

University of Southern California
Daniel J. Epstein Department of Industrial and Systems Engineering
Department of Aerospace and Mechanical Engineering

ISE 232L / AME 232L: Manufacturing Processes

Class Number 31603D, Units 3

Spring 2023

Course Syllabus

Course General:

The course meets Tuesday & Thursday, 9:30~10:50 am.

Lecture sessions: VHE-217

Lab sessions: SAL-109

Course Instructor: Dr. Yong Chen, Tel: 213-740-7829, Email: yongchen@usc.edu.

Office Hours: Tuesday & Thursday (2 - 3:30 pm) or by appointment, OHE-430E or Zoom access:
<https://usc.zoom.us/j/92470967353>

Teaching Assistant: Mr. Yeowon Yoon, Tel: 619-322-3218, Email: yeowonyo@usc.edu.

Office Hours: Tuesday & Thursday (11-12:30 pm) or by appointment, GER-242B or Zoom access:
<https://usc.zoom.us/j/92655091143>

Course Description:

This course aims to provide students with an understanding and appreciation of the breadth and depth of the field of manufacturing and the strong interrelationships between manufacturing processes, product design, and material properties. It will introduce traditional manufacturing processes such as casting, forming, lathing, milling, and polymer injection molding, and emerging manufacturing processes such as layer manufacturing, electronic device fabrication, and MEMS manufacturing. It will also discuss modern digital technologies used in manufacturing, such as computer-aided design and engineering, computer-numerical control, and computer-integrated manufacturing. Group projects are designed to prepare the students to gain an understanding of how everyday products are designed and manufactured.

The course is a combined lecture and laboratory teaching. The lectures will consist of seven parts: (1) Manufacturing processes and their relations to product design and material properties, (2) metal component manufacturing; (3) plastic component manufacturing; (4) digital product design and manufacturing; (5) prototyping and additive processes; (6) semiconductor and MEMS manufacturing; and (7) manufacturing of complex products. Various case studies and related videos will be used in the lectures. The Labs will require students to form teams to design and prototype an innovative device using the CAD software system (SolidWorks) and 3D printers.

The newly established VSoE's Baum Family Maker Space (<https://viterbiundergrad.usc.edu/bfms/>) will be used in the students' course projects.

Prerequisites:

No formal prerequisites. An introductory course on material science (e.g., MASC 110L) is desired but not required.

Textbook

“*Manufacturing Engineering and Technology*,” Seventh Edition, Serope Kalpakjian and Steven R. Schmid, Pearson Prentice Hall, 2013.

Grading Policy:

The grading for the class will be determined using the following weights:

• Problem assignments.....	20%
• Lab Quiz	5%
• Midterm exam.....	10%
• Final exam.....	20%
• Dissection project.....	15%
• Prototyping project.....	25%
• Participation.....	5%
<u>Total Score</u>	100%

Problem Assignments: Students will be given reading and homework assignments (including labs) from the textbook. Homework assignments should be turned in promptly. They should demonstrate that the student has thoughtfully considered the course material and its value. Points will be deducted for late submissions.

Lab Quiz: One quiz will be given based on lab teaching in the first half of the semester.

Midterm Exam: One midterm examination will be given in the middle of the semester.

Final Exam: One final examination will be given at the end of the semester based on the university’s final exam schedule.

Dissection & Prototyping Projects: The objective of the class projects is to help the students to gain hands-on experience and to use learned materials to solve real-world problems. Each project team will have three students who are expected to work together to accomplish the given tasks.

- (1) In the dissection project, each team is expected to dissect an everyday product and analyze the manufacturing processes and material of its components.
- (2) In the prototyping project, each team is expected to develop an innovative product related to the project idea. A functional prototype and its CAD models need to be built and demonstrated at the end of the project.

Each project team must prepare a presentation for each project to explain their ideas, methods, and results to the class. Presentations will take about 15 minutes per team, and the presenters should be prepared to answer questions on the topic. The presentation and a project report will be used to evaluate team-based grades.

Participation: Participation in the classes and labs is required and will be considered. Bonus points are available for enthusiastic participation in class. If you will miss a class, please let the professor know it before the class and work with your fellow students and us to catch up on what you miss. Please put cell phones in vibrate mode before coming to the lectures and labs.

Tentative Course Schedule:

In general, there are two-hour lectures and one-hour laboratory each week.

