

MET-2151: 3D DIGITAL DESIGN & PRINTING

Cuyahoga Community College

Viewing: MET-2151 : 3D Digital Design & Printing

Board of Trustees:

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Academic Term:

Fall 2020

Subject Code

MET - Mech Eng/Manuf Ind Eng Tech

Course Number:

2151

Title:

3D Digital Design & Printing

Catalog Description:

Covers the major technology shifts in human history that have transitioned into 3D printing and explore emerging trends of the technology. Includes fundamentals of preparing CAD files for 3D printing, comparison of various 3D printing technologies in terms of advantages, relative precision, applications, advantages, and material use, engineering processes employing 3D printing, using applicable software to produce 3D models, and an emphasis on advance digital design using Solidworks for 3D printing.

Credit Hour(s):

3

Lecture Hour(s):

2

Lab Hour(s):

3

Requisites

Prerequisite and Corequisite

MET 1250 Introduction to Additive Manufacturing and MET-1270 Additive Manufacturing Processes and MET 2601 3D Solid Modeling, or departmental approval.

Outcomes

Course Outcome(s):

Explain the evolution of 3D printing for 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.

Objective(s):

1. Explain the different applications and industries that utilizes 3D printing.
2. Identify commercially available 3D printing machines.
3. List the advantages of 3D printing as an Additive Manufacturing process.
4. Discuss how the designer's role in manufacturing is evolving over time.

Course Outcome(s):

Prepare CAD models for 3D printing.

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.

Objective(s):

1. Explain CAD model to STL file format conversion process.
 2. Package STL files for 3D printing.
 3. Identify 3D modeling software.
 4. Explain 3D modeling processes.
 5. Transfer STL files to given 3D printer.
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Course Outcome(s):

Set up a 3D Printer for 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.

Objective(s):

1. Recognize variations from one Additive Manufacturing machine to another in construction and operations.
 2. Load models and support materials.
 3. Implement relevant rapid set-up using standard methods.
 4. Apply trouble shooting techniques.
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Course Outcome(s):

Apply the fundamentals of 3D printing to produce and analyze printed components.

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.

Objective(s):

1. Implement Rapid set-up using standard methods.
 2. Operate various types of 3D printers.
 3. Run additive manufacturing software.
 4. Operate various types of 3D printers for additive manufacturing.
 5. Unload and post process built additive manufacturing parts.
 6. Inspect additive manufacturing parts for build quality.
 7. Create injection modeling apparatus.
 8. Perform part validation.
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Methods of Evaluation:

- A. Technical Documents
- B. Presentations
- C. Production of Parts
- D. Quizzes
- E. Midterm Examination
- F. Final Examination
- G. Final Project

Course Content Outline:

1. CONCEPTS
 - a. Printing
 - i. Part Set-up
 - ii. Positioning concepts
 - iii. Operating elements
 - iv. Removal of support
 - v. Errors
 - vi. Causes
 - vii. Corrective measures
 - viii. Maintenance of equipment
 - ix. Packing of 3D files
 - b. Solid Modeling

- i. Production drawings
- ii. Parametric design changes
- iii. Feature-based design
- iv. Geometric parameters
- v. Assembly drawings
- vi. View/model rendering
- vii. Rendering
- viii. Solid modeling
- ix. Individual class project
- x. Project requirements
- xi. Tolerances
- xii. Design process
- xiii. m.Computer aided engineering

c. Concurrent engineering

2. SKILLS

a. Printing

- i. Identify the relationships in geometric figures
- ii. Set up of part such as: orient & align
- iii. Utilize system management
- iv. Understand and utilize appropriate cure times
- v. Understand and utilize temperatures appropriately in relation to the finished product
- vi. Use support tools and features effectively
- vii. Work with various 3D printers
- viii. Diagnose machine failures; identify service and preventive maintenance requirements.

b. Solid Modeling

- i. Computer efficiency
- ii. Software application and customization
- iii. Design and modify parts and systems using a design process
- iv. Apply and identify the proper tolerances for a drawing
- v. Create 2 D detail and assembly drawings
- vi. Utilize threads on drawings with proper standards
- vii. Demonstrate team work and oral communication
- viii. Parametric design changes
- ix. Feature-based design
- x. Geometric parameters
- xi. Assembly drawings
- xii. View/model rendering

c. Rendering

- i. Solid modeling
- ii. Individual class project
- iii. Project requirements
- iv. Tolerances
- v. Design process

3. ISSUES

a. Printing

- i. Equipment sufficiency
- ii. Safety in operation of 3D printers
- iii. Interface with software program to convert to STL files

b. Solid modeling

- i. Working with diverse individuals and teams
- ii. Developing a level of comfort with the computer and software
- iii. Developing a positive attitude about using tools of the engineering field
- iv. Presenting solutions using a problem solving process

Resources

Planchard, David. (2019) *Engineering Graphics with Solidworks*, SDC Publications.

Chua, C. Leong, K. (2017) *3D Printing and Additive Manufacturing: Principles and Applications.*, Hackensack, NJ: World Scientific Publishing Co.

Gebhardt A., Kessler, J. and Thurn L. (2019) *3D printing: Understanding Additive Manufacturing*, Cincinnati, OH: Hanser Publications.

Redwood, B., Schoffer, F. and Garret, B. (2018) *The 3D Printing Handbook: Technologies, Design and Applications*, Amsterdam, The Netherlands: 3D Hubs B.V.

Resources Other

Instructor Handouts

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