

 FLORIDA ATLANTIC UNIVERSITY	NEW COURSE PROPOSAL Undergraduate Programs		UUPC Approval <u>9/8/25</u> UFS Approval _____ SCNS Submittal _____ Confirmed _____ Banner Posted _____ Catalog _____	
Department Biomedical Engineering College COECS <i>(To obtain a course number, contact erudolph@fau.edu)</i>				
Prefix BME Number 4740	<i>(L = Lab Course; C = Combined Lecture/Lab; add if appropriate)</i> Lab Code	Type of Course Lecture	Course Title Control for Biomedical Systems	
Credits <i>(See Definition of a Credit Hour)</i> 3	Grading <i>(Select One Option)</i> Regular <input checked="" type="radio"/> Sat/UnSat <input type="radio"/>	Course Description <i>(Syllabus must be attached; see Template and Guidelines)</i> This is a senior-level BME elective. It introduces the students to analysis, simulations, and design of biomedical processes. The course covers basic BME control systems concepts, linear and nonlinear BME models, MATLAB and Simulink simulation and design methods for BME control systems.		
Effective Date <i>(TERM & YEAR)</i> Spring 26				
Prerequisites, with minimum grade* MAP 2302 Differential Equations (or Engineering Math) with a grade of C or better		Corequisites N/A	Registration Controls <i>(Major, College, Level)</i> BME, COECS, Senior	
*Default minimum passing grade is D-. Prereqs., Coreqs. & Reg. Controls are enforced for all sections of course				
WAC/Gordon Rule Course <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No WAC/Gordon Rule criteria must be indicated in syllabus and approval attached to proposal. See WAC Guidelines .		Intellectual Foundations Program (General Education) Requirement <i>(Select One Option)</i> None General Education criteria must be indicated in the syllabus and approval attached to the proposal. See Intellectual Foundations Guidelines .		
Minimum qualifications to teach course PhD in Science or Engineering				
Faculty Contact/Email/Phone Zvi Roth, rothz@fau.edu, 561) 297-3471		List/Attach comments from departments affected by new course N/A		
Approved by Department Chair <u>Javad Hashemi</u> College Curriculum Chair <u>Jalan Liu</u> College Dean _____ UUPC Chair <u>Korey Sorge</u> Undergraduate Studies Dean <u>Dan Meeroff</u> UFS President _____ Provost _____			Date <u>3/31/25</u> <u>8/28/25</u> <u>8/28/2025</u> <u>9/8/25</u> <u>9/8/25</u> _____ _____	

Email this form and syllabus to mjenning@fau.edu seven business days before the UUPC meeting.

Control for Biomedical Systems

3 credits

Dr. Zvi Roth

Office: Engineering East 519

Office hours: TBA or by Zoom

Classroom: TBA

Telephone: 561-297-3471 (used rarely)

Email: rothz@fau.edu (the better option)

TA name	N/A
Office	N/A
Office hours	N/A
Telephone	N/A
Email	N/A

Course Description

This is a senior-level BME elective. It introduces the students to analysis, simulations, and design of biomedical processes. The course covers basic BME control systems concepts, linear and nonlinear BME models, MATLAB and Simulink simulation and design methods for BME control systems.

Instructional Method

May vary from one semester to another: In-Person with Recording, Fully Online, In-Person with no recording.

Prerequisites/Corequisites

MAP 2302 Differential Equations (or Engineering Mathematics) with a grade of C or better.

Course Objectives/Student Learning Outcomes

The following are some of the course's interdisciplinary concepts and specific skills that a student is expected to master after completing the course:

- 1) Derivation of a mathematical model of a dynamic bio-system based on first physical principles, drawn from various engineering disciplines.
- 2) Construction of a system's dynamic model based on empirically obtained data.
- 3) Recognition and simulation of system nonlinearities and their effect on the system dynamic behavior.

- 4) Understanding of the process of linearization.
- 5) Simulation, analysis and design of systems, using MATLAB and SIMULINK
- 6) Understanding of basic Control Systems concepts: Transient and Steady State Design

ABET Student Outcomes relevant to this course:

Student Outcome 1 (SO1): *An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. (Problem Solving).*

Student Outcome 2 (SO2): *An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. (Design).*

Student Outcome 3 (SO3): *An ability to communicate effectively with a range of audiences. (Written Communication only. ABET also looks for verbal communication, but not in this course).*

Student Outcome 6 (SO6): *An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions. (Experimentation and/or simulation).*

Course Evaluation Method

Grade is based on:

Midterm Exam (Date TBA)	25%
Final Exam (Date TBA)	25%
Homework 1 assignments with simulations (Modeling & Control)	25%
Homework 2 assignments (Modeling & Control)	25%

An easy 1% bonus that can be added to every homework submission that is given for a “grader-friendly” submission (as explained further down in “Special Course Requirements”).

