



# Automotive Robotics System Integrator/Planner

QP Code: ASC/Q8304

Version: 1.0

NSQF Level: 6

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## ASC/Q8304: Automotive Robotics System Integrator/Planner

### Brief Job Description

The individual is primarily involved in installation, interfacing and programming processes of industrial robot and cobot systems. They support the robot technician in activities such as robotic cell anatomy, robotic cell layout mapping and development, wire harnessing, interfacing and installation of robot/cobot setups and their programming.

### Personal Attributes

The person should be result oriented with good technical and analytical skills, should have Excellent Interpersonal Skills, communication and presentation skills and a good team player. They should have ability to manage projects, prioritizing of work and mentoring the budding engineers.

### Applicable National Occupational Standards (NOS)

#### Compulsory NOS:

1. [ASC/N9810: Manage work and resources \(Manufacturing\)](#)
2. [ASC/N9812: Interact effectively with team, customers and others](#)
3. [ASC/N8316: Identify product feasibility and setup requirements](#)
4. [ASC/N8317: Selection and setup of end-effector and robot](#)
5. [ASC/N8318: Installation, commissioning and integration of robot system](#)
6. [ASC/N8319: Robot/Cobot programming and application testing](#)

### Qualification Pack (QP) Parameters

<b>Sector</b>	Automotive
<b>Sub-Sector</b>	Research & Development
<b>Occupation</b>	Automotive Product Development
<b>Country</b>	India
<b>NSQF Level</b>	6
<b>Credits</b>	19

<b>Aligned to NCO/ISCO/ISIC Code</b>	NCO-2015/1223.0102
<b>Minimum Educational Qualification &amp; Experience</b>	<p>Diploma (3 years (Mechanical/Automobile/ Electrical / Electronics) from recognized regulatory body) with 4 Years of experience of relevant experience after class 12th OR Certificate-NSQF (Automotive Prototype Manufacturing Lead Technician Level 5) with 3 Years of experience of relevant experience OR M.E. (in the relevant field) with 1 Year of experience in the relevant field OR M.Tech (in the relevant field) with 1 Year of experience in the relevant field OR B.E./B.Tech (in the relevant field) with 2 Years of experience in the relevant field</p>
<b>Minimum Level of Education for Training in School</b>	
<b>Pre-Requisite License or Training</b>	NA
<b>Minimum Job Entry Age</b>	22 Years
<b>Last Reviewed On</b>	28th July,2022
<b>Next Review Date</b>	28th July,2025
<b>NSQC Approval Date</b>	28th July,2022
<b>Version</b>	1.0

## ASC/N9810: Manage work and resources (Manufacturing)

### Description

This NOS unit is about implementing safety, planning work, adopting sustainable practices for optimising the use of resources.

### Scope

The scope covers the following :

- Maintain safe and secure working environment
- Maintain Health and Hygiene
- Effective waste management practices
- Material/energy conservation practices

### Elements and Performance Criteria

#### *Maintain safe and secure working environment*

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

- PC1.** identify hazardous activities and the possible causes of risks or accidents in the workplace
- PC2.** implement safe working practices for dealing with hazards to ensure safety of self and others
- PC3.** conduct regular checks of the machines with support of the maintenance team to identify potential hazards
- PC4.** ensure that all the tools/equipment/fasteners/spare parts are arranged as per specifications/utility into proper trays, cabinets, lockers as mentioned in the 5S guidelines/work instructions
- PC5.** organise safety drills or training sessions to create awareness amongst others on the identified risks and safety practices
- PC6.** fill daily check sheet to report improvements done and risks identified
- PC7.** ensure that relevant safety boards/signs are placed on the shop floor for the safety of self and others
- PC8.** report any identified breaches in health, safety and security policies and procedures to the designated person

#### *Maintain Health and Hygiene*

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

- PC9.** ensure workplace, equipment, restrooms etc. are sanitized regularly
- PC10.** ensure team is aware about hygiene and sanitation regulations and following them on the shop floor
- PC11.** ensure availability of running water, hand wash and alcohol-based sanitizers at the workplace
- PC12.** report advanced hygiene and sanitation issues to appropriate authority
- PC13.** follow stress and anxiety management techniques and support employees to cope with stress, anxiety etc
- PC14.** wear and dispose PPEs regularly and appropriately

#### *Effective waste management practices*

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

**PC15.** ensure recyclable, non-recyclable and hazardous wastes are segregated as per SOP

**PC16.** ensure proper mechanism is followed while collecting and disposing of non-recyclable, recyclable and reusable waste

*Material/energy conservation practices*

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

**PC17.** ensure malfunctioning (fumes/sparks/emission/vibration/noise) and lapse in maintenance of equipment are resolved effectively

