Type of Course: B. Tech CSE Robotics and AI

Prerequisite: Engg. Mathematics and Engg. Physics, Computer Proficiency and Basics of Electrical and Electronics

Rationale: In this lab, students embark on an immersive journey through the fundamentals of robotics, bridging theoretical knowledge with practical challenges. It is designed to develop their proficiency in both classical and modern robotics concepts by engaging with hands-on experiments such as matrix transformations, sensor integration, actuator control, and simulation-based analysis. Through activities that include solving mechanical force problems in robotics, designing flowcharts and pseudocode, and comparing open versus closed-loop control systems, students cultivate analytical and programming skills essential for designing, optimizing, and implementing robotic systems. Additionally, the lab introduces historical and industrial perspectives, enhancing understanding of the contextual evolution in robotics. By combining experimental and simulation approaches, the lab ensures students are well-prepared for real-world robotics challenges and positions them for advanced academic or professional pursuits in technology and engineering. These experiences deepen technical competency and inspire innovative thinking for future breakthroughs.

Teaching and Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect Hrs/	Tut Hrs/	Lab Hrs /Week		T	P	T	CE	P	
0	0	2	1	-	30	-	-	20	50

Lect- Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory,**P**- Practical, **CE**- CE, **T** - Theory,**P**- Practical

List of Practical:

Sr. No	Topics
1	Solve problems using matrix transformations and rotation matrices in MATLAB.
2	Experiment to understand mechanical forces on a robotic arm using simulation tools like MATLAB.
3	Design flowcharts and pseudocode for basic robotic tasks.
4	Research and present a timeline of major milestones in robotics.
5	Use a case-study approach to analyze how robotics solves problems in manufacturing or healthcare.
6	Integrate proximity or vision sensors to create a system that reacts to environmental changes.
7	Build a simple actuator-driven robotic mechanism like a moving lever.
8	Program a basic task (e.g., motor control) using Arduino.
9	Implement both types of control for a servo motor and compare results in SIMULINK and MATLAB
10	Write and execute a basic program for PID control and observe system stabilization in SIMULINK and MATLAB
11	Perform calculations and visualize transitions between coordinate spaces using roboanalyzer.
12	Analyze and demonstrate DOF in a robotic manipulator using roboanalyzer.

Objectives: After Learning the Course, the students shall be able to:

1. Demonstrate proficiency in matrix operations and coordinate transformations using MATLAB/Simulink.
2. Analyze mechanical forces and simulate robotic arm dynamics.
3. Design logical sequences and pseudocode for basic robotic tasks.
4. Compare and implement open-loop and closed-loop control systems.
5. Integrate sensors and actuators into functioning microcontroller-based systems.
6. Critically evaluate the historical evolution and industrial applications of robotics.