BME 343 – Biomedical Engineering Signal and Systems Analysis
Fall 2013

Instructor Name:

Stanislav Emelianov, Ph.D.
BME 4.202L (office)
Phone: 471-1733 (emergencies only)
emelian@mail.utexas.edu

Teaching Assistant(s) Name(s):

Diego Dumani
Varun Pattani

2010-2012 Catalog Data:

Unique: 14370
Lecture: MWF 10:00 to 11:00, BUR 108
Laboratory: **F** 11:00 to 13:00, BME 3.312

Unique: 14375
Lecture: MWF 10:00 to 11:00, BUR 108
Laboratory: **T** 14:00 to 16:00, BME 3.312

Unique: 14380
Lecture: MWF 10:00 to 11:00, BUR 108
Laboratory: **M** 17:00 to 19:00, BME 3.312

Unique: 14385
Lecture: MWF 10:00 to 11:00, BUR 108
Laboratory: **W** 17:00 to 19:00, BME 3.312

BME 343 BIOMEDICAL ENGINEERING SIGNAL AND SYSTEMS ANALYSIS
Restricted to biomedical engineering majors. Signals and systems representation; sampling and quantization; time and frequency domains; Laplace and z-transforms, transfer functions, and frequency response; two-port networks; Bode plots; convolution; stability; Fourier series; Fourier transform; AM/FM modulation; filter design; and applications in biomedical engineering.

Prerequisite(s):

Biomedical Engineering 311,314, Mathematics 427K

Textbook(s):

Required: Linear Systems and Signals, B.P. Lathi, 2nd edition, Oxford University Press, 2005

Other Required Material:

MATLAB (student version, available at Campus Computer store)
Lecture notes and other materials available on the class Web site

Course Objectives:

The course introduces the representation, description, characteristics, generation, and applications of biomedical signals. Classical methods including convolution, Laplace transforms, and Fourier methods, are used to analyze biomedical signals and systems. Linear systems are represented by a transfer function providing the basis for system identification in the time and frequency domains. A central focus of the course is the analysis and representation of digital or discrete signals in the time/frequency domains. Important analytical techniques will be presented including the Fast Fourier Transform (FFT) and z-transform. This class will make extensive use of MATLAB homework projects.

Topics Covered (# of classes per topic):

1. General Characteristics of Linear Systems and Biomedical Signals (4 classes)
2. Continuous time systems analysis: impulse response, convolution, system stability (5 classes)
3. Discrete time systems analysis: difference equations, impulse response, discrete time convolution (5 classes)
4. Laplace Transforms: unilateral Laplace transform, inverse Laplace transform, solution of differential equations using Laplace transforms (5 classes)
5. Frequency Response of Linear Systems (3 classes)
6. z-Transforms: properties, inverse z-transform, solution of difference equations (4 classes)
7. Fourier Series: properties, application to time invariant systems, applications (6 classes)
8. Fourier Transforms: properties, application to linear time invariant systems (4 classes)
9. Sampling: Nyquist criteria, analog to digital conversion (4 classes)
10. Image Processing: two-dimensional frequency representation, applications of 2D Fourier Transforms to biomedical image analysis (4 classes)

Class/Laboratory Schedule (Type, number and duration of sessions each week):

1. Class: 3 per week; 50 minutes each
2. Laboratory: 1 per week; 120 minutes

Design Assignments:

None

Grading Policy:

The course grade will be determined by homework (9 HWs, 3 points each, 27 points total), laboratories (9 labs, 2 points each, 18 points total), four midterm examinations (Ch 1: 6 points; Ch B-3: 14 points; Ch 4-5: 14 points; Ch 6-8, 21 points, 55 points total), and final examination (Ch B-8, 55 points). Attendance is not counted towards the grade.

Overview of Major Course Requirements and Assignments:

The students will attend three lecture (3 hours total) and one laboratory session (2 hours) per week. There will be reading, homework and laboratory assignments every week. In addition, there will be several midterm examinations.

Final Exam Date and Time:

The Final Exam Schedule will be available approximately three weeks prior to the end of the semester.

Class Website:

All materials for the class will be distributed electronically via Blackboard or Canvas: http://courses.utexas.edu or http://canvas.utexas.edu
The student will be responsible for checking the course site regularly for class work and announcements.

Academic Integrity

Each student must be vigilant of Academic Integrity at all times. The University of Texas at Austin Honor Code states:

> **The core values of the University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the University is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community.**

Academic dishonesty will not be tolerated and will be dealt with in as severe a manner as possible. Standards for Academic Integrity at UT Austin are detailed at http://deanofstudents.utexas.edu/sjs/acint_student.php

Accommodations for Religious Holidays

By UT Austin policy, you must notify the instructor of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence.

Notice for Students with Disabilities

Students with disabilities may request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities, 471-6259, http://www.utexas.edu/diversity/ddce/ssd/