Qualification Pack

Fabrication and Service Technician

Semester 3: ICE Servicing/ Semester 3: EV Servicing/ Semester 4: Battery Management System- BMS/ Semester 4: Electric Motors

QP Code: ASC/Q6422

Version: 1.0

NSQF Level: 4

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Qualification Pack

ASC/Q6422: Fabrication and Service Technician

Brief Job Description

The individuals at this job are responsible for the fabrication, assembly, and production of mechanical components and structures. They work in manufacturing settings, workshops, or fabrication facilities, where they use various tools, machinery, and techniques to create parts and products according to specifications.

Personal Attributes

The person should be patient, organised, team-oriented and have the ability to work for long hours in adverse conditions.

Applicable National Occupational Standards (NOS)

Compulsory NOS:

1. ASC/N3126: Basic Welding
2. ASC/N3127: Advance Welding
3. ASC/N3128: Fabrication
4. ASC/N9837: Applied Physics
5. ASC/N6459: Manufacturing Skills
6. ASC/N6315: Quality Management
7. ASC/N8379: Robotics
8. ASC/N9839: English Language Skills
9. DGT/VSQ/N0104: Employability Skills (120 Hours)

Options*(Not mandatory):*

Option 1: Semester 3: ICE Servicing

1. ASC/N1479: ICE Servicing

Option 2: Semester 3: EV Servicing

1. ASC/N1480: EV Servicing

Option 3: Semester 4: Battery Management System- BMS

1. ASC/N8380: Battery Management System- BMS

Option 4: Semester 4: Electric Motors

1. ASC/N8381: Electric Motors

Qualification Pack (QP) Parameters

Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Production Engineering
Country	India
NSQF Level	4
Credits	40
Aligned to NCO/ISCO/ISIC Code	NCO-2015/3115.0602
Minimum Educational Qualification & Experience	Certificate-NSQF (Machining and Assembly Technician, Level-3.5) OR 12th Class OR 10th Class + I.T.I (2 Years)
Minimum Level of Education for Training in School	
Pre-Requisite License or Training	NA
Minimum Job Entry Age	17 Years
Last Reviewed On	NA
Next Review Date	30/11/2026
NSQC Approval Date	30/11/2023

Qualification Pack

Version	1.0
Reference code on NQR	QG-04-AU-01361-2023-V1-ASDC
NQR Version	1

Remarks:

Mandatory: It is Mandatory to select at least one optional NOS in every semester to meet the 40 credits requirement in a year for diploma progression (As per NCVET Diploma guidelines)

ASC/N3126: Basic Welding

Description

This NOS unit is about to Integration of Basic Welding Technologies to Manufacturing Process.

Scope

The scope covers the following :

- Selection of appropriate welding processes as per Requirement
- Establish standardized procedures for each welding process.
- Design and prepare welding joints according to industry standards.

Elements and Performance Criteria

Selection of appropriate welding processes as per Requirement

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

PC1. Gather information about the materials being joined, the desired joint design, and the required mechanical properties, such as strength, ductility, and corrosion resistance.

PC2. Assess the compatibility of the materials being welded, considering factors like melting points, thermal conductivity, and chemical composition.

PC3. Research and evaluate different welding processes (e.g., MIG, TIG, arc welding, etc.) based on their capabilities, advantages, and limitations

PC4. Evaluate the required production scale and desired welding speed, as some processes may be more suitable for high-volume or mass production.

Establish standardized procedures for each welding process

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

PC5. Establish clear objectives for the standardized procedure, such as achieving a specific joint strength, reducing defects, or improving efficiency

PC6. Create a detailed written procedure that outlines each step in the welding process, including material preparation, equipment setup, welding parameters, and post-weld operations

PC7. Determine the appropriate voltage, current, wire feed speed, and other parameters for the chosen welding process, considering factors like material type, joint design, and desired weld properties

PC8. Perform tests using the developed procedure to validate its effectiveness in achieving the established objectives

Design and prepare welding joints according to industry standards

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

PC9. Measure and analyze the dimensions and angles of the joint to be welded, ensuring they meet the required specifications

PC10. Choose the most suitable joint design based on factors like material properties, joint loading, and the desired strength and durability

PC11. Ensure proper alignment and fit of the joint components before welding, minimizing gaps or misalignments that could lead to poor welds.

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. Welding processes knowledge: Understanding various welding processes, such as MIG, TIG, arc, and resistance welding, including their advantages, limitations, and applications.

KU9. Material properties knowledge: Familiarity with different materials' properties, such as melting points, ductility, and corrosion resistance, and how they affect welding outcomes.

KU10. Joint design and geometry: Knowledge of different welding joint types, their advantages, and how to analyze and select the appropriate joint design based on the specific application.

KU11. Welding equipment and safety: Understanding the operation, maintenance, and safety aspects of welding equipment, such as welders, torches, and protective gear

KU12. Quality control and inspection: Knowledge of quality control systems, inspection techniques, and defect identification in welds, such as undercutting, lack of fusion, or incomplete penetration

KU13. Welder training and certification: Understanding the importance of welder training, certification, and skill levels to ensure consistent and high-quality welds.

KU14. Automation and robotics: Knowledge of automation and robotics integration in welding processes, their benefits, and how to implement them effectively.

KU15. Manufacturing process optimization: Understanding the overall manufacturing process and how to optimize it by integrating welding technologies, minimizing waste, and improving efficiency.

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
Selection of appropriate welding processes as per Requirement	**10**	**20**	**20**	**-**
PC1. Gather information about the materials being joined, the desired joint design, and the required mechanical properties, such as strength, ductility, and corrosion resistance.	3	5	5	-
PC2. Assess the compatibility of the materials being welded, considering factors like melting points, thermal conductivity, and chemical composition.	3	5	5	-
PC3. Research and evaluate different welding processes (e.g., MIG, TIG, arc welding, etc.) based on their capabilities, advantages, and limitations	2	5	5	-
PC4. Evaluate the required production scale and desired welding speed, as some processes may be more suitable for high-volume or mass production.	2	5	5	-
Establish standardized procedures for each welding process	**5**	**10**	**10**	**-**
PC5. Establish clear objectives for the standardized procedure, such as achieving a specific joint strength, reducing defects, or improving efficiency	1	2	2	-
PC6. Create a detailed written procedure that outlines each step in the welding process, including material preparation, equipment setup, welding parameters, and post-weld operations	2	3	3	-
PC7. Determine the appropriate voltage, current, wire feed speed, and other parameters for the chosen welding process, considering factors like material type, joint design, and desired weld properties	1	2	2	-
PC8. Perform tests using the developed procedure to validate its effectiveness in achieving the established objectives	1	3	3	-
Design and prepare welding joints according to industry standards	**5**	**10**	**10**	**-**

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC9. Measure and analyze the dimensions and angles of the joint to be welded, ensuring they meet the required specifications	2	4	4	-
PC10. Choose the most suitable joint design based on factors like material properties, joint loading, and the desired strength and durability	2	3	3	-
PC11. Ensure proper alignment and fit of the joint components before welding, minimizing gaps or misalignments that could lead to poor welds.	1	3	3	-
NOS Total	**20**	**40**	**40**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N3126
NOS Name	Basic Welding
Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Metal Joining
NSQF Level	4
Credits	4
Version	1.0
Last Reviewed Date	30/11/2023
Next Review Date	30/11/2026
NSQC Clearance Date	30/11/2023

ASC/N3127: Advance Welding

Description

This NOS unit is about to Integration of Advance Welding Technologies to Manufacturing Process

Scope

The scope covers the following :

- Evaluate advanced welding technologies to determine their suitability for specific manufacturing processes.
- Optimize the manufacturing process by integrating advanced welding technologies,
- Develop and refine advanced welding processes to achieve optimal weld quality.

Elements and Performance Criteria

Evaluate advanced welding technologies to determine their suitability for specific manufacturing processes.

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

PC1. Analyze the specific manufacturing process to identify its requirements, challenges, and potential areas for improvement that could be addressed by integrating advanced welding technologies.

PC2. Evaluate the technical feasibility of each advanced welding technology by examining factors like equipment availability, compatibility with existing processes, and required infrastructure modifications.

PC3. Assess the economic feasibility of integrating advanced welding technologies, considering factors like equipment costs, operational expenses, and potential cost savings through increased efficiency and product quality.

PC4. Evaluate the environmental impact of each advanced welding technology, including factors like energy consumption, waste generation, and emissions.

PC5. Collect and analyze data from the pilot tests, case studies, and research to make informed decisions on the most suitable advanced welding technology for the specific manufacturing process.

Optimize the manufacturing process by integrating advanced welding technologies

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

PC6. Analyze the current manufacturing process to identify areas where advanced welding technologies can be integrated to improve efficiency and quality

PC7. Evaluate and select the most suitable advanced welding technologies based on the manufacturing process requirements, material properties, and desired outcomes.

PC8. Install the selected advanced welding equipment, ensuring proper setup and integration with existing manufacturing systems.

PC9. Develop and optimize welding processes using advanced technologies, considering factors like welding parameters, joint design, and material properties.

Develop and refine advanced welding processes to achieve optimal weld quality

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

PC10. Design and prepare welding joints to ensure proper fit-up, alignment, and cleanliness, which are crucial for optimal weld quality.

PC11. Develop detailed welding procedures that outline the process steps, equipment settings, and quality control measures to ensure consistent weld quality.

PC12. Perform preliminary welding tests to assess the weldability of materials and identify potential issues or challenges that may affect weld quality.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. relevant organisational standards such as work standard, Standard Operating Procedure, quality process, maintenance standards etc. followed in the company

KU2. importance of cycle-time and required output as per work order and work instructions

KU3. drawing standards used by the company

KU4. Technical knowledge: A strong understanding of materials science, metallurgy, and engineering principles to evaluate the suitability of advanced welding technologies for specific manufacturing processes.

KU5. Welding processes expertise: In-depth knowledge of various advanced welding processes, including their capabilities, limitations, and optimal application scenarios.

KU6. Equipment familiarity: Familiarity with advanced welding equipment, control systems, and automation technologies to ensure efficient and effective integration.

KU7. Quality control and inspection: Knowledge of quality control methods, non-destructive testing techniques, and weld inspection procedures to maintain consistent weld quality.

KU8. Process optimization: Ability to analyze and optimize manufacturing processes to integrate advanced welding technologies, considering factors like production efficiency, cost, and environmental impact.

