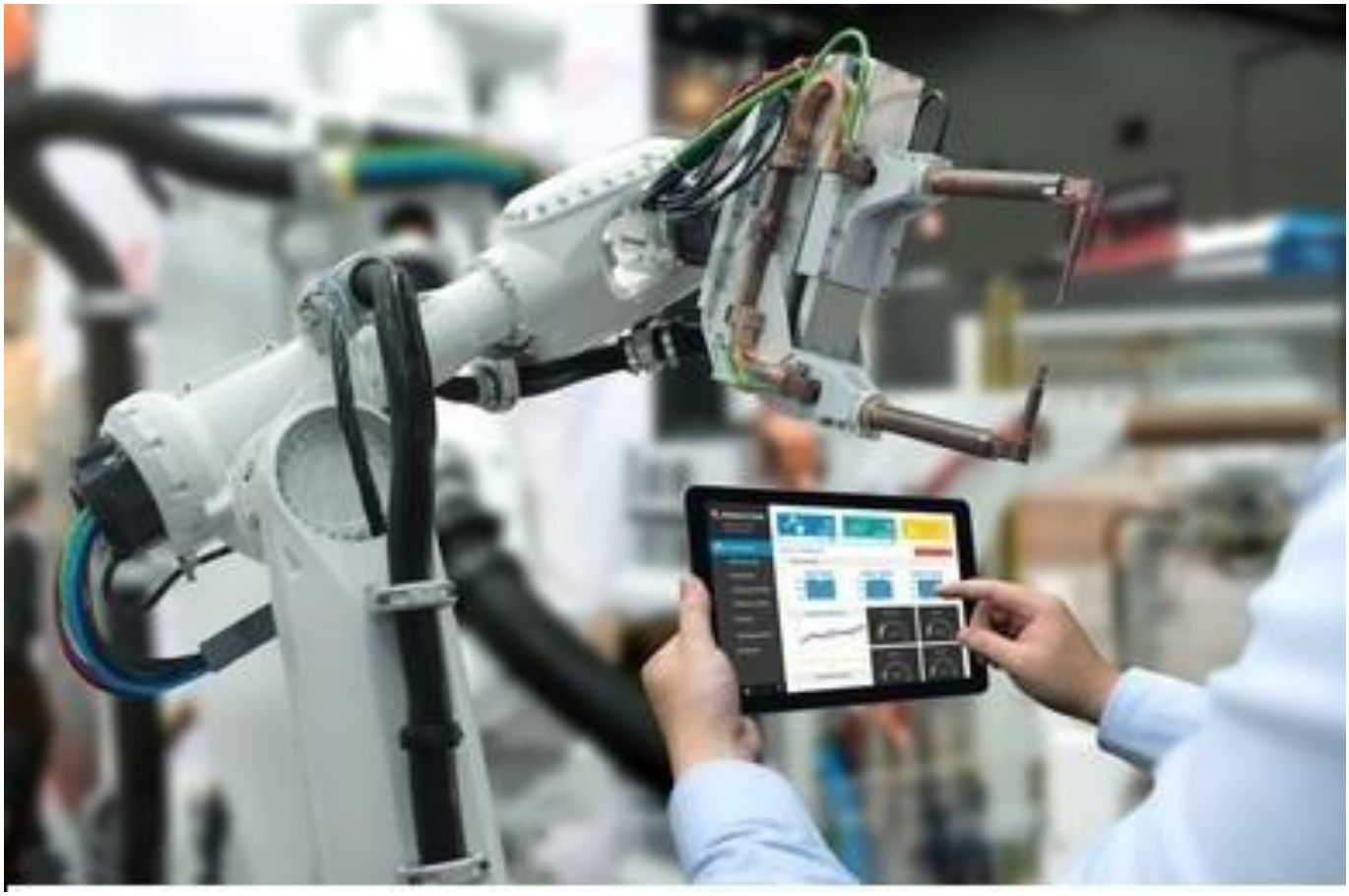

Automotive Automation and Robotics Engineer

QP Code: ASC/Q8303

Version: 1.0

NSQF Level: 6

Automotive Skills Development Council || 153, GF, Okhla Industrial Area, Phase 3
New Delhi 110020

Contents

ASC/Q8303: Automotive Automation and Robotics Engineer

Brief Job Description

The individual at this job is responsible for strategizing and implementing the automation within an organization for all its processes at both the new development and production phase.

Personal Attributes

The person should be organized, team-oriented and have the ability to work independently for long hours. He should be result-oriented, keen observer and have an eye for detail and quality. The individual should also be able to demonstrate skills for information order, imagination, oral expression, analytical approach, deductive reasoning and comprehension.

