BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END-SEMESTER EXAMINATION)

CLASS: B.PHARM **SEMESTER:III**
BRANCH: PHARMACY **SESSION: MO/2019**

SUBJECT: BP304T PHARMACEUTICAL ENGINEERING

TIME: 3.00 Hours **FULL MARK: 75**

INSTRUCTIONS:

1. **The missing data, if any, may be assumed suitably.**
2. **Before attempting the question paper, be sure that you have got the correct question paper.**
3. **Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.**
4. **This question paper consists of (03) three parts. Read the part wise instructions before attempting the questions.**

PART-I
Objective types questions (Instruction: Answer all questions)

Q1. (10 x 2 = 20 Marks)

A. What should be the relationship between frictional coefficient (μ) and half of angle of nip for smooth functioning of crushing rolls?

B. The size reduction scheme is as follows:
1 1/2 1/16
How much energy per kg of material is required for the second step size reduction as compared to first step?

C. Log-probability plot is obtained by plotting the ……(…… variables) vs. …… (…….. variables) in ……. graph paper.

D. What is the viscosity of water in Pa S unit at 20 °C?

E. What will be the terminal settling velocity as per Stokes' law, if the particle radius is 'r'?

F. Write the relationship between the energy emitted by the black body and absolute temperature.

G. Thermal conductivity of common brick is 0.86 Btu/ft. h.°F. Convert in W/m. °C.

H. Define rectification.

I. Write down the formula to calculate the LMTD.

J. Give one example where LMTD was not always valid.

PART-II
Short Answers
(Instruction: Answer seven out of nine questions)

(7 x 5 = 35 Marks)

Q2. It is desired to separate quartz particles from galena particles by taking advantage of their different specific gravities. A hydraulic classifier is employed under free-settling conditions. Separation is to be carried out in water at 20°C. The specific gravity of quartz is 1.8 and that of galena 7.8. The original mixture of particles has a size range from 0.00048 to 0.00289 cm. It is found that three fractions are obtained, one of quartz only, one of galena only, and one of a mixture of quartz and galena. What are the size ranges of two substances in three different fractions?

PTO

Q3. Describe the drying rate curve.

Q4. A crushing roll has rolls of 100 cm diameter and they are set so that the crushing surfaces are 4 cm apart at the narrowest point. If the angle of nip is 30 °, calculate the feed diameter.

Q5. Establish the relation between Kozeny and Poiseuille's equation.

Q6. Derive the Bernoulli's theorem.

Q7. Discuss the importance of proper mixing in solid dosage form preparation.

Q8. Describe overall heat transfer coefficient and do the integration over total surface and conceptualize the LMTD.

Q9. Derive the equation to determine the heat flow when compound resistances are in series.

Q10. To determine the particle size of sand particle by using Stokes' law, sand particles were dropped in liquid paraffin. The time required to cover 12 cm height of a measuring cylinder was measured at 20 °C. What will be the minimum time in seconds to cover 12 cm height in liquid paraffin so that particle size could be determined by applying Stokes' law?

Data Given:

Density of liquid paraffin at 20 °C = 0.82 g/mL.

Viscosity of liquid paraffin at 20 °C = 26.50 mPa.S

Density of sand = 1825 kg/m3

PART-III

Long Answers

(Instruction: Answer two out of three questions)

(2 x 10 = 20 marks)

Q11. A solution of organic colloids is to be concentrated from 14 to 66% solids in a vertical tube evaporator. The solution has a negligible elevation in boiling pint, and the specific heat of the feed is 0.75 J/g. °C. Saturated steam is available at 0.8 atm abs (95ºC), and the pressure in the condenser is 100 mm Hg abs (45ºC). The feed enters at 25°C. The overall heat transfer coefficient is 1750 W/m2.°C. The evaporator must evaporate 24500 kg of water per hour. The heat of vaporization of steam λ_S at 0.8 atm abs is 2273 KJ/Kg. The enthalpy of superheated water vapour at 100 mm Hg abs (H_v) is 2378 KJ/Kg.

i) What is the feed rate in kg/h?

ii) What is the steam consumption in kg/h?

iii) What is the economy of the evaporator?

Q12. A continuous fractionating column is to be designed to separate 36000 kg/h of a mixture of 49% benzene and 51% toluene into an overhead product containing 97% benzene and a bottom product containing 96% toluene. The percentages are by weight. A reflux ratio of 3.5 to 1 mole of product is to be used. The molal latent of benzene and toluene are 7360 and 7960 cal/g mole, respectively. Benzene and toluene form a nearly ideal system with a relative volatility of about 2.6. The feed has a boiling point of about 95°C at 760 mm Hg pressure. a) Calculate the moles of overhead product and bottom product per hour.; b) Determine the number of ideal plates and the position of feed plate if the feed is liquid and at its boiling point. (Graph paper will be provided)

x	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	0.95
y	0.21	0.37	0.51	0.64	0.72	0.79	0.86	0.91	0.96	0.98

Q13. A flat furnace wall consists of 265 mm of refractory fireclay brick, 135 mm of kaolin brick, and 7 mm of steel plate. The fire side of the refractory is at 1400°C, and the outside of the steel is 25°C. An accurate heat balance over the furnace shows the heat loss from the wall to be 450 W/m2. It is known that there may be thin layers of air between the layers of brick and steel. To how many millimetres of steel are these air layers equivalent?

Thermal conductivity values are as follows:

Fireclay brick 1.38 W/m. °C

Kaolin brick 0.138 W/m. °C

Steel 45 W/m. °C

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