**PC18.** prepare and analyze material and energy audit reports to decipher excessive consumption of material and water

**PC19.** identify possibilities of using renewable energy and environment friendly fuels

**PC20.** identify processes where material and energy/electricity utilization can be optimized

### **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.** the organisation's emergency procedures for different emergency situations and the importance of following the same

**KU3.** evacuation procedures for workers and visitors

**KU4.** how and when to report hazards as well as the limits of responsibility for dealing with hazards

**KU5.** potential hazards, risks and threats based on the nature of work

**KU6.** various types of fire extinguisher

**KU7.** various types of safety signs and their meaning

**KU8.** appropriate first aid treatment relevant to different condition e.g. bleeding, minor burns, eye injuries etc.

**KU9.** relevant standards, procedures and policies related to 5S followed in the company

**KU10.** the various materials used and their storage norms

**KU11.** importance of efficient utilisation of material and water

**KU12.** basics of electricity and prevalent energy efficient devices

**KU13.** common practices of conserving electricity

**KU14.** common sources and ways to minimize pollution

**KU15.** categorisation of waste into dry, wet, recyclable, non-recyclable and items of single-use plastics

**KU16.** waste management techniques

**KU17.** significance of greening

### **Generic Skills (GS)**

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

- GS1.** read safety instructions/guidelines
- GS2.** modify work practices to improve them
- GS3.** work with supervisors/team members to carry out work related tasks
- GS4.** complete tasks efficiently and accurately within stipulated time
- GS5.** inform/report to concerned person in case of any problem
- GS6.** make timely decisions for efficient utilization of resources
- GS7.** write reports such as accident report, in at least English/regional language

## Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Maintain safe and secure working environment</i>	<b>20</b>	<b>13</b>	-	<b>8</b>
<b>PC1.</b> identify hazardous activities and the possible causes of risks or accidents in the workplace	4	2	-	2
<b>PC2.</b> implement safe working practices for dealing with hazards to ensure safety of self and others	3	1	-	2
<b>PC3.</b> conduct regular checks of the machines with support of the maintenance team to identify potential hazards	2	2	-	1
<b>PC4.</b> ensure that all the tools/equipment/fasteners/spare parts are arranged as per specifications/utility into proper trays, cabinets, lockers as mentioned in the 5S guidelines/work instructions	3	2	-	1
<b>PC5.</b> organise safety drills or training sessions to create awareness amongst others on the identified risks and safety practices	2	-	-	-
<b>PC6.</b> fill daily check sheet to report improvements done and risks identified	2	2	-	-
<b>PC7.</b> ensure that relevant safety boards/signs are placed on the shop floor for the safety of self and others	2	2	-	1
<b>PC8.</b> report any identified breaches in health, safety and security policies and procedures to the designated person	2	2	-	1
<i>Maintain Health and Hygiene</i>	<b>13</b>	<b>7</b>	-	<b>5</b>
<b>PC9.</b> ensure workplace, equipment, restrooms etc. are sanitized regularly	3	2	-	1
<b>PC10.</b> ensure team is aware about hygiene and sanitation regulations and following them on the shop floor	2	1	-	-
<b>PC11.</b> ensure availability of running water, hand wash and alcohol-based sanitizers at the workplace	2	2	-	1
<b>PC12.</b> report advanced hygiene and sanitation issues to appropriate authority	1	1	-	1



<b>Assessment Criteria for Outcomes</b>	<b>Theory Marks</b>	<b>Practical Marks</b>	<b>Project Marks</b>	<b>Viva Marks</b>
<b>PC13.</b> follow stress and anxiety management techniques and support employees to cope with stress, anxiety etc	2	1	-	1
<b>PC14.</b> wear and dispose PPEs regularly and appropriately	3	-	-	1
<i>Effective waste management practices</i>	<b>6</b>	<b>4</b>	-	<b>1</b>
<b>PC15.</b> ensure recyclable, non-recyclable and hazardous wastes are segregated as per SOP	3	2	-	-
<b>PC16.</b> ensure proper mechanism is followed while collecting and disposing of non-recyclable, recyclable and reusable waste	3	2	-	1
<i>Material/energy conservation practices</i>	<b>11</b>	<b>6</b>	-	<b>6</b>
<b>PC17.</b> ensure malfunctioning (fumes/sparks/emission/vibration/noise) and lapse in maintenance of equipment are resolved effectively	2	2	-	1
<b>PC18.</b> prepare and analyze material and energy audit reports to decipher excessive consumption of material and water	3	2	-	1
<b>PC19.</b> identify possibilities of using renewable energy and environment friendly fuels	3	1	-	2
<b>PC20.</b> identify processes where material and energy/electricity utilization can be optimized	3	1	-	2
<b>NOS Total</b>	<b>50</b>	<b>30</b>	-	<b>20</b>

## National Occupational Standards (NOS) Parameters

<b>NOS Code</b>	ASC/N9810
<b>NOS Name</b>	Manage work and resources (Manufacturing)
<b>Sector</b>	Automotive
<b>Sub-Sector</b>	Generic
<b>Occupation</b>	Generic
<b>NSQF Level</b>	5
<b>Credits</b>	TBD
<b>Version</b>	1.0
<b>Last Reviewed Date</b>	30/09/2021
<b>Next Review Date</b>	30/09/2024
<b>NSQ Clearance Date</b>	30/09/2021

## **ASC/N9812: Interact effectively with team, customers and others**

### **Description**

This unit is about communicating with team members, superior and others.

