

Clinically Inspired Engineering Design

BME 3012 Section 1234

Class Periods: Tuesdays (periods 8-9) 3:00 PM - 4:55 PM
and Thursdays (period 9) 4:05 PM - 4:55 PM

Location: Communicore Building room C1-003

Academic Term: fall 2022

Instructor:

Dr. Lakiesha N. Williams

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Office Hours: Thursdays, 2:30 pm -3:30 pm or by appointment via Zoom. <https://ufl.zoom.us/j/3060372417>

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

Please contact through the Canvas website

- Ta-Tyonna Buck, tatyonna.buck@ufl.edu. office hours TBD vis Zoom. <https://ufl.zoom.us/j/6602003835>

Course Description

In this course, students will be exposed to real clinical problems, thereby learning to communicate with medical professionals in order to (1) identify unmet needs, (2) develop prototypes and initial concepts for clinical problems, and (3) critically evaluate potential solutions for clinical problems.

Course Pre-Requisites / Co-Requisites

Pre-requisites: BME 3060 – Biomedical Engineering Fundamentals and PCB 3713C – Cellular and Systems Physiology (minimum grade of C in listed courses)

Co-requisites: BME 3101 – Biomedical Materials and EGM 2511 – Engineering Mechanics

Course Objectives

By the end of this course, students will be able to describe how the engineering design process can be applied to address clinical problems. Students will specifically learn how to:

- Identify medical needs through interactions with healthcare professional(s) and/or patients.
- Define engineering, regulatory, and economic constraints for the engineering design process in the biomedical industry.
- Develop risk, reliability, and safety assessments.
- Understand cost evaluation for potential designs.
- Evaluate critical legal issues in intellectual property protection.
- Identify, discuss, and resolve potential ethical issues in the development of medical technology.

Materials and Supply Fees

None

Relation to Program Outcomes (ABET):

The table below is an example. Please consult with your department's ABET coordinator when filling this out.

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Low
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare,	High

as well as global, cultural, social, environmental, and economic factors	
3. An ability to communicate effectively with a range of audiences	High
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	High
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	High
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	High

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software

Recommended Textbooks

Title: Biodesign: The Process of Innovating Medical Technologies
Author: York, Zenios, Makower, Brinton, Kumar, Watkins, Denend
Edition: 2nd Edition
Publisher: Cambridge University Press
ISBN #: ISBN-13: 978-1107087354 and ISBN-10: 9781107087354

This textbook is **available online for free** through the UF Library. To access, search for the title through the library catalog or use this link: <https://ebookcentral.proquest.com/lib/ufi/detail.action?docID=5120125>

Required Software

OnShape will be used to teach computer-aided design (CAD). OnShape is a cloud-based, CAD software system that is freely available for educational purposes. To access OnShape, you should set-up an account through OnShape Education (<https://www.onshape.com/products/education>) account set-up is accessed by clicking on "Getting Started"). Please use your University of Florida e-mail address and actual student ID number when signing up so that the system can verify your student status and university affiliation. For the "What are you using OnShape for?" question, please write "BME 3012 an undergraduate course at the University of Florida on clinically-inspired design."

For the CAD project, you may use either OnShape or Solidworks. As a UF engineering student, you have access to Solidworks through UF Apps or by following the directions below. Note, if you are upgrading from a previous version of SolidWorks you must do a complete uninstall of the old version before beginning the install process for the new version. Select Advanced Options on the uninstall screen and select all items for complete removal.

1. Go to <http://www.solidworks.com/SEK>
2. School License ID, SDK-ID or SEK-ID: XSEK12
3. Complete the remaining fields appropriately then select Request Download
4. Read and accept the SolidWorks Student Access Initiative agreement
5. Download and install the software using the on-screen instructions
6. Use Serial Number 9020004987248527WXDF5XG8

General Course Schedule Overview

Topic: Overview of the Engineering Design Process

Topic: Needs Assessment and Brainstorming

Topic: Design Constraints

Topic: Stakeholders

Topic: Concept Selection

Topic: Team Dynamics

Topic: Clinical Communication

Topic: Project Management

Topic: CAD, Dimensioning, and 3D Printing

Topic: Prototyping and Simulating

Topic: Experimental Design and Testing

Topic: Risk, Reliability, and Safety

Topic: Ethics

Topic: Economics

Topic: FDA Regulations and Intellectual Property

Attendance Policy, Class Expectations, and Make-Up Policy

Participation: Students are expected to attend scheduled class sessions in-person. Attending class is critical for understanding the course material and working with your team. The highest total grades are regularly earned by students who come to class and are prepared to actively participate in activities and discussions.

