Advanced Manufacturing Processes & Analysis

EML 6267 Sections 1FE2/2FED/CAMP
Class Periods: MWF, Periods 7, 1:55-2:45 pm
Location: CSE E122
Academic Term: Spring 2020

Instructor:
Name: Yong Huang
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Office Phone Number: 352-392-5520
Office Hours: MW 2:45 – 3:45 pm, MAE B-230 and by appointment

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

- Yunxia Chen, yunxia.chen@ufl.edu, NSC 523
  Fifth floor break area, Nuclear Sci. Bldg. (NSC), 9:15-10:15 am, Mondays and Wednesdays 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

- Materials introduction and mechanical behavior of materials
- Machining - Single and multiple point cutting processes
- Machining - Abrasive cutting processes
- Additive manufacturing processes and their applications
- 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;
b) develop mathematical descriptions for mechanics of some traditional processes; and
c) learn to model mechanics of 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, *Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing*, Springer, New York.

- Chua, C. K., Leong, K. F., and Lim, C. S., 2010, *Rapid Prototyping: Principles and Applications*, 3rd ed., World Scientific, Singapore, Singapore.
- Liou, F. W., 2008, *Rapid Prototyping and Engineering Applications: A Toolbox for Prototype Development*, CRC Press, Boca Raton, FL.
- Huang, Y., Wang, L., and Liang, S. Y., 2019, *Handbook of Manufacturing*, World Scientific Publishing, Singapore.

Course Schedule

Tentative teaching schedule is on the last page.

Attendance Policy, Class Expectations, and Make-Up Policy

Class policies

- Attendance in class is expected. 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/report policies

General policies

- *Homework and reports (including lab report, one-page project abstract, project report draft, project report, project presentation slides, and project presentation feedback) must be on any type of 8.5'' × 11'' paper, and all work must be shown. Multiple sheets must be stapled in a proper order. Homework and reports must have the homework assignment number (for homework only), team number (for lab and 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.
- [On-campus students] Homework and presentation feedback should be submitted to the instructor at the start of class on the due date. In general, e-copy will not be accepted. If you must turn in your homework earlier, you must place it into the TA's office (located in NSC 523) and notify the TA via email. The reports (except presentation feedback) must be submitted to the TA by e-mail through Canvas by 8:30 AM on the due date.
- [Off-campus students] Homework and reports must be submitted to the TA by e-mail through Canvas by 8:30 AM on the due date.
- 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.

Lab and project reports (To be submitted as PDF files)

- The course has **an additive manufacturing lab** and **an additive manufacturing project**.
- The lab is to design and print a part with a UF logo and your team number within a 3'' × 3''× 3'' footprint.
- The project can be a literature survey or technology development one. 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. If 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 project.
- [Off-campus students] Each team may have one to three students for the lab and the project.
- Lab and project teams can be different, and each lab or project team will be assigned with a team number based on the sign-up result.
- The report length should be up to five (5) pages for the lab report and fifteen (15) pages for the project report excluding the cover page (title and team number and team member information) and reference section. The lab report should describe the design and manufacturing process. The project report may include your project title, abstract, conclusions, and references in addition to the technical or review body. Each 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.

Project: Presentation slides (To be submitted as PDF files)

- Presentations must include the title, team number and member names, date of submission, and page number.
- Presentations must indicate sources as needed.

Project: Oral presentation (On-campus students only)

- Each group must give a 15-minute presentation in class, and the presentation schedule will be announced later.

Project: Feedback on a presentation (All students)

- Each student must choose another presentation and write comments and suggestions about it.
- Feedback cover page must include your name/sorting number and the presentation title/date.

Exam policies

- [On-campus students] All exams will be held in the regular classroom. 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.
- 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 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 web site and announced in class.*

Evaluation of Grades

Assignment	**Percentage of Final Grade**
Midterm exam (2)	40% (20% each)
Final exam (cumulative)	25%
Project	15% (Report: 5%, Presentation: 5%, Feedback: 5%)
Additive manufacturing lab	10% (Product and report)
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 regards 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)

Index (week)	Date	Topics
1	Jan. 6, 8, 10	Introduction to manufacturing processes (subtractive and additive), Introduction to additive manufacturing
2	Jan. 13, 15, 17	Introduction to additive manufacturing, Single point cutting processes
3	Jan. 22, 24	M.L.K Holiday, Single point cutting processes
4	Jan. 27, 29, 31	Single/multiple point cutting processes
5	Feb. 3, 5, 7	Multiple point cutting processes ☺ Project topic and one-page abstract (PDF) due (**02/03**)
6	Feb. 10, 12, 14	Abrasive cutting processes, ☺ Exam 1 (**02/10**)
7	Feb. 17, 19, 21	Abrasive cutting processes, AM - Vat photopolymerization
8	Feb. 24, 26, 28	AM - Vat photopolymerization, AM - Material jetting
9	Mar. 2-6	Spring break
10	Mar. 9, 11, 13	AM - Material jetting, Additive manufacturing lab
11	Mar. 16, 18, 20	AM - Binder jetting, AM - Material extrusion
12	Mar. 23, 25, 27	AM - Powder bed fusion, AM - Directed energy deposition ☺ Exam 2 (**03/23**)
13	Mar. 30, Apr. 1, 3	AM - Directed energy deposition, AM - Sheet lamination, ☺ Project report draft (PDF) and lab product/report (PDF) due (**03/30**)
14	Apr. 6, 8, 10	Project presentations (email your PPT to the TA the night before your presentation)
15	Apr. 13, 15, 17	Project presentations, Other manufacturing innovations
16	Apr. 20, 22	Other manufacturing innovations, Review ☺ Project final report (PDF), presentation slides (PDF), and peer rating and feedback (hard copy) due (**04/20**)
	As announced	Guest lectures when appropriate

IMPORTANT DATE:
April 30 (Thursday, 30D) Final exam, 3:00 - 5:00 pm, E122 CSE