U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: VI**
Branch: Chemical Engineering **Duration: 3 hrs.**
Course Code: 19CH6DCPED **Max Marks: 100**
Course: Process Equipment Design **Date: 20.09.2023**

Instructions: 1. Answer any one unit.
2. Missing data, if any, may be suitably assumed.
3. Perry's Chemical Engineer's Handbook, IS4503 and IS2825 code books are permitted to use.

UNIT - I

1 A rotary drier using counter-current flow is to be designed to dry 10,000 kg/h of wet salt of 100 mesh containing 5% moisture on the wet basis to a final moisture content of 0.1%. Wet salt enters the drier at 27°C. The ambient air at 30°C dry bulb and 25°C wet bulb will be heated to 150°C in a finned tube heater using 10 bar steam as the heating medium. The heated air at 150°C is passed counter currently through the drier. The average specific heat capacity of salt is 0.879 kJ/kg°C. The boiling point rise (BPR) of the salt may be assumed to be equal to 10°C.

a) Determine the water content in the feed, in the product and the rate of drying. **10**

b) Find the vaporization temperature of water in the solid. Calculate the air outlet and product outlet temperatures. **20**

c) Determine the heat requirement and estimate the air flow rate to the drier. **25**

d) Estimate the length and diameter of the drier. **25**

e) Draw the schematic of the drier designed. **20**

UNIT - II

2 It is desired to separate 10 kg/s of a saturated vapour mixture of acetic acid and water containing 40 mol % of acetic acid (CH_3COOH) by a fractional distillation column. The distilled product contains 98 mol % of water and the residue contains 98 mol % of acetic acid. The reflux ratio of 2 times the minimum reflux is employed. The column is operating at 1.05 atm.

a) Estimate the minimum reflux ratio using the McCabe-Thiele method. **15**

b) Determine the number of plates required for a bubble cap distillation column and the height of the column. **15**

c) Calculate condenser and re-boiler loads. **10**

(d) Determine the diameter of the column. **20**

(e) Design the dimensions of the plate and bubble cap, assuming a 100 mm bubble cap diameter. **10**

(f) Calculate the diameter of gas and liquid nozzles. **10**

(g) Draw a neat schematic diagram of the sectional front view and bubble cap. **20**

******