



CENTER of
EXCELLENCE
Research to Standards

ADDITIVE MANUFACTURING

ASTM INTERNATIONAL
Additive Manufacturing Center of Excellence

ADDITIVE MANUFACTURING COURSE CATALOG



ASTM PROFESSIONAL CERTIFICATE COURSE IN AM

Provides a comprehensive understanding of all the aspects of AM technology



ROLE-BASED CERTIFICATE COURSES

Provides skill sets for specific AM roles such as Design Engineer, Application Engineer, and Quality Engineer.



E-LEARNING COURSES

Modular online courses to support self-paced learning

amcoe.org/ewd

ABOUT AM COE

The ASTM International Additive Manufacturing Center of Excellence (AM CoE) is a collaborative partnership among ASTM—and its 30,000 members—and representatives from government, academia, and industry that conducts strategic R&D to advance standards across all aspects of additive manufacturing (AM) which will accelerate the development and adoption of robust, game-changing technologies. The Center acts as a focal point for bringing together experts and leaders across industry, academia, and government. The center has five important functions to accelerate AM adoption: Research and Development, Education and Workforce Development, Advisory Services, Industry Consortia, Standardization and Certification.

About Education and Workforce Development (E&WD)

E&WD is one of the key functions of AM CoE with a mission to provide comprehensive programs that educates and trains the additive manufacturing workforce at all levels, while continually incorporating new advances to respond to industry needs and leverage standardization, certification, and AM CoE partner expertise.

E&WD offers several certificate courses that are designed to meet the large demand for a skilled workforce to support the rapid implementation of AM technology. These certificate programs are aimed to fill the AM knowledge gap by providing world-class training from industry leaders to equip the future AM workforce with highly valued technical skills.

In this issue:

- 4** ASTM Professional Certificate Course in AM
- 6** Certificate in AM Safety
- 7** Certificate in Metal Additive Manufacturing Quality Assurance
- 8** Certificate in Intro to Inspection & Quality Assurance of AM
- 9** Certificate in Establishing an AM Facility for Critical Part Production Using PBF-LB/M
- 10** Certificate in Design for AM
- 11** Certificate in Advanced Design for AM
- 12** Certificate in AM Cybersecurity
- 13** Certificate in Advanced Metal Laser Powder Bed Fusion Process (PBF-LB)
- 14** Short Certificate Courses
- 15** e-Learning



Course delivery format

- ▶ Instructor-led in-person sessions
- ▶ Instructor-led virtual sessions
- ▶ Pre-recorded on-demand sessions



Course duration

- ▶ 4 days for Instructor-led in-person sessions
- ▶ 4 weeks for Instructor-led virtual sessions (2 modules per week)

ASTM PROFESSIONAL CERTIFICATE COURSE IN AM

About the course

This course will equip attendees with core technical knowledge related to common AM practices and will allow them to earn a Professional AM Certificate that will serve as the foundation for earning future specialized role-based AM certificates through the ASTM AM CoE. Attendees will complete a multiple-choice exam to earn the General AM Certificate and the digital badge upon course completion. Certificates follow the internationally recognized Standard Practice for Certificate Programs (ASTM E2659-18)

The course comprises 8 modules that cover all the general concepts of the AM process chain. World-renowned AM experts from industry, academia, and government lead the courses.

Audience

For the AM novice or if you have experience and are looking to advance your knowledge and stay relevant. The course is recommended for technicians, managers, engineers, and other individuals from government agencies, industry, and academia with any level of AM experience.

Course Topics

AM Overview

Provides an overview of AM with descriptions of different AM process categories, process steps, Materials, applications, and associated terminologies.

Design and Simulation

Outlines key considerations for AM design, including creating and working with design files, defining requirements, criticality, material suitability, and conducting analysis and simulation.

Feedstock

Covers feedstock behavior and its effects on part performance, powder characterization techniques, powder handling, and storage, and powder re-use strategies.

Metrology and Post-Processing

Provides a fundamental understanding on the applications of metrology on AM, and various post-processing methods, procedures, thermal processes, as applicable to different material systems.

