CE 515: Advanced Strength of Materials-Fall 2024
(Class Room: 2220 Engineering Building 3, TTh 11:45am-1:00 pm)

Instructor: Tasnim Hassan
Office: FWH 3347 (make an appointment to meet me in the office)
Office Hours: MTTh 5:30-6:30 pm using Zoom (link is posted on Moodle website)
Please email me at least 24 hours ahead to make an appointment with me outside office hours
Phone: 919-699-5224 (cell, for urgent matters only)
E-mail: thassan@ncsu.edu

Teaching Assistant: Lucas Lima, PhD Student (lmaciel@ncsu.edu)
TA Office Hours: W 5:30-6:30 pm using Zoom (link is posted on Moodle website)

Prerequisite: An undergraduate course on Mechanics of Solids or Strength of Materials

Student Learning Outcomes:

1. Analyze stresses and strains at a point: transform stresses and strains, determine principal stresses and strains, principal directions for 3D problems, and analyze strain rosette data.
2. Use elastic constitutive equations for 3D stresses and strains.
3. Use approximate theories of strength of materials for analysis of stresses and strains of open and closed thin-walled section bars subjected to torsion and unsymmetric bending.
4. Analyze curved beams, beams on elastic foundation, shear deformation of beams, and stress concentration problems.
5. Analyze failure using classical plasticity theory and fracture mechanics.

This course essentially bridges the gap between elementary strength of materials and more advanced courses in structural analysis and structural mechanics; provides background in the classical theory of elasticity (mathematical stress analysis) and approximate theories of structural analysis (engineering stress analysis; strength of materials); establishes the relationship between the simplified and more general theories; enriches skill for interpretation of analysis results.

Topics and No. of Lectures (See Lecture Schedule later):

1. Introduction, review of undergraduate strength of materials – 1.5 lectures
2. Fundamentals of stress, strain, and deformation – 4.5 lectures
3. Isotropic and anisotropic linear elastic stress-strain relations – 1 lecture
4. St. Venant's classical theory of torsion: non-circular bars, thin-walled open sections, thin-walled single-cell tubes, multi-cell thin-walled tubes – 4 lectures
5. Unsymmetric bending and transverse shear; shear flow and shear center in thin-walled sections - 3 lectures
6. Curved beams -1.5 lectures
7. Pressurized cylinder, plates with circular holes – 1 lecture
8. Beams on elastic foundations – 1.5 lectures
9. Nonlinear beams, transverse shear on beam – 2 lectures
10. Introduction to plasticity theory: yield criteria, flow rules; rigid-perfectly plastic bodies, and failure criteria – 3 lectures
11. Introduction to fracture mechanics- 3 lectures

Grade Distribution and Exam Schedule:

Homework	20%	Assigned weekly and due in one week
Test 1	20%	Thu, Oct 10th, In-class (for on-campus students)
Test 2	20%	Thu, Nov 7th, In-class (for on-campus students)
Final Exam	40%	Thu, Dec 5th, 12:00-2:30 pm 2220 EB 3 (for on-campus students)

Engineering on-line (EOL) students will take the two tests and final exam on the same day before the on-campus students complete their exams or the day before the campus students' schedule above. Please contact the instructor as soon as possible with any conflict with your work schedule**. Set up your EOL office-approved proctor ASAP, and let the EOL office know about your proctor. Before each test and final exam, please contact the EOL office to schedule your tests and exam.**

Note. Final grade will be decided based on the scores in HWs, two tests and the final exam.

Standard Grading Procedure:

97-100	A+	93-96.9	A	90-92.9	A-
87-89.9	B+	83-86.9	B	80-82.9	B-
77-79.9	C+	73-76.9	C	70-72.9	C-
67-69.9	D+	63-66.9	D	60-62.9	D-
<60	F				

Homework: Will usually be assigned weekly and due EXACTLY one week from the day of the assignment. HWs will be assigned and submitted by students through Moodle. Late submission will not be accepted without a valid reason.

Textbook: A.P. Boresi, R.J. Schmidt, Advanced Mechanics of Materials, John Wiley & Sons, Inc., 6th Edition. *You may purchase a used book online at a reasonable price, so act quickly to get a good quality used book.*

Last day to drop a course without a grade and last day to change from credit to audit is Thu, Oct 17, 2023 (see Academic Calendar of Fall 2024 later for more detail).

