U.S.N.										

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

Autonomous Institute Affiliated to VTU

October 2024 Supplementary Examinations

Programme: B.E. **Semester: VI**
Branch: Chemical Engineering **Duration: 3 hrs.**
Course Code: 22CH6PCPMS **Max Marks: 100**
Course: Process Modelling & Simulation

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

			CO	PO	Marks
		UNIT – I			
1	a)	Define process modeling and explain its importance in chemical engineering.	*CO* 1	*PO1*	**06**
	b)	Why are models needed in chemical engineering? Classify mathematical models used in this field.	*CO* 1	*PO1*	**06**
	c)	Component 'C' undergoes an irreversible second-order reaction with component 'D' to form product 'E' at a specific reaction rate *k*. Write the component balance equations when the reaction occurs in (i) A Continuous Stirred-Tank Reactor (CSTR) and (ii) A Plug Flow Reactor (PFR). Make necessary assumptions wherever needed.	*CO2*	*PO3*	**08**
		UNIT – II			
2	a)	Develop the mathematical model for a gas-phase pressurized CSTR undergoing a first-order reaction A→B. Assume ideal gas behavior and constant volume.	*CO2*	*PO3*	**10**
	b)	Formulate a mathematical model for a semi-batch reactor where component A is fed into the reactor at a constant rate F_A, and it undergoes a first-order irreversible reaction A→B. Assume the volume is changing and the density is constant.	*CO2*	*PO3*	**10**
		OR			
3	a)	Derive the mathematical model for a batch reactor where a first-order irreversible reaction A→B takes place. Assume constant density and provide the component and energy balances.	*CO2*	*PO3*	**10**
	b)	Develop the mathematical model for a non-isothermal jacketed CSTR with a first-order exothermic reaction A→B. Include both component and energy balances. Assume plug flow condition inside the jacket.	*CO2*	*PO3*	**10**

			UNIT - III			
	4	a)	Two concentric cylindrical metallic shells are separated by a solid material. If the two metal surfaces are maintained at different temperatures. Find the steady state temperature distribution within the separating material.	***CO*** 3	***PO4***	**08**
		b)	Derive an equation to find the effectiveness of heat transfer through an extended surface of finite length.	***CO*** 3	***PO4***	**12**
			UNIT – IV			
	5	a)	Develop a mathematical model for a multicomponent flash drum where a liquid stream at high temperature and pressure is flashed into a drum. The pressure is reduced irreversibly at constant enthalpy. Include mass and energy balances along with the vapor-liquid equilibrium relations.	***CO*** 3	***PO4***	**10**
		b)	Develop a mathematical model for a binary continuous distillation column. Assume constant molar overflow and negligible heat losses. Include mass and energy balances for both the rectifying and stripping sections.	***CO*** 3	***PO4***	**10**
			OR			
	6	a)	Explain the role of activity coefficient models with relevant equations used in simulation tools.	***CO*** 3	***PO4***	**10**
		b)	Write the equations describing a batch distillation column with hold up used to separate multicomponent mixture. List the assumptions and nomenclature used clearly.	***CO*** 3	***PO4***	**10**
			UNIT – V			
	7	a)	Differentiate between the simulation and modeling. Explain various simulation tools used in Chemical Engineering with their advantages and limitations.	***CO*** 6	***PO12***	**10**
		b)	Explain the dynamic simulation and process optimization with examples.	***CO*** 6	***PO12***	**10**

****