Name:

Enrolment No:

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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2020

Course: Chemical Reaction Engineering I **Semester: V**
Program: B.Tech (CE+RP) **Time 03 hrs.**
Course Code: CHCE3004 **Max. Marks: 100**
Instructions: In case of data missing make necessary assumptions
Note:

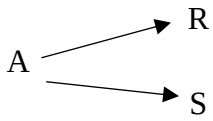
S. No.	**SECTION A (6X10=60) (**Attempt **all** questions**)**	**Marks**	**CO**
Q 1	Discuss in detail about product distribution for parallel reaction.	**10 M**	**CO1**
Q 2	State the difference between temperature dependency from Collision theory and that from Transition-state theory.	**10 M**	**CO1**
Q 3	At certain temperature, the half-life periods and initial concentration for a reaction are $t_{1/2}$ = 420 s, C_{Ao} = 0.405 mol/l $t_{1/2}$ = 275 s, C_{Ao} = 0.64 mol/l find the rate constant of a reaction.	**10 M**	**CO2**
Q 4	(a) Define (i) Space time (ii) Space Velocity (iii) Holding time (iv) Half Life. (b) Discuss the theory of maximization of rectangles for finding optimum sizes of two mixed reactors in series.	**(5+5) M**	**CO3**
Q 5	It is required to produce 9.5 kg/s of ethylene by cracking a feed stream of pure etane in a plug flow reactor operated at 1100 K and 6 atm. The cracking reaction is first order with K = 3.07 / s. at 1100 K. $C_2H_6 \longrightarrow C_2H_4 + H_2$ Find the volume of reactor to achieve 80 % conversion of ethane.	**10 M**	**CO4**
Q 6	Explain Plug Flow Reactors in Series and in Parallel with equation.	**10 M**	**CO5**

SECTION B (2X20=40M)

Question **No. 7** compulsory. Answer **any one** in question **No. 8**

Q 7	A gas phase decomposition of A is carried out in a mixed reactor. The stoichiometry of the decomposition is A $\longrightarrow$ R + S. the initial concentration of A (C_{Ao}) is 0.003 mol/l. the following data are obtained by conduction various runs using C_{Ao} = 0.003 mol/l.						**20 M**	**CO2**

Run no.	1	2	3	4	5
Space time, Second	0.4	5.0	14	45	195
X_A	0.20	0.60	0.76	0.90	0.97

	Find a rate equation for this decomposition.		
Q 8	Reactant A in the liquid phase reacts to produce R and S by the following reactions in parallel.  Both these reactions are first order. A feed with $C_{Ao} = 1$, $C_{Ro} = 0$ and $C_{So} = 0$ enters in two mixed flow reactors in series ($\tau_1 = 2$ min; $\tau_2 = 5$ min). the composition within the first reactor is $C_{A1} = 0.40$, $C_{R1} = 0.40$ and $C_{s1} = 0.2$. find the composition of exit stream from the second reactor. **OR** Explain Recycle Ratio with its range. Derive the performance equation for recycle reactor with varying density system.	**20 M**	**CO4**