### **Scope**

The scope covers the following :

- Communicate effectively with team members
- Interact with superiors
- Respect gender and ability differences

### **Elements and Performance Criteria**

#### *Communicate effectively with team members*

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

- PC1.** implement ways to share information with team members in line with organisational requirements
- PC2.** ensure that work requirements are clearly communicated to the team members through all means including face-to-face, telephonic and written
- PC3.** manage and co-ordinate with team members to integrate work as per requirements
- PC4.** work in a way that show respect for all team members and customers
- PC5.** carry out commitments made to team members and let them know in good time if there is any discrepancy with reasons
- PC6.** resolve conflicts within the team members at work to achieve smooth workflow
- PC7.** guide the team members to follow the organisation's policies and procedures
- PC8.** ensure team goals are given preference over individual goals
- PC9.** respect personal space of colleagues and customers

#### *Interact with superiors*

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

- PC10.** report progress on job allocated and team performance to the superiors
- PC11.** escalate problems to superiors that cannot be handled
- PC12.** train the team members to report completed work and receive feedback on work done
- PC13.** encourage team members to rectify errors as per feedback and minimize mistakes in future

#### *Respect gender and ability differences*

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

- PC14.** ensure team shows sensitivity towards all genders and PwD
- PC15.** adjust communication styles to reflect gender sensitivity and sensitivity towards person with disability
- PC16.** help PwD team members to overcome the challenges, if asked

### **Knowledge and Understanding (KU)**

The individual on the job needs to know and understand:

- KU1.** the importance of effective communication and establishing good working relationships with team members and superiors
- KU2.** different methods of communication as per the circumstances
- KU3.** gender based concepts, issues and legislation
- KU4.** organisation standards and guidelines to be followed for PwD
- KU5.** rights and duties at workplace with respect to PwD
- KU6.** organisation policies and procedures pertaining to written and verbal communication

### **Generic Skills (GS)**

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

- GS1.** read safety instructions/guidelines
- GS2.** modify work practices to improve them
- GS3.** work with supervisors/team members to carry out work related tasks
- GS4.** complete tasks efficiently and accurately within stipulated time
- GS5.** make timely decisions for efficient utilization of resources
- GS6.** read instructions/guidelines/procedures
- GS7.** write in English/any one language

## Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Communicate effectively with team members</i>	<b>20</b>	<b>14</b>	-	<b>8</b>
<b>PC1.</b> implement ways to share information with team members in line with organisational requirements	2	2	-	-
<b>PC2.</b> ensure that work requirements are clearly communicated to the team members through all means including face-to-face, telephonic and written	2	2	-	2
<b>PC3.</b> manage and co-ordinate with team members to integrate work as per requirements	2	1	-	2
<b>PC4.</b> work in a way that show respect for all team members and customers	3	1	-	2
<b>PC5.</b> carry out commitments made to team members and let them know in good time if there is any discrepancy with reasons	2	2	-	-
<b>PC6.</b> resolve conflicts within the team members at work to achieve smooth workflow	3	2	-	-
<b>PC7.</b> guide the team members to follow the organisation's policies and procedures	2	1	-	-
<b>PC8.</b> ensure team goals are given preference over individual goals	2	1	-	-
<b>PC9.</b> respect personal space of colleagues and customers	2	2	-	2
<i>Interact with superiors</i>	<b>18</b>	<b>10</b>	-	<b>7</b>
<b>PC10.</b> report progress on job allocated and team performance to the superiors	4	3	-	2
<b>PC11.</b> escalate problems to superiors that cannot be handled	4	2	-	1
<b>PC12.</b> train the team members to report completed work and receive feedback on work done	5	2	-	2
<b>PC13.</b> encourage team members to rectify errors as per feedback and minimize mistakes in future	5	3	-	2

<b>Assessment Criteria for Outcomes</b>	<b>Theory Marks</b>	<b>Practical Marks</b>	<b>Project Marks</b>	<b>Viva Marks</b>
<i>Respect gender and ability differences</i>	<b>12</b>	<b>6</b>	-	<b>5</b>
<b>PC14.</b> ensure team shows sensitivity towards all genders and PwD	4	2	-	2
<b>PC15.</b> adjust communication styles to reflect gender sensitivity and sensitivity towards person with disability	4	2	-	2
<b>PC16.</b> help PwD team members to overcome the challenges, if asked	4	2	-	1
<b>NOS Total</b>	<b>50</b>	<b>30</b>	-	<b>20</b>

