Principles of Fracture Mechanics

EGM 6570 Sections 1200, 1201 and 1204

Class Periods: Monday/Wednesday/Friday, Period 5, 11:45 am – 12:35 pm
Location: CSE E122
Academic Term: Spring 2018

Instructor

Douglas Spearot, Ph.D.
Email: dspearot@ufl.edu
Phone: 352-392-6747
Office Hours: Monday/Wednesday/Friday, 12:35 – 1:30 pm, NEB 133 (or by appointment)

Teaching Assistants

None. Contact Prof. Spearot for all questions related to course material.

Course Description

Introduction to the mechanics of fracture of brittle and ductile materials. Linear elastic fracture mechanics; elastic-plastic fracture mechanics; standard fracture testing; numerical methods related to fracture; composite materials; creep and fatigue crack growth.

Required Textbook

Fracture Mechanics: Fundamentals and Applications, Fourth Edition, 2017.
Anderson, T.L.
https://www.crcpress.com/Fracture-Mechanics-Fundamentals-and-Applications-Fourth-Edition/Anderson/p/book/9781498728133

Assessment Methods

Your grade for this course will be determined based on your performance on homework and exams as follows:

Homework 25%

Approximately 8 homework assignments will be assigned via Canvas periodically during the semester. Assignments will be collected at the beginning of class on the due date via upload to Canvas. **No late homework assignments will be accepted without prior approval.** To receive full credit on each homework assignment, solutions must include all pertinent sketches or diagrams (if necessary), equations, solutions and final answers with correct units. Homework must be legible and professional (neat, orderly, final solutions circled or boxed). Illegible homework solutions will be marked as incorrect. Homework solutions will be posted on Canvas.

***Exams 75%* (3 equally weighted)**

Three exams will be given during the semester. Exam dates/time/format are to be determined based on number of students and EDGE options for proctoring. Exams will consist primarily of numerical problems but will also include short answer problems as appropriate for the course material.

Grading Scale

An example numerical grading scheme is provided below. This information should only be used as a general guide as the course instructor reserves the right to adjust the final numerical grading demarcations. Course grades will be "curved" if necessary – this decision will not be made until the end of the semester once all exams and homework assignments are graded.

93-100 = A, 90–92.9 = A-, 87–89.9 = B+, 83–86.9 = B, 80–82.9 = B-, 77–79.9 = C+, 73–76.9 = C
70–72.9 = C-, 67–69.9 = D+, 63–66.9 = D, 60–62.9, <60 = E

Attendance Policy, Class Expectations, and Make-Up Policy
Class attendance is highly recommended, but is not mandatory. Excused absences for homework submission and exams must be consistent with university policies in the graduate catalog and require appropriate documentation (http://gradcatalog.ufl.edu/). Homework extensions and make-up exams will be provided for excused absences in which notification is provided before the assignment date.

Students Requiring Accommodations
Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, https://www.dso.ufl.edu/drc) by providing appropriate documentation. Once registered, students will receive an accommodation letter, which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation
Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at: https://evaluations.ufl.edu/evals. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at: https://evaluations.ufl.edu/results/.

University Honesty Policy
UF students are bound by The Honor Pledge, "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. If you have any questions or concerns, please consult with the instructor in this class.

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. 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 regarding 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
If you or a friend is in distress, please contact umatter@ufl.edu or 352-392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center
http://www.counseling.ufl.edu/cwc or 352-392-1575; or contact the University Police Department: 352-392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS)
Contact the Student Health Care Center at 352-392-1161.

University Police Department
Contact UFPD at 352-392-1111 (or 9-1-1 for emergencies) or http://www.police.ufl.edu/.

Academic Resources

E-learning technical support
Call 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. You may also find answers to common problems at https://lss.at.ufl.edu/help.shtml.

Career Resource Center
Located in the Reitz Union and offers career assistance and counseling. Call 352-392-1601 or https://www.crc.ufl.edu/.

Library Support
Information on various ways to receive assistance using the libraries or finding resources. http://cms.uflib.ufl.edu/ask.

Teaching Center
Located in Broward Hall and provides general study skills and tutoring. Call 352-392-2010 or 352-392-6420 or https://teachingcenter.ufl.edu/.

Writing Studio
Located at 302 Tigert Hall. Provides help brainstorming, formatting, and writing papers. Call 352-846-1138 or https://writing.ufl.edu/writing-studio/.

On-Campus Student Complaints
https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

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

Principles of Fracture Mechanics

EGM 6570 Sections 1200, 1201 and 1204*

Week	Dates (M,W,F)	Sections	Topic(s)
Week #1	1/8, 1/10, 1/12	1.1 – 1.4	Syllabus and history
		5.1 – 5.4	Review of material deformation
Week #2	~~1/15~~, 1/17, 1/19	6.1 – 6.2	Review of material deformation
		2.1 – 2.2	Atomic view of fracture
Week #3	1/22, 1/24, 1/26	2.3 – 2.6	Griffith energy balance
			R and driving force curves
Week #4	1/29, 1/31, ~~2/2~~	2.6 – 2.7	Stress analysis
			Westergaard stress functions
Week #5	2/5, 2/7, 2/9	2.8 – 2.11	Crack tip plasticity
			Mixed mode fracture
Week #6	2/12, 2/14, 2/16	7.1 – 7.3	Fracture testing for LEFM
		3.1 – 3.2	CTOD and J integral
Week #7	2/19, 2/21, 2/23	3.2	**EXAM 1 (Chapters 1,2,5,6,7)**
			Experimental measurement of J
Week #8	2/26, 2/28, 3/2	3.3 – 3.5	J controlled fracture
		7.4 – 7.5	Fracture testing for EPFM
Week #9	~~3/5, 3/7, 3/9~~		**NO CLASS**
			SPRING BREAK
Week #10	~~3/12, 3/14~~, 3/16	3.6	Large scale yielding
			J-Q theory
Week #11	3/19, 3/21, 3/23	4.1 – 4.2	Dynamic fracture
			Elastodynamic theory
Week #12	3/26, 3/28, 3/30	4.2 – 4.3	Viscoelastic creep crack growth
		10.1 – 10.2	Fatigue crack growth basics
Week #13	4/2, 4/4, 4/6	10.3 – 10.5	**EXAM 2 (Chapters 3,4,5,6,7)**
			Fatigue crack growth and threshold
Week #14	4/9, 4/11, 4/13	10.6 – 10.9	Fatigue micromechanisms
		11.1	Variable amplitude loading
Week #15	~~4/16~~, 4/18, 4/20	11.2 – 11.4	Stress corrosion cracking
			Hydrogen embrittlement
Week #16	4/23, 4/25	11.5	Corrosion fatigue and testing
			Liquid metal embrittlement
Finals Week	TBD		**EXAM 3 (Chapters 4,5,6,10,11)**

– Strikethrough dates are either university holidays or Prof. Spearot is out of town at a professional meeting; class will be either prerecorded or cancelled.

* Course schedule may change over the course of the semester; changes will be communicated in class and/or electronically.