Qualification Pack

Additive Manufacturing- Design and Application Engineer

QP Code: CSC/Q0412

Version: 1.0

NSQF Level: 5.5

Capital Goods & Strategic Skill Council || 1st Floor, L-29, Outer Circle, Connaught Place
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Qualification Pack

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Qualification Pack

CSC/Q0412: Additive Manufacturing- Design and Application Engineer

Brief Job Description

The Additive Manufacturing Design & Application Engineer willl play a crucial role in advancing the additive manufacturing capabilities, with a focus on computer graphics (CAD- Autodesk, SolidWorks, Creo, Inventor etc.) applications. He will be responsible for designing and optimizing 3D printed components for various applications, leveraging your expertise in both additive manufacturing and computer graphics.

Personal Attributes

An additive manufacturing engineer brings innovative thinking, meticulous attention to detail, and strong analytical skills to optimize processes and drive efficiency in 3D printing workflows.

Applicable National Occupational Standards (NOS)

Compulsory NOS:

1. CSC/N0435: Design and produce 3D computer model for the prototype of metal parts
2. CSC/N0436: Identify the Process & Select the additive material to be used
3. CSC/N0437: Write Process instructions, and collate data for RCA- root cause analysis
4. CSC/N0438: Developing prototypes of new products using 3D printers or other computer-controlled equipment
5. CSC/N0439: Implement corrective actions for process and quality issues/ Perform Quality Assurance and Testing
6. CSC/N0440: Interface with design engineers to ensure manufacturability of new designs
7. CSC/N1341: Collaboratively coordinate with the team .
8. CSC/N0530: Follow health, safety and environment guidelines at workplace.
9. DGT/VSQ/N0102: Employability Skills (60 Hours)

Qualification Pack (QP) Parameters

Sector	Capital Goods

Qualification Pack

Sub-Sector	Machine Tools, Dies, Moulds and Press Tools, Plastics Manufacturing Machinery, Textile Manufacturing Machinery, Process Plant Machinery, Electrical and Power Machinery, Light Engineering Goods, Defence Equipment, Fire-Fighting & Safety Equipment
Occupation	Design
Country	India
NSQF Level	5.5
Credits	16
Aligned to NCO/ISCO/ISIC Code	2144.0401
Minimum Educational Qualification & Experience	UG in relevant field (UG Degree in relevant field + 3 years of relevant experience or 3/ 4 years UG B,Sc,. BE, B.Tech (Electrical, Electronics, Mechanical, Mechatronics, Instrumentation and Control)* or 10+3 years Diploma in relevant field + 5 year of relevant experience or Previous NSQC level 5 + 1.5 years of relevant experience *Subject to being offered as 6 months internship/ project)
Minimum Level of Education for Training in School	
Pre-Requisite License or Training	NA
Minimum Job Entry Age	21 Years
Last Reviewed On	NA
Next Review Date	31/01/2029
NSQC Approval Date	31/01/2024
Version	1.0
Reference code on NQR	QG-5.5-CG-02048-2024-V1-CGSC
NQR Version	1.0

Qualification Pack

CSC/N0435: Design and produce 3D computer model for the prototype of metal parts

Description

This NOS is about designing and prototyping of metal parts

Scope

The scope covers the following :

- Design and produce 3D computer model for the prototype of metal parts

Elements and Performance Criteria

Design and produce 3D computer model for the prototype of metal parts

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

PC1. Represent the desired specifications and dimensions of the metal part prototype. It should be precise to ensure compatibility with additive manufacturing processes.

PC2. Evaluate the design for suitability with AM processes, considering factors such as overhangs, support structures, and material usage efficiency to enhance manufacturability.

PC3. Choose appropriate metal materials for the prototype based on mechanical properties, durability, and suitability for additive manufacturing techniques.

PC4. Ensure that the surface finish of the prototype meets the required standards, considering factors such as roughness, porosity, and defects, to achieve the desired functional and aesthetic properties.

PC5. Validate the structural integrity of the design through simulation and analysis to ensure it meets performance requirements and can withstand expected loads and stresses.

PC6. Optimize the design process to minimize production time and costs while maintaining quality standards, considering factors such as material consumption, machine utilization, and post-processing requirements.

PC7. Communicate with stakeholders, including clients, engineers, and manufacturing teams, to understand requirements, gather feedback, and ensure alignment throughout the design and production process.

PC8. Ensure that the design and production processes adhere to relevant industry standards, regulations, and safety requirements to guarantee product reliability and compliance.

PC9. Stay updated with advancements in additive manufacturing technologies, materials, and design methodologies to continuously improve processes and explore innovative solutions for enhanced performance and competitiveness.

PC10. Maintain comprehensive documentation of the design and production process, including design iterations, simulations, test results, and any modifications made, to facilitate traceability, analysis, and future improvements

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. • Familiarity with different AM processes such as Fused Deposition Modeling (FDM), Stereolithography (SLA), Selective Laser Sintering (SLS), Binder Jetting, etc.
• Understanding the strengths, weaknesses, and applications of each process.
• Knowledge of process parameters, build volumes, and materials compatibility for different AM systems.

KU2. • Understanding of materials commonly used in additive manufacturing such as polymers, metals, ceramics, and composites.
• Knowledge of material properties, including mechanical, thermal, and chemical properties, and how they influence part performance.

KU3. Awareness of material compatibility with specific AM processes and their post-processing requirements.

KU4. Proficiency in CAD software and design principles tailored for AM, such as topology optimization, lattice structures, and support optimization.

KU5. Ability to redesign traditional parts for AM, exploiting the design freedom offered by additive processes to improve performance, reduce weight, or consolidate assemblies.

KU6. Skills in process simulation and optimization tools to predict part distortions, residual stresses, and build failures.

KU7. Knowledge of design modifications and process parameters adjustments to optimize build quality and minimize defects.

KU8. Understanding of AM-specific quality assurance techniques, including layer-wise monitoring, non-destructive testing (NDT), and metrology.

KU9. Knowledge of industry standards and certifications relevant to additive manufacturing.

KU10. Awareness of various industries leveraging additive manufacturing, such as aerospace, automotive, healthcare, and consumer goods.

KU11. Understanding of specific application requirements and challenges within each industry.

KU12. Knowledge of emerging trends and innovations in additive manufacturing technologies and applications.

KU13. Ability to collaborate with cross-functional teams including design engineers, materials scientists, and production specialists.

KU14. Effective communication skills to articulate design concepts, technical challenges, and solutions to stakeholders.

KU15. Understanding of regulatory requirements and standards governing additive manufacturing processes and materials.

KU16. Knowledge of intellectual property issues related to AM, including patent landscape analysis and infringement considerations.

