



**CENTRE OF EXCELLENCE IN MANUFACTURING
NATIONAL INSTITUTE OF TECHNOLOGY,
TIRUCHIRAPPALLI**

Advanced Manufacturing Lab

Human Simulation: 50 Hours

PREREQUISITES	Basic knowledge in Design, Manufacturing Process, About Robots , Kinematics
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WHO SHOULD ATTEND	Students, Engineers, Managers who need to manage and Optimize In Robotic Simulation.
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Basic concepts 2 Hours

Training introduction - Basic methodology and purpose - Starting Process Simulate Standalone - Basic options setup - Examining object types - The prototype and instance relationship - Creating a study - Process Simulate introduction - Process Simulate viewer overview - Window layout management

Process Simulate Standalone environment 1 Hour

Working with viewers - Graphic Viewer setup and control - Customizing the user configuration - Entity selection - Introduction to selection filters - Introduction to Display By Type - Measurement and units - Graphical visualization and performance - Additional commands - Accessing online help and release notes

Placement command 3 Hours

Introduction to placement - Introduction to Fast Placement and Restore Design Relative Location - Changing pick behavior and creating frames - Introduction to Placement Manipulator - Introduction to Relocate

Quick introduction to kinematics 4 Hours

Fundamentals of kinematics - Creating device operations - Inverse kinematics review - Using inverse kinematics

Analysis tools and study data 2 Hours

Study data - Multi part appearances - Creating and using snapshots - Using the Markup Editor - Adding text in the Graphic Viewer - Storing pictures of the study - Introduction to collision detection - More on collision detection - Factors that affect collision detection - Cutting sections with section planes - Cutting sections with section volumes - Recording Process Simulate simulations to an .AVI file

Modeling basics 8 Hours

Overview of Process Simulate basics - Process Simulate basic modeling tools - Modeling concepts - Solid creating with primitives - Using wireframe to create solids (optional) - Modeling gun shanks (optional) - Modeling a more complex object (optional)

Kinematics basics 8 Hours

Kinematics background - Kinematics basics summary - Joint dependency basics - Introduction to kinematic cranks - Kinematic branching - Defining speed and acceleration - Defining an object as a tool - Adding kinematics to a simple robot - Inverse kinematics device creation and usage

Other selected modeling and kinematics topics 8 Hours

Rails, gantries, and positioners (external axis) definition . - More kinematic branching and cranks - Variable joint limits - More on kinematic functions - Train joint function example - Cam joint function example - More topics (not covered in class)

Introduction to Process Simulate Human 3 Hours

Creating a study (again) - Process Simulate Human Overview - Human Models - Introduction to Human Task Simulation

Basic Human Operations 2 Hours

Setting Human Options - Positioning and Walking - Human Operation Modification - Vision Window, Vision Envelope, and Grasp Envelope - Basic Posturing and Kinematic Jogging - More Posturing and Kinematic Jogging - Postures Library

Automatic Posture Tools 2 Hours

Grasping and Releasing Objects - Assigning Object Weight and Lifting Frequency - Auto Grasp - Creating a Simple Grasp Task - Picking Up and Following Objects by Walking - Setting Down Objects – No Walking - Scenario for Using Hand Tools - Humans and Direct Kinematics Scenarios (Optional) - Humans and Inverse Kinematics Scenarios (Optional) . - Humans and Moving Line Scenarios (Optional) - Other Human Simulation Scenarios (Optional)

Ergonomics 2 Hours

Ergonomics Introduction - Assigning Additional Forces to Any Body Part - Ergonomics Report Viewer - Introduction to OWAS - Introduction to NIOSH - Introduction to Static Strength Prediction (SSP) - Introduction to Lower Back Analysis using DMH - Introduction to Cumulative Back Load - Introduction to RULA - Introduction to Fatigue - Introduction to Garg (Optional) - Introduction to EAWS (Optional) - Introduction to Custom Reports (Optional Lesson)

Assigning a Duration to Human Operations 2 Hours

Human Task Time Assignment Introduction - Simple Methods for Assigning Duration - Putting it all together - Where do you go from here?