## National Occupational Standards (NOS) Parameters

<b>NOS Code</b>	ASC/N9812
<b>NOS Name</b>	Interact effectively with team, customers and others
<b>Sector</b>	Automotive
<b>Sub-Sector</b>	Generic
<b>Occupation</b>	Generic
<b>NSQF Level</b>	5
<b>Credits</b>	TBD
<b>Version</b>	1.0
<b>Last Reviewed Date</b>	30/12/2021
<b>Next Review Date</b>	28/07/2025
<b>NSQ Clearance Date</b>	28/07/2022

## ASC/N8316: Identify product feasibility and setup requirements

### Description

This NOS unit is about developing the feasibility report and setup finalization for automobile manufacturing process, defining and calculating the numbers of equipment and resources needed to commission the process.

### Scope

The scope covers the following :

- Feasibility study and report generation
- Application identification
- Setup and equipment identification
- Work load and payload calculations

### Elements and Performance Criteria

#### *Feasibility study and report generation*

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

- PC1.** read and interpret product documents like need analysis, feasibility, technical specification, process flow diagram, product drawings and other engineering documents to prepare/interpret the project design
- PC2.** identify all the components to be joined in a particular production cell and inputs and outputs in a robotic cell
- PC3.** identify assembly plan and sequence of operations to be perform for integrating the system
- PC4.** define material loading and unloading sequence in the robotic cell

#### *Application identification*

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

- PC5.** collect and interpret the data of production volume and time available for the production
- PC6.** perform mathematical calculations on given data to calculate total work to be done to size the production line
- PC7.** interpret the application to be implemented on robotic system from the project documents
- PC8.** calculate other jigs/fixture and equipment required during the assembly process
- PC9.** define standard work cycle of the system

#### *Setup and equipment identification*

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

- PC10.** read components' drawings and production drawings to identify the machine type and equipment to be used in the application
- PC11.** identify specification and quantity of material required for the production process
- PC12.** define process flow diagram of the production process
- PC13.** assess the designed process and identify potential failures in it by following organizational procedures
- PC14.** perform payload calculation of the process for the selection of robot



**PC15.** interpret production volume and product size from the product design and project documents

**PC16.** identify process repeatability and cycle time

### **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.** use of electronic equipment like computers and printers
- KU3.** data safety and non-disclosers norms
- KU4.** cyber safety and work confidentiality good practices
- KU5.** importance of different documents involved in product development
- KU6.** BIW Structure and different joining technologies
- KU7.** classification of the automation elements as power and safety elements (electrical incomer, circuit breakers, compressed air, hydraulic power pack, FRL, pressure relief valve etc.), input elements (proximity sensors, push buttons, limit switches, reed switches), control elements (relay, contactors, VFD, HMI, pneumatic and hydraulic solenoid valves) and output elements (indicators, buzzer, induction motors, pneumatic and hydraulic actuators)
- KU8.** types of control system used in the automation system
- KU9.** installation process includes mounting, wiring standards, routing, element assembly
- KU10.** programming of PLC and simulation tools from different makers along with integration of automation elements
- KU11.** calculation of cycle time of process
- KU12.** procedure of developing a manufacturing process
- KU13.** possible failures of automation system
- KU14.** importance of different documents involved in product development
- KU15.** robot work environment and conditions of operations

### **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>Feasibility study and report generation</i>	<b>12</b>	<b>12</b>	-	<b>6</b>
<b>PC1.</b> read and interpret product documents like need analysis, feasibility, technical specification, process flow diagram, product drawings and other engineering documents to prepare/interpret the project design	3	3	-	1
<b>PC2.</b> identify all the components to be joined in a particular production cell and inputs and outputs in a robotic cell	3	3	-	2
<b>PC3.</b> identify assembly plan and sequence of operations to be perform for integrating the system	3	3	-	2
<b>PC4.</b> define material loading and unloading sequence in the robotic cell	3	3	-	1
<i>Application identification</i>	<b>12</b>	<b>12</b>	-	<b>6</b>
<b>PC5.</b> collect and interpret the data of production volume and time available for the production	2	2	-	1
<b>PC6.</b> perform mathematical calculations on given data to calculate total work to be done to size the production line	2	2	-	2
<b>PC7.</b> interpret the application to be implemented on robotic system from the project documents	3	3	-	1
<b>PC8.</b> calculate other jigs/fixture and equipment required during the assembly process	3	3	-	1
<b>PC9.</b> define standard work cycle of the system	2	2	-	1
<i>Setup and equipment identification</i>	<b>16</b>	<b>16</b>	-	<b>8</b>
<b>PC10.</b> read components' drawings and production drawings to identify the machine type and equipment to be used in the application	2	2	-	1
<b>PC11.</b> identify specification and quantity of material required for the production process	3	3	-	2
<b>PC12.</b> define process flow diagram of the production process	3	3	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<b>PC13.</b> assess the designed process and identify potential failures in it by following organizational procedures	2	2	-	1
<b>PC14.</b> perform payload calculation of the process for the selection of robot	2	2	-	1
<b>PC15.</b> interpret production volume and product size from the product design and project documents	2	2	-	1
<b>PC16.</b> identify process repeatability and cycle time	2	2	-	1
<b>NOS Total</b>	<b>40</b>	<b>40</b>	<b>-</b>	<b>20</b>

