

OAN Number:
OAN Date:

Board of Trustees Date: 06/19/14
Effective Date: 08/25/14

CUYAHOGA COMMUNITY COLLEGE
OFFICIAL COURSE OUTLINE
Mapped

SUBJECT AREA TITLE

Mechanical Engineering Technology/Manufacturing Industrial Engineering Technology

COURSE TITLE

Introduction To Additive Manufacturing

SUBJECT AREA CODE-COURSE NUMBER

MET - 1250

COURSE CREDIT HOURS

3.00

I. DESCRIPTION OF COURSE:

A. CATALOG DESCRIPTION: Principles of the applications of Additive Manufacturing. Advantages of using Additive Manufacturing over traditional Subtractive Manufacturing processes are studied.

B. LECTURE HOURS: 3.00

C. LAB HOURS: None

D. OTHER REQUIRED HOURS: 00

E. PREREQUISITE(S): None

II. GENERAL EDUCATION OUTCOMES:

Upon satisfactory completion of MET 1250 - Introduction To Additive Manufacturing, the student should be able to perform the following outcomes and supporting objectives:

A. Outcome: Critical Thinking: Analyze and synthesize ideas to make evidence-based decisions and find rational solutions to problems.

Supporting Outcomes:

1. Explain the basic principles of Additive Manufacturing.
2. Explain the use of the term, "Additive Manufacturing" vs. old term, "Rapid Prototyping."
3. Differentiate between Additive Manufacturing and Subtractive Manufacturing (CNC Machining).
4. Identify Additive Manufacturing other related technologies.

B. Outcome: Information Literacy: Determine where and how to acquire, evaluate, and ethically use information from multiple sources for academic success and lifelong learning.

Supporting Outcomes:

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

C. Outcome: Oral Communication: Produce verbal and non-verbal communication for an intended audience that is clear and concise, uses standard rules for spoken language, and effectively organizes language, images and other symbols.

Supporting Outcomes:

1. Explain the basic principles of Additive Manufacturing.
2. Explain the use of the term, "Additive Manufacturing" vs. old term, "Rapid Prototyping."
3. Identify Additive Manufacturing other related technologies.

D. Outcome: Written Communication: Produce writing for an intended audience that is clear and concise, uses standard rules for written language, and effectively organizes language, images and other symbols.

Supporting Outcomes:

1. Explain the basic principles of Additive Manufacturing.
2. Explain the use of the term, "Additive Manufacturing" vs. old term, "Rapid Prototyping."

3. Identify Additive Manufacturing other related technologies.

III. OUTCOMES/OBJECTIVES:

Upon satisfactory completion of MET 1250 - Introduction To Additive Manufacturing, the student should be able to perform the following outcomes and supporting objectives:

A. Outcome: Explain the basic principles of Additive Manufacturing.

Supporting Objectives:

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

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

Supporting Objectives:

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.

C. Outcome: Differentiate between Additive Manufacturing and Subtractive Manufacturing (CNC Machining).

Supporting Objectives:

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.

D. Outcome: Identify Additive Manufacturing other related technologies.

Supporting Objectives:

1. Describe Reversed Engineering Technology.
2. Describe Computer-Aided Engineering.
3. Describe Haptic-Base CAD.
4. Describe CAD/CAM processes.

IV. COURSE CONTENT:

A. Introduction and Basic Principles

1. Definition Additive Manufacturing
2. Uses of AM Parts
3. Benefits of AM
4. Distinction Between AM and CNC Machining
5. The key elements of Additive Manufacturing.
6. Advantages of using Additive Manufacturing over traditional manufacturing processes.

B. The Generic AM Process

1. CAD
2. Conversion to STL
3. Transfer to AM Machine and STL File Manipulation
4. Machine Set-Up
5. Build
6. Removal
7. Post-processing
8. Application

C. Development of Additive Manufacturing Technology

1. Computer-Aided Design Technology

2. Lasers
 3. Printing Technologies
 4. Programmable Logic Controllers
 5. Materials
 6. Computer Numerically Controlled Machining
- D. Generalized Additive Manufacturing Process Chain:
1. The (8) Steps in Additive Manufacturing
 - a. Conceptualization to CAD
 - b. Conversion to STL
 - c. Transfer to AM Machine and STL File Manipulation.
 - d. Machine Set-Up
 - e. Build
 - f. Removal of Cleanup
 - g. Post-process
 - h. Application
- E. Industries using Additive Manufacturing
- F. Milestones in AM Development
- G. AM around the World

V. METHODS OF STUDENT EVALUATION MAY INCLUDE ANY OF THE FOLLOWING:

- A. Problem assignments
- B. Quizzes and/or midterm
- C. Final examination
- D. Research Assignment
- E. Written Report
- F. Oral Presentation.

VI. RESOURCES MAY INCLUDE ANY OF THE FOLLOWING:

- A. Gibson, Rosen, Stucker. *Additive Manufacturing Technologies, Rapid Prototyping to Direct Digital Manufacturing*. . Springer Science + Business Media, LLC, 2010.
- B. Hopkinson, Hague, Dickens. . *Rapid Prototyping, an Industrial Revolution for the Digital Age*.. John Wiley & Sons, NJ, 2006.

VII. ADDITIONAL RESOURCES:

Handouts specified by instructor