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/N8305: Designing, selection and integration of Automation Systems
4. ASC/N8306: Selection, Installation, Commissioning and Maintenance of Industrial Robot
5. ASC/N8307: Integration of robots and automation systems using industrial networking protocols
6. ASC/N8308: Plan, Design and operate 3D Printing machine for product generation

Qualification Pack (QP) Parameters

Sector	Automotive
Sub-Sector	Research & Development
Occupation	Automotive Product Development
Country	India
NSQF Level	6
Aligned to NCO/ISCO/ISIC Code	NCO-2015/2144.0804

Minimum Educational Qualification & Experience	3 years Diploma (Mechanical/Automobile/ Electrical / Electronics) from recognized regulatory body with 3 years of relevant experience after class 12th OR B.E./B.Tech (Mechanical/Automobile / Electrical/ Electronics Engineering) with 1 Year of relevant experience, OR M.E./M.Tech (Mechanical/Automobile / Electrical/ Electronics Engineering) OR Certificate-NSQF (Automotive Prototype Manufacturing Lead Technician Level 5) with 3 Years of relevant experience
Minimum Level of Education for Training in School	
Pre-Requisite License or Training	NA
Minimum Job Entry Age	24 Years
Last Reviewed On	30/12/2021
Next Review Date	30/12/2024
NSQC Approval Date	30/12/2021
Version	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
Maintain safe and secure working environment	20	13	-	8
PC1. identify hazardous activities and the possible causes of risks or accidents in the workplace	4	2	-	2
PC2. implement safe working practices for dealing with hazards to ensure safety of self and others	3	1	-	2
PC3. conduct regular checks of the machines with support of the maintenance team to identify potential hazards	2	2	-	1
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	3	2	-	1
PC5. organise safety drills or training sessions to create awareness amongst others on the identified risks and safety practices	2	-	-	-
PC6. fill daily check sheet to report improvements done and risks identified	2	2	-	-
PC7. ensure that relevant safety boards/signs are placed on the shop floor for the safety of self and others	2	2	-	1
PC8. report any identified breaches in health, safety and security policies and procedures to the designated person	2	2	-	1
Maintain Health and Hygiene	13	7	-	5
PC9. ensure workplace, equipment, restrooms etc. are sanitized regularly	3	2	-	1
PC10. ensure team is aware about hygiene and sanitation regulations and following them on the shop floor	2	1	-	-
PC11. ensure availability of running water, hand wash and alcohol-based sanitizers at the workplace	2	2	-	1
PC12. report advanced hygiene and sanitation issues to appropriate authority	1	1	-	1

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

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N9810
NOS Name	Manage work and resources (Manufacturing)
Sector	Automotive
Sub-Sector	Generic
Occupation	Generic
NSQF Level	6
Credits	TBD
Version	1.0
Last Reviewed Date	30/12/2021
Next Review Date	30/12/2024
NSQC Clearance Date	30/12/2021

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

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

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N9812
NOS Name	Interact effectively with team, customers and others
Sector	Automotive
Sub-Sector	Generic
Occupation	Generic
NSQF Level	6
Credits	TBD
Version	1.0
Last Reviewed Date	30/12/2021
Next Review Date	30/12/2024
NSQC Clearance Date	30/12/2021

ASC/N8305: Designing, selection and integration of Automation Systems

Description

This NOS unit is about performing task related to designing, selection and integration of automation systems for the manufacturing processes to meet the specification set by the organization.

Scope

The scope covers the following :

- Develop/interpret e-plan, layout and drawings
- Perform installation and integration of the automation system
- Carry out maintenance of automation system
- Perform post-installation activities

Elements and Performance Criteria

Develop/Interpret e-plan, layout and drawings

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

PC1. prepare/interpret the project design by obtaining information from mechanical drawings and layout diagram

PC2. prepare design of electrical wiring, schematic diagram and project documentation as per organizational SOP and guidelines

PC3. prepare the e-plan consists of layout, mechanical drawings and project execution phases as per work instructions

PC4. identify and select the automation elements in align with electrical, mechanical and environmental parameters like power, response time, inbuilt protections, dimension, weight, package, thermal characteristics etc. as per the e-plan and required specifications

PC5. decide on the core and auxiliary support process as per specifications & drawings

PC6. plan and administer automation project as per the e-plan

Perform installation and integration of the automation system

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

PC7. mount and place the electrical and mechanical components safely as per design and project document

PC8. route electrical wires, make wiring connections etc. as per the wiring diagram and SOP

PC9. perform assembly of the system components like D.C. valve, cylinder assembly etc. as per the mechanical drawings and SOP

PC10. perform the pre-commissioning to ensure proper functionality of installed automation components

PC11. carry out the various integration activities like programming, wiring with external elements etc. as per design document and SOP

