Course Syllabus

Course Information

Course Number: BMEN 4310.501

Course Title: Feedback Systems in Biomedical Engineering

Term: Fall 2016

Professor Contact Information

Name: Soudeh A. Khoubrouy, PhD
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Office hours: TBD (Check e-Learning) and by appointment

Course Pre-requisites, Co-requisites, and/or Other Restrictions

Pre-requisite: ENG 2300, MATH 2420

Course Description

BMEN 4310 Feedback Systems in Biomedical Engineering (3 semester credit hours) Notions of inputs, outputs, and states. Linearity versus nonlinearity. Deterministic versus stochastic systems. Top down versus bottom up modeling. Sensitivity and reduction of sensitivity via feedback. Introduction to stability. Feedback for stabilization and disturbance rejection. Numerical simulation and controller design via computational approaches.

Program Educational Objectives

Biomedical Engineering Bachelor's graduates are expected to attain the following Program Educational Objectives within a few years after graduation:

- *Careers that lead to leadership roles in biomedical engineering or related fields, or*
- *Gain admission to graduate, professional, or health related programs.*

Student Learning Objectives/Outcomes

After completing this course, students are expected to be able to:

- *Understand the design procedure for feedback control systems and understand how feedback impacts transient and steady state performance. (SO e)*
- *Use specifications of feedback system performance. Apply the root-locus method of feedback system design. [Under some constraint to meet needs.] (SO c)*
- *Perform analysis and control methods in the frequency domain. (SO a)*

- *Find the transfer function and state space models for control system analysis and synthesis. Controllability and observability of systems. (SO k)*

Required Textbooks and Materials

Feedback Control of Dynamic Systems, 7th Edition, by Franklin, Powell, and Emami-Naeini

Assignments & Academic Calendar

Homework: *Homework will be posted on e-Learning and due within the first 10 minutes of the class on the due date. Otherwise, it will not be accepted. You are encouraged to work and learn in groups in doing the homework problems but you need to submit each set of assignments individually and mention the name(s) of your team-mate(s) if there is any. On the day that homework is due, a short quiz may be given that is heavily based on the homework, which will count as extra credit towards the homework grade.*

Exams: *There are two mid-term exams and a comprehensive final exam. The exams must be individual efforts. No makeup examinations (or quizzes) will be offered in this course. In the event of an excused absence (illness, job-related travel, holy day absence, etc.; Proper documents should be provided), the weight of the exam will be shifted to the remaining exams.*

Students have one week to review graded homework, exams, or projects with the professor for any possible grading corrections. After one week no changes will be allowed.

Tentative Schedule

Dates	Topics	
August 22, 24	Chapter 1	Overview of Feedback Control
August 24	Chapter 2	Dynamic Models and Examples
August 29, 31, September 7, 12, 14	Chapter 3	Review of the Laplace Transform, System Modeling Diagrams, Effects of Pole Locations, Time-Domain Specification, Stability
September 19, 21, 26, 28, October 3, 5, 10	Chapter 4	The Basic Equation of Control, System Type, PID Control, Problems and Review
TBD		Exam 1
October 12, 17	Chapter 5	Root Locus of a Basic Feedback System, Guidelines for Sketching a Root Locus
October 19, 24, 26, 31, November 2, 7, 9, 14, 16	Chapter 6	Frequency Response, The Nyquist Stability Criterion, Bode'sGain-phaserelationship,Closed-loop Frequency Response, Compensation, Problems and Review
TBD		Exam 2
November 28, 30, December 5, 7	Chapter 7	System Description in State Space, Block Diagrams, Biomedical Systems, Problems and Review
TBD		Final Exam

Grading Policy

The evaluation of the student's work is the instructor's professional judgment and not subject to negotiation. The grades for this class will consist of:

- *Homework* *20%*
- *Exam 1* *25%*
- *Exam 2* *25%*
- *Final Exam* *30%*

Final grades will be assigned according to the following scale: 100-90 A; 89-80 B; 79-70 C; 69-60 D and below 60 F.

Course & Instructor Policies

- *On-time class attendance is mandatory.*
- *As courtesy to classmates and instructor, electronic devices should be turned off during class, except when permitted by the instructor. Cell phone use (e.g., texting) is disruptive to class and will not be tolerated.*

Comet Creed

This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:

"As a Comet, I pledge honesty, integrity, and service in all that I do."

UT Dallas Syllabus Policies and Procedures

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus.

Please go to http://go.utdallas.edu/syllabus-policies for these policies.

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.