## National Occupational Standards (NOS) Parameters

<b>NOS Code</b>	ASC/N8316
<b>NOS Name</b>	Identify product feasibility and setup requirements
<b>Sector</b>	Automotive
<b>Sub-Sector</b>	Research & Development
<b>Occupation</b>	Automotive Product Development
<b>NSQF Level</b>	6
<b>Credits</b>	TBD
<b>Version</b>	1.0
<b>Next Review Date</b>	NA

## **ASC/N8317: Selection and setup of end-effector and robot**

### **Description**

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

### **Scope**

The scope covers the following :

- Robot and EOAT (End of arm tooling) selection
- Layout marking of robotic cell and tool assembly
- Positioning of equipment/components in the cell

### **Elements and Performance Criteria**

#### *Robot and EOAT Selection*

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

- PC1.** identify profile of the product panel and application of the robot in it by interpreting the process documents
- PC2.** read manual and technical specification of robots and define the requirements for the robot needed
- PC3.** select the robot on the basis of reachability requirements and accuracy requirements of the robot in the application
- PC4.** select the EOAT on the basis of its capability of handling maximum load
- PC5.** identify the zoning area and stroke area of robot by interpreting the process documents
- PC6.** determine the application controllers and external I/O devices required as per the project specifications and requirements

#### *Layout marking of robotic cell and tool assembly*

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

- PC7.** determine area required for system implementation and availability of power, pneumatic and coolant supply
- PC8.** plan material space, trolleys, supply of material to line side & material handling equipment
- PC9.** find the position of equipment and finalize the robot positions according to it

#### *Positioning of components in the cell*

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

- PC10.** identify the mounting and Tool Center Point (TCP) of equipment
- PC11.** finalize the required work tables of fixtures, orientation of loading and unloading and material flow in the robotic cell
- PC12.** mount and place all the components of robotic cell like robot, tip dressers, jigs/fixture/grippers, docking units, sensor and cable trays etc. as per the design document

### **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.** software and 3D tools used in organisation
- KU3.** basics of electrical safety
- KU4.** safe operation of electronic equipment like computers and printers
- KU5.** data safety and non-disclosers norms
- KU6.** cyber safety and work confidentiality good practices
- KU7.** robot anatomy and Robot applications
- KU8.** EOAT anatomy and pneumatic systems
- KU9.** pay load requirements, reachability requirements and accuracy requirements
- KU10.** criteria and parameters for the selection of robot, EOAT and other accessories needed
- KU11.** procedure of designing and layouting of robotic cell and its positions
- KU12.** criteria for writing the new equipment specification manual

### **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 and EOAT Selection</i>	<b>16</b>	<b>16</b>	-	<b>8</b>
<b>PC1.</b> identify profile of the product panel and application of the robot in it by interpreting the process documents	3	3	-	2
<b>PC2.</b> read manual and technical specification of robots and define the requirements for the robot needed	3	2	-	1
<b>PC3.</b> select the robot on the basis of reachability requirements and accuracy requirements of the robot in the application	3	2	-	2
<b>PC4.</b> select the EOAT on the basis of its capability of handling maximum load	3	3	-	1
<b>PC5.</b> identify the zoning area and stroke area of robot by interpreting the process documents	2	3	-	1
<b>PC6.</b> determine the application controllers and external I/O devices required as per the project specifications and requirements	2	3	-	1
<i>Layout marking of robotic cell and tool assembly</i>	<b>12</b>	<b>12</b>	-	<b>6</b>
<b>PC7.</b> determine area required for system implementation and availability of power, pneumatic and coolant supply	4	4	-	2
<b>PC8.</b> plan material space, trolleys, supply of material to line side & material handling equipment	4	4	-	2
<b>PC9.</b> find the position of equipment and finalize the robot positions according to it	4	4	-	2
<i>Positioning of components in the cell</i>	<b>12</b>	<b>12</b>	-	<b>6</b>
<b>PC10.</b> identify the mounting and Tool Center Point (TCP) of equipment	4	4	-	2
<b>PC11.</b> finalize the required work tables of fixtures, orientation of loading and unloading and material flow in the robotic cell	4	4	-	2

