Registration No: | | | | | | | | | | |

Total Number of Pages: 02 **M.TECH**
P2HTCC11

2nd Semester Regular Examination 2016-17
Analysis & Design of Heat Exchanger
Branch: HEAT POWER & THERMAL ENGG, HEAT POWER ENGG, THERMAL ENGG
Time: 3 Hours
Max Marks: 100
Q.CODE:Z956
Answer Question No.1 which is compulsory and any FOUR from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions: *Short answer type*** **(2 x 10)**

a) What do you mean by hydraulic diameter and its impact on heat exchanger?
b) In a liquid to gas heat exchanger, it is best to put extended surfaces on the gas side. Why?
c) Are we really getting extra advantage by providing Baffles in Shell and tube heat exchanger? Justify your answer.
d) What do you mean by compact heat exchanger and write the importance of Area density in it.
e) How can the flow induced vibration be minimized?
f) List the effect of channel divergence.
g) In a counter flow gas regenerator, having same heat capacity rate for fluids, the effectiveness and NTU are 40% and 0.50 respectively, if at part load operation NTU is doubled what is new effectiveness.
h) Under what condition, the effectiveness NTU method is preferred over LMTD method as a method of analysis of Heat exchanger
i) What are the heat transfer modes are involved in heat exchanger for heat transfer augmentation?
j) Define approach & cooling efficiency for a cooling tower.

Q2 **a)** What are the various sources of a noise in a heat exchanger? How it can be minimized? **(10)**
b) What are the causes of development of stress in a heat exchanger and how thermal stress can be minimized? **(10)**

Q3 The condenser of a large steam power plant is a heat exchanger in which stem is condensed to liquid water. Assume the condenser to be a shell-and-tube heat exchanger consisting of a single shell and 30,000 tubes, each executing two passes. The tubes are of thin wall construction with D=25 mm, and steam condenses on their outer surface with an associated convection coefficient of h_0=11,000 W/m^2.K. the heat transfer rate that must be effected by the exchanger is q=2x10^9 W , and this is accomplished by passing cooling water through the tubes at a rate of 3x10^4 kg/sec. the water enters at 20^0C while the steam condenses at 50^0C. What is the temperature of the cooling water emerging from the condenser? What is the required tube length L per pass? **(20)**

Q4 **a)** Derive the effectiveness of a counter flow heat exchanger. **(10)**
b) What would be the effectiveness of counter flow heat exchanger if C_{min}/C_{max}=0 and C_{min}/C_{max}=1 **(10)**

Q5 **a)** Show with neat sketch of temperature distribution for unmixed cross flow heat exchanger and explain it. **(10)**

b) Water at the rate of 4.55 kg/s is heated from 35.0 to 50.15^{o}C in a shell and tube heat exchanger. On the shell side one pass is used with water as heating fluid 1.152 kg/s entering the heat exchanger at 80.3^{0}C.The overall heat transfer coefficient is 1209 W/m^{2} K and the average velocity in 2.05 cm diameter tube is 0.466 m/s. Because of space limitation the tube length must not be longer than 3.5 m. calculate the number of tube passes, the number of tube per pass and the length of tubes. Take appropriate F. **(10)**

Q6 **a)** The pumping power in heat exchanger is a function pressure drop, core mass velocity, friction factor, hydraulic diameter, fluid density for a steady flow one pass heat exchanger. Derive the expression. **(10)**

b) What do you mean by differential thermal expansion? Write the necessary steps are being taken to avoid this **(10)**

Q7 **Write short note on** **(5x4)**

a) Line of balance
b) Flow pattern of baffles Turbulence and friction factor in pipe flow
c) Stress in tubes of pressure vessel
d) Regenerator Vs, Recuperator