PC12. develop HMI screen for system monitoring controls like process, alarm and maintenance of automation system

PC13. do the necessary parameter setting to drive conveyor motor with VFD

PC14. start the automation system, look for any warnings/errors in it and rectify the same as per organizational guidelines

PC15. perform all necessary tests and procedures required as per industry standards

PC16. perform dry-run of the automation system with the existing manufacturing process

Carry out maintenance of automation system

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

PC17. prepare maintenance schedule and checklist for conducting the preventive, predictive and breakdown maintenance of the automation system

PC18. generate the fallback action plan for failures of critical activities

PC19. identify the critical spares with the help of supplier, maintenance team and plan for their availability

PC20. develop the maintenance manual with the help of supplier and maintenance team

Perform post-installation activities

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

PC21. conduct the trials of automation system as per the e-plan to align it with existing or new manufacturing process

PC22. handover the system to production team & train them on it as per organizational guidelines and procedures

PC23. prepare documents and records such as experience under development, TGW /TGR faced during process trials etc. as a reference for future development

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. product portfolio of organization

KU2. company manufacturing processes

KU3. Standard operation procedures recommended by manufacturer for using equipment/machinery in use

KU4. how to read wiring diagrams, mechanical drawings and floor layout

KU5. how to select electrical and mechanical automation elements based on specification

KU6. 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)

KU7. types of control system used in the automation system

KU8. installation process includes mounting, wiring standards, routing, element assembly

KU9. programming of PLC and simulation tools from different makers along with integration of automation elements

KU10. HMI screen development process consists of process control, alarm and maintenance of automation system

KU11. device and control parameters to drive conveyor motor with VFD

KU12. APQP procedures, TGW TGR and knowledge management protocol

KU13. industry standards like safety device rating, wire and cable size capacity, connector types etc.

KU14. possible failures of automation elements and its replacement

Generic Skills (GS)

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

GS1. communicate effectively at the workplace

GS2. attentively listen and comprehend the information given by the process managers

GS3. write observations and any work-related information in English/regional language

GS4. recognise a workplace problem and take suitable action

GS5. analyse and apply the information gathered from observation, experience, reasoning or communication to act efficiently

GS6. complete the assigned tasks in a timely and efficient manner

GS7. coordinate with shop floor workers and team for installing the new systems efficiently

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Develop/Interpret e-plan, layout and drawings	14	9	-	3
PC1. prepare/interpret the project design by obtaining information from mechanical drawings and layout diagram	2	1	-	1
PC2. prepare design of electrical wiring, schematic diagram and project documentation as per organizational SOP and guidelines	3	2	-	1
PC3. prepare the e-plan consists of layout, mechanical drawings and project execution phases as per work instructions	2	2	-	-
PC4. identify and select the automation elements in align with electrical, mechanical and environmental parameters like power, response time, inbuilt protections, dimension, weight, package, thermal characteristics etc. as per the e-plan and required specifications	4	2	-	1
PC5. decide on the core and auxiliary support process as per specifications & drawings	2	1	-	-
PC6. plan and administer automation project as per the e-plan	1	1	-	-
Perform installation and integration of the automation system	17	21	-	12
PC7. mount and place the electrical and mechanical components safely as per design and project document	2	2	-	2
PC8. route electrical wires, make wiring connections etc. as per the wiring diagram and SOP	2	2	-	1
PC9. perform assembly of the system components like D.C. valve, cylinder assembly etc. as per the mechanical drawings and SOP	2	2	-	1
PC10. perform the pre-commissioning to ensure proper functionality of installed automation components	1	2	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC11. carry out the various integration activities like programming, wiring with external elements etc. as per design document and SOP	2	3	-	1
PC12. develop HMI screen for system monitoring controls like process, alarm and maintenance of automation system	2	2	-	1
PC13. do the necessary parameter setting to drive conveyor motor with VFD	1	2	-	1
PC14. start the automation system, look for any warnings/errors in it and rectify the same as per organizational guidelines	2	2	-	1
PC15. perform all necessary tests and procedures required as per industry standards	2	2	-	2
PC16. perform dry-run of the automation system with the existing manufacturing process	1	2	-	1
Carry out maintenance of automation system	**6**	**7**	**-**	**3**
PC17. prepare maintenance schedule and checklist for conducting the preventive, predictive and breakdown maintenance of the automation system	3	2	-	1
PC18. generate the fallback action plan for failures of critical activities	1	1	-	1
PC19. identify the critical spares with the help of supplier, maintenance team and plan for their availability	1	2	-	1
PC20. develop the maintenance manual with the help of supplier and maintenance team	1	2	-	-
Perform post-installation activities	**3**	**3**	**-**	**2**
PC21. conduct the trials of automation system as per the e-plan to align it with existing or new manufacturing process	1	1	-	1
PC22. handover the system to production team & train them on it as per organizational guidelines and procedures	1	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC23. prepare documents and records such as experience under development, TGW /TGR faced during process trials etc. as a reference for future development	1	1	-	1
NOS Total	**40**	**40**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N8305
NOS Name	Designing, selection and integration of Automation Systems
Sector	Automotive
Sub-Sector	Research & Development
Occupation	Automotive Product Development
NSQF Level	6
Credits	TBD
Version	1.0
Last Reviewed Date	30/12/2021
Next Review Date	30/12/2024
NSQC Clearance Date	30/12/2021

