FLORIDA POLYTECHNIC UNIVERSITY

Syllabus: Fatigue and Fracture Mechanics

Spring semester 2026

Course Information

- **Course Number and Title**: EML 4541: Fatigue and Fracture Mechanics
- **Credit Hours:** 3
- **Academic Term:** Spring 2026

Instructor Information

- **Instructor:** Dr. Sanna Siddiqui
- **Office:** ARC 1186
- **Office Hours:** MW: (2:00pm-3:00pm); F: (10:30am-11:00am)
- **Office Phone:** (863) 874-8564
- **E-mail: ssiddiqui@floridapoly.edu;** All course-related e-mails should be sent to the instructor via the CANVAS course e-mail portal.

Course Delivery and Course Description

- Class Meeting Day, Time & Location: MW 4:00-5:15PM in IST 1068
- Course Modality: In-Person
- **Semester Dates**: January 12, 2026- April 28, 2026
- **Course Website**: Will be posted to the Canvas Course Site for Fatigue and Fracture Mechanics
- **Official Catalog Course Description**: An introduction to fatigue and fracture mechanics will be presented in this course. Topics will include the failure analysis process, and fatigue and fracture mechanics exhibited by metals, ceramics, polymers and composite materials used in a variety of engineering applications and subject to various environmental/in-service operating conditions.
    - **Course Pre and/or Co-Requisites:** EGN 3331: Strength of Materials and EGN 3365: Structure and Properties of Materials
    - Communication/Computation Skills Requirement (6A-10.030): No
- **Required Texts**: Metal Fatigue in Engineering by R.I. Stephens, A. Fatemi, R.R. Stephens, and H.O. Fuchs, 2nd edition, John Wiley & Sons, 2001.
- **Reference Texts**: Fatigue and Fracture- Understanding the Basics by F.C. Campbell, 1st edition, ASM International, 2012, ISBN-13: 978-1-61503-976-0
- **Equipment and Materials**: **Note**: Only use of the following calculator models as used on the Fundamentals of Engineering (FE) Exam will be allowed:
    - "**Casio:** All fx-115 and fx-991 models (Any Casio calculator must have "fx-115" or "fx-991" in its model name.)
    - **Hewlett Packard:** The HP 33s and HP 35s models, but no others
    - **Texas Instruments:** All TI-30X and TI-36X models (Any Texas Instruments

calculator must have “TI-30X” or “TI-36X” in its model name.)”

- **Resources and Reference Materials**: Will be provided on Canvas as needed

Course Objectives and Outcomes

- **Course Objectives**:
  - An introduction to fatigue and fracture mechanics will be presented in this course. Concepts learned in Strength of Materials and Structure and Property of Materials will be applied towards engineering failure analysis. Students will be introduced to fatigue and fracture mechanics, and learn the process for assessing causes for failure of a variety class of material types that includes metals, ceramics, polymers and composites subject to different loading, manufacturing and environmental conditions.
- **Course Learning Outcomes**:
  - Students will be able to apply introductory concepts of engineering failure analysis, as it applies to fatigue and fracture mechanics, to identify causes for failure of a variety class of material types (metals, ceramics, polymers, composites) subject to different loading/environmental conditions.
  - Students will be able solve for fatigue properties, identify fatigue life/endurance limit of a variety of materials, and learn stages of fatigue crack growth
  - Students will learn how to analyze fracture surfaces and connect key microstructural defects to modes of failure
  - Students will work in teams to determine solutions to fatigue and fracture mechanic problems/case studies, and develop skills to communicate results effectively.
- **Alignment with Program Outcomes**:

Course Learning Outcome	Learning Level (e.g. Bloom’s/ABET Assessment Example)	Program Learning Outcome (ABET 1-7)
Students will be able to apply introductory concepts of engineering failure analysis, as it applies to fatigue and fracture mechanics, to identify causes for failure of a variety class of material types (metals, ceramics, polymers, composites) subject to different loading/environmental conditions.	**Comprehension/ABET Assessment-** Concept Evaluation Assessments/Case Studies, Exams, Homework, Projects	An ability to apply knowledge of mathematics, science, and engineering (ABET 7) An ability to identify, formulate and solve engineering problems (ABET 1)
Students will be able solve for fatigue properties, identify fatigue life/endurance limit of a variety of materials, and learn stages of fatigue crack growth	**Knowledge/ABET Assessment-** Concept Evaluation Assessments, Exams, Homework, Projects	An ability to identify, formulate and solve engineering problems (ABET 1) An ability to use the techniques, skills, and modern tools necessary for engineering practice (ABET 2) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions (ABET 6)

