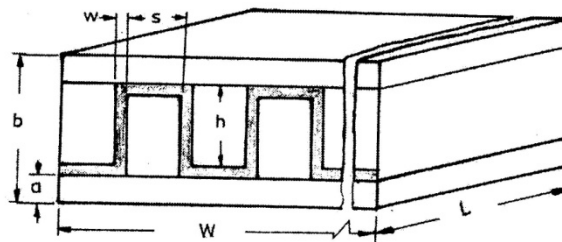


GUJARAT TECHNOLOGICAL UNIVERSITY**M.E –IIst SEMESTER–EXAMINATION – JULY- 2012****Subject code: 1722101****Date: 06/07/2012****Subject Name: Design of Heat Exchange Equipments****Time: 10:30 am – 13:00 pm****Total Marks: 70****Instructions:**

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 °C to 90 °C. The water flow rate is 4 kg/s. The heating is to be effected by engine oil, which enters at shell at 200 °C and leaves 110 °C. The heat transfer coefficient for oil is 950 W/m² K. There are 2 shell and 4 tube passes and from the tube to water is 6215 W/m² 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/m² K, and from the tube to water is 6215 W/m² 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 °C to 60 °C by hot water in counter in the tube of cooling from 95 °C to 85 °C. Find the length of heat exchanger required to achieve these temperatures. 07

Properties of E- glycol at mean temperature of 60 °C :

$$P_c = 1087 \text{ kg/m}^3$$

$$\Gamma_c = 4.747 \times 10^{-6} \text{ m}^2/\text{s}$$

$$\text{Pr}_c = 51$$

$$C_{pc} = 2.562 \times 10^{-3} \text{ J/kg K}$$

$$k_c = 0.2594 \text{ W/m K}$$

Properties of water at mean temperature of 90 °C :

$$P_h = 1087 \text{ kg/m}^3$$

$$\Gamma_h = 4.747 \times 10^{-6} \text{ m}^2/\text{s}$$

$$\text{Pr}_h = 1.98$$

$$k_h = 0.675 \text{ W/m K}$$

$$C_{ph} = 4205.5 \text{ J/kg K}$$

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
