

# MET-1250: INTRODUCTION TO ADDITIVE MANUFACTURING

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## Cuyahoga Community College

**Viewing: MET-1250 : Introduction to Additive Manufacturing**

**Board of Trustees:**

2014-06-19

**Academic Term:**

Spring 2019

**Subject Code**

MET - Mech Eng/Manuf Ind Eng Tech

**Course Number:**

1250

**Title:**

Introduction to Additive Manufacturing

**Catalog Description:**

Principles of the applications of Additive Manufacturing. Advantages of using Additive Manufacturing over traditional Subtractive Manufacturing processes are studied.

**Credit Hour(s):**

3

**Lecture Hour(s):**

3

## Requisites

**Prerequisite and Corequisite**

MATH-0955 Beginning Algebra I or appropriate score on Math placement test to placement into 1000-level Mathematics.

## Outcomes

**Course Outcome(s):**

Explain the basic principles of Additive Manufacturing.

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Oral Communication: Demonstrate effective verbal and nonverbal communication for an intended audience that is clear, organized, and delivered effectively following the standard conventions of that language.

Written Communication: Demonstrate effective written communication for an intended audience that follows genre/disciplinary conventions that reflect clarity, organization, and editing skills.

**Objective(s):**

1. Describe AM and its processes.
2. Describe the post processing of built AM parts.
3. Describe the use of AM parts.
4. Describe AM machines and their variations in construction, operations and material requirements.
5. Explain the generic AM processes.
6. Explain the role of CAD in AM.
7. Explain the conversion of CAD file to AM's STL file format.
8. Explain STL file transfer to AM machines.
9. Explain the AM machines setup procedures.
10. Describe how parts are built by AM machines.
11. Describe the post processing of built AM parts.

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**Course Outcome(s):**

Explain the use of the term, "Additive Manufacturing" vs. old term, "Rapid Prototyping."

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Oral Communication: Demonstrate effective verbal and nonverbal communication for an intended audience that is clear, organized, and delivered effectively following the standard conventions of that language.

Written Communication: Demonstrate effective written communication for an intended audience that follows genre/disciplinary conventions that reflect clarity, organization, and editing skills.

**Objective(s):**

1. Describe automated Fabrication (Autofab).
  2. Describe free-form or solid free-form fabrication.
  3. Describe Additive Manufacturing or Layer Based Manufacturing.
  4. Describe Stereolithography or 3D Printing.
  5. Describe Rapid Prototyping.
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**Course Outcome(s):**

Differentiate between Additive Manufacturing and Subtractive Manufacturing (CNC Machining).

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Information Literacy: Acquire, evaluate, and use information from credible sources in order to meet information needs for a specific research purpose.

**Objective(s):**

1. Explain the differences in their Materials requirement.
  2. Explain the speed of production differences.
  3. Explain the difference in complexity of parts produced.
  4. Explain parts accuracy.
  5. Explain Geometrical accuracy.
  6. Explain the programming requirements.
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**Course Outcome(s):**

Identify Additive Manufacturing other related technologies.

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Oral Communication: Demonstrate effective verbal and nonverbal communication for an intended audience that is clear, organized, and delivered effectively following the standard conventions of that language.

Written Communication: Demonstrate effective written communication for an intended audience that follows genre/disciplinary conventions that reflect clarity, organization, and editing skills.

**Objective(s):**

1. Describe Reversed Engineering Technology.
  2. Describe Computer-Aided Engineering.
  3. Describe Haptic-Base CAD.
  4. Describe CAD/CAM processes.
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**Methods of Evaluation:**

- a. Problem assignments
- b. Quizzes and/or midterm
- c. Final examination
- d. Research Assignment
- e. Written Report
- f. Oral Presentation.

**Course Content Outline:**

1. Introduction and Basic Principles
  - a. Definition Additive Manufacturing
  - b. Uses of AM Parts
  - c. Benefits of AM
  - d. Distinction Between AM and CNC Machining
  - e. The key elements of Additive Manufacturing.
  - f. Advantages of using Additive Manufacturing over traditional manufacturing processes.
2. The Generic AM Process
  - a. CAD
  - b. Conversion to STL
  - c. Transfer to AM Machine and STL File Manipulation
  - d. Machine Set-Up
  - e. Build
  - f. Removal
  - g. Post-processing
  - h. Application
3. Development of Additive Manufacturing Technology
  - a. Computer-Aided Design Technology
  - b. Lasers
  - c. Printing Technologies
  - d. Programmable Logic Controllers
  - e. Materials
  - f. Computer Numerically Controlled Machining
4. Generalized Additive Manufacturing Process Chain:
  - a. The (8) Steps in Additive Manufacturing
    - i. Conceptualization to CAD
    - ii. Conversion to STL
    - iii. Transfer to AM Machine and STL File Manipulation.
    - iv. Machine Set-Up
    - v. Build
    - vi. Removal of Cleanup
    - vii. Post-process
    - viii. Application
5. Industries using Additive Manufacturing
6. Milestones in AM Development
7. AM around the World

**Resources**

Gibson, Rosen, Stucker. *Additive Manufacturing Technologies, Rapid Prototyping to Direct Digital Manufacturing*. Springer Science + Business Media, LLC, 2010.

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Hopkinson, Hague, Dickens. *Rapid Prototyping, an Industrial Revolution for the Digital Age*. John Wiley Sons, NJ, 2006.

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**Resources Other**

Handouts specified by instructor

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