

CE 599 Special topics: Mechanics of Soft Materials and 3D Printing (3 units)
2018 Fall Semester --- Course Syllabus

Days, Time	Thursday 3:30-6:10 PM
Location	TBD
Professor:	Qiming Wang
Office	BHE 222
Phone	213-821-4715
Email	qimingw@usc.edu
Office Hours	Tue, Fri 3-5PM or by appointment
Teaching assistant:	TBD
Email	TBD
Office Hours	TBD
COURSE DESCRIPTION	The course will cover the fundamental mechanics knowledge of soft materials and 3D printing technologies. The course will be divided into two parts. In the first part (lectures 1-8), mechanics of soft materials will be covered, and then these theories will be applied to understand mechanics of soft active materials such as hydrogels and electroactive polymers. In the second part (lecture 9-14), the mechanics theories will be further used to understand the mechanics problems related to emerging 3D printing technologies. Three representative 3D printing methods will be covered: Fused Deposition Modeling (FDM), Stereolithography (STL), and Selective Laser Sintering (SLS).
COURSE OBJECTIVES	The course will serve as a basis of mechanics of deformable solids that can be connected to various branches of solid mechanics, such as Soil Mechanics, Mechanics of Composite Materials, Nonlinear Finite Element Methods, Geotechnical Mechanics, Structural Stability (CE 543, Dr. Wang is the instructor), Plates and Shells. The course is valuable for students who are pursuing research in Engineering Mechanics, Stabilities of Structures and Materials, Polymer Mechanics and 3D printing, and are prepared for practicing engineers or scientists.
LEARNING OBJECTIVES	The students will learn (1) how to analyze the finite deformation of solids, (2) how to analyze the viscoelasticity of solids, (3) how to understand rubber-based soft materials, hydrogels, electroactive polymers, and (4) how to understand fundamentals of 3D printing processes such as FDM, STL, and SLS.
Prerequisite	Very basic knowledge about stress and strain.
Textbook (optional)	Gerhard A Holzapfel “Non-linear solid mechanics”. L. R. G. Treloar “The physics of rubber elasticity”. Pau F. Jacobs “Rapid Prototyping and Manufacturing: Fundamentals of Stereolithography”
Grading Schema	Homework 30% Midterm exam 30% Final Presentation 20% Final Report 20%

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2018 Fall Semester --- Class schedule

Time: Thursday 3:30-6:10 PM, Location: VKC 105

Date	Lecture#	Topic	HW	HW due
8/23	1	Finite deformation of solids I: strain tensor, stress tensor	HW1	
8/30	2	Finite deformation of Solids II: constitutive models, field equations	HW2	HW1
9/6	3	Finite deformation of Solids III: examples	HW3	HW2
9/13	4	Introduction to polymers chains	HW4	HW3
9/20	5	Introduction to polymer elasticity	HW5	HW4
9/27	6	Mechanics of electroactive polymers	HW6	HW5
10/4		Midterm exam		
10/11	7	Mechanics of hydrogels	HW7	HW6
10/18	8	Viscoelasticity of solids	HW8	HW7
10/25	9	Mechanics problems of extrusion-based 3D printing: Fused Deposit Modeling (FDM)	HW9	HW8
11/1	10	Mechanics problems of photopolymerization-based 3D printing: Stereolithography (STL)	HW10	HW9
11/8	11	Mechanics problems of sintering-based 3D printing: Selective Laser Sintering (SLS)	HW11	HW10
11/15	12	Selective topics of cutting-edge research in 3D printing: Lightweight structures, Robotics, etc		HW11
11/22		Thanksgiving Holiday		
11/29		Final Presentation 3:30-6:10PM, location TBD		
12/6		Final project paper due 5 pm 12/6 through email: qimingw@usc.edu		

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2018 fall Semester---course policy

1. Homework and Exam policy

Homework: Homework assignment schedule and due dates are shown on the class schedule table. Homework will be due 6:10 PM on the day indicated on the class schedule table.

Midterm Exam: Open books, computers, and internet. No discussion among students.

Final presentation: All students are required to carry out a small research project related to the course. The students are encouraged to talk to the instructor as soon as possible about their project plan. They are required to give a final presentation 3:30-6: 10 PM November 29, 2018.

Final report: All students are required to write a short report about their final project. The length should be within 5 pages. The due date will be 11:59 PM December 6, 2018. No late final report will be accepted.

	Credit Policies
Late work	50% credit
Make-up work	50% Credit
Incomplete work	Partial Credit dependent on the percentage
Extra credit	Case by case

2. Grading

The final grades will be determined based on: Homework 30%, Midterm exam 30%, Final presentation 20% and Final report 20%.

3. Communication

Please email questions and concerns to qimingw@usc.edu. The instructor will respond within 24 hours. Allow ample time for feedback prior to assignment submission deadlines. Questions about assignment should be asked at least 12 hours before its due time.

4. Attendance & Class Participation

Please email the instructor in advance when you will be absent.

You are allowed to miss one class without any penalty to your grade. Absences for reasons of a religious holiday, serious illness, death in the student's immediate family, or required participation in university-sponsored activities are, with the appropriate documentation, considered excused absences. If you miss more than two classes for these reasons, you will need to provide documentation for excuse from your academic dean.

For excused absences (not to exceed 3 class meetings), it is the students responsibility to obtain any class notes or other missed course materials from peers in the course and to speak with the

instructor to make arrangements for missed examinations or graded assignments. How to make up is left to the discretion of the instructor.

Make-up work for unexcused absences will not be offered. Four (4) unexcused absences will result in an immediate failure (“F”) for the course.

You are also expected to show up to class on time. I understand that sometimes the weather, transportation, etc. can get in the way of arriving to class on time. However, try to plan accordingly. *If you arrive late for three times, it will count as one unexcused absence.*

5. Statement on Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one’s own academic work from misuse by others as well as to avoid using another’s work as one’s own.

All students are expected to understand and abide by these principles. SCampus, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in

Appendix A: <http://www.usc.edu/dept/publications/SCAMPUS/gov/>. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: <http://www.usc.edu/student-affairs/SJACS/>.

6. Statement for Students with Disabilities

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 Contact Information

- Office Location: STU 301 Phone number: (213) 740-0776
- Open: 8:30 a.m. until 5:00 p.m., Monday through Friday.

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 scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

Support Systems:

Student Counseling Services (SCS) – (213) 740-7711 – 24/7 on call

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

National Suicide Prevention Lifeline – 1 (800) 273-8255

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. www.suicidepreventionlifeline.org

Relationship and Sexual Violence Prevention Services (RSVP) – (213) 740-4900 – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender-based harm. engemannshc.usc.edu/rsvp

Sexual Assault Resource Center

For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: sarc.usc.edu

Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086

Works with faculty, staff, visitors, applicants, and students around issues of protected class. equity.usc.edu

Bias Assessment Response and Support

Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. studentaffairs.usc.edu/bias-assessment-response-support

The Office of Disability Services and Programs

Provides certification for students with disabilities and helps arrange relevant accommodations. dsp.usc.edu

USC Support and Advocacy (USCSA) – (213) 821-4710

Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. studentaffairs.usc.edu/ssa

Diversity at USC

Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. diversity.usc.edu

USC Emergency Information

Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible. emergency.usc.edu

USC Department of Public Safety – UPC: (213) 740-4321 – HSC: (323) 442-1000 – 24-hour emergency or to report a crime.

Provides overall safety to USC community. dps.usc.edu