With all the available bonus points the maximum course score may reach 102%. The course’s grade scale remains unaffected: The A range extends to 90-104%.

Course Grading Scale

The overall letter course grade will be determined as follows:

A= 90-100%, A-=85-89%, B+=80-84%, B=75-79%, B- =70-74%, C+=65-69%, C=50-64%, No C- and D+ grades, D=45-49%, D-=40-44%, F=0-39%.

In general, there will be no overall grade-curving. The sum of the exams and HWs grades, as is, will be mapped to the final letter grade. All final grades that fall within 1% of a next letter grade threshold will be reviewed. Special consideration to overcome a 1% grade deficit will be extended only to students who are in good standing (which includes submission of all HW, independent work, and no involvement in any unethical conduct).

Policy on Makeup Tests, Late Work, and Incompletes (if applicable)

Two-days late homework submission (via email) is accepted with no penalty. Thereafter there is a one-quarter penalty for every additional late day.

The class is expected to take exams at the same time, with the exception of remote students who sign up as fully online students.

If you contemplate withdrawal from the course (with a W grade) please discuss your plans with the course instructor to explore the possibility of an I grade instead.

Additional FAU rules: Please note that students may not be penalized for absences due to participation in university-approved activities, including athletic or scholastics teams, musical and theatrical performances, and debate activities. Instructors must allow these students to make up missed work without any reduction in the student's final course grade. Reasonable accommodation must also be made for students participating in a religious observance. Also, note that grades of Incomplete ("I") are reserved for students who are passing a course but have not completed all the required work because of exceptional circumstances.

Special Course Requirements (if applicable)

Homework Submissions and Deadlines: Please follow the following requirements:

- a) Individual submissions. Please submit the homework in Word or pdf formats.
- b) Handwritten submissions will be read and graded only if the handwriting is very readable.
- c) See Late Work policy and penalties.
- d) Canvas Grade Book, Assignments and Calendar are all tied together. Every "assignment" (and this includes homework projects, other projects, and exams) is graded directly from the Canvas Grades, using the Speed Grader tool. Any grade and comments instantly become available to the student.
- e) The theoretical solutions and related MATLAB-Simulink simulations of each problem better reside in the same place within the submitted solution. It is very time consuming to grade problems in which the calculations and the simulations are not in the same place. Please avoid sending the theoretical solutions and the simulations in separate files. Please avoid separating the theory and simulations, within the same file. The correct submission format is the one showing in every past Gallery Solution. Any homework that is submitted in the above "reader-friendly" format will receive a 1% bonus point.
- f) In each homework submission, each of the problems will be graded by a letter grade (A, A-, B+ etc.). The total grade will be posted in Canvas on a scale of 0-25%. Bonus points (due to selection to the gallery, or well-organized submission) will be added on top of the HW posted grade.
- g) MATLAB-Simulink simulations are expected in each problem and carry between 25-50% of each problem's grade. Just a theoretical solution may qualify for a problem grade that is somewhere between C and B. You may lose too many points if you do not attach MATLAB-Simulink simulations (with good annotation of the MATLAB code and good visibility of Simulink blocks).

- h) Every required MATLAB and Simulink methods will be thoroughly demonstrated in class. Very often Simulink .slx files and MATLAB .m files (created by the instructor) will be shared with the class via the Canvas Modules. There are already many model files posted in the previous years' Canvas Modules (typically under "Resource Material" title).
- i) All Simulink scope output graphs must be presented over a bright background, which is very easy to set up. Please avoid dark backgrounds that severely compromise the readability of the results.

Advice regarding help in the homework: To better manage your time try not to get stuck for hours "fighting against the MATLAB or Simulink program". Instead e-mail Dr. Roth (rothz@fau.edu) your diagrams and/or results copied and pasted on a Word (or pdf) document, or simply e-mail the jpg file. It is best to use a snipping tool to crop any screen diagram, or scope graphs. Instructor will then be able to watch your Word (or pdf) file question and quickly help you with the debugging. Do not e-mail any raw MATLAB m files or Simulink models – it is too time consuming to fish these out from the e-mail attachments.

For a weekend and late evening advice, as much as possible, please do your best to assist the instructor in getting you a quick fix help: Repeat the question (so that the instructor does not have to look it up in Canvas). Placing your attempted diagram in a pdf file may work best in case the instructor has no immediate access to a computer but does see emails via phone or tablet. Until the advice comes, please do other problems, or work on other courses assignments.

