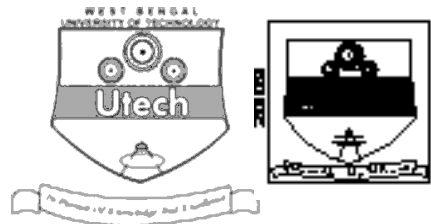


CS/M.TECH (MBT) (SUPPLE)/SEM-3/MBT-304/09
DOWNSTREAM PROCESSING (SEMESTER - 3)



1.
Signature of Invigilator

2.
Signature of the Officer-in-Charge

Reg. No.

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Roll No. of the Candidate

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CS/M.TECH (MBT) (SUPPLE)/SEM-3/MBT-304/09
ENGINEERING & MANAGEMENT EXAMINATIONS, JULY – 2009
DOWNSTREAM PROCESSING (SEMESTER - 3)

Time : 3 Hours]

[Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2. You have to answer the questions in the space provided marked 'Answer Sheet'. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification.**
9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

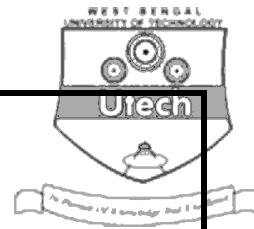
FOR OFFICE USE / EVALUATION ONLY

Marks Obtained

Question Number											Total Marks	Examiner's Signature
Marks Obtained												

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Head-Examiner/Co-Ordinator/Scrutineer

S-53071 (27/07)



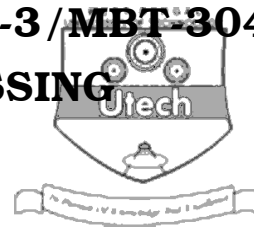
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CS/M.TECH (MBT) (SUPPLE)/SEM-3/MBT-304/09

DOWNSTREAM PROCESSING

SEMESTER - 3



Time : 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

1. Complete the following statements with appropriate formulas or expressions :

10 × 1 = 10

- i) In multistage countercurrent extraction, the ratio of solute concentrations in feed and effluent is expressed, in terms of the extraction factor, as
- ii) In multistage batch extraction, the ratio of solute concentrations in final raffinate and feed is expressed, in terms of the extraction factor, as
- iii) In batch extraction, the fraction solute extracted, p , is related to the extraction factor, E , as
- iv) For compressible cakes, the relation between specific cake resistance and pressure drop in filtration is
- v) Rejection coefficient in membrane ultrafiltration is defined as
- vi) van Deemter equation in column chromatography is
- vii) Resolution in column chromatography is defined as
- viii) In constant-pressure filtration with negligible medium resistance, how does the batch filtration time vary with volume of filtrate collected ?
- ix) The terminal velocity of a spherical particle in centrifugal setting obeying Stokes' Law is
- x) The Freundlich model for adsorption equilibria relating q , solute adsorbed [mg] per unit volume [cm^3] adsorbent, and y , solute concentration in feed solution [mg/L] is



GROUP – B

Answer any *three* of the following.

3 × 20 = 60



2. 100 c.c. of fermentation broth pretreated with filter-aid may be filtered in 24 min in a 5 cm dia *Buchner funnel* attached to an aspirator, under ordinary atmospheric pressure. Find the time required to filter 3,000 L of this broth in a plate-and-frame filter press consisting of 15 frames each of area 3,520 cm² at 2 atm pressure. (Assume negligible filter medium resistance and cake compressibility = 0.67).
3. 7,300 litres of a suspension containing 0.28 g auromycin crystals / 100 cm³ of acetone solvent is to be filtered using a filter with area 1.3 m², a filter medium of negligible resistance and at a pressure drop of 2.6 m water. Estimate the filtration time. The following test data is available :

t (s) :	10	20	30
V (l) :	0.500	0.707	0.866

N. B. : The test filtration was carried out at the same pressure and using the same filter medium, but filter area was 89 cm² and the feed solution contained 0.34 g auromycin/100 cm³ solvent.

4. 1 L water is used to 'strip' a certain amino acid from 4.7 L of toluene containing 0.006 M of this amino acid. The amino acid partitions between toluene and water as per the equilibrium relation $x^2 = Ky$ ($K = 0.001 \text{ mol L}^{-1}$), where x and y are solute concentrations in organic and aqueous phases respectively. Find the % of amino acid originally present that is extracted.
5. A steroid present in aqueous solution at a concentration of 6.8 mg L⁻¹ is to be extracted using an organic solvent *viz.* methylene dichloride (in the ratio of 12 c.c. solvent per 100 c.c. steroid solution). What fraction of steroid can be extracted if the partition coefficient for the steroid is 170 ? What is the steroid concentration in the organic phase after extraction ? What should be the volume of solvent per 100 c.c. solution if the fraction steroid extracted is to be increased to 90% ?



6. It is desired to ultrafilter 840 L of a solution containing 0.061% (by weight) of a certain protein which has a molecular weight of 16,900 and a diffusion coefficient of $1.1 \times 10^{-6} \text{ cm}^2/\text{s}$. The objective is to increase the solution concentration to 2% (by weight). The ultrafilter used has 8 hollow fibre cartridges with each cartridge having ultrafiltration surface area of 1.20 m^2 . The initial flux obtained is $5.7 \times 10^{-5} \text{ cm/s}$ under a pressure drop of 31 atmosphere.
- Assuming negligible concentration polarization estimate the time required to concentrate it.
 - Confirm whether this assumption is valid assuming C.P. layer thickness is about 0.01 cm.
7. A chromatographic separation of a two-component sample on a 50 cm column gave the retention times for the solutes A and B as 2.5 and 3.1 minutes respectively with base widths of the two chromatographic peaks being 0.24 and 0.3 minutes respectively. Calculate the
- number of theoretical plates
 - plate height and
 - resolution of the two peaks
 - re-calculate the resolution of the two peaks on an 80 cm column.
8. Calculate the retention volumes, capacity factors and relative retention of two solutes giving peaks 1 and 2 with retention times of 3.5 and 5.0 minutes respectively on a chromatographic column at a flow rate of 2.2 ml/min. The t_0 value is 1.5 min.

END