Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_

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**End Semester Examination – Nov/Dec – 2018**

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| **Code :** | **14FP2010** | **Duration :** | **3hrs** |
| **Sub. Name :** | **UNIT OPERATIONS IN FOOD PROCESS ENGINEERING - II** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | Demonstrate the process of flash distillation and derive the mass balance equation. | CO2 | 10 |
| b. | Water alcohol mixture of about 100kg is separated in a batch distillation unit until the left out concentration of alcohol in the bottom liquid is 10%. The feed initially contains 40% alcohol. All the composition are on molar basis. Find out the moles of alcohol produced in the process (Assume the value of YD as 0.46 and XD as 0.3145) and derive the material balance for the above process. | CO3 | 10 |
| (OR) | | | | |
| 2. | a. | Draw and label the various parts of the fractionating column and explain the working in detail. | CO2 | 8 |
| b. | Steam distillation process is used for separating out a spice oil from the pepper by passing steam into the chamber at 60 kPa at the rate of 350 kg/hour for 35 minutes. If the molecular weight of the volatile oil and steam are 170 and 20 respectively, find the quantity of pipperine distilled. Consider the total pressure as 101.3 kPa. | CO3 | 8 |
| c. | State the purpose of vacuum distillation process. | CO1 | 4 |
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| 3. | a. | Show that the binary gas mixtures will have same diffusivity coefficient. | CO3 | 10 |
|  | b. | Describe the Ballman and Hildebrandt extraction equipments in detail . | CO1 | 10 |
| (OR) | | | | |
| 4. | a. | Quote the extraction principle. | CO1 | 3 |
| b. | The natural food colour from beet root is to be extracted with water. The saturated concentration of the colour in water is found to be 1.6 kg/m3. In a lab scale extractor containing about one litre volume, it has taken 10 minutes to extract the colour from beet root to an extent of 985 ppm. Under similar condition in a commercial plant of 10 m3 capacity, it is desired to extract 12 kg of colour into the water. How much time does it take for extraction? | CO3 | 10 |
| c. | List out the applications of extraction in detail. | CO2 | 7 |
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| 5. | a. | Explain how adsorption takes with the help of Fixed bed adborbing unit. | CO2 | 10 |
| b. | Calculate the nucleation rate of sodium chloride crystals at 27°C which have a surface tension of 6.56 ergs/cm2. The solution has a fractional super saturation of (s value) of 0.035. the density of MgCl2 is 2.32 x 103 g/cm3. and molecular weight of MgCl2 is 95.23. | CO3 | 6 |
| c. | Enlist the role of absorbption in food processing. | CO1 | 4 |
| (OR) | | | | |
| 6. |  | Generalize the concept, construction and working of Super Critical Fluid Extraction and discuss its application and limitations. | CO3 | 20 |
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| 7. |  | Compare the different types of crystallization equipment with a diagram. | CO3 | 20 |
| (OR) | | | | |
| 8. | a. | Describe the working of different types of membranes used in food industries. | CO1 | 10 |
| b. | Estimate the osmotic pressure of orange juice with 20% total solids at 25℃. The density of orange juice is 1035 kg/m3, Gas constant = 8.314 (m3 kPa/kg mol K) and molecular weight is 180 kg/kg mol. | CO3 | 5 |
| c. | Tabulate the applications of crystallization in food processing. | CO1 | 5 |
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|  | | **Compulsory**: |  |  |
| 9. | a. | Point out the role of various membrane modules with a neat sketch. | CO3 | 10 |
| b. | An ultrafiltration membrane was examined microscopically and found to have about 1,80,000 pores with an average diameter of 0.6 x 10-6 m per mm2 of membrane surface. The thickness of the membrane is 140x10-6 m. The viscosity of the permeate is 0.0013 Pa.s. Estimate the following : a) Porosity of the membrane (€), b) Hydraulic Permeability (LP) and c) Permeate Flux(J) for a Trans membrane Pressure Difference(∆PTM) of 1.5 Pa. | CO3 | 10 |