- **Software:** MATLAB with SIMULINK Latest Release is available for free download from the Mathworks web site. There is a license agreement between FAU and Mathworks. As a student downloads the software (to his/her desktop or laptop, the student's number will be checked by Mathworks.

Classroom Etiquette Policy

Live classroom attendance is expected but not mandated. At severe COVID times (as instructed by FAU official notices) masks must be worn and social distancing must be maintained.

Policy on the Recording of Lectures

Because of a new Florida Statute in 2021, the following model language is suggested for inclusion in course syllabi, at the discretion of individual faculty:

Students enrolled in this course may record video or audio of class lectures for their own personal educational use. A class lecture is defined as a formal or methodical oral presentation as part of a university course intended to present information or teach students about a particular subject. Recording class activities other than class lectures, including but not limited to student

presentations (whether individually or as part of a group), class discussion (except when incidental to and incorporated within a class lecture), labs, clinical presentations such as patient history, academic exercises involving student participation, test or examination administrations, field trips, and private conversations between students in the class or between a student and the lecturer, is prohibited. Recordings may not be used as a substitute for class participation or class attendance and may not be published or shared without the written consent of the faculty member. Failure to adhere to these requirements may constitute a violation of the University's Student Code of Conduct and/or the Code of Academic Integrity.

By registering for this class, the students hereby consent to recording of the class and potential use of the class material for other purposes.

Attendance Policy

Students are expected to attend all of their scheduled University classes and to satisfy all academic objectives as outlined by the instructor. The effect of absences upon grades is determined by the instructor, and the University reserves the right to deal at any time with individual cases of non-attendance. Students are responsible for arranging to make up work missed because of legitimate class absence, such as illness, family emergencies, military obligation, court-imposed legal obligations or participation in University-approved activities. Examples of University-approved reasons for absences include participating on an athletic or scholastic team, musical and theatrical performances and debate activities. It is the student's responsibility to give the instructor notice prior to any anticipated absences and within a reasonable amount of time after an unanticipated absence, ordinarily by the next scheduled class meeting. Instructors must allow each student who is absent for a University-approved reason the opportunity to make up work missed without any reduction in the student's final course grade as a direct result of such absence.

Counseling and Psychological Services (CAPS) Center

Life as a university student can be challenging physically, mentally and emotionally. Students who find stress negatively affecting their ability to achieve academic or personal goals may wish to consider utilizing FAU's Counseling and Psychological Services (CAPS) Center. CAPS provides FAU students a range of services – individual counseling, support meetings, and psychiatric services, to name a few – offered to help improve and maintain emotional well-being. For more information, go to <http://www.fau.edu/counseling/>

Disability Policy

In compliance with the Americans with Disabilities Act Amendments Act (ADAAA), students who require reasonable accommodations due to a disability to properly execute coursework must register with Student Accessibility Services (SAS) and follow all SAS procedures. SAS has offices across three of FAU's campuses – Boca Raton, Davie and Jupiter – however disability services are available for students on all campuses. For more information, please visit the SAS website at www.fau.edu/sas/.

Code of Academic Integrity

Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards because it interferes with the university mission to provide a high-quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see [University Regulation 4.001](#).

Artificial Intelligence Preamble

FAU recognizes the value of generative AI in facilitating learning. However, output generated by artificial intelligence (AI), such as written words, computations, code, artwork, images, music, etc., for example, is drawn from previously published materials and is not your own original work. FAU students are not permitted to use AI for any course work unless explicitly allowed to do so by the instructor of the class for a specific assignment.

Class policies related to AI use are decided by the individual faculty. Some faculty may permit the use of AI in some assignments but not others, and some faculty may prohibit the use of AI in their course entirely. In the case that an instructor permits the use of AI for some assignments, the assignment instructions will indicate when and how the use of AI is permitted in that specific assignment. It is the student's responsibility to comply with the instructor's expectations for each assignment in each course. When AI is authorized, the student is also responsible and accountable for the content of the work. AI may generate inaccurate, false, or exaggerated information. Users should approach any generated content with skepticism and review any information generated by AI before using generated content as-is.

If you are unclear about whether or not the use of AI is permitted, ask your instructor before starting the assignment.

Failure to comply with the requirements related to the use of AI may constitute a violation of the Florida Atlantic Code of Academic Integrity, [Regulation 4.001](#).

Proper Citation:

If the use of AI is permitted for a specific assignment, then use of the AI tool must be properly documented and cited. For more information on how to properly cite the use of AI tools, visit www.fau.edu/ai/citation.

Required Texts/Readings

Textbook: Michael C.K. Khoo “Physiological Control Systems: Analysis, Simulation and Estimation”, Second Edition, Wiley 2018.

Course Subjects: See Course Description (1-2 weeks for each subject).