USC Viterbi
School of Engineering
Sonny Astani Department of Civil and Environmental Engineering

CE 507: Mecahnics of Solids

Units: 4
Fall 2020 Monday 3:30-6:50 PM (200 minutes)

Location: online

Instructor: Prof Vincent Lee
Office: KAP 230B
Office Hours: 2 hours per week, time and day TBD
9-5pm daily on Piazza
Contact Info: Email: vlee@usc.edu
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Teaching Assistant: TBD
Office:
Office Hours:
Contact Info:

IT Help: TBD
Hours of Service:
Contact Info:

Course Description

The materials presented will serve as a basis for the studies of the fundamental theory of linear elasticity applicable to multiple branches of solid mechanics, including the theories of finite elements, geotechnical (soil) mechanics, structural mecahnics, elastic wave propagation applicable to earthquake engineering, plates and shells and composite materials. The course is valuable and fundamental for students prepared to be practicing engineers and/or research scientisits.

Learning Objectives and Outcomes

By the end of the course, the student will be able to:

1. Understand, learn and use the theory of tensors in the theory of stresses, deformation and strains.
2. Study the theory of deformation, strains and stresses nd treated separately and independently.
3. study their dependence through the three-dimensional generalized stress-strain theory, the so-called constiutuive relations of linear, isotropic materials.
4. Learn the two-dimensioanl theory of plane elasticity in both rectangular and polar coordindates using Airy Stress functions
5. Learn the three-dimensioanl theory of elastic bars subjected to end loads.
6. Learn the theory of bars of arbitrary cross-section subjected to torsion using Prandtl torsion functions
7. Study the Bending of Bars, displacement of cantilever Beams subjected to Transverse End forces in three-diemsnion.
8. Study energy theorems, complementary energy theorems, virtual displacement methods and related Rayleigh-Ritz methods.
9. Study plasticity and viscoelasticity

Prerequisite or Recommended Preparation: *undergraduate Civil or Mechanical engineering course in Mechanics of Deformable Bodies or a course in Solid Mechanics*

Co-Requisite(s): *None*

Concurrent Enrollment: *None*

Course Notes

This is an internet course presented by DEN, Distnace Educational Network

The class will have letter grade. The class will use the DEN blackboard website as the primary medium for distribution of course material, including assignments, typed and written lecture notes and for syllabus, announcements and examination dates.

Technological Proficiency and Hardware/Software Required

N/A

Textbook and Supplementary Materials

P.L. Gould: Introduction to Linear Elasticity, Springer-Verlag, 3rd Ed. ISBN 9781461448327 or 2nd Ed., ISBN 0387941002, OR

Ref: A. P. Boresi ad K.P. Chong Elasticity in Engineering Mechanics, Elsevier, ISBN 0-444-01177-3

The above textbooks are available for purchase from the USC bookstore. Supplemental reading material will be provided as needed.

Description and Assessment of Assignments

The points per homework assignment and their % grade in the table below are only approximate.

All homework assigned are due on the first class of next week

Assignment	Points	% of Grade
1	60 to 70	1.66
2	60 to 70	1.67
3	60 to 70	1.67
4	60 to 70	1.66
5	60 to 70	1.67
6	60 to 70	1.67
7	60 to 70	1.66
8	60 to 70	1.67
9	60 to 70	1.67
10	60 to 70	1.66
11	60 to 70	1.67
12	60 to 70	1.67
TOTAL		20

Grading Scale

Students will be graded based on their total scores (possibly relative to the overall class performance) The following is merely a rough guideline, and is subject to revision depending on the overall class performance.

Assignment	Points	% of Grade
Homework	60/70 each	20%
Midterm I	100	24%
Midterm II	100	24%
Final	100	32%
TOTAL		100%

Assignment Submission Policy

Unless otherwise stated, homework assignments are due at the beginning of the class and/or submitted in DEN dropbox. Solutions will be posted on DEN blackboard shortly after the assignments are turned in.

