

**SPRING 2020**

**EAS 4240 Aerospace Structural Composites 1** (Class No. 12724, Section No. 1507)

**EAS 5242 Mechanics of Composite Materials** (Class No. 23791)

**MWF 5<sup>th</sup> period (11:45 AM - 12:35 PM) CSE E118**

*Modifications to this syllabus may be required during the semester. Changes will be posted on Canvas.*

**Course Objectives:** The objectives are to provide an intermediate level coverage of the stress analysis of laminated composite plates. It stresses fundamental mechanics of materials principals to the study of anisotropic layered materials. Classical laminate theory is developed from theory through practical implementation. Additionally, the basic micro-mechanics of heterogeneous material systems is developed to determine the equivalent homogenized properties. Failure theories of composites are studied as well as thermal and moisture effects that lead to stress and applied to the lamina and the laminate. A survey of composite fabrication methods, common composite constituents, special considerations for experimental characterization and nondestructive evaluation is also covered. Upon completion of this course, students are expected to understand basic composite vocabulary, laminate theory and micromechanics. Additional reinforcement of linear algebra and calculus are provided.

**Instructor:** Dr. Peter Ifju, Room 131 NEB, 392-6744, [ifju@ufl.edu](mailto:ifju@ufl.edu). office hours: 2<sup>nd</sup> period MWF

**Pre-requisites:** *EGM 3520 Mechanics of Materials.*

**Textbook:** Principles of Composite Material Mechanics (Third Edition or Fourth Addition) by R.F. Gibson, CRC Press, Boca Raton, FL (ISBN 978-1-4398-5005-3).

**Course Topics:**

1. Introduction including constituents, applications
2. Introduction to manufacturing processes
3. Composite fabrication lab
4. Lamina stress-strain relationships
5. Micromechanics for effective mechanical properties of continuous fiber-reinforced lamina
6. Micromechanics for effective hygrothermal properties of continuous fiber-reinforced lamina
7. Strength of continuously fiber-reinforced lamina
8. Analysis of lamina hygrothermal behavior
9. Analysis of laminates for in-plane loading
10. Analysis of laminates for bending moments
11. Analysis of laminates for hygrothermal effects
12. Strength of laminates with mechanical loading
13. Special considerations for mechanical testing of composites and their constituents

**Contribution of course to meeting the professional component:**

- 4A. EAS 4240 supports several program outcomes enumerated in the Mission Statement of the Department of Mechanical and Aerospace Engineering. Specific AE program outcomes supported by this course include: (1) Possess knowledge of aerospace structures and materials, design of aerospace systems and mathematics. (AE Program Outcome A5).
- 4B. Mathematical Sciences (15%), Physical Sciences (15%), Engineering Sciences (70%)

### **Relationship of course to program outcomes:**

This course achieves the following ABET outcomes [note that the outcome number corresponds to the respective ABET outcomes (a) through (k).]:

- Apply knowledge of mathematics, science, and engineering [outcome (a), high coverage (35%); method of assessment is specially selected problems on three exams]
- Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability [outcome (c), low coverage (10%); method of assessment one homework problem of project length]
- Identify, formulate, and solve engineering Problems [outcome (e), high coverage (35%); method of assessment is specially selected homework problems and select problems on three exams]
- Understand professional and ethical responsibilities [outcome (f), low coverage, assessed informally]
- Communicate Effectively [outcome (g), low coverage (5%), class interaction]
- Understand the impact of engineering solutions in a global, economic, environmental and societal context [outcome (h), low coverage, assessed informally in evaluating homework]
- Recognize the need for, and engage in life-long learning [outcome (i), low coverage discussion of practical problems in fabricating composite laminates during lab component, introduce journal papers in class content and discuss the results and conclusions of journal papers, Additionally, extensive computer programming is assigned]
- Use the techniques, skills, and modern engineering tools necessary for engineering practice [outcome (k), high coverage (15%); method of assessment is assignments and extensive computer programming].

### **Evaluation of grades:**

Homework assignments	20%
Exam #1	25%
Exam #2	25%
Exam #3 (final exam)	30%

- Homework will be assigned on a weekly basis during the semester and will typically be due on Wednesdays.
- Exam 1 will be in-class. Exam 2 and the Final Exam will be take-home exams. The Final exam will be due during exam week.

<b>Percent</b>	<b>Grade</b>	<b>Grade Points</b>
92 - 100	A	4.00
90.0 - 91.9	A-	3.67
87 - 89.9	B+	3.33
83 - 86.9	B	3.00
80.0 - 82.9	B-	2.67
77 - 79.9	C+	2.33
73 - 76.9	C	2.00
70.0 - 72.9	C-	1.67
67 - 69.9	D+	1.33
63 - 66.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

### **University Honesty Policy:**

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by

the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. A violation of the honor code will result in academic sanctions (typically a failing grade assigned for the course) and further disciplinary action. If you have any questions or concerns, please consult with the instructor or TAs in this class.

### **Software Use and Copyrighted Material:**

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use and the use of copyrighted material. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

### **Student Privacy:**

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see:

<http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

### **Campus Resources:**

#### *Health and Wellness*

#### **U Matter, We Care:**

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

**Counseling and Wellness Center:** <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

#### **Sexual Assault Recovery Services (SARS)**

Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

#### *Academic Resources*

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu).  
<https://lss.at.ufl.edu/help.shtml>.

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.  
<https://teachingcenter.ufl.edu/>.

**Writing Studio, 302 Tigert Hall**, 846-1138. Help brainstorming, formatting, and writing papers.  
<https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus:** [https://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

**On-Line Students Complaints:** <http://www.distance.ufl.edu/student-complaint-process>.