**GEORGIA INSTITUTE OF TECHNOLOGY**
**AE/CHBE/ME/MSE 7772 FUNDAMENTALS OF FRACTURE MECHANICS**
Fall 2026

**Instructor:** Prof. Shuman Xia; e-mail: shuman.xia@me.gatech.edu

**Prerequisite:** Mechanics of Materials

**Textbook and Required Course Materials:**

Fracture Mechanics: Fundamentals and Applications by T. L. Anderson, 3rd or 4th Edition. Common print ISBNs: 9780849316562 (3rd Edition) and 9781498728133 (4th Edition).

Homework assignments, supplemental readings, and course announcements will be posted on Canvas at https://canvas.gatech.edu/.

**References:**

A Course on Nonlinear Fracture Mechanics by J. W. Hutchinson (http://www.seas.harvard.edu/hutchinson/papers/353-5.pdf)

Advanced Fracture Mechanics by M. F. Kanninen and C. H. Popelar

**Web Resources:**

Course communication and homework distribution will be handled through Canvas at https://canvas.gatech.edu/. Students are responsible for checking Canvas and their Georgia Tech email regularly for announcements and updates.

**Course Description:**

Advanced study of failure of structural materials under load, mechanics of fracture, and microscopic and macroscopic aspects of the fracture of engineering materials. Crosslisted between AE, CHE, CEE, ME, and MSE 7772.

**Course Outcomes:**

Outcome 1: Students will understand the basic concepts of linear-elastic fracture mechanics (LEFM) and elastic-plastic fracture mechanics (EPFM).

Outcome 2: Students will apply fracture mechanics concepts to predict fracture and crack growth in structural components that contain cracks or crack-like defects.

Outcome 3: Students will use fracture mechanics principles in materials evaluation and life prediction for engineering components.

Outcome 4: Students will describe important micro-mechanisms of crack growth in metals and ceramics.

**Homework:**

Homework will be posted on Canvas (https://canvas.gatech.edu/).

**Exams:**

The course includes one midterm exam and one final exam. Exam dates, locations, and additional instructions will be announced in class and on Canvas.

**Percentage for Grade Calculation:**

Homework 25% of final grade
Midterm Exam 30% of final grade
Final Exam 45% of final grade

**Scale:**

Final scores will be calculated as the weighted average of the above components and converted to letter grades in accordance with Institute policy and instructor judgment.

**Course Outline:**

Intro / Overview - Ch. 1
Fundamentals of LEFM - Ch. 2
Basic Concepts of EPFM - Ch. 3
Fracture Mechanisms in Ceramics and Metals - Ch. 5-6
Fracture Toughness Testing - Ch. 7
Fatigue and Stress Corrosion Cracking - Ch. 10-11

**Attendance Policy:**

Regular attendance is expected because the course material builds sequentially and directly supports homework and exams. Students remain responsible for all course material, announcements, and deadlines. Documented excuses and Institute-approved absences will be handled in accordance with Georgia Tech policy.

**Absences for Medical Reasons:**

In the event of a medical emergency or an illness severe enough to require medical attention, students are responsible for contacting the Office of the Dean of Students as soon as possible to report the issue, provide dated documentation from a medical professional, and request assistance in notifying their instructors. All medical documentation will be handled confidentially by the Dean's office and will be used to determine whether communication with instructional faculty is appropriate. In short, students will work with the Office of the Dean of Students to verify their illness, and the Dean's office will then communicate with me as needed.

**Additional Criteria for Successful Completion of the Course:**

Complete all major graded work, including homework, the midterm exam, and the final exam, unless an approved exception is granted.

Submit work by the posted deadlines, monitor Canvas and Georgia Tech email for course communications, and abide by Georgia Tech academic integrity requirements and student conduct expectations.

**Academic Integrity:**

Unless otherwise authorized by the instructor, submitted work should reflect each student's own understanding. Exams are to be completed alone. 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. For information on Georgia Tech's Academic Honor Code, please visit https://catalog.gatech.edu/policies/honor-code/ or https://catalog.gatech.edu/rules/18/. Any student suspected of cheating or plagiarizing on an assignment or exam will be reported to the Office of Student Integrity.

**Acceptable Student Conduct (Student-Faculty Expectations Agreement):**

At Georgia Tech, it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. Students are expected to contribute to a respectful, professional, and engaged learning environment and to follow the Student-Faculty Expectations Agreement.

**Diversity and Disability Statement:**

Georgia Tech values diversity and inclusion; we are committed to a climate of mutual respect and full participation. Our goal is to create learning environments that are usable, equitable, inclusive, and welcoming. If there are aspects of the instruction or design of this course that result in barriers to your inclusion or accurate assessment or achievement, please notify the instructor as soon as possible. Students with disabilities should contact the Office of Disability Services to discuss options for removing barriers in this course, including accommodations. ODS can be reached at 404.894.2563, dsinfo@gatech.edu, or https://disabilityservices.gatech.edu.

**Core IMPACTS Statement:**

Not applicable. This is a graduate course and is not part of the USG Core IMPACTS curriculum.