Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII (NEW) - EXAMINATION – SUMMER 2018

Subject Code: 2181924 Date: 02/05/2018

Subject Name: Design of Heat Exchanger(Department Elective III)

Time: 10:30 AM to 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			MARKS
Q.1	**(a)**	According to constructional features classify heat exchange equipments.	**03**
	(b)	Explain the factors to be considered while selecting heat exchangers?	**04**
	(c)	With usual nomenclature derive ε – NTU method for counter flow heat exchanger.	**07**
Q.2	**(a)**	Explain parallel and series arrangements of hairpin heat exchanger with its sketch.	**03**
	(b)	Explain any two effects of fouling in heat exchanger.	**04**
	(c)	What is hairpin heat exchanger? List the steps for design procedure of double pipe heat exchanger and list application of it.	**07**
		OR	
	(c)	Derive expression for hydraulic diameter and equivalent diameter in case of double pipe heat exchanger with and without fin with neat sketch.	**07**
Q.3	**(a)**	Why compact heat exchangers are more suitable for gaseous fluid?	**03**
	(b)	Explain the effect of Heat Transfer and Pressure Drop in compact heat exchanger.	**04**
	(c)	Air at 1 atm and 400 K and with a velocity of u_∞= 10 m/s flows across a compact heat exchanger matrix having σ(Amin/Afr) = 0.534 and Hydraulic diameter (Dh) = 0.3633 cm. Calculate the heat transfer coefficient, h and frictional pressure drop for air side. The length of matrix is 0.6 m. Use following properties ρ = 0.8825 kg/m^3, μ = 2.29 × 10^{-5} kg/ms, Cp = 1013 J/kg K, Pr = 0.719. Use Figure. 1 for extra data.	**07**
		OR	
Q.3	**(a)**	Why fouling fluids are not used in compact heat exchangers?	**03**
	(b)	Explain in brief plate fin heat exchanger and tube fin heat exchanger.	**04**
	(c)	What are the techniques used for heat transfer enhancement in compact heat exchanger?	**07**
Q.4	**(a)**	Explain pinch analysis.	**03**
	(b)	What is a baffle? Discuss different type and geometry of baffles used in shell and tube heat exchanger.	**04**
	(c)	List the various ways with reason to improve performance of shell and tube heat type heat exchanger.	**07**
		OR	
Q.4	**(a)**	Discuss the various methods for enhancement of heat transfer.	**03**
	(b)	In which type of heat exchangers multipass system is used and What is the need of it?	**04**
	(c)	Explain methods for performance evaluation of Heat Transfer Enhancement technique.	**07**
Q.5	**(a)**	List the steps for design procedure of shell and tube heat exchanger.	**03**
	(b)	Shell and tube type heat exchangers are the most common type of heat exchangers .Why? State its different applications in industries.	**04**

(c) Distilled water with a flow rate of 50 kg/s enters a baffled shell-and-tube heat exchanger at 32° C and leaves at 25° C. Heat will be transferred to 150 kg/s of raw water coming from a supply at 20° C. Design a heat exchanger for this purpose and find out heat transfer coefficient using kern method. A single shell and single tube pass is preferable. The tube diameter is ¾" (19 mm OD and 16 mm ID) and tubes are laid out in 1" (25.4 mm) square pitch. A maximum length of the heat exchanger of 8 m is required because of space limitations. The tube material is 0.5 Cr-alloy (k=42.3 W/m . K). Assume a total fouling resistance of 0.000176 m^2 .K/W. Note that surface over design should not exceed 30 %. The maximum flow velocity through the tube is also suggested to be a 2 m/s to prevent erosion. Perform a thermal and hydraulic analysis of the heat exchanger. Assume following data: The properties of the tube-side fluid at 20° C are C_p = 4182 J/kg.K; k = 0.598 W/m^2 .K; P_r = 7.01; ρ = 998.2 kg/m^3 ; μ = 10.02 × 10^{-4} N.s / m^2 ; baffle spacing = 0.5 m (25 % cut); CTP = 0.93; CL = 1.0. **07**

OR

Q.5 **(a)** What is the use of tie rods and spacers in shell-and-tube heat Exchangers ? **03**

(b) Discuss various shell types suggested by TEMA standard for shell and tube heat exchangers. **04**

(c) Name and explain the various leakages and bypass streams taken in to account in determination of shell side heat transfer coefficient and pressure drop in Bell Delaware method. **07**

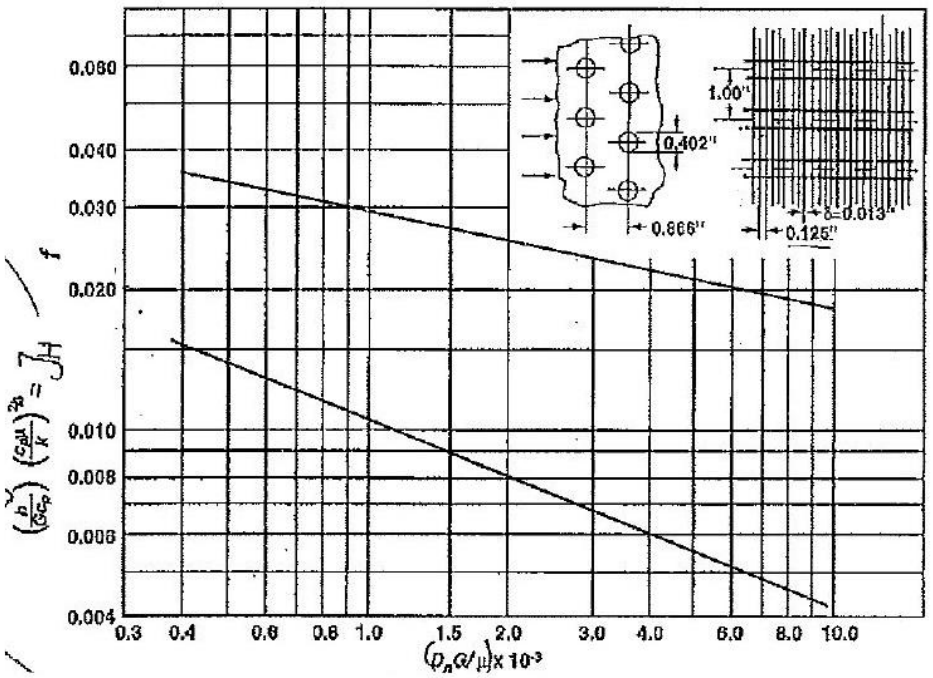

Figure. 1

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