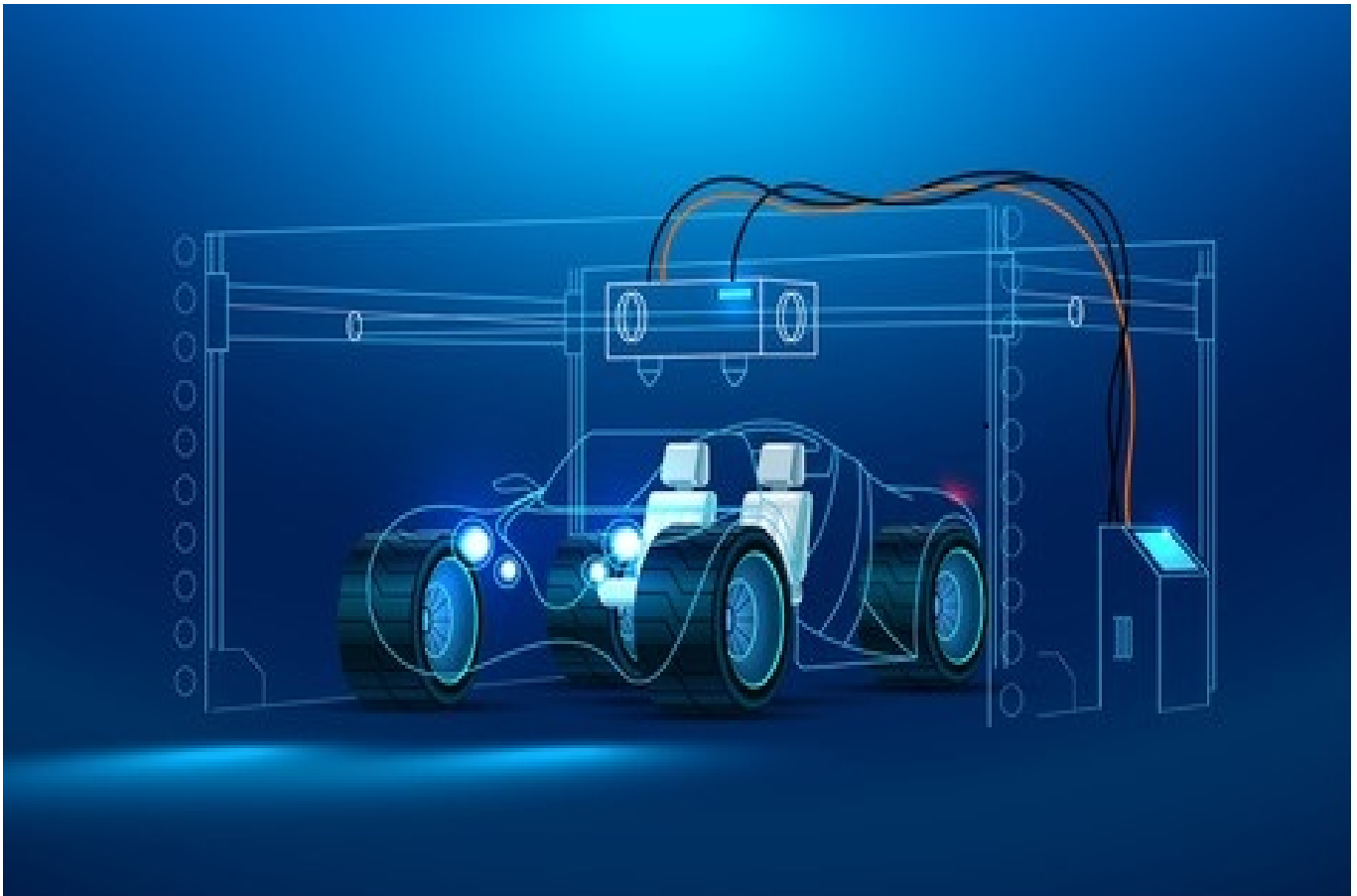


Qualification Pack



Automotive Additive Manufacturing Technician

QP Code: ASC/Q6411

Version: 2.0

NSQF Level: 3.5

Automotive || 153, GF, Okhla Industrial Area, Phase 3
New Delhi 110020 || email:garima@asdc.org.in