Generic Skills (GS)

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

GS1. read and interpret workplace related drawing

GS2. communicate the changes and requirements to supervisor by using relevant drawing terms and nomenclature

GS3. attentively listen and comprehend the information given by the supervisor/team members

GS4. write in English/regional language

GS5. recognise problem in drawing and take suitable action

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

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Evaluate advanced welding technologies to determine their suitability for specific manufacturing processes.	**10**	**20**	**20**	**-**
PC1. Analyze the specific manufacturing process to identify its requirements, challenges, and potential areas for improvement that could be addressed by integrating advanced welding technologies.	2	4	4	-
PC2. Evaluate the technical feasibility of each advanced welding technology by examining factors like equipment availability, compatibility with existing processes, and required infrastructure modifications.	2	4	4	-
PC3. Assess the economic feasibility of integrating advanced welding technologies, considering factors like equipment costs, operational expenses, and potential cost savings through increased efficiency and product quality.	2	4	4	-
PC4. Evaluate the environmental impact of each advanced welding technology, including factors like energy consumption, waste generation, and emissions.	2	4	4	-
PC5. Collect and analyze data from the pilot tests, case studies, and research to make informed decisions on the most suitable advanced welding technology for the specific manufacturing process.	2	4	4	-
Optimize the manufacturing process by integrating advanced welding technologies	**5**	**10**	**10**	**-**
PC6. Analyze the current manufacturing process to identify areas where advanced welding technologies can be integrated to improve efficiency and quality	2	2	2	-
PC7. Evaluate and select the most suitable advanced welding technologies based on the manufacturing process requirements, material properties, and desired outcomes.	1	3	3	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC8. Install the selected advanced welding equipment, ensuring proper setup and integration with existing manufacturing systems.	1	2	2	-
PC9. Develop and optimize welding processes using advanced technologies, considering factors like welding parameters, joint design, and material properties.	1	3	3	-
Develop and refine advanced welding processes to achieve optimal weld quality	**5**	**10**	**10**	**-**
PC10. Design and prepare welding joints to ensure proper fit-up, alignment, and cleanliness, which are crucial for optimal weld quality.	1	3	3	-
PC11. Develop detailed welding procedures that outline the process steps, equipment settings, and quality control measures to ensure consistent weld quality.	2	4	4	-
PC12. Perform preliminary welding tests to assess the weldability of materials and identify potential issues or challenges that may affect weld quality.	2	3	3	-
NOS Total	**20**	**40**	**40**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N3127
NOS Name	Advance Welding
Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Metal Joining
NSQF Level	4
Credits	4
Version	1.0
Last Reviewed Date	30/11/2023
Next Review Date	30/11/2026
NSQC Clearance Date	30/11/2023

ASC/N3128: Fabrication

Description

This NOS unit is about to perform Fabrication of structures, components, and products from raw materials

Scope

The scope covers the following :

- Develop detailed designs and specifications for the structure, component, or product.
- Establish a layout plan for the fabrication process.
- Perform quality control checks and inspections at various stages of the fabrication process.

Elements and Performance Criteria

Develop detailed designs and specifications for the structure, component, or product

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

PC1. Conduct research on similar structures, components, or products to understand best practices, identify potential design challenges, and gather inspiration for innovative solutions.

PC2. Establish design parameters such as size, weight, material requirements, and performance criteria based on the project requirements and research findings.

PC3. Create initial design concepts that meet the established design parameters and address the project requirements.

PC4. valuate the feasibility of the conceptual designs by assessing factors like manufacturability, cost, and performance.

PC5. Determine the most suitable fabrication processes for each stage of the project, such as cutting, shaping, welding, and finishing techniques.

Establish a layout plan for the fabrication process.

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

PC6. Calculate the necessary workspace for the fabrication process, considering factors like the size of the structure, available machinery, and required clearance for movement and handling of materials.

PC7. Identify key workstations involved in the fabrication process, such as cutting, shaping, welding, assembly, and finishing areas, and determine their optimal locations within the workspace.

PC8. Plan for the storage and organization of tools and equipment required for each workstation, ensuring easy access and minimal downtime during the fabrication process

PC9. Integrate quality control checkpoints throughout the layout plan to facilitate regular inspections and testing of the fabricated structure, component, or product.

Perform quality control checks and inspections at various stages of the fabrication process

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

PC10. Establish designated areas or workstations for performing quality control checks and inspections, ensuring they are well-equipped and organized

PC11. Measure and verify the dimensions of components and products against the design specifications using measuring tools, such as calipers, micrometers, and rulers.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. relevant organisational standards such as work standard, Standard Operating Procedure, quality process, maintenance standards etc. followed in the company

KU2. importance of cycle-time and required output as per work order and work instructions

KU3. drawing standards used by the company

KU4. use of drawing tools such as scales, compass, types of pencils, CAD and CAM software etc

KU5. the basics of engineering drawing, orthographic projection, isometric projection, GD&T etc

KU6. importance of various projections, views, symbols and dimensions of drawing

KU7. use of geometric shapes like lines, angles, circles, etc for interpreting the drawing

KU8. Technical knowledge: A strong understanding of materials science, mechanical principles, and engineering design to create functional and durable structures, components, and products.

KU9. Design and drafting: Proficiency in creating technical drawings, blueprints, and 3D models using Computer-Aided Design (CAD) software to visualize and communicate design concepts effectively.

KU10. Material properties: In-depth knowledge of various raw materials' properties, such as strength, ductility, corrosion resistance, and thermal expansion, to select the most suitable materials for specific applications.

KU11. Manufacturing processes: Familiarity with various manufacturing processes, including cutting, shaping, welding, and finishing techniques, to understand their capabilities, limitations, and optimal application scenarios.

KU12. Quality control and inspection: Knowledge of quality control methods, non-destructive testing techniques, and inspection procedures to ensure consistent product quality and adherence to industry standards.

KU13. Safety and environmental considerations: Understanding of safety practices, hazardous materials handling, and environmental impact to minimize risks and maintain a safe working environment.

Generic Skills (GS)

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

GS1. read and interpret workplace related drawing

GS2. communicate the changes and requirements to supervisor by using relevant drawing terms and nomenclature

GS3. attentively listen and comprehend the information given by the supervisor/team members

GS4. write in English/regional language

GS5. recognise problem in drawing and take suitable action

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

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Develop detailed designs and specifications for the structure, component, or product	**10**	**20**	**20**	**-**
PC1. Conduct research on similar structures, components, or products to understand best practices, identify potential design challenges, and gather inspiration for innovative solutions.	2	4	4	-
PC2. Establish design parameters such as size, weight, material requirements, and performance criteria based on the project requirements and research findings.	2	4	4	-
PC3. Create initial design concepts that meet the established design parameters and address the project requirements.	2	4	4	-
PC4. valuate the feasibility of the conceptual designs by assessing factors like manufacturability, cost, and performance.	2	4	4	-
PC5. Determine the most suitable fabrication processes for each stage of the project, such as cutting, shaping, welding, and finishing techniques.	2	4	4	-
Establish a layout plan for the fabrication process.	**5**	**10**	**10**	**-**
PC6. Calculate the necessary workspace for the fabrication process, considering factors like the size of the structure, available machinery, and required clearance for movement and handling of materials.	1	2	2	-
PC7. Identify key workstations involved in the fabrication process, such as cutting, shaping, welding, assembly, and finishing areas, and determine their optimal locations within the workspace.	1	2	2	-
PC8. Plan for the storage and organization of tools and equipment required for each workstation, ensuring easy access and minimal downtime during the fabrication process	1	3	3	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC9. Integrate quality control checkpoints throughout the layout plan to facilitate regular inspections and testing of the fabricated structure, component, or product.	2	3	3	-
Perform quality control checks and inspections at various stages of the fabrication process	**5**	**10**	**10**	**-**
PC10. Establish designated areas or workstations for performing quality control checks and inspections, ensuring they are well-equipped and organized	2	4	4	-
PC11. Measure and verify the dimensions of components and products against the design specifications using measuring tools, such as calipers, micrometers, and rulers.	3	6	6	-
NOS Total	**20**	**40**	**40**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N3128
NOS Name	Fabrication
Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Metal Joining
NSQF Level	4
Credits	4
Version	1.0
Last Reviewed Date	30/11/2023
Next Review Date	30/11/2026
NSQC Clearance Date	30/11/2023

ASC/N9837: Applied Physics

Description

This NOS is about to Maintain a healthy and productive work environment by adhering Industrial Safety.

Scope

The scope covers the following :

- Create mathematical models and simulations to represent the fabrication process.
- Develop and test fabrication technology prototypes based on the optimized process parameters.
- Explore new and innovative fabrication techniques, incorporating emerging physics principles and technologies.

Elements and Performance Criteria

Create mathematical models and simulations to represent the fabrication process

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

PC1. Collect relevant data on the fabrication process, including material properties, process parameters, and any other factors that may influence the outcome

PC2. Create a preliminary representation of the fabrication process, outlining the key components, interactions, and relationships between various factors.

PC3. Translate the conceptual model into a set of mathematical equations that describe the behavior of the fabrication process, incorporating relevant physics principles and material properties.

PC4. Implement the numerical models to generate simulations of the fabrication process, visualizing the behavior of the system over time and under varying conditions.

Develop and test fabrication technology prototypes based on the optimized process parameters

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

PC5. Create a detailed design of the fabrication technology prototype, incorporating the optimized process parameters and considering factors such as material selection, geometry, and manufacturing constraints.

PC6. Obtain the required materials and components for the prototype, ensuring they meet the necessary specifications and quality standards.

PC7. Set up the fabrication equipment and tools according to the optimized process parameters, ensuring proper calibration and safety measures are in place.

PC8. Carry out the fabrication process using the optimized parameters, adhering to the designed prototype specifications and maintaining accurate records of the process.

Explore new and innovative fabrication techniques, incorporating emerging physics principles and technologies.

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

PC9. Perform thorough literature reviews to gather information on existing fabrication techniques, their limitations, and potential areas for improvement.

PC10. Create conceptual models and simulations to visualize and evaluate the proposed innovative fabrication techniques, incorporating relevant physics principles and material properties.

PC11. Develop and test prototypes of the innovative fabrication techniques, refining the design and process parameters based on experimental results and feedback.

PC12. Perform experiments to validate the innovative fabrication techniques, ensuring their effectiveness and reliability in real-world applications.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. relevant manufacturing, quality and maintenance standards and procedures followed in the organisation

KU2. functional processes like Procurement, Store management, inventory management, quality management and key contact points for query resolution

KU3.

KU4. requirement of raw materials, tools and equipment on the shift/line

KU5. Strong foundation in physics: A deep understanding of fundamental physics principles, such as mechanics, electromagnetism, thermodynamics, and quantum mechanics, is crucial for applying these concepts to fabrication technologies.

KU6. Material science knowledge: Familiarity with the properties, behaviors, and characteristics of different materials, as well as their response to various fabrication processes, is vital for designing efficient technologies.

KU7. Mathematical proficiency: Proficiency in mathematical concepts, such as calculus, linear algebra, and differential equations, is necessary for developing accurate models and simulations of fabrication processes.

KU8. Process engineering understanding: Knowledge of process engineering principles, including heat transfer, mass transfer, and reaction kinetics, helps in optimizing fabrication process parameters and identifying potential issues.

KU9. Fabrication techniques awareness: Familiarity with various fabrication techniques, such as casting, forging, welding, and additive manufacturing, allows for the selection and improvement of suitable methods for specific applications.

KU10. Computational modeling expertise: Skills in using computational tools, such as finite element analysis (FEA) and computational fluid dynamics (CFD), to model and simulate fabrication processes are essential for optimization and innovation

Generic Skills (GS)

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

GS1. Read and interpret workplace related documentation.

GS2. Communicate using terms, names, grades and other nomenclature pertaining to the automotive trade.

GS3. attentively listen and comprehend the information given by the master technician/team members

GS4. write reports related to production process in English/regional language

GS5. recognise a workplace problem and take suitable action

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

GS7. plan and organise work according to the work requirements

GS8. report to the supervisor or deal with a colleague individually, depending on the type of concern

GS9. complete the assigned tasks with minimum supervision

GS10. explore new approach of doing things to resolve issues

GS11. suggest improvements (if any) in current ways of working

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Create mathematical models and simulations to represent the fabrication process	**5**	**10**	**10**	**-**
PC1. Collect relevant data on the fabrication process, including material properties, process parameters, and any other factors that may influence the outcome	2	3	3	-
PC2. Create a preliminary representation of the fabrication process, outlining the key components, interactions, and relationships between various factors.	1	3	3	-
PC3. Translate the conceptual model into a set of mathematical equations that describe the behavior of the fabrication process, incorporating relevant physics principles and material properties.	1	2	2	-
PC4. Implement the numerical models to generate simulations of the fabrication process, visualizing the behavior of the system over time and under varying conditions.	1	2	2	-
Develop and test fabrication technology prototypes based on the optimized process parameters	**5**	**10**	**10**	**-**
PC5. Create a detailed design of the fabrication technology prototype, incorporating the optimized process parameters and considering factors such as material selection, geometry, and manufacturing constraints.	1	3	3	-
PC6. Obtain the required materials and components for the prototype, ensuring they meet the necessary specifications and quality standards.	2	3	3	-
PC7. Set up the fabrication equipment and tools according to the optimized process parameters, ensuring proper calibration and safety measures are in place.	1	2	2	-
PC8. Carry out the fabrication process using the optimized parameters, adhering to the designed prototype specifications and maintaining accurate records of the process.	1	2	2	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Explore new and innovative fabrication techniques, incorporating emerging physics principles and technologies.	**5**	**10**	**10**	**-**
PC9. Perform thorough literature reviews to gather information on existing fabrication techniques, their limitations, and potential areas for improvement.	2	3	3	-
PC10. Create conceptual models and simulations to visualize and evaluate the proposed innovative fabrication techniques, incorporating relevant physics principles and material properties.	1	2	2	-
PC11. Develop and test prototypes of the innovative fabrication techniques, refining the design and process parameters based on experimental results and feedback.	1	3	3	-
PC12. Perform experiments to validate the innovative fabrication techniques, ensuring their effectiveness and reliability in real-world applications.	1	2	2	-
NOS Total	**15**	**30**	**30**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N9837
NOS Name	Applied Physics
Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Generic
NSQF Level	4
Credits	3
Version	1.0
Last Reviewed Date	30/11/2023
Next Review Date	30/11/2026
NSQC Clearance Date	30/11/2023

ASC/N6459: Manufacturing Skills

Description

This NOS is about to Optimize production processes to minimize waste, reduce downtime using Manufacturing Skills.

