Roll No .....

ME - 701 (A)

B.E. VII Semester

Examination, December 2015

Design of Heat Exchanger

Time : Three Hours

Maximum Marks : 70

Note: i) Answer five questions. In each question (except 2) part A, B, C is compulsory and D part has internal choice.

ii) All parts of each questions are to be attempted at one place.

iii) All questions carry equal marks, out of which part A and B (Max.50 words) carry 2 marks, part C (Max.100 words) carry 3 marks, part D (Max.400 words) carry 7 marks.

iv) Except numericals. Derivation, Design and Drawing etc.

1. a) Explain are the requirements of the heat exchanger.

   b) Explain different flow arrangements in recuperative heat exchangers.

   c) Determine the overall heat transfer coefficient for liquid-to-gas heat transfer through a 3mm thick steel plate (k=50 W/m.K). Consider the heat transfer coefficients $h_i = 2500$ W/m^2.K, $h_0 = 50$ W/m^2.K and fouling factor on one side $R_{fi} = 0.0002$ m^{2}K/W.

   d) Classify industrial heat exchanger on the basis of construction and explain each of them.

   OR

   Explain briefly the selection criteria of a heat exchanger for a given duty.

2. A counter flow, concentric tube heat exchanger is used to cool the lubricating oil for a large industrial gas turbine engine. The flow rate of cooling water through the inner tube (D_i= 25mm) is 0.2 kg/s, while the flow rate of oil through the outer annulus (D_o = 45 mm) is 0.1 kg/s. The oil and water enters at the temperature of 100°C and 30°C, respectively. How long the tube must be made if the outlet temperature of the oil is to be 60°C.

OR

A counter flow heat exchanger is employed to cool 0.55 kg/s of engine oil (Cp = 2.45 kJ/kg.K) from 115°C to 40°C by using water. The inlet and outlet temperature of water are 15°C and 75°C respectively. The overall heat transfer coefficient is 1450 W/m^{2}K. Using NTU method, calculate (i) the mass flow rate of water (ii) the effectiveness of the heat exchanger and (iii) the surface area required.

3. a) Where the TEMA standards are applicable? Explain different classes of heat exchangers as per TEMA standards.

   b) Differentiate between various shells, standardised by TEMA.

   c) Explain function of single segmental baffle, expansion joint and impingement protection.

   d) Explain various parameters for specifying tube size for a shell and tube heat exchanger. Also, explain various layouts of tubes that can be used in the heat exchanger.

OR

What factors should be considered to determine the fluid that should be routed through the shell side and the fluid that on the tube side.

4. a) What factors that should be considered while selecting material for the heat exchanger?

   b) What are requirements that must be met by the tubing material of a heat exchanger?

   c) How the fouling occurs in the heat exchanger?

   d) Explain the eddy current testing of heat exchangers.

OR

Explain various types of corrosion that may occur in heat exchangers.

5. a) Write short note on desert coolers.

   b) What are the types of fins that are used in the heat exchanger?

   c) Differentiate between the condensers and the evaporators.

   d) Discuss the working of micro heat exchangers. State its advantages and limitations.

OR

What are the requirements of a heat exchanger? Discuss various software available for designing of heat exchangers.

******