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



**End Semester Examination – Nov / Dec – 2019**

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| **Code :** | **17BT2003** | **Duration :** | **3hrs** |
| **Sub. Name :** | **PRINCIPLES OF CHEMICAL 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. |  | Sulphur trioxide gas is obtained by the combustion of iron pyrites (FeS2) according to the following equation 4FeS2 + 15O2 ---- 2Fe2O3 + 8 SO3.  How many kilograms of pyrites are burned to obtain 100 kg of sulphur trioxide?  How many kilograms of O2 are consumed in the production of 50 kg of SO3 ? | CO1 | 20 |
| **(OR)** | | | | |
| 2. | a. | Steam is flowing at the rate of 2000 kg/hr in a 3 inch NB 40 scheule pipe at 440 kPa (4.4 bar) absolute and 453 K (180OC). Calculate the lenear velocity of the steam in the pipe line (SI). Given internal diameter of the pipe is 3.068 inch, specific volume of the steam at 440 kpa and 453 K is V =0.461 m3/kg. | CO2 | 10 |
| b. | The flow rate of water through a pipe is reported as 15 cubic feet per minute. Taking the density of water as 1 gm/cm3. Calculate the mass flow rate in kg/sec. | CO1 | 10 |
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| 3. |  | Natural gas is piped from the well at 300K and 400 kPa. The gas is found to contain 93% methane, 4.5% ethane and rest is nitrogen.(assuming volume % is equal to mole %). Calculate the following (i) The partial pressure of nitrogen (ii) The density at standard conditions in kg/m3 (iii) Average molecular weight of the gas. | CO2 | 20 |
| **(OR)** | | | | |
| 4. | a. | A 150 lit cylinder contains gas at 300 K and 10 bar. What is the mass of O2 in the cylinder in STP condition? | CO2 | 10 |
| b. | Develop ideal gas equation with suitable assumptions and equations. | CO3 | 10 |
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| 5. | a. | Define process flow sheet with its characteristics and suitable diagram. | CO2 | 10 |
| b. | Develop material balance equations for batch, fed-batch and continuous processes from the common equation of material balance and discuss their characteristics. | CO3 | 10 |
| **(OR)** | | | | |
| 6. | a. | Explain the Drying mechanism with a suitable diagram of continuous rotary dryer. | CO3 | 10 |
| b. | In a textile mill, a double effect evaporator system concentrates weak liquor containing 4%(by mass) caustic soda to produce a dye containing 25% solids (by mass). Calculate the evaporation of water per 100 kg of feed in the evaporator. | CO3 | 10 |
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| 7. |  | A drier is fed with wet solid to reduce the moisture content from 80% to 15%. The product leaving the drier is admitted to an oven which further brings down the moisture to 2%. If the drier can handle 1000 kg of wet solid per day. Calculate   1. The weight of products leaving the drier and the oven per day. 2. The percentage of the original water that is removed in from the drier and the oven. | CO3 | 20 |
| **(OR)** | | | | |
| 8. |  | A triple effect evaporator is used to concentrate 1000 kg of aqueous solution from a concentration of 20% solute to 80% solute. Assuming an equal amount of vaporization in each effect. Calculate the composition, the weight of the solution entering the second and third effect evaporator. | CO2 | 20 |
|  | | **Compulsory**: |  |  |
| 9. |  | The compositions of Coal consists of 85% carbon and 15% ash.The cinder formed in the combustion of coal contains 75% ash and 25% carbon. Determine the weight of cinder formed by the combustion of 100 kg coal and the percentage of carbon converted to cinder. | CO3 | 20 |