BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: BE **SEMESTER: V**
BRANCH: BIOTECHNOLOGY **SESSION : MO/2019**

SUBJECT : BT5027 REACTION ENGINEERING

TIME: 1.5 HOURS **FULL MARKS: 25**

INSTRUCTIONS:
1. The total marks of the questions are 30.
2. Candidates may attempt for all 30 marks.
3. In those cases where the marks obtained exceed 25 marks, the excess will be ignored.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. The missing data, if any, may be assumed suitably.

Q1 (a) Differentiate between 'Elementary' and 'non-Elementary' reaction. [2]
(b) Milk is pasteurized if it is heated to 63 °C for 30 min, but if it is heated to74°C it only needs 15 s for the same result. Find the activation energy of this sterilization process. [3]

Q2 (a) Derive the first order rate equation in terms of conversion by integral method. [2]
(b) After 8 min in a batch reactor, reactant (C_{A0} = 1 mol/L) is 80% converted; after 18 min, conversion is 90%. Find a rate equation to represent this reaction. [3]

Q3 Prove that, for a constant volume process, $T_{Batch} = T_{PFR}$ [5]

Q4 For the reaction A → R, second-order kinetics and C_{A0} = 1 mol/L, we get 50% conversion after 1 hour in a batch reactor. What will be the.
(i) conversion and
(ii) concentration of 'A' after 1 hour if C_{A0} = 10 mol/L? [2+3]

Q5 (a) For the reaction A→4R; with 30% inert present. Calculate ε_A. [2]
(b) A stream of pure gaseous reactant A (C_{A0} = 660 mmol/L) enters a PFR at a flow rate of F_{A0} = 540 mmol/min and polymerizes there as follows: 3A→R; $-r_A$ = 54 mmol/L. min. How large a reactor is needed to lower the concentration of A in the exit stream to C_A = 330 mmol/L? [3]

Q6 (a) Derive the performance equation of a MFR. [2]
(b) The off gas from a boiling water nuclear power reactor contains a whole variety of radioactive trash, one of the most troublesome being Xe-133 ($t_{1/2}$ = 5.2 days). This off gas flows continuously through a tank in which its mean residence time is 30 days, and where we can assume that the contents are well mixed. Find the fraction of activity removed in the tank. [3]

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