ASC/N8306: Selection, Installation, Commissioning and Maintenance of Industrial Robot

Description

This NOS unit is about performing task related to selection, installation, commissioning and maintenance of industrial robot for the manufacturing processes to meet the specifications set by the organization.

Scope

The scope covers the following :

- Select the industrial robot as per e-plan requirement
- Perform installation and commissioning of robot
- Carry out maintenance of industrial robot
- Perform post-installation activities

Elements and Performance Criteria

Select the Industrial Robot as per E Plan Requirement

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

PC1. prepare/interpret the project document to obtain information regarding robots and automation system requirements

PC2. select the industrial robot based on mobility, application and robot types like Cylindrical, SCARA, Delta and Articulated

PC3. select the robot based on technical parameters like payload, reach limit, speed, repeatability etc.

PC4. select the suitable end effector like grippers, handling device, spot, sealer and spray gun for the robot to align it with the application

Perform installation and commissioning of robot

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

PC5. prepare the suitable mounting design like floor, ceiling, pedestal etc. as per e-plan, layout diagram and robot manual

PC6. position the robot and controller on the designated installation area

PC7. connect all cables, wire harness, safety peripherals, tooling etc. as per e-plan, layout diagram and robot manual

PC8. perform the pre-commissioning to ensure proper functionality of safety elements like operator station controls (E-stop, cycle start, reset), safety peripherals such as light curtains, gate plug connections, tooling and teach pendant controls

PC9. turn on the power of robot, look for any warnings/errors in it and rectify the same as per organisational guidelines

PC10. set the initial settings like robot jogging, mastering and axis limits in a standalone environment as per guidelines and robot manual

PC11. program the robot as per the path required for using point to point control system with necessary instructions

PC12. integrate the robot with automation elements like proximity sensors, motor conveyor with VFD, pneumatic fixtures, indexing table etc. as per SOP and design document

Carry out maintenance of industrial robot

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

PC13. prepare maintenance schedule and checklist for conducting the preventive, predictive and breakdown maintenance of the robot

PC14. generate the fallback action plan for failures of critical activities

PC15. identify critical spares like encoder, encoder battery, dedicated fuse etc. with the help of supplier, maintenance team and plan for their availability

PC16. develop the maintenance manual with the help of supplier and maintenance team

Perform post-installation activities

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

PC17. conduct the trials of robot as per the e-plan to align it with existing or new manufacturing process

PC18. fine tune the robot program with required cycle time

PC19. perform the backup processes like teach pendant programs, parameters, mastering data using different backup devices as per organisational guidelines

PC20. handover the system to production team & train them on it as per organisational guidelines and procedures

PC21. prepare documents and records such as experience under development, TGW /TGR faced during process trials etc. as a reference for future development

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. product portfolio of organisation

KU2. company manufacturing processes

KU3. Standard Operation Procedures (SOP) recommended by manufacturer for using equipment/machinery in use

KU4. how to select industrial robots based on specifications like applications, robot types, technical parameters

KU5. types of end effector and their selection criteria

KU6. installation process includes robot mounting, wiring standards, routing, safety peripherals and tool integration

KU7. 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

KU8. robot mastering, types and different conditions to do mastering

KU9. teach pendant controls and displays

KU10. robot programming methods, instructions using teach pendant and simulation tools

KU11. APQP procedures, TGW TGR and knowledge management protocol

KU12. industry standards like safety device and its rating, wire and cable size capacity, connector types

KU13. possible failures of automation elements and their replacement

KU14. robot maintenance which includes robot arm, controller and peripheral elements
KU15. robot backup procedures during maintenance
KU16. process cycle time calculation

Generic Skills (GS)

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

GS1. communicate effectively at the workplace
GS2. attentively listen and comprehend the information given by the process managers
GS3. write observations and any work-related information in English/regional language
GS4. recognise a workplace problem and take suitable action
GS5. analyse and apply the information gathered from observation, experience, reasoning or communication to act efficiently
GS6. complete the assigned tasks in a timely and efficient manner
GS7. coordinate with shop floor workers and team for installing the new systems efficiently

