Advanced Manufacturing Processes & Analysis

EML 6267 Class # 18873/18876/18875 Sections CAMP/2FED/1FE2
Class Periods: MWF, Periods 6, 12:50-1:40 pm
Location: NEB 100
Academic Term: Spring 2024

Instructor:
Name: Yong Huang
Email Address: yongh@ufl.edu
Office Phone Number: 352-392-5520
Office Hours: MW 1:40 – 2:30 pm, 492 Wertheim and by appointment

Teaching Assistant(s):
Please contact through the Canvas website

- Chuanshen Zhou, zhou.c@ufl.edu, public area facing Wertheim Building 3rd floor stairway, 9:30-10:30 am, Tuesdays and Thursdays and by appointment

Course Description
To provide an integrated treatment of the analysis and applications of advanced manufacturing processes.
Credits: 3

Course Pre-Requisites / Co-Requisites
Graduate standing

Course Outline

- Introduction to subtractive and additive manufacturing processes
- Modeling: machining - single point cutting processes
- Modeling: machining - abrasive cutting processes
- Modeling: additive manufacturing processes
- Other advanced manufacturing innovations

Course Objectives
This graduate course is targeted at all engineering students who are interested in learning about manufacturing and its recent advances. The students are expected to:
a) learn the fundamentals of major classes of manufacturing processes; and
b) develop mathematical descriptions for mechanics of some traditional and advanced manufacturing processes.

Materials and Supply Fees
N/A

Required Textbooks and Software
None. Some notes and reading materials will be provided.

Websites

- Required: Canvas (http://elearning.ufl.edu/)
- Other: Society of Manufacturing Engineers (http://www.sme.org/)

Recommended Materials
Gibson, I., Rosen, D. W., and Stucker, B., 2010 (1st ed.) or 2015 (2nd ed.), *Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing*, Springer, New York.

Chua, C. K., and Leong, K. F., 2016, *3D Printing and Additive Manufacturing: Principles and Applications*, 5th ed., World Scientific, Singapore, Singapore.

Liou, F. W., 2019, *Rapid Prototyping and Engineering Applications: A Toolbox for Prototype Development*, 2nd ed., CRC Press, Boca Raton, FL.

Huang, Y., Wang, L., and Liang, S.Y., 2019, *Handbook of Manufacturing*, World Scientific Publishing, Singapore.

Course Schedule
The tentative teaching schedule is on the last page.

Online Course Recording
Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Attendance Policy, Class Expectations, and Make-Up Policy
Class policies

- Attendance in class is expected unless announced otherwise. If one has a conflict with the scheduled office hours, he/she should make an appointment with the instructor/TA(s) as needed.
- Students are responsible for all announcements, assignments, etc., made during lectures, including changes in the scheduling of lecture topics, homework assignments, and exams. Class absence is not a valid excuse for being unprepared.
- Homework assignments, homework solutions, class handouts, sample exam(s), and other course-related postings will be available on Canvas. Any changes in the schedule or assignments will also be announced on Canvas. Check for updates on the website before every class and monitor your Canvas-related mailbox regularly. Solutions to homework will be posted on Canvas.

Homework policies/policies on additive manufacturing lab and additive manufacturing research project

A. General policies

- *Homework and reports (including lab report, one-page research project abstract, research project midterm and final reports, research project presentation slides, and research project presentation feedback) must be on any type of 8.5'' × 11'' paper, and all work must be shown. Multiple sheets must be organized (or stapled for in-person submissions if needed) in proper order. Homework and reports must have the homework assignment number (for homework only), team number (for lab and research project) and name(s), assigned sorting number (for homework and feedback only; to be given on Canvas), the date of submission in the upper right corner of the first page, and a page number in the bottom right corner of each page.*
- Format of the reports: single spacing, one-inch margin, and 12 pt. Times New Roman for the main text body.
- Homework is due in class exactly one week after the date it is assigned (unless announced otherwise). The due dates of the reports are specified as seen from the class tentative schedule (last page). In general, late homework and reports will not be accepted.
- Homework and reports must be submitted via Canvas before the start of class on the due date unless announced otherwise.
- Working in groups is permitted and encouraged. However, copying homework/reports is NOT permitted.
- *Only selected problems* from each homework assignment may be graded, and each homework assignment will be given a score of 0 to 10: 5 points for completeness and 5 points for correctness for the graded problems. No homework assignment drop policy is honored.

