ME 6203 – Inelastic Deformation of Solids

Fall 2026

Credit 3-0-3

Prerequisites Graduate standing; ME6201 Principles of Continuum Mechanics recommended

Instructor
Professor Richard W. Neu
Office: 4105 MRDC
Tel: 404-894-3074
Email: rick.neu@gatech.edu
Virtual Office Link:
https://gatech.zoom.us/j/2014424609?pwd=THlEWUVlelZoODMycC9VRThvdjdBQT09

References
Khan, A.S. and Huang, S., *Continuum Theory of Plasticity*, Wiley, 1995. (r)
Rees, D.W.A., *Basic Engineering Plasticity*, Elsevier, 2006. (e)
Besson, J., Cailletaud, G., Chaboche, J.-L., and Forest, S., *Non-Linear Mechanics of Materials*, Springer, 2010. (e)
Ottosen, N.S. and Ristinmaa, M., *The Mechanics of Constitutive Modeling*, Elsevier, 2005. (e)
Chakrabarty, J., *Theory of Plasticity*, Butterworth-Heinemann, 2006. (e)
Hosford, W.F., *Fundamentals of Engineering Plasticity*, Cambridge Univ. Press, 2013. (e)
Findley, W.N., Lai, J.S., and Onaran, K., *Creep and Relaxation of Nonlinear Viscoelastic Materials*, North-Holland, 1976. (e)
Frost, H.J. and Ashby, M.F., *Deformation-Mechanism Maps*, Pergamon Press, 1982. (web version at http://engineering.dartmouth.edu/defmech)
(r) on reserve at GT library
(e) electronic book at GT library

Objectives To obtain an understanding of the phenomenological aspects of nonlinear and time-dependent material behavior. To obtain the ability to develop and use mathematical models that describe inelastic deformation behavior. To introduce models suitable for rate-independent and rate-dependent plasticity, creep, viscoplasticity, viscoelasticity, and damage.

Topics
Introductory topics – history, stress-strain behavior, yield criteria (3 weeks)
Rate-independent plasticity (4 weeks)
Numerical methods – integration schemes (1 week)
Rate-dependent plasticity, viscoplasticity, and creep (3 weeks)
Crystal plasticity (1 week)
Viscoelasticity (1 week)
Damage mechanics (1 week)

Evaluation
25% Homework
25% Midterm Exam
20% Critical Paper Review
30% Project

A > 90, **B** > 80, **C** > 70, **D** > 60

Canvas All lecture slides, handouts, homework solutions, your scores, and much more can be found on Canvas.

Attendance and Participation

This course will be conducted as an active learning environment. Students are expected to engage regularly with course content and activities.

- **Residential students** are expected to attend class and participate in discussions and in-class activities.
- **Distance Learning (DL) students** are expected to engage with recorded lectures and course materials in a timely manner and to participate through assigned activities, discussions, or other course interactions.

Regular engagement—whether through in-person attendance or timely interaction with course materials—is strongly correlated with success in this course.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Please review Georgia Tech's Honor Code and the student Code of Conduct. Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Core IMPACTS

Not applicable

Accommodations

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Collaboration and Group Work

You are allowed to work in groups on all homework and out of class projects, but any work you turn in must be written in your own hand and be clear on your solution approach and resources used. Exams are to be your own work.

Use of Generative AI

Generative AI tools (e.g., ChatGPT, Gemini, Copilot, and similar systems) may be used in this course as aids to support learning, exploration, and design. When used appropriately, these tools can assist with brainstorming, conceptual understanding, code development, data analysis, and communication.

However, the following expectations apply:

- **You remain fully responsible for all submitted work.** Any material produced with the assistance of AI must be understood, verified, and critically evaluated by you.
- **AI may not be used as a substitute for your own thinking.** Submitting AI-generated solutions without comprehension, modification, or validation is not acceptable.
- **Transparency is required.** Any substantive use of generative AI must be clearly acknowledged. This includes a brief description of how the tool was used (e.g., ideation, debugging, drafting text, etc.).
- **Engineering judgment is essential.** AI-generated results may be incomplete, incorrect, or misleading. You are expected to apply sound engineering principles to assess and validate all results.
- **Exams remain individual work.** Use of generative AI is not permitted during exams unless explicitly stated otherwise.

Appropriate use of generative AI in this course is intended to **enhance your ability to think, design, and evaluate engineering solutions**, not replace those skills.

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

Late homework will be penalized accordingly. Make-up exams are given for illness, approved Institute activities, or religious observances.