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 – Nov/Dec– 2017**

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| **Code :** | **14FP2001** | **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. | Define molarity, molality and normality. | CO1 | 6 |
| b. | Convert 30 mg/s to its equivalent in kg/hr. | CO1 | 4 |
| c. | Show that the equation of motion s = ut + ½ at2 and v2 = u2 + 2as are dimentsionally consistent. Where s, a, u, v and t are the displacement, acceleration, initial velocity, final velocity and time respectively. | CO2 | 10 |
| (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  i. the average molecular mass of the gas mixture,  ii.the composition by mass and iii. the density of the mixture in kg/m3 at NTP. | CO2 | 12 |
| b. | A force equal to 25 kgf is applied on the piston with a diameter of 2 cm. Find the pressure exerted on a piston in kPa. | CO2 | 8 |
| 3. | a. | Compare the equation of state for ideal and real gas and explain the need for volume correction factor and pressure correction factor. | CO1 | 8 |
| b. | One mole of carbon-dioxide was found to occupy a volume of 1.32 litre at 48°C and at a pressure of 16.4 atm. Calculate the pressure of the gas that would have been expected to behave ideally and non-ideally. | CO2 | 12 |
| (OR) | | | | |
| 4. | a. | Two engineers are calculating the average molecular weight of a gaseous mixture containing oxygen and other gases. One of them using the correct molecular weight of 32 for oxygen determines the average molecular weight correctly as 39.2. The other using an incorrect value of 16, determines the average molecular weight as 32.8. This is the only error in his calculations. What is the mole percent of oxygen in the mixture? | CO2 | 6 |
| b. | Derive the expression for critical temperature, critical pressure and critical volume from Vander Waals equation. | CO1 | 14 |
| 5. | a. | Write short notes on i. Hess’s law of constant heat summation ii. Standard heat of formation iii. Molal specific heat capacity | CO1 | 9 |
| b. | On the basis of the data and the chemical reactions given below, find the heat of formation of ZnSO4 from elements.   1. Zn + S (rhomb) ----------- ZnS ∆H = -44 kcal/kg mol. 2. 2ZnS + 3O2 ---------- 2ZnO + 2SO2 ∆H = -221.88 kcal/kg mole 3. 2SO2 + O2 ------------ 2SO3 ∆H = - 46.88 kcal/kg mole 4. ZnO + SO3 ------------ ZnSO4 ∆H = - 55.10 kcal/kg mole | CO2 | 11 |
| (OR) | | | | |
| 6. | a. | Calculate the number of kilo calories required to heat from 500K to 1500K, 1 cubic meter (1atm 0°C) of a gas having the following composition by volume. CO2 – 70%, N2 – 27%, O2 – 2% and H2 – 1%. The specific heat correlation is given below  Cp = a + bT + cT2 Where  a b c  CO2 6.339 10.14x10-3 -3.415x10-6  N2 6.457 1.389x10-3 -0.069x10-6  O2 6.117 3.167x10-3 -1.005x10-6  H2 6.946 -0.196x10-3 0.4757x10-6  T is in Kelvin and Cp is in kcal/kmol K | CO2 | 15 |
| b. | Calculate the standard heat of reaction of the following reaction  C2H6(g) ------------------ C2H4(g) + H2(g)  Data:  Component ∆Hc° (kJ/mol)  C2H6(g) -1561  C2H4(g) -1411  H2(g) -286 | CO2 | 5 |
| 7. | a. | Write short note on i. Relative humidity ii. Dry bulb temperature iii. Wet bulb temperature and iv. Dew point temperature | CO1 | 8 |
| b. | Dry bulb and wet bulb temperatures of 1 atmospheric air stream are 40°C and 30°C respectively. Determine i. Humidity ratio ii. relative humidity iii. specific enthalpy. | CO2 | 12 |
| (OR) | | | | |
| 8. | a. | It is required to make 1000 kg mixed acid containing 60% H2SO4, 32% HNO3 and 8% water by blending i) the spent acid containing 11.3% HNO3, 44.4% H2SO4 and 44.3% H2O ii) aqueous 90% HNO3 and iii) aqueous 98% H2SO4. All percentages are by mass. Calculate the quantities of the three acids required for blending. | CO2 | 15 |
| b. | What are the various methods of solving the material balance problems without chemical reactions | CO1 | 5 |
|  | | **Compulsory**: | | |
| 9. |  | Milk with 3.8% fat and 8.1% fat-free solids (FFS) is used for the production of canned concentrated milk. The process includes separation of the cream in a centrifuge and concentration of the partially defatted milk in an evaporator. If the cream that is produced in the centrifuge contains 55% water, 40% fat, and 5% fat-free solids, calculate how much milk is necessary in order to produce a can of concentrated milk that contains 410 g milk with 7.8% fat and 18.1% fat-free solids. How much cream and how much water must be removed in the centrifuge and the evaporator respectively? Assume steady state. | CO2 | 20 |

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