B. Introduction to additive manufacturing lab and additive manufacturing research project

- The course has **an additive manufacturing lab** and **an additive manufacturing research project**.
- The lab is to design and print a part with a UF logo and your team number within a 3'' × 3''× 3'' footprint. You may print it using your own printer or any on-campus resources including the MAE Rapid Prototyping Lab (https://mae.ufl.edu/rapidpro/). For off-campus students, only the STL file is to be submitted if you cannot access a printer.
- The research project can be a literature survey or a technology development report.
    - **If it is literature survey oriented**, it is expected to identify a specific additive manufacturing-related topic (technology, design, material(s), application(s), process modeling, process monitoring/control, education, environmental/societal concerns, to name a few) and offer an in-depth understanding of the selected topic, which should be different from any available literature. Ten or more technical papers (not review papers) are expected to be read and criticized.
    - **If it is technology development based**, it is expected to identify an additive manufacturing process to be improved, articulate its current challenge(s), propose how you solve one of the identified challenges either analytically or numerically, and present some preliminary results based on the proposed approach.
- [On-campus students] Each team should have three students for the lab and the research project.
- [Off-campus students] Each team may have one to three students for the lab and the research project.
- Lab and research project teams can be different, and each lab or research project team will be assigned a team number based on the sign-up result.
- A point-of-contact (POC) should be identified by each team and listed as the first team member in the reports and presentations. **The POC member is responsible for report/presentation file submissions** as well as communications with Prof. Huang or the TA(s) on behalf of the team.
- The report length should be up to five (5) pages for the lab report and midterm research project report and fifteen (15) pages for the final research project report excluding the cover page (title, team number, and team member information) and reference section.
    - The lab report should describe the design and manufacturing process.
    - The research project report may include your project title, abstract, conclusions, and references in addition to the technical or review body. Each research project report should have **a Similarity Index less than 15%** based on the iThenticate or Turnitin comparison results, and selected reports may be further improved and submitted for publication review.
    - Submitted as PDF files using the following naming convention for Team xx
        - Additive manufacturing lab related: EML6267Lxx.PDF for lab report. **Lab presentation slides are to be appended to the end of the lab report, one slide per page.**
        - Additive manufacturing research project related: EML6267PxxA.PDF, EML6267PxxM.PDF, and EML6267PxxF.PDF for research project abstract, midterm report, and final report, respectively. **Final presentation slides are to be appended to the end of the final report, one slide per page.** No slides are to be appended for the midterm report.

C. Additive manufacturing lab: Oral presentation

- Each research project group must give a 3-minute midterm presentation (2 minutes for presentation and 1 minute for Q&A) For off-campus students, only 2-minute presentations are needed.
- Lab presentation must be prepared using the provided template and uploaded onto Canvas the night before the presentation day.
- [On-campus students] Each group must give their presentation in class unless announced otherwise.
- [Off-campus students] Each group must record their presentation in Zoom using the presentation sharing mode and upload it to a specified cloud space twenty-four hours before the presentation day. The presentation will be played to the class by Prof. Huang or the TA(s).

D. Additive manufacturing research project: Oral presentations

- There will be midterm and final presentations, and the schedule will be announced later based on the team sign-up result.

- Each research project group must give a 5-minute midterm presentation (4 minutes for presentation and 1 minute for Q&A) and a 15-minute final presentation (12 minutes for presentation and 3 minutes for Q&A). For off-campus students, only 4-minute and 12-minute presentations are needed.
- Both midterm and final presentations must include the title, team number and member names, date of submission, and page number, and each presentation file should be uploaded onto Canvas the night before your presentation.
- Presentations must indicate sources as needed.
- [On-campus students] Each group must give their presentations in class unless announced otherwise.
- [Off-campus students] Each group must record their presentations in Zoom using the presentation sharing mode and upload them to a specified cloud space twenty-four hours before their presentation times. The presentation will be played to the class by Prof. Huang or the TA(s).

E. Additive manufacturing research project: Feedback and peer rating form

- Each student needs to write a summary of each team presentation (including your own team) as part of a homework assignment (HW #5).
- Each student needs to complete a peer rating form (to be provided) on other teams (except your own team) as well as your team members, which is to be uploaded onto Canvas as a PDF file.

Exam policies

- [On-campus students] All exams will be held in the regular classroom unless announced otherwise. The first two exams will be held during the regular class periods. The final exam will be held at the time assigned by the Registrar.
- [Off-campus students] All exams will follow UF EDGE regulations unless announced otherwise.
- A scientific/graphing calculator is required for exams. Calculators with communications capabilities will not be allowed.
- **All exams will be closed book and notes. Use of 8.5″ × 11″ formula sheet(s) (one-sided, one for each midterm and three for the final exam) is permitted.** Note: You are not allowed to have verbose descriptions/explanations and figures on the formula sheet(s). Only equations and definitions of variables appearing in the equations are allowed. Formula sheet(s) should be turned in with your exam.
- It is the students' responsibility to demonstrate their knowledge on exams with all work shown. *Partial credit* may be given for work that can be followed and where the nature and magnitude of the mistake can be identified. *No credit* will be given for correct answers with insufficient indication of how they were obtained.
- Absence from a scheduled exam without prior consent of the instructor will result in zero credit for that exam. In the event of a last-minute emergency, you need to submit appropriate official documentation of the emergency (e.g., illness, accident, etc.) as soon as possible.