Qualification Pack

Contents

ASC/Q6411: Automotive Additive Manufacturing Technician	3
<i>Brief Job Description</i>	3
Applicable National Occupational Standards (NOS)	3
<i>Compulsory NOS</i>	3
<i>Qualification Pack (QP) Parameters</i>	3
ASC/N9803: Organize work and resources (Manufacturing)	5
DGT/VSQ/N0102: Employability Skills (60 Hours)	11
ASC/N6428: Designing of a new or existing product by using design software tools	19
ASC/N6427: Operate and maintain 3D printing machine for product generation	24
Assessment Guidelines and Weightage	30
<i>Assessment Guidelines</i>	30
<i>Assessment Weightage</i>	31
Acronyms	32
Glossary	33

Qualification Pack

ASC/Q6411: Automotive Additive Manufacturing Technician

Brief Job Description

The individual in this job is responsible for preparing object model of the part/product and manufacturing of parts/product on 3D printing machine.

Personal Attributes

The person should be organised, team-oriented and have the ability to work independently for long hours in adverse conditions. They should be result-oriented, keen observers and have an eye for detail and quality.

Applicable National Occupational Standards (NOS)

Compulsory NOS:

1. [ASC/N9803: Organize work and resources \(Manufacturing\)](#)
2. [DGT/VSQ/N0102: Employability Skills \(60 Hours\)](#)
3. [ASC/N6428: Designing of a new or existing product by using design software tools](#)
4. [ASC/N6427: Operate and maintain 3D printing machine for product generation](#)

Qualification Pack (QP) Parameters

Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Production Engineering
Country	India
NSQF Level	3.5
Credits	14
Aligned to NCO/ISCO/ISIC Code	NCO-2015/2144.0801

Qualification Pack

Minimum Educational Qualification & Experience	5th grade pass with 4 Years of experience of relevant experience OR 8th grade pass with 1 Year of experience of relevant experience OR 9th grade pass
Minimum Level of Education for Training in School	
Pre-Requisite License or Training	NA
Minimum Job Entry Age	19 Years
Last Reviewed On	NA
Next Review Date	30/12/2024
NSQC Approval Date	30/12/2021
Version	2.0
Reference code on NQR	2021/AUT/ASDC/04780
NQR Version	2

Qualification Pack

ASC/N9803: Organize work and resources (Manufacturing)

Description

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

Scope

The scope covers the following :

- Maintain safe and secure working environment
- Health and hygiene
- Perform work as per quality standards
- 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.** follow safe working practices while dealing with hazards to ensure safety of self and others
- PC3.** carry out routine check of the machine for identifying potential hazards
- PC4.** use appropriate protective clothing/equipment for specific tasks and work
- PC5.** follow safety hazards and preventive techniques during fire drill
- PC6.** report any identified breaches in health, safety and security policies and procedures to the designated person

Health and hygiene

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

- PC7.** ensure workstation and equipment are regularly clean and sanitized
- PC8.** clean hands with soap, alcohol-based sanitizer regularly
- PC9.** avoid contact with ill people and self-isolate in a similar situation
- PC10.** wear and dispose PPEs regularly and appropriately
- PC11.** report advanced hygiene and sanitation issues to appropriate authority
- PC12.** follow stress and anxiety management techniques

Perform work as per quality standards

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

- PC13.** ensure that work is accomplished as per the requirements within the specified timeline
- PC14.** ensure team goals are given preference over individual goals

Effective waste management practices

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

- PC15.** follow the fundamentals of 5S for waste management

Qualification Pack

- PC16.** segregate waste into different categories
- PC17.** follow processes specified for disposal of hazardous waste
- PC18.** identify recyclable, non-recyclable and hazardous waste
- PC19.** dispose non-recyclable, recyclable and reusable waste appropriately at identified location

Material/energy conservation practices

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

- PC20.** identify ways to optimize usage of material in various tasks/activities/processes
- PC21.** check for spills/leakages in various tasks/activities/processes
- PC22.** plug spills/leakages and escalate to appropriate authority if unable to rectify
- PC23.** check if the equipment/machine is functioning normally before commencing work and rectify wherever required
- PC24.** report malfunctioning (fumes/ sparks/emission/vibration/noise) and lapse in maintenance of equipment
- PC25.** ensure electrical equipment and appliances are properly connected and turned off when not in use