Appendix: Optional Process Simulate Human Topics 2 Hours

Creating Hand Models (Optional) - Using Other “Jack” Mannequins (Optional) - Using Jack Collaboration (Optional) - Posture Recorder (Optional) - Using Jack Collaboration (Optional) - Posture Recorder (Optional) - Using Body and Hand Motion Capture - Controlling the Eyes, Head, and Legs (Optional) - Hand Grasps and Reaches – Grasp Wizard - Creating and Using a Custom Datacard (Optional) - Introduction to the Task Creator (TSB) - Joint Limitation Library



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Advanced Manufacturing Lab

Basic Robotic Simulation: 40 Hours

PREREQUISITES	Basic knowledge in Design, Manufacturing Process, About Robots , Kinematics
WHO SHOULD ATTEND	Students, Engineers, Managers who need to manage and Optimize In Robotic Simulation.
PROVIDED COURSE MATERIALS	Student guide and Activity material

Basic concepts	1 Hour
Training introduction - Basic methodology and purpose - Starting Process Simulate Standalone - Basic options setup - Examining object types - The prototype and instance relationship - Creating a study - Process Simulate introduction - Process Simulate viewer overview - Window layout management	
Process Simulate Standalone environment	1 Hour
Working with viewers - Graphic Viewer setup and control - Customizing the user configuration - Entity selection - Introduction to selection filters - Introduction to Display By Type - Measurement and units - Graphical visualization and performance - Additional commands - Accessing online help and release notes	
Placement command	3 Hours
Introduction to placement - Introduction to Fast Placement and Restore Design Relative Location - Changing pick behavior and creating frames - Introduction to Placement Manipulator - Introduction to Relocate	
Quick introduction to kinematics	4 Hours
Fundamentals of kinematics - Creating device operations - Inverse kinematics review - Using inverse kinematics	
analysis tools and study data	2 Hours
Study data - Multi part appearances - Creating and using snapshots - Using the Markup Editor - Adding text in the Graphic Viewer - Storing pictures of the study - Introduction to collision detection - More on collision detection - Factors that affect collision detection - Cutting sections with section planes - Cutting sections with section volumes - Recording Process Simulate simulations to an .AVI file	
Modeling basics	8 Hours
Overview of Process Simulate basics - Process Simulate basic modeling tools - Modeling concepts - Solid creating with primitives - Using wireframe to create solids (optional) - Modeling gun shanks (optional) - Modeling a more complex object (optional)	
Kinematics basics	8 Hours

Kinematics background - Kinematics basics summary - Joint dependency basics - Introduction to kinematic cranks - Kinematic branching - Defining speed and acceleration - Defining an object as a tool - Adding kinematics to a simple robot - Inverse kinematics device creation and usage

Other selected modeling and kinematics topics 8 Hours

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General robotics 4 Hours

Creating a study (again) - Robotics overview

Spot welding applications 4 Hours

Spot welding primer (optional topic) - Process methodology - Manufacturing feature representation - Projecting spot mfg features . - Editing a weld path - Multi sections - Weld distribution center (WDC) - Process methodology, revisited - Overview of gripper creation (optional) - Study setup - Material handling (pick and place) operations - Creating a rough mounted workpiece (pedestal welding) path—Orienting workpiece locations - Introduction to weld gun search - Servo guns

Material handling applications 4 Hours

Overview of gripper creation (optional) - Material handling study setup - Material handling (pick and place) operations

Continuous applications 4 Hours

Overview of continuous robotic applications - Continuous mfg representation - Projecting continuous mfg features - Continuous mfg features and continuous feature operations - Seventh axis and more (external axis usage) - Creating continuous mfg features (arc weld, paint, and debur) - Projecting continuous mfg features (arc weld, paint, and debur) - Modifying continuous mfg features (arc weld, paint, and debur)

Final steps for robotic path development 4 Hours

Test robot's reachability to the locations - Dynamic and static collision detection - Editing location attributes - Introduction to path modification (via locations) - Via Location creation tools - Location modification tools - Path modification tools - Additional path creation tools - Introduction to adding OLP commands to locations - Multiple robot simulation - Working with hard and soft limits - Robotic swept volumes and interference zones - Adding events to a sequence of simulative operations - Creating sequences of simulative operations - Review of the process structure hierarchy - Creating compound operations - Creating a robotic sequence (method 1 and 2) - Creating and updating spot welds - Overview of the roller hemming tool - Overview of the OLP tools - Other robotics features - Putting it all together