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



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

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| **Code :** | **14BT2015** | **Duration :** | **3hrs** |
| **Sub. Name :** | **BIOREACTOR ENGINEERING** | **Max. Marks :** | **100** |

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

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| **Q. No.** |  | **Questions** | | **Course**  **Outcome** | **Marks** |
| 1. |  | Aerobic degradation of benzoic acid by a mixed culture of microorganisms can be represented by the following reaction.  **C6H5COOH + aO2 + bNH3 cC5H7NO2 + dH2O + eCO2**  Determine a, b, c, d and e if RQ=0.9  i) Determine the yield coefficients Yx/s and Yx/o2  ii) Determine the degrees of reduction for substrate and bacteria. | | CO1 | 20 |
| **(OR)** | | | | | |
| 2. |  | Assume that experimental measurement for a certain organism have shown that cells can convert substrate carbon to biomass.   1. Calculate the stoichiometric coefficients for following biological reactions:   **C6H12O6 + aO2 + bNH3 cC4.4H7.3N0.86O1.2 + dH2O + eCO2**  **C16H34+ a O2 + b NH3 cC4.4H7.3N0.86O1.2 + d H2O + e CO2**   1. Calculate the yield coefficients biomass with respect to substrate and oxygen supply for both the reactions. Also, comment on the differences. | | CO1 | 20 |
|  |  |  | |  |  |
| 3. |  | For the following data, calculate carrying capacity coefficient, net specific growth rate, growth rate at time 15 hrs, doubling time, biomass and product yield coefficient, maximum cell mass concentration if 𝑋0=8.5 𝑔𝑙 and 𝑆0=125 𝑔𝑙 .     |  |  |  |  | | --- | --- | --- | --- | | **Time**  **(hr)** | **Glucose**  **concentration (g/l)** | ***S. cerevisiae***  **concentration**  **(g/l)** | **Ethanol concentration**  **(g/l)** | | 0 | 105 | 0.4 | 0 | | 5 | 97 | 2.52 | 2.7 | | 10 | 87 | 3.21 | 3.9 | | 15 | 74 | 6.72 | 6.5 | | 20 | 63 | 12.11 | 9.7 | | 25 | 52 | 16.81 | 10.1 | | 30 | 39 | 25.72 | 12.7 | | 35 | 28 | 49.32 | 28.8 | | | CO2 | 20 |
| **(OR)** | | | | | |
| 4. |  | | Derive the expression for various toxic compound inhibition models for growth of microorganism. | CO2 | 20 |
|  |  | |  |  |  |
| 5. |  | | Classify and write detailed notes on various methods to determine volumetric mass transfer coefficient. | CO3 | 20 |
| **(OR)** | | | | | |
| 6. |  | | Explain the effect of air flow rate on KLa in mechanically agitated and non mechanically agitated reactors. | CO3 | 20 |
|  |  | |  |  |  |
| 7. |  | | Elucidate the working and principle of various air lift loop bioreactor with a neat sketch with its advantages and disadvantages. | CO2 | 20 |
| **(OR)** | | | | | |
| 8. |  | | Elaborate on the bioreactor consideration of Packed bed bioreactor with a neat sketch. | CO2 | 20 |
|  | | | **Compulsory**: |  |  |
| 9. |  | | Enumerate any five parameters that can be monitored and controlled during fermentation process in detail with a neat sketch. | CO1 | 20 |