Total No. of Questions : 12]

SEAT No. : ____

P3325

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[4959]-48
B.E. (Mechanical)
INDUSTRIAL HEAT TRANSFER EQUIPMENTS
(2008 Course) (Semester - II) (Elective - IV) (402050 A)

Time : 3 Hours] ***[Max. Marks : 100***

Instructions to the candidates:

1) ***Solve Q.1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8, Q. 9 or Q. 10, Q. 11 or Q. 12.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data if necessary.***

SECTION - I

Q1) a) A shell-and-tube heat exchanger is designed to cool the shell-side lubricating oil from 65°C to 60°C. Following are the specifications for the shell-and-tube heat exchanger: **[6]**

Tube outside diameter = 19 mm

Tube wall thickness = 1.2mm

Tube pitch = 25 mm, square layout number of baffles = 14

Crossflow area near the shell centerline = 0.04429 m^2

Number of effective tube rows crossed in one window zone = 3:868

Flow area through the window zone = 0.01261m^2 oil flow rate = 36.3kg/s

Ideal tube bank friction factor = 0:23

Number of effective tube rows baffle section = 9

Shell-side Reynolds number = 242

Oil density = 849 kg/m^3

P.T.O.

Factors for various leakage and bypass flows for the pressure drop correction are,

For baffle-to-shell and tube-to-baffle leakage streams = 0.59, for baffle-to-shell bypass stream = 0.69 and

For unequal baffle spacing on inlet and exit baffle sections = 0.81.

Calculate- the shell side pressure drop

b) Classify heat exchangers according to construction? **[5]**

c) What are the different assumptions made in the design of thermal heat exchangers? **[5]**

OR

Q2) a) Explain plate heat exchangers? What are the different assumptions made for that? **[6]**

b) Explain construction and working of hairpin heat exchangers? **[6]**

c) Draw and explain tube layout pattern with figure? **[4]**

Q3) a) Why Baffles are used in heat exchangers? What are different types of baffles used in general (shapes and sizes)? **[6]**

b) A shell and tube heat exchanger is to be provided with tubes 4m long and 3.1 cm outer diameter and 2.7 cm inner diameter. The heat exchanger is required for heating water from 22°C to 45°C with the help of condensing steam at 1000c on the outside of tubes. Calculate the number of tubes required if the water flow rate through tubes is 10 kg/sec and heat transfer coefficients on vapor and water side are 5500 W/m^2 °C and 850 W/m^2 °C respectively. Neglect all other resistances. Assume Cp of water = 4168 J/kg°C. Also calculate the rate of steam consumption if latent heat is 2200 kJ/kg. **[6]**

c) Short notes on: contents in TEMA standard. **[4]**

OR

Q4) a) Explain stepwise procedure for the calculation of heat exchanger design using kern's method? **[8]**

b) Explain various leakage and bypass streams on the shell side. How do they affect the performance of STHE? **[8]**

Q5) a) What do you understand by compact heat exchanger? State advantages and limitation of compact heat exchanger as compare to shell and tube heat exchanger? **[6]**

b) Explain in detail gasketed type plate fin exchanger? **[6]**

c) Draw a well labeled diagram tube fin heat exchangers and also explain its working. **[6]**

OR

Q6) a) A counter flow heat exchanger is employed to cool 0.55kg/sec of oil from 115°C to 40°C by the use of water. The inlet and outlet temperatures of cooling water are 15°C and 75°C, respectively. The overall heat transfer coefficient is expected to be 1450 W/m^2 °C. Using NTU METHOD, calculate the following: **[9]**

i) The mass flow rate of water

ii) The effectiveness of the heat exchanger,

iii) The surface area required.

b) "Brazed aluminum Plate Fin Heat Exchanger (PFHE) is the only choice for cryogenic field application"- COMMENT on the statement. **[9]**

SECTION - II

Q7) a) Explain all types of direct contact type condensers? Draw a neat sketch from one of them? **[6]**

b) Write short notes on

i) Air cooled condenser **[5]**

ii) Water cooled condenser **[5]**

OR

Q8) a) Describe chillers in detail? **[5]**

b) Describe direct expansion evaporator with sketch? **[5]**

c) Which parameters to be specially considered for design of condensers compared to design of heat exchangers? **[6]**

Q9) a) What are the different parameters measure during testing of cooling towers? **[5]**

b) Different materials used for the construction of cooling towers? **[5]**

c) List out different mechanical and electrical components for smooth operations of cooling towers? **[6]**

OR

Q10)a) Factors which affects the performace of cooling towers? **[6]**

b) Different auxiliary components used for construction of cooling towers? Explain each component in brief? **[10]**

Q11) Write short notes on (any three)

a) Selection of material for wick. **[6]**

b) Explain constructional features of Printed Circuit Board (PCB)? How it works? **[6]**

c) State advantages and disadvantages of forced electronics cooling? **[6]**

d) Explain cooling of personal computers? **[6]**

OR

Q12) Solve all questions:

a) Draw a well labeled diagram of heat pipe. Explain construction and working of heat pipe? Write Advantages of heat pipe. **[10]**

b) What are the different performance characteristics related with heat pipe? **[3]**

c) How does cooling of electric motor carried out? **[3]**

d) What are the different working fluids used in Heat pipes? **[2]**