Online class evaluations will be available for students to complete during the last two weeks of class. Students will receive an email message directing them to a website where they can login using their Unity ID and complete evaluations. All evaluations are confidential; instructors will never know how any one student responded to any question. (https://isa.ncsu.edu/for-the-pack/classeval/for-students/)

Academic Integrity: Students are expected to adhere to the guidelines for academic integrity as outlined in the NC State University Code of Student Conduct https://studentconduct.dasa.ncsu.edu/academic-integrity-overview/

Students with Disability: Reasonable accommodation will be made for students registered with Disability Services for student. For more information see, CCEE DRO Guidelines and Practices: (https://docs.google.com/document/d/15Lz0RfoksnENm_BIdC2KgSgAFIKSidJm/edit) and NCSU Disability Resource Office website (https://dro.dasa.ncsu.edu/)

Lectures, Tests and the Final Exam Schedule

Lecture Number	Date	Topic
Lecture 1	Tue, Aug 20, 2024	Intro; review of undergrad concepts
Lecture 2	Thu, Aug 22, 2024	
Lecture 3	Tue, Aug 27, 2024	Fundamentals of stress, strain, and deformation
Lecture 4	Thu, Aug 29, 2024	
Lecture 5	Tue, Sep 03, 2024	
Lecture 6	Thu, Sep 05, 2024	
Lecture 7	Tue, Sep 10, 2023	Linear elastic stress-strain
Lecture 8	Thu, Sep 12, 2024	Classical theory of torsion *Review for Test 1*
Wellness day – Tue, Sep 17, 2023 – no class		
Lecture 9	Thu, Sep 19, 2024	
Lecture 10	Tue, Sep 24, 2024	
Lecture 11	Thu, Sep 26, 2024	
Lecture 12	Tue, Oct 01, 2024	Unsymmetric bending *Review for Test 1*
Lecture 13	Thu, Oct 03, 2024	Unsymmetric bending
Lecture 14	Tue, Oct 08, 2024	Unsymmetric bending; shear flow and shear center
Test 1 on Thu, Oct 10, 2024, 11:45 am-1:00 pm for campus students		
Mon-Tue, Oct 14-15, 2024 Fall Break		
Lecture 15	Thu, Oct 17, 2024	Curved beams
Lecture 16	Tue, Oct 22, 2024	Pressurized cylinder
Lecture 17	Thu, Oct 24, 2024	Plate with holes
Lecture 18	Tue, Oct 29, 2024	Beam on elastic foundations *Review for Test 2* Nonlinear beams
Lecture 19	Tue, Oct 31, 2024	Transverse shear
Lecture 20	Thu, Nov 05, 2024	Plasticity theory
Test 2 on Thu, Nov 07, 2024, 11:45 am-1:00 pm for campus students		
Lecture 21	Tue, Nov 12, 2024	Plasticity theory
Lecture 22	Thu, Nov 14, 2024	Plasticity theory
Lecture 23	Tue, Nov 19, 2024	Fracture mechanics
Lecture 24	Tue, Nov 21, 2024	Fracture mechanics
Lecture 25	Thu, Nov 26, 2024	Fracture mechanics
Wed-Fri, Nov 27-29, 2024, Thanksgiving Holiday		
Lecture 26	Tue, Dec 03, 2024	*Review for Final Exam*
Final exam on Thu, Dec 05, 2024, 12:00-2:30 pm for campus students		

Fall 2024 Academic Calendar

August 19 Monday First day of classes
August 23 Friday Last day to add a course without permission
August 30 Friday Census Date/Official Enrollment Date
September 2 Monday Labor Day (University closed; No classes)
September 3 Tuesday Classes resume
September 17 Tuesday Wellness Day (No classes)
September 18 Wednesday Classes resume
October 9 Wednesday Schedule for 2025 Spring and Summer terms published; Shopping Cart opens
October 14 – 15 Mon. – Tue Fall Break (No classes)
October 16 Wednesday Classes Resume
October 17 Thursday Drop/Revision Deadline
October TBA Enrollment begins for Spring 2025 term
November 27 – 29 Wed. – Fri.Thanksgiving Holiday (No classes; University closed Thursday & Friday)
December 2 Monday Classes resume
Nov. 22 – Dec. 3 Fri. – Tues. Last week of semester
December 3 Tuesday Last day of classes
December 4 Wednesday Reading Day
December 5 – 11 Thur. – Wed. Final Examinations
December 13 Friday Fall grades due by 5 p.m.
December 14 Saturday Fall Commencement Exercises