Scope

The scope covers the following :

- Analyze and map the current production processes for Improvement.
- Implement lean manufacturing principles to streamline processes and eliminate non-value-added activities.
- Maintain and optimize production equipment to minimize downtime, enhance productivity.
- Optimize inventory levels and supply chain management.

Elements and Performance Criteria

Analyze and map the current production processes for Improvement.

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

PC1. Collect data and information about the current production processes, including process flow, materials, equipment, workforce roles, and performance metrics

PC2. Establish the scope and boundaries of the production processes to be analyzed, ensuring a focused and manageable approach to the improvement project.

PC3. Create visual representations of the production processes, such as flowcharts or value stream maps, to understand the sequence of activities, handoffs, and decision points

PC4. Determine relevant performance metrics for the production processes, such as cycle time, throughput, yield, and waste generation, to evaluate their efficiency and effectiveness

PC5. Investigate and identify the underlying causes of inefficiencies, bottlenecks, and issues within the production processes, using techniques like 5 Whys, Fishbone Diagrams, or Pareto Analysis

PC6. Create actionable plans to address the identified improvement opportunities, outlining specific tasks, responsibilities, timelines, and expected outcomes

PC7. Regularly track and evaluate the implementation of improvement plans, measuring the impact on process performance, and making adjustments as needed to ensure successful optimization.

Implement lean manufacturing principles to streamline processes and eliminate non-value-added activities.

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

PC8. Assess the current production processes, identifying areas that can be improved, and determining which lean manufacturing principles can be applied to optimize the system.

PC9. Create a comprehensive plan outlining the specific lean principles to be implemented, the timeline, and the resources required for successful execution.

PC10. Adopt JIT practices to minimize inventory levels, reduce lead times, and ensure that materials and components are available when needed, eliminating unnecessary storage and handling costs.

PC11. Develop standardized work procedures to ensure consistency, reduce variability, and promote efficiency in production processes.

PC12. Implement visual aids and tools to communicate key performance indicators, production goals, and work instructions, promoting a clean, organized, and safe working environment.

PC13. Establish key performance indicators (KPIs) to track the effectiveness of the lean implementation and make data-driven decisions to further optimize the production processes.

Maintain and optimize production equipment to minimize downtime, enhance productivity

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

PC14. Implement a preventive maintenance schedule to proactively address potential equipment failures, reducing downtime and extending the lifespan of the machinery

PC15. Utilize predictive maintenance techniques, such as condition monitoring and predictive analytics, to forecast equipment failures and schedule maintenance activities accordingly.

PC16. Stay updated on the latest equipment upgrades and retrofits that can enhance productivity, reduce downtime, and improve energy efficiency.

PC17. Maintain an inventory of essential spare parts and consumables to ensure quick and efficient repairs in case of equipment failures.

PC18. Maintain accurate documentation and records of equipment maintenance, repairs, and performance to facilitate decision-making and continuous improvement efforts..

Optimize inventory levels and supply chain management

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

PC19. Analyze historical sales data, market trends, and other relevant factors to forecast future demand for products, helping to determine appropriate inventory levels and production schedules.

PC20. implement and maintain an effective inventory management system, such as an Enterprise Resource Planning (ERP) or Warehouse Management System (WMS), to track inventory levels, monitor stock movements, and generate accurate reports.

PC21. Determine appropriate safety stock levels to minimize the risk of stockouts while avoiding excess inventory, balancing the trade-off between holding costs and stockout costs.

PC22. Establish reorder points for each item, considering lead times, demand variability, and desired service levels, to ensure timely replenishment of inventory.

PC23. Evaluate and optimize transportation and logistics processes, such as mode selection, routing, and carrier selection, to minimize costs and lead times while maintaining service levels

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. relevant manufacturing, quality and maintenance standards and procedures followed in the organisation

KU2. functional processes like Procurement, Store management, inventory management, quality management and key contact points for query resolution

KU3. requirement of raw materials, tools and equipment on the shift/line

KU4. how to prepare shift roster and maintain performance information of the team

KU5. use of ERP system for maintaining and updating production line data

KU6. documents and reports related to production process

KU7. various process improvement techniques like Kaizen, 5S, Poka Yoke, TQM etc

KU8. how to audit gaps and issues in production process and their analysis

KU9. Process Analysis: Understanding the flow of materials, information, and energy within a production process, identifying bottlenecks, and inefficiencies.

KU10. Lean Manufacturing Principles: Knowledge of the eight wastes (overproduction, waiting, unnecessary motion, overprocessing, excess inventory, defects, unused talent, and transportation) and how to eliminate them to improve efficiency.

KU11. Six Sigma Methodologies: Familiarity with Six Sigma tools like DMAIC (Define, Measure, Analyze, Improve, Control) and DFSS (Design for Six Sigma) to identify and resolve quality issues.

KU12. Data Collection and Analysis: Ability to collect, organize, and interpret data from various sources to make informed decisions.

KU13. Maintenance Strategies: Understanding different maintenance approaches like preventive, predictive, and condition-based maintenance to minimize downtime.

KU14. Quality Management: Knowledge of quality control and assurance techniques to ensure consistent product quality.

Generic Skills (GS)

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

GS1. read and interpret work instructions, reports and process documents

GS2. communicate the production requirements and issues to the seniors and other departments

GS3. attentively listen and comprehend the information given by the master technician/team members

GS4. write reports related to production process in English/regional language

GS5. recognise a workplace problem and take suitable action

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

GS7. plan and organise work according to the work requirements

GS8. report to the supervisor or deal with a colleague individually, depending on the type of concern

GS9. complete the assigned tasks with minimum supervision

GS10. explore new approach of doing things to resolve issues

GS11. suggest improvements (if any) in current ways of working

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Analyze and map the current production processes for Improvement.	**5**	**20**	**20**	**-**
PC1. Collect data and information about the current production processes, including process flow, materials, equipment, workforce roles, and performance metrics	1	3	3	-
PC2. Establish the scope and boundaries of the production processes to be analyzed, ensuring a focused and manageable approach to the improvement project.	1	3	3	-
PC3. Create visual representations of the production processes, such as flowcharts or value stream maps, to understand the sequence of activities, handoffs, and decision points	1	3	3	-
PC4. Determine relevant performance metrics for the production processes, such as cycle time, throughput, yield, and waste generation, to evaluate their efficiency and effectiveness	-	2	2	-
PC5. Investigate and identify the underlying causes of inefficiencies, bottlenecks, and issues within the production processes, using techniques like 5 Whys, Fishbone Diagrams, or Pareto Analysis	-	3	3	-
PC6. Create actionable plans to address the identified improvement opportunities, outlining specific tasks, responsibilities, timelines, and expected outcomes	1	3	3	-
PC7. Regularly track and evaluate the implementation of improvement plans, measuring the impact on process performance, and making adjustments as needed to ensure successful optimization.	1	3	3	-
Implement lean manufacturing principles to streamline processes and eliminate non-value-added activities.	**5**	**5**	**5**	**-**

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC8. Assess the current production processes, identifying areas that can be improved, and determining which lean manufacturing principles can be applied to optimize the system.	-	1	1	-
PC9. Create a comprehensive plan outlining the specific lean principles to be implemented, the timeline, and the resources required for successful execution.	1	1	1	-
PC10. Adopt JIT practices to minimize inventory levels, reduce lead times, and ensure that materials and components are available when needed, eliminating unnecessary storage and handling costs.	1	1	1	-
PC11. Develop standardized work procedures to ensure consistency, reduce variability, and promote efficiency in production processes.	1	-	-	-
PC12. Implement visual aids and tools to communicate key performance indicators, production goals, and work instructions, promoting a clean, organized, and safe working environment.	1	1	1	-
PC13. Establish key performance indicators (KPIs) to track the effectiveness of the lean implementation and make data-driven decisions to further optimize the production processes.	1	1	1	-
Maintain and optimize production equipment to minimize downtime, enhance productivity	**5**	**8**	**8**	**-**
PC14. Implement a preventive maintenance schedule to proactively address potential equipment failures, reducing downtime and extending the lifespan of the machinery	1	2	2	-
PC15. Utilize predictive maintenance techniques, such as condition monitoring and predictive analytics, to forecast equipment failures and schedule maintenance activities accordingly.	1	1	1	-
PC16. Stay updated on the latest equipment upgrades and retrofits that can enhance productivity, reduce downtime, and improve energy efficiency.	1	2	2	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC17. Maintain an inventory of essential spare parts and consumables to ensure quick and efficient repairs in case of equipment failures.	1	1	1	-
PC18. Maintain accurate documentation and records of equipment maintenance, repairs, and performance to facilitate decision-making and continuous improvement efforts..	1	2	2	-
Optimize inventory levels and supply chain management	**5**	**7**	**7**	**-**
PC19. Analyze historical sales data, market trends, and other relevant factors to forecast future demand for products, helping to determine appropriate inventory levels and production schedules.	1	2	2	-
PC20. implement and maintain an effective inventory management system, such as an Enterprise Resource Planning (ERP) or Warehouse Management System (WMS), to track inventory levels, monitor stock movements, and generate accurate reports.	1	2	2	-
PC21. Determine appropriate safety stock levels to minimize the risk of stockouts while avoiding excess inventory, balancing the trade-off between holding costs and stockout costs.	1	1	1	-
PC22. Establish reorder points for each item, considering lead times, demand variability, and desired service levels, to ensure timely replenishment of inventory.	1	1	1	-
PC23. Evaluate and optimize transportation and logistics processes, such as mode selection, routing, and carrier selection, to minimize costs and lead times while maintaining service levels	1	1	1	-
NOS Total	**20**	**40**	**40**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N6459
NOS Name	Manufacturing Skills
Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Production Engineering
NSQF Level	4
Credits	4
Version	1.0
Last Reviewed Date	30/11/2023
Next Review Date	30/11/2026
NSQC Clearance Date	30/11/2023

ASC/N6315: Quality Management

Description

This NOS is about to Implementing effective quality control and assurance practices in a Manufacturing Process.

Scope

The scope covers the following :

- Develop and implement quality standards and guidelines based on industry best practices.
- Establish quality control checkpoints at various stages of the manufacturing process.
- Perform regular quality audits and inspections to assess the effectiveness of quality control.

Elements and Performance Criteria

Develop and implement quality standards and guidelines based on industry best practices.

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

PC1. Identify the existing quality gaps in the manufacturing process by comparing the current practices with industry best practices, regulatory requirements, and customer specifications.