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Select the Industrial Robot as per E Plan Requirement	11	5	-	4
PC1. prepare/interpret the project document to obtain information regarding robots and automation system requirements	2	1	-	1
PC2. select the industrial robot based on mobility, application and robot types like Cylindrical, SCARA, Delta and Articulated	3	1	-	1
PC3. select the robot based on technical parameters like payload, reach limit, speed, repeatability etc.	3	2	-	1
PC4. select the suitable end effector like grippers, handling device, spot, sealer and spray gun for the robot to align it with the application	3	1	-	1
Perform installation and commissioning of robot	17	21	-	8
PC5. prepare the suitable mounting design like floor, ceiling, pedestal etc. as per e-plan, layout diagram and robot manual	2	3	-	1
PC6. position the robot and controller on the designated installation area	1	2	-	-
PC7. connect all cables, wire harness, safety peripherals, tooling etc. as per e-plan, layout diagram and robot manual	2	3	-	1
PC8. perform the pre-commissioning to ensure proper functionality of safety elements like operator station controls (E-stop, cycle start, reset), safety peripherals such as light curtains, gate plug connections, tooling and teach pendant controls	3	3	-	2
PC9. turn on the power of robot, look for any warnings/errors in it and rectify the same as per organisational guidelines	2	2	-	1
PC10. set the initial settings like robot jogging, mastering and axis limits in a standalone environment as per guidelines and robot manual	2	2	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC11. program the robot as per the path required for using point to point control system with necessary instructions	3	3	-	1
PC12. integrate the robot with automation elements like proximity sensors, motor conveyor with VFD, pneumatic fixtures, indexing table etc. as per SOP and design document	2	3	-	1
Carry out maintenance of industrial robot	**6**	**7**	**-**	**3**
PC13. prepare maintenance schedule and checklist for conducting the preventive, predictive and breakdown maintenance of the robot	3	2	-	1
PC14. generate the fallback action plan for failures of critical activities	1	1	-	1
PC15. identify critical spares like encoder, encoder battery, dedicated fuse etc. with the help of supplier, maintenance team and plan for their availability	1	2	-	1
PC16. develop the maintenance manual with the help of supplier and maintenance team	1	2	-	-
Perform post-installation activities	**6**	**7**	**-**	**5**
PC17. conduct the trials of robot as per the e-plan to align it with existing or new manufacturing process	1	2	-	1
PC18. fine tune the robot program with required cycle time	1	2	-	1
PC19. perform the backup processes like teach pendant programs, parameters, mastering data using different backup devices as per organisational guidelines	2	2	-	1
PC20. handover the system to production team & train them on it as per organisational guidelines and procedures	1	-	-	1
PC21. prepare documents and records such as experience under development, TGW /TGR faced during process trials etc. as a reference for future development	1	1	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
NOS Total	40	40	-	20

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N8306
NOS Name	Selection, Installation, Commissioning and Maintenance of Industrial Robot
Sector	Automotive
Sub-Sector	Research & Development
Occupation	Automotive Product Development
NSQF Level	6
Credits	TBD
Version	1.0
Last Reviewed Date	30/12/2021
Next Review Date	30/12/2024
NSQC Clearance Date	30/12/2021

ASC/N8307: Integration of robots and automation systems using industrial networking protocols

Description

This NOS unit is about performing tasks related to integration of robots and automation systems using industrial networking protocols used in manufacturing processes to meet the specification set by the organization.

Scope

The scope covers the following :

- Install the elements in different layers of industrial network architecture and protocols
- integrate and establish communication using I/O link master and network protocols
- Fetching vital data from robotics and automation system using industrial networking
- Carry out maintenance and troubleshooting of communication network between robotics and automation system
- Perform post-installation activities

Elements and Performance Criteria

Install the elements in different layers of industrial network architecture and protocols

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

PC1. analyse the installed automation elements, systems and robots into different layers of network architecture like field devices, control devices, networks.

PC2. design/interpret the network consists of devices, automation systems and robots

PC3. select and install suitable network protocols like MODBUS, CC-LINK, Profinet, Profibus, OPC UA, MQTT etc. based on control system requirements

PC4. connect the intelligent devices and system using suitable network topology like STAR, LINE, RING as per network design document

Integrate and establish communication using I/O link master and network protocols

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

PC5. connect the automation elements like sensors, control devices to I/O link master as per SOP

PC6. install the cable between devices in alignment with signaling parameters like bend radius, signal ground, terminal resistor, cable length etc.

