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GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022  
B. Tech Degree Examinations, December – 2020  
(Fifth Semester)  
**BBTPC 5030 – UPSTREAM PROCESS ENGINEERING**  
(Biotechnology)

Time: 2 hrs

Maximum: 50 Marks

**The figures in the right hand margin indicate marks.**

**PART – A: (Multiple Choice Questions)****(1 x 10 = 10 Marks)****Q.1. Answer ALL questions**

- a. With increase in pressure, the relative volatility for a binary system  
(i) increases. (ii) decreases.  
(iii) remains same. (iv) either (1) or (2), depends on the system.
- b. Raoult's law applies to the  
(i) all liquid solutions (ii) non-ideal solution only.  
(iii) non-volatile solute. (iv) solvents.
- c. In case of a hammer crusher, the  
(i) Feed may be highly abrasive (ii) Minimum product size is 3 mm  
(iii) Maximum feed size may be 50 mm (iv) Rotor shaft carrying hammers can be vertical or horizontal
- d. Which type of mixer is used when the flow needs to be changed often?  
(i) Paddle Mixer (ii) Static mixer  
(iii) Mechanical mixer (iv) Mechanical aerator
- e. What is the percentage of TSS removed by a rotary drum fine screen?  
(i) 50% (ii) 60%  
(iii) 65-75% (iv) 25-45%
- f. Mass transfer rate between two fluid phases does not necessarily depend on the \_\_\_\_\_ of the two phases.  
(i) Chemical properties (ii) Physical properties  
(iii) interfacial area (iv) Degree of turbulence
- g. Maximum water velocity in tubes of a 1-2 shell and tube heat exchanger may be around \_\_\_\_\_ metres/second.  
(i) 1 (ii) 10  
(iii) 20 (iv) 30
- h. The heat transfer co-efficient in film type condensation is \_\_\_\_\_ that for dropwise condensation  
Is same as (ii) lower than  
(iii) greater than (iv) half
- i. Critical speed of a ball mill depends on  
(i) the radius of the mill (shell) and the radius of the particles (ii) the radius of the mill (shell) and the density of the particles  
(iii) the radius of the balls and the radius of the particles (iv) the radius of the balls and the radius of the mill (shell)
- j. Pitot tube is used to measure -  
(i) liquid level in a tank (ii) flow velocity at a point  
(iii) angular deformation (iv) vorticity

**PART – B: (Short Answer Questions)****(2 x 5 = 10 Marks)**Q.2. Answer ALL questions

- A plait point is the point on the solubility curve, where the tie line reduces to a point. What is the number of plait point for a ternary system containing 2 pairs of partially miscible liquids?
- What is relative volatility? Give expression of relative volatility for a binary mixture.
- Explain what you mean by operating line in mass transfer operation?
- Give expression for Sherwood number and Grashof number.
- Distinguish between molecular and eddy diffusion.

**PART – C: (Long Answer Questions)****(6 x 5 = 30 Marks)**Answer ANY FIVE questions

Marks

- Explain the principles of grinding and classical laws for prediction of energy consumption in size reduction operations. (6)
- Water flows through a smooth circular pipe under turbulent conditions. In the viscous sub-layer, the velocity varies linearly with the distance from the wall. Water (density =  $1000 \text{ kg m}^{-3}$ , viscosity =  $1 \times 10^{-3} \text{ kg m}^{-1}\text{s}^{-1}$ ) flows at an average velocity of  $1 \text{ m s}^{-1}$  through the pipe. For this flow condition, the friction factor is 0.005. Calculate the velocity at a distance of 0.05 mm from the wall of the pipe. (6)
- A feed mixture of A and B (45 mole % A and 55 mol % B) is to be separated into a top product containing 96 mol % A and bottom product having 95 mol % B. The feed is 50% vapour and reflux ratio is 1.5 times the minimum. Determine the number of ideal trays required and the location of feed tray. (6)
- Write short notes on i) Flash vaporization ii) Extractive Distillation (6)
- Discuss the usefulness of sealing strips in shell and tube exchanger. (6)
- Derive the relationship between the overall mass-transfer coefficient for liquid phase  $KL$  and the individual mass-transfer coefficients,  $kL$  and  $kG$ . How can this relationship be simplified for sparingly soluble gases? (6)
- Explain the procedure to determine the minimum number of theoretical plates by PonchonSavarit method and McCabe Thiele method (6)
- A  $30\text{cm} \times 15\text{cm}$  venturi-meter is provided in a vertical pipe line carrying oil of specific gravity 0.9, the flow being upwards. The difference in elevation of the throat section and entrance section of the venturi-meter is 30 cm. The differential U-tube mercury manometer section of the guage deflection of 25cm. Calculate :  
(i) The discharge of oil,  
(ii) The pressure difference between the entrance section and the throat section.  
Data: Coefficient of discharge = 0.98, (6)

Specific gravity of mercury = 13.6.

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