PC2. Establish clear quality objectives and goals that align with the organization's vision, mission, and strategic priorities.

PC3. Create comprehensive quality policies and procedures that outline the processes, responsibilities, and expectations for maintaining product quality throughout the manufacturing process.

PC4. Define quality metrics and key performance indicators (KPIs) to measure the effectiveness of quality control and assurance practices and track progress towards quality objectives.

PC5. Develop quality manuals and other relevant documentation that clearly communicate quality policies, procedures, and guidelines to all stakeholders, including employees, suppliers, and customers

Establish quality control checkpoints at various stages of the manufacturing process

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

PC6. Establish quality control checkpoints at various stages of the manufacturing process.

PC7. Determine the critical process parameters that, if not controlled, could lead to defects or deviations in the final product.

PC8. Select appropriate inspection methods and tools, such as visual inspection, measurement devices, or testing equipment, to assess the quality of the product at each checkpoint

PC9. Develop sampling plans that define the number of units to be inspected, the acceptance or rejection criteria, and the sampling techniques to be used at each checkpoint.

PC10. Design inspection forms and checklists that outline the specific criteria, measurements, or tests to be performed at each checkpoint, ensuring consistency and clarity in the inspection process.

PC11. Identify and mark the locations where quality control checkpoints will be implemented within the manufacturing process, ensuring they are accessible, visible, and appropriately timed.

PC12. Analyze the inspection results and take appropriate corrective actions to address identified issues, minimize the impact of defects, and prevent their recurrence in the future.

Perform regular quality audits and inspections to assess the effectiveness of quality control

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

PC13. Develop a schedule for quality audits and inspections, considering factors such as production cycles, product types, and regulatory requirements.

PC14. Create detailed checklists that cover all essential aspects of the manufacturing process, including raw materials, equipment, processes, documentation, and finished products.

PC15. Monitor the implementation of identified corrective and preventive actions, ensuring that the necessary improvements are made and maintaining a continuous cycle of quality improvement.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. fundamentals of the CNC/conventional machine

KU2. various types of machining processes such as drilling, boring, turning etc.

KU3. SOP recommended by the manufacturer for using tools, jigs, fixtures, measuring instruments etc., during the machining processes.

KU4. how to select and modify the CNC machining program

KU5. SOP recommended by the organisation for operating CNC and conventional machine

KU6. Technical Knowledge: A strong understanding of the manufacturing process, raw materials, and production equipment is essential to identify potential quality issues and develop appropriate solutions.

KU7. Quality Management Principles: Familiarity with quality management concepts, such as the PDCA (Plan-Do-Check-Act) cycle, ISO 9000 standards, and Six Sigma methodologies, will help in designing and implementing effective quality control systems.

KU8. Statistical Process Control (SPC): Understanding SPC techniques, such as control charts, capability analysis, and process capability studies, will enable you to monitor and improve the manufacturing process continuously.

KU9. Sampling Techniques: Knowledge of various sampling techniques, like random sampling, stratified sampling, and attribute sampling, is vital for selecting representative samples for quality inspection and analysis.

KU10. Measurement and Testing Methods: Familiarity with different measuring instruments, testing methods, and calibration procedures is necessary to ensure accurate and reliable quality assessments.

Generic Skills (GS)

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

GS1. read and interpret work instructions, machine drawings, reports and process documents

GS2. communicate the machining requirements to the seniors and other departments

GS3. communicate issues to the supervisor that occur during machining process

GS4. attentively listen and comprehend the information given by the master technician/team members

GS5. write reports related to production process in English/regional language

GS6. recognise a workplace problem and take suitable action

GS7. analyse and apply the information gathered from observation, experience, reasoning or communication to act efficiently

GS8. plan and organise work according to the work requirements

GS9. report to the supervisor or deal with a colleague individually, depending on the type of concern

GS10. complete the assigned tasks with minimum supervision

GS11. suggest improvements (if any) in current ways of working

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Develop and implement quality standards and guidelines based on industry best practices.	**10**	**20**	**20**	**-**
PC1. Identify the existing quality gaps in the manufacturing process by comparing the current practices with industry best practices, regulatory requirements, and customer specifications.	2	4	4	-
PC2. Establish clear quality objectives and goals that align with the organization's vision, mission, and strategic priorities.	2	4	4	-
PC3. Create comprehensive quality policies and procedures that outline the processes, responsibilities, and expectations for maintaining product quality throughout the manufacturing process.	2	4	4	-
PC4. Define quality metrics and key performance indicators (KPIs) to measure the effectiveness of quality control and assurance practices and track progress towards quality objectives.	2	4	4	-
PC5. Develop quality manuals and other relevant documentation that clearly communicate quality policies, procedures, and guidelines to all stakeholders, including employees, suppliers, and customers	2	4	4	-
Establish quality control checkpoints at various stages of the manufacturing process	**5**	**10**	**10**	**-**
PC6. Establish quality control checkpoints at various stages of the manufacturing process.	1	1	1	-
PC7. Determine the critical process parameters that, if not controlled, could lead to defects or deviations in the final product.	1	2	2	-
PC8. Select appropriate inspection methods and tools, such as visual inspection, measurement devices, or testing equipment, to assess the quality of the product at each checkpoint	1	1	1	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC9. Develop sampling plans that define the number of units to be inspected, the acceptance or rejection criteria, and the sampling techniques to be used at each checkpoint.	-	2	2	-
PC10. Design inspection forms and checklists that outline the specific criteria, measurements, or tests to be performed at each checkpoint, ensuring consistency and clarity in the inspection process.	1	2	2	-
PC11. Identify and mark the locations where quality control checkpoints will be implemented within the manufacturing process, ensuring they are accessible, visible, and appropriately timed.	-	1	1	-
PC12. Analyze the inspection results and take appropriate corrective actions to address identified issues, minimize the impact of defects, and prevent their recurrence in the future.	1	1	1	-
Perform regular quality audits and inspections to assess the effectiveness of quality control	**5**	**10**	**10**	**-**
PC13. Develop a schedule for quality audits and inspections, considering factors such as production cycles, product types, and regulatory requirements.	2	3	3	-
PC14. Create detailed checklists that cover all essential aspects of the manufacturing process, including raw materials, equipment, processes, documentation, and finished products.	2	3	3	-
PC15. Monitor the implementation of identified corrective and preventive actions, ensuring that the necessary improvements are made and maintaining a continuous cycle of quality improvement.	1	4	4	-
NOS Total	**20**	**40**	**40**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N6315
NOS Name	Quality Management
Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Automotive Quality Assurance
NSQF Level	4
Credits	4
Version	1.0
Last Reviewed Date	30/11/2023
Next Review Date	30/11/2026
NSQC Clearance Date	30/11/2023

ASC/N8379: Robotics

Description

This NOS is about to Perform tasks with high precision and accuracy using Industrial Robotics.

Scope

The scope covers the following :

- Calibrate and align the robot's mechanical, electrical, and control systems.
- Set up and integrate the robot into its designated work cell.
- Regularly inspect, maintain, and service the robot and its components

Elements and Performance Criteria

Calibrate and align the robot's mechanical, electrical, and control systems

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

PC1. Assemble the required tools and equipment for calibration, such as calibration kits, alignment tools, measurement devices, and diagnostic software

PC2. Adjust and fine-tune the mechanical components of the robot, such as joints, links, and bearings, to ensure smooth and accurate motion.

PC3. Verify and adjust the electrical connections and components, such as motors, sensors, and control circuits, to ensure proper signal transmission and functionality

PC4. Optimize the robot's control system, including the software, firmware, and communication protocols, to ensure precise and responsive control.

PC5. Maintain detailed records of the calibration and alignment process, including the steps taken, adjustments made, and any relevant measurements or observations

Set up and integrate the robot into its designated work cell

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

PC6. Develop a detailed layout and design of the work cell, considering factors such as available space, equipment placement, material flow, and ergonomics for both human and robot operators.

PC7. Choose the appropriate robot type, model, and configuration based on the specific tasks and requirements of the work cell.

PC8. Connect and integrate other work cell equipment, such as conveyors, palletizers, or vision systems, to ensure seamless interaction with the robot and optimal workflow.

PC9. Develop and test the robot's program, ensuring that it can perform the required tasks accurately and efficiently within the designated work cell.

Regularly inspect, maintain, and service the robot and its components

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

PC10. Develop a maintenance and service schedule, considering factors such as the robot's usage, manufacturing processes, and recommended service intervals by the manufacturer.

PC11. Inspect and maintain the robot's electrical components, including wiring, connectors, and power supplies, to ensure safe and efficient operation.

PC12. Maintain accurate records of maintenance and service activities, including dates, tasks performed, and any issues or observations noted.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. fundamentals of the conventional machine

KU2. various types of machining processes such as drilling, boring, turning etc

KU3. SOP recommended by the manufacturer for using tools, jigs, fixtures, measuring instruments etc., during the machining processes

KU4. how to select and modify the Robot program

KU5. SOP recommended by the organisation for operating Robot and conventional machine

KU6. Robotics Fundamentals: A strong understanding of robotics principles such as mechanics, electronics, control systems, and programming is essential

KU7. Programming Languages: Proficiency in programming languages commonly used in robotics, such as Python, and Robot Operating System (ROS), is crucial

KU8. Robotics Software: Familiarity with robotics software like simulation tools (e.g., Gazebo, V-Rep), path planning algorithms, and motion planning software is vital

KU9. Mathematics: A strong foundation in mathematics, including linear algebra, calculus, and geometry, is necessary for robotics tasks

KU10. Mechanical Engineering: Knowledge of mechanical engineering principles, such as kinematics, dynamics, and structural analysis, is essential for designing and maintaining robotic systems

KU11. Electrical Engineering: Understanding of electrical and electronic systems, including sensors, actuators, and control circuits, is vital for integrating and operating industrial robots

Generic Skills (GS)

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

GS1. read and interpret work instructions, machine drawings, reports and process documents

GS2. communicate the machining requirements to the seniors and other departments

GS3. communicate issues to the supervisor that occur during machining process

GS4. attentively listen and comprehend the information given by the master technician/team members

GS5. write reports related to production process in English/regional language

GS6. recognise a workplace problem and take suitable action

GS7. analyse and apply the information gathered from observation, experience, reasoning or communication to act efficiently

GS8. plan and organise work according to the work requirements

GS9. report to the supervisor or deal with a colleague individually, depending on the type of concern

GS10. complete the assigned tasks with minimum supervision

GS11. suggest improvements (if any) in current ways of working

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Calibrate and align the robot's mechanical, electrical, and control systems	**10**	**20**	**20**	**-**
PC1. Assemble the required tools and equipment for calibration, such as calibration kits, alignment tools, measurement devices, and diagnostic software	2	4	4	-
PC2. Adjust and fine-tune the mechanical components of the robot, such as joints, links, and bearings, to ensure smooth and accurate motion.	2	4	4	-
PC3. Verify and adjust the electrical connections and components, such as motors, sensors, and control circuits, to ensure proper signal transmission and functionality	2	4	4	-
PC4. Optimize the robot's control system, including the software, firmware, and communication protocols, to ensure precise and responsive control.	2	4	4	-
PC5. Maintain detailed records of the calibration and alignment process, including the steps taken, adjustments made, and any relevant measurements or observations	2	4	4	-
Set up and integrate the robot into its designated work cell	**5**	**10**	**10**	**-**
PC6. Develop a detailed layout and design of the work cell, considering factors such as available space, equipment placement, material flow, and ergonomics for both human and robot operators.	1	3	3	-
PC7. Choose the appropriate robot type, model, and configuration based on the specific tasks and requirements of the work cell.	1	2	2	-
PC8. Connect and integrate other work cell equipment, such as conveyors, palletizers, or vision systems, to ensure seamless interaction with the robot and optimal workflow.	1	3	3	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC9. Develop and test the robot's program, ensuring that it can perform the required tasks accurately and efficiently within the designated work cell.	2	2	2	-
Regularly inspect, maintain, and service the robot and its components	**5**	**10**	**10**	**-**
PC10. Develop a maintenance and service schedule, considering factors such as the robot's usage, manufacturing processes, and recommended service intervals by the manufacturer.	1	2	3	-
PC11. Inspect and maintain the robot's electrical components, including wiring, connectors, and power supplies, to ensure safe and efficient operation.	2	4	4	-
PC12. Maintain accurate records of maintenance and service activities, including dates, tasks performed, and any issues or observations noted.	2	4	3	-
NOS Total	**20**	**40**	**40**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N8379
NOS Name	Robotics
Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Automotive Product Development
NSQF Level	4
Credits	4
Version	1.0
Last Reviewed Date	30/11/2023
Next Review Date	30/11/2026
NSQC Clearance Date	30/11/2023

ASC/N9839: English Language Skills

Description

This NOS is about to Comprehend and analyze a wide range of texts, Literature using English Language Skills in Fabrication Process.