Generic Skills (GS)

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

GS1. CAD Proficiency

GS2. Understanding of Additive Manufacturing Technologies

GS3. Design for Additive Manufacturing (DfAM)

GS4. Problem-solving Skills

GS5. Project Management

GS6. Knowledge of Quality Assurance Techniques
GS7. Communication Skills
GS8. Continuous Learning
GS9. Attention to Detail
GS10. Creativity and Innovation
GS11. Teamwork and Collaboration
GS12. Regulatory Compliance
GS13. Customer Focus

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Design and produce 3D computer model for the prototype of metal parts	**30**	**70**	**-**	**-**
PC1. Represent the desired specifications and dimensions of the metal part prototype. It should be precise to ensure compatibility with additive manufacturing processes.	-	-	-	-
PC2. Evaluate the design for suitability with AM processes, considering factors such as overhangs, support structures, and material usage efficiency to enhance manufacturability.	-	-	-	-
PC3. Choose appropriate metal materials for the prototype based on mechanical properties, durability, and suitability for additive manufacturing techniques.	-	-	-	-
PC4. Ensure that the surface finish of the prototype meets the required standards, considering factors such as roughness, porosity, and defects, to achieve the desired functional and aesthetic properties.	-	-	-	-
PC5. Validate the structural integrity of the design through simulation and analysis to ensure it meets performance requirements and can withstand expected loads and stresses.	-	-	-	-
PC6. Optimize the design process to minimize production time and costs while maintaining quality standards, considering factors such as material consumption, machine utilization, and post-processing requirements.	-	-	-	-
PC7. Communicate with stakeholders, including clients, engineers, and manufacturing teams, to understand requirements, gather feedback, and ensure alignment throughout the design and production process.	-	-	-	-
PC8. Ensure that the design and production processes adhere to relevant industry standards, regulations, and safety requirements to guarantee product reliability and compliance.	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC9. Stay updated with advancements in additive manufacturing technologies, materials, and design methodologies to continuously improve processes and explore innovative solutions for enhanced performance and competitiveness.	-	-	-	-
PC10. Maintain comprehensive documentation of the design and production process, including design iterations, simulations, test results, and any modifications made, to facilitate traceability, analysis, and future improvements	-	-	-	-
NOS Total	**30**	**70**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0435
NOS Name	Design and produce 3D computer model for the prototype of metal parts
Sector	Capital Goods
Sub-Sector	Machine Tools, Dies, Moulds and Press Tools, Plastics Manufacturing Machinery, Textile Manufacturing Machinery, Process Plant Machinery, Electrical and Power Machinery, Light Engineering Goods, Defence Equipment, Fire-Fighting & Safety Equipment
Occupation	Design
NSQF Level	5.5
Credits	2
Version	1.0
Last Reviewed Date	31/01/2024
Next Review Date	31/01/2029
NSQC Clearance Date	31/01/2024

CSC/N0436: Identify the Process & Select the additive material to be used

Description

This NOS is about selection of the materials used in additive manufacturing

Scope

The scope covers the following :

- Identify the Process & Select the additive material to be used

Elements and Performance Criteria

Identify the Process & Select the additive material to be used

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

PC1. Demonstrate comprehensive understanding of various additive manufacturing processes such as Fused Deposition Modeling (FDM), Stereolithography (SLA), Selective Laser Sintering (SLS), etc.

PC2. Evaluate the strengths, weaknesses, and applications of each additive manufacturing process.

PC3. Select appropriate materials for specific additive manufacturing applications considering factors such as mechanical properties, thermal properties, chemical compatibility, etc

PC4. Research and evaluate new additive materials in the market for potential applications.

PC5. Analyze the job requirements including part geometry, function, environment, and regulatory compliance to determine the most suitable additive manufacturing process and material.

PC6. Ensure that the selected additive materials meet quality standards and regulatory requirements.

PC7. Conduct material testing and validation to verify performance characteristics and suitability for the intended application.

PC8. Manage cost associated with additive material selection, including material procurement costs, processing costs, and post-processing requirements.

PC9. Optimize material usage to minimize waste and reduce overall production costs.

PC10. Seek opportunities to improve additive material selection processes through the adoption of new technologies, materials, or methodologies.

PC11. Collect feedback from manufacturing operations and incorporates lessons learned into future material selection decisions.

PC12. Identify and mitigate potential risks associated with additive material selection, such as material compatibility issues, regulatory compliance challenges, or supply chain disruptions.

PC13. Develop contingency plans to address unforeseen issues that may arise during material selection or processing.

PC14. Maintain accurate records of additive material specifications, testing results, and performance evaluations.

PC15. Prepares comprehensive reports and presentations to document material selection processes and outcomes for internal review and external stakeholders as needed.

PC16. Ensure compliance with industry standards and best practices related to additive material selection, handling, and processing.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. • Familiarity with different AM processes such as Fused Deposition Modeling (FDM), Stereolithography (SLA), Selective Laser Sintering (SLS), Binder Jetting, etc.
• Understanding the strengths, weaknesses, and applications of each process.
• Knowledge of process parameters, build volumes, and materials compatibility for different AM systems.

KU2. • Understanding of materials commonly used in additive manufacturing such as polymers, metals, ceramics, and composites.
• Knowledge of material properties, including mechanical, thermal, and chemical properties, and how they influence part performance.

KU3. Awareness of material compatibility with specific AM processes and their post-processing requirements.

KU4. Proficiency in CAD software and design principles tailored for AM, such as topology optimization, lattice structures, and support optimization.

KU5. Ability to redesign traditional parts for AM, exploiting the design freedom offered by additive processes to improve performance, reduce weight, or consolidate assemblies.

KU6. Skills in process simulation and optimization tools to predict part distortions, residual stresses, and build failures.

KU7. Knowledge of design modifications and process parameters adjustments to optimize build quality and minimize defects.

KU8. Understanding of AM-specific quality assurance techniques, including layer-wise monitoring, non-destructive testing (NDT), and metrology.

KU9. Knowledge of industry standards and certifications relevant to additive manufacturing.

KU10. Awareness of various industries leveraging additive manufacturing, such as aerospace, automotive, healthcare, and consumer goods.

KU11. Understanding of specific application requirements and challenges within each industry.

KU12. Knowledge of emerging trends and innovations in additive manufacturing technologies and applications.

KU13. Ability to collaborate with cross-functional teams including design engineers, materials scientists, and production specialists.

KU14. Effective communication skills to articulate design concepts, technical challenges, and solutions to stakeholders.

KU15. Understanding of regulatory requirements and standards governing additive manufacturing processes and materials.

KU16. Knowledge of intellectual property issues related to AM, including patent landscape analysis and infringement considerations.

Generic Skills (GS)

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

GS1. CAD Proficiency
GS2. Understanding of Additive Manufacturing Technologies
GS3. Design for Additive Manufacturing (DfAM)
GS4. Problem-solving Skills
GS5. Project Management
GS6. Knowledge of Quality Assurance Techniques
GS7. Communication Skills
GS8. Continuous Learning
GS9. Attention to Detail
GS10. Creativity and Innovation
GS11. Teamwork and Collaboration
GS12. Regulatory Compliance
GS13. Customer Focus

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Identify the Process & Select the additive material to be used	**30**	**70**	**-**	**-**
PC1. Demonstrate comprehensive understanding of various additive manufacturing processes such as Fused Deposition Modeling (FDM), Stereolithography (SLA), Selective Laser Sintering (SLS), etc.	-	-	-	-
PC2. Evaluate the strengths, weaknesses, and applications of each additive manufacturing process.	-	-	-	-
PC3. Select appropriate materials for specific additive manufacturing applications considering factors such as mechanical properties, thermal properties, chemical compatibility, etc	-	-	-	-
PC4. Research and evaluate new additive materials in the market for potential applications.	-	-	-	-
PC5. Analyze the job requirements including part geometry, function, environment, and regulatory compliance to determine the most suitable additive manufacturing process and material.	-	-	-	-
PC6. Ensure that the selected additive materials meet quality standards and regulatory requirements.	-	-	-	-
PC7. Conduct material testing and validation to verify performance characteristics and suitability for the intended application.	-	-	-	-
PC8. Manage cost associated with additive material selection, including material procurement costs, processing costs, and post-processing requirements.	-	-	-	-
PC9. Optimize material usage to minimize waste and reduce overall production costs.	-	-	-	-
PC10. Seek opportunities to improve additive material selection processes through the adoption of new technologies, materials, or methodologies.	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC11. Collect feedback from manufacturing operations and incorporates lessons learned into future material selection decisions.	-	-	-	-
PC12. Identify and mitigate potential risks associated with additive material selection, such as material compatibility issues, regulatory compliance challenges, or supply chain disruptions.	-	-	-	-
PC13. Develop contingency plans to address unforeseen issues that may arise during material selection or processing.	-	-	-	-
PC14. Maintain accurate records of additive material specifications, testing results, and performance evaluations.	-	-	-	-
PC15. Prepares comprehensive reports and presentations to document material selection processes and outcomes for internal review and external stakeholders as needed.	-	-	-	-
PC16. Ensure compliance with industry standards and best practices related to additive material selection, handling, and processing.	-	-	-	-
NOS Total	**30**	**70**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0436
NOS Name	Identify the Process & Select the additive material to be used
Sector	Capital Goods
Sub-Sector	Machine Tools, Dies, Moulds and Press Tools, Plastics Manufacturing Machinery, Textile Manufacturing Machinery, Process Plant Machinery, Electrical and Power Machinery, Light Engineering Goods, Defence Equipment, Fire-Fighting & Safety Equipment
Occupation	Design
NSQF Level	5.5
Credits	1
Version	1.0
Last Reviewed Date	31/01/2024
Next Review Date	31/01/2029
NSQC Clearance Date	31/01/2024

