Tribhuvan University
Institute of Engineering
Examination Control Division
2083

Examination	Regular √		Back
Level	BE	Full Marks	60
Program	BCH	Pass Marks	40
Year/Part	III/II	Time	3 Hrs.

Subject:- Mass Transfer II (Model Question) **Course Code:- (ENCH 353)**

√ Candidates are required to give their answers in their own words as **far as practicable**.
√ Attempt **all** questions
√ The figures in the margin indicate **Full Marks.**
√ Necessary figure(s) are/is attached herewith.
√ Assume suitable data if necessary
√ Equilateral triangular graph will be provided.

<table>
<tr><th>QN</th><th>Description</th><th>Marks</th><th>Chapter No.</th></tr>
<tr><td>1</td><td>a) Briefly explain the effect of temperature on Liq-Liq Equilibria (LLE.
b) The system water (A)-chlorobenzene (B)-pyridine (C) at 25°C. Equilibrium tie-line data, interpolated from those of Peake and Thompson, Ind. Eng. Chem., 44, 2439 (1952), in weight percent are shown below:
<table>
<tr><td colspan="10">Solvent phase</td></tr>
<tr><td>A</td><td>0.05</td><td>0.67</td><td>1.15</td><td>1.62</td><td>2.25</td><td>2.87</td><td>3.95</td><td>6.40</td><td>13.2</td></tr>
<tr><td>B</td><td>99.95</td><td>88.28</td><td>79.90</td><td>74.2</td><td>69.15</td><td>65.58</td><td>61.0</td><td>53.0</td><td>37.8</td></tr>
<tr><td>C</td><td>0</td><td>11.05</td><td>18.95</td><td>24.10</td><td>28.60</td><td>31.55</td><td>35.05</td><td>40.60</td><td>49.0</td></tr>
<tr><td colspan="10">Water phase</td></tr>
<tr><td>A</td><td>99.92</td><td>94.82</td><td>88.71</td><td>80.72</td><td>73.92</td><td>62.05</td><td>50.87</td><td>37.90</td><td>13.2</td></tr>
<tr><td>B</td><td>0.08</td><td>0.16</td><td>0.24</td><td>0.38</td><td>0.58</td><td>1.85</td><td>4.18</td><td>8.90</td><td>37.8</td></tr>
<tr><td>C</td><td>0</td><td>5.02</td><td>11.05</td><td>18.90</td><td>25.50</td><td>36.10</td><td>44.9</td><td>53.20</td><td>49.0</td></tr>
</table>
It is desired to reduce the pyridine concentration of 2000 kg of an aqueous solution from 50 to 2% in a single batch extraction with chlorobenzene. What amount of solvent is required? Solve on triangular coordinates.</td><td>3 + 7</td><td>1</td></tr>
<tr><td>2</td><td>a) Write short note on supercritical fluid extraction.
b) One thousand kilograms of crushed oil seeds (19.5% oil, 80.5% meal) is extracted with 1500 kg of 'pure' hexane in a batch extraction vessel. Calculate the fraction of the oil extracted using the right-triangular diagram. Equilibrium data are give below.</td><td>3+5</td><td>2</td></tr>
</table>

	<table><tr><th colspan="12">Overflow 100 kg solution</th></tr><tr><td>w_A kg</td><td>0.3</td><td>0.45</td><td>0.54</td><td>0.70</td><td>0.77</td><td>0.91</td><td>0.99</td><td>1.19</td><td>1.28</td><td>1.28</td><td>1.28</td></tr><tr><td>w_B kg</td><td>99.7</td><td>90.6</td><td>84.54</td><td>74.47</td><td>69.45</td><td>60.44</td><td>54.45</td><td>44.45</td><td>38.50</td><td>34.55</td><td>24.63</td></tr><tr><td>w_C kg</td><td>0</td><td>8.95</td><td>14.92</td><td>24.83</td><td>29.77</td><td>39.65</td><td>44.58</td><td>54.35</td><td>60.22</td><td>64.17</td><td>73.89</td></tr><tr><td colspan="12">Underflow 100 kg slurry</td></tr><tr><td>W'_A kg</td><td>67.2</td><td>67.1</td><td>66.93</td><td>66.58</td><td>66.26</td><td>65.75</td><td>65.33</td><td>64.39</td><td>63.77</td><td>63.23</td><td>61.54</td></tr><tr><td>W'_B kg</td><td>32.8</td><td>29.94</td><td>28.11</td><td>25.06</td><td>23.62</td><td>20.9</td><td>19.07</td><td>16.02</td><td>14.13</td><td>12.87</td><td>9.61</td></tr><tr><td>W'_C kg</td><td>0</td><td>2.96</td><td>4.96</td><td>8.36</td><td>10.12</td><td>13.35</td><td>15.6</td><td>19.59</td><td>22.10</td><td>23.90</td><td>28.85</td></tr></table>		
3	a) Differentiate between physical and chemical adsorption. b) Write short on regeneration of adsorbent. c) Write the principle of chromatography and state few applications. d) A solid adsorbent is used to remove colour impurity from an aqueous solution. The original value of colour on an arbitrary scale is 48. It is required to reduce this to 10% of its original value. Using the following data, find the quantity of fresh adsorbent used for 1000 kg of solution for a two-stage cross-current operation when the intermediate colour value is 24. <table><tr><td>kg adsorbent/kg solution</td><td>0</td><td>0.001</td><td>0.004</td><td>0.008</td><td>0.02</td><td>0.04</td></tr><tr><td>Equilibrium color</td><td>48</td><td>43</td><td>31.5</td><td>21.5</td><td>8.5</td><td>3.5</td></tr></table>	2+3+2 + 5	3
4	a) Define membrane characterization. Write short note on molecular weight cut off and pore size distribution. b) Write in detail about polymeric membrane.	5 + 5	4
5	a) Explain briefly about spray dryer with its schematic diagram. b) A granular wet solid is dried on a tray dryer under cross-flow of hot air from 30% initial moisture to 1% final moisture. The solid loading is 35 kg dry solid per m^2 tray area. The constant drying rate is N_c = 4.5 kg/m^2h. The critical moisture is 10% and the equilibrium moisture is 0.2%. i. total drying time if the falling rate is linear in moisture content.	4+ 6	5
6	a) Derive the equation to calculate the evaporation rate of solvent to achieve the required crystal size. Make a necessary assumption for the derivation. b) Discuss in detail about secondary nucleation.	6 + 4	6

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Signature of Moderators

Full Name: …….

Date: ……

Contact No:

…….

Signature of Setter

Full Name: …….

Date: ……

Contact No: