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



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

**End Semester Examination – April/May– 2017**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| **Code :** | **14FP3002** | **Duration :** | **3hrs** |
| **Sub. Name :** | **MASS TRANSFER PROCESSES IN FOOD ENGINEERING** | **Max. marks :** | **100** |

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q. No. | Sub Div. | Questions | Course  Outcome | Marks |
| 1. | a. | A solution of NaCl in water contains 20% NaCl (by mass) at 333 K. The density of the solution is 1.127 kg/lit. Find the molarity, normality and molality of the solution. | CO2 | 9 |
| b. | The available nitrogen in an urea sample is found to be 45% (by mass). Find the actual urea content in the sample. | CO2 | 7 |
| c. | Find the equivalent mass of PO4 radical and Na3PO4. At. wt Na – 23, P – 31, O -16 and Cl – 35.45. | CO2 | 4 |
| (OR) | | | | |
| 2. | a. | A gas mixture has the following composition by volume.  Ethylene 30.6%  Benzene 24.5%  Oxygen 1.3%  Methane 15.5%  Ethane 25.0%  Nitrogen 3.1%  Find a) the average molecular mass of the gas mixture, b) the composition by mass and c) the density of the mixture in kg/m3 at NTP | CO2 | 12 |
| b. | Calculate the available nitrogen in the following a) Commercial ammonium sulphate (96% pure) b) Pure sodium nitrate (100%).At. wt N – 14, S – 32, Na - 23 | CO2 | 8 |
| 3. | a. | Explain T-x,y and P-x,y diagram for vapour liquid equilibrium with neat sketch | CO1 | 12 |
| b. | What is ideal and non ideal solution and define Raoult’s law | CO1 | 8 |
| (OR) | | | | |
| 4. | a. | Methyl alcohol and ethyl alcohol at 100°C have vapour pressure 2710 mm and 1635 mm Hg respectively. Calculate the total pressure and composition of the vapour in contact with a liquid containing 30% by weight methyl alcohol and 70% by weight ethyl alcohol at 100°C. | CO2 | 13 |
| b. | Explain steam distillation with neat sketch. | CO1 | 7 |
| 5. |  | A single effect evaporator is to be designed to concentrate 9000 kg/hr of a solution from 12% to 20% solids. Feed enters at 25°C. Saturated steam at 110°C (latent heat = 540 kcal/kg) is available and the condensate leaves at the condensing temperature. Saturation temperature of vapour to the condenser is 40°C (latent heat = 580 kcal/kg). Specific heats of all solutions may be taken as 1.0. Boiling point of the solution is negligible. The evaporator has an overall heat transfer coefficient of 1900 kcal/hrm2°C. Calculate i) the steam consumption in kg/hr ii) the area of heating surface required in m2. | CO2 | 20 |
| (OR) | | | | |
| 6. | a. | What is the difference between distillation and liquid liquid extraction | CO1 | 8 |
| b. | Explain the liquid liquid equilibirium for the system of three liquids with one pair partially miscible. | CO1 | 12 |
| 7. | a. | What are the factors that will affect the rate of leaching? Explain. | CO1 | 6 |
| b. | Explain single stage leaching with constant under flow. | CO1 | 14 |
| (OR) | | | | |
| 8. | a. | Explain the extraction of oleoresin and oil by using supercritical fluids with neat sketch. | CO1 | 14 |
| b. | What are the advantages and limitations of supercritical fluid extraction. | CO1 | 6 |
|  | | **Compulsory**: |  |  |
| 9. | a. | For the production of marmalade, the fruits are mixed with sugar and pectin and the mixture is boiled to about 65% solids concentration. Find the amount of fruits, sugar, and pectin that must be used for the production of 1000 kg marmalade, if the solids content of the fruits is 10%, the ratio of sugar to fruit in the recipe is 56:44, and the ratio of sugar to pectin is 100. | CO2 | 14 |
| b. | How many kg/h of sugar syrup with 10% sugar must be fed to an evaporator to produce 10000 kg/h of sugar syrup with 65% sugar? | CO2 | 6 |

ALL THE BEST