

(3 Hours)

(Total Marks : 80)

- N.B. (i) Question No. 1 is Compulsory.**
(ii) Attempt any three questions from question no. 2 to 6.
(iii) Figure to the RHS indicates full Marks.
(iv) Make suitable assumptions if Necessary.
(v) Due credit will be given to neatness and cleanliness

Que. 1. Explain the following:-

- (a) Piping system Design Codes [20]
 (b) Maxwell body and Voigt body
 (c) General equation of Furnace Performance
 (d) Analogy between Mass, Momentum and Heat transfer

- Que. 2** (a) Classify the transient heat conduction process. Show that the transient temperature response of a body during Newtonian cooling and heating methods. [10]
 (b) Explain the concepts of flow patterns with neat diagram. [10]

- Que. 3** (a) Derive an equation of linear distribution of shear stresses acting on cylindrical element of fluid of radius R in steady flow through a vertical cylindrical tube [10]
 (b) What do you mean by Nucleate boiling? Explain with typical pool boiling curve. [10]

- Que. 4** (a) Estimate the heat transfer coefficient of pool boiling of water at 2.1 bar, from a surface [10] at 125°C. Check that the critical flux is not exceeded. Data:- Physical Properties
 From steam tables:- Saturation Temperature, $T_s = 121.8^\circ\text{C}$
 $\rho_L = 941.6 \text{ kg/m}^3$, $\rho_v = 1.18 \text{ kg/m}^3$, $C_{pL} = 4.25 \text{ J/kg}^\circ\text{C}$, $k_L = 687 \times 10^{-3} \text{ W/m}^\circ\text{C}$
 $\mu_L = 230 \times 10^{-6} \text{ Ns/m}^2$, $\text{Lamda (Latent Heat)} = 2198 \times 10^3 \text{ J/kg}$, (surface tension) $\sigma = 55 \times 10^{-3} \text{ N/m}$, $p_w = \text{at } 125^\circ\text{C} = 2.321 \times 10^5 \text{ N/m}^2$, $P_s = 2.1 \times 10^5 \text{ N/m}^2$. Use Foster Zuber co-relation and Zuber co- relation equations.
 (b) Finned tube is used to increase the effective surface area of heat - exchanger tubing. Explain [10]

- Que. 5** (a) Derive an equations for Simple well Stirred Furnace Model with neat diagram [10]
 (b) Write notes on (i) Reactor design process and (ii) Furnace Heat Balance [10]

- Que. 6.** (a) Explain the term Air cooled Condensers.
 Write its applications, advantage and disadvantage. [12]
 (b) Explain wall thickness: Pipe Schedule Number. [08]