



**SCHOOL OF BIO SCIENCES AND TECHNOLOGY**  
**CONTINUOUS ASSESSMENT TEST -II**  
**WINTER SEMESTER 2024-2025**

Programme Name & Branch : M.Sc. Integrated Biotechnology Course  
Code : TBIT 206L  
Course Name : Fundamentals of Chemical Engineering  
Slot : B1 + TB1  
Faculty Name(s) : Dr. Venkat Kumar S, Dr. Dhanya V  
Class Number(s) : VL2024250501290, VL2024250501291  
Date of Examination : 17-MAR-2025  
Exam Duration : 90 minutes  
Maximum Marks: 50

**General instruction(s): Answer all the questions.**

| Q. No  | Question                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Marks    |          |          |          |        |         |          |         |    |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|--------|---------|----------|---------|----|
| 1.     | Soya bean seeds are extracted with hexane in a batch reactor after the certain time interval ('t'). The seeds that need to be processed contain 25% oil, 68% solids, 7% moisture. At the end of the extraction, Deoiled cake (DOC) is separated from the hexane-oil mixture. DOC analysis yields 1.4% oil, 90% solids and 8.6% moisture. Find the % recovery of oil, all percentage are by weight.                                                                                                                                                                                                                                           | 10       |          |          |          |        |         |          |         |    |
| 2.     | 600 Kg spent acid, 800 Kg aqueous $\text{HNO}_3$ and 1800 Kg aqueous $\text{H}_2\text{SO}_4$ are blended to prepare a mixed acid. Spent acid contains 60% $\text{H}_2\text{SO}_4$ , 20% $\text{HNO}_3$ , 20% water. Aqueous $\text{HNO}_3$ contains 95% $\text{HNO}_3$ and 5% water. Aqueous $\text{H}_2\text{SO}_4$ contains 96% $\text{H}_2\text{SO}_4$ and 4% water. All % are by wt. Calculate the mole% and weight% of each component in the mixed acid.                                                                                                                                                                                | 10       |          |          |          |        |         |          |         |    |
| 3.     | Corn steep liquor contains 5% invert sugar and 60% water; the rest can be considered solids. Beet molasses containing 50% sucrose, 5% invert sugar, 20% water and the remaining solids is mixed with corn steep liquor in a mixed tank. Water is added to promote a dilute sugar mixture containing 2% (w/w) invert sugars. 200 Kg corn steep liquor and 50 Kg molasses are fed into the tank<br>(a) How much water is required<br>(b) What is the concentration of sucrose in the final mixture?                                                                                                                                            | 10       |          |          |          |        |         |          |         |    |
| 4.     | <p>A solution containing 15% NaCl, 5% KCl and water is fed to the process shown in figure at the rate of 25,500 kg/h. The compositions of the stream are as follows: Evaporator product P: NaCl =20%, KCl=25% and water. Recycle product R: NaCl =25 % and water. Calculate the flow rates in kg/h and compute the composition of feed to the evaporator(F')</p> <pre>graph LR     F[Fresh feed F] --&gt; F_prime[F']     F_prime --&gt; Evaporator     Evaporator --&gt; NaCl[NaCl only]     Evaporator --&gt; P[P]     P --&gt; Crystallizer     Crystallizer --&gt; KCl[KCl only]     Crystallizer --&gt; R[R]     R --&gt; F_prime</pre> | 10       |          |          |          |        |         |          |         |    |
| 5.     | <p>Toluene is heated from 300 K to 350 K at the rate of 0.5 kg/s. Calculate the heat required to be added to toluene using constants, given below. (<math>C = a + bT + cT^2 + dT^3</math> and the values of constant are given based on kJ/kmol.k for C)</p> <table><tr><td>0</td><td><math>bx10^3</math></td><td><math>cx10^6</math></td><td><math>dx10^9</math></td></tr><tr><td>1.8083</td><td>812.223</td><td>-1512.67</td><td>1630.01</td></tr></table>                                                                                                                                                                                 | 0        | $bx10^3$ | $cx10^6$ | $dx10^9$ | 1.8083 | 812.223 | -1512.67 | 1630.01 | 10 |
| 0      | $bx10^3$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | $cx10^6$ | $dx10^9$ |          |          |        |         |          |         |    |
| 1.8083 | 812.223                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | -1512.67 | 1630.01  |          |          |        |         |          |         |    |