CSC/N0437: Write Process instructions, and collate data for RCA- root cause analysis

Description

This NOS is about selection of the materials used in additive manufacturing

Scope

The scope covers the following :

- Identify the Process & Select the additive material to be used

Elements and Performance Criteria

Write Process instructions, and collate data for RCA- root cause analysis

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

PC1. Provide clear and easily understandable instructions to technicians and operators involved in the manufacturing process.

PC2. Demonstrate accurate steps required for the manufacturing process, including specific measurements, tolerances, and materials.

PC3. Ensure consistency across all instructions to maintain uniformity in the manufacturing process.

PC4. Update instructions to incorporate any process improvements, new technologies, or changes in materials.

PC5. Avoid unnecessary complexity or verbosity, ensuring that instructions are concise and to the point.

PC6. Incorporate diagrams, illustrations, or videos where necessary to enhance understanding and provide visual guidance.

PC7. Include safety instructions and precautions to minimize the risk of accidents or injuries during the manufacturing process.

PC8. Establish a system for feedback from operators and technicians to identify any ambiguities or areas for improvement in the instructions.

PC9. Evaluate the efficiency of the manufacturing process by monitoring adherence to the instructions and identifying areas for optimization.

PC10. Define the problem or issue encountered in the additive manufacturing process, such as defects in printed parts, inconsistent material properties, or failures during printing.

PC11. Collect relevant data related to the problem, including process parameters, material properties, environmental conditions, and equipment performance.

PC12. Map out the additive manufacturing process from design to final production to identify potential points of failure or deviation.

PC13. Analyze the data to determine the root cause or causes of the issue, considering factors such as material quality, design flaws, machine calibration, operator error, or environmental factors.

PC14. Determine the most significant contributing factors to focus on for corrective action based on their impact on the manufacturing process and product quality.

PC15. Brainstorm and evaluate potential solutions to address the root causes identified, considering both short-term fixes and long-term preventive measures.

PC16. Implement the selected solutions, which may involve adjustments to process parameters, changes to material specifications, updates to design guidelines, or improvements in equipment maintenance procedures.

PC17. Monitor the additive manufacturing process to assess the effectiveness of the implemented solutions and ensure that the issue does not recur.

PC18. Document the RCA process, including findings, actions taken, and outcomes, to provide a reference for future troubleshooting and process improvement efforts.

PC19. Use insights gained from the RCA process to drive continuous improvement in additive manufacturing processes, technologies, and workflows.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. • Familiarity with different AM processes such as Fused Deposition Modeling (FDM), Stereolithography (SLA), Selective Laser Sintering (SLS), Binder Jetting, etc.
• Understanding the strengths, weaknesses, and applications of each process.
• Knowledge of process parameters, build volumes, and materials compatibility for different AM systems.

KU2. • Understanding of materials commonly used in additive manufacturing such as polymers, metals, ceramics, and composites.
• Knowledge of material properties, including mechanical, thermal, and chemical properties, and how they influence part performance.

KU3. Awareness of material compatibility with specific AM processes and their post-processing requirements.

KU4. Proficiency in CAD software and design principles tailored for AM, such as topology optimization, lattice structures, and support optimization.

KU5. Ability to redesign traditional parts for AM, exploiting the design freedom offered by additive processes to improve performance, reduce weight, or consolidate assemblies.

KU6. Skills in process simulation and optimization tools to predict part distortions, residual stresses, and build failures.

KU7. Knowledge of design modifications and process parameters adjustments to optimize build quality and minimize defects.

KU8. Understanding of AM-specific quality assurance techniques, including layer-wise monitoring, non-destructive testing (NDT), and metrology.

KU9. Knowledge of industry standards and certifications relevant to additive manufacturing.

KU10. Awareness of various industries leveraging additive manufacturing, such as aerospace, automotive, healthcare, and consumer goods.

KU11. Understanding of specific application requirements and challenges within each industry.

KU12. Knowledge of emerging trends and innovations in additive manufacturing technologies and applications.

KU13. Ability to collaborate with cross-functional teams including design engineers, materials scientists, and production specialists.

KU14. Effective communication skills to articulate design concepts, technical challenges, and solutions to stakeholders.

KU15. Understanding of regulatory requirements and standards governing additive manufacturing processes and materials.

KU16. Knowledge of intellectual property issues related to AM, including patent landscape analysis and infringement considerations.

Generic Skills (GS)

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

GS1. CAD Proficiency

GS2. Understanding of Additive Manufacturing Technologies

GS3. Design for Additive Manufacturing (DfAM)

GS4. Problem-solving Skills

GS5. Project Management

GS6. Knowledge of Quality Assurance Techniques

GS7. Communication Skills

GS8. Continuous Learning

GS9. Attention to Detail

GS10. Creativity and Innovation

GS11. Teamwork and Collaboration

GS12. Regulatory Compliance

GS13. Customer Focus

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Write Process instructions, and collate data for RCA-root cause analysis	**30**	**70**	**-**	**-**
PC1. Provide clear and easily understandable instructions to technicians and operators involved in the manufacturing process.	-	-	-	-
PC2. Demonstrate accurate steps required for the manufacturing process, including specific measurements, tolerances, and materials.	-	-	-	-
PC3. Ensure consistency across all instructions to maintain uniformity in the manufacturing process.	-	-	-	-
PC4. Update instructions to incorporate any process improvements, new technologies, or changes in materials.	-	-	-	-
PC5. Avoid unnecessary complexity or verbosity, ensuring that instructions are concise and to the point.	-	-	-	-
PC6. Incorporate diagrams, illustrations, or videos where necessary to enhance understanding and provide visual guidance.	-	-	-	-
PC7. Include safety instructions and precautions to minimize the risk of accidents or injuries during the manufacturing process.	-	-	-	-
PC8. Establish a system for feedback from operators and technicians to identify any ambiguities or areas for improvement in the instructions.	-	-	-	-
PC9. Evaluate the efficiency of the manufacturing process by monitoring adherence to the instructions and identifying areas for optimization.	-	-	-	-
PC10. Define the problem or issue encountered in the additive manufacturing process, such as defects in printed parts, inconsistent material properties, or failures during printing.	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC11. Collect relevant data related to the problem, including process parameters, material properties, environmental conditions, and equipment performance.	-	-	-	-
PC12. Map out the additive manufacturing process from design to final production to identify potential points of failure or deviation.	-	-	-	-
PC13. Analyze the data to determine the root cause or causes of the issue, considering factors such as material quality, design flaws, machine calibration, operator error, or environmental factors.	-	-	-	-
PC14. Determine the most significant contributing factors to focus on for corrective action based on their impact on the manufacturing process and product quality.	-	-	-	-
PC15. Brainstorm and evaluate potential solutions to address the root causes identified, considering both short-term fixes and long-term preventive measures.	-	-	-	-
PC16. Implement the selected solutions, which may involve adjustments to process parameters, changes to material specifications, updates to design guidelines, or improvements in equipment maintenance procedures.	-	-	-	-
PC17. Monitor the additive manufacturing process to assess the effectiveness of the implemented solutions and ensure that the issue does not recur.	-	-	-	-
PC18. Document the RCA process, including findings, actions taken, and outcomes, to provide a reference for future troubleshooting and process improvement efforts.	-	-	-	-
PC19. Use insights gained from the RCA process to drive continuous improvement in additive manufacturing processes, technologies, and workflows.	-	-	-	-
NOS Total	**30**	**70**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0437
NOS Name	Write Process instructions, and collate data for RCA- root cause analysis
Sector	Capital Goods
Sub-Sector	Machine Tools, Dies, Moulds and Press Tools, Plastics Manufacturing Machinery, Textile Manufacturing Machinery, Process Plant Machinery, Electrical and Power Machinery, Light Engineering Goods, Defence Equipment, Fire-Fighting & Safety Equipment
Occupation	Design
NSQF Level	5.5
Credits	2
Version	1.0
Last Reviewed Date	31/01/2024
Next Review Date	31/01/2029
NSQC Clearance Date	31/01/2024

