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



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

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| **Code :** | **14BT2019** | **Duration :** | **3hrs** |
| **Sub. Name :** | **CHEMICAL REACTION ENGINEERING** | **Max. Marks :** | **100** |

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | | **Marks** |
| 1. |  | |  | | --- | | Explain the classification of chemical reactions with suitable examples. | | CO1 | | 20 |
| **(OR)** | | | | | |
| 2. | a. | List the various theories of temperature dependency on the rate of reaction and discuss any one in detail. | CO1 | | 10 |
| b. | Experiments show that the reaction between H2(g) and I(g) to produce HI (g) proceeds with a rate.  Suggest a two-step mechanism which is consistent with this rate. | CO1 | | 10 |
|  |  |  |  | |  |
| 3. |  | Derive an integrated rate expression for third order reaction of the type A+B+D 🡪 Products. | CO1 | | 20 |
| **(OR)** | | | | | |
| 4. |  | For the aqueous reaction A🡪 Products the following data were obtained at 250C in which the concentration of A is given at different intervals of time   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | t (min) | 0 | 10 | 20 | 30 | 40 | | CA (mol/lit) | 0.86 | 0.74 | 0.635 | 0.546 | 0.405 |   Find the reaction order and calculate rate constant assuming F=80%. | CO1 | | 20 |
|  |  |  |  | |  |
| 5. | a. | |  | | --- | | Derive the performance equation for continuous stirred tank reactor? | | CO2 | | 10 |
| b. | Compare the features and applications of different reactors. | CO2 | | 10 |
| **(OR)** | | | | | |
| 6. |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Find a rate equation for the gas phase decomposition R+S occurring isothermally in a mixed flow reactor from the following data:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Trial Nos | 1 | 2 | 3 | 4 | 5 | |  | 0.423 | 5.1 | 13.5 | 44 | 192 | | XA (fractional decomposition of A) | 0.22 | 0.63 | 0.75 | 0.88 | 0.96 | | | CO2 | | 20 |
| 7. |  | A sample tracer hytane was injected as a pulse into a vessel and the effluent concentration is measured as a function of time. The following data are obtained:   |  |  | | --- | --- | | t(min) | C(g/m3) | | 2 | 5 | | 4 | 10 | | 6 | 6 | | 8 | 3 | | 10 | 1.5 | | 12 | 0.6 | | 14 | 0 |   Construct the E curve and determine the fraction of material leaving the vessel that has present between 3 and 6 min in the vessel. | CO3 | | 20 |
| **(OR)** | | | | | |
| 8. |  | It is proposed to operate a batch reactor for converting A into R. This is a liquid phase reaction with stoichiometry A🡪R. Find the time required to drop the concentration of A from CA0= 1.3mol/l to CAf= 0.30mol/l.   |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | CA, mol/l | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 1.0 | 1.3 | 2.0 | | -rA, mol/l.min | 0.1 | 0.3 | 0.5 | 0.6 | 0.5 | 0.25 | 0.1 | 0.06 | 0.05 | 0.045 | 0.042 | | | CO3 | 20 |
|  | | **Compulsory**: | |  |  |
| 9. |  | The data given below represent a continuous response to a pulse input into a closed vessel which is to be used as chemical reactor. Calculate the mean residence time of fluid in the vessel tˉ and tabulate and construct the E curve.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | t(min) | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | | C(g/l) | 0 | 3 | 5 | 5 | 4 | 2 | 1 | 0 | | | CO2 | 20 |