PC7. establish the communication between automation systems, intelligent devices and robots by doing parameter settings like baud rate, distance, station ID and station type

PC8. set the network parameters of automation system on the device manufacturers software as per SOP and organizational guidelines

PC9. turn on the power of automation devices, system in the network and look for healthy communication between them

Fetching vital data from robotics and automation system using industrial networking

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

PC10. interpret the different types of data from I/O link master like process, device and event data

PC11. fetch the machine data of robotics and automation systems like communication status, healthy hardware, life diagnosis, condition monitoring as per organisational guidelines

PC12. fetch the process and control data of robotics and automation system like cycle start/stop, production status, operator status, system monitor as per organisational guidelines

Carry out maintenance and troubleshooting of communication network between robotics and automation system

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

PC13. prepare maintenance and troubleshooting schedule and checklist for conducting the preventive, predictive and breakdown maintenance of the industrial networking

PC14. conduct various tests such as hardware test, link test, loop back test etc. to check the functionality of system

PC15. install network devices like repeaters and routers into the network in order to amplify the signal due to increase in communication distance and fault finding

PC16. generate the fallback action plan for failures of critical activities

PC17. identify the critical spares with the help of supplier, maintenance team and plan for their availability

PC18. develop the maintenance manual with the help of supplier and maintenance team

Perform post-installation activities

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

PC19. conduct the trials of system as per the e-plan to align it with existing or new manufacturing process

PC20. handover the system to production team & train them on it as per organizational guidelines and procedures

PC21. prepare documents and records such as experience under development, TGW /TGR faced during process trials etc. as a reference for future development

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. product portfolio of organisation

KU2. company manufacturing processes

KU3. Standard operation procedures recommended by manufacturer for using equipment/machinery in use

KU4. different layers of network architecture

KU5. types of network protocols, topology and its significance

KU6. design of industrial network between devices based on protocols, topology and device parameters

KU7. signaling parameters required to do cable installation between devices

KU8. allocation of device parameters like station ID, baud rate etc. to the devices connected to the network

KU9. device manufacturer software for network parameter settings and device communication

KU10. working and integration of different elements using I/O link master to the controller

KU11. data types like machine, process and control data from robot and automation systems in the network

KU12. maintenance and troubleshooting procedures like hardware, self-loop back, link test etc.
KU13. functioning of various network devices like routers, network switch, repeaters

Generic Skills (GS)

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

GS1. communicate effectively at the workplace
GS2. attentively listen and comprehend the information given by the process managers
GS3. write observations and any work-related information in English/regional language
GS4. recognise a workplace problem and take suitable action
GS5. analyse and apply the information gathered from observation, experience, reasoning or communication to act efficiently
GS6. complete the assigned tasks in a timely and efficient manner
GS7. coordinate with shop floor workers and team for installing the new systems efficiently

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Install the elements in different layers of industrial network architecture and protocols	11	10	-	4
PC1. analyse the installed automation elements, systems and robots into different layers of network architecture like field devices, control devices, networks.	3	2	-	1
PC2. design/interpret the network consists of devices, automation systems and robots	3	3	-	1
PC3. select and install suitable network protocols like MODBUS, CC-LINK, Profinet, Profibus, OPC UA, MQTT etc. based on control system requirements	3	3	-	1
PC4. connect the intelligent devices and system using suitable network topology like STAR, LINE, RING as per network design document	2	2	-	1
Integrate and establish communication using I/O link master and network protocols	12	9	-	5
PC5. connect the automation elements like sensors, control devices to I/O link master as per SOP	2	2	-	1
PC6. install the cable between devices in alignment with signaling parameters like bend radius, signal ground, terminal resistor, cable length etc.	3	2	-	1
PC7. establish the communication between automation systems, intelligent devices and robots by doing parameter settings like baud rate, distance, station ID and station type	3	2	-	1
PC8. set the network parameters of automation system on the device manufacturers software as per SOP and organizational guidelines	2	2	-	1
PC9. turn on the power of automation devices, system in the network and look for healthy communication between them	2	1	-	1
Fetching vital data from robotics and automation system using industrial networking	7	9	-	4

