

3D Print Technology

Exam Information	Description
Exam number 821 Items 31 National Career Cluster Human Services Certification available No, In Pilot Status	The 3D Print Technology industry certification exam assesses fundamental principles, technologies, and applications of 3D printing. Learners demonstrate knowledge of hands-on experience with various 3D printing methods and the ability to design, prepare, and execute 3D prints. The exam also evaluates knowledge of real-world applications and implications of 3D printing through practical exercises and demonstrations.

Exam Blueprint and Performance Skills

Standard	Percentage of exam score
1. Printer Technology	11%
2. Printer Hardware/Software	39%
3. Printer Maintenance	23%
4. 3D Design For Printing	23%
5. 3D Printing Real World Applications	5%

*Includes performance skill evaluation

Standard 1 - Printer Technology

Candidates will understand different types of 3D printing technology and the components of those technologies.

Objective 1 Fused Deposition Modeling (FDM) Printers

1. Understand how FDM printers work.
2. Explore the variety of filament materials used with FMD printers such as PLA, ABS, PETG, etc.

Objective 2 Stereolithography (SLA, DLP) Printers

1. Understand how SLA and DLP printers work.
2. Explain the difference between SLA and DLP processes.
3. Explore the variety of liquid polymer materials such as standard ABS, castable, flexible, and high temp.

Objective 3 Selective Laser Sintering (SLS, SLM) Printers

1. Understand how SLS printers work.
2. Explain the difference between SLS and SLM printers.
3. Explore the variety of powdered materials used with SLS printers, such as Powder.

Objective 4 Multi Jet Fusion (MJF) Printers

1. Understand how MJF printers work
2. Explore the variety of powdered materials used with MJF printers, such as Alloy metals, wood, and polymers.

Objective 5 Directed Energy Deposition (DED) Printers

1. Understand how DED printers work.
2. Explore the variety of powdered alloy metal materials used with DED printers.

Optional: Standard performance evaluations on the final page of this document

Standard 2 - Printer Hardware/Software

Candidates will understand how to use the hardware and software involved with 3D Printing.

Objective 1 Printer Hardware Functions

1. Explore the most common hardware components of 3D printers, such as:
 - a. Stepper Motors
 - b. Extruders
 - c. Hotend
 - i. heat sink - A metal device for absorbing and dissipating heat
 - ii. heat break - The piece connecting the heatsink to the heat block
 - iii. heat block- Conducts heat from the thermistor to the nozzle
 - iv. nozzle
 - d. Light sources
 - e. Limit switch
 - f. Lead screw

Objective 2 Slicer Programs

1. Use different Slicer Programs to prepare 3D Models for printing. These are Cura, PrusaSlicer, LycheeSlicer, and ChiTuBox.
2. Explore the variety of slicer settings and how they affect the printing process, such as Layer Height, Wall Count, Infill (density, type/pattern), Exposure Time, Print Orientation, Support Structures (normal, tree/ organic), etc.
3. Understand and use the steps of the slicing process.
 - a. Import 3D File into slicing software.
 - b. Adjust slicing settings and orient the 3D Model.
 - c. Generate the toolpath by slicing the 3D model into layers.
 - d. Preview the sliced layers to ensure accuracy and identify any potential issues.
 - e. Export the sliced model in the appropriate file format (e.g., G-code) compatible with the 3D printer.
 - f. Transfer the sliced file to the 3D printer for printing.

Objective 3 File Types

1. Use 3D Modeling Software to export 3D Models to appropriate printable formats, such as .stl, .obj, .3mf, .svg, etc.
2. Unzip files from Compressed/Zipped folders when downloading files off the internet.
3. Use Slicer Programs to export 3D Printer files for printing, such as .gcode.

Standard 3 - Printer Maintenance

Candidates will understand and be able to maintain a 3D printer, including assembly and troubleshooting.

Objective 1 Filament (FDM) Maintenance

1. Assemble and maintain basic consumable parts such as Nozzle, Print Bed, Hot End, Bowden Tube, Stepper Motors, and Extruder.

Objective 2 Resin (SLA/DLP) Maintenance

1. Understand the process of assembling and maintaining basic parts such as FEP Film, Reservoir, & Cleaning Station.
2. Understand and implement proper safety equipment such as Nitrile Gloves, Safety Goggles, Isopropyl Alcohol, & Ventilation.

Objective 3 Identify & troubleshoot common print problems, such as:

1. Bed Leveling (Nozzle too far, nozzle too close)
2. Flow rate
3. Bed & nozzle temperature

Standard 4 - 3D Design For Printing

Candidates will understand how to efficiently design 3D models for printing.

Objective 1 3D Modeling Software

1. Use 3D Modeling Software to create 3D models for printing such as Sketchup, Blender, Inventor, Onshape, Tinkercad, etc
2. Use 3D Modeling Software to modify/kitbash existing models downloaded from the internet.
3. Use 3D Modeling Software to clean up existing models to make them suitable for 3D Printing.

Objective 2 Designing For Printing Limitations

1. Candidates will understand how to design models that are optimized for 3D printing, using concepts such as Overhangs, Bridging, Orientation, Thickness, Tolerance, Supports, etc.
2. Candidates will be able to accurately measure an object in metric and/or imperial units using calipers, rulers, etc.

Objective 3 CAD Modeling

1. Candidates will create a variety of hard surface models such as fixtures, assembly parts, etc

Objective 4 Organic Modeling

1. Candidates will create a variety of organic models such as characters, animals, etc.

Objective 5 Design Process

1. Candidates will understand the steps in a design process from having a need to finishing a final product that fulfills that need.
 - a. Identify & define the design problem
 - b. Brainstorm and plan
 - c. Build a prototype
 - d. Test the prototype
 - e. Refine & Optimize
2. Candidates will understand and demonstrate sketching designs from different perspectives.
3. Candidates will find and solve local problems using designs and 3D-printed products of their own design

Standard 5 - 3D Printing Real World Applications

Candidates will explore what industries and groups are using 3D Printing currently and what areas it is growing in.

Objective 1 Understand the difference between primary and secondary manufacturing processes:

1. Primary - creation of stock (ie: filament, resin, polymer powder, etc.) Secondary - converting stock to finished goods

2. Candidates should have knowledge of several industries that use additive manufacturing:
 - a. Aerospace
 - b. Manufacturing
 - c. Medical
 - d. Automotive

Objective 2 Candidates should have knowledge of several hobbyists' uses of 3D printing:

1. Tabletop Gaming
2. Art
3. Home Improvement
4. DIY
5. Cosplay

Optional: Standard performance evaluations on the final page of this document

Performance Skills Evaluation

Exam name: 3D Print Technology

Candidate Name: _____

Performance assessments may be completed and evaluated any time before the certification is issued. The following performance skills can be used in connection with the associated standards and exam. The evaluator will function as the subject matter expert to determine if the candidate meets the skills requirements with a Yes/No for passing.

Performance Skills

- Candidates will be able to apply design principles and techniques with 3D modeling software and tools to create digital models of objects that can be printed with a 3D printer.
- Candidates will be able to operate and maintain a 3D printer, including setting up the printer, loading the filament, adjusting the settings, troubleshooting common issues, and cleaning the printer.

Pass:

Evaluator Name:

Date:
