



**CERTIFIED ADDITIVE MANUFACTURING
TECHNICIAN (CAMT)
BODY OF KNOWLEDGE**



sme.org/CAMT

CERTIFIED ADDITIVE MANUFACTURING TECHNICIAN

BODY OF KNOWLEDGE 2024

Topics	Importance	Competency	Fundamentals Weighting
1.0. OVERVIEW			30%
1.1. Key AM Terminology and Definition	High	Apply and Analyze	
1.1.1. AM/3D Printer/Printing			
1.1.2. 3D Scanning			
1.1.3. Hybrid Manufacturing			
1.1.4. Rapid Prototyping			
1.1.5. Rapid Tooling			
1.1.6. Subtractive Manufacturing			
1.2. Key Steps	High	Apply and Analyze	
1.2.1. Generate a 3D model			
1.2.2. File Conversion			
1.2.3. File Transfer to Machine			
1.2.4. Machine Setup			
1.2.5. Build			
1.2.6. Remove			
1.2.7. Post Processing			
1.2.8. Part Inspection			
1.2.9. Quality Assurance			
1.2.10. Secondary Processing			
1.2.11. Application			
1.3. Uses of AM Parts	Medium	Remember and Understand	
1.3.1. Prototyping			
1.3.2. Functional Parts			
1.4. Industries Using AM	Medium	Remember and Understand	
1.4.1. Aerospace and Aviation/Defense			
1.4.2. Architecture and Construction			
1.4.3. Art and Fashion			
1.4.4. Consumer Products			

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Topics	Importance	Competency	Fundamentals Weighting
1.4.5. Food and Pharmaceutical			
1.4.6. Manufacturing and Industrial			
1.4.7. Medical Devices and Products			
1.4.8. Transportation			
1.5. AM Processes	High	Apply and Analyze	
1.5.1. Binder Jetting			
1.5.2. Directed Energy Deposition			
1.5.3. Material Extrusion			
1.5.4. Material Jetting			
1.5.5. Powder Bed Fusion			
1.5.6. Sheet Lamination			
1.5.7. Vat Photo Polymerization			
1.6. Materials	High	Evaluate Problems & Create Solutions	
1.6.1. Bio-Materials			
1.6.2. Ceramics			
1.6.3. Composites			
1.6.4. Concrete			
1.6.5. Metals			
1.6.6. Paper			
1.6.7. Plaster			
1.6.8. Polymers			
1.6.9. Sand			
1.6.10. Waxes			
1.6.11. Other Materials (Like, food)			
1.7. Advantages of AM	Medium	Remember and Understand	
1.7.1. AM Integration with Traditional Manufacturing			
1.7.2. Design Complexity			

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Topics	Importance	Competency	Fundamentals Weighting
1.7.3. Design Flexibility			
1.7.4. Ease of Prototyping			
1.7.5. Mobility of Production System			
1.7.6. Simplified Set-Up			
1.7.7. Supports Mass Customization			
1.7.8. Sustainability			
1.7.9. Tailoring Material Properties			
1.7.10. Tooling			
1.8. Disadvantages of AM	Medium	Remember and Understand	
1.8.1. Accuracy			
1.8.2. Cost of Technology and ROI			
1.8.3. Inspection			
1.8.4. Material Properties			
1.8.5. Standards are Developing			
1.8.6. Surface Finish			
1.8.7. Workforce Needs Development			
1.9. Foundations of Quality	High	Evaluate Problems & Create Solutions	
1.9.1. Data Quality			
1.9.2. Feedstock Quality			
1.9.3. Machine Quality Factors			
1.9.4. Output Quality			
1.9.5. Finishing Quality			
2.0 SOFTWARE FLOW			20%
2.1. DFAM	Medium	Apply and Analyze	
2.1.1. Process Design Guidelines			
2.1.2. Topology Optimization			
2.1.3. Part Consolidation			

