

# NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR

## Even Semester End-term Examination, 2021-22

Course Code: CHE610

Full Marks: 30

Course Name: Chemical Reactor Analysis

Time: 90 Minutes

Question Paper No.: NITDGP/CHE610/A1

Date of Exam: 22/04/2022

Instructions: Answer **any four** questions.

Materials to be supplied: Graph paper shall be supplied, if required.

Question No.	Body of the Question	Marks	Mapped CO
1	<p>RTD experiments are carried out in a non-ideal reactor with pulse tracer injection. The mean and the standard deviation of the residence time are found to be 10.2 min and 4.3 min respectively. The reaction is shown below.</p> <p><math>A \rightarrow \text{Products}</math>                      <math>k = 0.3 \text{ min}^{-1}</math></p> <p>(i) Calculate, using Tanks-in-series model, the exit conversion in the reactor.</p> <p>(ii) Also calculate the exit conversion assuming the reactor to be</p> <p>(a) ideal PFR and (b) ideal CSTR.</p>	4.5  	

## Course Outcomes

CO1: Design &amp; analyse fluid-solid non-catalytic, catalytic and fluid-fluid reactors

CO2: Design &amp; analyse multiphase reactors

CO3: Design and analyse bioreactors and non-ideal reactors

	<p>The reaction in the pellets is first-order in both hydrogen and the organic. Hydrogen and nitrogen are fed in equimolar portions at a total pressure of 15 atm and 425 K and a total molar rate of 8 mol/s. The following data are furnished:</p> <p>Solubility of <math>H_2</math>, <math>H' = 0.0075 \text{ kmol}/(\text{m}^3 \cdot \text{atm})</math>  Bed porosity = 0.43 Pellet density = <math>1600 \text{ kg}/\text{m}^3</math>  <math>A_p = 2.0 \text{ m}^2/\text{kg}</math>  <math>D_e = 3.5 \times 10^{-10} \text{ m}^2/\text{s}</math>  Pseudo first order reaction rate constant = <math>4 \times 10^{-5} \text{ m}^3/(\text{kg cat. s})</math>  <math>k_g a_i = 6.5 \text{ s}^{-1}</math>    <math>k_l a_i = 2.2 \times 10^{-3} \text{ s}^{-1}</math>    <math>k_c = 2.2 \times 10^{-5} \text{ m/s}</math></p> <p>Compute the individual resistances as a percentage of the total resistance.</p>		
6	<p>RTD experiments are carried out in a non-ideal reactor with pulse tracer injection. The mean and the standard deviation of the residence time are found to be 8.5 min and 2.1 min respectively. The reaction is shown below.</p> <p><math>A \rightarrow \text{Products}</math>    <math>k = 0.1 \text{ min}^{-1}</math></p> <p>Calculate, using Dispersion model, the exit conversion in the reactor.</p>	7.5	CO3

**NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR****Even Semester End-term Examination, 2021-22****Course Code: CHE 614**

Full Marks: 30

**Course Name: Artificial intelligence (AI) in process industry**

Time: 90 Minutes

Question Paper No.: NITDGP/CHE614/1

Date of Exam: 22/04/2022

Instructions: Answer all the questions.

Materials to be supplied: NA

Question No.	Body of the Question	Marks	Mapped CO
1	What is difference between training data, test data and validation data in neural network training?	2	CO2
2	How do you decide the optimum number of nodes in hidden layer in neural network?	2	CO2
3	What is difference between regression and classifications in machine learning? Explain with an example.	2	CO1
4	Explain with example: Phenomenological model and Black box model. Write their comparative advantages and disadvantages.	2	CO1
5	What is local minima and global minima in an optimization problem?	2	CO3
6	What do you understand by optimization? Explain with an example from chemical industry.	2	CO3
7	Gradient decent algorithm and genetic algorithm: Which one is better optimization algorithm and why?	2	CO3
8	What do you understand by fault diagnosis system in context with chemical industry?	2	CO1
9	What are the advantages of genetic programming over ANN?	2	CO2
10	There is a multiphase catalytic industrial reactor running in a chemical plant. How will you find the optimum process parameters for the reactors to maximize profit? Explain your approach.	2	CO1
11	Write three applications areas of artificial intelligence in chemical engineering.	2	CO1
12	How do you select input and output of neural network model for an industrial reactor modelling problem? Explain your approach.	2	CO2
13	Why data cleaning is important in ANN modelling? How will you clean the data?	2	CO2
14	Write steps to develop an ANN model. Explain with an example	2	CO2
15	Give two examples from chemical industry where classifications can be used.	2	CO1

**Course Outcomes**

CO1 : Acquire an idea about the application of artificial intelligence in chemical process industry

CO2 : To learn the fundamental knowledge of Neural network base modeling and their application in chemical process industries

CO3: To learn the fundamental knowledge of different stochastic optimization techniques and their application in industry