



ISE232L/AME232L: Manufacturing Processes

Units: 4

Fall 2024 — Tuesday & Thursday, 4:00 – 5:50 pm

Location: DMC 157

Instructor: Yong Chen

Office: OHE 430E

Office Hours: Tuesday & Thursday (2 – 3:30 pm)

Contact Info: yongchen@usc.edu, 213-740-7829.

Timeline for replying to emails/calls: within 48 hours.

Teaching Assistant: TBA

Office: GER242

Office Hours: TBD

Contact Info: TBD.

USC Catalogue Description

This course aims to provide students an understanding of manufacturing engineering and technology, and the interrelationship between manufacturing processes, product design and material properties.

Course Description

This course aims to provide students with an understanding and appreciation of the breadth and depth of the field of manufacturing engineering, and the strong interrelationships between manufacturing processes, product design and material properties. It will introduce traditional manufacturing processes such as casting, forming, lathing, milling, 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 engineering, such as computer-aided design and engineering, computer-numerical control, and three-dimensional (3D) printing. Group projects are designed to prepare the students to understand how everyday products are designed, prototyped, and manufactured.

Learning Objectives

This 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 micromanufacturing; and (7) manufacturing of complex products and manufacturing systems. 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 provided CAD software systems and 3D printers. The course outcomes for a student are:

- Gain an understanding of the objectives, constraints, and basic processes of manufacturing.
- Gain an understanding of which types of manufacturing processes are suitable for which materials, and for various quantities of production.
- Gain an understanding of the basic range of materials used in manufacturing, and the appropriate uses and applications of these various materials.
- Gain an understanding of the difference between forming, subtractive, and additive manufacturing processes and when each might be suitable.

- Gain hands-on experience with several materials and production / forming processes.
- Obtain an introduction to the practical issues, constraints, and other factors that can affect manufacturing processes. Supplement this knowledge through visits to lab facilities.
- Obtain experience working in small teams through student projects and demonstrations.

Prerequisite(s): None

Recommended Preparation: An introductory course on material science (e.g., MASC 110L) or chemistry (e.g., CHEM 105aL or CHEM 115aL) is desired.

Course Notes

The course grading type is Letter. The course is web-enhanced using Blackboard. Copies of lecture slides and other class information will be posted on Blackboard each week. The course is a combined lecture and laboratory teaching. In the labs, the students will be required to use provided CAD software systems and 3D printers.

Technological Proficiency and Hardware/Software Required

The students are desired to have a laptop that can install provided software systems.

Required Readings and Supplementary Materials

The required textbook is "Manufacturing Engineering and Technology," Seventh Edition, Serop Kalpakjian and Steven R. Schmid, Pearson Prentice Hall, 2014. The book can be purchased online or in the USC bookstore.

Description and Assessment of Assignments

The course will have the following assessment tools:

Problem Assignments: Students will be given reading assignments 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 material presented and its value. Half of the 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.

Lab & Course Projects: The objective of the class projects is to help the students gain hands-on experience and use learned materials to solve real world problems. Each project team will have 3 students, who are expected to work together to accomplish the given tasks.

- (1) In the course project, each team is expected to dissect an everyday product and analyze the manufacturing processes and material of its components.
- (2) In the lab project, each team is expected to develop an innovative product related to the course project. 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 10 minutes per team, and the presenters should be prepared to answer questions on the topic. The presentation and a project report will be used in the evaluation of team-based grades.

Participation: Participation in the classes and labs is required and will be considered.

Grading Breakdown

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

Assessment Tool (assignments)	Points	% of Grade
Problem assignments	100	20
Lab Quiz	100	5
Midterm exam	100	10
Final exam	100	20
Lab project	100	25
Course project	100	15
Participation	100	5
TOTAL	100	100

Grading Scale

Course final grades will be determined using the following scale:

A	95-100
A-	90-94
B+	87-89
B	83-86
B-	80-82
C+	77-79
C	73-76
C-	70-72
D+	67-69
D	63-66
D-	60-62
F	59 and below

Assignment Submission Policy

Most assignments are to be submitted using the Blackboard system. The submission deadline will be set for the assignments and shown in the Blackboard system.