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Topics	Importance	Competency	Fundamentals Weighting
2.1.4. Process Simulation			
2.1.5. Customized Infill for Lightweighting			
2.2. Data Sources	High	Apply and Analyze	
2.2.1. Formats - (STL, AMF)			
2.2.2. Sources - (CAD, Imaging)			
2.3. Data Preparation	High	Apply and Analyze	
2.3.1. Model Evaluation			
2.3.2. Model Repair			
2.3.3. Build Layout			
2.3.4. Support Design and Creation			
2.3.5. Creation of Slice Files			
2.4. In-Situ-Build Monitoring	High	Apply and Analyze	
2.4.1. Layer Height			
2.4.2. Temperature			
2.4.3. Process Parameters			
2.5. Post Build Data Management	High	Apply and Analyze	
2.5.1. Document Build Parameters			
2.5.2. Statistical Process Control			
2.5.2.1. Track Trends of Multiple Builds			
2.5.3. Informal/Formal ERP Systems			
3.0 APPLICATIONS			15%
3.1. Applications Discovery and Justification	Low	Remember and Understand	
3.2. Conceptual Prototyping (Form and Fit)	Medium	Remember and Understand	
3.3. Shop Aid (Jigs and Fixtures)	Medium	Remember and Understand	
3.3.1. Alignment and Holding Fixtures			
3.3.2. Measurement Aids			
3.3.3. Tool Storage (Kitting)			
3.4. Tooling	Medium	Remember and Understand	

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Topics	Importance	Competency	Fundamentals Weighting
3.4.1. Sacrificial Tooling			
3.4.1.1. Ceramic Cores			
3.4.1.2. Investment Casting Wax/SLA Pattern			
3.4.1.3. Sand Casting			
3.4.1.4. Soluble Cores			
3.4.2. Reusable Tooling			
3.4.2.1. EDM Electrode			
3.4.2.2. Lay up Tooling			
3.4.2.3. Master Patterns			
3.4.2.4. Metal Forming			
3.4.2.5. Mold			
3.4.2.6. Paper Pulp Tooling			
3.4.2.7. Part Fixtures			
3.4.2.8. Thermoforming			
3.5. End Use Parts	Medium	Remember and Understand	
3.5.1. Aerospace and Aviation/Defense			
3.5.1.1. Ceramic (Armor Components, Nozzles, etc.)			
3.5.1.2. Composites (Air Ducts, Structural Parts, etc.)			
3.5.1.3. Concrete (Barricks, Bridges, etc.)			
3.5.1.4. Metals (Brackets, Engines, Fuel Injectors, Munition, Turbine Blades, etc.)			
3.5.1.5. Polymer (Accessories, Air Ducts, Configuration Parts, Non-structural parts, etc.)			
3.5.1.6. 3D Printed Electronics (Antennas, Sensors, etc.)			
3.5.2. Architecture and Construction			
3.5.2.1. Concrete (Bridges, Flooring, Houses, Walls, etc.)			
3.5.2.2. Metal (Bridges, Decorative Elements, Door Hardware, Faucets, Light Switches, etc.)			
3.5.2.3. Plaster (Decorative Elements)			

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Topics	Importance	Competency	Fundamentals Weighting
3.5.2.4. Wood Fiber (Ceiling Fan Propellers, Decorative Elements)			
3.5.3. Art and Fashion/Consumer Products			
3.5.3.1. Ceramic (Sculptures, Vases)			
3.5.3.2. Metal (Golf Clubs, Jewelry, Sculptures)			
3.5.3.3. Polymers (Furniture, Helmets, Shoes, Smart Phone Cases)			
3.5.3.4. Wood Fiber (Furniture)			
3.5.4. Food and Pharmaceutical			
3.5.4.1. Medicines (Combination Pills, Pill Structures, Time Release Implants)			
3.5.4.2. Organic Plant Matter (Custom Diet and Nutrition, Decorative Chocolate, Meat Substitutes)			
3.5.5. Manufacturing and Industrial			
3.5.5.1. Metal - (Jigs, Fixtures, Molds, Patterns)			
3.5.5.2. Polymer - (Jigs, Fixtures, Molds, Patterns)			
3.5.5.3. Ceramics (Cores, Molds)			
3.5.5.4. Composites (Machine parts, Jigs, Fixtures)			
3.5.6. Medical Devices and Products			
3.5.6.1. Metals (Artificial Hips, Artificial Knees, Cranial Plates, Dental Implants, Spinal Implants)			
3.5.6.2. Polymers (Aligners, Cranial Plates, Hearing Aids, Planning Models, Prosthetics, Spinal Implants, Surgical Guides)			
3.5.6.3. Ceramics (Bone Implants, Dental Implants)			
3.5.7. Transportation			
3.5.7.1. Polymers (Car Bodies, Trim)			

