CLASS: BPHARM   SEMESTER : IV
BRANCH: PHARMACY   SESSION : SP/18

SUBJECT: PS4409 PHARMACEUTICAL ENGINEERING I

TIME: 3. Hours   FULL MARKS: 60

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
4. **Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a)	Write down the dimension of a) kinematic viscosity; b) power	[2]
Q.1(b)	Do the dimension analysis of $\Delta p = f(D, U, \mu, \rho, L)$ where D: diameter of the pipe; U: linear velocity of the fluid; μ: viscosity of the fluid; ρ: density of the fluid; L: length of the pipe.	[4]
Q.1(c)	Describe the working principle of differential manometer to measure the pressure drop.	[6]
Q.2(a)	Define economy, capacity and steam consumption of an evaporator.	[2]
Q.2(b)	Derive the equation for material and energy balance of a single effect evaporator with proper assumptions.	[4]
Q.2(c)	What are the various factors affecting the economy of an evaporator? Discuss the effects in details.	[6]

Q.3   A solution of organic colloids is to be concentrated from 10 to 58% 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 (95ºC), and the pressure in the condenser is 100 mm Hg abs (45ºC). The feed enters at 20 °C. The overall heat transfer coefficient is 1764 W/m2. °C. The evaporator must evaporate 25000 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.

Q.3(a)	What is the feed rate in kg/h?	[2]
Q.3(b)	What is the steam consumption in kg/h?	[4]
Q.3(c)	How many square meter of surface are required?	[6]
Q.4(a)	Which law governs the radiation?	[2]
Q.4(b)	Describe the working principle of climbing film type evaporator with diagram.	[4]
Q.4(c)	Discuss the advantages of multiple effect evaporator over single effect evaporator. Discuss in detail the different types of feeding in multiple effect evaporator with diagram.	[6]
Q.5(a)	When the ratio of outer diameter to the inner diameter is 2.0 the error in the use of arithmetic mean is 4%. Prove it.	[2]
Q.5(b)	Do the integration over total surface and conceptualize logarithmic mean temperature difference with proper assumptions.	[4]
Q.5(c)	A standard 1-inch Schedule 40 steel pipe (outside diameter = 3.35 cm; inside diameter = 2.67 cm; and thickness = 0.33 cm) carries saturated steam at 140°C. The pipe is insulated with 60 mm layer of 85 percent magnesia pipe covering, and outside this magnesia there is a 40 mm layer of cork. The inside temperature of the pipe wall is 138°C, and the outside temperature of the cork is 28°C. Thermal conductivities in W/m. °C, are: for steel, 45; for magnesia, 0.0588; for cork, 0.0519. Calculate a) the heat loss from 100 m of pipe in Watts; b) the temperature at the boundaries between metal and magnesia and between magnesia and cork.	[6]
Q.6(a)	Logarithmic mean temperature difference (LMTD) is not always valid. Establish the statement with examples.	[2]
Q.6(b)	Deduce the equation to calculate the overall heat transfer coefficient from individual coefficients considering both outside area and inside area of the pipe.	[4]