QP Code: RO20MTECH227 Reg. No | | | | | | | | | | | AR 19

GIET UNIVERSITY, GUNUPUR – 765022

M. Tech (Second Semester Examinations) – October' 2021

MPTE2041 – DESIGN OF HEAT EXCHANGERS

(Heat Power and Thermal Engineering)

Time: 2 hrs Maximum: 50 Marks

(The figures in the right hand margin indicate marks)

PART – A

Q.1. Answer ***ALL*** questions (2 x 10 = 20)

a. What do you mean by compact heat exchanger and write the importance of Area density in it.

b. Write the parameters that influence fouling resistances

c. Water is flowing through a 12 mm tube filling 80% of its cross section. What is its hydraulic diameter?

d. Differentiate between regenerative and recuperative heat exchanger.

e. Draw the schematic of a two shell and four tube pass heat exchangers?

f. What is fouling factor and how do the temperature and the velocity affect it?

g. When is a heat exchanger classified as compact heat exchanger? Give an example of a natural compact heat exchanger.

h. What are the causes of pressure drop in shell and tube heat exchangers?

i. Differentiate between regenerators and recuperators.

j. In a steam condenser, the steam is effectively at as Constant temperature of 50 Degree Celsius throughout the heat exchanger, While the temperature of cooling water increases from 20°C to 31°C as it passes through the condenser. Calculate the NTU for this heat exchanger.

PART – B **(6 x 5 = 30 Marks)**

Answer ***ANY FIVE*** questions Marks

2. Show with neat sketch of temperature distribution for unmixed cross flow heat exchanger and explain it. (6)

3. In a shell and tube counter flow heat exchanger, water flows through a copper tube of 20 mm ID and 23 mm OD. Oil passes through the shell. Water enters at 20 ^{o}C and leaves at 30 ^{o}C. Oil enters at 75 ^{o}C and leaves at 60 ^{o}C. Water and oil have the coefficients of 4500 and 1250 W/m^2 K respectively. Thermal conductivity of the tube wall is 355 W/ m-K. The fouling factor for water and oil are 0.0004 and 0.0001 respectively. If the length of the tube is 2.4 m, Calculate overall Heat transfer coefficient. (6)

4. What do you mean by differential thermal expansion? Write the necessary steps are being taken to avoid this (6)

5. Cold water enters a counter flow heat exchanger at 10° C at a rate of 8 kg/s, where it is heated by a hot water stream that enters the heat exchanger at 70° C at a rate of 2 kg/s. Cp of water is 4.18 kJ/kg-K. Determine the maximum heat transfer rate and the outlet temperatures of the cold and the hot water streams for this limiting case. (6)

6. Prove that the effectiveness of the heat exchangers is independent of flow direction if one side fluid is undergoing a phase change. Derive an expression for effectiveness of such heat exchangers. (6)

7. Explain how the makeup water requirement is estimated from energy and mass balance of a cooling tower. (6)

8. In an oil-to-water heat exchanger, the oil enters the exchanger at 100°C with a heat capacity rate of 3700 W/K. Water is available at 15°C and 0.6 kg/s. Determine the exit temperatures in parallel-flow arrangement for U = 500W/m2-K and surface area of 10 m2. Consider Cp= 1.88 and 4.19 J./g-K for Oil and water, respectively. (6)

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