

NOS Code	ASC/N8115
NOS Name	Product Reverse Engineering
Sector	Automotive
Sub-Sector	Research and Development
Occupation	Automotive Product Designing
NSQF Level	5.5
Credits	2
Version	1.0
Last Reviewed Date	29/09/2023
Next Review Date	29/09/2026
NSQC Clearance Date	29/09/2023

ASC/N8115: Product Reverse Engineering

Description

This NOS unit is about scanning the object, carry out reverse engineering for product modification, designing of new models by using appropriate computer graphic techniques and 3D printing of designed model for developing the prototype of product.

Scope

The scope covers the following:

- Carry out object scanning, reverse engineering and designing modified component
- Develop product prototype by 3D printing

Elements and Performance Criteria

Carry out object scanning, reverse engineering and designing modified component

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

- PC1. obtain the design requirements and specifications such as material used for making the component, packaging and other requirements to decide the dimensions, measurements and tolerances of the aggregate/component and instructions from the design team or supervisor
- PC2. prepare the object for scanning by spray coat a temporary matte powder on object to improve scan accuracy
- PC3. use a high accuracy 3D scanner to capture the important sections of the part
- PC4. scan the object and create mesh files of the object in 3D scanner by following SOP
- PC5. import the mesh files or scanned data into CAD software equipped with reverse engineering tools
- PC6. extract the shape of the scan in order to create a solid model that is editable with CAD tools i.e. semi-automatic surfacing, automatic surfacing, and manual redrawing
- PC7. identify flaws in the scanned model, fix issues and create a blueprint by using reverse engineering tools in CAD software
- PC8. use the scanned data or model of object in CAD software as a reference for reverse engineering process.
- PC9. Create a rectified 3D model of product.
- PC10. prepare layouts and various views of drawing to generate a relationship between components and assemblies
- PC11. Submit the drawings to the supervisor and design team
- PC12. tag and store the drawings with the right numbers and codes properly as per the organisational guidelines.
- PC13. convert the object model into STL or AMF file format as per the 3D printer requirement.
- PC14. transfer the verified object model STL / AMF file into portable storage device or directly to 3D printer as per SOP/WI

Develop product prototype by 3D printing

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

- PC15. set the 3D printing machine and its parameters such as room temperature range, air cleanliness as per SOP/WI
- PC16. select encoding format for the 3D printing program file
- PC17. set the part orientation, printing time & the amount of material used on the machine
- PC18. set the laser or nozzles temperature to defined values as per process specification
- PC19. start and operate the machine and perform 3D printing operations as per SOP/WI to develop prototype of product
- PC20. rectify any process errors if any during the machine operation and report the same to the concerned person as per organizational guidelines
- PC21. remove the printed prototype of product from machine without damaging its structure
- PC22. clean the prototype for improving the surface finish as per SOP
- PC23. inspect the prototype as per the drawing/process using for required quality and if non-conforming, take action as per organisational guidelines
- PC24. store & preserve the prototype of product manufactured as per organizational guidelines and procedures

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

- KU1. relevant standards and procedures followed in the company
- KU2. 3D Reverse engineering
- KU3. steps of the reverse engineering process
- KU4. different types of 3D scanners
- KU5. working mechanism of 3D scanner
- KU6. procedure of using 3D scanner and printer
- KU7. various requirements in terms of design and utility of the component
- KU8. different types of designing processes and associated software like CATIA, AutoCAD, Unigraphics etc.
- KU9. Droughting Standards & Techniques- e.g. ANSI series IS/ ISO
- KU10. technical drawing practices as per the company standards
- KU11. drawings and modelling techniques like 2D and 3D
- KU12. different type of views generated in engineering drawings
- KU13. computer programming and drafting
- KU14. Limits & Fits, GD&T etc.
- KU15. algebra and trigonometric rules and applications
- KU16. how to interpret Tolerance Analysis sheet supplied by the design team
- KU17. how to check various dimensional mismatches which may happen on the actual product assembly
- KU18. Technology 3D Printing such as Fused Deposition Modelling, Stereo Lithography, Metal Laser Sintering
- KU19. symbols and notifications being displayed by the 3D Printing machine and their corresponding meaning
- KU20. functionality of different buttons and switches available on the Scanner/printer Machine dashboard
- KU21. how to upload and remove code files from the machine memory

