

**PELLISSIPPI STATE COMMUNITY COLLEGE
MASTER SYLLABUS**

**3-D ADDITIVE MANUFACTURING
MET 2270**

Lecture/Lab Hours: 3 / 3

Credit Hours: 4

Date Revised: Spring 2017

Catalog Course Description

A state of the art course in rapid technologies and additive manufacturing methods. An overview is included on the most widely used technologies, materials, and applications. Students will create files, select appropriate technology, build settings and parameters, and print complex three-dimensional parts.

Prerequisites

MET 1012 or consent of instructor, and MET 1100 and MET 2240

Co-requisites

None

Textbooks and Other Supplies

Understanding Additive Manufacturing: Andreas Gebhardt, Hanser Publications, most current edition

Week/Topic Basis

Week	Topic
1-2	Introduction and basic principles of additive manufacturing
2	Basic definitions and applications of additive manufacturing
3	The generalized additive manufacturing process chain
4	Photopolymerization and powder bed fusion processes
5	Extrusion based and sheet lamination processes
6	Beam deposition and printing processes
7	Design considerations
8	Design considerations (cont.)
9	Guidelines for process selection

10	Preparation of CAD models
11	Conversion of STL files and other software issues
12	Production planning and control
13	Post processing material removal and surface improvements
14	Post processing quality assurance techniques
15	Final Exam

Engineering Technology General Outcomes (Educational objectives)

- I. Apply basic engineering theories and concepts creatively to analyze and solve technical problems.
- II. Utilize with a high degree of knowledge and skill equipment, instruments, software, and technical reference materials currently used in industry.
- III. Communicate effectively using developed writing, speaking, and graphics skills.
- IV. Assimilate and practice the concepts and principles of working in a team environment.
- V. Obtain employment within the discipline or matriculate to a four year program in engineering or industrial technology.

Engineering Technology Concentration Competencies

NOTE: At the program level all 6 competencies apply to roman numerals I – V of the Engineering Technology General Outcomes (Educational objectives) listed above.

Students will

- A. Apply the knowledge, techniques, skills, and modern tools for the concentration of study to specifically defined engineering technology activities.
- B. Demonstrate the knowledge of mathematics, science, engineering and technology to engineering technology problems using developed practical knowledge.
- C. Conduct and report the results of standard tests and measurements, and conduct, analyze and interpret experiment or project results.
- D. Function effectively as a member of a technical team.
- E. Identify, analyze and solve specifically defined engineering technology-based problems.
- F. Employ written, oral and visual communication in a technical environment.

Course Goals

NOTES: Capital letters after course goals reference goals of the Engineering Technology Program.

The course will

1. Present an overview of the evolution of and the terminology used in additive manufacturing (A)
2. Enhance the student's knowledge of the generalized additive manufacturing procedure used in three dimensional printers (A)
3. Develop an awareness of how additive manufacturing can be applied as a cost effective alternative to other conventional manufacturing methods (A, B)
4. Expand the student's understanding of six common process methods used in the field of additive manufacturing (A)
5. Develop guidelines for the process selection (A, B, E)
6. Develop an awareness of design considerations and tooling requirements for a particular application and process (A, B, E)
7. Enhance the student's knowledge of post-processing requirements (A, B)
8. Build the skills required to create an object using additive manufacturing processes (A, B, C, D, E)
9. Foster the student's ability to prepare written and oral reports on the results of laboratory projects (F)

Expected Student Learning Outcomes

NOTE: Numbers after Expected Student Learning Outcomes reference the course goals listed above.

The student will

- a. Describe the history of additive manufacturing from 1983 to the present (1)
- b. Define the specific terms and acronyms used in the field of additive manufacturing (1)
- c. Recall the universal eight step additive manufacturing process chain used to create a part in all the different process methods (2)
- d. List a minimum of seven applications where additive manufacturing can be used in the manufacturing or medical fields (3)
- e. Describe the photopolymerization process and applications where it is used (4)
- f. Describe the powder bed fusion process and applications where it is used (4)
- g. Describe the extrusion based process and applications where it is used (4)
- h. Describe the sheet laminating process and applications where it is used (4)
- i. Describe the beam deposition process and applications where it is used (4)
- j. Describe the printing process and applications where it is used (4)
- k. Access the design constraints and choose an appropriate process for creating a part using additive manufacturing (5,6)
- l. Analyze a design, create a three dimensional CAD solid model, convert the CAD file to a STL (Stereo Lithography) file format, transfer the STL file to the additive manufacturing machine, set up the additive manufacturing machine, build the part, and complete post-processing procedures (3, 4, 5, 6, 7, 8)
- m. Prepare comprehensive reports on the parts created in the laboratory (9)

- n. Prepare and deliver an oral presentation using proper speech techniques (9)

Evaluation

Total evaluation will be based on the following point distribution.

Testing Procedures

Unit Exams

50 points

There will be 4-6 unit exams administered during the course. They will include definitions, discussion questions, short answer questions, true/false questions, and problem solving.

Final Exam

15 Points

There will be a comprehensive final exam administered at the end of the course.

Laboratory Experiences

Laboratory Projects

35 points

Laboratory will include special projects supported by written reports, and one oral presentation. The instructor will provide guidelines and requirements for the projects.

Field Work

N/A

Other Evaluation Methods

N/A

Grading Scale

Final grade for this course will be based on the following alphabetical/numerical scale.

A	93-100
B+	88-92
B	83-87
C+	79-82
C	74-78
D	65-73
F	Below 65

Policies

Attendance Policy

Pellissippi State expects students to attend all scheduled instructional activities. As a minimum, students in all courses (excluding distance learning courses) must be present

for at least 75 percent of their scheduled class and laboratory meetings in order to receive credit for the course. Individual departments/programs/disciplines, with the approval of the vice president of Academic Affairs, may have requirements that are more stringent. In very specific circumstances, an appeal of the policy may be addressed to the head of the department in which the course was taken. If further action is warranted, the appeal may be addressed to the vice president of Academic Affairs.

Academic Dishonesty

Academic misconduct committed either directly or indirectly by an individual or group is subject to disciplinary action. Prohibited activities include but are not limited to the following practices:

- Cheating, including but not limited to unauthorized assistance from material, people, or devices when taking a test, quiz, or examination; writing papers or reports; solving problems; or completing academic assignments.
- Plagiarism, including but not limited to paraphrasing, summarizing, or directly quoting published or unpublished work of another person, including online or computerized services, without proper documentation of the original source.
- Purchasing or otherwise obtaining prewritten essays, research papers, or materials prepared by another person or agency that sells term papers or other academic materials to be presented as one's own work.
- Taking an exam for another student.
- Providing others with information and/or answers regarding exams, quizzes, homework or other classroom assignments unless explicitly authorized by the instructor.
- Any of the above occurring within the Web or distance learning environment.

Please see the Pellissippi State Policies and Procedures Manual, Policy 04:02:00 Academic/Classroom Conduct and Disciplinary Sanctions for the complete policy.

Accommodations for Disabilities

Students that need accommodations because of a disability, have emergency medical information to share, or need special arrangements in case the building must be evacuated should inform the instructor immediately, privately after class or in her or his office. Students must present a current accommodation plan from a staff member in Disability Services (DS) in order to receive accommodations in this course. [Disability Services](#) (<http://www.pstcc.edu/sswd/>) may be contacted via [Disability Services email](#) or by visiting Alexander 130.

Other Policies

Safety and Equipment Abuse

Repeated safety violations will result in a reduction of final grade, at the instructor's discretion. Flagrant violations which result in equipment damage or personal injury could result in automatic failure of the course