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.** preventative and remedial actions to be taken in case of exposure to toxic material
- KU7.** various types of fire extinguisher
- KU8.** various types of safety signs and their meaning
- KU9.** appropriate first aid treatment relevant to different condition e.g. bleeding, minor burns, eye injuries etc.
- KU10.** relevant standards, procedures and policies related to 5S followed in the company
- KU11.** the various materials used and their storage norms
- KU12.** efficient utilisation of material and water
- KU13.** basics of electricity and prevalent energy efficient devices
- KU14.** common practices of conserving electricity
- KU15.** common sources and ways to minimize pollution
- KU16.** categorisation of waste into dry, wet, recyclable, non-recyclable and items of single-use plastics
- KU17.** usage of different colors of dustbins

Qualification Pack

KU18. waste management techniques

KU19. 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. ask for clarifications from superior about the job requirement

GS4. work with supervisors/team members to carry out work related tasks

GS5. complete tasks efficiently and accurately within stipulated time

GS6. inform/report to concerned person in case of any problem

GS7. make timely decisions for efficient utilization of resources

GS8. write reports such as accident report, in at least English/regional language

GS9. be punctual and utilize time efficiently

Qualification Pack

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Maintain safe and secure working environment</i>	11	5	-	7
PC1. identify hazardous activities and the possible causes of risks or accidents in the workplace	2	1	-	2
PC2. follow safe working practices while dealing with hazards to ensure safety of self and others	2	-	-	1
PC3. carry out routine check of the machine for identifying potential hazards	2	1	-	1
PC4. use appropriate protective clothing/equipment for specific tasks and work	2	1	-	1
PC5. follow safety hazards and preventive techniques during fire drill	2	1	-	1
PC6. report any identified breaches in health, safety and security policies and procedures to the designated person	1	1	-	1
<i>Health and hygiene</i>	7	5	-	2
PC7. ensure workstation and equipment are regularly clean and sanitized	2	2	-	1
PC8. clean hands with soap, alcohol-based sanitizer regularly	1	1	-	1
PC9. avoid contact with ill people and self-isolate in a similar situation	1	-	-	-
PC10. wear and dispose PPEs regularly and appropriately	1	-	-	-
PC11. report advanced hygiene and sanitation issues to appropriate authority	1	1	-	-
PC12. follow stress and anxiety management techniques	1	1	-	-
<i>Perform work as per quality standards</i>	5	3	-	2
PC13. ensure that work is accomplished as per the requirements within the specified timeline	2	2	-	1

Qualification Pack

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC14. ensure team goals are given preference over individual goals	3	1	-	1
<i>Effective waste management practices</i>	15	10	-	4
PC15. follow the fundamentals of 5S for waste management	3	2	-	1
PC16. segregate waste into different categories	2	1	-	-
PC17. follow processes specified for disposal of hazardous waste	2	2	-	1
PC18. identify recyclable, non-recyclable and hazardous waste	4	2	-	1
PC19. dispose non-recyclable, recyclable and reusable waste appropriately at identified location	4	3	-	1
<i>Material/energy conservation practices</i>	12	7	-	5
PC20. identify ways to optimize usage of material in various tasks/activities/processes	2	1	-	1
PC21. check for spills/leakages in various tasks/activities/processes	2	1	-	1
PC22. plug spills/leakages and escalate to appropriate authority if unable to rectify	2	1	-	-
PC23. check if the equipment/machine is functioning normally before commencing work and rectify wherever required	2	2	-	1
PC24. report malfunctioning (fumes/sparks/emission/vibration/noise) and lapse in maintenance of equipment	2	1	-	1
PC25. ensure electrical equipment and appliances are properly connected and turned off when not in use	2	1	-	1
NOS Total	50	30	-	20

Qualification Pack

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N9803
NOS Name	Organize work and resources (Manufacturing)
Sector	Automotive
Sub-Sector	Generic
Occupation	Generic
NSQF Level	3
Credits	1.5
Version	3.0
Last Reviewed Date	NA
Next Review Date	31/03/2025
NSQC Clearance Date	31/03/2022