CSC/N0438: Developing prototypes of new products using 3D printers or other computer-controlled equipment

Description

This NOS is about printing prototypes using 3D printers

Scope

The scope covers the following :

- About developing prototypes of new products using 3D printers or other computer-controlled equipment

Elements and Performance Criteria

Developing prototypes of new products using 3D printers or other computer-controlled equipment

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

PC1. Produce prototypes that accurately represent the design specifications and functional requirements provided by stakeholders.

PC2. Ensure that prototypes meet dimensional accuracy standards, adhering closely to CAD models or design blueprints.

PC3. Choose appropriate materials for prototyping based on the intended use, durability, and desired properties of the final product.

PC4. Achieve high-quality prints with minimal defects such as warping, layer misalignment, or surface imperfections.

PC5. Implement design optimizations to leverage the capabilities of additive manufacturing technologies, such as minimizing support structures, reducing print time, and improving part strength.

PC6. Produce prototypes within specified timeframes, balancing speed with quality considerations.

PC7. Optimize material usage and printing parameters to minimize prototyping costs while maintaining quality standards.

PC8. Collaborate with design teams to iterate on prototypes based on feedback and design revisions, ensuring rapid development cycles.

PC9. Troubleshoot and resolve issues related to printing processes, materials, or design compatibility to maintain project timelines.

PC10. Maintain detailed records of prototyping activities, including material usage, print settings, and any deviations from design specifications.

PC11. Provide regular progress reports to project stakeholders.

PC12. Conduct thorough inspections and testing of prototypes to verify functionality, structural integrity, and compliance with design requirements.

PC13. Stay updated on advancements in additive manufacturing technologies, materials, and techniques. Implement learnings to improve prototyping processes and outcomes over time.

PC14. Work closely with other engineering teams, including design, manufacturing, and quality assurance, to ensure seamless integration of prototypes into the product development lifecycle.

PC15. Adhere to safety protocols and industry regulations governing the use of additive manufacturing equipment and materials, maintaining a safe working environment for all team members

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. • Familiarity with different AM processes such as Fused Deposition Modeling (FDM), Stereolithography (SLA), Selective Laser Sintering (SLS), Binder Jetting, etc.
• Understanding the strengths, weaknesses, and applications of each process.
• Knowledge of process parameters, build volumes, and materials compatibility for different AM systems.

KU2. • Understanding of materials commonly used in additive manufacturing such as polymers, metals, ceramics, and composites.
• Knowledge of material properties, including mechanical, thermal, and chemical properties, and how they influence part performance.

KU3. Awareness of material compatibility with specific AM processes and their post-processing requirements.

KU4. Proficiency in CAD software and design principles tailored for AM, such as topology optimization, lattice structures, and support optimization.

KU5. Ability to redesign traditional parts for AM, exploiting the design freedom offered by additive processes to improve performance, reduce weight, or consolidate assemblies.

KU6. Skills in process simulation and optimization tools to predict part distortions, residual stresses, and build failures.

KU7. Knowledge of design modifications and process parameters adjustments to optimize build quality and minimize defects.

KU8. Understanding of AM-specific quality assurance techniques, including layer-wise monitoring, non-destructive testing (NDT), and metrology.

KU9. Knowledge of industry standards and certifications relevant to additive manufacturing.

KU10. Awareness of various industries leveraging additive manufacturing, such as aerospace, automotive, healthcare, and consumer goods.

KU11. Understanding of specific application requirements and challenges within each industry.

KU12. Knowledge of emerging trends and innovations in additive manufacturing technologies and applications.

KU13. Ability to collaborate with cross-functional teams including design engineers, materials scientists, and production specialists.

KU14. Effective communication skills to articulate design concepts, technical challenges, and solutions to stakeholders.

KU15. Understanding of regulatory requirements and standards governing additive manufacturing processes and materials.

KU16. Knowledge of intellectual property issues related to AM, including patent landscape analysis and infringement considerations.

Generic Skills (GS)

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

GS1. CAD Proficiency
GS2. Understanding of Additive Manufacturing Technologies
GS3. Design for Additive Manufacturing (DfAM)
GS4. Problem-solving Skills
GS5. Project Management
GS6. Knowledge of Quality Assurance Techniques
GS7. Communication Skills
GS8. Continuous Learning
GS9. Attention to Detail
GS10. Creativity and Innovation
GS11. Teamwork and Collaboration
GS12. Regulatory Compliance
GS13. Customer Focus

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Developing prototypes of new products using 3D printers or other computer-controlled equipment	**30**	**70**	**-**	**-**
PC1. Produce prototypes that accurately represent the design specifications and functional requirements provided by stakeholders.	-	-	-	-
PC2. Ensure that prototypes meet dimensional accuracy standards, adhering closely to CAD models or design blueprints.	-	-	-	-
PC3. Choose appropriate materials for prototyping based on the intended use, durability, and desired properties of the final product.	-	-	-	-
PC4. Achieve high-quality prints with minimal defects such as warping, layer misalignment, or surface imperfections.	-	-	-	-
PC5. Implement design optimizations to leverage the capabilities of additive manufacturing technologies, such as minimizing support structures, reducing print time, and improving part strength.	-	-	-	-
PC6. Produce prototypes within specified timeframes, balancing speed with quality considerations.	-	-	-	-
PC7. Optimize material usage and printing parameters to minimize prototyping costs while maintaining quality standards.	-	-	-	-
PC8. Collaborate with design teams to iterate on prototypes based on feedback and design revisions, ensuring rapid development cycles.	-	-	-	-
PC9. Troubleshoot and resolve issues related to printing processes, materials, or design compatibility to maintain project timelines.	-	-	-	-
PC10. Maintain detailed records of prototyping activities, including material usage, print settings, and any deviations from design specifications.	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC11. Provide regular progress reports to project stakeholders.	-	-	-	-
PC12. Conduct thorough inspections and testing of prototypes to verify functionality, structural integrity, and compliance with design requirements.	-	-	-	-
PC13. Stay updated on advancements in additive manufacturing technologies, materials, and techniques. Implement learnings to improve prototyping processes and outcomes over time.	-	-	-	-
PC14. Work closely with other engineering teams, including design, manufacturing, and quality assurance, to ensure seamless integration of prototypes into the product development lifecycle.	-	-	-	-
PC15. Adhere to safety protocols and industry regulations governing the use of additive manufacturing equipment and materials, maintaining a safe working environment for all team members	-	-	-	-
NOS Total	**30**	**70**	**-**	**-**

Qualification Pack

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0438
NOS Name	Developing prototypes of new products using 3D printers or other computer-controlled equipment
Sector	Capital Goods
Sub-Sector	Machine Tools, Dies, Moulds and Press Tools, Plastics Manufacturing Machinery, Textile Manufacturing Machinery, Process Plant Machinery, Electrical and Power Machinery, Light Engineering Goods, Defence Equipment, Fire-Fighting & Safety Equipment
Occupation	Design
NSQF Level	5.5
Credits	3
Version	1.0
Last Reviewed Date	31/01/2024
Next Review Date	31/01/2029
NSQC Clearance Date	31/01/2024

CSC/N0439: Implement corrective actions for process and quality issues/ Perform Quality Assurance and Testing

Description

This NOS is about quality control and testing of the process

Scope

The scope covers the following :

- About Implementing corrective actions for process and quality issues/ Perform Quality Assurance and Testing

Elements and Performance Criteria

Implement corrective actions for process and quality issues/ Perform Quality Assurance and Testing

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

PC1. Recognize and document deviations from expected outcomes in additive manufacturing processes.

