U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

August 2024 Supplementary Examinations

Program: B.E. **Semester: VI**
Branch: Chemical Engineering **Duration: 3 hrs.**
Course Code: 19CH6DCPMS **Max Marks: 100**
Course: Process Modelling and Simulation

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT – I	CO	PO	Marks
1	a)		What are the steps involved in developing mathematical model of a system? Explain in brief.	*CO1*	*PO2*	**10**
	b)		Apply continuity equation to a pipe flow system and develop the model equation. Assume plug flow condition in the pipe.	*CO1*	*PO2*	**05**
	c)		Explain in detail the usage of the mathematical model in Chemical Engineering.	*CO1*	*PO2*	**05**
			UNIT – II			
2	a)		Develop a model for the gas liquid bubble reactor where reactant A from gas phase diffuse into liquid phase reactant B. Check consistency of the model and comment on inconsistency, if any.	*CO2*	*PO3*	**12**
	b)		Develop a mathematical model of two heated tanks in series with constant heat supply by steam in the first tank.	*CO2*	*PO3*	**08**
			OR			
3	a)		Develop a mathematical model of a jacketed non-isothermal CSTR with suitable assumptions. Assume that reaction is of n^{th} order and perfectly mixed cooling jacket is used to remove heat from the reactor. Check consistency of the model.	*CO2*	*PO3*	**12**
	b)		Develop mathematical model for continuous stirred tank bioreactor (CSTB) to find biomass and substrate concentration in the reactor. Check consistency of the developed model.	*CO2*	*PO3*	**08**
			UNIT – III			
4	a)		Consider 1D transient heat conduction in a rectangular slab. The total width of the rectangular slab is 0.4 cm. Initially the temperature is uniform at 40^0C. The temperature of the end face (x = 0.4 cm) of the rectangular slab is made 300^0C at t = 0 s and	*CO3*	*PO4*	**14**

			surface at x = 0 is insulated. Use implicit discretization and take Δt = 0.1 s, Δx = 0.1 cm and $\alpha=10^{-5}$ m^2/s. List the tri-diagonal system of equations and determine the temperature at the centre and the intermediate points at 0.1 s.			
		b)	Derive the partial differential equation for one dimensional transient heat conduction without heat generation in a cylinder.	*CO3*	*PO4*	**06**
			UNIT – IV			
	5	a)	Develop the model equations for multicomponent flash drum steady sate model. Comment on consistency of the model.	*CO2*	*PO3*	**12**
		b)	Discuss the importance of fluid package. Explain any two equation of state based fluid package in brief.	*CO2*	*PO3*	**08**
			OR			
	6	a)	Develop the unsteady state model for distillation column. Assume 100% tray efficiency, well mixed condenser drum and reboiler; liquids are well mixed in each tray, negligible vapor holdups, and liquid-vapor thermal equilibrium.	*CO2*	*PO3*	**15**
		b)	Develop mathematical model for a single component vaporizer consider a liquid phase dynamic model and develop mathematical model equations for a single component vaporizer.	*CO2*	*PO3*	**05**
			UNIT – V			
	7	a)	Describe the two approaches of simulation in detail.	*CO6*	*PO12*	**10**
		b)	Explain the features of simulation tools used in chemical engineering processes with their advantages and limitations	*CO6*	*PO12*	**10**

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