P P SAVANI UNIVERSITY

Seventh Semester of B. Tech. Examination

December 2021

SECH4510 Chemical System Modelling

22.12.2021, Wednesday **Time: 9:00 a.m. To 11:30 a.m.** **Maximum Marks: 60**

Instructions:

1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.

SECTION – I

Q - 1	Define the Following: (Any Five)	**[05]**
(i)	Models	
(ii)	Conservation principle	
(iii)	Chemical process	
(iv)	Lumped parameters	
(v)	MATLAB	
(vi)	Euler method	
(vii)	Computational techniques	
Q - 2 (a)	Explain Conservation Laws in Engineering System.	**[05]**
Q - 2 (b)	Draw a flowchart of systematic model building.	**[05]**
	OR	
Q - 2 (a)	Linearize Arrhenius Equation $k_{(T)} = \alpha e^{-E/RT}$	**[05]**
Q - 2 (b)	State the uses of mathematical modelling.	**[05]**
Q - 3 (a)	Develop the model of stirred tank blending process.	**[05]**
Q - 3 (b)	Draw a neat diagram of model used in engineering system and explain the variables.	**[05]**
	OR	
Q - 3 (a)	Explain the following with advantages and disadvantages.	**[05]**
	(i) White Box modelling	
	(ii) Black Box modelling	
Q - 3 (b)	Develop the model of stirred tank heating process.	**[05]**
Q - 4	Attempt any one	**[05]**
(i)	State the difference between the following models with examples.	
	(i) Lumped v/s distributed	
	(ii) Deterministic v/s stochastic	
(ii)	State the Degrees of Freedom Analysis for the Stirred-Tank Model.	

SECTION – II

Q - 1	State few mathematical solvers used in chemical industries.	**[05]**
Q - 2	Solve $\frac{d}{d} = yx^2 - 1.2\,y$ with the initial condition y (0) = 1 over the interval [0,2] using Range Kutta-4 method. Use h=0.5.	**[10]**
	OR	
Q - 2	Solve the following ODE in the range [0,5] using h=0.5 with Euler's Method. $\frac{d^2y}{d^2} - t + y = 0$, y (0) = 2, $\frac{d}{d}(0) = 0$	**[10]**
Q - 3 (a)	State the condition of elliptical PDE and give two equations stating the examples of PDE.	**[05]**
Q - 3 (b)	Mention all the ODE solvers used in MATLAB.	**[05]**
	OR	

Q - 3 (a)	What is the importance of a mathematical programming language to solve the mathematical relation?	[05]
Q - 3 (b)	Explain the condition of parabolic PDE and give two equations stating the examples of PDE.	[05]
Q - 4	Attempt any one	[05]
(i)	Discuss the following terms: (i) Simulation and Validation (ii) Local Error	
(ii)	Discuss the following terms: (i) Computational techniques (ii) Shooting method	

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