Mechanical Testing

Focuses on fatigue testing and characterization and addresses testing requirements applicable to AM parts. Static and dynamic test methods, testing considerations, and interpretation of the results are the key focus areas.

Non-Destructive Inspection

Details non-destructive testing and inspection methods that can be applied to AM. Specific techniques are explained along with their benefits, limitations, and other requirements to perform the inspection.

AM Safety

Provides an outline of safety considerations, including insights on risk assessment strategies such as identifying hazards, mitigation measures, facility design considerations, engineering and administrative considerations, and regulatory codes applicable to AM.

Qualification and Certification

Provides a general understanding on the activities necessary to qualify a process and certify a part against a set of application-based regulations.





CERTIFICATE IN AM SAFETY



Course delivery format

- ▶ Instructor-led in-person sessions
- ▶ Instructor-led virtual sessions
- ▶ Pre-recorded on-demand sessions



Course duration

2 days

About the course

With more and more industrial sectors adopting additive manufacturing (AM) technology, there is a growing need to fully understand safety of its use. Proper implementation of safe practices is needed to support the rapid growth of the field. This course provides knowledge on the general elements needed when setting up facility for AM and the safety issues to be considered during the life of the AM processes. This course is based on learning, and leveraging all the different regulatory standards and codes applicable to AM. It takes proven safety management tools and plugs the AM specific needs into them.

Audience

This course is ideal for users, engineers, and managers of AM Facility, EH&S Managers, individuals from government agencies, industry, and academia.

Course Topics

- The different regulatory standards and codes applicable to AM
- Provides guidance on how these standards can apply to your facility
- Identify some of the most relevant standards and how they are specifically applied to preserving the safety and wellbeing of all employees using additive manufacturing technologies
- Understanding many of the safety elements and best practices that need to be considered when setting up a facility



Course delivery format

- ▶ Instructor-led in-person sessions
- ▶ Instructor-led virtual sessions
- ▶ pre-recorded on-demand sessions



Course duration
2 days

CERTIFICATE IN METAL ADDITIVE MANUFACTURING QUALITY ASSURANCE

About the course

As additive manufacturing continues to mature as a production manufacturing method, it becomes more important than ever to demonstrate quality assurance to create quality products. This course provides a comprehensive understanding on the routes to releasing products requiring quality assurance and control, and guidance for what is key to control quality output and demonstrate compliance to requirements.

This course is developed and delivered by industry experts who have several years of experience in the quality aspects of Additive Manufacturing.

Audience

This course is suitable for AM Engineers, AM operators, QA/QC Engineers, and other individuals with existing experience in AM who wish to know the route to qualification and certification.

Course Topics

The approaches in this course based on ASTM Additive Manufacturing Standards and how they can be combined with the 'traditional' manufacturing toolkit, including:

- Quality Manufacturing Systems - processes, materials, and how standards can help define a quality culture at your organization to achieve qualification and certification
- Linking Quality to Certification & Qualification
- Fundamental requirements for regulated industries
- Demonstration of Suitable Qualified & Experienced Personnel – People are key
- Lean Manufacturing Methods – Driving towards 'right first time'
- Configuration Management & Change Control – What is essential?
- How can we track performance, prevent deviations, and what to do if quality deviates?
- How do we use NDT, in-process monitoring, and other AM tools?



CERTIFICATE IN INTRO TO INSPECTION & QUALITY ASSURANCE OF AM



Course delivery format

Instructor-led virtual sessions



Course duration
2 days

About the course

Inspection of additively manufactured components is crucial to confirming integrity and quality of parts before entering into service. This course, developed in partnership with America Makes, outlines the current methods available for non-destructive evaluation, covering from powder to part. The current Standards landscape for NDE will be covered, as well as using the specially designed America Makes Educational Specimen to provide a practical example of the methods discussed. Understanding quality assurance (QA) requirements for additively manufactured is important to produce quality parts. The QA requirements for additively manufactured parts are different from that of the traditional parts because of the unique nature of the process.

