

Name:

Enrolment No:



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2021

Course: Chemical Reaction Engineering II

Program: B.Tech. CERP

Course Code: CHCE3031

Semester: VI

Time 03 hrs.

Max. Marks: 100

Instructions: (i) This question paper has three sections- A, B and C. All questions of each section are compulsory. (iii) Attempt all the sub-parts of a question together.

SECTION A (30 Marks)

1. Each Question will carry 5 Marks

2. Instruction: Complete the statement / Select the correct answer(s)

S. No.		Marks	CO
Q 1	Write brief about Micro fluid and Macro fluid.	05	CO1
Q 2	Write about an importance of surface area in catalyst.	05	CO3
Q 3	Discuss the effectiveness factor for solid catalyzed reaction	05	CO2
Q 4	Is the selectivity of multiple reactions affected by catalysts? Explain.	05	CO5
Q 5	Write short notes on Tank in series model for the non-Ideal Reactor.	05	CO2
Q 6	What is sol gel method of preparation of catalyst?	05	CO4

SECTION B (50 Marks)

1. Each question will carry 10 marks

2. Instruction: Write short / brief notes

Q 1	State and explain the steps in heterogeneous catalytic reaction with schematic diagram.	10	CO3																												
Q 2	Develop Langmuir Hinshelwood model for the following reaction when adsorption of A is rate limiting step $A + B \rightleftharpoons R + S$	10	CO4																												
Q 3	A sample of tracer was injected as pulse to a reactor and the effluent concentration measured as a function of time. The results are <table border="1"><tbody><tr><td>T(min)</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>12</td><td>14</td></tr><tr><td>C (g/m³)</td><td>0</td><td>1</td><td>5</td><td>8</td><td>10</td><td>8</td><td>6</td><td>4</td><td>3</td><td>2.2</td><td>1.5</td><td>0.6</td><td>0</td></tr></tbody></table> <p>The mean and the variance of the distribution are 5.15 min and 6.1 min². A first order chemical reaction (k = 0.1/min) is carried out in the vessel. Determine conversion expected. (a) Using tanks in series model</p>	T(min)	0	1	2	3	4	5	6	7	8	9	10	12	14	C (g/m ³)	0	1	5	8	10	8	6	4	3	2.2	1.5	0.6	0	10	CO2
T(min)	0	1	2	3	4	5	6	7	8	9	10	12	14																		
C (g/m ³)	0	1	5	8	10	8	6	4	3	2.2	1.5	0.6	0																		

	(b) Using maximum mixedness model.		
Q 4	Derive the performance equation for plug flow reactor containing porous Catalysts.	10	CO4
Q 5	Give two examples from real life or industry to illustrate and explain the meaning of (A) complete micro mixing (B) complete segregation and (C) the implications of these terms for process and process operation.	10	CO1
SECTION-C (20 marks)			
1. Each Question carries 20 Marks.			
2. Instruction: Write long answer.			
Q 1	What is catalyst deactivation? How and why, it occurs? What are the factors that are responsible for deactivating a porous catalyst pellet? Derive an expression for conversion (X_A) as a function of time in case of irreversible first -order reaction, $A \rightarrow R$, which is carried out isothermally in a batch reactor on a catalyst that is decaying (as a result of aging) as per following decay law: $-\frac{da}{dt} = k_d a^2$	20	CO5