

B E. Food Technology and Biochemical Engineering Fourth Year Second Semester 2022

Subject: **Separation and Purification Processes (Hons)**

Time: 3 hrs. Full Marks: 70

Use separate answerscript for each part.

PART I (35 Marks)

Answer question no. 5 and any three from the rest.

1. What is the principal of the Reverse Osmosis (RO) process? Deduce an expression for the rejection coefficient,  $R$  from the flux equations of the solvent and the solute through the membrane. 2+8
2. Calculate the osmotic pressure of a solution (by both the equation and the data given ) containing 0.15 gmol NaCl per 1000 gm water at 25°C.(Density of water at 25°C is 997 kg/ m<sup>3</sup>).

Data given:

gmol NaCl/ kg water	Density(kg/m <sup>3</sup> ).	Osmotic pressure (atm)
1. 0	997	0
2. 0.01.	997.4.	0.47
3. 0.10.	1001.1.	4.56
4. 0.50.	1017.2.	22.55
5. 1.00.	1036.2.	45.80
6. 2.00.	1072.3.	96.2

3. What were the various stages in the development of membranes in RO? 10
4. What is meant by concentration polarisation in the membrane processes? Deduce an expression for the concentration polarisation factor. 4+6
5. Write short notes on any one (5)
  - (a) Negative effects of concentration polarisation on membrane processes.
  - (b) Application of RO in the food industry where the concentrate is of major interest.

[ Turn over

**B.E (FTBE) 4TH YEAR-2ND SEMESTER 2022**  
**SEPARATION AND PURIFICATION PROCESSES (HONS.)**

Part-II ( Full marks 50 )

Answer any three of the following questions ( 3x 16 = 48 )

(Maximum 2 marks will be awarded for cleanliness and to-the-point answering)

1. (a) Mention the criteria based on which you may choose separation processes for food/ biochemical operations
- (b) Name six different separation processes practiced in food / biochemical operations
- (c) Write the differences between 'cross-flow' and 'dead-end' filtration.
- (d) What are 'downcomer', 'bubble cap' and 'tray' in a distillation tower? (4 + 3 + 3+ (3x2))
2. (a) What is the difference between solvent extraction and leaching ? Cite one example of use of solvent extraction as separation process.
- (b) Write the advantages of using SCE ?
- (c) Name the property based on which separation by distillation is done for liquid mixtures
- (d) What are 'up-stream' and 'down-stream' processes?
- (e) What are basis of separation through 'crystallization' and 'evaporation'?
- (f) What do you mean by 'raffinate'? ((2+2) + 4+ 1+ 2 + (1.5x2),+2
3. (a) Write the steps undertaken in a general chromatographic separation process.
- (b) Define the following terms 'analyte', 'eluent', 'detector' and 'chromatogram'.
- (c) Classify different types of chromatographic techniques.
- (d) Name two materials used as stationary phase in a gas-liquid chromatography. (3 + (4x2) +3 + 2)
4. (a) Give examples of 'carrier gas' used in chromatography.
- (b) Give example of adsorbents in liquid-solid chromatography. Give example of separation using this technique.
- (c) What is 'TLC' and what is 'R<sub>f</sub>' ?
- (d) Write short note on : (any two )
  - (i) Planner chromatography (ii) Partition chromatography
  - (iii) Adsorption chromatography (2 + (2+1) + (2+2) + (3.5x2))

End