PC2. Identify quality issues in manufactured parts through inspection, testing, and analysis.

PC3. Utilize data analytics and statistical methods to identify trends and patterns indicative of process or quality issues.

PC4. Conduct thorough root cause analysis to determine the underlying reasons for process deviations and quality issues.

PC5. Employ techniques such as fishbone diagrams, 5 Whys, or fault tree analysis to identify contributing factors.

PC6. Collaborate with cross-functional teams to gather relevant information and insights for comprehensive analysis.

PC7. Formulate effective corrective action plans based on the findings of root cause analysis.

PC8. Prioritize corrective actions based on their potential impact on process stability and product quality

PC9. Ensure corrective actions are aligned with industry standards, regulatory requirements, and best practices in additive manufacturing

PC10. Lead or support the implementation of corrective actions within the additive manufacturing process.

PC11. Coordinate with relevant stakeholders, including production teams, engineers, and quality assurance personnel, to ensure timely and effective implementation.

PC12. Monitor progress and adjust implementation strategies as necessary to achieve desired outcomes.

PC13. Develop and execute quality assurance testing protocols for additive manufacturing processes and products.

PC14. Utilize a variety of testing methods, including dimensional inspection, material analysis, mechanical testing, and non-destructive testing, to assess product quality.

PC15. Ensure adherence to relevant industry standards, specifications, and customer requirements during testing procedures.

PC16. Analyze testing data to evaluate conformance to quality standards and specifications.

PC17. Document test results, including any deviations or non-conformities, in a clear and comprehensive manner.

PC18. Generate reports summarizing testing activities, findings, and recommendations for improvement.

PC19. Drive continuous improvement initiatives to enhance process efficiency and product quality in additive manufacturing.

PC20. Proactively identify opportunities for optimization and innovation through collaboration with internal teams and external partners.

PC21. Participate in lessons learned sessions to capture insights from corrective actions and quality assurance activities for future reference.

PC22. Ensure compliance with relevant regulations, standards, and certifications governing additive manufacturing processes and products.

PC23. Stay updated on industry developments and regulatory changes to ensure adherence to the latest requirements.

PC24. Collaborate with regulatory affairs teams to address any compliance issues or concerns effectively.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. • Familiarity with different AM processes such as Fused Deposition Modeling (FDM), Stereolithography (SLA), Selective Laser Sintering (SLS), Binder Jetting, etc.
• Understanding the strengths, weaknesses, and applications of each process.
• Knowledge of process parameters, build volumes, and materials compatibility for different AM systems.

KU2. • Understanding of materials commonly used in additive manufacturing such as polymers, metals, ceramics, and composites.
• Knowledge of material properties, including mechanical, thermal, and chemical properties, and how they influence part performance.

KU3. Awareness of material compatibility with specific AM processes and their post-processing requirements.

KU4. Proficiency in CAD software and design principles tailored for AM, such as topology optimization, lattice structures, and support optimization.

KU5. Ability to redesign traditional parts for AM, exploiting the design freedom offered by additive processes to improve performance, reduce weight, or consolidate assemblies.

KU6. Skills in process simulation and optimization tools to predict part distortions, residual stresses, and build failures.

KU7. Knowledge of design modifications and process parameters adjustments to optimize build quality and minimize defects.

KU8. Understanding of AM-specific quality assurance techniques, including layer-wise monitoring, non-destructive testing (NDT), and metrology.

KU9. Knowledge of industry standards and certifications relevant to additive manufacturing.

KU10. Awareness of various industries leveraging additive manufacturing, such as aerospace, automotive, healthcare, and consumer goods.

KU11. Understanding of specific application requirements and challenges within each industry.

KU12. Knowledge of emerging trends and innovations in additive manufacturing technologies and applications.

KU13. Ability to collaborate with cross-functional teams including design engineers, materials scientists, and production specialists.

KU14. Effective communication skills to articulate design concepts, technical challenges, and solutions to stakeholders.

KU15. Understanding of regulatory requirements and standards governing additive manufacturing processes and materials.

KU16. Knowledge of intellectual property issues related to AM, including patent landscape analysis and infringement considerations.

Generic Skills (GS)

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

GS1. CAD Proficiency

GS2. Understanding of Additive Manufacturing Technologies

GS3. Design for Additive Manufacturing (DfAM)

GS4. Problem-solving Skills

GS5. Project Management

GS6. Knowledge of Quality Assurance Techniques

GS7. Communication Skills

GS8. Continuous Learning

GS9. Attention to Detail

GS10. Creativity and Innovation

GS11. Teamwork and Collaboration

GS12. Regulatory Compliance

GS13. Customer Focus

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Implement corrective actions for process and quality issues/ Perform Quality Assurance and Testing	**30**	**70**	**-**	**-**
PC1. Recognize and document deviations from expected outcomes in additive manufacturing processes.	-	-	-	-
PC2. Identify quality issues in manufactured parts through inspection, testing, and analysis.	-	-	-	-
PC3. Utilize data analytics and statistical methods to identify trends and patterns indicative of process or quality issues.	-	-	-	-
PC4. Conduct thorough root cause analysis to determine the underlying reasons for process deviations and quality issues.	-	-	-	-
PC5. Employ techniques such as fishbone diagrams, 5 Whys, or fault tree analysis to identify contributing factors.	-	-	-	-
PC6. Collaborate with cross-functional teams to gather relevant information and insights for comprehensive analysis.	-	-	-	-
PC7. Formulate effective corrective action plans based on the findings of root cause analysis.	-	-	-	-
PC8. Prioritize corrective actions based on their potential impact on process stability and product quality	-	-	-	-
PC9. Ensure corrective actions are aligned with industry standards, regulatory requirements, and best practices in additive manufacturing	-	-	-	-
PC10. Lead or support the implementation of corrective actions within the additive manufacturing process.	-	-	-	-
PC11. Coordinate with relevant stakeholders, including production teams, engineers, and quality assurance personnel, to ensure timely and effective implementation.	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC12. Monitor progress and adjust implementation strategies as necessary to achieve desired outcomes.	-	-	-	-
PC13. Develop and execute quality assurance testing protocols for additive manufacturing processes and products.	-	-	-	-
PC14. Utilize a variety of testing methods, including dimensional inspection, material analysis, mechanical testing, and non-destructive testing, to assess product quality.	-	-	-	-
PC15. Ensure adherence to relevant industry standards, specifications, and customer requirements during testing procedures.	-	-	-	-
PC16. Analyze testing data to evaluate conformance to quality standards and specifications.	-	-	-	-
PC17. Document test results, including any deviations or non-conformities, in a clear and comprehensive manner.	-	-	-	-
PC18. Generate reports summarizing testing activities, findings, and recommendations for improvement.	-	-	-	-
PC19. Drive continuous improvement initiatives to enhance process efficiency and product quality in additive manufacturing.	-	-	-	-
PC20. Proactively identify opportunities for optimization and innovation through collaboration with internal teams and external partners.	-	-	-	-
PC21. Participate in lessons learned sessions to capture insights from corrective actions and quality assurance activities for future reference.	-	-	-	-
PC22. Ensure compliance with relevant regulations, standards, and certifications governing additive manufacturing processes and products.	-	-	-	-
PC23. Stay updated on industry developments and regulatory changes to ensure adherence to the latest requirements.	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC24. Collaborate with regulatory affairs teams to address any compliance issues or concerns effectively.	-	-	-	-
NOS Total	**30**	**70**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0439
NOS Name	Implement corrective actions for process and quality issues/ Perform Quality Assurance and Testing
Sector	Capital Goods
Sub-Sector	Machine Tools, Dies, Moulds and Press Tools, Plastics Manufacturing Machinery, Textile Manufacturing Machinery, Process Plant Machinery, Electrical and Power Machinery, Light Engineering Goods, Defence Equipment, Fire-Fighting & Safety Equipment
Occupation	Design
NSQF Level	5.5
Credits	1
Version	1.0
Last Reviewed Date	31/01/2024
Next Review Date	31/01/2029
NSQC Clearance Date	31/01/2024

