Q. No. CHE 610/31

B.TECH/EVEN
REG/(22-23)

Even Semester Mid-term Examination, 2022-23

CHEMICAL REACTOR ANALYSIS

CHE 610

Full Marks : 25 *Time* : 90 Minutes

The figures in the margin indicate full marks.

Answer any *two* questions.

1. A tracer is injected as a pulse to a non-ideal reactor and the effluent tracer concentration is measured as a function of time. The data is given below.

t (min)	0	3	6	9	12
C(g/m^3)	0	2	7	5	0

$A \rightarrow$ Products $k = 0.1\ min^{-1}$

(i) Calculate, using Tanks-in-series model, the exit conversion in the reactor mentioned in the reactor for a first order liquid-phase irreversible reaction.

(ii) Calculate the exit conversion if the reactor is ideal CSTR and ideal PFR. [10 + 2.5]

2. A solid feed consisting of 30% by weight of 1 mm particles, 50% of 2 mm particles and 20% of 4 mm particles is treated in a gas-solid noncatalytic fluidized bed reactor. The reaction completion times for 1, 2 and 4 mm particles are 3, 6 and 12 min respectively. The bed contains 100 kg of solid with a feed rate of 50 kg/min.

(i) Compute the conversion of solid in the reactor.

(ii) Derive the equations used. [8 + 4.5]

3. (a) Using heat generation and removal curves, explain the differences between the stable and unstable steady states in a nonisothermal CSTR?

(b) Explain sustained oscillation and limit cycle in an unsteady nonisothermal CSTR. [6.5+6]

4. In a slurry reactor, catalytic hydrogenation of methyl linoleate (first order) is carried out and the following experimental data are obtained.

Run No.	p_{H_2} (atm)	d_p (μm)	M (kg/m^3)	Rate of reaction (kmol/m^3.min)
1	3	40	5.0	0.125
2	6	40	0.2	0.0356
3	6	80	0.16	0.0146

$H' = 2.0$ mol H_2/(atm.m^3)

What is the rate-controlling resistance? [12.5]

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Even Semester Mid-term Examination, 2022-23

NON CONVENTIONAL ENERGY ENGINEERING

CHE 612

Full Marks : 25 *Time* : 90 Minutes

The figures in the margin indicate full marks.

Graph paper shall be supplied, if required.

Answer *all* the questions.

Question No.	Body of the Question	Marks	Mapped CO

1. (a) Explain the variation of the power output of a wind turbine with the tip speed of the rotor. 2 CO1,CO2

   (b) Derive the expression for power extracted from the wind. What maximum theoretical power can be extracted and under what condition? 3 CO1, CO2

   (c) A HAWT has the following data: 2 CO1, CO2

   Speed of the wind =10 m/s at 1 atm. and 15°C

   Diameter of the rotor = 120 m

   Speed of the rotor = 40 rpm

   Calculate the maximum possible torque produced at the shaft.

   (d) Explain the different components of WECS with a neat sketch. 3 CO1,CO2

(e) Find the maximum power output of a turbine if the wind speed is 8 m/s, air density is 1.2 kg/m^3 and the rotor diameter is 60 m. 2 CO1, CO2

(f) Differentiate between HAWT and VAWT. 2 CO1, CO2

2. (a) What do you mean by solar insolation? What are the factors on which insolation depends? Define air mass. What is the value of air mass when the sun is at its zenith? 3 CO1, CO2

(b) Classify the different types of solar collectors. 2 CO1, CO2

(c) Describe the basic principle of a liquid flat plate collector with the schematic diagram. 3 CO1, CO2

(d) Calculate the difference in the number of daylight hours (day length) at Srinagar on January 1 and July 1. The Srinagar is 34° 5′N. 3 CO1, CO2

COURSE OUTCOMES

- CO1: Learn about energy technology of different conventional and non-conventional energy resource and Recent worldwide energy market scenario
- CO2: Design & analyze of different renewable energy collectors and renewable energy thermal power plants
- CO3: Learn industrial and domestic applications of different renewable energy sources
- CO4: Solve energy technology problems of different difficulty levels through tutorials

Q. No. CHE 614/ 35

B.TECH/EVEN
REG/(22-23)

Even Semester Mid-term Examination, 2022-23

ARTIFICIAL INTELLIGENCE IN CHEMICAL INDUSTRIES

CHE 614

Full Marks : 25 *Time* : 90 Minutes

The figures in the margin indicate full marks.

Graph paper shall be supplied, if required.

Answer *all* the questions.

Question No.	Body of the Question	Marks	Mapped CO

1. You have given input and output data from an industrial reactor. Write in detail step by step procedure to develop a reactor model by artificial neural network.

   Explain the purpose of each step.

   How you can ensure that you have develop a reliable reactor model? 10 CO2

2. What is phenomenological modelling and black box modelling. Write the advantages and disadvantages of both. 5 CO1

3. Explain the difference between training data, validation data and test data in neural modelling. 5 CO2

4. Write 3 areas in chemical industry where artificial intelligence can be applied and profit can be increased. 5 CO1