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC10. interpret the different types of data from I/O link master like process, device and event data	1	3	-	1
PC11. fetch the machine data of robotics and automation systems like communication status, healthy hardware, life diagnosis, condition monitoring as per organisational guidelines	3	3	-	2
PC12. fetch the process and control data of robotics and automation system like cycle start/stop, production status, operator status, system monitor as per organisational guidelines	3	3	-	1
Carry out maintenance and troubleshooting of communication network between robotics and automation system	**7**	**9**	**-**	**5**
PC13. prepare maintenance and troubleshooting schedule and checklist for conducting the preventive, predictive and breakdown maintenance of the industrial networking	1	1	-	1
PC14. conduct various tests such as hardware test, link test, loop back test etc. to check the functionality of system	2	2	-	2
PC15. install network devices like repeaters and routers into the network in order to amplify the signal due to increase in communication distance and fault finding	1	1	-	-
PC16. generate the fallback action plan for failures of critical activities	1	1	-	1
PC17. identify the critical spares with the help of supplier, maintenance team and plan for their availability	1	2	-	1
PC18. develop the maintenance manual with the help of supplier and maintenance team	1	2	-	-
Perform post-installation activities	**3**	**3**	**-**	**2**
PC19. conduct the trials of system as per the e-plan to align it with existing or new manufacturing process	1	2	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC20. handover the system to production team & train them on it as per organizational guidelines and procedures	1	-	-	-
PC21. prepare documents and records such as experience under development, TGW /TGR faced during process trials etc. as a reference for future development	1	1	-	1
NOS Total	**40**	**40**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N8307
NOS Name	Integration of robots and automation systems using industrial networking protocols
Sector	Automotive
Sub-Sector	Research & Development
Occupation	Automotive Product Development
NSQF Level	6
Credits	TBD
Version	1.0
Last Reviewed Date	30/12/2021
Next Review Date	30/12/2024
NSQC Clearance Date	30/12/2021

ASC/N8308: Plan, Design and operate 3D Printing machine for product generation

Description

This NOS is about planning, designing and operating the 3D printing machine for product generation like critical spare parts ,fixture for the component as per project document.

Scope

The scope covers the following :

- Interpret the component/fixture design
- Design the object model using Computer Aided Design software
- Perform 3D Printing Operations

Elements and Performance Criteria

Interpret the component/fixture design

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

PC1. identify the work requirements and work to be done by interpreting the component/fixture design

PC2. identify and select software like CATIA, Auto- CAD, Fusion 360 etc. for creating the designs and models as per the project document

PC3. collate the design requirements in terms of material used for making the component, packaging and other requirements to decide the dimensions, measurements and tolerances of the aggregate/component

Design the object model using Computer Aided Design software

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

PC4. develop and design specifications of the component by using the Geometric and Trigonometric rules/formula as per project document

PC5. set the required unit and dimension parameters and insert sketches, scanned images, diagrams, signs or symbols, etc. of required product design in a CAD file

PC6. create a 3D model of product by using CAD techniques as per the information received from the Project Document

PC7. prepare layouts and various views of drawing to generate a relationship between components and assemblies

PC8. convert the object model into STL or AMF file format as per the 3D printer requirement

PC9. check object model files for common errors such as holes, self-intersections, manifold errors, faces etc. and rectify the same by following organizational recommended procedures

Perform 3D printing operations

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

PC10. select suitable 3D printing machine as per specified machine specifications (i.e. build speed, extrusion speed, nozzle temperature) and raw material to print the components as per product specifications

PC11. set the 3D printing machine and its parameters such as room temperature range, air cleanliness as per SOP/WI

PC12. select and upload the standard tesselation language (.stl) code file needed for machine operation

PC13. pre-heat the bed of the machine to adequate temperature as per process specifications

PC14. set the laser or nozzles temperature to defined values as per process specification

PC15. start the 3D printing machine and perform 3D printing operations as per SOP/WI

PC16. inspect the printed part as per the project document for required quality and if non-conforming, take action as per organizational guidelines

PC17. store & preserve the printed parts manufactured as per organizational guidelines and procedures

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. relevant manufacturing standards and procedures followed in the company

KU2. organization methodology/procedures used for automotive product design

KU3. different types of designing processes and associated software like CATIA, AutoCAD, Fusion 360 etc.

KU4. Draught Standards & Techniques- e.g. ANSI series IS/ ISO

KU5. technical drawing practices as per the company standards

KU6. drawings and modelling techniques like 2D and 3D

KU7. methods of using instruments like Vernier callipers, Micrometres, rulers and other inspection tools

KU8. how to identify and correct errors in the object model file

KU9. all the symbols and notifications being displayed by the 3D Printing machine and their corresponding meaning

KU10. error detection and rectification at various stages of part generation

KU11. types of 3D Printing techniques

KU12. types of materials available for fabrication in various 3D printing technique

KU13. various inspection methods for inspecting the quality of product

Generic Skills (GS)

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

GS1. read equipment manuals and process documents

GS2. attentively listen and comprehend the information given by the process managers

GS3. communicate effectively at the workplace

GS4. write observations and any work related information in English/regional language

GS5. recognize a workplace problem and take suitable action

GS6. analyse and apply the information gathered from observation, experience, reasoning or communication to act efficiently