Students will learn how to analyze fracture surfaces and connect key microstructural defects to modes of failure	**Analysis/ABET Assessment-** Projects, Concept Evaluation Assessments/Case Studies, Exams	An ability to use the techniques, skills, and modern tools necessary for engineering practice (ABET 2) An understanding of professional and ethical responsibility (ABET 4)
Students will work in teams to determine solutions to fatigue and fracture mechanic problems/case studies and develop skills to communicate results effectively.	**Application/ABET Assessment-** Projects/Case Studies, Concept Evaluation Assessments	Students will work in teams to determine solutions to engineering statics problems, and develop skills to communicate results effectively (ABET 3, ABET 5) An understanding of professional and ethical responsibility (ABET 4) An ability to apply knowledge of mathematics, science, and engineering (ABET 7)

Academic Support Resources

- **Library**: Students can access the Florida Polytechnic University Library through the University website and Canvas, on and off campus. Students may direct questions to library@floridapoly.edu.
- **Tutoring and Learning Center**: The Tutoring and Learning Center (The TLC) provides tutoring to all Florida Poly students who may need additional academic support. The TLC is staffed by students who have excelled in the courses they tutor. They offer support by reviewing concepts and materials from class, clarifying points of confusion and providing assistance with learning strategies. While the focus of TLC is to provide support to students in freshman-level courses, upper-level courses are also tutored at the Center. The TLC is located in the IST Commons (second floor).
    - **Knack Tutoring**: Students looking for additional assistance outside of the classroom are advised to consider working with a peer tutor through Knack. Florida Polytechnic University has partnered with Knack to provide students with access to verified peer tutors who have previously aced this course. To view available tutors, visit floridapoly.joinknack.com and sign in with your student account.
- **Academic Success Coaches**: All students at Florida Poly are assigned an Academic Success Coach. Your Academic Success Coach can assist you with academic success strategies. Please visit the Student Success Center on the second floor of the IST building to meet with an Academic Success Coach.
- **Writing Center**: Located on the second floor of the IST (2059/2061), the Writing Center helps students to develop their writing and presentation skills. Consultations are available in person and virtually. For more detail, visit floridapoly.edu/writing center.

Course Policies:

- **Attendance** see also University Policy, which reads "Students are expected to attend all of their scheduled University classes and to satisfy all academic objectives as defined by the instructor." Attendance at all class meetings is expected. Absence does not excuse a student from material covered or any activity done on that day, nor does it extend a

deadline. Falsifying attendance for yourself or for another student is an act of academic dishonesty and subject to academic discipline.

- Students should inform the instructor as soon as possible if an absence is expected. The instructor should be contacted as soon as possible if an absence was due to an unforeseen emergency. Documentation may be required in either case. Exceptions to any attendance requirements may be made on a case-by-case basis.

- **Grading Scale**:

Grade	Percentage
A	93-100
A-	90-92
B+	86-89
B	83-85
B-	80-82
C+	76-79
C	70-75
D	60-69
F	0-59

  - Percentages that fall between grades will be rounded up. Grades for each assignment will be posted to Canvas and students should make sure they are recorded correctly. However, there is no guarantee that the percentages or projected grades provided there are correct. The instructor will calculate final percentages and will determine final grades regardless of Canvas calculations.

