SIES GRADUATE SCHOOL OF TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

Organizes
Student Development Program
On

Modelling Robot Kinematics using Python Programming

Date: **22 July-3 July 2020**
Mode: Online

Introduction:

Robot kinematics studies the relationship between the dimensions and connectivity of kinematic chains, the position, velocity and acceleration of each of the links in the robotic system. It will lead to plan and control movement and to compute actuator forces and torques. The manual calculation of motion parameters is difficult due to increase in number of links and joints.

This program is developed to automate the calculation of motion parameters of the robot using commonly used and platform-independent programming language, python and validation of motion parameters using a software Roboanalyzer.

Objectives:

1. To study the parameters of motion in kinematics robotics
2. To study various design principles of robotics through kinematic analysis, workspace analysis, and trajectory planning

Course outcome:

At the end of the program, learner will be able to…

1. Compute the motion parameters
2. Validate motion parameters using modelling using Roboanalyzer*
3. Validate motion parameters using python programming
4. Compute the workspace for robot
5. Compute the trajectory planning for a robot

Course Content:

➢ 1: Introduction to Basics of Python Programming
➢ 2: Introduction to Basics of Robotics
➢ 3: Kinematics of Robot and Roboanalyzer
➢ 4: Workspace Analysis and Trajectory Planning

Sr. No	Module	Content
1	Introduction to Basics of Python Programming	Installation of Python version 3.7.2. Use of print function with string, data type, variables, input function and escape character. Indexing and slicing of strings Formation of list and array. How to read and load data from files. Plotting data and chart. Formation of Matrix and various Matrix operations Creating and saving plots, Multiple plots and sub plots. Embellishing Plot.
2	Introduction to Basics of Robotics	Definition of robot, Evolution of robots, Laws of robots, International Robotic Standards, Types of robots, Selection of robots, Robot Classifications, Degrees of freedom, Robot configuration, Accuracy and repeatability, Specification of a robot
3	Kinematics of Robot	**Direct Kinematics:** Link coordinates D-H Representation, Direct kinematic analysis for Four axis, SCARA Robot and three, five, and six axis Articulated Robots. Programming the direct kinematics analysis using python programming **Inverse Kinematics:** The inverse kinematics problem, General properties of solutions, inverse kinematics of four axis SCARA robot. Programming the inverse kinematics analysis using python programming
4	Workspace Analysis and Trajectory Planning	Workspace Analysis, work envelope of a Four axis SCARA robot and five axis articulated robot Joint space technique - Continuous path motion, Interpolated motion, Straight line motion and Cartesian space technique in trajectory planning. Programming the workspace and trajectory analysis using python programming

> **Resource Person:**
> **Prof. Pradip P. Patil**
> **Prof. Prashant K. Ambadekar**

Who Should Attend:

Any students from Second year, third year and final year of engineering

Certificate will be provided after successful completion of the course.