Meen 4152

Lightweight Energy Efficient Structures: Composite Mechanics and Materials

Spring 2015

**Instructor**

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**Course Information**

Course Office Hours TuTh 11:00AM - 12:00PM or by appointment

Course times TuTh 1:00 – 2:20 pm

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**Course Description:**

Materials, Mechanics and Failure Criteria of anisotropic materials (composites) and cellular solids

**Prerequisite(s):** ENGR 2332

**Course Learning Outcomes:**

Upon successful completion of this course, students will:

1. Understand material constituents and their selection for development of lightweight structural materials.
2. Solve mechanics of composites using micromechanics for continuous and short fiber reinforcement
3. Solve mechanics of composites using macromechanics using transformation of stress and strain
4. Solve problems of unidirectional lamina using micromechanics concepts
5. Solve Failure criterion problems
6. Solve problems on the elastic behavior of multidirectional laminates
7. Compute the effects of hygrothermal on stress analysis of laminates
8. Evaluate the different methods of characterization and testing of composites
9. Solve the mechanics of honeycombs
10. Design sandwich panels with foam cores

**Required text**: Engineering Mechanics of Composite Materials, Second edition, Isaac M. Daniel and Ori Ishai (2005) | ISBN-10: 019515097X | ISBN-13: 978-0195150971

**Additional Reading Resources**: Cellular solids: Structure and properties – Second edition, Lorna J. Gibson and Michael F. Ashby, Cambridge Solid State Science Series (2001)

**Course Instruction and Assignments**

1. Backboard Vista, at <http://ecampus.unt.edu>, will be used for posting the course materials and instructions, assignments, submission of assignments, email communications about the course, and the course grade-book.
2. Homework due date is final.

• The hand-written homework must be turned in at the beginning of class.

• Late homework submittals will not be accepted without prior authorization.

• Write on one side of page only.

• Submitted work must be legible and presented in a logical, easy-to-follow manner or it will be graded as zero. Model solutions will be shown in the class.

1. Discussion and exchange of ideas are important parts of the learning process and I encourage collaboration in a community of scholars. However, you must be sure the work you submit for grading is your own. Submitted works that are copies from solution manuals or website solutions or your classmates will be treated as plagiarism.
2. Attendance is required for all class hours.
3. No make-up on quizzes and homework assignments.
4. No make-up will be given for the scheduled exams, unless the student has a legitimate excuse documentation (e.g., letter from court clerk that he/she must appear in a court, letter from physician that he/she is sick, etc.) then your score on the final exam will be substituted for the missed exam score; otherwise, the missed exam will be scored as 0. Only one such substitution is permitted during the semester.

**Exams and Quizzes**

Class exams and quizzes are written and closed textbook and notebooks unless announced as such.

A ruler, laptop and scientific calculator are encouraged for classes, quizzes and exams. Limits or extent of use will be outlined ahead of each exam.

Grades are based in part on the student's ability to communicate. You must present your entire solution in an orderly way for each problem. Full grade points will not be assigned only on the final answers with correct steps. You must show the complete process of your solution. Partial credits will be assigned for correct steps that have been taken in a solution.

Requests for the review of a graded exam problem must be submitted in writing no later than the next class day following the return of a graded exam. The graded exam should be attached to your request and you must explain your reason for requesting a grade review. In this matter, the review is not limited to a single problem requested by the student. Upon review, the exam score may increase, remain the same, or decrease.

An I (incomplete) grade is given only for extenuating circumstances and in accordance with University and Departmental Policies.

**Grading:**

**Undergraduate:**

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| --- | --- |
| Two exams | **40 percent** |
| Homework | **20 percent** |
| **Design Project** | **10 percent** |
| **Final comprehensive exam** | **30 percent** |

**Grade Distribution**

90-100 = A; 80-89 = B; 70-79 = C; 60 - 69 = D; Below 60= F

**Date Topic/Reading Homework Problems**

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| --- | --- | --- |
| Date | Course Topic | Book |
| 1/20 | Introduction, concepts of lightweight and energy efficiency | Chapter 1/2 |
| 1/22, 1/27, 1/29 | Micromechanics of Composite Lamina | Chapter 3 |
| 2/3- 2/17; | Macromechanics of composite lamina | Chapter 4 |
| 2/19-3/3 | Micromechanics of unidirectional lamina | Chapter 5 |
| 3/5 | Review for Exam-1 |  |
| 3/12; 3/24-3/31 | Macromechanics and failure criteria of composite lamina | Chapter 6 |
| 4/2-4/14 | Elastic behavior of multidirectional laminates/cellular/sandwich structures | Chapter 7 |
| 4/14-4/21 | Hygrothermal effects | Chapter 8 |
| 4/23 | SAMPE expo |  |
| 4/28-5/7 | Stress and failure of multidirectional laminates | Chapter9 |
| 5/14 | Final exam |  |

**Disabilities Accommodation:**

The University of North Texas complies with Section 504 of the 1973 Rehabilitation Act and with the Americans with Disabilities Act of 1990. The University of North Texas provides academic adjustments and auxiliary aids to individuals with disabilities, as defined under the law. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring accommodation, please see the instructor and/or contact the Office of Disability Accommodation at 940.565.4323 during the first week of class.

**Additional Class Policies**

1. The Student Evaluation of Teaching Effectiveness (SETE) is a requirement for all organized classes at UNT. This short survey will be made available to you at the end of the semester, providing you a chance to comment on how this class is taught.  I am very interested in the feedback I get from students, as I work to continually improve my teaching. I consider the SETE to be an important part of your participation in this class.
2. The UNT Catalog procedures on cheating and plagiarism will be vigorously enforced. It is the duty of each student to protect their work so it is not available to others for submission as their efforts. This is especially true of files that are generated on the computer. Students that knowingly allow others to use their work are partners in this unethical behavior. All rules relating to academic dishonesty will be enforced in accordance with University policies.
3. State common law and federal copyright laws protect this course lectures and materials. They have my own original expression and revisions to the textbook author(s) and I record them at the same time that I deliver them in order. Whereas you are authorized to take notes in class, thereby creating a derivative work from my lecture, and/or make a print of my lecture notes/slides. The authorization extends only to making one set of notes for your own personal use and no other use. You are not authorized to record my lectures, to provide your notes to anyone else or to make any commercial use of them without express prior permission from me.
4. This syllabus is subject to change at any time during the semester with changes to be announced during the class hours.
5. Cell phones, iPhones, iPods, iPads, laptops must be **powered off** before the start of the class and left in your pocket, purse, or book bag.