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

CLASS: BPHARM **SEMESTER: III**
BRANCH: PHARMACY **SESSION: MO2025**

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 of questions (Instruction: Answer all questions)

Q1.		10 x 2 = 20
A.	A solution of organic colloids is to be concentrated from 20 % to 70 % solids in a vertical tube evaporator. If the evaporator must evaporate 24000 kg of water per hour, what will be feed rate and thick liquor rate?	CO3 & CO4 (BL3 & BL4)
B.	If the ratio of outer radius and inner radius of a cylindrical pipe is 3, calculate the ratio of logarithmic mean radius to arithmetic mean radius.	CO3 & CO4 (BL3 & BL4)
C.	If a suspension contains 950 g of solid material in 1680 cu cm of total volume, then calculate the volume fraction voids in suspension when the density of solid material is 1200 kg/cu m.	CO3 & CO4 (BL3 & BL4)
D.	A flat furnace wall (area = 4 m^2) is constructed of a 450 mm layer of sil-o-cel crick, with a thermal conductivity of 0.45 W/m.°C. Calculate the thermal resistance per square meter of the wall.	CO3 & CO4 (BL3 & BL4)
E.	Define steam consumption of a single effect evaporation process.	CO1 (BL1)
F.	Write down the equation governs the heat transfer thorough radiation mechanism.	CO2 (BL2)
G.	Calculate the critical speed in rpm of a ball mill (diameter = 300 mm) loaded with 5 mm (diameter) balls.	CO3 & CO4 (BL3 & BL4)
H.	Describe incompressible and compressible fluid.	CO2 (BL2)
I.	In case of free settling, write down the formula to calculate the terminal settling velocity in transition flow region?	CO1 & CO2 (BL1 & BL2)
J.	Differentiate fluid flow based on Reynold's number.	CO1(BL1)

PART-II

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

(7 x 5 = 35 Marks)

Q2.	Define Newtonian and non-Newtonian fluid. Demonstrate graphically the various types of non-Newtonian fluids.	CO3 & CO4 (BL4 & BL5)
Q3.	Determine the mass flow rate of a liquid by using Venturi meter.	CO3 & CO4 (BL4 & BL5)
Q4.	Do the dimension analysis of $\Delta p = f(D, \rho, L, U, \mu)$ without changing the sequence the independent variables in the given function.	CO2 & CO3 (BL3 & BL4)
Q5.	Discuss the theory of wet bulb temperature.	CO2 & CO3 (BL3 & BL4)
Q6.	Establish the condition by which a crushing roll runs smoothly.	CO2 & CO3 (BL3 & BL4)
Q7.	Write a short note on a) drying rate curve and critical moisture content; b) equilibrium moisture content; c) free moisture content.	CO2 & CO3 (BL3 & BL4)

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Q8.	An orifice meter with flange tap is to be installed in a 200 mm line to measure the flow of water. The maximum flow rate is expected to be 70 m^3/h at 15°C. The manometer used to measure the differential pressure is to be filled with a manometer fluid (ρ = 13.6 g/cm^3) and water is to fill the leads above the surface of the manometer fluid. The water temperature will be at 15°C throughout. If the maximum manometer reading is to be 150 cm, what diameter to nearest millimetre, should be specified for the orifice.	CO4 & CO5 (BL5 & BL6)
Q9.	A solution of organic colloids is to be concentrated from 15 to 75 % solids in a vertical tube evaporator. The solution has a negligible elevation in boiling pint, and the specific heat of the feed is 0.95 J/g.°C. Saturated steam is available at 0.8 atm abs (95°C), and the pressure in the condenser is 100 mm Hg abs (45°C). The feed enters at 30°C. The overall heat transfer coefficient is 2000 W/m^2°C. The evaporator must evaporate 24000 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?	CO4 & CO5 (BL5 & BL6)
Q10.	Write a short note on Tyler standard screen.	CO3 & CO4 (BL4 & BL5)

PART-III
Long Answers
(Instruction: Answer two out of three questions)

(2 x 10 = 20 marks)

Q11.	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 3.80 and that of galena 8.50. The original mixture of particles has a size range from 0.000122 to 0.00268 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?	CO4 & CO5 (BL5 & BL6)
Q12.	A flat furnace wall consists of 300 mm of refractory fireclay brick, 150 mm of kaolin brick, and 10 mm of steel plate. The fire side of the refractory is at 2000°C, and the outside of the steel is 65°C. An accurate heat balance over the furnace shows the heat loss from the wall to be 1000 W/m^2. 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	CO4 & CO5 (BL5 & BL6)
Q13.	Explain with details the various factors affecting the evaporation process.	CO1 & CO2 (BL1 & BL2)

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