

Course Number : AR504
Course Name : Robot Programming, Modeling, and Simulation
Credit Distribution : 2-0-2-3
Intended for : UG, PG and PhD
Prerequisite : Consent of faculty advisor
Mutual Exclusion : None

1. Preamble:

Students will be introduced to the main topics in context to the robot programming, robot modeling and simulation. The aim is to provide the students with the skills required to model the system of interest.

2. Course Modules with quantitative lecture hours:

ROS (Robot operating system): Prerequisites, basic structure, ROS master, ROS node, ROS topics, ROS msg, ROS bag record and play, rqt graph, rqt plot, ROS publisher, and subscriber node. **(10 hours)**

URDF modeling: Basic structure of urdf file, robot links and joints and its representation inside the urdf, writing urdf from scratch for a robot of interest, urdf test, and visualization. **(12 hours)**

Robot simulation environments: Brief description of various simulation platforms for robots. Demonstration in PyBullet and Gazebo. Import plane with zero and nonzero orientation. Import urdf of interest and fetch joint and pose info. Test the movement of interest in context to the model. Import multiple models in the simulation environments. **(10 hours)**

Robot control in the simulation environment: Automatic heading correction, robot navigation to the goal, and visual servoing. Case studies and course projects. **(10 hours)**

Laboratory/practical/tutorial Modules:

ROS, URDF modelling, Robot simulation environments, Robot control in the simulation environment

3. Textbooks:

1. Joseph L., Mastering ROS for Robotics Programming: Design, build, and simulate complex robots using the Robot Operating System.
2. Quigley, Morgan, Brian Gerkey, and William D. Smart. *Programming Robots with ROS: a practical introduction to the Robot Operating System.* " O'Reilly Media, Inc.", 2015.

4. References:

1. ROS Tutorials by ROS.org
2. PyBulletQuickguide:
<https://usermanual.wiki/Document/pybullet20quickstart20guide.479068914/html>

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.		None	None	None

6. Justification of new course proposal if cumulative similarity content is >30%: None