

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	M.Tech. in Electronics & Instrumentation Engineering (Robotics and Artificial Intelligence)
Semester:	I
Course Code:	6ME803CC25
Course Title:	Robot Simulation Lab
Course Type:	Core
Year of introduction:	2025-26

L	T	Practical component				C
		LPW	PW	W	S	
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Course Learning Outcomes (CLOs):

After successful completion of the course, student will be able to –

1. model the robotic mechanism using different CAD software (BL3)
2. make use of MATLAB Simulink tools for simulation of robotic system (BL3)
3. analyze the robotic mechanism using Simscape Multibody tools (BL4)
4. create simple simulation environment using ROS and Gazebo. (BL6)

Unit	Syllabus	Teaching Hours (Total 30)
Unit I	CAD-based robot simulation using Creo/Solidworks/Adams Understanding of CAD software, creating CAD models of parts, understanding joints and constraints, assembling of parts to mechanism, various motion actuators, application of boundary conditions, understanding simulation parameters, kinematic motion simulation of mechanism, dynamic simulation of robotic mechanism using multibody dynamic analysis tool, exporting CAD models in standard format, structural analysis of mechanism.	10
Unit II	Programming based robot simulation using MATLAB Understanding MATLAB Simulink, modelling the system in Simulink, simulation parameters and settings, state-space modelling in Simulink, creating 3D models, joints and constraints in Simulink, kinematic and dynamic motion simulation of robotic mechanism, import CAD geometry to Simulink, Understanding Simscape multibody, difference of Simscape and Simulink, modelling and simulation of robotic mechanism using Simscape multibody.	10

Unit III **Robot Operating System (ROS)** 10

Overview of ROS and its applications, ROS installation and workspace setup, Understanding ROS packages, nodes, topics, and services, Writing and running a simple ROS publisher and subscriber, ROS messages, parameters, and launch files, Using ROS tools: rqt_graph, rviz, and rosbag, Introduction to TF (transform library) for coordinate frames, Introduction to Gazebo and its integration with ROS, Launching and controlling a simulated robot in Gazebo, Creating a simple simulation environment

Suggested list of experiments:

Sr. No.	Title	Hours
1.	To model a planar mechanism and simulate it using CAD software	6
2.	To create multibody robotic mechanism and simulate it using CAD software	6
3.	To prepare a program using MATLAB for motion simulation of robotic system	6
4.	To model and simulate simple mechanisms using Simulink	4
5.	To model and simulate robotic mechanism using Simscape Multibody	4
6.	To understand ROS packages, nodes, topics, and services	6
7.	To create a simulation environment using Gazebo	6
8.	To integrate the Gazebo simulation environment with ROS	4
9.	Mini project	6

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

w.e.f. the academic year 2025 - 26 and onwards

