

Short Term Course : Mathematical Foundation of Robotics
Centre for Advanced Studies, AKTU (Lucknow)
Department of Mechatronics and Automation

1 Course Name : Mathematical Foundation of Robotics - (25 Hours)

2 Course description:

Welcome to the first course in the Industrial Robotics series. This is an advanced course designed for learners who are pursuing bachelor's degree or have a bachelor's degree in engineering or a similar field.

Learners will succeed in this course if they have familiarity with basic operations on matrices and vectors, as well as exposure to derivatives and partial derivatives.

The fundamental challenge this course addresses is how one can create robots that operate well in the real world.

This course deals with basic concepts of robot kinematics, dynamics, path planning, trajectory generations, and control.

3 What Students will learn

- How to describe, analyze and think critically about fundamental problems in robotics, such as how to change the position or configuration of a robot
- The role of mathematics in describing robotic arms, mobile robots and other robotic platforms with Hands On.
- How to use the industry standard programming environment (Robo Analyzer, Robot Operating System)

4 Course Plan: (20 Hours)

Short Course On MFRO			
Lecture no	Hours	Learning objects	Topics to be covered
1-2	2	MFRO*	Basic Concept, Rotation Matrix, Homogeneous/Transformation matrix
3-4	2	MFRO	Eular angle representation, D-H parameter
5-6	2	MFRO	Forward and Inverse kinematic,
7	2	MFRO	Solution of inverse kinematics
8	2	MFRO	Jacobians
9-10	3	Dynamics	Velocity, Dynamics of manipulators
11-12	2	Trajectory	Trajectory planning and avoidance
13-14	2	Trajectory	Path planning
15	3	Control	Basic of control of Manipulators

* Mathematical Foundation of Robotics

5 Hands On: (5 hours)

- Introduction of Robo Analyzer Simulator - 1 hour
- Kinematic Analysis of manipulators on Robo analyzer - 1 hour
- Dynamics Analysis of manipulators on Robo analyzer - 1 hour
- Trajectory Generation Analysis of manipulators on Robo analyzer - 1 hour
- Force and Torque Analysis of manipulators on Robo analyzer - 1 hour

6 Course Instructor

Dr. Manish Raj
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