

# Industrial Robotic System Planning

Unit Code: ASC/N8353

Version: 1.0

NSQF Level: 5.5

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## Description

This NOS unit is about performing tasks related to planning of selection, setup and installation of robots and end-effector

## Scope

The scope covers the following :

- Robot selection
- Planning for EOAT and safety mechanism

## Elements and Performance Criteria

### *Robot Selection*

To be competent, the user/individual on the job must be able to:

- PC1.** define the specific task or tasks that need to be automated along with industry type. Understand the objectives, goals, and performance requirements of the automation project
- PC2.** choose the type of robot that best suits the application. Common types include articulated robots, SCARA robots, delta robots, and cartesian robots. Consider factors like the range of motion and the complexity of the task.
- PC3.** analyse and determine no of axis required in the robot to complete the objective
- PC4.** analyze the physical characteristics of the workpiece(s) to be handled or processed, including size, shape, weight, and material. This information is essential for selecting an appropriate robot
- PC5.** calculate the payload capacity and reach (working envelope) required for the robot to perform the task effectively. Consider not only the weight of the workpiece but also any additional loads such as tooling or sensors
- PC6.** determine the desired cycle time and speed for the automation process. This helps in selecting a robot with the necessary speed and acceleration capabilities.
- PC7.** assess the level of precision and repeatability needed for the application. Some tasks may require high levels of accuracy, while others may tolerate lower precision
- PC8.** take into account the environmental conditions in which the robot will operate, including temperature, humidity, dust, and any potential exposure to chemicals or contaminants. Ensure that the selected robot and EOAT can withstand these conditions
- PC9.** identify safety requirements and standards that apply to the automation task. Ensure that the chosen robot comply with safety regulations and can be integrated into the existing safety system.

### *Planning for EOAT and safety mechanism*

To be competent, the user/individual on the job must be able to:

- PC10.** clearly define the objectives of the automation process and identify specific tasks, operations EOAT will perform.
- PC11.** determine the type of EOAT on the basis of size, shape, weight and material of the workpiece. Also consider the variation in geometry and material of workpieces
- PC12.** determine how the EOAT should grip, manipulate, or handle the workpieces, considering factors like orientation, stacking, delicate handling and level of precision required.

- PC13.** determine the type of EOAT options include Grippers (Vacuum, magnetic, mechanical) , suction cups, specialized tools, and custom-designed attachments. Choose the one that can securely and efficiently handle the workpiece.
- PC14.** select material of EOAT which is compatible with workpiece after evaluating durability, wear resistance, temperature, humidity, dust and chemical compatibility. Ensure that the selected EOAT can withstand these conditions
- PC15.** ensure that the selected EOAT and robot are compatible with each other in terms of mounting and communication interfaces. Verify that EOAT can be integrated into the automation system seamlessly
- PC16.** identify potential hazards and risks associated with robot's operation and interaction with human operators and other equipment and familiarizing with relevant safety regulations and standards in industry for robotic systems
- PC17.** clearly define safety goals and objectives. On the basis of potential hazard, risk assessment and safety objectives identify and select appropriate safety measures. Choose safeguarding device appropriate for the robotic cell i.e. safety fences and barriers, safety mats, light curtains, photo sensors, area scanners, safety laser scanners
- PC18.** ensure compatibility of robot with safety interlocks to ensure that the robot stops if certain condition is not met, and include an emergency stop system that allows operators to quickly and easily halt the robot's motion in case of an emergency
- PC19.** maintained detailed documents of robot, EOAT, robotic cell components and safety measures implemented in the robotic cell. Prepare a bill of materials for complete robotic cell

## Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

- KU1.** organisation procedures for health, safety and security, individual role and responsibilities in this context
- KU2.** safety standards and parameters need to follow during work
- KU3.** current market trend compared to conventional activity
- KU4.** application areas of Robotics and Automation
- KU5.** evolution of Robot history in the industry
- KU6.** objective of Robotic Automation for uninterrupted man less production
- KU7.** safe operation of electronic equipment like computers and printers
- KU8.** robot anatomy and Robot applications
- KU9.** selection criteria of robot
- KU10.** EOAT anatomy and pneumatic systems
- KU11.** End of arm Tooling (EOAT) design and its various types
- KU12.** pay load requirements, reachability requirements and accuracy requirements
- KU13.** criteria and parameters for the selection of robot, EOAT and other accessories needed
- KU14.** procedure of designing and layouting of robotic cell and its positions
- KU15.** effective layout making with proper man and material movement

## Generic Skills (GS)

User/individual on the job needs to know how to:

- GS1.** follow instructions, guidelines, procedures, rules, and service level agreements
- GS2.** listen effectively and communicate information accurately
- GS3.** follow rule-based decision-making processes
- GS4.** make decisions on suitable courses
- GS5.** plan and organize the work to achieve targets and meet deadlines
- GS6.** apply problem-solving approaches to different situations
- GS7.** analyse the business impact and disseminate relevant information to others
- GS8.** apply balanced judgments to different situations
- GS9.** check the work is complete and free from errors

## Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Robot Selection</i>	<b>17</b>	<b>21</b>	-	<b>11</b>
<b>PC1.</b> define the specific task or tasks that need to be automated along with industry type. Understand the objectives, goals, and performance requirements of the automation project	2	1	-	1
<b>PC2.</b> choose the type of robot that best suits the application. Common types include articulated robots, SCARA robots, delta robots, and cartesian robots. Consider factors like the range of motion and the complexity of the task.	2	2	-	1
<b>PC3.</b> analyse and determine no of axis required in the robot to complete the objective	2	2	-	2
<b>PC4.</b> analyze the physical characteristics of the workpiece(s) to be handled or processed, including size, shape, weight, and material. This information is essential for selecting an appropriate robot	2	3	-	1
<b>PC5.</b> calculate the payload capacity and reach (working envelope) required for the robot to perform the task effectively. Consider not only the weight of the workpiece but also any additional loads such as tooling or sensors	3	3	-	2
<b>PC6.</b> determine the desired cycle time and speed for the automation process. This helps in selecting a robot with the necessary speed and acceleration capabilities.	2	3	-	1
<b>PC7.</b> assess the level of precision and repeatability needed for the application. Some tasks may require high levels of accuracy, while others may tolerate lower precision	1	3	-	1
<b>PC8.</b> take into account the environmental conditions in which the robot will operate, including temperature, humidity, dust, and any potential exposure to chemicals or contaminants. Ensure that the selected robot and EOAT can withstand these conditions	2	2	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<b>PC9.</b> identify safety requirements and standards that apply to the automation task. Ensure that the chosen robot comply with safety regulations and can be integrated into the existing safety system.	1	2	-	1
<i>Planning for EOAT and safety mechanism</i>	<b>13</b>	<b>29</b>	-	<b>9</b>
<b>PC10.</b> clearly define the objectives of the automation process and identify specific tasks, operations EOAT will perform.	1	2	-	1
<b>PC11.</b> determine the type of EOAT on the basis of size, shape, weight and material of the workpiece. Also consider the variation in geometry and material of workpieces	2	4	-	1
<b>PC12.</b> determine how the EOAT should grip, manipulate, or handle the workpieces, considering factors like orientation, stacking, delicate handling and level of precision required.	2	4	-	1
<b>PC13.</b> determine the type of EOAT options include Grippers (Vacuum, magnetic, mechanical) , suction cups, specialized tools, and custom-designed attachments. Choose the one that can securely and efficiently handle the workpiece.	1	3	-	1
<b>PC14.</b> select material of EOAT which is compatible with workpiece after evaluating durability, wear resistance, temperature, humidity, dust and chemical compatibility. Ensure that the selected EOAT can withstand these conditions	1	2	-	1
<b>PC15.</b> ensure that the selected EOAT and robot are compatible with each other in terms of mounting and communication interfaces. Verify that EOAT can be integrated into the automation system seamlessly	2	4	-	1
<b>PC16.</b> identify potential hazards and risks associated with robot's operation and interaction with human operators and other equipment and familiarizing with relevant safety regulations and standards in industry for robotic systems	1	3	-	1

<b>Assessment Criteria for Outcomes</b>	<b>Theory Marks</b>	<b>Practical Marks</b>	<b>Project Marks</b>	<b>Viva Marks</b>
<b>PC17.</b> clearly define safety goals and objectives. On the basis of potential hazard, risk assessment and safety objectives identify and select appropriate safety measures. Choose safeguarding device appropriate for the robotic cell i.e. safety fences and barriers, safety mats, light curtains, photo sensors, area scanners, safety laser scanners	1	3	-	1
<b>PC18.</b> ensure compatibility of robot with safety interlocks to ensure that the robot stops if certain condition is not met, and include an emergency stop system that allows operators to quickly and easily halt the robot's motion in case of an emergency	1	2	-	-
<b>PC19.</b> maintained detailed documents of robot, EOAT, robotic cell components and safety measures implemented in the robotic cell. Prepare a bill of materials for complete robotic cell	1	2	-	1
<b>NOS Total</b>	<b>30</b>	<b>50</b>	<b>-</b>	<b>20</b>

**National Occupational Standards (NOS) Parameters**

<b>NOS Code</b>	ASC/N8353
<b>NOS Name</b>	Industrial Robotic System Planning
<b>Sector</b>	Automotive
<b>Sub-Sector</b>	Research & Development
<b>Occupation</b>	Automotive Product Development
<b>NSQF Level</b>	5.5
<b>Credits</b>	2
<b>Minimum Educational Qualification &amp; Experience</b>	Pursuing 3rd year of UG (in Relevant trade) OR Pursuing 3rd year of UG ((In Relevant trade) and continuous education) OR Completed 2nd year diploma after 12th OR 12th grade with 1 year NAC plus CITS with 1 Year of experience In Relevant trade OR 12th grade pass with 1 year NTC plus 1year NAC/CITS with 2 Years of experience In Relevant trade OR Completed 3 year diploma after 10th with 2 Years of experience In Relevant trade OR 12th grade Pass with 3 Years of experience In Relevant trade
<b>Version</b>	1.0
<b>Next Review Date</b>	NA
<b>CCN Category</b>	1