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



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

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| **Code :** | **18FP3001** | **Duration :** | **3hrs** |
| **Sub. Name :** | **MASS TRANSFER AND SEPARATION PROCESSES IN FOOD ENGINEERING** | **Max. marks :** | **100** |

**ANSWER ANY FIVE QUESTIONS (5 x 16 = 80 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | Derive the expression to compute the velocity of flow in pipe using Pitot tube. | CO1 | 8 |
|  | b. | A 60 cm diameter pipe conveying liquid food converges in to 50 cm diameter at the other end and then branches into two pipes of diameters 30 cm and 15 cm respectively. If the average velocity in the 60 cm pipe is 6 m/s, compute the following : i) the discharge in the pipe, ii) the velocity at the converging end and iii) the velocity in the 30 cm pipe if the average velocity in the 15 cm pipe is 2.5 m/s. | CO2 | 8 |
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| 2. | a. | Write the working of Falling film evaporator with figure. | CO3 | 8 |
| b. | Derive the mass balance for triple effect evaporator. | CO4 | 8 |
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| 3. | a. | Draw the diagram of screw press and explain its working. | CO3 | 8 |
| b. | Write a note on Super Critical Fluid Extraction process. | CO3 | 8 |
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| 4. |  | Fruit juice is filtered using a filter press having a cross sectional area of 2 m2 under a gauge pressure of 1.5 x 105 Pa. The feed has a solid content of 25 g per litre whose density is 900 kg/m3. The viscosity of the filtrate is 0.001 Pa. s. The volume of the filtrate collected with time are as given below:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | T, min | 8 | 26 | 52 | 90 | | V, litre | 5 | 10 | 15 | 20 |   Determine the specific cake resistance(α) and equivalent cake thickness(Lm). | CO3 | 16 |
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| 5. | a. | Explain the working of basket centrifuge with a neat sketch. | CO3 | 10 |
| b. | A bowl centrifuge is used for separation of cream from milk which has the discharge diameters of 10 cm and 14 cm. If the density of milk is same as that of water and the cream density is 840 kg/m3, calculate the radius of the neutral zone in the centrifuge. | CO6 | 6 |
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| 6. | a. | A fruit juice has solids suspended on it. A sedimenter is used to settle the solids to decant the clear decoction. The suspended solids have an average diameter of 1.3x 10-5 m. Find the terminal velocity of the particles if the density of the solids is 1250 kg/m3 and the specific gravity of the juice is 1.08 and its viscosity is 1.1x10-3 Pa.s. | CO5 | 8 |
| b. | Explain the working of plate and frame filter press with a neat sketch. | CO3 | 8 |
| 7. | a. | Derive the expression to find the settling velocity of particles in a centrifuge. | CO3 | 8 |
| b. | A basket centrifuge with solid walls of 0.7 m height contains 80 kg of water. The centrifuge rotates at 3000 rpm. Consider the density of water as 1000 kg/m3. Calculate the following : i) Angular Velocity, ii) Inner radius of the annular water mass (r22 – r12) and iii) Pressure (P) developed at the walls of the centrifuge. | CO5 | 8 |
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| **COMPULSORY QUESTION (1 x 20 = 20 Marks)** | | | | |
| 8. | a. | Explain the tubular and plate and frame membrane configurations with necessary figures. | CO3 | 10 |
| b. | The concentration of milk protein is being accomplished by using an ultrafiltration membrane to separate water. The 30 kg/min of feed stream has 8% solids and is being increased to 23% total solids. The membrane tube has a 8 cm inside diameter and the pressure difference is 2200 kPa. Estimate the flux of water through the membrane and length of the membrane tube when the hydraulic permeability is 5x10-5 kg of water/m2k Pa. s. | CO6 | 10 |