20

- (a) What is by-pass factor?
- (b) What is sensible heating process?
- (c) What is surging?
- (d) What is polytropic efficiency of compressor?
- (e) What is difference between centrifugal compressor and Axial flow compressor?
- (f) What is slip factor?
- (g) What is fouling factor in heat exchanger and how to reduce it?
- (h) How to optimize the size of condenser?
- (i) What is environmental consideration for design of thermal system?
- (j) What are factor required for selection of heat exchanger?

SECTION – B

2. Attempt any five of the following questions:

5 x 10 = 50

- (a) Classify internal and system heat gain? And also explain each with classification?
- (b) Design a condenser for a refrigeration system using R-717. The condensing temperature is 313 K and the condensate is sub cooled by 10 K. Enthalpy at the end of compression is 1530 kJ/Kg. The refrigerant flow rate is 0.1 kg/s. The economic water velocity is 1.5 m/s and is related with the overall heat transfer coefficient (on outer diameter) ($\text{Kj/m}^2\text{-s-K}$)

$$\frac{1}{U} = 0.13 + \frac{0.5}{V^{0.8}}$$

- Pipe diameter are $D_i = 15$ mm and $D_o = 20$ mm and pipe length not to be exceeds 3000 mm. The water temperature rise is 5 K with inlet temperature 303 K. Obtain the number of tubes. Using the energy balance between cooling water and heating capacity, get the number of tubes through which water enters in the beginning.
- (c) What type of compressor is most commonly used in refrigerators and windows air conditioners? Name the important parts of reciprocating compressor and explain the working of each part with neat sketch.
 - (d) How is a motor selected for a compressor?
 - (e) Describe a cold storage. Does it preserve frozen foods only? What factors are considered in the design of cold storage?
 - (f)
 - (i) What is air conditioning?
 - (ii) What effect does infiltration or ventilation have on the cooling load?
 - (g) What is difference between multi-stage refrigeration and cascade refrigeration?
 - (h) Derive an relationship between the effectiveness and number of transfer unit for a counter flow heat exchanger.

Attempt any two of the following questions:

2 x 15 = 30

- 3 A single compression system uses ammonia as the working medium. The pressure limits are 15.99 bar and 2.908 bar. Get:-
- Kilogram of ammonia circulated/ tons
 - Heat transfer from condenser /second/ton
 - Compressor work/ tons
 - Coefficient of performance and compressor displacement.
- 4 Following results were obtained in test conducted on a vapour compression refrigerant: Evaporator temperature = -28.5°C, condenser pressure = 2.75 bar, refrigerant entering the condenser at 3 °C superheat, refrigerant leaving the condenser is at 12.8 °C. Determine the COP. The following properties are given:

P (bar)	Saturation Temp(°C)	Enthalpy (kJ/kg)		Entropy vapour (kJ/kg K)	Specific heat at constant pressure (kJ/kg K)	
		h_f	h_g		Liquid	vapor
2.75	14	438.48	802.9	5.5287	1.381	0.669
0.412	-28.5	381.58	783.24	5.6852	-----	-----

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- Represent optimization problem mathematically.
 - State various types of simulation techniques.