Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E –IIst SEMESTER–EXAMINATION – JULY- 2012

Subject code: 1722101 **Date: 06/07/2012**

Subject Name: Design of Heat Exchange Equipments

Time: 10:30 am – 13:00 pm **Total Marks: 70**

Instructions:

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

Q.1 (a) Discuss the heat transfer principles used for design of heat exchange equipments in brief. 07

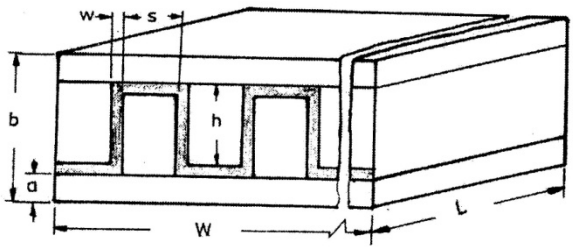
(b) Compare the LMTD and ε-NTU approach for design and analysis of heat exchangers. 07

Q.2 (a) State and explain the basic advantages and limitations of compact heat exchangers. 07

(b) Explain the design of plate fin heat exchangers. 07

OR

(b) Derive an expression to calculate the compactness(β) of the plate fin heat exchangers having a rectangular fin configuration as shown in Fig No. 1 07



Que No 2 (b) OR Fig No. 1

Q.3 (a) Compare the plate heat exchanger with shell and tube type heat exchangers. 07

(b) Explain the analysis of plate heat exchangers. 07

OR

Q.3 (a) State and explain the advantages and limitations of plate heat exchangers. Also state its different applications in various industries with reasons. 07

(b) Explain the approximate method of plate heat exchangers design. 07

Q.4 (a) Shell and tube type heat exchangers are the most common type of heat exchangers .Why? State its different applications in industries. 07

(b) A shell and tube heat exchanger is to be designed to heat water from 27 ^{o}C to 90 ^{o}C. The water flow rate is 4 kg/s. The heating is to be effected by engine oil, which enters at shell at 200 ^{o}C .The and leaves 110 ^{o}C. The heat transfer coefficient for oil is 950 W/m^2 K. There are 2 shell and 4 tube passes and from the tube to water is 6215 W/m^2 K. The diameter of the tube is 30 mm. Find the flow rate of the oil and length of the tube. 07

OR

Q.4 (a) Explain the classification of shell and tube type heat exchangers as per TEMA standards. Draw the sketch of shell and tube type heat exchanger and label the different parts. 07

Q.4 (b) A counter flow shell and tube heat exchanger is used to cool engine oil flowing through 07

the tube at 0.25 kg/s. The specific heat of is 2.2kJ/kg k. This oil is cooled by the water, which flows at 0.3 kg/s. The oil enters at 560 K and leaves at 340 K. The cooling water enters at 298 k. find the length of the tube if the heat transfer coefficient from oil to tube surface is 2340 W/m^2 K, and from the tube to water is 6215 W/m^2 K. The mean diameter of the tube is 18 mm.

Q.5 (a) Explain the design of furnaces. 07

(b) A double pipe heat exchanger consists of a tube of 0.06 m inner diameter and 0.069 m outer diameter surrounded by a shell of 0.117 m bore. Ethylene glycol flowing in the annulus at a rate of 2 kg/s is heated from 40 ^{0}C to 60 ^{0}C by hot water in counter in the tube of cooling from 95 ^{0}C to 85 ^{0}C. Find the length of heat exchanger required to achieve these temperatures. 07

Properties of E- glycol at mean temperature of 60 ^{0}C :

P_c = 1087 kg/m^3

Γ_c = $4.747 \times 10^{-6}\ m^2/s$

Pr_c = 51

C_{pc} = 2.562×10^{-3} J /kg K

k_c = 0.2594 W/m K

Properties of water at mean temperature of 90 ^{0}C :

P_h = 1087 kg/m^3

Γ_h = $4.747 \times 10^{-6}\ m^2/s$

Pr_h = 1.98

k_h = *0.675* W/m K

C_{ph} = *4205.5* J /kg K

OR

Q.5 (a) Explain the design of double pipe heat exchangers. 07

(b) Explain the classification of surface condensers. Explain the air-cooled condensers in detail. 07

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