Qualification Pack

Automotive Production Equipment Design Engineer

QP Code: ASC/Q6405

Version: 2.0

NSQF Level: 5

Automotive Skills Development Council || 153, Gr Floor, Okhla Industrial Area, Phase - III, Leela Building
New Delhi - 110020

Contents

ASC/Q6405: Automotive Production Equipment Design Engineer

Brief Job Description

The individual at this job is responsible for design details of the equipment- mechanism, fixtures, tools, gauges and other instruments for manufacturing & measuring the quality standards of the production process.

Personal Attributes

The person should work independently and be judicious in making decisions pertaining to one's area of work. The individual should be result-oriented. The individual should also be able to demonstrate skills for information order, imagination, oral expression, analytical approach, deductive reasoning and comprehension.

Applicable National Occupational Standards (NOS)

Compulsory NOS:

1. ASC/N9810: Manage work and resources (Manufacturing)
2. ASC/N9812: Interact effectively with team, customers and others
3. ASC/N6413: Design fixtures, workstation and their mechanisms
4. ASC/N6422: Release the drawings and manage the documentation for engineering change
5. ASC/N6811: Select and operate 3D Printing machine for product generation

Qualification Pack (QP) Parameters

Sector	Automotive
Sub-Sector	Research & Development
Occupation	Automotive Product Designing
Country	India
NSQF Level	5
Aligned to NCO/ISCO/ISIC Code	NCO-2015/2144.0301

Minimum Educational Qualification & Experience	3 years Diploma (Industrial/Production/Mechanical Engineer/Tool Design) from a recognized body (after class 12th) with 1 Year of relevant experience OR B.E./B.Tech (Mechanical/Automobile/Industrial/Production)
Minimum Level of Education for Training in School	
Pre-Requisite License or Training	NA
Minimum Job Entry Age	23 Years
Last Reviewed On	29/07/2021
Next Review Date	29/07/2026
NSQC Approval Date	29/07/2021
Version	2.0

ASC/N9810: Manage work and resources (Manufacturing)

Description

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

Scope

The scope covers the following :

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

Elements and Performance Criteria

Maintain safe and secure working environment

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

PC1. identify hazardous activities and the possible causes of risks or accidents in the workplace

PC2. implement safe working practices for dealing with hazards to ensure safety of self and others

PC3. conduct regular checks of the machines with support of the maintenance team to identify potential hazards

PC4. ensure that all the tools/equipment/fasteners/spare parts are arranged as per specifications/utility into proper trays, cabinets, lockers as mentioned in the 5S guidelines/work instructions

PC5. organise safety drills or training sessions to create awareness amongst others on the identified risks and safety practices

PC6. fill daily check sheet to report improvements done and risks identified

PC7. ensure that relevant safety boards/signs are placed on the shop floor for the safety of self and others

PC8. report any identified breaches in health, safety and security policies and procedures to the designated person

Maintain Health and Hygiene

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

PC9. ensure workplace, equipment, restrooms etc. are sanitized regularly

PC10. ensure team is aware about hygiene and sanitation regulations and following them on the shop floor

PC11. ensure availability of running water, hand wash and alcohol-based sanitizers at the workplace

PC12. report advanced hygiene and sanitation issues to appropriate authority

PC13. follow stress and anxiety management techniques and support employees to cope with stress, anxiety etc

PC14. wear and dispose PPEs regularly and appropriately

Effective waste management practices

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

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

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

Material/energy conservation practices

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

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

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

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

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

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. organisation procedures for health, safety and security, individual role and responsibilities in this context

KU2. the organisation's emergency procedures for different emergency situations and the importance of following the same

KU3. evacuation procedures for workers and visitors

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

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

KU6. various types of fire extinguisher

KU7. various types of safety signs and their meaning

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

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

KU10. the various materials used and their storage norms

KU11. importance of efficient utilisation of material and water

KU12. basics of electricity and prevalent energy efficient devices

KU13. common practices of conserving electricity

KU14. common sources and ways to minimize pollution

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

KU16. waste management techniques

KU17. significance of greening

Generic Skills (GS)

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

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

Assessment Criteria

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

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

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N9810
NOS Name	Manage work and resources (Manufacturing)
Sector	Automotive
Sub-Sector	Generic
Occupation	Generic
NSQF Level	5
Credits	TBD
Version	1.0
Last Reviewed Date	29/07/2021
Next Review Date	29/07/2026
NSQC Clearance Date	29/07/2021

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

Description

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

Scope

The scope covers the following :

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

Elements and Performance Criteria

Communicate effectively with team members

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

PC1. implement ways to share information with team members in line with organisational requirements

PC2. ensure that work requirements are clearly communicated to the team members through all means including face-to-face, telephonic and written

PC3. manage and co-ordinate with team members to integrate work as per requirements

PC4. work in a way that show respect for all team members and customers

PC5. carry out commitments made to team members and let them know in good time if there is any discrepancy with reasons

PC6. resolve conflicts within the team members at work to achieve smooth workflow

PC7. guide the team members to follow the organisation's policies and procedures

PC8. ensure team goals are given preference over individual goals

PC9. respect personal space of colleagues and customers

Interact with superiors

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

PC10. report progress on job allocated and team performance to the superiors

PC11. escalate problems to superiors that cannot be handled

PC12. train the team members to report completed work and receive feedback on work done

PC13. encourage team members to rectify errors as per feedback and minimize mistakes in future

Respect gender and ability differences

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

PC14. ensure team shows sensitivity towards all genders and PwD

PC15. adjust communication styles to reflect gender sensitivity and sensitivity towards person with disability

PC16. help PwD team members to overcome the challenges, if asked

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

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

Generic Skills (GS)

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

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

Assessment Criteria

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

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

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N9812
NOS Name	Interact effectively with team, customers and others
Sector	Automotive
Sub-Sector	Generic
Occupation	Generic
NSQF Level	5
Credits	TBD
Version	1.0
Last Reviewed Date	29/07/2021
Next Review Date	29/07/2026
NSQC Clearance Date	29/07/2021

ASC/N6413: Design fixtures, workstation and their mechanisms

Description

This NOS is about designing the new equipment in coordination with the Process Designer, manager and Tool Room agency.

Scope

The scope covers the following :

- Prepare the drawings of new equipment
- Design the mechanism, Layout development & detail illustration

Elements and Performance Criteria

Prepare the drawings of new equipment

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

PC1. analyze & perform the apparatus for manufacturing of new equipment such as workstation, mechanisms, gauge, fixtures & associated parts

PC2. ensure the dimensions for the new equipment based on the process requirement, space constraints, and auxiliary main equipment selected for the process by the process engineer

PC3. prepare the drawings for the required equipment using CAD software

PC4. share the drawings for the new equipment to the in-house tool room or third-party agency whichever applicable for preview & later for fabrication

Design the mechanism, Layout development & detail illustration

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

PC5. use the equipment prepared above for process and identify the sequence of equipment operation

PC6. determine the mechanism of working for the equipment based on the sequence of operations and the manufactured product

PC7. use simulation software for demonstrating the equipment operation and review the drawings, if required

PC8. verify the operation sequence program in consultation with the process engineer, in case of robotics/automation application for equipment functioning

PC9. ensure the outline, dimensions and other details for selected equipment to be used such as motors, sensors, automation parts, etc. for layout preparation

PC10. perform the repetition of the above process till the final equipment dimensions, profile, mechanism of operation etc. are finalized

PC11. use outside tool room agency if required, in consultation with Process Designer/manager for the design, and manufacture of tools, fixtures. Transfer necessary layout & other information to such agency

PC12. verify that typical allowances for trimming, shrinkage and warping, etc. based on past experience of the metal forming process

PC13. inform the in-house tool room or third-party agency for reviewing the complete equipment profile, dimensions and accordingly if required update the drawings after finalizing the above parameters

PC14. ensure proper use of GD&T requirements for the above processes

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. company manufacturing processes & the equipment in use

KU2. sequence of operations for each process

KU3. type of automotive systems being used for the process

KU4. CAD software and GD&T

KU5. problem solving techniques -TOPS 8D, 7 QC tools etc.

