

### Course Content

Course Code: 17EARE302	Course Title: Robot Dynamics & Control	
L-T-P : 3-0-0	Credits: 3	Contact Hrs: 40
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40		Exam Duration: 3 Hours

Content	Hrs
<b>Unit - 1</b>	
<b>Chapter 1: Dynamics of Open Chains</b> Introduction to robot dynamics, Lagrangian Formulation, Basic Concepts and examples, General Formulation, Mass Matrix, Gravity terms, Inertia Matrix, Coriolis Matrix, Friction, Effect of Payload	9
<b>Chapter 2: Actuation, Gearing, &amp; Friction</b> Introduction, Characteristics of actuating systems robot, Comparison of actuating systems dynamics, Motors and Gearing, Apparent Inertia, Independent joint control, Motor Inertias, Friction, Joint and Link Flexibility, Robot Dynamics in the URDF format	7
<b>Unit - 2</b>	
<b>Chapter 3: Motion Control</b> Introduction to robot motion control, trends in robotic research, motion control, types of manipulator control, robust & adaptive control, motion and model-based control, kinematic and dynamic control schemes, Feedforward and feedback control	8
<b>Chapter 4: Trajectory Planning</b> Introduction to trajectory generation, Cubic polynomial schemes, Higher-order polynomial function, cycloidal function, parabolic blends, joint-space, and task-space schemes	7
<b>Unit - 3</b>	
<b>Chapter 5: Motion Planning</b> Overview of Motion Planning, Types of Motion Planning Problems, Motion planning- arms vs. mobile robots, Motion Planning Schemes – Graph-based methods, Motion Planning Schemes – Analytical approaches	5
<b>Chapter 6: Manipulator-mechanism design</b> Introduction, Basing the design on task requirements, Kinematic configuration, Quantitative measures of workspace Attributes, Stiffness and deflections, Position sensing, Force sensing	5

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**Text Books (List of books as mentioned in the approved syllabus)**

1. Modern Robotics: Mechanics, Planning, and Control, K. M. Lynch and F. C. Park, Cambridge University Press, 2017
2. Introduction to Robotics: Mechanics and Control, John J. Craig, Pearson; 3rd edition (27 July 2004)
3. Robotics, Vision and Control Fundamental Algorithms in MATLAB, Peter Corke, Springer Berlin Heidelberg, Springer, Cham, 978-3-319-54413-7

**References**

1. Robot Modeling and Control, M. W. Spong, S. Hutchinson, and M. Vidyasagar, Wiley, 2020

**Evaluation Scheme**

**ISA Scheme**

<b>Assessment</b>	<b>Weightage in Marks</b>
ISA-1	20
ISA-2	20
Activity/Assignment	10
<b>Total</b>	<b>50</b>