Qualification Pack

DGT/VSQ/N0102: Employability Skills (60 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.** identify employability skills required for jobs in various industries
- PC2.** identify and explore learning and employability portals

Constitutional values - Citizenship

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

- PC3.** recognize the significance of constitutional values, including civic rights and duties, citizenship, responsibility towards society etc. and personal values and ethics such as honesty, integrity, caring and respecting others, etc.
- PC4.** follow environmentally sustainable practices

Becoming a Professional in the 21st Century

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

- PC5.** recognize the significance of 21st Century Skills for employment
- PC6.** 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

Basic English Skills

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

Qualification Pack

- PC7.** use basic English for everyday conversation in different contexts, in person and over the telephone
- PC8.** read and understand routine information, notes, instructions, mails, letters etc. written in English
- PC9.** write short messages, notes, letters, e-mails etc. in English

Career Development & Goal Setting

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

- PC10.** understand the difference between job and career
- PC11.** prepare a career development plan with short- and long-term goals, based on aptitude

Communication Skills

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

- PC12.** follow verbal and non-verbal communication etiquette and active listening techniques in various settings
- PC13.** work collaboratively with others in a team

Diversity & Inclusion

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

- PC14.** communicate and behave appropriately with all genders and PwD
- PC15.** escalate any issues related to sexual harassment at workplace according to POSH Act

Financial and Legal Literacy

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

- PC16.** select financial institutions, products and services as per requirement
- PC17.** carry out offline and online financial transactions, safely and securely
- PC18.** identify common components of salary and compute income, expenses, taxes, investments etc
- PC19.** 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:

- PC20.** operate digital devices and carry out basic internet operations securely and safely
- PC21.** use e- mail and social media platforms and virtual collaboration tools to work effectively
- PC22.** use basic features of word processor, spreadsheets, and presentations

Entrepreneurship

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

- PC23.** identify different types of Entrepreneurship and Enterprises and assess opportunities for potential business through research
- PC24.** develop a business plan and a work model, considering the 4Ps of Marketing Product, Price, Place and Promotion
- PC25.** 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:

- PC26.** identify different types of customers
- PC27.** identify and respond to customer requests and needs in a professional manner.

Qualification Pack

PC28. follow appropriate hygiene and grooming standards

Getting ready for apprenticeship & Jobs

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

PC29. create a professional Curriculum vitae (Résumé)

PC30. search for suitable jobs using reliable offline and online sources such as Employment exchange, recruitment agencies, newspapers etc. and job portals, respectively

PC31. apply to identified job openings using offline /online methods as per requirement

PC32. answer questions politely, with clarity and confidence, during recruitment and selection

PC33. 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 and different learning and employability related portals

KU2. various constitutional and personal values

KU3. different environmentally sustainable practices and their importance

KU4. Twenty first (21st) century skills and their importance

KU5. how to use English language for effective verbal (face to face and telephonic) and written communication in formal and informal set up

KU6. importance of career development and setting long- and short-term goals

KU7. about effective communication

KU8. POSH Act

KU9. Gender sensitivity and inclusivity

KU10. different types of financial institutes, products, and services

KU11. how to compute income and expenditure

KU12. importance of maintaining safety and security in offline and online financial transactions

KU13. different legal rights and laws

KU14. different types of digital devices and the procedure to operate them safely and securely

KU15. how to create and operate an e- mail account and use applications such as word processors, spreadsheets etc.

KU16. how to identify business opportunities

KU17. types and needs of customers

KU18. how to apply for a job and prepare for an interview

KU19. 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

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

Qualification Pack

- GS3.** behave politely and appropriately with all
- GS4.** how to work in a virtual mode
- 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

Qualification Pack

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Introduction to Employability Skills</i>	1	1	-	-
PC1. identify employability skills required for jobs in various industries	-	-	-	-
PC2. identify and explore learning and employability portals	-	-	-	-
<i>Constitutional values - Citizenship</i>	1	1	-	-
PC3. recognize the significance of constitutional values, including civic rights and duties, citizenship, responsibility towards society etc. and personal values and ethics such as honesty, integrity, caring and respecting others, etc.	-	-	-	-
PC4. follow environmentally sustainable practices	-	-	-	-
<i>Becoming a Professional in the 21st Century</i>	2	4	-	-
PC5. recognize the significance of 21st Century Skills for employment	-	-	-	-
PC6. 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	-	-	-	-
<i>Basic English Skills</i>	2	3	-	-
PC7. use basic English for everyday conversation in different contexts, in person and over the telephone	-	-	-	-
PC8. read and understand routine information, notes, instructions, mails, letters etc. written in English	-	-	-	-
PC9. write short messages, notes, letters, e-mails etc. in English	-	-	-	-
<i>Career Development & Goal Setting</i>	1	2	-	-

Qualification Pack

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC10. understand the difference between job and career	-	-	-	-
PC11. prepare a career development plan with short- and long-term goals, based on aptitude	-	-	-	-
<i>Communication Skills</i>	2	2	-	-
PC12. follow verbal and non-verbal communication etiquette and active listening techniques in various settings	-	-	-	-
PC13. work collaboratively with others in a team	-	-	-	-
<i>Diversity & Inclusion</i>	1	2	-	-
PC14. communicate and behave appropriately with all genders and PwD	-	-	-	-
PC15. escalate any issues related to sexual harassment at workplace according to POSH Act	-	-	-	-
<i>Financial and Legal Literacy</i>	2	3	-	-
PC16. select financial institutions, products and services as per requirement	-	-	-	-
PC17. carry out offline and online financial transactions, safely and securely	-	-	-	-
PC18. identify common components of salary and compute income, expenses, taxes, investments etc	-	-	-	-
PC19. identify relevant rights and laws and use legal aids to fight against legal exploitation	-	-	-	-
<i>Essential Digital Skills</i>	3	4	-	-
PC20. operate digital devices and carry out basic internet operations securely and safely	-	-	-	-
PC21. use e- mail and social media platforms and virtual collaboration tools to work effectively	-	-	-	-
PC22. use basic features of word processor, spreadsheets, and presentations	-	-	-	-

Qualification Pack

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Entrepreneurship</i>	2	3	-	-
PC23. identify different types of Entrepreneurship and Enterprises and assess opportunities for potential business through research	-	-	-	-
PC24. develop a business plan and a work model, considering the 4Ps of Marketing Product, Price, Place and Promotion	-	-	-	-
PC25. identify sources of funding, anticipate, and mitigate any financial/ legal hurdles for the potential business opportunity	-	-	-	-
<i>Customer Service</i>	1	2	-	-
PC26. identify different types of customers	-	-	-	-
PC27. identify and respond to customer requests and needs in a professional manner.	-	-	-	-
PC28. follow appropriate hygiene and grooming standards	-	-	-	-
<i>Getting ready for apprenticeship & Jobs</i>	2	3	-	-
PC29. create a professional Curriculum vitae (Résumé)	-	-	-	-
PC30. search for suitable jobs using reliable offline and online sources such as Employment exchange, recruitment agencies, newspapers etc. and job portals, respectively	-	-	-	-
PC31. apply to identified job openings using offline /online methods as per requirement	-	-	-	-
PC32. answer questions politely, with clarity and confidence, during recruitment and selection	-	-	-	-
PC33. identify apprenticeship opportunities and register for it as per guidelines and requirements	-	-	-	-
NOS Total	20	30	-	-

Qualification Pack

National Occupational Standards (NOS) Parameters

NOS Code	DGT/VSQ/N0102
NOS Name	Employability Skills (60 Hours)
Sector	Cross Sectoral
Sub-Sector	Professional Skills
Occupation	Employability
NSQF Level	4
Credits	2
Version	1.0
Last Reviewed Date	31/01/2024
Next Review Date	31/01/2027
NSQC Clearance Date	31/01/2024

Qualification Pack

ASC/N6428: Designing of a new or existing product by using design software tools

Description

This NOS is about designing of a new or existing product by using 2D and 3D design software tools and converting the design into 3D printer supporting format.

Scope

The scope covers the following :

- Interpret the design of new or existing product
- Design the object model using Computer Aided Design software
- Convert the design into 3D printer supporting format

Elements and Performance Criteria

Interpret the design of new or existing product

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

- PC1.** identify the customer requirements and work to be done by interpreting the work order, process manuals and instructions from internal design team and supervisor
- PC2.** identify and select most suitable Computer Aided Design Software like catia, unigraphics, Fusion 360 etc. for creating the designs and models as per design requirement
- PC3.** interpret the new or existing product and collate the design requirements in terms of material used for making the component, packaging and other requirements to decide the dimensions, measurements and tolerances of the aggregate/component
- PC4.** refer any issues related to design concept clarity, dimensions and practicality to competent internal specialist or supervisor if they cannot be resolved by own

Design the object model using Computer Aided Design Software

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

- PC5.** create an object model as per drawing/dimension by using selected CAD software
- PC6.** develop and design specifications of the component by using the Geometric and Trigonometric rules/ formula provided by the supervisor
- PC7.** set the required unit and dimension parameters and insert sketches, scanned images, diagrams, signs or symbols, etc. of required product design in the software
- PC8.** create a 3D model of product by using CAD techniques as per the information received from the customer
- PC9.** use the software features like tools modeling, sculpting, generative design, simulation, assemblies, collaboration, tool validation and design options like free form, solid, and mesh modeling for creating the object model as per the information received
- PC10.** verify the object model by comparing it with the information and specifications mentioned in the product modelling document

Convert the design into 3D Printer supporting format

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

Qualification Pack

- PC11.** convert the object model into STL or AMF file format as per the 3D printer requirement
- PC12.** check object model files for common errors such as holes, self-intersections, manifold errors, faces etc. and rectify the same by following organisational recommended procedures
- PC13.** transfer the verified object model STL / AMF file into portable storage device or directly to 3D printer as per SOP/WI

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.** how to read and interpret sketches and engineering drawings
- KU4.** different types of designing processes and associated software like CATIA, AutoCAD, Unigraphics etc.
- KU5.** Draughting Standards & Techniques- e.g. ANSI series IS/ISO
- KU6.** technical drawing practices as per the company standards
- KU7.** drawings and modelling techniques like 2D and 3D
- KU8.** methods of using instruments like Vernier callipers, Micrometres, rulers and other inspection tools
- KU9.** function of different Computer aided design Software tools
- KU10.** algebra and trigonometric rules and applications
- KU11.** how to identify and correct errors in the object model file

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

Qualification Pack

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Interpret the design of new or existing product</i>	12	16	-	7
PC1. identify the customer requirements and work to be done by interpreting the work order, process manuals and instructions from internal design team and supervisor	2	4	-	2
PC2. identify and select most suitable Computer Aided Design Software like catia, unigraphics, Fusion 360 etc. for creating the designs and models as per design requirement	4	4	-	2
PC3. interpret the new or existing product and collate the design requirements in terms of material used for making the component, packaging and other requirements to decide the dimensions, measurements and tolerances of the aggregate/component	3	4	-	1
PC4. refer any issues related to design concept clarity, dimensions and practicality to competent internal specialist or supervisor if they cannot be resolved by own	3	4	-	2
<i>Design the object model using Computer Aided Design Software</i>	14	23	-	9
PC5. create an object model as per drawing/dimension by using selected CAD software	2	4	-	2
PC6. develop and design specifications of the component by using the Geometric and Trigonometric rules/ formula provided by the supervisor	4	4	-	1
PC7. set the required unit and dimension parameters and insert sketches, scanned images, diagrams, signs or symbols, etc. of required product design in the software	2	4	-	1
PC8. create a 3D model of product by using CAD techniques as per the information received from the customer	2	4	-	1

Qualification Pack

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC9. use the software features like tools modeling, sculpting, generative design, simulation, assemblies, collaboration, tool validation and design options like free form, solid, and mesh modeling for creating the object model as per the information received	2	4	-	2
PC10. verify the object model by comparing it with the information and specifications mentioned in the product modelling document	2	3	-	2
<i>Convert the design into 3D Printer supporting format</i>	4	11	-	4
PC11. convert the object model into STL or AMF file format as per the 3D printer requirement	1	3	-	1
PC12. check object model files for common errors such as holes, self-intersections, manifold errors, faces etc. and rectify the same by following organisational recommended procedures	2	4	-	2
PC13. transfer the verified object model STL / AMF file into portable storage device or directly to 3D printer as per SOP/WI	1	4	-	1
NOS Total	30	50	-	20

Qualification Pack

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N6428
NOS Name	Designing of a new or existing product by using design software tools
Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Production Engineering
NSQF Level	3.5
Credits	5.5
Version	2.0
Last Reviewed Date	NA
Next Review Date	30/12/2024
NSQC Clearance Date	30/12/2021

Qualification Pack

ASC/N6427: Operate and maintain 3D printing machine for product generation

Description

This NOS is about operation and maintenance of 3D printing machines for product generation and performing the post processing of the fabricated product as per organizational standards.

