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



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

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| **Code :** | **14BT2049** | **Duration :** | **3hrs** |
| **Sub. Name :** | **PROCESS EQUIPMENT DESIGN** | **Max. Marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | | | **Marks** | |
| 1. | a. | Interpret the properties of engineering materials for the construction of storage tank and give its applications. | CO1 | | | 10 | |
| b. | Draw a neat flowsheet for ethanol production and ethanol plant layout with neat sketch. | CO1 | | | 10 | |
| **(OR)** | | | | | | | |
| 2. | a. | The rate of flow of water in a 150 mm diameter pipe is measured with a venture meter with a 50 mm diameter throat. When the pressure drop over the converging section is 121 mm of water, the flowrate is 2.91 kg/s. What is the coefficient for converging cone of meter at this flowrate? | CO1 | | | 10 | |
| b. | Illustrate the citric acid plant layout. What are the main criteria required for location of plant layout? | CO2 | | | 10 | |
|  |  |  |  | | |  | |
| 3. | a. | Illustrate the design and explain the procedure of Venturimeter, Orifice meter. Differentiate between Venturimeter and orifice meter. | CO1 | | | 10 | |
| b. | A cylindrical storage tank has diameter of 30 mm and tank height of 15 m. Liquid is stored in tank of density 810 kg/m3. Material of construction is Stainless steel. Plate size is 3x1.2 m in varying thickness available. Joint efficiency is 85%. Corrosion allowance is not necessary. Calculate shell thickness of the tank and estimate the total number of plates required. | CO2 | | | 10 | |
| **(OR)** | | | | | | | |
| 4. | a. | Formulate the design of continuous stirred tank reactor with diagram and derive the equation. | | CO2 | | | 10 |
| b. | Hypothesize and illustrate the design of double pipe heat exchanger. | | CO1 | | | 10 |
|  |  |  | |  | | |  |
| 5. | a. | Compile the design of a single effect evaporator with a clear picture. | | CO2 | | | 10 |
| b. | Differentiate between Cocurrent and counter current heat exchanger. | | CO1 | | | 5 |
| c. | Discriminate the design of gate and globe valve with figure. | | CO3 | | | 5 |
| **(OR)** | | | | | | | |
| 6. | a. | Acetic anhydride is hydrolyzed in a CSTR by using large excess of water. The concentration of acetic anhydride in the initial mixture is CAO= 0.3 mol/lit. The degree of conversion with respect to initial mixture is 0.7. The volumetric flow rate of the initial mixture = 20 lit/min. The reaction is first order having reaction rate constant k = 0.38 min-1. Estimate   1. The volume of single CSTR required for the desired degree of conversion. 2. The volume of the plug flow reactor for the same process. 3. No. of CSTR in series, whose total volume is close to that of plug flow reactor. | | | CO3 | | 15 |
| b. | Define LMTD and give its uses. | | | CO1 | | 5 |
|  |  |  | | |  | |  |
| 7. | a. | Describe the working principle and design of spray dryer with neat sketch. | | | CO1 | | 10 |
| b. | Sketch the design and working principle of single effect evaporator. | | | CO3 | | 10 |
| **(OR)** | | | | | | | |
| 8. | a. | Describe the fractional distillation column design procedure with neat sketch. | | | CO2 | | 10 |
| b. | Illustrate the design of Bollmann extractor. | | | CO3 | | 10 |
|  | | **Compulsory:** | | |  | |  |
| 9. | a. | A reactor is said to be ideal when \_\_\_\_\_\_\_\_\_\_ can be exactly calculated from the knowledge of mixing patterns. | | | CO1 | | 2 |
| b. | Differentiate between batch reactor and continuous reactor. | | | CO1 | | 4 |
| c. | Write down the design of ideal batch reactor . | | | CO3 | | 14 |