Recommended reading: Reading is an opportunity for students to learn and review course material. Reading also provides a perspective on the course material that is different than that provided by the instructor. The required textbook is a very good and widely used engineering design text. Many students actually find the textbook enjoyable to read! The assigned textbook readings are designed to help students be prepared for this course, and also be prepared to excel in senior design. Additional readings pertinent to specific topics may also be assigned.

Homework: Homework assignments provide students with an opportunity to apply concepts and affirm their understanding of the course material. All assignments should be turned in electronically via the course website. Assignments turned in late will not be graded, except under extreme circumstances at the discretion of the instructor (not the STS, TA, or graders). Students are encouraged to work cooperatively on group assignments. However, each student must individually submit assignments consisting of his or her own work. Copying another student's work (or allowing a student to copy your work) will be considered a violation of the University honor code.

Clinical Design Project: The design project is an opportunity to learn, practice, apply, and master the engineering design process. There will be one large group project (teams of 3). For the project, groups will be assigned by the instructor. The project will be based on a clinical problem presented in-class by a guest speaker. Being present and attentive for the guest speaker's lecture is critical for successful completion of the project. All projects will involve written deliverables and/or in-class presentations. Accommodations for missing an in-class presentation will only be made for student who provide appropriate documentation of an excused absence. Excused absences must be consistent with University policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>). Further project details will be discussed in class and distributed on the course website. A final physical product is required at end of project.

CAD Assignments: The CAD assignments are designed to introduce students to CAD throughout the semester. CAD is a skill that requires practice and training. Thus, students are strongly encouraged to dedicate a little bit of time each week to learning CAD, instead of completing all assignments in the final days before the deadline.

CAD Project: The CAD project is designed to provide each student the opportunity to practice and receive feedback on their computer-aided design skills. This project also acts as a mechanism to widen the course's grading scheme because it is a major individual (instead of team-based) project. Further details on the CAD assignments and project will be discussed in class and distributed on the course Canvas website.

Re-Grade Policy: If a student feels that an assignment was graded incorrectly, they should return the assignment and a written description of the grading error to the instructor (not the STS, TA, or graders) within 5 business days of receiving the graded assignment. All re-grade requests should be sent via Canvas e-mail. The instructor will evaluate the request and adjust the grade if an error was made. Any request for re-grading where the student has altered the assignment after it was returned to gain a grade benefit will be considered a violation of the University honor code.

Changes to the Syllabus: Occasionally, course policies may need to be changed due to unforeseen circumstances or to improve the course. The instructor reserves the right to make necessary changes.

This statement is required:

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies:

<https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>

BME Course Instruction Expectations for Fall 2022

The purpose of this statement is to share the general UF BME faculty consensus for Fall 2022 course instruction. All BME courses listed in the UF Schedule of Courses are categorized as in-person; this categorization was present when student signed up to enroll in their courses. The decisions of course format (i.e. whether to offer synchronous zoom participation or recorded Zoom lectures and the extent that an instructor accommodates students) should be made by the instructor. Instructors are not expected to offer "hybrid" format to accommodate a student's internship schedule, desire not to attend class, or preference. Students should notify an instructor of an upcoming absence, and the instructor is required to make accommodations only in the case of university-recognized reasons. Outside of university-recognized reasons, it is at the instructor's discretion whether to accommodate an absence. Course format and accommodations should be selected based on the instructor's aim to enhance individual student and class learning. Note that the college requests for faculty (not required) to post course materials on Canvas with the expectation that students will be getting ill and having to quarantine. Making course materials readily available on Canvas as much as possible will make it easier for students to stay informed and help prevent them from falling behind. The college request does NOT mean offering classes via Zoom.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Participation/ Attendance	100 each	15%
Homework	100	15%
CAD Demo	100	25%
Final Project Paper	100	15%
Final Project Poster	100	15%
Final Project Demo	100	15%

Grading Policy

The following is given as an example only.

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33

73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

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.ua.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.ua.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 broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

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 Program Coordinator
- Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.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](https://title-ix.ufl.edu), 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 support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

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/state-authorization-status/#student-complaint>.