

Sl. No. of Q.P. 2308

Unique Paper Code: 1141202

Name of the Paper: Unit Operations

Name of Course : B.Tech. Polymer Science

Semester: 2nd

Duration: Three hours

Maximum Marks: 75

Medium of setting of Question Paper: English

F-4

Instructions for candidates: Attempt five questions in all. Question No.1 is compulsory.  
Use of calculator is allowed and log table may be provided.

Q.1

- a. Define unit operation and give its classification
- b. By using definition and standards convert one newton to pounds force.
- c. What is limiting reagent and how to calculate percentage yield in chemical reactions?
- d. Explain total energy balance equation in flow system.
- e. Describe the purposes and equipment used in agitation.
- f. Derive Equation for steady state conduction in flat slab.
- g. Explain stefan-boltzmann law of black body radiation .
- h. Describe long tube evaporators with upward flow and its limitation.
- i. Illustrate mass transfer in dryers and its equation.

(9X3)

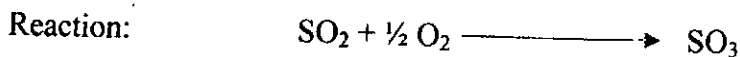
Q.2

- a) A substance of heat capacity of 0.8 BTU/ (lb) F° enter a heat exchanger at a temperature of 50 °F. It leaves at a temperature of 100°F. The exit pipe is 30 ft above the entrance. The inlet velocity is 20 ft/sec, and exit velocity is 80 ft/sec. the flow in steady state and no pump in between.
  - i. How many Btu are needed to heat the materials
  - ii. How many ft-lb are needed to increase the velocity
  - iii. When all above quantity converted to Btu, what percentage change is there in total heat needed?
- b) Write short notes on contact condensers for heat exchange
- c) Explain long tube evaporators with upward flow

(5,4,3)

Q.3

- a) In the Production of SO<sub>3</sub>, 100 mole of SO<sub>2</sub> and 100 mole of O<sub>2</sub> are fed to the reactor. If percentage conversion of SO<sub>2</sub> is 80 %, calculate the composition of product on mole basis



- b) Discuss Barometric equation for pressure analysis
- c) Discuss falling film evaporators.

(5,4,3)

**Q.4.**

- a) Derive equation for calculating the number of ideal stages by absorption factor method.
- b) Describe spray drier and its one dimensional equation for volume-surface mean diameter  $D_s$  of the drops from a disk atomizer.
- c) Define Reynolds number and explain its significance in fluid mechanics.

(5, 4, 3)

**Q.5**

- a) A layer of pulverized cork 150 mm thick is used as a layer of thermal insulation in a flat wall. The temperature of cold side of the cork is 40°F, and that of the warm side is 180 °F. The thermal conductivity of the cork at 32 °F is 0.020 Btu/ft.-h °F, and that at 200°F is 0.060. The area of the wall is 25 ft<sup>2</sup>. What is the rate of heat flow through the wall in Btu per hour (watts)?
- b) Write a note on motionless mixtures.
- c) Explain Reflux ratio.

(5,4, 3)

**Q.6**

- a) Describe factors influencing plate efficiency.
- b) Define Graetz number and Peclet number.
- c) Describe method for measurement of humidity.

(5,4, 3)