NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B. Tech in Electronics and Instrumentation Engineering
Course Code:	2EIDE62
Course Title:	Robotic Control System
Course Type:	([] Core/[] Value Added Course/[√] **Departmental Elective**/ [] Institute Elective/[]University Elective/[]Any other)
Year of introduction:	2023-2024

Credit Scheme

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

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

1. illustrate properties of robotic hardware useful in autonomous robots
2. relate the implementation of robots in real world complex applications
3. formulate solution algorithm related to localization, obstacle avoidance and mapping
4. develop control algorithm for decision making in intelligent robotic system

Syllabus: **Total Teaching hours: 30**

Unit	Syllabus	Teaching hours
Unit-I	**Introduction** Fundamental of robots, components of a complete robot, case studies for wheeled locomotion, legged locomotion and aerial locomotion.	03
Unit-II	**Sensor technology** Overview of sensor classification, sensor interface for obstacle avoidance, sensors for area scanner, LIDAR on an autonomous robot, feature extraction using range sensor data, inertial measuring unit, sensor for localization and tracking, GPS sensor for path planning, application of encoder in robotics.	09
Unit-III	**Robot autonomous navigation** Introduction to fuzzy logic control for navigation, simultaneous localization and mapping, obstacle avoidance techniques, navigation architecture, programming related to navigation algorithms, case study of navigation with path planning.	08

Unit-IV	**Robot vision control** Vision for robot control, position based and image based visual servoing, depth measurement with vision system, face and object recognizer application in robotics, case studies of visual servoing in robotics.	07
Unit-V	**Intelligent robotic system** Introduction to artificial intelligence in robotics, reasoning about robot space, case study for intelligent robotics.	03

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: Laboratory Work will consist of minimum 10 experiments based on the above syllabus.

Suggested List of Experiments:

1. To analyze servo motor sequence using servo controller
2. To demonstrate working of encoder sensor
3. To demonstrate working of range sensor
4. To study feature extraction using range sensor data
5. To learn and demonstrate working of 360 degree LIDAR for 2D plane
6. To demonstrate working of GPS sensor
7. To determine path localization using GPS sensor
8. To learn path planning algorithm using six wheeled mobile robot
9. To learn path planning using six legged hexapod robot
10. To demonstrate face detection using vision kit
11. To demonstrate object detection using vision kit
12. To demonstrate collision avoidance for robot navigation
13. To demonstrate robot programming on robotic kit
14. To demonstrate motion control of Humanoid Robot
15. To perform pick and place algorithm using industrial robotic arm

Suggested Readings/ References:

1. Roland siegwart, Introduction to autonomous mobile robot. PHI Learning Pvt Ltd.
2. Gregory dudek, Computational principle of mobile robotics. Cambridge University press.
3. Diwakar Vaish, Python robotics projects: build smart and collaborative robots using python, Packt Publishing.
4. Robin R. Murphy, Introduction to AI robotics, PHI Learning Pvt Ltd.

Suggested Case List: --

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