CONCEPT

Industrial Robotics for Engineers: Robot Cells, Collaborative Robots and Integration

Industrial Robotics for Engineers: Robot Cells, Collaborative Robots and Integration

Introduction:

Industrial robotics projects stall when a robot is bought on datasheet reach alone, the gripper cannot hold the real part, the cell fails its safety review or the arm never talks cleanly to the line controller. This Core Concept course gives engineers the working knowledge to select robot types, set up frames and tools, program and simulate motion, add vision picking, safeguard the cell to ISO 10218 and ISO/TS 15066 and hand it over to production. Participants produce a Robot Cell Specification and Deployment Plan for an application at their own site.

Course Objectives:

- Select articulated, SCARA, delta, cartesian, collaborative and autonomous mobile robots against payload, reach, repeatability and cycle time needs of a named application
- Set up world, base, tool and user frames and check reach, joint limits and singularities for a planned robot path
- Specify drives, sensors and end-effectors that match part geometry, weight, surface and changeover needs
- Program robot motion with a teach pendant and verify it in offline simulation, including vision-guided part location
- Apply ISO 10218 and ISO/TS 15066 safety requirements and integrate the robot cell with the line PLC through handshake signals and interlocks
- Build a costed deployment roadmap for a robot cell from pilot through acceptance testing to scale-up

Target Audience:

- Manufacturing engineers responsible for selecting automation for welding, assembly, palletising and machine tending
- Automation and controls engineers responsible for connecting robots to line controllers and safety systems
- Maintenance engineers responsible for keeping robot arms, grippers and mobile robots running
- Project engineers responsible for robot cell procurement, installation and acceptance
- Process and industrial engineers responsible for cycle time, layout and labour planning on robotised lines

Course Outline:

Day 1: Industrial Robot Types, Specifications and Current-State Assessment

- Articulated, SCARA, Delta and Cartesian Gantry Robot Configurations Compared
- Collaborative Robots and IFR Levels of Collaboration from Coexistence to Responsive Collaboration
- Autonomous Mobile Robots Versus Guided Vehicles: Laser Mapping and Load Transfer
- Robot Datasheet Reading: Payload, Reach, Degrees of Freedom and ISO 9283 Repeatability
- Robot Application Screening Matrix for Welding, Palletising, Machine Tending and Assembly

Day 2: Kinematics, Drives, Sensors and End-Effectors

- Coordinate Frames: World, Base, Tool and User Frames with Tool Centre Point Calibration
- Forward and Inverse Kinematics, Joint Limits, Singularities and Work Envelope Checks
- Servo Motors, Reduction Gearboxes, Encoders and Pneumatic Actuators on the Robot Arm
- Force-Torque Sensors, Proximity Switches and Safety Laser Scanners in the Robot Cell
- End-Effector Selection: Vacuum, Parallel Jaw, Magnetic Grippers and Tool Changers

Day 3: Robot Programming, Offline Simulation and Vision-Guided Picking

- Teach Pendant Programming: Jog Modes, Waypoints, Joint and Linear Motion Types
- Robot Program Structure: Subroutines, Position Registers, Digital I/O and Error Recovery
- Offline Programming and Simulation for Reach, Cycle Time and Collision Checks
- 2D and 3D Machine Vision Calibration for Part Location and Orientation
- AI-Based Bin Picking and Grasp Detection at Overview: Training Data, Limits and Fallbacks

Day 4: Robot Safety, PLC Integration and Performance Problems

- ISO 10218-1 and ISO 10218-2:2011 Requirements for Robots and Robot Applications
- ISO/TS 15066 Collaborative Applications: Task-Based Risk Assessment and Contact Checks
- Safeguarding Layout: Perimeter Fencing, Light Curtains, Area Scanners and Safety-Rated Zones
- Robot-to-PLC Handshake Signals, Fieldbus I/O Mapping and Cell Interlock Sequence
- Cycle Time Losses, Collision Recovery and Robot Controller Fault Code Diagnosis

Day 5: Robot Cell Walkthrough and Deployment Roadmap

- Inspection Walkthrough: Robot Cell Audited Against a Safety, Layout and Reach Checklist
- Inspection Robots and Drones for Pipelines, Tanks and Structures at Overview
- Robot Investment Case: Payback, Utilisation and Labour Redeployment Calculation
- Phased Rollout: Pilot Cell, Factory Acceptance Test, Site Acceptance Test and Scale-Up
- Robot Cell Specification and Deployment Plan Build and Peer Review

Skills You Will Gain:

- Robot Type Selection
- Tool Centre Point Calibration
- Teach Pendant Programming
- Offline Robot Simulation
- Gripper and End-Effector Design
- Robot Cell Safeguarding
- Robot-PLC Handshake Design
- Robot Investment Appraisal

Why Attend This Course:

- Return with a Robot Cell Specification and Deployment Plan for a real application at your own site
- Avoid buying the wrong robot by testing reach, payload and cycle time in simulation before purchase
- Pass safety reviews sooner by laying out guarding and collaborative contact checks to the cited ISO requirements
- Compare robot deployments with engineers from automotive, food, logistics, metals and energy operations

Conclusion:

A robot delivers value only when the right arm, the right gripper, a verified program, a safe layout and a clean link to the line controller come together. The course moves from robot types and datasheets, through frames, kinematics, drives, sensors and end-effectors, to teach pendant programming, offline simulation, vision picking, ISO safety requirements and PLC integration. The final day applies a cell walkthrough and investment case to build the Robot Cell Specification and Deployment Plan for use at the participant's site.