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

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

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| **Code :** | **17FP2001** | **Duration :** | **3hrs** |
| **Sub. Name :** | **PRINCIPLES OF FOOD PROCESS ENGINEERING** | **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. | Verify the dimensional consistency of the equation(i) X=ut+1/2at2 where **X** is the length, **u**-initial velocity **a** is acceleration and **t** - the time.(ii)Q=KAdT/dx where **Q** is the rate of heat transfer, **K** is the Thermal conductivity, **A** is the area, **dT** is the temperature difference and **dx** – thickness. | CO1 | 10 |
| b. | Elaborate the concept of moisture content in foods. | CO1 | 6 |
| c. | Distinguish between Base and Derived units. | CO1 | 4 |
| (OR) | | | | |
| 2. | a. | Define the terms Force, Pressure, Work, Energy and Heat. | CO1 | 10 |
| b. | Make the following conversion  i) 294 g/L of H2SO4 to normality (N)  ii) 4.8 mg/ml CaCl2 to normality (N)  iii) 5 N H3PO4 to g/L  iv) 54.75 g/L HCl to molarity (M)  v) 3 M K2SO4 to g/L | CO1 | 10 |
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| 3. | a. | Illustrate the thermodynamic properties of air-vapor mixture with a neat sketch of psychrometric chart. | CO2 | 10 |
| b. | Atmospheric air at 1 atmospheric pressure has 25 ºC dry bulb temperature and 75% relative humidity. Using Psychometric Chart Calculate Dew point temperature, specific volume of air, Enthalpy, wet bulb temperature and specific humidity. | CO2 | 10 |
| (OR) | | | | |
| 4. | a. | Explain Dalton’s law and Amagat’s Law with a neat diagram. | CO2 | 6 |
| b. | Define Ideal gas equation and Van der Waal’s gas equation. | CO2 | 4 |
| c. | Deduce the vapour pressure (PV), dew point temperature, Specific humidity, Relative humidity and saturation ratio of atmospheric air having barometric pressure as 1 bar dry bulb temperature as 45 ºC and wet bulb temperature as 25 ºC. | CO2 | 10 |
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| 5. | a. | Explain the types of fluid with an example. | CO3 | 6 |
| b. | The diameter of a pipe at the section 1 and 2 are 10 cm and 15 cm respectively. Find the discharge through the pipe and the velocity of water flowing through the pipe at section 1 is 5m/s. Determine also the velocity at section 2. | CO3 | 4 |
| c. | Derive Bernoulli’s and continuity Equation . | CO3 | 10 |
| (OR) | | | | |
| 6. | a. | A pitot-static tube placed in the centre of a 300 mm pipe lines has one orifice pointing upstream and other perpendicular to it. The mean velocity in the pipe is 0.80 of the central velocity. Find the discharge through the pipe if the pressure difference between the two orifices is 60 mm water. Take the coefficient of pitot tube as Cv = 0.98. | CO3 | 4 |
| b. | Explain in detail about Laminar and turbulent flow. | CO3 | 6 |
| c. | Elaborate the working principle of Pitot tube with a neat diagram. | CO3 | 10 |
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| 7. | a. | How much weight reduction would result when a material is dried from 80% moisture to 50% moisture? | CO4 | 5 |
| b. | Explain the unsteady state process with an example. | CO4 | 5 |
| c. | 1000 kg of mixed acid of composition 40% H2SO4, 45% HNO3, and 15% H20 is to be produced by strengthening waste acid of composition 30% H2SO4, 36% HNO3, and 34% H20 by weight. Concentrated sulphuric acid of strength 95% and concentrated nitric acid containing 80% are available for this purpose. How many kilograms of spent acid and concentrated acids are mixed together? | CO4 | 10 |
| (OR) | | | | |
| 8. | a. | Determine the amount of a juice concentrate containing 65% solids and single strength juice containing 15% solids that must be mixed to produce 100 kg of a concentrate containing 45% solids. | CO4 | 5 |
| b. | Alcohol content in beverages are reported as percent by volume. A “proof” is twice the volume percent of alcohol. The density of absolute ethanol is 0.7893 g/cm3. The density of a solution containing 60% by weight of ethanol is 0.8911 g/cm3. Calculate the volume of absolute ethanol that must be diluted with water to produce 1 liter of 60% by weight, ethanol solution. Calculate the “proof” of a 60% ethanol solution. | CO4 | 5 |
| c. | Illustrate the material balance for Evaporation process in single effect and triple effect evaporators.An evaporator has a rated evaporation capacity of 500 kg water/h. Deduce the rate of production of juice concentrate containing 45% total solids from raw juice containing 12% solids. | CO4 | 10 |
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|  | | **Compulsory**: |  |  |
| 9. | a. | Calculate the amount of steam at 121.1◦C (250◦F) that must be added to 100 kg of a food product with a specific heat of 3559 J/(kgK) to heat the product from 4.44◦C (40◦F) to 82.2◦C (180◦F) by direct steam injection. | CO5 | 5 |
| b. | Paraphrase the following: i) Potential Energy ii) Kinetic energy  iii) Enthalpy iv) Sensible heat v) Latent heat | CO5 | 5 |
| c. | Steam is used for peeling potatoes in a semicontinuous operation. Steam is supplied at the rate of 4 kg per 100 kg of unpeeled potatoes. The unpeeled potatoes enter the system with a temperature of 17oC, and the peeled potatoes leave at 35oC. A waste stream from the system leaves at 60oC.The specific heats of unpeeled potatoes, waste stream, and peeled potatoesare 3.7, 4.2, and 3.5 kJ/(kg K), respectively. If the heat content (assuming 0oC reference temperature) of the steam is 2750 kJ/kg, determine the quantities  of the waste stream and the peeled potatoes from the process. | CO5 | 10 |