Scope

The scope covers the following :

- Develop and practice reading comprehension skills.
- Develop analytical skills to break down complex texts into their core components,
- Enhance your written and verbal communication skills to clearly convey ideas, instructions.

Elements and Performance Criteria

Develop and practice reading comprehension skills

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

PC1. Establish a clear reading goal, such as improving overall comprehension or focusing on a specific area, like understanding complex texts or enhancing speed reading.

PC2. Select reading materials that cater to your reading goals and interests, ensuring a balance between challenging and enjoyable texts.

PC3. Expand your vocabulary by learning new words and phrases from the texts you read.

PC4. Regularly assess your reading comprehension skills by taking quizzes, writing summaries, or discussing texts with others.

Develop analytical skills to break down complex texts into their core components

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

PC5. Analyze individual paragraphs within a text, identifying their main ideas and supporting details, as well as the relationships between them.

PC6. Create visual representations of the text's structure and key ideas using mind-mapping tools, which can help you identify relationships between different components and organize your thoughts.

PC7. Engage in critical thinking to challenge assumptions, evaluate evidence, and question the author's arguments or perspectives.

PC8. Analyze the results obtained from the Assessment

Enhance your written and verbal communication skills to clearly convey ideas, instructions

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

PC9. Develop active listening skills to understand others better and respond appropriately

PC10. Engage in reading various materials, such as books, articles, and reports, to improve your comprehension and writing skills.

PC11. Record your conversations or presentations and review them later to identify areas for improvement in your tone, clarity, or delivery

PC12. Maintain a growth mindset and be open to learning from your experiences, feedback, and mistakes.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. fundamentals of the Fabrication Process

KU2. various types of machining processes such as drilling, boring, turning etc

KU3. SOP recommended by the manufacturer for using tools, jigs, fixtures, measuring instruments etc., during the machining processes

KU4. how to select and modify the CNC machining program

KU5. Vocabulary: A strong command of the English language is essential to understand the meaning of complex words and phrases used in various texts

KU6. Grammar and Syntax: Understanding grammar rules and sentence structure is crucial for accurately interpreting the meaning of a text and identifying its underlying structure.

KU7. Reading Comprehension: The ability to read and understand the main ideas, supporting details, and relationships between different parts of a text is vital for effective analysis.

KU8. Critical Thinking: Analyzing and evaluating the information presented in a text requires the ability to think critically, identify patterns, and make connections between different pieces of information

KU9. Contextual Understanding: Knowing the historical, cultural, and social context in which a text was written can greatly enhance one's ability to comprehend its meaning and significance

KU10. Literary Devices: Familiarity with various literary devices such as metaphors, similes, symbolism, and imagery can help in understanding the nuances and deeper meanings of a text.

Generic Skills (GS)

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

GS1. read and interpret work instructions, machine drawings, reports and process documents

GS2. communicate the machining requirements to the seniors and other departments

GS3. communicate issues to the supervisor that occur during machining process

GS4. attentively listen and comprehend the information given by the master technician/team members

GS5. write reports related to production process in English/regional language

GS6. recognise a workplace problem and take suitable action

GS7. analyse and apply the information gathered from observation, experience, reasoning or communication to act efficiently

GS8. plan and organise work according to the work requirements

GS9. report to the supervisor or deal with a colleague individually, depending on the type of concern

GS10. complete the assigned tasks with minimum supervision

GS11. suggest improvements (if any) in current ways of working

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Develop and practice reading comprehension skills	**5**	**10**	**10**	**-**
PC1. Establish a clear reading goal, such as improving overall comprehension or focusing on a specific area, like understanding complex texts or enhancing speed reading.	1	2	2	-
PC2. Select reading materials that cater to your reading goals and interests, ensuring a balance between challenging and enjoyable texts.	2	3	3	-
PC3. Expand your vocabulary by learning new words and phrases from the texts you read.	1	3	3	-
PC4. Regularly assess your reading comprehension skills by taking quizzes, writing summaries, or discussing texts with others.	1	2	2	-
Develop analytical skills to break down complex texts into their core components	**5**	**10**	**10**	**-**
PC5. Analyze individual paragraphs within a text, identifying their main ideas and supporting details, as well as the relationships between them.	1	3	3	-
PC6. Create visual representations of the text's structure and key ideas using mind-mapping tools, which can help you identify relationships between different components and organize your thoughts.	1	2	2	-
PC7. Engage in critical thinking to challenge assumptions, evaluate evidence, and question the author's arguments or perspectives.	1	3	3	-
PC8. Analyze the results obtained from the Assessment	2	2	2	-
Enhance your written and verbal communication skills to clearly convey ideas, instructions	**5**	**10**	**10**	**-**
PC9. Develop active listening skills to understand others better and respond appropriately	1	2	2	-
PC10. Engage in reading various materials, such as books, articles, and reports, to improve your comprehension and writing skills.	1	3	3	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC11. Record your conversations or presentations and review them later to identify areas for improvement in your tone, clarity, or delivery	1	3	3	-
PC12. Maintain a growth mindset and be open to learning from your experiences, feedback, and mistakes.	2	2	2	-
NOS Total	**15**	**30**	**30**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N9839
NOS Name	English Language Skills
Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Generic
NSQF Level	4
Credits	3
Version	1.0
Last Reviewed Date	30/11/2023
Next Review Date	30/11/2026
NSQC Clearance Date	30/11/2023

DGT/VSQ/N0104: Employability Skills (120 Hours)

Description

This unit is about employability skills, Constitutional values, becoming a professional in the 21st Century, digital, financial, and legal literacy, diversity and Inclusion, English and communication skills, customer service, entrepreneurship, and apprenticeship, getting ready for jobs and career development.

Scope

The scope covers the following :

- Introduction to Employability Skills
- Constitutional values - Citizenship
- Becoming a Professional in the 21st Century
- Basic English Skills
- Career Development & Goal Setting
- Communication Skills
- Diversity & Inclusion
- Financial and Legal Literacy
- Essential Digital Skills
- Entrepreneurship
- Customer Service
- Getting ready for Apprenticeship & Jobs

Elements and Performance Criteria

Introduction to Employability Skills

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

PC1. understand the significance of employability skills in meeting the current job market requirement and future of work

PC2. identify and explore learning and employability relevant portals

PC3. research about the different industries, job market trends, latest skills required and the available opportunities

Constitutional values – Citizenship

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

PC4. recognize the significance of constitutional values, including civic rights and duties, citizenship, responsibility towards society etc. for personal growth and the nation's progress

PC5. follow personal values and ethics such as honesty, integrity, caring and respecting others, etc.

PC6. follow and promote environmentally sustainable practices

Becoming a Professional in the 21st Century

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

PC7. recognize the significance of 21st Century Skills for employment

PC8. practice the 21st Century Skills such as Self-Awareness, Behaviour Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn for continuous learning etc. in personal and professional life

PC9. adopt a continuous learning mindset for personal and professional development

Basic English Skills

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

PC10. use English as a medium of formal and informal communication while dealing with topics of everyday conversation in different contexts

PC11. speak over the phone in English, in an audible manner, using appropriate greetings, opening, and closing statements both on personal and work front

PC12. read and understand routine information, notes, instructions, mails, letters etc. written in English

PC13. write short messages, notes, letters, e-mails etc., using accurate English

Career Development & Goal Setting

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

PC14. identify career goals based on the skills, interests, knowledge, and personal attributes

PC15. prepare a career development plan with short- and long-term goals

Communication Skills

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

PC16. follow verbal and non-verbal communication etiquette while communicating in professional and public settings

PC17. use active listening techniques for effective communication

PC18. communicate in writing using appropriate style and format based on formal or informal requirements

PC19. work collaboratively with others in a team

Diversity & Inclusion

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

PC20. • ensure personal behaviour, conduct, and use appropriate communication by taking gender into • consideration

PC21. empathize with a PwD and aid a PwD, if asked

PC22. escalate any issues related to sexual harassment at the workplace in accordance with the POSH Act

Financial and Legal Literacy

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

PC23. identify and select reliable institutions for various financial products and services such as bank account, debit and credit cards, loans, insurance etc.

PC24. carry out offline and online financial transactions, safely and securely, using various methods and check the entries in the passbook

PC25. identify common components of salary and compute income, expenses, taxes, investments etc

PC26. identify relevant rights and laws and use legal aids to fight against legal exploitation

Essential Digital Skills

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

PC27. operate digital devices and use their features and applications securely and safely

PC28. carry out basic internet operations by connecting to the internet safely and securely, using the mobile data or other available networks through Bluetooth, Wi-Fi, etc.

PC29. display responsible online behaviour while using various social media platforms

PC30. create a personal email account, send and process received messages as per requirement

PC31. carry out basic procedures in documents, spreadsheets and presentations using respective and appropriate applications

PC32. utilize virtual collaboration tools to work effectively

Entrepreneurship

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

PC33. identify different types of Entrepreneurship and Enterprises

PC34. use research and networking skills to identify and assess opportunities for potential business

PC35. develop a business plan and a work model, considering the 4Ps of Marketing Product, Price, Place and Promotion

PC36. identify sources of funding, anticipate, and mitigate any financial/ legal hurdles for the potential business opportunity

Customer Service

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

PC37. identify different types of customers

PC38. identify and respond to customer requests and needs in a professional manner

PC39. use appropriate tools to collect customer feedback

PC40. follow appropriate hygiene and grooming standards

Getting ready for apprenticeship & Jobs

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

PC41. create a professional Curriculum vitae (Résumé)

PC42. search for suitable jobs using reliable offline and online sources such as Employment exchange, recruitment agencies, newspapers etc. and job portals, respectively

PC43. apply to identified job openings using offline /online methods as per requirement

PC44. answer questions politely, with clarity and confidence, during recruitment and selection

PC45. identify apprenticeship opportunities and register for it as per guidelines and requirements

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. need for employability skills

KU2. different learning and employability related portals

KU3. various constitutional and personal values

KU4. different environmentally sustainable practices and their importance

KU5. Twenty first (21st) century skills and their importance

KU6. how to use English language for effective verbal (face to face and telephonic) and written communication in formal and informal set up

KU7. importance of career development and setting long- and short-term goals

KU8. Do's and don'ts of effective communication

KU9. POSH Act

KU10. inclusivity and its importance

KU11. different types of disabilities and appropriate verbal and non-verbal communication and behaviour towards PwD

KU12. different types of financial institutes, products, and services

KU13. components of salary and how to compute income and expenditure

KU14. importance of maintaining safety and security in offline and online financial transactions

KU15. different legal rights and laws

KU16. different types of digital devices and the procedure to operate them safely and securely

KU17. how to create and operate an e- mail account

KU18. use applications such as word processors, spreadsheets etc.