- **Assignment/Evaluation Methods**:

Activity	Percentage
Exams 1-3	70%
In Class Concept Evaluation Assessments	10%
Homework	10%
Final Project	10%
Total	**100%**

  - **Exams 1-3 (Totaling 70% of total grade)**
    Exams will be administered in-class during the regular class time. Exams will be closed book and closed notes. A one page (8.5" x 11") written reference sheet (front and back) will be allowed during the exam. Only use of the following calculator models as used on the Fundamentals of Engineering (FE) Exam will be allowed:
    - "**Casio:** All fx-115 and fx-991 models (Any Casio calculator must have "fx-115" or "fx-991" in its model name.)
    - **Hewlett Packard:** The HP 33s and HP 35s models, but no others
    - **Texas Instruments:** All TI-30X and TI-36X models (Any Texas Instruments calculator must have "TI-30X" or "TI-36X" in its model name.)"
  - Make-up examinations will only be administered if there is a documented approved excused absence (as based upon university policy), and should be

completed within 1 week of exam date, unless approved by course instructor for extenuating circumstances.

- **In-Class Concept Evaluation Assessments (10% of total grade)**
  As per university policy, students are expected to attend their course lectures in-person. With that consideration, in-class concept evaluation assessments/case studies (10% of student's grade) will be administered during the lecture time. In-class concept evaluation assessments will be done in groups of 2 to 3 students and will be due at the end of class, unless otherwise noted by the course instructor. Make-up in-class concept evaluation assessments will not be accepted, except in the case of a documented university-approved excused absence.

- **Homework (10% of the total grade)**
  Homework assignments should be submitted electronically as a single pdf file through the CANVAS course website by the submission deadline. Homework assignments will be graded based upon sufficient attempt/effort to completion. Late/make-up homework assignments will not be accepted. The lowest homework grade will be dropped upon determination of final course grade.

- **Final Project (10% of the total grade)**
  To encourage a project-based learning environment, students will be assigned a final project (10% of student grade), to assess proficiency in applying concepts taught throughout the semester. Details regarding project submission and grading, specific to the project, will be provided to students at the time of project assignment.

Late Work/Make-up work

- Make-up in-class concept evaluation assessments and make-up examinations will only be administered if there is a documented approved excused absence (as based upon university policy). Late/make-up homework/project assignments will not be accepted. Exceptions to any late work/make-up work requirements due to extenuating circumstances may be made on a case-by-case basis.

- **Official Email Address**
  - Florida Polytechnic University email is the official method of communication for the University. Students are *required* to check their Florida Poly e-mail frequently.

University Policies

Reasonable Accommodations

The University is committed to ensuring equal access to all educational opportunities. The Office of Disability Services (ODS), facilitates reasonable accommodations for students with disabilities and documented eligibility. It is the student's responsibility to self-identify as a student with disabilities and register with ODS to request accommodations. If you have already registered with ODS, please ensure that you have requested an accommodation letter for this course through the ODS student portal, and communicate with your instructor about your approved accommodations as soon as possible. Arrangements for testing accommodations must be made

in advance. Accommodations are not retroactive. If you are not registered with ODS but believe you have a temporary health condition or permanent disability requiring an accommodation, please contact ODS as soon as possible: DisabilityServices@floridapoly.edu; (863) 874-8770; www.floridapoly.edy/disability.

Accommodations for Religious Observances, Practices and Beliefs
The University will reasonably accommodate the religious observances, practices, and beliefs of individuals in regard to admissions, class attendance, and the scheduling of examinations and work assignments. (See University Policy.)

Title IX
Florida Polytechnic University is committed to ensuring a safe, productive learning environment on our campus that prohibits sex discrimination and sexual misconduct, including sexual harassment, sexual assault, dating violence, domestic violence and stalking. Resources are available if you or someone you know needs assistance. Any faculty or staff member you speak to is required to report the incident to the Title IX Coordinator. Please know, however, that your information will be kept private to the greatest extent possible. You will not be required to share your experience. If you want to speak to someone who is permitted to keep your disclosure confidential, please seek assistance from the Florida Polytechnic University Ombuds Office, BayCare's Student Assistance Program, 1-800-878-5470 and locally within the community at Peace River Center, 863-413-2707 (24-hour hotline) or 863-413-2708 to schedule an appointment. The Title IX Coordinator is available for any questions to discuss resources and options available.

Academic Integrity
Violations of academic integrity regulation include actions such as cheating, plagiarism, use of unauthorized resources (including but not limited to use of Artificial Intelligence tools), illegal use of intellectual property, and inappropriately aiding other students. Such actions undermine the central mission of the university and negatively impact the value of your Florida Poly degree. Suspected violations will be fully investigated, possibly resulting in sanctions up to and including expulsion from the university.

