NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	Minor in Smart Automation (Disciplinary) Offered by B.Tech. in Electronics and Instrumentation Engineering
Semester :	V
Course Code:	3EI302DC24
Course Title:	Robotics Application in Industries
Course Type:	Core Course - II under Minor (Disciplinary)
Year of Introduction:	2024-2025

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

At the end of the course, the students will be able to –

1. understand the basics of robotics and automation **(BL2)**
2. describe the properties of robotic hardware useful in industrial robot **(BL2)**
3. determine control techniques for industrial robots **(BL3)**
4. analyse industrial application using robotic assembly line **(BL3)**

Unit	Contents	Teaching hours (Total 45)
Unit-I	**Introduction** Fundamental of robotics, robot arm components, robot in automation, types of robot manipulators, work envelope of robot manipulators.	03
Unit-II	**Robot sensor and end effector** Sensor in robotics arm application, selection of transducers, position and displacement sensors, types of end effectors, tools and end effector interface, robotic arm configurations with various sensors, types of end effectors as a tool and as gripper, pneumatic/hydraulic sequencing operation.	08
Unit-III	**Robot peripheral control** Control system analysis, modeling and control of joint robot, robot arm IO control, Introduction to manipulator kinematics, fundamental of robotic arm kinematics, denavit-hartenberg presentations, direct kinematics problems, joint space trajectory planning for robotic arm, consideration of joint interpolated trajectory.	10
Unit-IV	**Robot application in manufacturing** Multiple robot and machine interface, work cell control, programming language-feature and application, program for PNP (pick and Place) activity, robotic arm control system in industrial applications-material handling, welding, spray painting, machining, robotic arm configuration for pick and place process, spot welding process in car manufacturing, use of robots in automotive industries, case studies of effective robot used in industry.	12
Unit-V	**Robot programming language** Use of program for robot work cycle, manual programming method, walk through programming method, teach pendent through programming method, offline programming method, requirement of robot programming languages.	07
Unit-VI	**Robot vision system**	05

Components and function of robot vision system, camera illumination, frame grabber with image presentation, application of machine vision, industrial usage of vision controlled robotic system.

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:
This shall consist of at least 10 practicals based on the above syllabus.

Suggested Reading:

1. Mikell Groover, Industrial robotics, McGraw Hill Education Pvt Ltd
2. R.K Rajput, Robotics and industrial automation, S. Chand Publishing
3. Richard K Miller, Industrial robot handbook, Springer
4. Norberto Pires, Industrial robot programming, Springer

Suggested List of Experiments (not restricted to the following):
(Only for Information)

1.	To analyse servo motor sequence using servo controller	**(02 Hrs)**
2.	To demonstrate working of encoder sensor	**(02 Hrs)**
3.	To study working of end effectors	**(02 Hrs)**
4.	To study robotic arm kinematics	**(02 Hrs)**
5.	To learn and demonstrate working of forward kinematics of robotic arm	**(02 Hrs)**
6.	To demonstrate inverse kinematics of robotic arm	**(02 Hrs)**
7.	To determine path and trajectory planning for robotic arm	**(02 Hrs)**
8.	To demonstrate robot programming on robotic arm kit	**(02 Hrs)**
9.	To demonstrate motion control of robotic arm	**(02 Hrs)**
10.	To perform pick and place algorithm using industrial ARM	**(02 Hrs)**
11.	To simulate robotic arm and conveyor belt-based application	**(02 Hrs)**
12.	To simulate object sorting mechanism using robotic arm	**(02 Hrs)**

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

w.e.f. the academic year 2024 - 25 and onwards