QPC: RD17001063 AR - 17 Reg. No.

GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

B. Tech Degree Examinations, December – 2020

(Seventh Semester)

BMEPE 7041 – DESIGN AND ANALYSIS OF HEAT EXCHANGER

(Mechanical Engineering)

Time: 2 hrs Maximum: 50 Marks

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions) (1 x 10 = 10 Marks)

Q.1. Answer ***ALL*** questions

a. Water is flowing through a square duct of side 10 mm filling 80% of its cross section. What is its hydraulic diameter?
(i) 6 mm (ii) 6.15 mm
(iii) 6.5 mm (iv) None of the above

b. Which of the following is/are example/s of heat exchanger?
(i) Feed water heater in which a stream of steam is directly mixed with cold water and the mixture leaves at uniform temperature (ii) Feed water heater in which a stream of steam and cold water are not mixed and separated by partition through which heat flows
(iii) both (iv) none of the above

c. Which of the following phases of designing of heat exchangers does designer consider corrosive nature of the fluid in?
(i) The thermal analysis (ii) The mechanical design
(iii) The design for manufacture (iv) none of the above

d. The engine oil at 150 C is cooled to 80 C in a parallel flow heat exchanger by water entering at 25 C and leaving at 60 C. Estimate the exchanger effectiveness.
(i)0.56 (ii)0.66
(iii)0.76 (iv)0.86

e. In a thin walled heat exchanger with no fouling, the overall heat transfer coefficient is
(i) $A(h_i^{-1}+ h_o^{-1})^{-1}$ (ii) $(h_i^{-1}+ h_o^{-1})^{-1}$
(iii) $A(h_i^{-1}+ h_o^{-1})$ (iv) $(h_i^{-1}+ h_o^{-1})$

f. In a liquid to gas heat exchanger, it is best to put extended surfaces on the gas side because
(i) This reduces fouling (ii) The gas side heat transfer coefficient is small
(iii) It reduces drag in high speed flows (iv) All of the above

g. In a condenser of a power plant, the steam condenses at a temperature of 60°C. The cooling water enters at 30°C and leaves at 45°C. The logarithmic mean temperature difference (LMTD) of the condenser is
(i) 16.2° C (ii) 16.2° C
(iii) 30° C (iv) 30° C

h. What is the purpose of using fins in a particular heat transfer system?
(i) to decrease rate of heat transfer (ii) to increase rate of heat transfer
(iii) to maintain rate of heat transfer at a constant rate (iv) None of the above

i. In regenerator energy is stored in
(i) gas medium (ii) fluid medium
(iii) thermal medium (iv) None of the above

j. What type of cooling system is used in the large power plants?
(i) cooling ponds (ii) natural flow system

(iii) cooling towers (iv) single deck system

PART – B: (Short Answer Questions) (2 x 5 = 10 Marks)

Q.2. Answer ***ALL*** questions

a. What is friction factor? What is the importance of it?

b. What is the difference between Regenerator and Recuperator?

c. In heat exchange between air and water across a tube wall, it is proposed to use fins to enhance the overall heat transfer coefficient. Would you put the fins on the air side or on the water side? Explain.

d. What do you mean by hydraulic diameter and its impact on heat exchanger?

e. What are the causes of pressure drop in shell and tube heat exchanger?

PART – C: (Long Answer Questions) (6 x 5 = 30 Marks)

Answer ***ANY FIVE*** questions Marks

3. What is the function of a heat exchanger? Explain different types of heat exchanger according to flow arrangements with neat sketches? (6)

4. Discuss recuperative and regenerative type of Heat Exchangers along with their specific applications. Explain the factors to be considered while selecting heat exchangers? (6)

5. Derive the effectiveness of counter flow heat exchanger. What would be the effectiveness of counter flow heat exchanger if Cmin/Cmax = 0 and Cmin/Cmax=1 (6)

6. When one of the two fluids undergoes phase change, show that effectiveness values for (6)

   both parallel flow and counter flow heat exchanger are equal and given by

   $\acute{\varepsilon} = 1 - \exp(-NTU)$.

7. How a tubular heat exchanger and flat plate heat exchanger work? Explain with neat sketches. What advantages does the flat plate heat exchanger have over the tube in tube heat exchanger? (6)

8. Discuss with a sketch the constructional features of a shell and tube heat exchanger with a focus on shell, tube bundles, tube passes and baffles. (6)

9. What do you mean by differential thermal expansion? Explain the different steps required to avoid this. (6)

10. With a neat sketch, discuss the purpose and principle of operation of a cooling tower? Also explain different parameters used in the design of cooling towers. (6)

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