Orthopaedic Biomechanics

EML 5598 Section 225C
Class Periods: MWF, 5th period (11:45 AM – 12:35 PM)
Location: MCCB G108
Academic Term: Spring 2025

Instructor:
Kerry E. Costello, PhD
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352-392-0800
Office Hours: Mondays after class (12:45 PM – 2:15 PM) or by appointment, WERT 482

Course Description
Catalog description: Orthopaedic Biomechanics (3 Credit Hours) Mechanical properties of human body's hard and soft tissues. Mechanical and biological considerations for repair and replacement of soft and hard tissues and joints. Fracture fixation, orthopaedic implants for hip and knee, orthotic and prosthetic devices.

Instructor's description: Students will become familiar with and, in some cases, use techniques and tools of modern orthopaedic biomechanics to analyze human or animal movement and musculoskeletal phenomena. Students will practice critically reading the peer-reviewed literature and will synthesize aspects of the field in assigned activities.

Course Pre-Requisites / Co-Requisites
Catalog prerequisite: mechanics of materials

Instructor's note: Undergraduate background in mechanics of materials, statics, dynamics, kinematics, and programming (MATLAB and/or Python) is expected. Students without this background will be expected to independently obtain resources and spend time to achieve adequate levels of proficiency to complete the course-assigned work. The instructor can help advise students needing to remediate.

Course Objectives
a. The student should gain a detailed understanding of the engineering and technologies used in the study of human biomechanics in vivo, including measurement of human motion using photogrammetry and radiographic techniques, measurement of force using external and internal or implanted sensors, dynamic pressure measurements, measurement of muscle activity, etc.
b. The student should gain a detailed understanding of the engineering and technologies used in the study of human biomechanics in vitro, such as robotic and multi-axis mechanical testing for quantifying tissue and joint properties using cadaveric materials.
c. The student should understand how to apply a spectrum of measurement techniques to provide quantitative assessment of clinically relevant human motions, forces, and actions.
d. The student should understand basic mechanical considerations in the selection or development of surgical procedures and implanted orthopaedic devices.
e. The student should gain a basic understanding of the benefits and challenges associated with applying machine learning in orthopaedic biomechanics.
f. The student will gain experience in critical review of the medical/ biomechanical literature.
g. The student will gain experience in the presentation of research findings with critical commentary and extemporaneous discussion.

Materials and Supply Fees
None

Required Textbooks and Software
There are no required texts. All readings are assigned on a per class basis and will be provided online on Canvas. Students will need access to MATLAB software (can use UF Apps) or Python (open source download).

Required Computer
UF student computing requirement: *https://news.it.ufl.edu/education/student-computing-requirements-for-uf/*

Course Schedule
This is a ROUGH outline of the typical flow of the course. The instructor will, at her sole discretion, modify the schedule and content of the course to complement the research and professional interests of the enrolled students. A detailed course schedule and associated readings will be posted on Canvas.
Weeks 1-3 – Introduction to Orthopaedic Biomechanics
Weeks 4-6 – Photogrammetric measurement of human motion
Weeks 7-8 – Other methods for quantifying human motion
Weeks 9 – Measuring forces externally, internally
Week 10 – SPRING BREAK (no class)
Weeks 11 – Measuring forces externally, internally (continued)
Week 12 – Measuring muscle activity and accessory data
Week 13 – Machine learning applications in Orthopaedic Biomechanics
Week 14 – Biomechanical Basis for Orthopaedic Surgical Procedures
Week 15 – Biomechanical Basis for the Design of Orthopaedic Implants

Attendance Policy, Class Expectations, and Make-Up Policy
Students are expected to attend class. A substantial part of the student's grade, and the value of the class, will be derived through participation in the class sessions. All written assignments are to be handed in online (on Canvas) before the beginning of class on the day they are due. **No late assignments will be accepted.**

Excused absences must be consistent with university policies in the Graduate Catalog (https://catalog.ufl.edu/graduate/regulations) and require appropriate documentation. Additional information can be found here: https://gradcatalog.ufl.edu/graduate/regulations/

Evaluation of Grades

Assignment	Percentage of Final Grade
Homeworks and in-class quizzes	30%
Exams (2)	30%
Class Presentations and Participation	10%
Term Project	30%

Grading Policy
The grading scale is given below. Grades will not be curved. If you do not agree with the grading of a particular exam or homework problem, presentation grade, or project grade, you will have one week from the date the grade is assigned to submit a written explanation of why you think the grade should be changed. However, the final decision will remain the instructor's.

Percent	Grade	Grade Points
90.0 - 100	A	4.00
86.7 - 89.9	B+	3.33
80.0 - 86.6	B	3.00
76.7 - 79.9	C+	2.33
70.0 - 76.6	C	2.00
66.7 - 69.9	D+	1.33
60.0 - 66.6	D	1.00
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
UF Graduate Catalog
Grades and Grading Policies

Students Requiring Accommodations
Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

In-Class Recording
Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

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://sccr.dso.ufl.edu/process/student-conduct-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 or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment
The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values, including the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of race, creed,

color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information, and veteran status.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:
• Your academic advisor or Graduate Coordinator
• HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
• Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu
• Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

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 with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.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 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: https://counseling.ufl.edu, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

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 suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://elearning.ufl.edu/.

Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling; https://career.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://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/;https://care.dso.ufl.edu.

On-Line Students Complaints*: https://distance.ufl.edu/getting-help/; https://distance.ufl.edu/state-authorization-status/#student-complaint.*