



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3171409

Semester – VII
Subject Name: Modeling, Simulation and plant layout of Food Processes

Type of course: Open elective

Prerequisite: Nil

Rationale: A model represents construction and working of some system of interest. A model is similar system it represents but it is simpler than the system. The purpose of a model is to allow the analyst to predict the effect of changes to the system. Simulation is used before an existing system is altered or a new system built, to meet specifications, to prevent under or over-utilization of resources, to reduce the chances of failure, to eliminate bottlenecks and to optimize system performance.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs
1.	Introduction: Introduction to mathematical modeling, Model building; Classification and uses of mathematical models; Formulation of mathematical model and fundamental laws.	04
2.	Batch processes in food industry: Introduction; Equilibria in batch processes; Steady state flow processes like Two Heated Tanks, Single-Component Vaporizer, Multi component Flash Drum, Ideal Binary Distillation Column, Batch Distillation With Holdup	08
3	Numerical methods: Iterative Convergence Methods, Interval Halving , Newton-Raphson Method , False Position , Explicit Convergence Methods, Muller Method, Explicit Numerical Integration Algorithms, Implicit Methods	10
4.	Basic concepts of plant layout and design: Introduction, Preparation of flow sheets for material movement and utility consumption in food plants, Layout and designing aspects of pilot and semi-commercial food processing plants; Scale-up; Application of Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM) in project planning and monitoring.	08

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	30	30	15	10	

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.



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Reference Books:

1. Process modeling, simulation and control: William L Luyben, TMH
2. Process analysis & simulation : Himmelblau, Kenneth & Birchoff, John Wills
3. Chemical process modeling and computer simulation : Amiya K Jana, PHI learning Pvt Ltd
4. Process Plant Simulation: B V Babu, Oxford University Press

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the process	10
CO-2	Analyze physical and chemical phenomena involved in various process	20
CO-3	develop mathematical models for various chemical processes	30
CO-4	use various simulation approaches	20
CO-5	Simulate a process using process simulators	20

List of Experiments:

- 1) Experiment 1: MATLAB's power of computational mathematics
- 2) Experiment 2: Basic commands, syntaxes and variables in MATLAB
- 3) Experiment 3: Generating and running script file
- 4) Experiment 4: Data types and operators of MATLAB
- 5) Experiment 5: Introduction to HYSYS
- 6) Experiment 6: Modeling of multi component distillation column
- 7) Experiment 7: Modeling of variable pressure distillation
- 8) Experiment 8: Modeling of gravity flow tank
- 9) Experiment 9: Simulation of the numerical method using MATLAB
- 10) Experiment 10: Simulating Heat exchanger and separation column using HYSYS
- 11) Experiment 11: Simulation of process involving recycle using HYSYS
- 12) Open ended problem

Major Equipment:

1. Process simulator HYSYS

2. MATLAB

List of Open Source Software/learning website:

- 1) <https://fddocuments.in/document/process-plant-simulation-babu.html>
- 2) <https://www.tutorialspoint.com/matlab/index.htm>
- 3) <https://sites.ualberta.ca/CMENG/che312/F06ChE416/HysysDocs/AspenHYSYSOperationsGuide.pdf>