NIRMA UNIVERSITY

School of Engineering, Institute of Technology

B.Tech. in Chemical Engineering

Third Year /Semester VI

Institute:	Institute of Technology
Name of Programme:	B. Tech. (Chemical Engineering)
Course Code:	3CH502CC24
Course Title:	Modeling and Process Simulations
Course Type:	Core
Year of introduction:	2024-25

L	**T**	**Practical component**			
		LPW	**PW**	**W**	**S**
3	-	2	-	-	-

Course Learning Outcomes (CLOs):

At the end of the course, student will be able to-

1. classify the structure of modular and equation-oriented mode simulators (BL4)
2. identify the partitions and tearing for the given flow diagram (BL3)
3. build models for different unit operations in chemical engineering (BL6)
4. apply various simulators for the simulation of the chemical processes (BL3)

Syllabus :		**Teaching Hours 45**
Unit I	**Basic Concepts of Process Modeling** General Aspects of Modelling and Process Simulation**,** Process Synthesis and Process Analysis, Study and Applications of Fundamental Laws, Introduction to Regression Analysis, Basics of Various Numerical Methods.	**08**
Unit II	**Modeling of Chemical Engineering Systems** Basics of Mass Balance, Energy balance for Non-Reactive Systems, Energy Balance for Reactive Systems, Modelling of Various Unit Operations like Absorber, Isotherms Mixtures, Reactors etc., State Space Representation of the System of Equations, Linearisation of Nonlinear Systems, Degree of freedom Analysis of Various Unit Operations.	**15**
Unit III	**Modular and Equation Solving Approaches** Modular Approach to Process Simulation, Equation-Solving Approach, Structure of Modular and Equation-Oriented Mode, Precedence-Ordering of Equation Set, Partitioning the Flowsheet, Tearing Algorithms, Algorithms Based on the Signal Flow Graph, Basic Tearing Algorithm, etc.	**12**
Unit IV	**Various Software/ Process Simulators** Introduction to Mathematical Software, Introduction to Process Simulators and Their Usage in Process Engineering.	**10**

Self Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
Laboratory work will be based on the above content of course.

Suggested Readings/References:

1. Luyben W. L., Process Modeling, Simulation and Control for Chemical Engineers, McGraw Hill Publication.
2. Ramirez W. F., Computational Methods for Process Simulation, Butterworth-Heinemann.
3. Biegler L. T., Grossman I. E., Westerberg A. W., Systematic Methods of Chemical Process Design, Prentice Hall Publication.
4. Babu B. V., Process Plant Simulation, Oxford Publication.

L= Lecture, T=Tutorial, P= Practical, C=Credit

List of Experiments:

Sr. No.	Practical	No. of Hours
1	To familiarise students with the basic of MATLAB/SCILAB	2
2	Write simple codes for solving chemical engineering models using MATLAB/SCILAB	2
3	Develop a model and solve the same using MATLAB	2
4	Solve ordinary differential equations with the help of MATLAB	2
5	To familiarise students with basic inputs required for steady-state simulations	2
6	Perform steady-state simulations of various basic unit operations part I	2
7	Perform steady-state simulations of basic unit operations- part II	2
8	Make students learn how to simulate different kinds of reactors in a process simulator	2
9	To familiarise students with various logical operators of a process simulator	2
10	Perform steady-state simulations of some simple flow sheet	2
11	Perform a process design of a multi-component distillation column	2
12	Perform Recycle Operations in a flowsheet	2