Audience

AM part inspectors, quality managers, and other interested in non-destructive testing of metal AM parts

Course topics

- Inspection methods that can be applied to Additive Manufacturing
- Inspection methods to identify typical artifacts or flaws from the additive manufacturing process
- Overview of the Standards Landscape for NDE, and what is being done to close the gaps
- Quality assurance fundamentals
- QA requirements for additive
- Sources of defects
- Effects of defects in structural integrity
- Surface quality
- Case study



CERTIFICATE IN ESTABLISHING AN AM FACILITY FOR CRITICAL PART PRODUCTION USING PBF-LB/M



Course delivery format

Instructor-led in-person/virtual, training available upon request



Course duration

2 days

About the course

This course is aimed at individuals with existing experience in AM, who wish to understand all the information needed to update an existing facility or create a new facility for the purpose of manufacturing safety critical parts using the laser powder bed fusion (PBF-LB) process with metal powders.

The course is based on ISO and ASTM standards and will provide detailed instruction on all aspects of the operations from feedstock selection and qualification to processing and post processing (IQ, OQ, PQ) using real life candidate parts from the attendees. This course is developed and delivered by industry experts who have several years of experience in setting up and managing AM facilities.

Audience

This course is suitable for AM Engineers, QA/QC Engineers, and other individuals with existing experience in AM who wish to establish an AM facility to produce critical parts.

Course topics

- Equipment selection based on candidate parts and ROI calculations
- Facility considerations, requirements, and controls
- Establishing factory and site acceptance tests
- Workflow and efficiency
- Make or buy decisions with post processing
- Machine maintenance, calibration, and certification
- Metallurgical process qualification
- QMS for all powder bed fusion work instruction
- Part qualification considerations
- Business plans and growth strategy
- Personnel training requirements
- Manufacturing plan creation
- Inspection and NDE for production
- Considerations for NASA 6030 spec
- In-situ monitoring



CERTIFICATE IN DESIGN FOR AM



Course delivery format

Instructor-led virtual, training available upon request



Course duration

2 days

About the course

The capability to produce unique designs for various applications is the key differentiator for additive manufacturing compared to conventional manufacturing. The Design for Additive Manufacturing Certificate Course provides foundational knowledge, design methods and techniques, an overview of design technologies, and practice exercising this knowledge.

Audience

This course is suitable for Design Engineers who want to learn unique design requirements for AM and AM Engineers who want to create optimized designs for AM

Course topics

- Drivers of design for AM
- Examples of design creativity
- Methods for part consolidation
- Generative design methods
- Material selection, design rules and detailed design
- Design standards



CERTIFICATE IN ADVANCED DESIGN FOR AM



Course delivery format

The course is available upon request and delivered in-person



Course duration

The course can be customized to 2 days, 3 days, and 4 days based on your requirement

About the course

The course presents best practices and includes a DfAM guidelines document that has been created over the years. It includes design rules and guiding principles for most AM processes and materials, with an emphasis on building high-quality, functional parts. Examples include minimum wall thicknesses, smallest diameters for pins and holes, the building of screw threads, clearances for moving parts, and overhanging features.

Participants will gain valuable hands-on experience by designing real parts and building them on industrial AM equipment.

Audience

The DfAM course is targeted at designers, engineers, and managers wanting to learn how to design parts that fully benefit from additive manufacturing. It is ideal for those involved in aerospace, medical, motor sports, energy/power, industrial machinery, automotive, and consumer products.

Course topics

- DfAM guidelines and best practices
- Design, re-design, and optimize products
- Using favorite design software (if you are a CAD user)
- Gain experience with best-in-class DfAM software such as Inspire from solidThinking and the lattice-structure capabilities in Magics from Materialise



Course delivery format

The course is available upon request and delivered in-person and virtual modes



Course duration

2 days



A version of this training is available for executives. The version of the training for executives intends to facilitate these decision-makers to the challenges of securing AM against a broad variety of threats. This training version is at a more strategic level and designed to be of about 6 hours duration.

CERTIFICATE IN AM CYBERSECURITY

About the course

This course provides concepts to ensure the integrity and security of the entire AM value chain. The course is intended to prepare organizations to understand the technical challenges and develop technical solutions addressing AM security threats.