Re-grading Policy

Any re-grade requests must be communicated with the instructor within one week after return of the graded paper. If needed, a written request may be provided to explain in detail what you want the grader to do and where you believe he/she has made a mistake in grading. The request must have a date on the top of the first page, your name, sorting number, and e-mail address.

Make-up Exam Policy

The dates and times for the exams are announced in advance. Except for valid medical reasons, no make-up exams will be given. Please schedule your other activities accordingly.

Miscellaneous Policies

Students will be held responsible for knowledge of all scheduling and policy announcements made in class. *Modifications to this syllabus may be required during the semester. Any changes to the syllabus will be posted on the course website and announced in class.*

Evaluation of Grades

Assignment	Percentage of Final Grade
Midterm exam (2)	30% (15% each)
Final exam (cumulative)	25%
Research project	10% (Midterm report: 5%, Presentation: 5%) (100 pt)
	15% (Final report: 5%, Presentation: 5%, Feedback: 5%) (100 pt)
Additive manufacturing lab	10% (Product and report) (100 pt)
Homework (5)	10%
	100%

Grading Policy

Percent	Grade	Grade Points
93.0 - 100	A	4.00
90.0 - 92.9	A-	3.67
87.0 - 89.9	B+	3.33
83.0 - 86.9	B	3.00
80.0 - 82.9	B-	2.67
77.0 - 79.9	C+	2.33
73.0 - 76.9	C	2.00
70.0 - 72.9	C-	1.67
67.0 - 69.9	D+	1.33
63.0 - 66.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

The instructor may adjust individual grades according to a holistic evaluation of the student's performance, improvement, and effort. More information on UF grading policy may be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center by visiting disability.ufl.edu/students/get-started. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu/evals. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code." On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TA(s) in this class.

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy
There are federal laws protecting your privacy with regard to grades earned in courses and on individual assignments. For more information, please see:
http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html

Campus Resources:
Health and Wellness

U Matter, We Care:
If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints*:* http://www.distance.ufl.edu/student-complaint-process.

EML 6267 Tentative Class Schedule (Spring) (2024)

Index (week)	Date	Topics
1	Jan. 8, 10, 12	Introduction to manufacturing processes (subtractive and additive), Introduction to additive manufacturing
2	Jan. 17, 19	M.L.K Holiday, Introduction to additive manufacturing
3	Jan. 22, 24, 26	Introduction to additive manufacturing ☺ Team sign-up sheet provided by the TA(s) (**Wed., 01/24**)
4	Jan. 29, 31, Feb. 2	Modeling of single point cutting processes ☺ Team sign-up due (**Wed., 01/31**)
5	Feb. 5, 7, 9	Modeling of single point cutting processes, Modeling of abrasive cutting processes ☺ Project topic and one-page abstract (PDF) due (**Wed., 02/07**)
6	Feb. 12, 14, 16	Modeling of abrasive cutting processes, ☺ Exam 1 (**Fri., 02/16**)
7	Feb. 19, 21, 23	Modeling of abrasive cutting processes
8	Feb. 26, 28, Mar. 1	AM modeling - Vat photopolymerization, AM modeling – Material and binder jetting
9	Mar. 4, 6, 8	Midterm research project presentations, Additive manufacturing lab ☺ Midterm research project report (PDF with slides included at the end) due (**Fri., 03/08**) (upload your PPT onto Canvas the night before your presentation)
10	Mar. 11-15	Spring break
11	Mar. 18, 20, 22	AM modeling – Material and binder jetting, AM modeling - Material extrusion
12	Mar. 25, 27, 29	AM modeling – Binder jetting and powder bed fusion, AM modeling - Directed energy deposition, ☺ Exam 2 (**Fri., 03/29**)
13	Apr. 1, 3, 5	AM - Directed energy deposition, Lab product presentation ☺ Lab product/report (PDF with slides included at the end) due (**Fri., 04/05**) (upload your PPT onto Canvas the night of **Thur., 04/04**)
14	Apr. 8, 10, 12	Final research project presentations (upload your PPT onto Canvas the night before your presentation)
15	Apr. 15, 17, 19	Final research project presentations, Other manufacturing innovations
16	Apr. 22, 24	Other manufacturing innovations, Review ☺ Research project final report (PDF with slides included at the end) and peer rating and feedback due (**Wed., 04/24**)
	As announced	Guest lectures when appropriate

IMPORTANT DATE:
April 30, 2024 (Tuesday) Final exam, 3:00 - 5:00 pm, NEB 100 unless announced otherwise