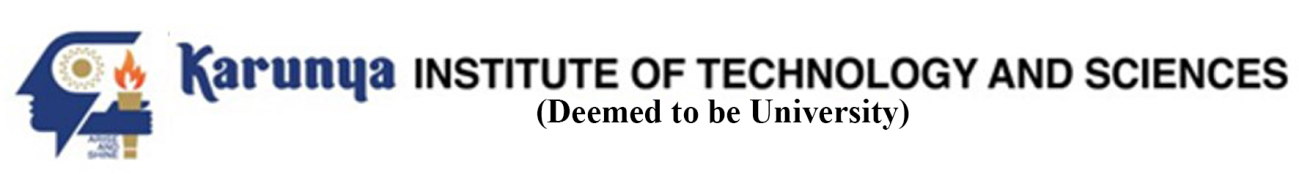
Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_



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

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| --- | --- | --- | --- |
| **Code :** | **14FP2021** | **Duration :** | **3hrs** |
| **Sub. Name :** | **FOOD PROCESS EQUIPMENT DESIGN** | **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. | Derive an expression for mass and energy balance of a dehydration system. | CO2 | 8 |
| b. | Illustrate with a neat sketch the working of fluidized bed dryer. | CO3 | 8 |
| c. | List the advantages of freeze drying. | CO3 | 4 |
| (OR) | | | | |
| 2. | a. | The initial moisture content of a food product is 77% (wet basis), and the critical moisture content is 30% (wet basis). If the constant drying rate is 0.1 kg H2O/(m2s), compute the time required for the product to begin the falling-rate drying period. The product has a cube shape with 5-cm sides, and the initial product density is 950 kg/m3. | CO2 | 10 |
| b. | Onions with 75 % moisture content on wet basis is dried to a final moisture content of 20 %. If we dry 1000 kg of onions, what is the final weight of the product, and how much water is removed? | CO2 | 5 |
| c | Write a note on constant drying rate period. | CO1 | 5 |
|  |  |  |  |  |
| 3. |  | A dilute solution is subjected to flash distillation. The solution is heated in a heat exchanger and then flashes in a vacuum vessel. If heat at a rate of 270000 kJ/h is transferred to the solution in the heat exchanger, calculate:   1. the temperature of the solution at the exit of the heat exchanger, 2. the amount of overhead vapor and residual liquid leaving the vacuum vessel.   The following data are given:  Flow rate and temperature of the solution at the inlet of the heat exchanger is 1000 kg/h and 50°C, heat capacity of the solution is 3.8 kJ/kg°C, and absolute pressure in the vacuum vessel is 70.14 kPa. | CO3 | 20 |
| (OR) | | | | |
| 4. | a. | Illustrate with a diagram construction and working of falling film evaporator. | CO3 | 10 |
| b. | How much saturated steam with 120.8 kPa pressure is required to concentrate1000 kg/h of juice from 12% to 20% solids at 95°C? Assume that the heat capacity of juice is 4 kJ/kg°C. | CO2 | 10 |
|  |  |  |  |  |
| 5. | a. | A thin cylindrical pressure vessel of 1.2 m diameter generates steam at a pressure of 1.75 N/mm2. Find the minimum wall thickness, if i) the longitudinal stress does not exceed 28 MPa; and ii) the circumferential stress does not exceed 42 MPa | CO3 | 10 |
| b. | A cast iron cylinder of internal diameter 200 mm and thickness 50 mm is subjected to a pressure of 5 N/mm2. Calculate the tangential and radial stresses at the inner, middle (radius = 125 mm) and outer surfaces. | CO2 | 10 |
| (OR) | | | | |
| 6. | a. | The reaction A→B is to be carried out isothermally in a continuous-flow reactor. Calculate the CSTR,PFR volume to consume 79% of A, when the entering molar flow rate is 5 mol A/h, the volumetric flow rate is constant at 10 L/h and the rate is –rA=(3 L/mol•h)CA2. | CO3 | 15 |
| b. | Classify the pressure vessels. | CO3 | 5 |
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| 7. | a. | Describe in detail about ferrous alloys and SS used for construction of food processing equipments. | CO2 | 15 |
| b. | Write a note on polymers used in coating and as construction material in equipments. | CO1 | 5 |
| (OR) | | | | |
| 8. |  | Explain the steps and general design procedure of food engineering equipments. | CO2 | 20 |
|  | |  |  |  |
|  | | **Compulsory**: |  |  |
| 9. | a. | Explain in brief about the following losses in storage vessels:   1. Breathing losses 2. Filling losses. 3. Boiling losses | CO2 | 15 |
| b. | Describe in detail about the Hortonspheres. | CO3 | 5 |