Name: Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2021

Programme Name: B. Tech (CE+RP) **Semester : VIII**
Course Name : Process Modelling and Simulation **Time : 03 hrs**
Course Code : CHCE4004 **Max. Marks : 100**

Instructions: 1) Assume suitable data wherever necessary.
2) The notations used here have usual meanings.
3) Put your signature at the bottom of every answer page.

SECTION A (Total Marks: 6 x 5 = 30)

S. No.	Select the correct answer.	Marks	CO
Q 1	The output from a model of a factory that makes bricks is most likely to be a) Dynamic model b) Static model	**05**	**CO1**
Q 2	The boundary condition, dT/dx = 0, is called as a) Neumann boundary condition b) Dirichlet boundary condition	**05**	**CO1**
Q 3	One of the assumptions of CSTB is that the feed is sterile. It means that a) Feed has no microorganism b) Feed rate is zero c) Feed has no substrate d) Both a and c	**05**	**CO2**
Q 4	Simulation can not produce optimum result a) True b) False	**05**	**CO3**
Q 5	The system of two dimensional heat conduction in plane slab at steady state is mathematically represented by-------- a) Partial differential equations b) Ordinary differential equations c) Analytical equations d) Polynomial equations	**05**	**CO4**
Q 6	ANN has following activation layer(s)--------- a) Input layer b) Hidden layer c) Output layer d) Both b and c	**05**	**CO5**

<table>
<tr><td colspan="4">SECTION B (Total Marks: 5 x 10 = 50)</td></tr>
<tr><td>Q 7</td><td>From the following data, determine the reaction order and specific reaction rate for the dissolution of MnO_2 in HBr.
Assume a rate law of the form: $-r''_{HBr} = kC^{\alpha}_{HBr}$
<table><tr><td>C_{A0} mol HBr/dm^3</td><td>0.1</td><td>0.5</td><td>1</td><td>2</td><td>4</td></tr><tr><td>$-r''_{A0}$ mol HBr/m^2.hr x 10^2</td><td>0.073</td><td>0.70</td><td>1.84</td><td>4.86</td><td>12.84</td></tr></table></td><td>10</td><td>CO1</td></tr>
<tr><td>Q 8</td><td>Develop the mathematical model for rectifying and stripping sections of a compartmental distillation column.</td><td>10</td><td>CO2</td></tr>
<tr><td>Q 9</td><td>Explain Monod growth model for cell growth kinetics used in bioreactor.</td><td>10</td><td>CO2</td></tr>
<tr><td>Q 10</td><td>Explain the working of artificial neural network.</td><td>10</td><td>CO4</td></tr>
<tr><td>Q 11</td><td>Differentiate between modular and equation oriented approach.</td><td>10</td><td>CO5</td></tr>
<tr><td colspan="4">SECTION-C (Total Marks: 1 x 20 = 20)</td></tr>
<tr><td>Q 12</td><td>The one-dimensional steady-state material balance for the reactor that expresses the fact that the change in the axial convection of benzene is equal to the amount produced by reaction is
$$\frac{dy}{dx} = 0.216y$$
With $y = 1$ at $x = 0$

y = concentration of benzene
x = axial coordinate.

(i) Calculate y at x = Your Roll No. (e.g. x = 1 for R900217001, x = 11 for R900217011, x = 101 for R900217101) using Runge-Kutta fourth order method.
(ii) Compare the analytical solution with the numerical solution and comment on the results.</td><td>14

06</td><td>CO3</td></tr>
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