KU19. different types of Enterprises and ways to identify business opportunities

KU20. types and needs of customers

KU21. how to apply for a job and prepare for an interview

KU22. apprenticeship scheme and the process of registering on apprenticeship portal

Generic Skills (GS)

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

GS1. read and write different types of documents/instructions/correspondence in English and other languages

GS2. communicate effectively using appropriate language in formal and informal settings

GS3. behave politely and appropriately with all to maintain effective work relationship

GS4. how to work in a virtual mode, using various technological platforms

GS5. perform calculations efficiently

GS6. solve problems effectively

GS7. pay attention to details

GS8. manage time efficiently

GS9. maintain hygiene and sanitization to avoid infection

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Introduction to Employability Skills	**1**	**1**	**-**	**-**
PC1. understand the significance of employability skills in meeting the current job market requirement and future of work	-	-	-	-
PC2. identify and explore learning and employability relevant portals	-	-	-	-
PC3. research about the different industries, job market trends, latest skills required and the available opportunities	-	-	-	-
Constitutional values – Citizenship	**2**	**1**	**-**	**-**
PC4. recognize the significance of constitutional values, including civic rights and duties, citizenship, responsibility towards society etc. for personal growth and the nation's progress	-	-	-	-
PC5. follow personal values and ethics such as honesty, integrity, caring and respecting others, etc.	-	-	-	-
PC6. follow and promote environmentally sustainable practices	-	-	-	-
Becoming a Professional in the 21st Century	**2**	**3**	**-**	**-**
PC7. recognize the significance of 21st Century Skills for employment	-	-	-	-
PC8. practice the 21st Century Skills such as Self-Awareness, Behaviour Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn for continuous learning etc. in personal and professional life	-	-	-	-
PC9. adopt a continuous learning mindset for personal and professional development	-	-	-	-
Basic English Skills	**2**	**3**	**-**	**-**

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC10. use English as a medium of formal and informal communication while dealing with topics of everyday conversation in different contexts	-	-	-	-
PC11. speak over the phone in English, in an audible manner, using appropriate greetings, opening, and closing statements both on personal and work front	-	-	-	-
PC12. read and understand routine information, notes, instructions, mails, letters etc. written in English	-	-	-	-
PC13. write short messages, notes, letters, e-mails etc., using accurate English	-	-	-	-
Career Development & Goal Setting	**1**	**2**	**-**	**-**
PC14. identify career goals based on the skills, interests, knowledge, and personal attributes	-	-	-	-
PC15. prepare a career development plan with short- and long-term goals	-	-	-	-
Communication Skills	**2**	**3**	**-**	**-**
PC16. follow verbal and non-verbal communication etiquette while communicating in professional and public settings	-	-	-	-
PC17. use active listening techniques for effective communication	-	-	-	-
PC18. communicate in writing using appropriate style and format based on formal or informal requirements	-	-	-	-
PC19. work collaboratively with others in a team	-	-	-	-
Diversity & Inclusion	**1**	**2**	**-**	**-**
PC20. • ensure personal behaviour, conduct, and use appropriate communication by taking gender into • consideration	-	-	-	-
PC21. empathize with a PwD and aid a PwD, if asked	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC22. escalate any issues related to sexual harassment at the workplace in accordance with the POSH Act	-	-	-	-
Financial and Legal Literacy	**2**	**3**	**-**	**-**
PC23. identify and select reliable institutions for various financial products and services such as bank account, debit and credit cards, loans, insurance etc.	-	-	-	-
PC24. carry out offline and online financial transactions, safely and securely, using various methods and check the entries in the passbook	-	-	-	-
PC25. identify common components of salary and compute income, expenses, taxes, investments etc	-	-	-	-
PC26. identify relevant rights and laws and use legal aids to fight against legal exploitation	-	-	-	-
Essential Digital Skills	**2**	**3**	**-**	**-**
PC27. operate digital devices and use their features and applications securely and safely	-	-	-	-
PC28. carry out basic internet operations by connecting to the internet safely and securely, using the mobile data or other available networks through Bluetooth, Wi-Fi, etc.	-	-	-	-
PC29. display responsible online behaviour while using various social media platforms	-	-	-	-
PC30. create a personal email account, send and process received messages as per requirement	-	-	-	-
PC31. carry out basic procedures in documents, spreadsheets and presentations using respective and appropriate applications	-	-	-	-
PC32. utilize virtual collaboration tools to work effectively	-	-	-	-
Entrepreneurship	**2**	**3**	**-**	**-**

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC33. identify different types of Entrepreneurship and Enterprises	-	-	-	-
PC34. use research and networking skills to identify and assess opportunities for potential business	-	-	-	-
PC35. develop a business plan and a work model, considering the 4Ps of Marketing Product, Price, Place and Promotion	-	-	-	-
PC36. identify sources of funding, anticipate, and mitigate any financial/ legal hurdles for the potential business opportunity	-	-	-	-
Customer Service	**1**	**2**	**-**	**-**
PC37. identify different types of customers	-	-	-	-
PC38. identify and respond to customer requests and needs in a professional manner	-	-	-	-
PC39. use appropriate tools to collect customer feedback	-	-	-	-
PC40. follow appropriate hygiene and grooming standards	-	-	-	-
Getting ready for apprenticeship & Jobs	**2**	**4**	**-**	**-**
PC41. create a professional Curriculum vitae (Résumé)	-	-	-	-
PC42. search for suitable jobs using reliable offline and online sources such as Employment exchange, recruitment agencies, newspapers etc. and job portals, respectively	-	-	-	-
PC43. apply to identified job openings using offline /online methods as per requirement	-	-	-	-
PC44. answer questions politely, with clarity and confidence, during recruitment and selection	-	-	-	-
PC45. identify apprenticeship opportunities and register for it as per guidelines and requirements	-	-	-	-
NOS Total	**20**	**30**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	DGT/VSQ/N0104
NOS Name	Employability Skills (120 Hours)
Sector	Cross Sectoral
Sub-Sector	Professional Skills
Occupation	Employability
NSQF Level	6
Credits	4
Version	1.0
Last Reviewed Date	30/11/2023
Next Review Date	30/11/2026
NSQC Clearance Date	30/11/2023

ASC/N1479: ICE Servicing

Description

This NOS is about to Perform ICE servicing involves maintenance, repair, and troubleshooting of internal combustion engines.

Scope

The scope covers the following :

- Conduct routine inspections of the engine.
- Check and maintain the Engine system.
- Utilize diagnostic tools and equipment to identify and troubleshoot.
- Maintain accurate records of maintenance, repairs, and inspections.

Elements and Performance Criteria

Conduct routine inspections of the engine

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

PC1. Inspect engine components for quality and completeness

PC2. Start the engine and listen for any unusual noises, such as knocks, ticks, or rough idling.

PC3. Utilize diagnostic tools and equipment to identify any fault codes or performance issues that may require further inspection or repair.

Check and maintain the Engine system

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

PC4. Perform routine visual inspections of the engine, checking for signs of wear, damage, or potential issues that may require maintenance or repair.

PC5. Replace engine oil and filters at recommended intervals to maintain proper lubrication, keep the engine clean, and prevent wear.

PC6. Inspect and replace air filters as needed to ensure proper airflow and fuel efficiency

PC7. Check and maintain the cooling system, including coolant levels, hoses, and radiator, to prevent overheating and ensure engine longevity.

PC8. Inspect and maintain fuel system components, such as fuel filters, fuel injectors, and fuel pumps, to ensure proper fuel delivery and engine performance

PC9. Utilize diagnostic tools and equipment to identify and troubleshoot engine-related issues, such as misfires, rough idling, or poor performance

PC10. check all the semi-precision mechanical, pneumatic, hydraulic and electrical parts in the auto components by using the correct methodology as indicated in the Work Instructions/SOPs

PC11. Inspect the exhaust system for leaks, damage, or corrosion, and address any issues to ensure proper emissions and engine performance.

Utilize diagnostic tools and equipment to identify and troubleshoot

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

PC12. Connect the appropriate diagnostic tools to the vehicle or machinery being examined

PC13. se the connected diagnostic tools to retrieve any stored error codes or data related to the issue.

PC14. Utilize the gathered data and test results to pinpoint the specific component or system causing the issue.

PC15. Perform the necessary repairs or replacements and retest the system to ensure the issue has been resolved.

Maintain accurate records of maintenance, repairs, and inspections

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

PC16. Standardize the formats and layouts of your records to make them easily readable and comparable across different time periods and equipment types

PC17. Conduct periodic reviews of your records to identify trends, patterns, or areas for improvement in your maintenance, repair, and inspection processes

PC18. Implement backup and version control measures to ensure that your records remain accessible and unaltered over time

PC19. Maintain accurate records of maintenance, repairs, and inspections to track the engine's history and ensure timely servicing for optimal performance and longevity.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. relevant standards and procedures followed in the company

KU2. various components and systems of a vehicle

KU3. various assembly operations and methods

KU4. the process flow of the assembly operations

KU5. SOP recommended by the manufacturer for using hand tools, measuring instruments and equipments required during the assembly process

KU6. Technical Knowledge: A strong understanding of the principles of internal combustion engines, their components, and their functions is crucial. This includes knowledge of engine types (such as diesel, gasoline, and rotary), fuel systems, ignition systems, cooling systems, and emission control systems

KU7. Mechanical Skills: Proficiency in using various hand and power tools, as well as the ability to disassemble, reassemble, and align engine components, is essential.

KU8. Electrical and Electronic Systems: Familiarity with electrical and electronic systems in ICEs, such as sensors, control modules, and wiring diagrams, is necessary for diagnosing and repairing issues.

KU9. Troubleshooting and Diagnostic Skills: The ability to identify and solve problems quickly and accurately is vital in ICE servicing. This involves understanding common.

Generic Skills (GS)

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

GS1. read and interpret drawings, work instructions, equipment manuals and process documents

GS2. communicate the assembly process requirements to the lead technician and co-workers

GS3. communicate issues to the supervisor that occur during assembling process

GS4. attentively listen and comprehend the information given by the lead technician/team members

GS5. write any work related information in English/regional language

GS6. recognise a workplace problem and take suitable action

GS7. analyse and apply the information gathered from observation, experience, reasoning or communication to act efficiently

GS8. plan and organise work according to the principles of 5S

GS9. complete the assigned tasks with minimum supervision

GS10. report to the supervisor or deal with a colleague individually, depending on the type of concern

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Conduct routine inspections of the engine	**3**	**6**	**6**	**-**
PC1. Inspect engine components for quality and completeness	1	2	2	-
PC2. Start the engine and listen for any unusual noises, such as knocks, ticks, or rough idling.	1	2	2	-
PC3. Utilize diagnostic tools and equipment to identify any fault codes or performance issues that may require further inspection or repair.	1	2	2	-
Check and maintain the Engine system	**5**	**14**	**14**	**-**
PC4. Perform routine visual inspections of the engine, checking for signs of wear, damage, or potential issues that may require maintenance or repair.	1	2	2	-
PC5. Replace engine oil and filters at recommended intervals to maintain proper lubrication, keep the engine clean, and prevent wear.	1	2	2	-
PC6. Inspect and replace air filters as needed to ensure proper airflow and fuel efficiency	1	2	2	-
PC7. Check and maintain the cooling system, including coolant levels, hoses, and radiator, to prevent overheating and ensure engine longevity.	1	-	-	-
PC8. Inspect and maintain fuel system components, such as fuel filters, fuel injectors, and fuel pumps, to ensure proper fuel delivery and engine performance	1	2	2	-
PC9. Utilize diagnostic tools and equipment to identify and troubleshoot engine-related issues, such as misfires, rough idling, or poor performance	-	2	2	-
PC10. check all the semi-precision mechanical, pneumatic, hydraulic and electrical parts in the auto components by using the correct methodology as indicated in the Work Instructions/SOPs	-	2	2	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC11. Inspect the exhaust system for leaks, damage, or corrosion, and address any issues to ensure proper emissions and engine performance.	-	2	2	-
Utilize diagnostic tools and equipment to identify and troubleshoot	**5**	**5**	**5**	**-**
PC12. Connect the appropriate diagnostic tools to the vehicle or machinery being examined	1	1	1	-
PC13. se the connected diagnostic tools to retrieve any stored error codes or data related to the issue.	1	2	2	-
PC14. Utilize the gathered data and test results to pinpoint the specific component or system causing the issue.	2	1	1	-
PC15. Perform the necessary repairs or replacements and retest the system to ensure the issue has been resolved.	1	1	1	-
Maintain accurate records of maintenance, repairs, and inspections	**2**	**5**	**5**	**-**
PC16. Standardize the formats and layouts of your records to make them easily readable and comparable across different time periods and equipment types	1	2	2	-
PC17. Conduct periodic reviews of your records to identify trends, patterns, or areas for improvement in your maintenance, repair, and inspection processes	1	1	1	-
PC18. Implement backup and version control measures to ensure that your records remain accessible and unaltered over time	-	1	1	-
PC19. Maintain accurate records of maintenance, repairs, and inspections to track the engine's history and ensure timely servicing for optimal performance and longevity.	-	1	1	-
NOS Total	**15**	**30**	**30**	**-**

Qualification Pack

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N1479
NOS Name	ICE Servicing
Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Technical Service & Repair
NSQF Level	4
Credits	3
Version	1.0
Last Reviewed Date	30/11/2023
Next Review Date	30/11/2026
NSQC Clearance Date	30/11/2023

ASC/N1480: EV Servicing

Description

This NOS is about Perform EV servicing involves maintenance, repair, and troubleshooting of electric vehicles.

