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

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**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

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

**End Semester Examination – Nov/Dec – 2017**

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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. | A food solid was dried from 40 to 10% moisture content in 2 h in a batch drier with constant air conditions. The drying rate remained constant down to a moisture content of 15%. If the equilibrium moisture content is 2%, calculate the total time required to dry from 40 to 4% moisture content. All moisture contents are given on a dry basis. | CO3 | 10 |
| b. | Illustrate with a neat sketch the various stages in drying rate curve. | CO3 | 10 |
| (OR) | | | | |
| 2. | a. | Illustrate with a neat sketch the working of cabinet dryer. | CO3 | 10 |
| b. | Give the classification of dryers. | CO1 | 10 |
| 3. | a. | Illustrate with neat sketches the construction and working of agitated thin film evaporator. | CO3 | 10 |
|  | b. | A solution with an initial solid concentration of 10 per cent is being concentrated in a single effect evaporator to a final solid concentration of 40 percent under a vacuum of 40 kPa. Steam at a pressure of 101 kPa (gauge) is used to concentrate the liquor. The feed is entering at a temperature of 35 °C and the temperature of the final liquid is 86°C corresponding to a vacuum of 40 kPa prevailing in the evaporator. If the feed rate is 1000 kg/h, find the quantity of steam required and the heat transfer area of the evaporator. The specific heat of the feed which is reasonably constant is 5 kJ/kg°C, and the overall heat transfer coefficient is 1.9 kW /m2 °C. | CO3 | 10 |
| (OR) | | | | |
| 4. | a. | Write a note on classification of evaporators. | CO2 | 5 |
|  | b. | A hot stream is cooled from 1000°F to 520°F by cold stream entering counter currently at 350°F and exiting at 800°F. Calculate the LMTD. | CO3 | 5 |
|  | c | A quantity of water is heated with steam of 5 bar from a temperature of 35°C to 100° C over a period of 1200 s. The mass of water is 50 kg and the specific heat capacity of water is 4.19 kJ/kg°C. Calculate the heat transfer rate. | CO3 | 10 |
| 5. | a. | A thin cylindrical pressure vessel of 1.5 m diameter generates steam at a pressure of 1.95 N/mm2. Find the minimum wall thickness, if i) the longitudinal stress does not exceed 30MPa; and ii) the circumferential stress does not exceed 42 MPa | CO3 | 10 |
|  | b. | Find the thickness for a tube of internal diameter 100 mm subjected to an internal pressure which is 5/8 of the value of the maximum permissible circumferential stress. Also find the increase in internal diameter of such a tube when the internal pressure is 90 N/mm2 . Take E = 205 kN/mm2 and μ = 0.29. Neglect longitudinal strain. | CO3 | 10 |
| (OR) | | | | |
| 6. | a. | The gas phase reaction A→B+C will be carried out isothermally in a 20 dm3 constant volume, well-mixed batch reactor. 20 moles of pure A is initially placed in the reactor. If the rate is –rA=kCA and k=0.865 min-1, calculate the time needed to reduce the number of moles of A in the reactor to 0.2 mol. | CO3 | 15 |
|  | b. | Derive an expression of basic molar balance equations for CSTR, PFR and Batch reactors. | CO1 | 5 |
| 7. | a. | How will you estimate the strength of equipments through different stresses. | CO2 | 10 |
|  | b. | Write the impact of corrosion over strength of equipments. | CO1 | 5 |
|  | c. | Give a note on choice of material in equipment design | CO2 | 5 |
| (OR) | | | | |
| 8. |  | Enumerate the usage of various non-ferrous metals in construction of food processing equipments. | CO2 | 20 |
|  | | **Compulsory:** |  |  |
| 9. | a. | Explain in detail about the various losses in storage tanks during handling of liquid food during processing. | CO2 | 10 |
|  | b. | Write a note over spherical shell tanks used in storage. | CO2 | 10 |

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