ASTM developed this course in collaboration with Auburn University and with the support of America Makes.

Audience

This course is oriented on both experts in AM who are not familiar with security and experts in cyber-security who are not familiar with AM.

Course topics

- Introduction to Security Disciplines
- AM Security Threats
- Adversarial Actors
- Threat Models
- Attack Analysis
- Defense Approaches
- Legal Aspects
- Specific Challenges
- Gaps in Standardization



CERTIFICATE IN ADVANCED METAL LASER POWDER BED FUSION PROCESS (PBF-LB)



Course delivery format

The course is available upon request and delivered in-person at the customer site or at ASTM facility



Course duration

4 days

About the course

This course is intended to build up dedicated knowledge about the Metal Laser Powder Bed Fusion Process, focusing on real applications. Partnering with Siemens Energy, one of the early adopters of AM in the energy sector, this course is designed to enhance additive thinking in the company by educating a core team, which can spread AM know-how within the company. The training will be conducted by experts from ASTM AM CoE with multi-year AM experience.

The training is conceived for a group of up to 15 participants to allow for interaction and deep dive into a specific topic of interest.

Audience

This training is designed for engineers, technicians and technical managers in designing and identifying parts for AM with a focus on Powder Bed Fusion.

Course topics

- Laser Powder Bed Fusion (PBF-LB) fundamentals
- Part Design and Process Chain
- Materials and Process
- Cost and Part Selection
- Activities and Case Studies



AM PROCESS DEVELOPMENT TO ACHIEVE OPTIMIZED MATERIAL PROPERTIES

About the course

In this course, an AM physical metallurgy-based approach will cover process fundamentals, impactful factors, and process controls to achieve a reliable, consistent product quality in production manufacturing environments.

This course is aimed at end users, researchers, instructors, application/design engineers, people with an interest in process development, material engineers, and material scientists.

AM QUALIFICATION AND CERTIFICATION FOR CRITICAL APPLICATIONS

About the course

This course provides a concise overview of the key considerations for Qualification and Certification of products for Critical Applications. Building on the fundamental building blocks of an established Quality Management System, what do you do next?

This course is for those who are using, or plan to use, AM in critical applications and would like to learn more about the routes to qualification and certification and/or metallic Powder Bed and Direct Energy Deposition methods

QUALITY ASSURANCE FOR ADDITIVE MANUFACTURING

About the course

This course will provide attendees with a strong baseline knowledge of what Quality Assurance means for AM, and what to consider when making components for critical applications.

This course is aimed at individuals who wish to increase their basic experience in Quality Assurance or those who have experience from other manufacturing technologies and wish to understand where AM may be different.

PROBABILISTIC FATIGUE MODELING IN AM

About the course

This course provides an overview of probabilistic fracture mechanics for low-cycle fatigue applications. Concepts of fatigue approaches in presence of defects will be delivered, together with simple description of the 'short-crack' effect for describing the fatigue strength of AM materials.

This course is aimed at experienced fatigue life analysts interested in a quick overview of probabilistic fracture mechanics and its applications for additive manufacturing.

FUNDAMENTALS OF NDE METHODS FOR AM

About the course

This course outlines the current methods available for non-destructive evaluation, covering from powder to part.

This course is aimed at AM part inspectors, quality managers, and others interested in non-destructive testing of metal AM parts



Course delivery format

- ▶ Instructor-led, virtual
- ▶ Available upon request



Course duration
4 hours



PRINCIPLES OF ADDITIVE MANUFACTURING



Course delivery format

The course is
offered on-demand
and self-paced



Course duration
4 hours

About the course

This course provides comprehensive introductory knowledge on Additive Manufacturing. The course covers terms and definitions, the evolution of the technology, software and hardware, applications and case studies, and current state-of-the-art.

This course is suitable for those who are new to this technology or anyone with interest in this innovative technology.



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Get Started

Contact the AM CoE team for scheduling and pricing details, and custom and private training options.

For more information,
email amcoe@astm.org

