

Modeling and Simulation

Course Code CS-323	Credit Hours 1-1
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Course Description

Introduction to fundamental concepts, techniques, and tools for creating mathematical models and conducting simulations to analyze complex systems. Covers mathematical modelling principles, simulation techniques, model validation, optimization, and real-world applications. Hands-on experience with simulation software. Ideal for engineering students seeking to enhance problem-solving skills and decision-making in engineering domains.

Text Book:

1. Introduction to Matlab for Engineering Students by David Houcque, Northwestern University latest edition.
2. <https://www.mathworks.com/help/simulink/simulation.html>
3. <https://www.mathworks.com/help/simulink/modeling.htm>

Reference Book: -

Prerequisites:

Nil.

Assessment System for Theory

	Without Project (%)	With Project/Complex Engineering Problems (%)
Quizzes	15	10-15
Assignments	10	5-10
Mid Terms	25	25
Project	-	5-10
End Semester Exam	50	45-50

Assessment System for Lab

Lab Work/ Psychomotor Assessment/ Lab Reports	70%
Lab Project/ Open Ended Lab Report/ Assignment/ Quiz	10%
Final Assessment/ Viva	20%

Teaching Plan

Theory:

Week No	Topics/Learning Outcomes	<u>Reading Assignment/ Home Work</u>	<u>CLO No.</u>	<u>Assessment Methodology</u>
1	Prepare Model Inputs and Outputs	Ref 1	1	Assignments, Quizzes, MSE, ESE
2	Configure Simulation Conditions		1	
3	Run Simulations		2	
4	View and Analyze Simulation Results		2	
5	Test and Debug Simulations		4	
6	Optimize Performance		4	
7-8	Simulation Guidelines & Best Practices		1	
9	MSE			
10	Design Model Architecture	Ref 1	3	
11	Manage Design Data		3	
12	Design Model Behavior		3	
13	Configure Signals, States, and Parameters		3	
14	Configure Inputs and Visualizations		3	
15	Analyze and Remodel Design, Test Model Components		4	
16	Modeling Guidelines & Best Practices		1	
17-18	End Semester Exam			

Practical

Experiment No	Description	Assessment Methodology	Learning Domain/ Taxonomy Level
1	Introductions to programming with MATLAB	Lab Manual, Lab Quiz, Lab Rubrics	P5, C3, C4
2	Find the response of a lumped variable model expressed in terms of transfer function using MATLAB for input of (i) unit step function (ii) unit impact function and (iii) unit ramp function		

3	Use of Simulink in MATLAB for engineering problems		
4	Introduction to Abaqus software for civil engineering applications		
5	How to model structural members such as beams, columns and trusses etc. for different loading & boundary conditions using Abaqus FEM software.		
6	Introduction to Visual Basic (VB) for civil engineering applications.		
7	Application of Visual Basic in automating repetitive tasks, data analysis & visualization.		