



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/M.TECH (MBT (NEW/OLD))/SEM-2/MBT-203/2011**

**2011**

**DOWN STREAM PROCESSING**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

**GROUP – A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for the following :

10 × 1 = 10

- i) An ultra filter belongs to the category of
  - a) cake filter
  - b) clarifying filter
  - c) cross flow filter
  - d) none of these.
- ii) For the continuous drying of sludge's and pastes the recommended drier is of
  - a) rotary type
  - b) turbo type
  - c) truck type
  - d) tunnel type.
- iii) Penicillin is recovered from the fermentation broth by
  - a) distillation
  - b) selective absorption
  - c) adsorption
  - d) liquid extraction.

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- iv) A useful solvent for supercritical fluid extraction used in flood processing industry is
- a) carbon dioxide                      b) sulfur dioxide  
c) hydrogen                              d) oxygen.
- v) The dispersion number for a CSTR is
- a) zero                                      b) 1  
c) 2    d) infinite.
- vi) Rate of drying is dependent on moisture content during
- a) falling rate period only  
b) constant rate period only  
c) critical moisture content  
d) both the constant and falling rate period.
- vii) The value of Lewis number for air water system is
- a)  $0.1$                                       b)  $1.0$   
c)  $10$                                         d)  $100$ .
- viii) Particles settling in the stokes range, their terminal velocity depends on their particle diameter
- a)  $(D_p)^2$                                   b)  $D_p$   
c)  $1/D_p$                                   d)  $(D_p)^{1/2}$ .
- ix) Rounded river sand has a sphericity ( $\phi$ ) of  $0.83$ . The shapes factor value for this sand is
- a)  $0.90$                                       b)  $1.0$   
c)  $1.20$                                       d)  $1.40$ .



x) Alcohol content of natural wine is

- a) 2%-7%                                      b) 7%-14%  
c) 14%-20%                                      d) 20%-25%.

**GROUP – B**

**( Short Answer Type Questions )**

Answer any *three* of the following.                      3 × 5 = 15

2. Explain the operation principles of micro-filtration and ultra filtration.
3. What is biomass ? What are the routes of conversion of biomass ?
4. Write down the major steps involved in the separation and purification of Intracellular enzyme.
5. Name and explain briefly the important types of chromatographic methods used for the separation of components.
6. What is the mechanical method of cell disruption ? Give a sketch of the apparatus.



**GROUP – C**

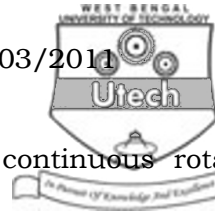
**( Long Answer Type Questions )**

Answer any *three* of the following.  $3 \times 15 = 45$

7. a) What is meant by Haemodialysis ? Give a schematic diagram of a Haemodialyser. 2 + 4
- b) A liquid containing dilute solute A at concentration  $C_i = 3 \times 10^{-2}$  kg mol per  $\text{m}^3$  is flowing rapidly by a membrane of thickness  $L = 3.0 \times 10^{-5}$  m. The distribution coefficient  $K' = 1.5$  and  $D_{ab} = 7.0 \times 10^{-11}$   $\text{m}^2$  per sec in the membrane. The solute diffuses through the membrane and its concentration on the other side is  $C_2 = 0.50 \times 10^{-2}$  kg mol per  $\text{m}^3$ . The mass transfer coefficient  $k_{c1}$  is large and can be considered as infinite and  $k_{c2} = 2.02 \times 10^{-5}$  m/sec
- i) Derive the equation to calculate the steady - state flux  $N_A$  and draw a sketch.
- ii) Calculate the flux and the concentration at the membrane interfaces. 9
8. a) A plate and frame press filtering a slurry gave a total of 25 cubic meter filtrate in 30 minutes and 35 cubic meter in 60 minutes when filtration is stopped. Estimate the washing time in minutes if 10 cubic meter of wash water are used. The resistance of the cloth can be neglected and a constant pressure is used throughout. 9



- b) Consider an ion-exchange chromatography column used to purify 20 g of a particular protein. At a superficial velocity of 20 cm/h the peak exits the column with  $Y_{\max}$  at 80 min. Estimate : (Standard deviation of the peak is 10 min.)
- How long the column be run to achieve 95% yield ?
  - How long must we run if the flow is increased to 40 cm/hr and Taylor dispersion controls ? 6
9. a) A rotary counter current dryer is to be designed for drying 20000 kg per hour of wet salt containing 7.5% (wet basis) water to 0.25% (wet basis) water. The wet salt enters the dryer at 30°C and it has a specific heat of 0.25 kcal per kg per/deg centigrade. Heated air at 150°C with a wet bulb of 40°C is available for drying the salt. If the outlet temperatures of air and salt are 65°C and 80°C respectively, calculate the length and diameter of the dryer.
- $H_{a-}$  the humidity of air at entry is 0.2418 kg water per/kg dry air deg. Centigrade latent heat 570 kcal/kg and ( $C_{SA} = C_G + h_A C_{PV} = 0.24 + 0.004 \times 0.45$ ). 10



- b) Give the principle of operation in continuous rotary vacuum filter press. 5

10. a) Write down the principle of liquid-liquid extraction. Derive the rate equation of extraction. 6

- b) 2000 kg/hr of  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  crystals are to be separated in a crystallizer by cooling a saturated solution from 50 deg. Centigrade to 18 deg. Centigrade. Cooling water enters the jacket at 15 deg. Centigrade and leaves at 20 deg. Centigrade. The over all heat transfer coefficient is estimated to be  $180 \text{ kcal/hr m}^2$  deg. Centigrade. There are 3 square meter of cooling surface per meter length.

- i) Estimate the cooling water required  
ii) Determine the number of crystallizer sections if each section is 3.5 meter long.

*Data :* Saturated solution of ferrous sulphate contains 140 and 74 parts of  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  per 100 parts excess water at 50 degree Centigrade and 18 degree Centigrade respectively. The sp. heat of solution is  $0.70 \text{ cal/gm}$  per degree Centigrade and heat of crystallization is  $75.8 \text{ cal/gram}$ . 9



11. a) How is commercial enzyme produced ? 6
- b) Prepare a flow sheet for the preparation of commercial enzyme. 9

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