- KU22. preservation of critical electronic parts/equipment from moisture/heat/environmental external conditions as specified in the process
- KU23. how to maintain the log book for produced parts
- KU24. how to detect and rectify error at various stages of part generation
- KU25. types of materials available for fabrication in various 3D printing technique
- KU26. various inspection methods for inspecting the quality of product
- KU27. optimum temperature range, air cleanliness and humidity required for the Scanner/Printer
- KU28. techniques of fabricating a component with 3D Printing

Generic Skills (GS)

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

- GS1. read and interpret notes, designs and instructions shared by different internal team
- GS2. communicate the process requirements to the supervisor and co-workers
- GS3. attentively listen and comprehend the information given by the supervisor/team members
- GS4. write work related information in English/regional language
- GS5. recognise a workplace problem and take suitable action
- GS6. analyse and apply the information gathered from observation, experience, reasoning or communication to act efficiently
- GS7. plan and organise work according to the work requirements
- GS8. complete the assigned tasks with minimum supervision
- GS9. visualize designs
- GS10. share technical information clearly using appropriate language

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Carry out object scanning, reverse engineering and designing modified component</i>	18	31		12
PC1. obtain the design requirements and specifications such as material used for making the component, packaging and other requirements to decide the dimensions, measurements and tolerances of the aggregate/component and instructions from the design team or supervisor	1	2		1
PC2. prepare the object for scanning by spray coat a temporary matte powder on object to improve scan accuracy	1	2		1

PC3. use a high accuracy 3D scanner to capture the important sections of the part	1	2		1
PC4. scan the object and create mesh files of the object in 3D scanner by following SOP	2	4		2
PC5. import the mesh files or scanned data into CAD software equipped with reverse engineering tools	1	1		1
PC6. extract the shape of the scan in order to create a solid model that is editable with CAD tools i.e. semi-automatic surfacing, automatic surfacing, and manual redrawing	2	2		1
PC7. identify flaws in the scanned model, fix issues and create a blueprint by using reverse engineering tools in CAD software	2	4		1
PC8. use the scanned data or model of object in CAD software as a reference for reverse engineering process.	2	3		1
PC9. Create a rectified 3D model of product.	1	2		1
PC10. prepare layouts and various views of drawing to generate a relationship between components and assemblies	1	2		1
PC11. Submit the drawings to the supervisor and design team	1	1		
PC12. tag and store the drawings with the right numbers and codes properly as per the organisational guidelines.	1	2		
PC13. convert the object model into STL or AMF file format as per the 3D printer requirement.	1	2		1
PC14. transfer the verified object model STL / AMF file into portable storage device or directly to 3D printer as per SOP/WI	1	2		
<i>Develop product prototype by 3D printing</i>	12	19		8
PC15. set the 3D printing machine and its parameters such as room temperature range, air cleanliness as per SOP/WI	1	2		1
PC16. select encoding format for the 3D printing program file	1	1		1
PC17. set the part orientation, printing time & the amount of material used on the machine	1	2		1
PC18. set the laser or nozzles temperature to defined values as per process specification	1	2		1

PC19. start and operate the machine and perform 3D printing operations as per SOP/WI to develop prototype of product	2	3		1
PC20. rectify any process errors if any during the machine operation and report the same to the concerned person as per organizational guidelines	1	2		1
PC21. remove the printed prototype of product from machine without damaging its structure	1	1		
PC22. clean the prototype for improving the surface finish as per SOP	1	2		1
PC23. inspect the prototype as per the drawing/process using for required quality and if non-conforming, take action as per organisational guidelines	2	3		1
PC24. store & preserve the prototype of product manufactured as per organizational guidelines and procedures	1	1		
NOS Total	30	50	-	20

National Occupational Standards (NOS) Parameters

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