GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor/Master of Engineering Syllabus

Subject Code : 3174402

Subject Name : Process Modeling and Simulation

WEF Academic Year:	2023-24
Semester:	VII
Category of the Course:	Professional elective course

Prerequisite :	Basics of unit operations, process engineering and numerical computations
Rationale :	The study of Process Modeling and Simulation within the realm of chemical engineering is of significant significance for understanding transport processes, enhancing design processes, and comprehending kinetics. This subject encompasses two key components: modeling and simulation. In the modeling and simulation segments, the focus lies on concepts related to modeling chemical engineering processes. This includes parameter estimation, network decomposition, the utilization of numerical techniques, data regression, convergence enhancement, specific-purpose simulation, and dynamic simulation, among other aspects.

Course Scheme:

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Practical		
L	T	P	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Course Content:

Sr. No.	Course Content	No. of Hours	% of Weightage
1	Definitions And Classification of Modelling, Fundamental Laws Of Chemical Engineering, Mathematical Models for Chemical Engineering Systems, Modeling difficulties, Degree of freedom analysis, Selection of design variables,	10	25
2	Equations of continuity, energy, momentum, and state, Transport	12	25

	properties, Equilibrium and chemical kinetics, Review of thermodynamic correlations for the estimation of physical properties like phase equilibrium, bubble and dew points,		
3	Continuous Flow Tanks, Mixing Vessels, Steam Jacketed Vessel, Batch Distillation, Gas Flow System, Simulation Of Gravity Flow Tank, CSTR In Series, Non-Isothermal CSTR, Binary Distillation Column, Batch Reactor, Jacketed Tubular Reactor, Countercurrent Liquid-Liquid Heat Exchanger	12	25
4	Simulation of the models, Sequential modular approach, Equation oriented approach, Partitioning and tearing, Introduction and use of process simulation software for flow sheet simulation.	10	25
	Total	**44**	**100**

Reference Book:

1. Chemical Process Modelling and Computer Simulationby Amiya K. Jana
2. Biquette W.B., Process Dynamics - Modeling Analysis and Simulation, Prentice Hall of India
3. Franks R.G.E., Mathematical Modeling in Chemical Engineering, John Wiley
4. John Ingham et.al., Chemical Engineering Dynamics - Modeling with PC Simulation, VCH Publishers
5. Luyben W.L., Process Modeling, Simulation and Control for Chemical Engineers, McGraw Hill International Edition

Course Outcome:

After Completion of the Course, Student will able to :

No	Course Outcomes	RBT Level*
CO-1	Illustrate use of fundamental laws to develop model for Chemical engineering processes	10
CO-2	Outline the scope of process optimization and its applications to chemical processes.	20
CO-3	Apply mathematical principles and techniques to solve the models for simulation.	20
CO-4	Analyse process plant simulation results using professional simulators.	25
CO-5	Formulate optimization problems and evaluate the solutions.	25

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Suggestive list of experiments

1. Introduction to process simulation
2. Equations of state: solution of problems using MS Excel
3. Phase equilibrium: solution of problems using MS Excel
4. Chemical Reaction equilibrium: solution of problems using MS Excel
5. Mass Balances with Recycle Streams: solution of problems using MS Excel
6. Simulation of Mass Transfer Equipments: solution of problems using MS Excel
7. Chemical Reactors: solution of problems using MS Excel
8. Transport Processes in One Dimension: solution of problems using MS Excel
9. Process simulation of typical chemical plants using Aspen Plus/ HYSYS

List Learning Resources Required:

1. Students can refer to video lectures available on the websites including NPTEL.
2. Students can perform experiments on Virtual lab by IITs.

****