Subject Code: RCH701

PAPER ID-310269

Roll No:

B TECH
(SEM-VII) THEORY EXAMINATION 2020-21
PROCESS MODELING & SIMULATION

Time: 3 Hours ***Total Marks: 70***

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 7 = 14**

a.	What is simulation?
b.	Explain the term 'Modeling'.
c.	Name two software for simulation.
d.	What is Golden number?
e.	Define Non-linear Programming problem.
f.	Differentiate between deterministic & stochastic process.
g.	What is variable hold up?

SECTION B

2. Attempt any *three* of the following: **7 x 3 = 21**

a.	What is mathematical model? Discuss its applications in unit operations.
b.	Discuss the modeling of reactive separation processes.
c.	A tank is used to dissolve a solid into a liquid solvent. The tank is provided with an agitator. This tank acts as a batch system. Do the modeling with respect to liquid as well as solid phases.
d.	Discuss the computational features of direct and iterative methods for solution of linear simultaneous equations.
e.	Present the simulation steps for counter current heat exchanger.

SECTION C

3. Attempt any *one* part of the following: **7 x 1 = 7**

(a)	Explain in detail, why modeling assumptions are important in the building of any model.
(b)	Present the steady state model of single component vaporizer.

4. Attempt any *one* part of the following: **7 x 1 = 7**

(a)	Explain distributed parameter model for packed bed.
(b)	With the suitable example discuss the application of total continuity equation and component continuity equation in developing a mathematical model.

5. Attempt any *one* part of the following: **7 x 1 = 7**

(a)	Elaborate time dependent models and their applications.
(b)	With a neat flow chart, discuss the Gauss elimination algorithm. Mention its advantages and limitations.

6. Attempt any *one* part of the following: **7 x 1 = 7**

(a)	Derive modeling equations for batch reactor.
(b)	Write the total continuity and component continuity of systems. For a perfectly mixed CSTR with the following reaction (first order, isothermal), $A \rightarrow B \rightarrow C$, Derive the material balance equations. Write down the unsteady state material balance equations, if the reaction occurs in non-isothermal conditions, where heat needed for endothermic reaction is supplied through electrical coil.

7. Attempt any *one* part of the following: **7 x 1 = 7**

(a)	Use the trapezoidal and Simpson's rule for with $\Delta x = 0.2$ to evaluate $\int_0^1 \frac{dx}{x}$ and compare your values with analytical result.
(b)	Oxygen is at temperature of 150 °C and pressure of 70 atm. Calculate molar volume from Vander-Wall's equation using Newton-Raphson method. Present the results for at least 4 iterations and write the computer program for the solution of the problem. Data: a = 1.360, b = 0.03183, R = 0.082 ltr/mol K

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