

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V(New) • EXAMINATION – WINTER 2016****Subject Code:2153613****Date:19/11/2016****Subject Name:Basics of Heat Transfer****Time:10:30 AM to 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

		MARKS
Q.1	Short Questions	14
	1 What is a gray surface ?	
	2 Define radiation shape factor.	
	3 What is thermal boundary layer?	
	4 State the Lambert cosine law.	
	5 How does a scale deposit affect the heat transfer rate?	
	6 What do you mean by optimum thickness of insulation ?	
	7 Define Irradiation.	
	8 What is meant by reflectivity?	
	9 Draw a temperature vs area diagram for condenser.	
	10 What are regenerators?	
	11 Define 'Thermal Conductivity'.	
	12 Give the statement of Duhring's rule.	
	13 Draw a neat sketch of 1-2 counter flow heat exchanger.	
	14 Define 'Evaporation'.	
Q.2	(a) Explain the general laws of heat transfer.	03
	(b) Derive an expression for steady state heat conduction through hollow sphere.	04
	(c) A horizontal pipe 1 ft in diameter is maintained at a temperature of 250°C in a room where the ambient air is at 15°C. Calculate the free convection heat loss per meter of length. K = 0.03406 W/m°C, Kinematic viscosity = 26.54*10 ⁻⁶ , Pr=0.687	07
	OR	
	(c) A large vertical plate 4 m high is maintained at 60°C and exposed to atmospheric air at 10°C. Calculate the rate of heat transfer coefficient if the plate is 10 m wide. Kinematic viscosity = 16.5*10 ⁻⁶ m ² /s, Pr=0.7, k=0.02685 W/m°C	07
Q.3	(a) A pipe of 65 mm OD is lagged with 50 mm layer of asbestos (K=0.14) and a 40 mm layer of cork (K=0.035 W/mK). If the temperature of the outer surface of the pipe is 423K and the temperature of the outer surface of the cork is 308K, calculate the heat loss per meter of the pipe.	03
	(b) List out various laws of radiation and discuss Kirchhoff's law in details.	04

- (c) Pressurized air is to be heated by flowing into a pipe of 2.54 cm diameter. The air at 200°C and 2 atm pressure enters in the pipe at 10 m/s. The temperature of the entire pipe is maintained at 220°C. Evaluate the heat transfer coefficient for a unit length of a tube considering the constant heat flux conditions are maintained at the pipe wall. What will be the bulk temperature of the air at the end of 3 m length of the tube?
 $K = 0.015 \text{ W/m}^0\text{C}$, viscosity $= 2.57 \times 10^{-5} \text{ kg/ms}$, $Pr = 0.681$, Density $= 1.49 \text{ kg/m}^3$, Specific Heat $= 1.025 \text{ kJ/kg}^0\text{C}$ **07**
- OR**
- Q.3** (a) Give the physical significance of groups : Reynolds's Number, Prandtl Number, Nusselt Number **03**
- (b) Calculate the critical radius of insulation for asbestos ($k=0.17 \text{ W/mK}$) surrounding a pipe and exposed to room air at 293K with, $h= 3.0 \text{ W/m}^2\text{K}$. Calculate the heat loss from a 473 K, 50mm diameter pipe when covered with the critical radius of insulation and without insulation. **04**
- (c) Derive an equation for unsteady state heat conduction and explain physical significance of Biot modulus and Fourier modulus with their expression. **07**
- Q.4** (a) Discuss the design steps for double pipe heat exchanger. **03**
- (b) Write a brief note about Plate Heat Exchanger. **04**
- (c) Derive the equation for L.M.T.D. in counter flow heat exchanger. State all the assumption made in derivation. **07**
- OR**
- Q.4** (a) Discuss function of following parts of shell and tube heat exchanger: **03**
 1) Baffle 2) Sealing Strip 3) Tie rods 4) Tubes side pass partition plate.
- (b) Distinguish between film wise and drop wise condensation. Which of the two gives a higher heat transfer coefficient? Why? **04**
- (c) What do you mean by effectiveness of heat exchanger? Derive a relationship between effectiveness and number of transfer units for a parallel flow exchanger. **07**
- Q.5** (a) Discuss working principal of Forced circulation evaporator. **03**
- (b) Why there is boiling point rise in evaporators? **04**
- (c) Classify the multiple effect evaporator (MEE) based on the mode of feed supply. What are the advantages and limitation of different mode of feed supply to MEE? **07**
- OR**
- Q.5** (a) Draw the pool boiling curve and write the highlight of each segment in brief. **03**
- (b) Explain the terms capacity and economy in steam heated evaporator. **04**
- (c) Discuss calandria type of evaporators with neat and clean diagram and its application. **07**