Scope

The scope covers the following :

- Prepare for 3D printing work
- Select and upload code files into system memory
- Perform printing operations
- Perform post-printing activities
- Carry out maintenance of 3D Printing machine

Elements and Performance Criteria

Prepare for 3D printing work

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

- PC1.** identify the work to be done and work requirements by interpreting instructions received from the supervisor
- PC2.** identify and select suitable 3D printing machine as per specified machine specifications (i.e. build speed, extrusion speed, nozzle temperature) and raw material to print the automotive components as per product specifications
- PC3.** check material and machine for any issues and required quality standards before use
- PC4.** determine the part orientation and support structure requirement from Computer Aided Design (CAD) data
- PC5.** set the 3D printing machine and its parameters such as room temperature range, air cleanliness as per SOP/WI
- PC6.** clean the 3D printing machine by following organisational recommended process before starting the operation

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 tessellation language (.stl) code file needed for machine operation
- PC8.** connect the data storage devices with the machine
- PC9.** coordinate with designer to rectify any errors which are generated during the file uploading process or errors observed during the running of the process

Perform printing operations

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

- PC10.** pre-heat the bed of the machine to adequate temperature as per process specifications
- PC11.** set the laser or nozzles temperature to defined values as per process specification

Qualification Pack

- PC12.** start and operate the machine and perform 3D printing operations as per SOP/WI
- PC13.** use the emergency stop button in case of any unfavorable situation
- PC14.** rectify any process errors if any during the machine operation and report the same to the concerned person as per organizational guidelines

Perform post-printing activities

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

- PC15.** remove the printed part from machine without damaging its structure
- PC16.** identify & carefully remove the support structures present in the fabricated part
- PC17.** clean the part for improving the surface finish as per SOP
- PC18.** clean and store the tools, equipment and auxiliaries after completion of work as per the guidelines
- PC19.** inspect the part as per the drawing/process using for required quality and if non-conforming, take action as per organisational guidelines
- PC20.** store & preserve the automotive parts manufactured as per organizational guidelines and procedures

Carry out maintenance of 3D Printing Machine

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

- PC21.** perform daily check of machine's critical parts as per maintenance checklist or manufacturer guidelines
- PC22.** carry out minor repairs, adjustments and alignment of loose bolts, belts, drive slacks, guards and covers
- PC23.** carry out troubleshooting of machine for issues and defects identification
- PC24.** perform lubrication of machine by using appropriate lubricant
- PC25.** place tags on machines for next maintenance cycles
- PC26.** maintain records of maintenance activities done on machine as per organizational procedures

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

- KU1.** relevant manufacturing standards and procedures followed in the company
- KU2.** organization methodology/procedures used for automotive product design
- KU3.** Technology 3D Printing such as Fused Deposition Modelling, Stereo Lithography, Metal Laser Sintering
- KU4.** symbols and notifications being displayed by the 3D Printing machine and their corresponding meaning
- KU5.** functionality of different buttons and switches available on the machine dashboard
- KU6.** how to upload and remove code files from the machine memory
- KU7.** preservation of critical electronic parts/equipment from moisture/heat/environmental external conditions as specified in the process
- KU8.** how to maintain the log book for produced parts
- KU9.** how to detect and rectify error at various stages of part generation

Qualification Pack

- 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.** techniques of fabricating a component with 3D Printing
- KU16.** maintenance activities for a 3D printing machine