"Behaviors of academic dishonesty in violation of this policy are listed below and are not intended to be all inclusive. Violations may result in the imposition of academic sanctions under this regulation and/or disciplinary sanctions under the Student Code of Conduct.

(a) *Cheating.* Intentionally using or attempting to use unauthorized materials, information, or study aids in any type of academic exercise.
(b) *Plagiarism.* Intentionally or knowingly representing the words or ideas of another as one's own in any academic exercise.
(c) *Fabrication.* Intentional and unauthorized falsification or invention of any information or citation in an academic exercise.
(d) *Multiple Submission.* Submission of the same or substantially the same work for credit in two or more courses. Multiple submissions shall not include those situations where the instructor gives the student prior written approval to use such prior academic work or endeavor.
(e) *Facilitating Academic Dishonesty.* Intentionally or knowingly assisting or attempting to assist another in violating any provision of this regulation.

(f) *Misconduct in Research and Creative Endeavors.* Serious deviation from the accepted professional practices within a discipline or from the policies of the University in carrying out, reporting, or exhibiting the results of research or in publishing, exhibiting, or performing creative endeavors. This does not include honest error or honest disagreement about the interpretation of data.
(g) *Misuse of Intellectual Property.* Illegal use of copyright materials, trademarks, trade secrets, or intellectual properties."

Recording Lectures

Students may, without prior notice, record video or audio of a class lecture for a class in which the student is enrolled for their own personal educational use. Recordings may not be used as a substitute for class participation or class attendance. Recordings may not be published or shared in any way, either intentionally or accidentally, without the written consent of the faculty member. Failure to adhere to these requirements is a violation of state law (subject to civil penalty) and the student code of conduct (subject to disciplinary action). *Recording class activities including, but not limited to, lab sessions, student presentations (whether individually or part of a group), class discussion (except when incidental to and incorporated within a class lecture), and invited guest speakers is* ***prohibited****.*

Course Schedule *(Tentative, Subject to Change)*

Week	Topic	Assessments Assigned
1 (Jan. 12th-16th)	Chp. 1: Introduction to Fatigue and Fracture	Homework 1
2 (Jan. 19th-23rd)	Review of Strength of Materials ***--No Class (Jan. 19th-Martin Luther King Jr. Day)--***	Homework 2
3 (Jan. 26th-30th)	Review of Strength of Materials; Chp 2: Fatigue Design Methods	Homework 3
4 (Feb. 2nd-6th)	Chp. 3: Macro/Micro Aspects of Fatigue of Metals	Homework 4
5 (Feb. 9th- 13th)	Chp. 4: Fatigue Tests and Stress-Life Approach;	
6 (Feb. 16th-20th)	Exam 1 Review, Exam 1	**Exam 1: Feb. 18th**
7 (Feb. 23rd-27th)	Chp. 4: Fatigue Tests and Stress-Life Approach	Homework 5
8 (Mar. 2nd-6th)	Chp. 5: Cyclic Deformation and Strain Life Approach	Homework 6
9 (Mar. 9th-13th)	Chp. 5: Cyclic Deformation and Strain Life Approach	Homework 7
10 (Mar. 16th-20th)	***--No Class (Spring Break)--***	
11 (Mar. 23rd-27th)	Exam 2 Review, Exam 2	Homework 8; **Exam 2: Mar. 25th**
12 (Mar. 30th- Apr. 3rd)	Chp. 9: Fatigue from Variable Amplitude Loading	Homework 9; Project
13 (Apr. 6th-10th)	Chp. 6: Fundamentals of Fracture Mechanics Chp. 7: Notches and Their Effects on Fatigue	Homework 10;
14 (Apr. 13th-17th)	Chp. 7: Notches and Their Effects on Fatigue	Homework 11
15 (Apr. 20th-24th)	Exam 3 Review, Exam 3	**Exam 3: Apr. 22nd**
16 (Apr. 27th- May 1st)	Chp. 11: Environmental Effects on Fatigue; Fatigue of Polymers, Ceramics and Composites	
Apr. 29th -May 1st	***--No Class (Reading Days)--***	

Syllabus can be modified at any time at the discretion of Dr. Siddiqui