Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Course: Chemical Reaction Engineering-II **Semester: VI**
Program: B.Tech. CE+RP **Time : 03 hrs.**
Course Code: CHCE3031 **Max. Marks: 100**

Instructions: (i) This question paper have total 03 Sections. All questions are compulsory.
(ii) Attempt all the sub-parts of a question together.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Define residence time distribution and write the relation between C and E.	**04**	**CO1**
Q 2	Discuss the significance of tank in series model.	**04**	**CO2**
Q 3	Does a catalyst alter equilibrium conversion of a chemical reaction? Explain.	**04**	**CO5**
Q 4	What is sol gel method of preparation of catalyst?	**04**	**CO3**
Q 5	What is the importance of pores in a catalyst particle? Differentiate micro and macro pore.	**04**	**CO4**

SECTION B
(4Qx10M= 40 Marks)

Q 6	Develop Langmuir Hinshelwood model for the following reaction when adsorption of A is rate limiting step $A + B \longleftrightarrow R + S$	**10**	**CO3**
Q 7	Derive an expression for first order solid catalyzed reaction considering pore diffusion.	**10**	**CO3**
Q 8	The following data on an irreversible reaction are obtained with decaying catalyst in a batch reactor (batch-solids, batch-fluid) What can you say about the kinetics	**10**	**CO5**

t, hr	0	0.25	0.5	1	2	(∞)
C_A, mol/liter	1.000	0.901	0.830	0.766	0.711	0.684

Q 9	Discuss and derive the dispersion model to describe the non-ideal behavior in tubular flow reactor.	**10**	**CO2**
SECTION-C (2Qx20M=40 Marks)			
Q 10	The decomposition of cumene is carried out over the platinum catalyst to form benzene and propylene. Draw a conceptual model depicting the sequences of the steps in this reaction and derive the rate law if surface reaction is the rate limiting.	**20**	**CO4**
Q 11	(a) Sketch and explain the RTD curve for ideal Plug flow and ideal batch reactor. (b) We want to perform in a tank reactor the liquid phase reaction $2A \rightarrow B$ It has been determined that the rate equation is: $r = \frac{0.5\, C_A}{1+0.5\, C_A}$ (r in mol. L^{-1}. h^{-1} and C_A in mol/L) In order to characterize the reactor, a pulse tracer test was performed, after which it was obtained that the tracer concentration measured versus time can be fitted to the following equation: $C(t) = 2\exp(-2t)$ (C in mg/L and t in h) a) Calculate E(t) and the average time in the reactor tm. b) Calculate F(t). Which fraction of the effluent will remain in the reactor after the first hour after injection of the tracer?	**10+10**	**CO1**