CSC/N0440: Interface with design engineers to ensure manufacturability of new designs

Description

This NOS is about checking the manufacturability of designs

Scope

The scope covers the following :

- About checking the manufacturability of the design

Elements and Performance Criteria

Interface with design engineers to ensure manufacturability of new designs

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

PC1. Demonstrate clear and concise communication skills when interacting with design engineers to understand design requirements and convey manufacturability constraints and recommendations effectively.

PC2. Collaborate with design engineers to identify potential manufacturability issues early in the design process and work together to find solutions that balance design intent with manufacturing feasibility.

PC3. Apply deep knowledge of additive manufacturing processes, materials, and limitations to provide informed feedback to design engineers regarding design features, material selection, tolerances, and part orientation for optimal manufacturability.

PC4. Analyze design geometries and provide guidance to design engineers on optimizing designs for additive manufacturing, including considerations such as minimizing support structures, reducing build time, and improving part performance.

PC5. Utilize CAD software and simulation tools proficiently to assess the manufacturability of designs, conduct feasibility studies, and generate recommendations for design modifications to enhance manufacturability.

PC6. Implement quality assurance measures to ensure that designs meet required standards and specifications for additive manufacturing processes, including dimensional accuracy, surface finish, and mechanical properties.

PC7. Maintain accurate records of design reviews, recommendations, and modifications, and provide detailed reports to design engineers outlining manufacturability assessments and proposed design enhancements.

PC8. Stay updated on advancements in additive manufacturing technologies, materials, and processes, and actively seek opportunities to improve manufacturability practices and processes through ongoing learning and professional development.

PC9. Work efficiently to provide timely feedback to design engineers, minimizing delays in the design iteration process and ensuring that manufacturability considerations are addressed promptly to meet project timelines.

PC10. Strive to exceed customer expectations by delivering manufacturable designs that meet or exceed performance requirements while adhering to project constraints and objectives.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. • Familiarity with different AM processes such as Fused Deposition Modeling (FDM), Stereolithography (SLA), Selective Laser Sintering (SLS), Binder Jetting, etc.
• Understanding the strengths, weaknesses, and applications of each process.
• Knowledge of process parameters, build volumes, and materials compatibility for different AM systems.

KU2. • Understanding of materials commonly used in additive manufacturing such as polymers, metals, ceramics, and composites.
• Knowledge of material properties, including mechanical, thermal, and chemical properties, and how they influence part performance.

KU3. Awareness of material compatibility with specific AM processes and their post-processing requirements.

KU4. Proficiency in CAD software and design principles tailored for AM, such as topology optimization, lattice structures, and support optimization.

KU5. Ability to redesign traditional parts for AM, exploiting the design freedom offered by additive processes to improve performance, reduce weight, or consolidate assemblies.

KU6. Skills in process simulation and optimization tools to predict part distortions, residual stresses, and build failures.

KU7. Knowledge of design modifications and process parameters adjustments to optimize build quality and minimize defects.

KU8. Understanding of AM-specific quality assurance techniques, including layer-wise monitoring, non-destructive testing (NDT), and metrology.

KU9. Knowledge of industry standards and certifications relevant to additive manufacturing.

KU10. Awareness of various industries leveraging additive manufacturing, such as aerospace, automotive, healthcare, and consumer goods.

KU11. Understanding of specific application requirements and challenges within each industry.

KU12. Knowledge of emerging trends and innovations in additive manufacturing technologies and applications.

KU13. Ability to collaborate with cross-functional teams including design engineers, materials scientists, and production specialists.

KU14. Effective communication skills to articulate design concepts, technical challenges, and solutions to stakeholders.

KU15. Understanding of regulatory requirements and standards governing additive manufacturing processes and materials.

KU16. Knowledge of intellectual property issues related to AM, including patent landscape analysis and infringement considerations.

Generic Skills (GS)

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

GS1. CAD Proficiency

GS2. Understanding of Additive Manufacturing Technologies

GS3. Design for Additive Manufacturing (DfAM)
GS4. Problem-solving Skills
GS5. Project Management
GS6. Knowledge of Quality Assurance Techniques
GS7. Communication Skills
GS8. Continuous Learning
GS9. Attention to Detail
GS10. Creativity and Innovation
GS11. Teamwork and Collaboration
GS12. Regulatory Compliance
GS13. Customer Focus

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Interface with design engineers to ensure manufacturability of new designs	**30**	**70**	**-**	**-**
PC1. Demonstrate clear and concise communication skills when interacting with design engineers to understand design requirements and convey manufacturability constraints and recommendations effectively.	-	-	-	-
PC2. Collaborate with design engineers to identify potential manufacturability issues early in the design process and work together to find solutions that balance design intent with manufacturing feasibility.	-	-	-	-
PC3. Apply deep knowledge of additive manufacturing processes, materials, and limitations to provide informed feedback to design engineers regarding design features, material selection, tolerances, and part orientation for optimal manufacturability.	-	-	-	-
PC4. Analyze design geometries and provide guidance to design engineers on optimizing designs for additive manufacturing, including considerations such as minimizing support structures, reducing build time, and improving part performance.	-	-	-	-
PC5. Utilize CAD software and simulation tools proficiently to assess the manufacturability of designs, conduct feasibility studies, and generate recommendations for design modifications to enhance manufacturability.	-	-	-	-
PC6. Implement quality assurance measures to ensure that designs meet required standards and specifications for additive manufacturing processes, including dimensional accuracy, surface finish, and mechanical properties.	-	-	-	-
PC7. Maintain accurate records of design reviews, recommendations, and modifications, and provide detailed reports to design engineers outlining manufacturability assessments and proposed design enhancements.	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC8. Stay updated on advancements in additive manufacturing technologies, materials, and processes, and actively seek opportunities to improve manufacturability practices and processes through ongoing learning and professional development.	-	-	-	-
PC9. Work efficiently to provide timely feedback to design engineers, minimizing delays in the design iteration process and ensuring that manufacturability considerations are addressed promptly to meet project timelines.	-	-	-	-
PC10. Strive to exceed customer expectations by delivering manufacturable designs that meet or exceed performance requirements while adhering to project constraints and objectives.	-	-	-	-
NOS Total	**30**	**70**	**-**	**-**

Qualification Pack

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0440
NOS Name	Interface with design engineers to ensure manufacturability of new designs
Sector	Capital Goods
Sub-Sector	Machine Tools, Dies, Moulds and Press Tools, Plastics Manufacturing Machinery, Textile Manufacturing Machinery, Process Plant Machinery, Electrical and Power Machinery, Light Engineering Goods, Defence Equipment, Fire-Fighting & Safety Equipment
Occupation	Design
NSQF Level	5.5
Credits	2
Version	1.0
Last Reviewed Date	31/01/2024
Next Review Date	31/01/2029
NSQC Clearance Date	31/01/2024

CSC/N1341: Collaboratively coordinate with the team .