Scope

The scope covers the following :

- Inspect and maintain electric motor components.
- Utilize diagnostic tools and equipment to identify and troubleshoot electric vehicle-related issues.
- Perform necessary repairs or replacements on electric vehicle components,
- Maintain accurate records of maintenance, repairs, and inspections.

Elements and Performance Criteria

Inspect and maintain electric motor components

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

PC1. Conduct a thorough visual inspection of the electric motor, checking for signs of wear, damage, or potential issues. This includes examining the exterior housing, ventilation, and cooling systems.

PC2. Apply appropriate lubricants to moving parts, such as bearings and brushes, to reduce friction, wear, and heat generation, thus extending the motor's lifespan.

PC3. Monitor and analyze motor vibrations using specialized equipment to detect potential issues.

Utilize diagnostic tools and equipment to identify and troubleshoot electric vehicle-related issues.

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

PC4. Adopt a systematic approach to troubleshooting, starting with a visual inspection, followed by checking for basic connections and functionality, and then moving on to more advanced diagnostics as needed.

PC5. Analyze diagnostic data obtained from the vehicle's onboard systems, such as fault codes, voltage readings, and current measurements, to identify potential issues and their causes.

PC6. Monitor the communication between various vehicle systems, such as the battery management system, power electronics, and vehicle control unit, to identify any faults or discrepancies in the data exchange.

PC7. Compare the gathered diagnostic data with manufacturer guidelines, service manuals, and industry best practices to help identify the root cause of the issue.

PC8. Maintain accurate records of the diagnostic process, including the symptoms observed, diagnostic data, and repairs carried out, for future reference and to ensure a comprehensive understanding of the vehicle's history.

PC9. inspect and mark the defects if any, such as in paint, dents, grooves, cracks, rough edges etc. on the physical body of the auto component

PC10. check all the semi-precision mechanical, pneumatic, hydraulic and electrical parts in the auto components by using the correct methodology as indicated in the Work Instructions/SOPs

PC11. check adhesion of roof-lining, insulation material, roof-rail etc. of the auto component

Perform necessary repairs or replacements on electric vehicle components.

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

PC12. Utilize diagnostic tools and equipment to identify the specific component or system that requires repair or replacement.

PC13. Determine the severity of the damage or wear on the affected component.

PC14. Ensure you have the appropriate tools, equipment, and replacement parts required for the specific repair or replacement task.

PC15. Maintain accurate records of the repair or replacement, including the date, component details, and any relevant observations or findings.

Maintain accurate records of maintenance, repairs, and inspections.

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

PC16. Use clear and concise language when documenting information, ensuring that others can easily understand the details and context of the recorded events.

PC17. Standardize the formats and layouts of your records to make them easily readable and comparable across different time periods and electric vehicle types.

PC18. Conduct periodic reviews of your records to identify trends, patterns, or areas for improvement in your EV maintenance, repair, and inspection processes.

PC19. Store records securely and organize them in a manner that allows for easy retrieval and reference when needed.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. relevant standards and procedures followed in the company

KU2. various components and systems of a vehicle

KU3. various assembly operations and methods

KU4. the process flow of the assembly operations

KU5. SOP recommended by the manufacturer for using hand tools, measuring instruments and equipments required during the assembly process

KU6. Electrical Systems: A strong understanding of electrical systems in EVs, including high-voltage systems, batteries, and charging infrastructure.

KU7. Electronics: Familiarity with various electronic components, control systems, and software used in electric vehicles.

KU8. Mechanical Knowledge: Knowledge of traditional automotive mechanics is essential, as EVs still have several conventional components like brakes, suspension, and steering systems.

KU9. Battery Technology: In-depth understanding of battery chemistry, management, and safety procedures is vital for handling and maintaining EV batteries.

KU10. Diagnostic Tools: Proficiency in using diagnostic tools and equipment to identify and resolve issues in electric vehicles.

KU11. Environmental Impact: Knowledge of the environmental impact of electric vehicles and related technologies, as well as understanding the importance of sustainability in the automotive industry.

Generic Skills (GS)

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

GS1. read and interpret drawings, work instructions, equipment manuals and process documents

GS2. communicate the assembly process requirements to the lead technician and co-workers

GS3. communicate issues to the supervisor that occur during assembling process

GS4. attentively listen and comprehend the information given by the lead technician/team members

GS5. write any work related information in English/regional language

GS6. recognise a workplace problem and take suitable action

GS7. analyse and apply the information gathered from observation, experience, reasoning or communication to act efficiently

GS8. plan and organise work according to the principles of 5S

GS9. complete the assigned tasks with minimum supervision

GS10. report to the supervisor or deal with a colleague individually, depending on the type of concern

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Inspect and maintain electric motor components	**3**	**6**	**6**	**-**
PC1. Conduct a thorough visual inspection of the electric motor, checking for signs of wear, damage, or potential issues. This includes examining the exterior housing, ventilation, and cooling systems.	1	2	2	-
PC2. Apply appropriate lubricants to moving parts, such as bearings and brushes, to reduce friction, wear, and heat generation, thus extending the motor's lifespan.	1	2	2	-
PC3. Monitor and analyze motor vibrations using specialized equipment to detect potential issues.	1	2	2	-
Utilize diagnostic tools and equipment to identify and troubleshoot electric vehicle-related issues.	**5**	**14**	**14**	**-**
PC4. Adopt a systematic approach to troubleshooting, starting with a visual inspection, followed by checking for basic connections and functionality, and then moving on to more advanced diagnostics as needed.	1	2	2	-
PC5. Analyze diagnostic data obtained from the vehicle's onboard systems, such as fault codes, voltage readings, and current measurements, to identify potential issues and their causes.	1	2	2	-
PC6. Monitor the communication between various vehicle systems, such as the battery management system, power electronics, and vehicle control unit, to identify any faults or discrepancies in the data exchange.	1	2	2	-
PC7. Compare the gathered diagnostic data with manufacturer guidelines, service manuals, and industry best practices to help identify the root cause of the issue.	1	-	-	-
PC8. Maintain accurate records of the diagnostic process, including the symptoms observed, diagnostic data, and repairs carried out, for future reference and to ensure a comprehensive understanding of the vehicle's history.	1	2	2	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC9. inspect and mark the defects if any, such as in paint, dents, grooves, cracks, rough edges etc. on the physical body of the auto component	-	2	2	-
PC10. check all the semi-precision mechanical, pneumatic, hydraulic and electrical parts in the auto components by using the correct methodology as indicated in the Work Instructions/SOPs	-	2	2	-
PC11. check adhesion of roof-lining, insulation material, roof-rail etc. of the auto component	-	2	2	-
Perform necessary repairs or replacements on electric vehicle components.	**5**	**5**	**5**	**-**
PC12. Utilize diagnostic tools and equipment to identify the specific component or system that requires repair or replacement.	1	1	1	-
PC13. Determine the severity of the damage or wear on the affected component.	2	1	1	-
PC14. Ensure you have the appropriate tools, equipment, and replacement parts required for the specific repair or replacement task.	1	2	2	-
PC15. Maintain accurate records of the repair or replacement, including the date, component details, and any relevant observations or findings.	1	1	1	-
Maintain accurate records of maintenance, repairs, and inspections.	**2**	**5**	**5**	**-**
PC16. Use clear and concise language when documenting information, ensuring that others can easily understand the details and context of the recorded events.	1	2	2	-
PC17. Standardize the formats and layouts of your records to make them easily readable and comparable across different time periods and electric vehicle types.	1	1	1	-
PC18. Conduct periodic reviews of your records to identify trends, patterns, or areas for improvement in your EV maintenance, repair, and inspection processes.	-	1	1	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC19. Store records securely and organize them in a manner that allows for easy retrieval and reference when needed.	-	1	1	-
NOS Total	**15**	**30**	**30**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N1480
NOS Name	EV Servicing
Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Technical Service & Repair
NSQF Level	4
Credits	3
Version	1.0
Last Reviewed Date	30/11/2023
Next Review Date	30/11/2026
NSQC Clearance Date	30/11/2023

ASC/N8380: Battery Management System- BMS

Description

This NOS is about to Carry out proper implementation and utilization of a BMS

Scope

The scope covers the following :

- Calibrate and configure the BMS according to the EV's specific requirements.
- Implement temperature management strategies using the BMS.
- Utilize the BMS to manage the charging process.
- Assess the state-of-health and state-of-function of the battery pack using the BMS data.

Elements and Performance Criteria

Calibrate and configure the BMS according to the EV's specific requirements.

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

PC1. Configure the charging settings for the BMS, including maximum charging voltage, current, and charging rates.

PC2. Set the discharging parameters for the BMS, such as maximum discharge current, voltage limits, and cut-off levels.

PC3. Configure the BMS to balance the individual cells within the battery pack, preventing overcharging or undercharging of specific cells.

Implement temperature management strategies using the BMS.

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

PC4. Integrate temperature sensors within the battery pack and connect them to the BMS.

PC5. Establish temperature thresholds for optimal battery performance, taking into account the battery chemistry and operating conditions.

PC6. Configure the BMS with control algorithms that respond to temperature variations.

PC7. Continuously monitor the battery pack's temperature and overall health using the BMS data.

Utilize the BMS to manage the charging process

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

PC8. Configure the BMS to set charging limits based on the EV's battery capacity and specific requirements.

PC9. Use the BMS to monitor and control the charging rate, ensuring that it stays within the optimal range for the EV's battery.

PC10. Implement cell-balancing features within the BMS to equalize the charge levels among individual battery cells.

PC11. Integrate the BMS with smart charging technologies, such as vehicle-to-grid (V2G) systems or time-of-use (TOU) tariffs, to optimize charging based on energy costs and grid demand.

Assess the state-of-health and state-of-function of the battery pack using the BMS data.

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

PC12. Gather BMS data regularly, including information on the battery's state-of-charge (SOC), voltage, current, temperature, and other relevant parameters.

PC13. Review past BMS data to identify trends, patterns, or anomalies in the battery's performance.

PC14. Regularly track changes in the SOH and SOF values over time to identify any signs of degradation or capacity loss.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. relevant standards and procedures followed in the company.

