MASTER SYLLABUS

MECH 322 – ADVANCED 3D PRINTING

CIP Code: 14.1901
For assistance determining CIP Code, please refer to this webpage https://nces.ed.gov/ipeds/cipcode/browse.aspx?y=55
or reach out to Sarah Todd at todds@canton.edu

Created by: Cullen Haskins
Updated by:
A. TITLE: ADVANCED 3D PRINTING

B. COURSE NUMBER: MECH 322

C. CREDIT HOURS (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity):

# Credit Hours: 2
# Lecture Hours _0_ per Week
# Lab Hours 15 Weeks – 2, 2-hour labs per week
Other ___ per Week

Course Length (# of Weeks): 15

D. WRITING INTENSIVE COURSE: No

E. GER CATEGORY: None

F. SEMESTER(S) OFFERED: Fall

G. COURSE DESCRIPTION:

This course builds on the topics of Introduction to 3D Printing. Topics include print material selection, mechanical properties of printed parts, dual extrusion printing, volume optimization, large-scale prints, accuracy, sizing and tolerances, resin printers, functional prototypes & production, emerging technology, limitations of 3D printing and health risks. Weekly labs examine new topics and offer opportunities for introducing, practicing, and refining 3D printing skills with an emphasis on creating functional prototypes.

H. PRE-REQUISITES: MECH 122
CO-REQUISITES: None

I. STUDENT LEARNING OUTCOMES:

<table>
<thead>
<tr>
<th>Course Student Learning Outcome [SLO]</th>
<th>PSLO</th>
<th>GER</th>
<th>ISLO</th>
</tr>
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<tbody>
<tr>
<td>a. Communicate an understanding of the benefits and limitations of 3D printing technologies.</td>
<td></td>
<td>5-Ind, Prof, Disc, Know Skills</td>
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<tr>
<td>b. Demonstrate proficiency in importing, slicing, and printing parts with multiple software and printer types.</td>
<td>ABET SO#1 Performance Indicator e – Select and apply knowledge of engineering and technology</td>
<td></td>
<td>5-Ind, Prof, Disc, Know Skills</td>
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c. Demonstrate appreciation for and implementation of proper safety procedures for Fused Deposition Modeling (FDM) and resin printing processes.

<table>
<thead>
<tr>
<th>KEY</th>
<th>Institutional Student Learning Outcomes</th>
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<tbody>
<tr>
<td>ISLO #</td>
<td>ISLO &amp; Subsets</td>
</tr>
<tr>
<td>1</td>
<td>Communication Skills</td>
</tr>
<tr>
<td></td>
<td>Oral [O], Written [W]</td>
</tr>
<tr>
<td>2</td>
<td>Critical Thinking</td>
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<tr>
<td></td>
<td>Critical Analysis [CA], Inquiry &amp; Analysis [IA], Problem Solving [PS]</td>
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<tr>
<td>3</td>
<td>Foundational Skills</td>
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<tr>
<td></td>
<td>Information Management [IM], Quantitative Lit./Reasoning [QTR]</td>
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<tr>
<td>4</td>
<td>Social Responsibility</td>
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<tr>
<td></td>
<td>Ethical Reasoning [ER], Global Learning [GL], Intercultural Knowledge [IK], Teamwork [T]</td>
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<tr>
<td>5</td>
<td>Industry, Professional, Discipline Specific Knowledge and Skills</td>
</tr>
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J. APPLIED LEARNING COMPONENT: **Yes** X **No**

If Yes, select one or more of the following categories:

- Classroom/Lab **X**
- Civic Engagement
- Internship
- Creative Works/Senior Project
- Critical Analysis [CA]
- Inquiry & Analysis [IA]
- Problem Solving [PS]
- Information Management [IM]
- Quantitative Lit./Reasoning [QTR]
- Ethical Reasoning [ER]
- Global Learning [GL]
- Intercultural Knowledge [IK]
- Teamwork [T]
- Entrepreneurship
- Service Learning
- Community Service
- (program, class, project)
K. TEXTS: None

L. REFERENCES:
3D Printing Failures: How to Diagnose & Repair All Desktop 3D Printing Issues by Sean Aranda, Self-Published

M. EQUIPMENT:
Computer Lab, single & dual extruder FDM printers, photocuring resin printers, and wash and cure station(s)

N. GRADING METHOD: A-F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:
Homework, Quizzes, Labs, & Exams

P. DETAILED COURSE OUTLINE:
See Lab Outline Below

Q. LABORATORY OUTLINE:
Lab 1. Emerging Technologies and Limitations
Lab 2. Student Presentations of 3D printing technology
Lab 3. Environmental and Health Risks
Lab 4. Student presentations of environmental and health risks
Lab 6. Mechanical Strength of Printed Parts
Lab 7. Mechanical Properties of 3D Printed Parts - Orientation
Lab 8. Mechanical Properties of 3D Printed Parts - Shell Thickness
Lab 9. Overhangs & Print Temperature
Lab 10. Supports & Print Temperature
Lab 11. Dual Extrusion Printing - Multi-Color
Lab 12. Dual Extrusion Printing - Multi-Material
Lab 13-14. Large-Scale Prints
Lab 15. Resin Printer Basics and Safety
Lab 16 - 18. Resin Printing
Lab 17. Resin Printing
Lab 19-20. Accuracy of 3D Prints
Lab 21-22. Print Sizing and Tolerances
Lab 23-24. Printing Interfacing Parts
Lab 25-28. Functional Prototypes
Final Exam