Grading Timeline

The standard timeline for grading and feedback is generally within a week after submission.

Additional Policies

Additional policies that students should be aware of: Participation in the classes and labs is required and will be taken into account. If you will miss a class, please let me know in advance and work with your fellow students to catch up on what you miss. Please turn cell phones and pagers off or put them in vibrate mode before coming to the classes and labs.

Tentative Course Schedule: A Weekly Breakdown (subject to change)

IMPORTANT:

In addition to in-class contact hours, all courses must meet a minimum standard for out-of-class time, which accounts for time students spend on homework, readings, writing, and other academic activities. Standard fall and spring sessions (001) require a final summative experience during the University's scheduled final exam day and time.

	Topics/Daily Activities (Tuesday)	Topics/Daily Activities (Thursday)	Readings/Preparation	Deliverables
Week 1 (Aug. 26)	Course introduction & Manufacturing background	Product development, Project overview & Team forming	Ch1	Team Formed
Week 2 (Sept. 2)	Lab 1 – CAD system introduction & Visit Viterbi Maker Space	Project idea discussion & Mechanical properties	Ch2	Project Assigned
Week 3 (Sept. 9)	Physical properties & Engineering materials (Metal)	Lab 2 CAD I	Ch3, 5, 6	
Week 4 (Sept. 16)	Engineering materials (Polymer & ceramics & composites)	Project Idea Presentation & Manufacturing process overview & Metal casting	Ch7	Project Idea Due
Week 5 (Sept. 23)	Metal casting & Polymer injection molding	Lab 3 CAD II	Ch10-12	Course Project Assigned
Week 6 (Sept. 30)	Forging	Lab 4 CAD III & Design for 3D printing	Ch19	
Week 7 (Oct. 7)	Sheet-metal forming & Course project discussion	Fall recess (no class)	Ch14, 16	
Week 8 (Oct. 14)	Mid-term Exam	Dissection Project Presentation & Machining introduction		Dissection Project Due
Week 9 (Oct. 21)	Lab 5 Lab Quiz	Cutting model & Prototyping project discussion	Ch21, 23	Prototyping Project Assigned
Week 10 (Oct. 28)	Metal machining & Intro to CAM & CNC	Lab 6 CNC machining demonstration (Viterbi Maker Space)	Ch24	Prototyping Project Assigned
Week 11 (Nov. 4)	Intro to Rapid Prototyping, Rapid tooling & 3D printing	Lab 7 Tour of Center of Advanced Manufacturing	Ch37&38	
Week 12 (Nov. 11)	3D Printing of polymers – SLA, SLS, FDM, 3DP	Lab 8 Prototyping project discussion	Ch20	Product Sketch Due

Week 13 (Nov. 18)	3D Printing of metal and ceramics	Semiconductor fabrication	Ch17, 28	
Week 14 (Nov. 25)	MEMS & Micromanufacturing	Thanksgiving Holiday (no class)	Ch29	
Week 15 (Dec. 2)	Prototyping Project Presentation & manufacturing systems & Wrap-up	Prototyping project demonstration & Tradeshow	Ch39&40	Prototyping Project Due
FINAL (Dec. 7)	Study day	Final exam		

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 Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on [Research and Scholarship Misconduct](#).

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University’s educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:

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 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 for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086

eeotix.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.

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 for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - (213) 740-0776

osas.usc.edu

OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

USC Campus Support and Intervention - (213) 821-4710

campussupport.usc.edu

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

Diversity, Equity and Inclusion - (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.

Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)

ombuds.usc.edu

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

Occupational Therapy Faculty Practice - (323) 442-3340 or otfp@med.usc.edu

chan.usc.edu/otfp

Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.