KU2. various components and systems of an Electric vehicle

KU3. various assembly operations and methods

KU4. Technical Knowledge: A strong understanding of the BMS hardware and software components, as well as the underlying principles of automation, control systems, and networking, is crucial.

KU5. Energy Management: Familiarity with energy consumption patterns, energy-saving techniques, and the ability to optimize energy usage within a building is essential for successful BMS implementation.

KU6. HVAC Systems: Understanding of HVAC systems, including heating, ventilation, and air conditioning, is vital since these systems are often controlled by a BMS.

KU7. Building Automation Protocols: Knowledge of various automation protocols, such as BACnet, LonWorks, and Modbus, is necessary for seamless communication between different devices and systems within the BMS.

KU8. Data Analysis: The ability to collect, analyze, and interpret data from the BMS is crucial for making informed decisions about system performance, energy efficiency, and maintenance requirements.

Generic Skills (GS)

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

GS1. read and interpret drawings, work instructions, equipment manuals and process documents

GS2. communicate the assembly process requirements to the lead technician and co-workers

GS3. communicate issues to the supervisor that occur during assembling process

GS4. attentively listen and comprehend the information given by the lead technician/team members

GS5. write any work related information in English/regional language

GS6. recognise a workplace problem and take suitable action

GS7. analyse and apply the information gathered from observation, experience, reasoning or communication to act efficiently

GS8. plan and organise work according to the principles of 5S

GS9. complete the assigned tasks with minimum supervision

GS10. report to the supervisor or deal with a colleague individually, depending on the type of concern

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Calibrate and configure the BMS according to the EV's specific requirements.	**3**	**6**	**6**	**-**
PC1. Configure the charging settings for the BMS, including maximum charging voltage, current, and charging rates.	1	2	2	-
PC2. Set the discharging parameters for the BMS, such as maximum discharge current, voltage limits, and cut-off levels.	1	2	2	-
PC3. Configure the BMS to balance the individual cells within the battery pack, preventing overcharging or undercharging of specific cells.	1	2	2	-
Implement temperature management strategies using the BMS.	**5**	**12**	**12**	**-**
PC4. Integrate temperature sensors within the battery pack and connect them to the BMS.	1	3	3	-
PC5. Establish temperature thresholds for optimal battery performance, taking into account the battery chemistry and operating conditions.	1	3	3	-
PC6. Configure the BMS with control algorithms that respond to temperature variations.	1	3	3	-
PC7. Continuously monitor the battery pack's temperature and overall health using the BMS data.	2	3	3	-
Utilize the BMS to manage the charging process	**5**	**8**	**8**	**-**
PC8. Configure the BMS to set charging limits based on the EV's battery capacity and specific requirements.	1	2	2	-
PC9. Use the BMS to monitor and control the charging rate, ensuring that it stays within the optimal range for the EV's battery.	2	2	2	-
PC10. Implement cell-balancing features within the BMS to equalize the charge levels among individual battery cells.	1	2	2	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC11. Integrate the BMS with smart charging technologies, such as vehicle-to-grid (V2G) systems or time-of-use (TOU) tariffs, to optimize charging based on energy costs and grid demand.	1	2	2	-
Assess the state-of-health and state-of-function of the battery pack using the BMS data.	**2**	**4**	**4**	**-**
PC12. Gather BMS data regularly, including information on the battery's state-of-charge (SOC), voltage, current, temperature, and other relevant parameters.	1	2	2	-
PC13. Review past BMS data to identify trends, patterns, or anomalies in the battery's performance.	1	1	1	-
PC14. Regularly track changes in the SOH and SOF values over time to identify any signs of degradation or capacity loss.	-	1	1	-
NOS Total	**15**	**30**	**30**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N8380
NOS Name	Battery Management System- BMS
Sector	Automotive
Sub-Sector	Research & Development
Occupation	Automotive Product Development
NSQF Level	4
Credits	3
Version	1.0
Last Reviewed Date	30/11/2023
Next Review Date	30/11/2026
NSQC Clearance Date	30/11/2023

ASC/N8381: Electric Motors

Description

This NOS is about to Developing electric motors with improved power output to meet the demands of Electric Vehicle.

Scope

The scope covers the following :

- Utilize advanced design techniques and software tools to optimize the electric motor's design.
- Design and implement advanced motor control systems.
- Perform extensive testing and validation of the developed electric motor.

Elements and Performance Criteria

Utilize advanced design techniques and software tools to optimize the electric motor's design.

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

PC1. Create a comprehensive 3D model of the electric motor, incorporating all relevant components, such as the stator, rotor, windings, and cooling systems

PC2. Investigate and select advanced materials for motor components, such as magnets, windings, and insulation, to enhance performance and durability.

PC3. Conduct sensitivity analyses to understand the impact of design parameters on the electric motor's performance.

Design and implement advanced motor control systems

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

PC4. Identify the specific performance requirements, constraints, and operating conditions of the electric motor system.

PC5. Design a suitable control strategy that can effectively manage the motor's performance under various operating conditions.

PC6. Develop control algorithms that can accurately sense and respond to the motor's operating conditions.

PC7. Integrate the developed control system with the electric motor and perform extensive testing to validate its performance

Perform extensive testing and validation of the developed electric motor.

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

PC8. Set up the necessary test equipment and facilities to conduct the tests, which may include load banks, dynamometers, environmental chambers, and data acquisition systems.

PC9. Perform the planned tests on the developed electric motor, carefully monitoring and recording the motor's performance, efficiency, and other relevant parameters throughout the testing process.

PC10. Identify any faults or issues that may arise during testing, and diagnose their root causes and Develop and implement corrective actions to address any issues identified during testing.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. relevant standards and procedures followed in the company

KU2. various components and systems of an electric vehicle

KU3. various assembly operations and methods

KU4. the process flow of the assembly operations

KU5. Electrical Engineering: A strong foundation in electrical engineering principles is essential for designing and analyzing electric motors. This includes understanding concepts like electromagnetism, circuit analysis, and power electronics.

KU6. Motor Design and Control: Knowledge of various types of electric motors (e.g., induction motors, permanent magnet motors) and their design considerations is crucial. Understanding motor control techniques, such as field-oriented control and sensorless control, is also important for optimizing motor performance.

KU7. Material Science: Understanding the properties of materials used in electric motor components, such as magnets, copper windings, and insulators, is vital for improving power output and efficiency.

KU8. Thermal Management: Electric motors generate heat during operation. Knowledge of heat transfer and cooling techniques is essential for ensuring the motor's reliability and longevity.

KU9. Energy Storage and Conversion: Familiarity with battery technologies and energy conversion systems (e.g., power inverters, DC-DC converters) is necessary for optimizing the overall electric vehicle powertrain.

KU10. System Integration: Understanding how electric motors interact with other vehicle systems, such as the power electronics, battery management system, and vehicle control units, is essential for developing a holistic electric vehicle powertrain solution.

Generic Skills (GS)

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

GS1. read and interpret drawings, work instructions, equipment manuals and process documents

GS2. communicate the assembly process requirements to the lead technician and co-workers

GS3. communicate issues to the supervisor that occur during assembling process

GS4. attentively listen and comprehend the information given by the lead technician/team members

GS5. write any work related information in English/regional language

GS6. recognise a workplace problem and take suitable action

GS7. analyse and apply the information gathered from observation, experience, reasoning or communication to act efficiently

GS8. plan and organise work according to the principles of 5S

GS9. complete the assigned tasks with minimum supervision

GS10. report to the supervisor or deal with a colleague individually, depending on the type of concern

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Utilize advanced design techniques and software tools to optimize the electric motor's design.	**5**	**10**	**10**	**-**
PC1. Create a comprehensive 3D model of the electric motor, incorporating all relevant components, such as the stator, rotor, windings, and cooling systems	1	2	2	-
PC2. Investigate and select advanced materials for motor components, such as magnets, windings, and insulation, to enhance performance and durability.	2	4	4	-
PC3. Conduct sensitivity analyses to understand the impact of design parameters on the electric motor's performance.	2	4	4	-
Design and implement advanced motor control systems	**5**	**10**	**10**	**-**
PC4. Identify the specific performance requirements, constraints, and operating conditions of the electric motor system.	1	2	2	-
PC5. Design a suitable control strategy that can effectively manage the motor's performance under various operating conditions.	2	3	3	-
PC6. Develop control algorithms that can accurately sense and respond to the motor's operating conditions.	1	2	2	-
PC7. Integrate the developed control system with the electric motor and perform extensive testing to validate its performance	1	3	3	-
Perform extensive testing and validation of the developed electric motor.	**5**	**10**	**10**	**-**
PC8. Set up the necessary test equipment and facilities to conduct the tests, which may include load banks, dynamometers, environmental chambers, and data acquisition systems.	1	2	2	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC9. Perform the planned tests on the developed electric motor, carefully monitoring and recording the motor's performance, efficiency, and other relevant parameters throughout the testing process.	2	4	4	-
PC10. Identify any faults or issues that may arise during testing, and diagnose their root causes and Develop and implement corrective actions to address any issues identified during testing.	2	4	4	-
NOS Total	**15**	**30**	**30**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N8381
NOS Name	Electric Motors
Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Automotive Product Development
NSQF Level	4
Credits	3
Version	1.0
Last Reviewed Date	30/11/2023
Next Review Date	30/11/2026
NSQC Clearance Date	30/11/2023

Assessment Guidelines and Assessment Weightage

Assessment Guidelines

Assessment Plan:

1. Components of Assessment: - Each subject will be assessed in three components: Theory (20% weightage), Practical (40% weightage), and On-job Training (OJT, 40% weightage).

2. Passing Parameters: - To pass the semester, students must meet both the assessment parameters given below.

Parameter 1 - Weighted Semester Score: - Students must achieve a minimum of 60% in the weighted average score across all three components (Theory, Practical, and OJT) for each subject.

Parameter 2 - Individual Component Score: - Students need to score at least 40% in each individual component (Theory, Practical, and OJT) of every subject.

Mandatory Note: This qualification can be offered as part of a Diploma program, in line with the 39th NSQC, ASDC Diploma (Diploma in Manufacturing Technology) approval. However, achieving 40 credits in a year is mandatory for progression within the Diploma course. Therefore, it is required to select at least one

optional NOS in every semester to meet this requirement.

Minimum Aggregate Passing % at QP Level : 40

(**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/N3126.Basic Welding	20	40	40	-	100	15
ASC/N3127.Advance Welding	20	40	40	-	100	15
ASC/N3128.Fabrication	20	40	40	-	100	15
ASC/N9837.Applied Physics	15	30	30	-	75	5
ASC/N6459.Manufacturing Skills	20	40	40	-	100	15
ASC/N6315.Quality Management	20	40	40	-	100	15
ASC/N8379.Robotics	20	40	40	-	100	10
ASC/N9839.English Language Skills	15	30	30	-	75	5
DGT/VSQ/N0104.Employability Skills (120 Hours)	20	30	-	-	50	5
Total	**170**	**330**	**300**	**-**	**800**	**100**

Optional: 1 Semester 3: ICE Servicing

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
ASC/N1479.ICE Servicing	15	30	30	-	75	10

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
Total	**15**	**30**	**30**	**-**	**75**	**10**

Optional: 2 Semester 3: EV Servicing

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
ASC/N1480.EV Servicing	15	30	30	-	75	10
Total	**15**	**30**	**30**	**-**	**75**	**10**

Optional: 3 Semester 4: Battery Management System- BMS

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
ASC/N8380.Battery Management System-BMS	15	30	30	-	75	10
Total	**15**	**30**	**30**	**-**	**75**	**10**

Optional: 4 Semester 4: Electric Motors

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
ASC/N8381.Electric Motors	15	30	30	-	75	10
Total	**15**	**30**	**30**	**-**	**75**	**10**

Acronyms

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

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.