Name:	
Enrolment No:	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2020

Programme Name: B. Tech (CE+RP) **Semester : VIII**
Course Name : Process Modelling and Simulation **Time : 03 hrs**
Course Code : CHEG440 **Max. Marks : 100**

Instructions: 1) Answer the questions section wise in the answer booklet. 2) Assume suitable data wherever necessary. 3) Report only final values after computation.

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

S. No.		Marks	CO
Q 1	---------- is considered to be a numerical computation technique used in conjunction with dynamic mathematical models. a) Analysis b) System simulation c) Dynamic computation d) None of these	**05**	**CO4**
Q 2	---------- follows the changes over time that results from the system activities. a) Dynamic model b) Static model c) Analytical model d) Numerical model	**05**	**CO1**
Q 3	The assumption of isothermal condition neglects------- a) Total continuity equation. b) Component continuity equation. c) Energy equation. d) Momentum equation.	**05**	**CO1**
Q 4	The system is called exactly specified when------ a) the degrees of freedom is equal to one. b) the degrees of freedom is greater than zero. c) the degrees of freedom is less than zero. d) the degrees of freedom is equal to zero.	**05**	**CO2**
Q 5	The assumption of ------ is that the reactor contents are perfectly mixed. a) PFR b) CSTR c) PBR d) FBR	**05**	**CO2**
Q 6	Model validation involves------- a) Mathematical formulation b) Data regression c) Testing of the model and its solution d) Algorithm development	**05**	**CO4**

SECTION B (Total Marks: 10 x 5 = 50)			
Q 7	Discuss in brief about the modeling aspects of the bioreactor using the growth rate expression proposed by Monod. ***OR*** Discuss in brief about the modeling aspects of the double effect evaporator.	**10**	**CO2**
Q 8	Explain in detail about lumped parameter model and distributed parameter model with suitable examples.	**10**	**CO3**
Q 9	Discuss about the components of a simple artificial neural network.	**10**	**CO5**
Q 10	What is meant by a boundary condition, and explain about its classification.	**10**	**CO1**
Q 11	Discuss the application of a partial differential equation in process modelling.	**10**	**CO4**
SECTION-C (Total Marks: 1 x 20 = 20)			
Q 12	The Van de Vusse reaction operated in a continuous stirred tank reactor is given as follows: $A \overset{k_1}{\rightarrow} B \overset{k_2}{\rightarrow} C$ $2A \overset{k_3}{\rightarrow} D$ The component material balance equations are described as: $\frac{dC_A}{dt} = -k_1 C_A - k_3 C_A^2 + \frac{F}{V}(C_{Af} - C_A)$ $\frac{dC_B}{dt} = k_1 C_A - k_2 C_B + \frac{F}{V} C_B$ (i) Identify state variables, input variables and parameters in a given system. (ii) Compute the steady state values of C_A and C_B using the given data. (iii) Perform three iterations employing the fourth-order Runge–Kutta method for dynamic study using a step size of 1 for $0 \leq t \leq 2$ h for a given data and report the values in the following table.	**04** **04** **12**	**CO2** **CO3**

	Iteration 1	Iteration 2	Iteration 3
Slope k_1			
Slope k_2			
Slope k_3			
Slope k_4			
C_A			
C_B			

	Data: Reactor volume (V) = 2 lit Feed flow rate (F) = 50 lit/h Feed concentration of reactant A(C_{Af}) = 10 mol/lit Kinetic constant (k_1) = 50 h^{-1} Kinetic constant (k_2) = 100 h^{-1} Kinetic constant (k_3) = 10 lit/mol.h		