GS7. complete assigned tasks in a timely and efficient manner

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Interpret the component/fixture design	9	8	-	5
PC1. identify the work requirements and work to be done by interpreting the component/fixture design	2	2	-	1
PC2. identify and select software like CATIA, Auto-CAD, Fusion 360 etc. for creating the designs and models as per the project document	4	4	-	2
PC3. collate the design requirements in terms of material used for making the component, packaging and other requirements to decide the dimensions, measurements and tolerances of the aggregate/component	3	2	-	2
Design the object model using Computer Aided Design software	17	17	-	7
PC4. develop and design specifications of the component by using the Geometric and Trigonometric rules/formula as per project document	3	3	-	1
PC5. set the required unit and dimension parameters and insert sketches, scanned images, diagrams, signs or symbols, etc. of required product design in a CAD file	3	3	-	2
PC6. create a 3D model of product by using CAD techniques as per the information received from the Project Document	4	4	-	1
PC7. prepare layouts and various views of drawing to generate a relationship between components and assemblies	2	2	-	1
PC8. convert the object model into STL or AMF file format as per the 3D printer requirement	2	2	-	1
PC9. check object model files for common errors such as holes, self-intersections, manifold errors, faces etc. and rectify the same by following organizational recommended procedures	3	3	-	1
Perform 3D printing operations	14	15	-	8

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC10. select suitable 3D printing machine as per specified machine specifications (i.e. build speed, extrusion speed, nozzle temperature) and raw material to print the components as per product specifications	3	2	-	1
PC11. set the 3D printing machine and its parameters such as room temperature range, air cleanliness as per SOP/WI	2	2	-	1
PC12. select and upload the standard tesselation language (.stl) code file needed for machine operation	2	2	-	1
PC13. pre-heat the bed of the machine to adequate temperature as per process specifications	1	2	-	1
PC14. set the laser or nozzles temperature to defined values as per process specification	-	2	-	1
PC15. start the 3D printing machine and perform 3D printing operations as per SOP/WI	2	2	-	1
PC16. inspect the printed part as per the project document for required quality and if non-conforming, take action as per organizational guidelines	2	2	-	1
PC17. store & preserve the printed parts manufactured as per organizational guidelines and procedures	2	1	-	1
NOS Total	**40**	**40**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N8308
NOS Name	Plan, Design and operate 3D Printing machine for product generation
Sector	Automotive
Sub-Sector	Research & Development
Occupation	Automotive Product Development
NSQF Level	6
Credits	TBD
Version	1.0
Last Reviewed Date	30/12/2021
Next Review Date	30/12/2024
NSQC Clearance Date	30/12/2021

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 the proportion of marks for Theory and Skills Practical for each PC.

2. The assessment for the theory part will be based on the knowledge bank of questions created by the SSC.

3. Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/option NOS/set of NOS.

4. Individual assessment agencies will create unique question papers for the theory part for each candidate at each examination/training center (as per assessment criteria below).

5. Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/ training center based on these criteria.

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/N8305.Designing, selection and integration of Automation Systems	40	40	-	20	100	20
ASC/N8306.Selection, Installation, Commissioning and Maintenance of Industrial Robot	40	40	-	20	100	20
ASC/N8307.Integration of robots and automation systems using industrial networking protocols	40	40	-	20	100	20
ASC/N8308.Plan, Design and operate 3D Printing machine for product generation	40	40	-	20	100	15
Total	**260**	**220**	**-**	**120**	**600**	**100**

Acronyms

NOS	National Occupational Standard(s)
NSQF	National Skills Qualifications Framework
QP	Qualifications Pack
TVET	Technical and Vocational Education and Training
VFD	Variable Frequency Drive
PLC	Programmable Logic Controller
TGW	Things Gone Wrong
TGR	Timing Gear Rear

Glossary

Sector	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.
Sub-sector	Sub-sector is derived from a further breakdown based on the characteristics and interests of its components.
Occupation	Occupation is a set of job roles, which perform similar/ related set of functions in an industry.
Job role	Job role defines a unique set of functions that together form a unique employment opportunity in an organisation.
Occupational Standards (OS)	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.
Performance Criteria (PC)	Performance Criteria (PC) are statements that together specify the standard of performance required when carrying out a task.
National Occupational Standards (NOS)	NOS are occupational standards which apply uniquely in the Indian context.
Qualifications Pack (QP)	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.
Unit Code	Unit code is a unique identifier for an Occupational Standard, which is denoted by an 'N'
Unit Title	Unit title gives a clear overall statement about what the incumbent should be able to do.
Description	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.
Scope	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.
Knowledge and Understanding (KU)	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.

Organisational Context	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.
Technical Knowledge	Technical knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
Core Skills/ Generic Skills (GS)	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.
Electives	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.
Options	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.