Grading Timeline

The homeworks and midterms will be graded and handed back roughly one week after their due date.

Additional Policies

Late homework will not be accepted. No exceptions except instution-established emergency reasons; credit for such late homework is with the discretion of the instructor.

Reasonable collaboration in solving homework problems is allowed. This includes reviewing and discussing the problems with current CE 471 students, TA or the instructor. Everybody has to write his/her own solution independently and make sure to fully understand it. Exchanging solutions, consulting with people other than class members, finding solutions on the web or elsewhere, etc. are not allowed. Violations result in losing the credit for the entire homework set in addition to a significant percentage of the overall course grade, all with the discretion of the instructor.

All answers should be clearly and fully justified. If the steps are not clear, points will be deducted even if the final answer is correct.

Attendance will be taken in every lecture. The students are expected to be attentive, and in particular refrain from using computers or hand held devices, except for the sole purpose of the class. Non-compliance will result in point deduction from class participation part of the grading, and possibly a percentage of the overall course grade, all with the discretion of the instructor.

Course Schedule: A Weekly Breakdown

	Topics/Daily Activities	Posted Lecture Notes	Deliverable/ Due Dates
Week 1 Aug24	Tensor Notation, Coordinate Transformation, Eigenvalues	L01, L02	Homework 1 assigned
Week 2 Aug31	Eigenvalues Icont.) Cubic Polynomials, State of stress, Equilibrium Equations	L03, L04, L05	Homework 2 assigned
Week 3	Sep 7 Labor Day USC holiday		
Week 4 Sep14	Principal Stresses, Strain and deformation, Strain Compatibility	L06, L07, L08	Homework 3 assigned;
Week 5 Sep21	Stress versus Strain, Linear Elasticity, Stress Compatibility – Beltrami-Mitchell Eqns	L09, L10, L11	Homework 4 assigned
Week 6 Sep28	3DExamples,Plane Stress, Plane Strain, 2D Cartessian Problems, **Mid-Term #1**	L12, L13	
Week 7 Oct 5	Plane stress, Plane strain, 2-D Cartesian Airy Stress functions	L13, L14, L15	Homework 5 assigned
Week 8 Oct12	Plane stress/Strain Polar Coordinates I - Airy Stress functions	L15, L16	Homework 6assigned
Week 9 Oct19	Polar Coordinates II	L17, L18	Homework 7 assigned
Week 10 Oct26	3-D Elastic bar subjected to End, Transverse loads, Review Mid-Term#2 Problems	L19, L20	Homework 8 assigned
Week 11 Nov 2	Torsion I **Mid-Term #2**	L21	
Week 12 Nov 9	Torsion II, Prandtl Torsion function, Examples	L22	Homework 9 assigned
Week 13 Nov16	Energy Methods I: Energy Theorems, complementary Energy Theorems	L23, L24	Homework 10 assigned;
Week 14 Nov23	Energy Methods II: Virtual displacement & related Rayleigh-Ritz methods	L25, L26	Homework 11 assigned **Last week of Class !!!!**
Week 15 No Class	Plasticity, elasticity vs plasticity, contributing properties, Yield Criteria	L27	Homework 12 assigned
Week 16 No Class	Viscoelasticity: elasticity vs viscoelasticity, constitutive models, Viscoelastic creep	L28	

FINAL **Dec2-9** **tbd**	Date: For the date and time of the final for this class, consult the USC *Schedule of Classes* at classes.usc.edu/.

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, policy.usc.edu/scientific-misconduct.

Support Systems:

Student Health Counseling Services - (213) 740-7711 – 24/7 on call
engemannshc.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) 740-4900 – 24/7 on call
engemannshc.usc.edu/rsvp
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) | Title IX - (213) 740-5086
equity.usc.edu, titleix.usc.edu
Information about how to get help or help a survivor of 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.

Bias Assessment Response and Support - (213) 740-2421
studentaffairs.usc.edu/bias-assessment-response-support
Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation 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
studentaffairs.usc.edu/ssa
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.