MSE 456 / TAM 428 / AE 428
Mechanical Behavior of Composite Materials – Fall 2016

Professor: Nancy R. Sottos, *n-sottos@illinois.edu*
Office Hrs: Tue. 12:20-1 pm, 210 MSEB
(or by appointment)

TAs:

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

Webpage: Illinois Compass *https://compass2g.illinois.edu*

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

Grading Breakdown:

22%	Exam 1
22%	Exam 2
20%	Homework
36%	Final Exam (Comprehensive)

Approximate Grade Scale:
(based on class average, the minimum for the range could be scaled lower)

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 will be due approximately 1 week after being assigned. Solutions will be available after the assignments are graded.
- Late homework will be accepted at a penalty of five percent a day until the solutions are made available. Hence, homework can only be a maximum of one week late.
- In general, makeup exams will not be given. Exam conflicts must be discussed with me at least two weeks prior to 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.

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.

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 (on line or on reserve at Grainger)

- K.K. Chawla, *Composite Materials*, 3rd Edition
  http://link.springer.com/content/pdf/10.1007%2F978-0-387-74365-3.pdf
  You can download for free from Springerlink 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.