

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V (NEW) EXAMINATION – SUMMER 2019

Subject Code: 2153613

Date: 31/05/2019

Subject Name: Basics of Heat Transfer

Time: 02:30 PM TO 05:00 PM

Total Marks: 70

Instructions:

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

- Q.1**
- (a) Define Biot number and fourier number with its application. **03**
- (b) An ice box has walls constructed at a 10 mm layer of cork-board contained between two wooden walls, each of 20 mm. **04**
- a) Find heat removed per unit area if the inner wall surface is kept at 263 k & outer is 303 k.
- Thermal conductivity of cork board and wood are 0.041 W/mk and 0.105 W/mk respectively.
- (c) What is thermal insulation? Derive the critical radius equation for cylindrical shape. **07**
- Q.2**
- (a) Differentiate thermodynamics and heat transfer. **03**
- (b) Calculate the critical radius of insulation for asbestos ($k=0.17$ W/mK) surrounding a pipe and exposed to room air at 293K with, $h= 3.0$ W/m²K. 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 the expression for Transient heat conduction for Spherical shape. **07**
- OR**
- (c) Explain the effect of temperature on thermal conductivity of solids, liquid and gas with proper reason. **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) Explain Kirchhoff's law of thermal radiation. **04**
- (c) Explain pool boiling point regimes with boiling curve. **07**
- OR**
- Q.3**
- (a) Explain types of convection. **03**
- (b) Differentiate types of condensation. **04**
- (c) Derive the equation of reynold's analogy. **07**
- Q.4**
- (a) Define Economy & Capacity of evaporators. **03**
- (b) What is the applications of baffles, tie rods, spacers and pass partitions in shell and tube heat exchangers? **04**
- (c) A single-effect evaporator is to be fed with 5000 kg/h solution containing 10% solute by weight. The feed at 313 K is to be concentrated to a solution containing 40% by weight of the solute under an absolute pressure of 101.325 kPa. Steam is available at an absolute pressure of 303.975 kPa (saturation temp. of 407 K.) The overall heat transfer coefficient is 1750 W/(m² K). **07**
- Cp of feed= 4.187 kJ/(kg*K)
- Calculate:

1) The heat transfer area.

2) The economy of the evaporator.

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Temperature, K	Enthalpy, kJ/kg	
	Vapour	liquid
313 K		170
373 K	2676	419
407 K	2725	563

OR

- Q.4** (a) What is the effect of Non-condensable gases in condensation? **07**
- (b) Explain Plate type heat exchanger with its advantage and disadvantage. **07**
- (c) Explain different feeding method of multiple effect evaporation. **07**
- Q.5** (a) Draw the temperature profile for Co-current and Counter-current heat exchanger. **03**
- (b) Explain Boiling Point Elevation and duhring's rule. **04**
- (c) Derive the equation of LMTD for countercurrent flow. **07**

OR

- Q.5** (a) Explain Wien's displacement law of radiation. **03**
- (b) Write Dittus Boelter equation to compute heat transfer coefficient. Explain all the terms with their SI units. **04**
- (c) Explain extended surface with different types. What is fin efficiency? What is fin effectiveness? **07**

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