Description

This OS unit is about building relationships and working with people and groups inside and outside the organization, using skills and habits, to achieve the team goals and objectives

Scope

The scope covers the following :

- This unit/task covers the following:
- Creating team environment
- Communicating - giving and receiving
- Working cooperatively
- Participating in team decision making
- Demonstrating Sense of Responsibility
- Showing respect for opinions, customs, and preferences

Elements and Performance Criteria

Define Key Performance Indicators

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

PC1. generate a report to communicate the KPIs when monitoring the performance of the AR/VR solution

PC2. define the frequency of measuring KPIs and report format for communication to stakeholders

PC3. define the plan to review technical performance and improve the process efficiency

PC4. identify the larger business and organizational context behind the requirements of the stakeholder

Communicate with Team members and other Stakeholders

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

PC5. keep stakeholders updated on changes in the project requirements

PC6. respond to request, feature request and data insight in a timely and accurate manner

PC7. use formal communication methods to collaborate with internal teams & stakeholders (such as meetings, conference calls, emails etc.)

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. the organisation's policies and procedures for working with colleagues, roles and responsibilities

KU2. the importance of effective communication and establishing good working relationships with colleagues

KU3. different methods of communication and the circumstances in which it is appropriate to use these

KU4. the importance of creating an environment of trust and mutual respect

KU5. the implications of own work on the work and schedule of others

KU6. different types of information that colleagues might need and the importance of providing this information when it is required

KU7. the importance of helping colleagues with problems, to meet quality and time standards as a team

Generic Skills (GS)

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

GS1. read and write instructions, guidelines, procedures, messages, emails, and other media in language of the workplace

GS2. communicate in common and technical terms in language of the workplace

GS3. listen effectively and orally communicate information

GS4. be punctual, do work scheduling and reporting

GS5. comply with workplace practices and ethics

GS6. maintain cleanliness and healthy environment

GS7. be customer friendly - understand real needs of the customer and suggest most appropriate solution

GS8. be safety conscious and avoid risk

GS9. be observant, vigilant, and security consciousness

GS10. respond, handle problem, and escalate as necessary

GS11. ask for clarification and advice from concerned persons

GS12. make decisions on a suitable course of action or response keeping in view resource utilization while meeting commitments

GS13. plan and organize work to achieve targets and deadlines

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Define Key Performance Indicators	**30**	**70**	**-**	**-**
PC1. generate a report to communicate the KPIs when monitoring the performance of the AR/VR solution	-	-	-	-
PC2. define the frequency of measuring KPIs and report format for communication to stakeholders	-	-	-	-
PC3. define the plan to review technical performance and improve the process efficiency	-	-	-	-
PC4. identify the larger business and organizational context behind the requirements of the stakeholder	-	-	-	-
Communicate with Team members and other Stakeholders	**-**	**-**	**-**	**-**
PC5. keep stakeholders updated on changes in the project requirements	-	-	-	-
PC6. respond to request, feature request and data insight in a timely and accurate manner	-	-	-	-
PC7. use formal communication methods to collaborate with internal teams & stakeholders (such as meetings, conference calls, emails etc.)	-	-	-	-
NOS Total	**30**	**70**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N1341
NOS Name	Collaboratively coordinate with the team .
Sector	Capital Goods
Sub-Sector	Generic
Occupation	Generic
NSQF Level	5
Credits	2
Version	1.0
Last Reviewed Date	31/01/2024
Next Review Date	31/01/2029
NSQC Clearance Date	31/01/2024

CSC/N0530: Follow health, safety and environment guidelines at workplace.

Description

This OS unit is about following adequate safety procedures to make work environment healthy and safe

Scope

The scope covers the following :

- This unit/task covers the following:
- Adhere to standard safety procedures of the company
- Follow healthy practices and posture
- Practice waste management and recycling
- Conserve material and resources

Elements and Performance Criteria

Adhere to standard safety procedures of the organisation

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

PC1. comply with general safety procedures and those for handling equipment, tools, chemicals, and hazardous material, as prescribed and followed in the organisation

PC2. remove finger rings or any other metal objects likely to interfere with the work

PC3. ensure that identification badge or any other object worn around the neck or on the clothing does not get caught in any rotating machine, or otherwise interfere with the work

PC4. use appropriate safety devices such as goggles, gloves, ear plugs, caps, ESD pins, covers, shoes, helmets etc. recommended for the work being performed

PC5. inform, escalate, or raise alarm about any suspicions, unaccounted hazardous material, devices, or other objects found in the premises

PC6. inform, escalate, or raise alarm about any breach of safety or security procedure in the organisation

PC7. help achieve zero accidents goals at work

PC8. avoid damage to sensitive electronic components due to negligence of ESD procedures

PC9. participate regularly in fire drills or other safety related workshops organised by the organisation

PC10. follow strictly all access control and perimeter safety procedures in designated factory areas such as robotic work stations, automated production lines, automated material movement and other potentially risky operations

PC11. ensure that other people follow all access control and perimeter safety procedures in designated factory areas and help avoid accidents

PC12. use emergency switches or other mechanisms of stopping a machine immediately in case any emergency situation has developed or about to happen

PC13. ensure that electrical equipment are properly grounded

PC14. follow Cyber Security guidelines and be vigilant at workplace

PC15. proceed to designated safe assembly area immediately on hearing fire alarm

Follow healthy practices and posture

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

PC16. wash hands and use sanitizers as recommended to prevent spread of diseases

PC17. follow common personal hygiene practices

PC18. maintain appropriate posture, especially in long hours of sitting or standing position and in handling heavy materials

PC19. participate in company organised health sessions such as exercises, games, yoga, physiotherapy, and other activities

PC20. handle heavy and hazardous materials with care, while maintaining appropriate posture, using suitable tools, and handling equipment such as trolleys, jacks, and ladders

PC21. learn and apply first aid devices available in the workplace

PC22. learn and apply safety and handling procedures for electrical shock and electrocution

PC23. learn and apply emergency medical help services

PC24. follow workplace decorum and avoid emotional outbursts or inappropriate language

PC25. prevent any harassment at workplace

Practice waste management and recycling

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

PC26. identify recyclable, non-recyclable, and hazardous waste generated in the workplace and comply with their disposal procedures

PC27. dispose non-recyclable waste and hazardous waste following recommended processes

PC28. deposit recyclable and reusable material at identified locations

PC29. support education and compliance of waste management processes

Conserve material and resources

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

PC30. identify ways to optimize usage of material and resources such as water, electricity, energy in various tasks, activities, and processes

PC31. check for spills and leakages of material in various tasks, activities, and processes and plug them

PC32. escalate the leakage issue to appropriate authority if needed

PC33. carry out routine cleaning of tools, machines, and equipment and maintain them in good working condition to optimize efficiency and wastage

PC34. check if the equipment is functioning normally before commencing work and rectify or report any malfunctioning to the responsible agency

PC35. check for any odour, sparks, fumes, emission, unusual vibration, noise, or any other objectionable presence in the environment and take immediate corrective action followed by report to responsible agency

PC36. ensure electrical equipment are properly connected for use and are switched off when not in use

PC37. support education and compliance of resource conservation processes

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. company policies on workplace, environment, and personnel management
KU2. company policy on occupational safety and health
KU3. professional hazards related to nature of work and how to deal with them
KU4. how to maintain the work area safe and secure
KU5. how to handle hazardous materials, tools, and equipment
KU6. emergency procedures for fire, electrocution, physical injury, wounds, etc.
KU7. need for proper body posture and use of appropriate handling equipment
KU8. understand electrical grounding practices
KU9. common sources of pollution and ways to minimize it
KU10. waste management - categorisation, colour coding, handling, and disposal procedure
KU11. organisation policies and procedures for minimizing waste
KU12. efficient use of electricity, material, and water in processes
KU13. organization policies regarding network usage and security
KU14. norms for professional behaviour at workplace and dealing with deviations