KU6. trouble shooting/fault finding in pneumatic, hydraulic, electrical control system elements

Generic Skills (GS)

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

GS1. communicate effectively at the workplace

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

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

GS4. recognise a workplace problem and take suitable action

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

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

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

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Prepare the drawings of new equipment	12	18	-	10
PC1. analyze & perform the apparatus for manufacturing of new equipment such as workstation, mechanisms, gauge, fixtures & associated parts	4	8	-	3
PC2. ensure the dimensions for the new equipment based on the process requirement, space constraints, and auxiliary main equipment selected for the process by the process engineer	4	4	-	3
PC3. prepare the drawings for the required equipment using CAD software	3	4	-	2
PC4. share the drawings for the new equipment to the in-house tool room or third-party agency whichever applicable for preview & later for fabrication	1	2	-	2
Design the mechanism, Layout development & detail illustration	18	32	-	10
PC5. use the equipment prepared above for process and identify the sequence of equipment operation	1	4	-	2
PC6. determine the mechanism of working for the equipment based on the sequence of operations and the manufactured product	2	4	-	1
PC7. use simulation software for demonstrating the equipment operation and review the drawings, if required	-	5	-	2
PC8. verify the operation sequence program in consultation with the process engineer, in case of robotics/automation application for equipment functioning	1	4	-	2
PC9. ensure the outline, dimensions and other details for selected equipment to be used such as motors, sensors, automation parts, etc. for layout preparation	3	3	-	1
PC10. perform the repetition of the above process till the final equipment dimensions, profile, mechanism of operation etc. are finalized	2	4	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC11. use outside tool room agency if required, in consultation with Process Designer/manager for the design, and manufacture of tools, fixtures. Transfer necessary layout & other information to such agency	3	3	-	1
PC12. verify that typical allowances for trimming, shrinkage and warping, etc. based on past experience of the metal forming process	2	-	-	-
PC13. inform the in-house tool room or third-party agency for reviewing the complete equipment profile, dimensions and accordingly if required update the drawings after finalizing the above parameters	2	3	-	1
PC14. ensure proper use of GD&T requirements for the above processes	2	2	-	-
NOS Total	**30**	**50**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N6413
NOS Name	Design fixtures, workstation and their mechanisms
Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Production Engineering
NSQF Level	5
Credits	TBD
Version	2.0
Last Reviewed Date	29/07/2021
Next Review Date	29/07/2026
NSQC Clearance Date	29/07/2021

ASC/N6422: Release the drawings and manage the documentation for engineering change

Description

This NOS unit is about the equipment designer releasing the drawings of the finalized equipment and making the documentation for change management

Scope

The scope covers the following :

- Release of tool drawings.
- Document for change management

Elements and Performance Criteria

Release of tool drawings

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

PC1. complete the parts listed and drawings/specifications for all the items required for the equipment

PC2. discuss and release the drawings of the equipment to the production department/in-house/external trol Room as per SOP and monitor its development for any revisions, clarity required etc.

PC3. modify/re-design in coordination with in-house tool room or a third-party agency, based on the severity of problem encountered while development of the equipment

Document for change management

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

PC4. review the impact on fixture parts/mechanism in case of an engineering change not for a design change or a process changes and decide the action of Rework based on cost and time available/production schedules on the equipment

PC5. coordinate activities related to WIP, stocks during ECN (Engineering Change Notice) Management; record these on the ECN document

PC6. complete the changes in drawing/part list and order the parts/rework with the help of validation/process engineer

PC7. ensure final changes in documentation after trials by validation agency and release the changed documents as per SOP

PC8. discuss with the process engineer/CFT (Cross-functional team) and share the finalized documents for equipment & PFMEA, CP (control plan) with the end-users

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. sequence of operations for each process

KU2. type of systems used in the process

KU3. process control and automation systems installed for the processes
KU4. technical and functional requirements for tools, online gauges, fixtures etc.
KU5. PFMEA/CP/WI, APQP, PPAP and ECN/PCN documentation requirements.
KU6. trouble shooting & fault finding for all the systems
KU7. Quality Management System (QMS) requirements

Generic Skills (GS)

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

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

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Release of tool drawings	11	18	-	8
PC1. complete the parts listed and drawings/specifications for all the items required for the equipment	4	9	-	4
PC2. discuss and release the drawings of the equipment to the production department/in-house/external trol Room as per SOP and monitor its development for any revisions, clarity required etc.	4	7	-	4
PC3. modify/re-design in coordination with in-house tool room or a third-party agency, based on the severity of problem encountered while development of the equipment	3	2	-	-
Document for change management	19	32	-	12
PC4. review the impact on fixture parts/mechanism in case of an engineering change not for a design change or a process changes and decide the action of Rework based on cost and time available/production schedules on the equipment	4	-	-	-
PC5. coordinate activities related to WIP, stocks during ECN (Engineering Change Notice) Management; record these on the ECN document	4	12	-	5
PC6. complete the changes in drawing/part list and order the parts/rework with the help of validation/process engineer	4	10	-	5
PC7. ensure final changes in documentation after trials by validation agency and release the changed documents as per SOP	4	5	-	1
PC8. discuss with the process engineer/CFT (Cross-functional team) and share the finalized documents for equipment & PFMEA, CP (control plan) with the end-users	3	5	-	1
NOS Total	**30**	**50**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N6422
NOS Name	Release the drawings and manage the documentation for engineering change
Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Production Engineering
NSQF Level	5
Credits	TBD
Version	2.0
Last Reviewed Date	29/07/2021
Next Review Date	29/07/2026
NSQC Clearance Date	29/07/2021

ASC/N6811: Select and operate 3D Printing machine for product generation

Description

This NOS describes the process of selecting the 3D printing machine for product generation and performing the postprocessing of the fabricated product.

Scope

The scope covers the following :

- Select 3D Printing machine
- Select and upload code files into system memory
- Pre-processing settings of the machine
- Operate and perform post-printing operations
- Inspection & storage of parts

Elements and Performance Criteria

Select 3D Printing machine

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

PC1. identify the 3D Printing technology such as Fused Deposition Modelling, StereoLithography etc.

PC2. identify and select the raw material to print the automotive components as per product specifications

PC3. determine the part orientation and support structure requirement from Computer Aided Design (CAD) data

PC4. determine the machine specifications such as build speed, extrusion speed, nozzle temperature required as per process application

PC5. determine the parameters such as room temperature range, air cleanliness for operating the machine

PC6. select the suitable 3D printing machine as per defined parameters

Select and upload code files into system memory

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

PC7. select the standard tesselation language (.stl) code file needed for machine operation

PC8. delete unwanted code files & upload new code files into the machine memory

PC9. select any pre-stored program from machine memory

PC10. connect the data storage devices with the machine

PC11. check the number of automotive parts to be manufactured for each design file

PC12. coordinate with designer to rectify any errors which are generated in the file uploading process or error observed during the running of process

Pre-processing settings of machine

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

PC13. perform daily check of machine's critical components

PC14. perform the pre-setting of 3D printing machine before the start of operation
PC15. prepare the machine for operation by cleaning it as per the recommended process
PC16. calculate the volume of material needed to generate the part as per the code provided
PC17. load adequate consumable material into the machine for non-stop working of the machine
PC18. pre-heat the bed of the machine to adequate temperature as per process specifications
PC19. set the laser or nozzles temperature to defined values as per process specification

Operate and perform post-printing operations

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

PC20. operate the machine, identify and rectify process errors if any
PC21. use emergency stop button in case of any unwanted situation
PC22. remove the part from machine without damaging its structure.
PC23. identify & carefully remove the support structures present in the fabricated part
PC24. clean the part for improving the surface finish

Inspection & storage of parts produced

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

PC25. inspect the part as per the drawing/process and if non-conforming, take action for rework or rejection
PC26. store & preserve the automotive parts manufactured

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. relevant manufacturing standards and procedures followed in the company
KU2. organization methodology/procedures used for automotive product design
KU3. all the symbols and notifications being displayed by the 3D Printing machine and their corresponding meaning
KU4. functionality of different buttons and switches available on the machine dashboard
KU5. how to upload and remove code files from the machine memory
KU6. preservation of critical electronic parts/equipments from moisture/heat/environmental external conditions as specified in the process
KU7. how to maintain the log book for produced parts
KU8. error detection and rectification at various stages of part generation
KU9. types of 3D Printing techniques
KU10. recommended process for cleaning machine
KU11. post-processing techniques
KU12. types of materials available for fabrication in various 3D printing technique
KU13. various inspection methods for inspecting the quality of product
KU14. optimum temperature range, air cleanliness and humidity required for the machine
KU15. types of files such as .stl, code file, etc generated in the various steps of the process
KU16. techniques of fabricating a component with 3D Printing