Week #	Tuesday (9:30-10:45 am)	Thursday (9:30-10:45 am)	Assignments
1	Jan. 10 – Ch1: Course introduction & Manufacturing background	Jan. 12 – Product development, Project overview & team forming	Team Formed
2	Jan. 17 – Lab 1	Jan. 19 – Team exercise, Project idea & Ch2: Mechanical properties	Project Assigned
3	Jan. 24 – Ch3 Physical properties & Ch5&6: Engineering material (Metal)	Jan. 26 – Ch7: Engineering material (Polymer)	
4	Jan. 31 – Lab 2	Feb. 2 – Project Idea Presentation (8min/team) Course project overview & Manufacturing process overview	Project Idea Due
5	Feb. 7 – Site visit: Pacific Design & Manufacturing (2/7-2/9) – Anaheim Convention Center	Feb. 9 – Ch10-12: Metal casting	Dissection Project Assigned
6	Feb. 14 – Lab 3	Feb. 16 – Ch19: Polymer injection molding	
7	Feb. 21 – Ch14: Forging	Feb. 23 – Ch16: Sheet-metal forming	
8	Feb. 28 – Lab 4	Mar. 2 – Sheet-metal forming & Dissection project discussion	
9	Mar. 7 - Lab 5 (Lab Quiz)	Mar. 9 – Ch21: Machining introduction & Ch23 Cutting model	
10	Mar. 14 – Spring recess (No Class)	Mar. 16 - Spring recess (No Class)	
11	Mar. 21 – Dissection Project Presentation (12min/team)	Mar. 23 – Mid-term Exam	Dissection Project Due
12	Mar. 28 – Prototyping project & Metal machining	Mar. 30 – Ch24: Intro to CAM & CNC	Prototyping Project Assigned
13	Apr. 4 – Ch20: NC & CAE & Prototyping	Apr. 6 – Ch20: Rapid Prototyping & Prototyping project	Product Sketch Due
14	Apr. 11 – Intro to SLA, SLS, FDM & 3DP	Apr. 13 – Rapid tooling & Rapid Manufacturing and other applications	
15	Apr. 18 - Lab 6 (Prototyping project)	Apr. 20 – Ch28&29: Semiconductor fabrication	
16	Apr. 25 - MEMS & Future manufacturing system & prototyping project discussion	Apr. 27 – Prototyping Project Presentation (12min/team)	
17	May 2 – Study Day		Prototyping Project Due
18	May 9 – Final exam (8 – 10 am)		

Academic integrity:

“The Department of Industrial and Systems Engineering adheres to the University’s policies and procedures governing academic integrity as described in SCampus. Students are expected to be aware of and to observe the academic integrity standards described in SCampus, and to expect those standards to be enforced in this course.” Check out the helpful “Trojan Integrity: A Guide to Avoiding Plagiarism” and other publications of the USC Office of Student Judicial Affairs (<http://www.usc.edu/student-affairs/SJACS/nonacademicreview.html>).

Disability Accommodation:

“Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m. - 5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.”

Policy on Religious Holidays:

University policy grants students excused absences from class for the observance of religious holy days. Students should contact instructor IN ADVANCE to request such an excused absence. Students are advised to scan the syllabi at the beginning of the semester to detect potential conflicts with their religious observances. Please note that this applies only to the sort of holy day that necessitates absence from class and/or whose religious requirements conflict with aspects of academic performance. Please refer to the Holy Days Calendar (<http://orl.usc.edu/religiouslife/holydays/>).

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Section 11, Behavior Violating University Standards <https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/>. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies at: <http://policy.usc.edu/scientific-misconduct/>.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the Office of Equity and Diversity <http://equity.usc.edu/> or to the Department of Public Safety <http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us>. This is important for the safety whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. The Center for Women and Men <http://www.usc.edu/student-affairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center sarc@usc.edu describes reporting options and other resources.

Support Systems

A number of USC’s schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the American Language Institute <http://dornsife.usc.edu/ali>, which sponsors courses and workshops specifically for international graduate students. The Office of Disability Services and Programs http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible,

USC Emergency Information <http://emergency.usc.edu/> will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.usc.edu/counseling

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention and Services (RSVP) - (213) 740-9355(WELL), press "0" after hours – 24/7 on call

studenthealth.usc.edu/sexual-assault

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED)- (213) 740-5086 | Title IX – (213) 821-8298
equity.usc.edu, titleix.usc.edu

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following *protected characteristics*: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations. The university also prohibits sexual assault, non-consensual sexual contact, sexual misconduct, intimate partner violence, stalking, malicious dissuasion, retaliation, and violation of interim measures.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298

usc-advocate.symplicity.com/care_report

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity | Title IX for appropriate investigation, supportive measures, and response.

The Office of Disability Services and Programs - (213) 740-0776
dsp.usc.edu

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Support and Advocacy - (213) 821-4710
uscsa.usc.edu

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101

diversity.usc.edu

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

dps.usc.edu, emergency.usc.edu

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call

dps.usc.edu

Non-emergency assistance or information.