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Topics	Importance	Competency	Fundamentals Weighting
3.5.7.2. Metals (Chassis Parts, Engine Parts)			
3.5.7.3. Composites (Air Ducting, Chassis Parts, Suspension Systems, Trim)			
4.0 TECHNOLOGY & METHODS			10%
4.1. Binder Jetting	High	Apply and Analyze	
4.1.1. Description			
4.1.2. Strengths			
4.1.3. Weaknesses			
4.2. Directed Energy Deposition	High	Apply and Analyze	
4.2.1. Description			
4.2.2. Strengths			
4.2.3. Weaknesses			
4.3. Direct Write	Medium	Apply and Analyze	
4.3.1. Description			
4.3.2. Strengths			
4.3.3. Weaknesses			
4.4. Hybrid Systems	Medium	Apply and Analyze	
4.4.1. Description			
4.4.2. Strengths			
4.4.3. Weaknesses			
4.5. Material Extrusion	High	Apply and Analyze	
4.5.1. Description			
4.5.2. Strengths			
4.5.3. Weaknesses			
4.6. Material Jetting	High	Apply and Analyze	
4.6.1. Description			
4.6.2. Strengths			
4.6.3. Weaknesses			

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Topics	Importance	Competency	Fundamentals Weighting
4.7. Powder Bed Fusion	High	Apply and Analyze	
4.7.1. Description			
4.7.2. Strengths			
4.7.3. Weaknesses			
4.8. Sheet Lamination	Medium	Apply and Analyze	
4.8.1. Description			
4.8.2. Strengths			
4.8.3. Weaknesses			
4.9. Vat Photopolymerization	High	Apply and Analyze	
4.9.1. Description			
4.9.2. Strengths			
4.9.3. Weaknesses			
5.0 DESIGN FOR ADDITIVE MANUFACTURING (DfAM)			5%
5.1. Design Process	Medium	Remember and Understand	
5.2. Design Strengths	Medium	Remember and Understand	
5.3. Design Verification	Medium	Remember and Understand	
5.4. Design Weaknesses	Medium	Remember and Understand	
6.0 BUSINESS & ECONOMICS			0%
6.1. Application Discovery and Justification			
6.2. Capital Purchase	Low	Remember and Understand	
6.2.1. Machine			
6.2.2. Facility Build/Modification			
6.2.3. Ancillary Equipment			
6.2.4. QA System			
6.2.5. Return on Investment			
6.3. Labor	Medium	Apply and Analyze	
6.3.1. Dedicated Employee Potential			
6.3.2. Roles and Shared Responsibility			

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Topics	Importance	Competency	Fundamentals Weighting
6.3.3. Skill Level(s) Required			
6.3.4. Initial/On-going Training			
6.4. Materials	Medium	Apply and Analyze	
6.4.1. Build Materials - Deliverable			
6.4.2. Support Cost - Consumed			
6.4.3. Post Processing Materials			
6.4.4. Waste Stream			
6.5. Maintenance Costs	Medium	Apply and Analyze	
6.5.1. Annual Preventive Maintenance			
6.5.2. Downtime Risk			
6.5.3. Energy Consumption			
6.5.4. Upgrades			
6.6. Inspection Costs	Low	Apply and Analyze	
6.6.1. Equipment			
6.6.2. Labor			
6.6.3. Sub-Contracted Inspection			
7.0 QUALITY			5%
7.1. Applicable Standards	High	Remember and Understand	
7.1.1. Quality Management Systems for Production			
7.1.1.1. SAE-AS9100 (Aerospace Quality Management System)			
7.1.1.2. NADCAP (Aerospace Quality System and AM)			
7.1.1.3. ISO-9001 (Quality System)			
7.1.1.4. ISO 13485 (Medical Device QMS)			
7.1.2. Standards for Materials Qualification			
7.1.2.1. SAE AMS			
7.1.2.2. ASTM-ISO Standards			
7.2. Workflow	Medium	Apply and Analyze	