Generic Skills (GS)

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

GS1. read equipment manuals and process documents
GS2. attentively listen and comprehend the information given by the process managers
GS3. communicate effectively at the workplace
GS4. write observations and any work related information in English/regional language
GS5. 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. complete assigned tasks in a timely and efficient manner

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Select 3D Printing machine	6	2	-	2
PC1. identify the 3D Printing technology such as Fused Deposition Modelling, StereoLithography etc.	1	1	-	1
PC2. identify and select the raw material to print the automotive components as per product specifications	1	1	-	1
PC3. determine the part orientation and support structure requirement from Computer Aided Design (CAD) data	1	-	-	-
PC4. determine the machine specifications such as build speed, extrusion speed, nozzle temperature required as per process application	1	-	-	-
PC5. determine the parameters such as room temperature range, air cleanliness for operating the machine	1	-	-	-
PC6. select the suitable 3D printing machine as per defined parameters	1	-	-	-
Select and upload code files into system memory	6	11	-	4
PC7. select the standard tesselation language (.stl) code file needed for machine operation	1	2	-	1
PC8. delete unwanted code files & upload new code files into the machine memory	1	3	-	1
PC9. select any pre-stored program from machine memory	1	2	-	1
PC10. connect the data storage devices with the machine	1	2	-	-
PC11. check the number of automotive parts to be manufactured for each design file	2	-	-	-
PC12. coordinate with designer to rectify any errors which are generated in the file uploading process or error observed during the running of process	-	2	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Pre-processing settings of machine	16	14	-	7
PC13. perform daily check of machine's critical components	-	2	-	-
PC14. perform the pre-setting of 3D printing machine before the start of operation	2	2	-	1
PC15. prepare the machine for operation by cleaning it as per the recommended process	2	2	-	1
PC16. calculate the volume of material needed to generate the part as per the code provided	8	-	-	2
PC17. load adequate consumable material into the machine for non-stop working of the machine	2	4	-	1
PC18. pre-heat the bed of the machine to adequate temperature as per process specifications	2	2	-	1
PC19. set the laser or nozzles temperature to defined values as per process specification	-	2	-	1
Operate and perform post-printing operations	8	11	-	4
PC20. operate the machine, identify and rectify process errors if any	-	2	-	1
PC21. use emergency stop button in case of any unwanted situation	-	2	-	1
PC22. remove the part from machine without damaging its structure.	4	3	-	1
PC23. identify & carefully remove the support structures present in the fabricated part	2	2	-	-
PC24. clean the part for improving the surface finish	2	2	-	1
Inspection & storage of parts produced	4	2	-	3
PC25. inspect the part as per the drawing/process and if non-conforming, take action for rework or rejection	2	1	-	2
PC26. store & preserve the automotive parts manufactured	2	1	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
NOS Total	30	50	-	20

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N6811
NOS Name	Select and operate 3D Printing machine for product generation
Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Plant and Equipment Maintenance
NSQF Level	5
Credits	TBD
Version	1.0
Last Reviewed Date	29/07/2021
Next Review Date	29/07/2026
NSQC Clearance Date	29/07/2021

Assessment Guidelines and Assessment Weightage

Assessment Guidelines

1. Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down the proportion of marks for Theory and Skills Practical for each PC.

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

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

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

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

6. In case of unsuccessful completion, the trainee may seek reassessment on the Qualification Pack.

Minimum Aggregate Passing % at QP Level : 70

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

Assessment Weightage

Compulsory NOS

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
ASC/N9810.Manage work and resources (Manufacturing)	50	30	-	20	100	15
ASC/N9812.Interact effectively with team, customers and others	50	30	-	20	100	10
ASC/N6413.Design fixtures, workstation and their mechanisms	30	50	-	20	100	25
ASC/N6422.Release the drawings and manage the documentation for engineering change	30	50	-	20	100	25
ASC/N6811.Select and operate 3D Printing machine for product generation	30	50	-	20	100	25
Total	**200**	**200**	**-**	**100**	**500**	**100**

Acronyms

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

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.