Generic Skills (GS)

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

GS1. communicating in the language of the workplace
GS2. reading and interpreting documents, drawings, symbols, and instructions
GS3. operating computer and common office equipment and diagnosing common electrical and interconnection problems
GS4. writing notes, reports, observations, emails
GS5. using personnel protective devices
GS6. maintaining clean and healthy work environment
GS7. using and operating safety devices and equipment
GS8. conducting work following workplace security processes and rules
GS9. responding to emergency situations pertaining to workplace
GS10. understanding people and collaborating to create a healthy workplace

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Adhere to standard safety procedures of the organisation	**62**	**38**	**-**	**-**
PC1. comply with general safety procedures and those for handling equipment, tools, chemicals, and hazardous material, as prescribed and followed in the organisation	-	-	-	-
PC2. remove finger rings or any other metal objects likely to interfere with the work	-	-	-	-
PC3. ensure that identification badge or any other object worn around the neck or on the clothing does not get caught in any rotating machine, or otherwise interfere with the work	-	-	-	-
PC4. use appropriate safety devices such as goggles, gloves, ear plugs, caps, ESD pins, covers, shoes, helmets etc. recommended for the work being performed	-	-	-	-
PC5. inform, escalate, or raise alarm about any suspicions, unaccounted hazardous material, devices, or other objects found in the premises	-	-	-	-
PC6. inform, escalate, or raise alarm about any breach of safety or security procedure in the organisation	-	-	-	-
PC7. help achieve zero accidents goals at work	-	-	-	-
PC8. avoid damage to sensitive electronic components due to negligence of ESD procedures	-	-	-	-
PC9. participate regularly in fire drills or other safety related workshops organised by the organisation	-	-	-	-
PC10. follow strictly all access control and perimeter safety procedures in designated factory areas such as robotic work stations, automated production lines, automated material movement and other potentially risky operations	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC11. ensure that other people follow all access control and perimeter safety procedures in designated factory areas and help avoid accidents	-	-	-	-
PC12. use emergency switches or other mechanisms of stopping a machine immediately in case any emergency situation has developed or about to happen	-	-	-	-
PC13. ensure that electrical equipment are properly grounded	-	-	-	-
PC14. follow Cyber Security guidelines and be vigilant at workplace	-	-	-	-
PC15. proceed to designated safe assembly area immediately on hearing fire alarm	-	-	-	-
Follow healthy practices and posture	-	-	-	-
PC16. wash hands and use sanitizers as recommended to prevent spread of diseases	-	-	-	-
PC17. follow common personal hygiene practices	-	-	-	-
PC18. maintain appropriate posture, especially in long hours of sitting or standing position and in handling heavy materials	-	-	-	-
PC19. participate in company organised health sessions such as exercises, games, yoga, physiotherapy, and other activities	-	-	-	-
PC20. handle heavy and hazardous materials with care, while maintaining appropriate posture, using suitable tools, and handling equipment such as trolleys, jacks, and ladders	-	-	-	-
PC21. learn and apply first aid devices available in the workplace	-	-	-	-
PC22. learn and apply safety and handling procedures for electrical shock and electrocution	-	-	-	-
PC23. learn and apply emergency medical help services	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC24. follow workplace decorum and avoid emotional outbursts or inappropriate language	-	-	-	-
PC25. prevent any harassment at workplace	-	-	-	-
Practice waste management and recycling	-	-	-	-
PC26. identify recyclable, non-recyclable, and hazardous waste generated in the workplace and comply with their disposal procedures	-	-	-	-
PC27. dispose non-recyclable waste and hazardous waste following recommended processes	-	-	-	-
PC28. deposit recyclable and reusable material at identified locations	-	-	-	-
PC29. support education and compliance of waste management processes	-	-	-	-
Conserve material and resources	-	-	-	-
PC30. identify ways to optimize usage of material and resources such as water, electricity, energy in various tasks, activities, and processes	-	-	-	-
PC31. check for spills and leakages of material in various tasks, activities, and processes and plug them	-	-	-	-
PC32. escalate the leakage issue to appropriate authority if needed	-	-	-	-
PC33. carry out routine cleaning of tools, machines, and equipment and maintain them in good working condition to optimize efficiency and wastage	-	-	-	-
PC34. check if the equipment is functioning normally before commencing work and rectify or report any malfunctioning to the responsible agency	-	-	-	-
PC35. check for any odour, sparks, fumes, emission, unusual vibration, noise, or any other objectionable presence in the environment and take immediate corrective action followed by report to responsible agency	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC36. ensure electrical equipment are properly connected for use and are switched off when not in use	-	-	-	-
PC37. support education and compliance of resource conservation processes	-	-	-	-
NOS Total	**62**	**38**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0530
NOS Name	Follow health, safety and environment guidelines at workplace.
Sector	Capital Goods
Sub-Sector	Machine Tools, Dies, Moulds and Press Tools, Plastics Manufacturing Machinery, Textile Manufacturing Machinery, Process Plant Machinery, Electrical and Power Machinery, Defence Equipment, Fire-Fighting & Safety Equipment, Homeland Security
Occupation	Service
NSQF Level	5
Credits	1
Version	1.0
Last Reviewed Date	31/01/2024
Next Review Date	31/01/2029
NSQC Clearance Date	31/01/2024

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:

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.

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

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

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Introduction to Employability Skills	**1**	**1**	**-**	**-**
PC1. identify employability skills required for jobs in various industries	-	-	-	-
PC2. identify and explore learning and employability portals	-	-	-	-
Constitutional values – Citizenship	**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	-	-	-	-
Becoming a Professional in the 21st Century	**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	-	-	-	-
Basic English Skills	**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	-	-	-	-
Career Development & Goal Setting	**1**	**2**	**-**	**-**

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	-	-	-	-
Communication Skills	**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	-	-	-	-
Diversity & Inclusion	**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	-	-	-	-
Financial and Legal Literacy	**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	-	-	-	-
Essential Digital Skills	**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	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Entrepreneurship	**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	-	-	-	-
Customer Service	**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	-	-	-	-
Getting ready for apprenticeship & Jobs	**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**	**-**	**-**

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	30/11/2023
Next Review Date	29/11/2026
NSQC Clearance Date	30/11/2023

Assessment Guidelines and Assessment Weightage

Assessment Guidelines

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 centre (as per assessment criteria below).

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

6. To pass the Qualification Pack assessment, every trainee should score a minimum of 70% of %

aggregate marks to successfully clear the assessment.

7. 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
CSC/N0435.Design and produce 3D computer model for the prototype of metal parts	30	70	-	-	100	15
CSC/N0436.Identify the Process & Select the additive material to be used	30	70	-	-	100	20
CSC/N0437.Write Process instructions, and collate data for RCA- root cause analysis	30	70	-	-	100	15
CSC/N0438.Developing prototypes of new products using 3D printers or other computer-controlled equipment	30	70	-	-	100	15
CSC/N0439.Implement corrective actions for process and quality issues/ Perform Quality Assurance and Testing	30	70	-	-	100	10
CSC/N0440.Interface with design engineers to ensure manufacturability of new designs	30	70	-	-	100	10
CSC/N1341.Collaboratively coordinate with the team .	30	70	-	-	100	5

Qualification Pack

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
CSC/N0530.Follow health, safety and environment guidelines at workplace.	62	38	-	-	100	5
DGT/VSQ/N0102.Employability Skills (60 Hours)	20	30	-	-	50	5
Total	**292**	**558**	**-**	**-**	**850**	**100**

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.