

Nirma University
School of Technology, Institute of Technology
B. Tech (Instrumentation and Control Engineering)
Department Elective

L	T	P	C
3	0	0	3

Course Code	2ICDE02
Course Title	Robot Dynamics and Control

Course Learning Outcome:

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

- illustrate kinematics analysis of robot systems
- interpret motion sequence tasks in robotic control
- analyze and design of control algorithm for path optimization in robotics

Syllabus

**Teaching
Hours**

UNIT 1: Introduction

Fundamental of robots, robot components, degree of freedom, robot coordinates, robot workspace.

03

UNIT 2: Robot kinematics

Overview of position analysis, homogeneous transformation, forward and inverse kinematics of robots, Denavit Hartenberg representation.

10

UNIT 3: Differential motion and velocities

Interpretation of differential motion of a frame, motion of a robot and its hand frame, calculation of jacobian, equations of motion, Joint space motion control, motion sequence case studies.

09

UNIT 4: Dynamics analysis and forces

Lagrangian mechanics, dynamic equation for multiple degree of freedom robots, static force analysis, transformation of forces and moments between coordinate frames.

08

UNIT 5: Trajectory planning

08

Path trajectory, joint space trajectory planning, cartesian space trajectory, operational space trajectory, position and velocity control, open loop and closed loop case studies.

UNIT 6: Visual servoing

07

Vision for control, visual pose estimation, stereo vision, position based and image based visual servoing, depth measurement with vision system, heuristic, application of control in robotics, case studies of visual servoing in robotics.

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.

References:

1. Saeed b Niku, Introduction to robotics, analysis, system, application, Pearson education.
2. Bruno Siciliano, Robotics: Modelling, Planning and Control, Springer Publications.
3. K S Fu, Robotics, McGraw Hill Education.
4. Mark w spong, Robot dynamics and control, Wiley Publishers.