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Topics	Importance	Competency	Fundamentals Weighting
7.2.1. Qualified CAD File			
7.2.2. Qualified Material/Material Tracking			
7.2.3. Qualified Machine			
7.2.4. Operator Qualification			
7.2.5. Part Set Up			
7.2.6. Quality Check (In process Inspection)			
7.2.7. Final part inspection			
8.0 POST PROCESSING			5%
8.1. Primary Post Processing	High	Evaluate Problems & Create Solutions	
8.1.1. Detach from Build Plate			
8.1.2. Remove Support Material/Structures			
8.1.3. Thermal/Non-Thermal Properties Enhancement			
8.2. Secondary Post Processing	Medium	Remember and Understand	
8.2.1. Bonding			
8.2.2. Edge Breaking			
8.2.3. Electro Plating			
8.2.4. Machining			
8.2.5. Painting			
9.0 MATERIALS			5%
9.1. General Considerations	High	Apply and Analyze	
9.1.2. Properties			
9.1.3. Qualification			
9.1.4. Vendor Considerations			
9.1.5. Material Life Cycle			
9.2. Biological Materials	Medium	Apply and Analyze	
9.2.1. Description			
9.2.2. Properties			

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Topics	Importance	Competency	Fundamentals Weighting
9.3. Ceramics	High	Apply and Analyze	
9.3.1. Description			
9.3.2. Properties			
9.4. Composites	Medium	Apply and Analyze	
9.4.1. Description			
9.4.2. Properties			
9.5. Metals	High	Apply and Analyze	
9.5.1. Description			
9.5.2. Properties			
9.6. Paper	Medium	Remember and Understand	
9.6.1. Description			
9.6.2. Properties			
9.7. Polymers	High	Apply and Analyze	
9.7.1. Description			
9.7.2. Properties			
9.8. Sand	Medium	Apply and Analyze	
9.8.1. Description			
9.8.2. Properties			
9.9. Wax	Medium	Apply and Analyze	
9.9.1. Description			
9.9.2. Properties			
10.0 SOFTWARE APPLICATIONS			0%
10.1. Design for Additive	Low	Remember and Understand	
10.1.1. Topolgy Optimization			
10.1.2. Generative Design			
10.1.3. Lattice Structure			
10.1.4. Model Decomposition			
10.2. Model and Build Prep and Repair	High	Apply and Analyze	

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Topics	Importance	Competency	Fundamentals Weighting
10.2.1. Native Format Modeler			
10.3. Build Simulation and Compensation	Low	Remember and Understand	
10.4. Machine Control Software	Medium	Apply and Analyze	
10.5. Machine Monitoring, Data Collection and Reporting	High	Remember and Understand	
10.6. ERP Software	Medium	Apply and Analyze	
11.0 SAFETY			10%
11.1. Hazards Associated with AM Processing	High	Apply and Analyze	
11.1.1. Mechanical			
11.1.2. Electrical			
11.1.3. Thermal			
11.1.4. Airborne Particles			
11.1.5. Chemicals			
11.2. Personal Protective Equipment	High	Evaluate Problems and Create Solutions	
11.3. Hazard Communication and Labeling	High	Apply and Analyze	
11.4. Use of Safety Data Sheets	High	Apply and Analyze	
11.5. Maintenance and Lockout/Tag-Out	High	Evaluate Problems and Create Solutions	
11.6. Facilities	High	Remember and Understand	
12.0 EMERGING TOPICS			0%
12.1. Robotics	Medium	Remember and Understand	
12.2. Internet of Things (IoT)	Medium	Remember and Understand	
12.3. Cloud Computing	Low	Remember and Understand	
12.4. Remote and Autonomous Operations	Medium	Remember and Understand	
12.5. Post Processing Techniques/Automation	High	Apply and Analyze	
12.6. Materials	High	Apply and Analyze	
12.7. Food and Pharmaceutical	Medium	Remember and Understand	
12.8. Artificial Intelligence	Low	Remember and Understand	
12.9. Large Scale	Medium	Remember and Understand	