<b>Assessment Criteria for Outcomes</b>	<b>Theory Marks</b>	<b>Practical Marks</b>	<b>Project Marks</b>	<b>Viva Marks</b>
<b>PC12.</b> mount and place all the components of robotic cell like robot, tip dressers, jigs/fixture/grippers, docking units, sensor and cable trays etc. as per the design document	4	4	-	2
<b>NOS Total</b>	<b>40</b>	<b>40</b>	-	<b>20</b>



## National Occupational Standards (NOS) Parameters

<b>NOS Code</b>	ASC/N8317
<b>NOS Name</b>	Selection and setup of end-effector and robot
<b>Sector</b>	Automotive
<b>Sub-Sector</b>	Research & Development
<b>Occupation</b>	Automotive Product Development
<b>NSQF Level</b>	6
<b>Credits</b>	TBD
<b>Version</b>	1.0
<b>Next Review Date</b>	NA

## **ASC/N8318: Installation, commissioning and integration of robot system**

### **Description**

This NOS unit is about performing tasks related to robot installation, commissioning and teaching. It is also about creating obstacle free robotic paths and integrating robot controller for actual parameters.

### **Scope**

The scope covers the following :

- Perform robot installation, commissioning and setup
- Carry out calibration and mastering of robot
- Perform robot teaching and testing

### **Elements and Performance Criteria**

#### *Perform robot installation, commissioning and setup*

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

- PC1.** install robot controller, licenses, tool, sensors and pneumatics into the system by following organisational procedures
- PC2.** integrate robot controller and robot as per SOP and design document
- PC3.** integrate safety fencing and controller panel as per SOP and design document
- PC4.** turn on the power of robot, do first operation, look for any warnings/errors in it and rectify the same as per organisational guidelines
- PC5.** check for sensors and external device connections with controller in case of any malfunction or no operation

#### *Carry out calibration and mastering of robot*

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

- PC6.** execute mastering for all servos by following organisational procedures
- PC7.** define the global and local points (Home and Home 2) as per SOP
- PC8.** carry out tool configuration and data mapping in the system as per SOP
- PC9.** fix the TCP and mount the frame on tool as per design and project document
- PC10.** calibrate base of tool and record the readings for future reference

#### *Perform robot teaching and testing*

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

- PC11.** insert instructions in the robotic system to execute teaching process
- PC12.** program the robot as per the path required for using point to point control system with necessary instructions
- PC13.** perform dry-run of the robot to check its functioning
- PC14.** perform all necessary tests and procedures required as per industry standards
- PC15.** override testing and motion types
- PC16.** create collision free path of the robot

### **Knowledge and Understanding (KU)**

The individual on the job needs to know and understand:

- KU1.** organizational policies, procedures, and guidelines that relate to designing and maintaining networks
- KU2.** software and system configuration
- KU3.** robot anatomy and operating system
- KU4.** EOAT anatomy and pneumatic systems
- KU5.** calibration and mastering processes
- KU6.** accuracy, speed and motion of robot
- KU7.** mechanism of linear and circular motion types
- KU8.** motion and time taken for diff activity

### **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>Perform robot installation, commissioning and setup</i>	<b>12</b>	<b>12</b>	-	<b>6</b>
<b>PC1.</b> install robot controller, licenses, tool, sensors and pneumatics into the system by following organisational procedures	2	3	-	1
<b>PC2.</b> integrate robot controller and robot as per SOP and design document	3	2	-	2
<b>PC3.</b> integrate safety fencing and controller panel as per SOP and design document	3	2	-	1
<b>PC4.</b> turn on the power of robot, do first operation, look for any warnings/errors in it and rectify the same as per organisational guidelines	2	3	-	1
<b>PC5.</b> check for sensors and external device connections with controller in case of any malfunction or no operation	2	2	-	1
<i>Carry out calibration and mastering of robot</i>	<b>14</b>	<b>14</b>	-	<b>6</b>
<b>PC6.</b> execute mastering for all servos by following organisational procedures	3	3	-	2
<b>PC7.</b> define the global and local points (Home and Home 2) as per SOP	3	3	-	1
<b>PC8.</b> carry out tool configuration and data mapping in the system as per SOP	3	3	-	1
<b>PC9.</b> fix the TCP and mount the frame on tool as per design and project document	3	3	-	1
<b>PC10.</b> calibrate base of tool and record the readings for future reference	2	2	-	1
<i>Perform robot teaching and testing</i>	<b>14</b>	<b>14</b>	-	<b>8</b>
<b>PC11.</b> insert instructions in the robotic system to execute teaching process	3	3	-	2
<b>PC12.</b> program the robot as per the path required for using point to point control system with necessary instructions	3	3	-	2

