

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 $u_{\infty} = 10$ m/s flows across a compact heat exchanger matrix having $\sigma(A_{min}/A_{fr}) = 0.534$ and Hydraulic diameter (D_h) = 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 $\rho = 0.8825$ kg/m ³ , $\mu = 2.29 \times 10^{-5}$ kg/ms, $C_p = 1013$ 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 3/4" (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 m² .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/m² .K; P_r = 7.01; ρ = 998.2 kg/m³; μ = 10.02 × 10⁻⁴ N.s / m²; 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 ?

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

(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.

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04

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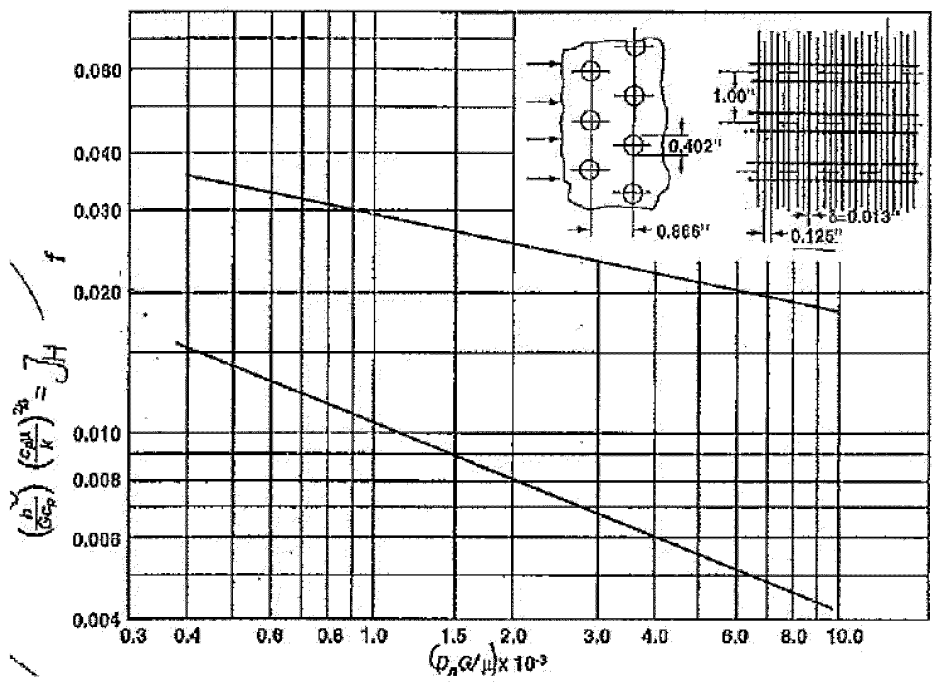


Figure. 1