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

Qualification Pack

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Prepare for 3D printing work</i>	7	11	-	4
PC1. identify the work to be done and work requirements by interpreting instructions received from the supervisor	1	1	-	1
PC2. identify and select suitable 3D printing machine as per specified machine specifications (i.e. build speed, extrusion speed, nozzle temperature) and raw material to print the automotive components as per product specifications	2	4	-	1
PC3. check material and machine for any issues and required quality standards before use	1	1	-	-
PC4. determine the part orientation and support structure requirement from Computer Aided Design (CAD) data	2	1	-	1
PC5. set the 3D printing machine and its parameters such as room temperature range, air cleanliness as per SOP/WI	1	3	-	1
PC6. clean the 3D printing machine by following organisational recommended process before starting the operation	-	1	-	-
<i>Select and upload code files into system memory</i>	2	4	-	1
PC7. select the standard tessellation language (.stl) code file needed for machine operation	1	2	-	-
PC8. connect the data storage devices with the machine	-	1	-	-
PC9. coordinate with designer to rectify any errors which are generated during the file uploading process or errors observed during the running of the process	1	1	-	1
<i>Perform printing operations</i>	7	11	-	5

Qualification Pack

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC10. pre-heat the bed of the machine to adequate temperature as per process specifications	2	3	-	1
PC11. set the laser or nozzles temperature to defined values as per process specification	1	3	-	1
PC12. start and operate the machine and perform 3D printing operations as per SOP/WI	2	2	-	1
PC13. use the emergency stop button in case of any unfavorable situation	-	1	-	1
PC14. rectify any process errors if any during the machine operation and report the same to the concerned person as per organizational guidelines	2	2	-	1
<i>Perform post-printing activities</i>	4	10	-	4
PC15. remove the printed part from machine without damaging its structure	-	2	-	1
PC16. identify & carefully remove the support structures present in the fabricated part	1	1	-	1
PC17. clean the part for improving the surface finish as per SOP	-	1	-	-
PC18. clean and store the tools, equipment and auxiliaries after completion of work as per the guidelines	1	2	-	1
PC19. inspect the part as per the drawing/process using for required quality and if non-conforming, take action as per organisational guidelines	1	2	-	1
PC20. store & preserve the automotive parts manufactured as per organizational guidelines and procedures	1	2	-	-
<i>Carry out maintenance of 3D Printing Machine</i>	10	14	-	6
PC21. perform daily check of machine's critical parts as per maintenance checklist or manufacturer guidelines	2	4	-	2

Qualification Pack

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC22. carry out minor repairs, adjustments and alignment of loose bolts, belts, drive slacks, guards and covers	2	3	-	2
PC23. carry out troubleshooting of machine for issues and defects identification	2	3	-	1
PC24. perform lubrication of machine by using appropriate lubricant	-	1	-	-
PC25. place tags on machines for next maintenance cycles	2	2	-	-
PC26. maintain records of maintenance activities done on machine as per organizational procedures	2	1	-	1
NOS Total	30	50	-	20

Qualification Pack

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N6427
NOS Name	Operate and maintain 3D printing machine for product generation
Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Production Engineering
NSQF Level	3
Credits	5
Version	3.0
Last Reviewed Date	NA
Next Review Date	30/12/2024
NSQC Clearance Date	30/12/2021

Assessment Guidelines and Assessment Weightage

Assessment Guidelines

1. Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down the proportion of marks for Theory and Skills Practical for each PC.
2. The assessment for the theory part will be based on the knowledge bank of questions created by the SSC.
3. Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/option NOS/set of NOS.
4. Individual assessment agencies will create unique question papers for the theory part for each candidate at each examination/training center (as per assessment criteria below).
5. Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/ training center based on these criteria.
6. In case of unsuccessful completion, the trainee may seek reassessment on the Qualification Pack.

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/N9803.Organize work and resources (Manufacturing)	50	30	-	20	100	15
DGT/VSQ/N0102.Employability Skills (60 Hours)	20	30	-	-	50	10
ASC/N6428.Designing of a new or existing product by using design software tools	30	50	-	20	100	45
ASC/N6427.Operate and maintain 3D printing machine for product generation	30	50	-	20	100	30
Total	130	160	-	60	350	100

Qualification Pack

Acronyms

NOS	National Occupational Standard(s)
NSQF	National Skills Qualifications Framework
QP	Qualifications Pack
TVET	Technical and Vocational Education and Training
PPE	Personal Protective Equipment
PwD	Person with Disability
SOP	Standard Operating Practices
PwD	Persons with Disability
PPE	Personal Protective Equipment
PwD	Person with Disability
SOP	Standard Operating Practices

Qualification Pack

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.

Qualification Pack

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.