<b>Assessment Criteria for Outcomes</b>	<b>Theory Marks</b>	<b>Practical Marks</b>	<b>Project Marks</b>	<b>Viva Marks</b>
<b>PC13.</b> perform dry-run of the robot to check its functioning	2	2	-	1
<b>PC14.</b> perform all necessary tests and procedures required as per industry standards	2	2	-	1
<b>PC15.</b> override testing and motion types	2	2	-	1
<b>PC16.</b> create collision free path of the robot	2	2	-	1
<b>NOS Total</b>	<b>40</b>	<b>40</b>	-	<b>20</b>

## National Occupational Standards (NOS) Parameters

<b>NOS Code</b>	ASC/N8318
<b>NOS Name</b>	Installation, commissioning and integration of robot system
<b>Sector</b>	Automotive
<b>Sub-Sector</b>	Research & Development
<b>Occupation</b>	Automotive Product Development
<b>NSQF Level</b>	6
<b>Credits</b>	TBD
<b>Version</b>	1.0
<b>Next Review Date</b>	NA

## **ASC/N8319: Robot/Cobot programming and application testing**

### **Description**

This NOS unit is about programming and application parameterization of the robot/cobot.

### **Scope**

The scope covers the following :

- Robot programming and parameterization
- Carry out application testing and dry run
- Operate robot on different modes

### **Elements and Performance Criteria**

#### *Robot programming and parameterization*

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

- PC1.** insert the instructions and define sequence of multiple paths/operation of the robot
- PC2.** modify path to achieve cycle time
- PC3.** assign application parameters in the program
- PC4.** create logics and insert variables for logical programming of the robot

#### *Carry out application testing and dry run*

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

- PC5.** define parameters of robot application (welding/material handling)
- PC6.** connect application controllers with robot controller as per the layout diagram and robot manual
- PC7.** estimate the process path and cycle time as per production requirements
- PC8.** perform dry run of the robot on the job to check it functioning
- PC9.** fine tune the robot program with required cycle time and finalize the program

#### *Operate robot on different modes*

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

- PC10.** check for safety door and interlocking systems for proper functioning
- PC11.** check safety fencing for proper functioning by applying T2 or AUT mode
- PC12.** perform dry run of robot on different operating modes
- PC13.** execute each operation on real job with all systems active
- PC14.** document the results in required formats by following organizational procedures

### **Knowledge and Understanding (KU)**

The individual on the job needs to know and understand:

- KU1.** organizational policies, procedures, and guidelines that relate to designing and maintaining networks
- KU2.** software and system configuration

- KU3.** robot anatomy and operating system
- KU4.** installation process includes robot mounting, wiring standards, routing, safety peripherals and tool integration
- KU5.** robot integration with automation elements like electro pneumatics and hydraulics, electrical components like circuit breakers, push buttons, sensors, relay, contactor, indicators, buzzer, motor conveyor, PLC, VFD, HMI
- KU6.** robot mastering, types and different conditions to do mastering
- KU7.** teach pendant controls and displays
- KU8.** robot programming methods, instructions using teach pendant and simulation tools
- KU9.** industry standards like safety device and its rating, wire and cable size capacity, connector types

### **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 programming and parameterization</i>	<b>12</b>	<b>12</b>	-	<b>6</b>
<b>PC1.</b> insert the instructions and define sequence of multiple paths/operation of the robot	3	3	-	2
<b>PC2.</b> modify path to achieve cycle time	3	3	-	1
<b>PC3.</b> assign application parameters in the program	3	3	-	1
<b>PC4.</b> create logics and insert variables for logical programming of the robot	3	3	-	2
<i>Carry out application testing and dry run</i>	<b>14</b>	<b>14</b>	-	<b>8</b>
<b>PC5.</b> define parameters of robot application (welding/material handling)	4	3	-	2
<b>PC6.</b> connect application controllers with robot controller as per the layout diagram and robot manual	3	3	-	1
<b>PC7.</b> estimate the process path and cycle time as per production requirements	3	3	-	2
<b>PC8.</b> perform dry run of the robot on the job to check it functioning	2	3	-	1
<b>PC9.</b> fine tune the robot program with required cycle time and finalize the program	2	2	-	2
<i>Operate robot on different modes</i>	<b>14</b>	<b>14</b>	-	<b>6</b>
<b>PC10.</b> check for safety door and interlocking systems for proper functioning	2	3	-	1
<b>PC11.</b> check safety fencing for proper functioning by applying T2 or AUT mode	3	3	-	2
<b>PC12.</b> perform dry run of robot on different operating modes	3	2	-	1
<b>PC13.</b> execute each operation on real job with all systems active	3	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>PC14.</b> document the results in required formats by following organizational procedures	3	3	-	1
<b>NOS Total</b>	<b>40</b>	<b>40</b>	-	<b>20</b>

