

MSE 456 / TAM 428 / AE 428
Mechanical Behavior of Composite Materials
Fall 2020

Tuesday and Thursday 11:00am-12:20pm
Online

Instructors:

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Textbook:

I.M. Daniel and O. Ishai, *Engineering Mechanics of Composite Materials*, 2nd ed.
(available online through UIUC library)

Webpage:

Illinois Compass <https://compass2g.illinois.edu>

Prerequisites:

TAM 251 or MSE 206 or equivalent;
Knowledge of basic matrix algebra and computations.

Grading Breakdown:

25%	Exam 1
25%	Exam 2
20%	Homework
30%	Final Exam (Comprehensive)

Approximate Grade Scale: (based on class average, minimums for ranges may be reduced)

A+	96-100
A-/A	88-95
B-/B/B+	75-87
C-/C/C+	62-74
D-/D/D+	49-61

Class Policies:

- **Homework:** Homework will be due approximately 1 week after being assigned. Solutions will be available after the assignments are graded.
- **Late Assignments:** Homework must be turned in *by 11:05am on the due date*. Any homework turned in after 11:05am will be considered late. Late homework will be accepted at a penalty of *25% per day* until the solutions are made available. Hence, homework can only be a maximum of one week late.
- **Exams:** In general, makeup exams will not be given. Exam conflicts must be discussed with me at least two weeks prior to the exam. Missed exams without a valid excuse will result in a zero on the exam.
- **Academic Integrity:** Any homework or exam handed in by an individual must represent their own original work. It is the responsibility of the student to refrain from infractions of academic integrity, which includes cheating, fabrication and plagiarism. Such infractions will be given no credit and will be subject to penalties outlined by the University of Illinois code of conduct.
- **Copyright Course Materials:** All materials for this course are considered copyright of the University of Illinois at Urbana-Champaign. It is wholly unacceptable for students to post course materials (homework, quizzes, exams, solutions, lecture notes, etc.) in public places, including unauthorized websites, for sale or otherwise. Any act of making course available on the WWW, or in any other format, is considered copyright violation.
- **Email:** All email correspondence must be made using a valid Illinois email address.

Objectives:

- Become familiar with common reinforcement and matrix materials used in advanced composites.
- Predict the properties of a broad spectrum of composite materials based on: the properties, relative amounts, the geometry, and orientation of the constituent reinforcement and matrix materials.
- Develop stress-strain relations and failure criteria for a broad spectrum of composite materials.
- Calculate the stress-strain response and failure of a laminated composite material under in-plane loading and/or bending using classical laminated plate theory.
- Analyze a particular composite design and determine if it meets appropriate design criteria such a failure or deflection specification.

Statement on anti-racism and inclusivity:

https://go.engineering.illinois.edu/ARTE_SyllabusStatement

Course Topics/Section:

I. *Materials Background*

- Types of Composites
- Reinforcements
- Matrices

II. *Composite Properties*

- Elastic Stiffness - Micromechanics
- Expansion & Transport
- Short Fiber Composites
- Particulate and Nanocomposites

III. *Orthotropic Materials*

- Generalized Hooke's Law For Anisotropic Materials
- Orthotropic Symmetry

IV. *Laminated Composites*

- Laminate Properties
- Laminate Strength and Failure Modes
- Thermal Stress

Additional References: (online or on reserve at Grainger)

- K.K. Chawla, *Composite Materials*, 3rd ed.
<http://link.springer.com/content/pdf/10.1007%2F978-0-387-74365-3.pdf>
You can download for free from Springer link from an Illinois IP address
- Agarwal, B. and L. Broutman, *Analysis and Performance of Fiber Composites*, 3rd ed, 2006.
- Jones, R.M., *Mechanics of Composite Materials*, 2nd ed. 1999.

Sexual Misconduct Reporting Obligation:

The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University's Title IX Office. In turn, an individual with the Title IX Office will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options.

A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found here: wecare.illinois.edu/resources/students/#confidential.

Other information about resources and reporting is available here: wecare.illinois.edu.

Religious Observances

Illinois law requires the University to reasonably accommodate its students' religious beliefs, observances, and practices in regard to admissions, class attendance, and the scheduling of

examinations and work requirements. You should examine this syllabus at the beginning of the semester for potential conflicts between course deadlines and any of your religious observances. If a conflict exists, you should notify your instructor of the conflict and follow the procedure at <https://odos.illinois.edu/community-of-care/resources/students/religious-observances/> to request appropriate accommodations. This should be done in the first two weeks of classes.

Disability-Related Accommodations

To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES, you may visit 1207 S. Oak St., Champaign, call 333-4603, e-mail disability@illinois.edu or go to <https://www.disability.illinois.edu>. If you are concerned you have a disability-related condition that is impacting your academic progress, there are academic screening appointments available that can help diagnosis a previously undiagnosed disability. You may access these by visiting the DRES website and selecting “Request an Academic Screening” at the bottom of the page.

Family Educational Rights and Privacy Act (FERPA)

Any student who has suppressed their directory information pursuant to Family Educational Rights and Privacy Act (FERPA) should self-identify to the instructor to ensure protection of the privacy of their attendance in this course. See <https://registrar.illinois.edu/academic-records/ferpa/> for more information on FERPA.