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CUSTOMIZED ASSESSMENT BLUEPRINT

ESSENTIALS OF ADDITIVE MANUFACTURING - PILOT

Test Code: 9116
Version: 01

Specific Competencies and Skills Tested in this Assessment:

Safety
Demonstrate understanding of hazards associated with Additive Manufacturing processing
Explain Personal Protective Equipment (PPE) required with Additive Manufacturing
Demonstrate knowledge of hazard communication and labeling in Additive Manufacturing
Discuss maintenance and lockout/tagout procedures

Fundamentals
Explain applications of Additive Manufacturing and identify industries using Additive Manufacturing parts
Explain Additive Manufacturing processes using ASTM standards
Demonstrate knowledge of key Additive Manufacturing terminology using ASTM standards
Compare advantages and disadvantages of Additive Manufacturing and traditional manufacturing
Demonstrate knowledge of foundations of quality (e.g., measurement)

Design
Discuss Additive Manufacturing design strengths and weaknesses
Demonstrate understanding of Additive Manufacturing design considerations (e.g., part orientation)
Demonstrate knowledge of design strategy and reverse engineering (e.g., design verification)

Inputs
Identify digital input sources and characteristics
Explain creation of build files (e.g., file manipulation, Stereolithography (STL))
Identify hardware input sources

Essentials of Additive Manufacturing - PILOT (continued)

Processes and Materials

Describe the Additive Manufacturing processes using ASTM definitions
Describe the seven technologies of Additive Manufacturing (Binder Jetting, Directed Energy Deposit, Material Extrusion, Material Jetting, Powder Bed Fusion, Sheet Lamination, Vat Polymerization)
Identify the advantages of materials with the various technologies
Describe material properties considerations (e.g., prototyping, functional)

Secondary and Post Processes

Explain secondary processing in Additive Manufacturing
Discuss critical material considerations in post-processing for polymers (e.g., sequence of events to part before finished)
Define Additive Manufacturing post-processes (e.g., metal additives, non-polymers, Hot Isostatic Pressing (HIP))

Essentials of Additive Manufacturing - PILOT (continued)

Written Assessment:

Administration Time: 2.5 hours
Number of Questions: 121

Areas Covered:

14%	Safety
28%	Fundamentals
15%	Design
12%	Inputs
22%	Processes and Materials
9%	Secondary and Post Processes

Sample Questions:

The vapor emitted during an Additive Manufacturing Material Extrusion (MEX) process is better known as

A. volatile organic compound
B. ultrafine particles
C. nanoparticles
D. particulate emissions

Improper belt tension alignment can lead to what build issue?

A. nozzle clogging
B. stringing
C. inaccurate prints
D. poor first layer adhesion

Additive Manufacturing is often used in healthcare for hearing aids because

A. Additive Manufacturing can print with corrosive-resistance materials
B. 3D printed parts are highly customizable
C. it is possible to print many parts at once
D. parts can be printed in different orientations

The process in which a liquid bonding agent is deposited to join powder materials is called

A. casting
B. electron beam melting
C. binder jetting
D. stereolithography

Essentials of Additive Manufacturing - PILOT (continued)

The standard unit of measure for Additive Manufacturing is

A. inches
B. millimeters
C. centimeters
D. micrometers

What is the smallest feature size typical of the Laser Powder Bed Fusion (PBF-LB) process?

A. .010 inch
B. .030 inch
C. .060 inch
D. .100 inch

The main factor that determines print time variation is

A. build plate
B. model design
C. part orientation
D. CAD quality

Which of the following Additive Manufacturing methods can repair or add features to pre-existing objects?

A. Ultrasonic Additive Manufacturing
B. Directed Energy Deposition
C. Selective Laser Melting
D. Fused Filament Fabrication

Ceramics in Additive Manufacturing have a resistance to

A. acid and heat
B. acid and moisture
C. heat and moisture
D. moisture and humidity

Breaking off the material used for printing that is not part of the final component is called

A. support removal
B. residual stress removal
C. surface finishing
D. Hot Isostatic Pressing (HIP)

Performance Assessment:

Administration Time: 1 hour and 50 minutes
Number of Jobs: 4

Areas Covered:

32% **Slicer Software Set-Up**
Participant will use a provided file for a 3D object and will create the slicer file for the 3D printer. The preview file for the layer-by-layer build will be viewed. The participant will add support structure as directed. The object will not be printed. The slicer file will be saved to the media storage device and used for the 3D Printer Hardware Set-Up job.

24% **3D Printer Hardware Set-Up**
Participant will load the prepared STL file to the 3D printer and demonstrate the steps to preparing to print, including preparing the build plate, nozzle, and loading filament. The object will not be printed. Finished object removal is simulated, and the participant will describe post-printing preventive maintenance activities for the 3D printer.

24% **Create a 3D Solid Model Drawing**
Using CAD software, the participant will draw a solid model with rounded corners, holes, a slot, and a pocket, and calculate the volume of the part. The drawing will be printed and saved to media storage device.

20% **Troubleshoot 3D Printing Projects**
Participant will view photos of failed 3D printed projects and record a description of the object, identify what went wrong, and suggest a way to correct the failure, completing the chart legibly.

Sample Job: Create a 3D Solid Model Drawing

Maximum Job Time: 30 minutes

Participant Activity: Using CAD software, the participant will create a 3D solid model drawing of the part shown in the picture with rounded corners, holes, a slot, and a pocket, and calculate the volume of the part. The drawing will be printed and saved to a USB or equivalent storage media, with the file name provided.