## National Occupational Standards (NOS) Parameters

<b>NOS Code</b>	ASC/N8319
<b>NOS Name</b>	Robot/Cobot programming and application testing
<b>Sector</b>	Automotive
<b>Sub-Sector</b>	Research & Development
<b>Occupation</b>	Automotive Product Development
<b>NSQF Level</b>	6
<b>Credits</b>	TBD
<b>Version</b>	1.0
<b>Next Review Date</b>	NA

## Assessment Guidelines and Assessment Weightage

### Assessment Guidelines

1. Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC.
2. The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
3. Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training centre (as per assessment criteria below).
4. Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/ training centre based on these criteria.
5. In case of successfully passing only certain number of NOSs, the trainee is eligible to take subsequent assessment on the balance NOS's to pass the Qualification Pack.
6. In case of unsuccessful completion, the trainee may seek reassessment on the Qualification Pack

### Minimum Aggregate Passing % at QP Level : 70

**(Please note:** Every Trainee should score a minimum aggregate passing percentage as specified above, to successfully clear the Qualification Pack assessment.)

## Assessment Weightage

Compulsory NOS

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
ASC/N9810.Manage work and resources (Manufacturing)	50	30	-	20	100	15
ASC/N9812.Interact effectively with team, customers and others	50	30	-	20	100	10
ASC/N8316.Identify product feasibility and setup requirements	40	40	-	20	100	20
ASC/N8317.Selection and setup of end-effector and robot	40	40	-	20	100	20
ASC/N8318.Installation, commissioning and integration of robot system	40	40	-	20	100	15
ASC/N8319.Robot/Cobot programming and application testing	40	40	-	20	100	20
<b>Total</b>	<b>260</b>	<b>220</b>	<b>-</b>	<b>120</b>	<b>600</b>	<b>100</b>

## Acronyms

<b>NOS</b>	National Occupational Standard(s)
<b>NSQF</b>	National Skills Qualifications Framework
<b>QP</b>	Qualifications Pack
<b>TVET</b>	Technical and Vocational Education and Training

## Glossary

<b>Sector</b>	Sector is a conglomeration of different business operations having similar business and interests. It may also be defined as a distinct subset of the economy whose components share similar characteristics and interests.
<b>Sub-sector</b>	Sub-sector is derived from a further breakdown based on the characteristics and interests of its components.
<b>Occupation</b>	Occupation is a set of job roles, which perform similar/ related set of functions in an industry.
<b>Job role</b>	Job role defines a unique set of functions that together form a unique employment opportunity in an organisation.
<b>Occupational Standards (OS)</b>	OS specify the standards of performance an individual must achieve when carrying out a function in the workplace, together with the Knowledge and Understanding (KU) they need to meet that standard consistently. Occupational Standards are applicable both in the Indian and global contexts.
<b>Performance Criteria (PC)</b>	Performance Criteria (PC) are statements that together specify the standard of performance required when carrying out a task.
<b>National Occupational Standards (NOS)</b>	NOS are occupational standards which apply uniquely in the Indian context.
<b>Qualifications Pack (QP)</b>	QP comprises the set of OS, together with the educational, training and other criteria required to perform a job role. A QP is assigned a unique qualifications pack code.
<b>Unit Code</b>	Unit code is a unique identifier for an Occupational Standard, which is denoted by an 'N'
<b>Unit Title</b>	Unit title gives a clear overall statement about what the incumbent should be able to do.
<b>Description</b>	Description gives a short summary of the unit content. This would be helpful to anyone searching on a database to verify that this is the appropriate OS they are looking for.
<b>Scope</b>	Scope is a set of statements specifying the range of variables that an individual may have to deal with in carrying out the function which have a critical impact on quality of performance required.
<b>Knowledge and Understanding (KU)</b>	Knowledge and Understanding (KU) are statements which together specify the technical, generic, professional and organisational specific knowledge that an individual needs in order to perform to the required standard.

<p><b>Organisational Context</b></p>	<p>Organisational context includes the way the organisation is structured and how it operates, including the extent of operative knowledge managers have of their relevant areas of responsibility.</p>
<p><b>Technical Knowledge</b></p>	<p>Technical knowledge is the specific knowledge needed to accomplish specific designated responsibilities.</p>
<p><b>Core Skills/ Generic Skills (GS)</b></p>	<p>Core skills or Generic Skills (GS) are a group of skills that are the key to learning and working in today's world. These skills are typically needed in any work environment in today's world. These skills are typically needed in any work environment. In the context of the OS, these include communication related skills that are applicable to most job roles.</p>
<p><b>Electives</b></p>	<p>Electives are NOS/set of NOS that are identified by the sector as contributive to specialization in a job role. There may be multiple electives within a QP for each specialized job role. Trainees must select at least one elective for the successful completion of a QP with Electives.</p>
<p><b>Options</b></p>	<p>Options are NOS/set of NOS that are identified by the sector as additional skills. There may be multiple options within a QP. It is not mandatory to select any of the options to complete a QP with Options.</p>