Biosignals and Systems

Prof. Nizamettin AYDIN

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Course Details

- Course Code : GBE 301

- Course Name: Biosignals and Systems

- Instructor   : Nizamettin AYDIN

Assesment

Method	Quantity	(%)
Attendance& participation	-	05
Quiz	-	10
Homework	3	15
Presentation	1	10
Midterm Exam(s)	1	20
Final Exam	1	40

Introduction to Biological Systems and Biosignals;

Basic Signal Processing;

Frequency Transformations;

Analog Analysis in Sinusoidal Steady State;

Analysis of Analog Models and Processes;

Transfer and Frequency Characteristics of Analog Models;

Relationships in Analog Models; Analysis of Transient Conditions ~ The Laplace Transform;
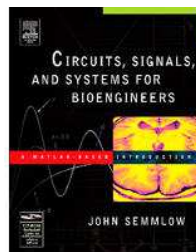
Systems Modeling and Behavior

Recommended books

Main course book:

Circuits, Signals, and Systems for Bioengineers: A MATLAB-Based Introduction

John Semmlow

- **Signals and Systems in Biomedical Engineering: Signal Processing and Physiological Systems Modeling** by Suresh R. Devasahayam
- **Signals and Systems Analysis in Biomedical Engineering** by Robert B. Northrop
- **Medical Imaging Signals and Systems** by Jerry L. Prince and Jonathan Links

Some recommended DSP books

- **Understanding Digital Signal Processing** by Richard G. Lyons.
- **The Scientist and Engineer's Guide to Digital Signal Processing** by Steven W. Smith.
- **Digital Signal Processing and the Microcontroller** by Dale Grover and John R. (Jack) Deller with illustrations by Jonathan Roth.
- **Discrete-Time Signal Processing** by A. V. Oppenheim and R. W. Schafer.
- **Digital Signal Processing: Principles, Algorithms, and Applications** by J. G. Proakis and D. G. Manolakis.
- **Digital Signal Processing in Communication Systems** by Marvin E. Frerking.
- **Multirate Digital Signal Processing** by R. E. Crochiere and L. R. Rabiner.
- **Theory and Application of Digital Signal Processing** by Rabiner and Gold.
- **Digital Signal Processing** by Alan V. Oppenheim and Ronald W. Schafer.
- **Disrete-Time Signal Processing** by Alan V. Oppenheim and Ronald W. Schafer **Digital Signal Processing** by William D. Stanley.

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Objective

- The main objective of this course is to introduce to students a broad range of bioengineering systems. The range of such systems is vast and therefore the selected material will provide students with only a taste for the range of bioengineering applications.

- As far as possible, various model systems will be introduced with reference to electric circuit models. Students will learn about the engineering foundation of various model systems and bio-signal data processing.

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Specific learning outcomes

- Briefly describe the basics of human physiology and biology.
- Perform quantitative measurement and analysis of typical biosignals
- Describe the operational details of various medical monitoring and data collection devices
- Describe and synthesize the computational process of various contemporary medical devices.

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Course Outline

- **1** Introduction
- **2** Basics of electrical systems
- **3** RLC circuits
- **4** Mathematical Approaches
- **5** Mathematical Approaches
- **6** Basic engineering concepts that underlie biological systems
- **7** Basic engineering concepts that underlie biological systems
- **8** medical devices
- **9** medical devices
- **10** Biocontrol
- **11** Biocontrol
- **12** Biosignal analysis
- **13** Biosignal analysis
- **14** Biosignal analysis

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Rules of the Conduct

- No eating /drinking in class
  - *except water*
- Cell phones must be kept outside of class or switched-off during class
  - *If your cell-phone rings during class or you use it in any way, you will be asked to leave and counted as unexcused absent.*
- No web surfing and/or unrelated use of computers,
  - when computers are used in class or lab.

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Rules of the Conduct

- You are responsible for checking the class web page often for announcements.
- Academic dishonesty and cheating will not be tolerated and will be dealt with according to university rules and regulations
  - *Presenting any work, or a portion thereof, that does not belong to you is considered academic dishonesty.*

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Attendance Policy

- The requirement for attendance is **70%**.
  - *Hospital reports are not accepted to fulfill the requirement for attendance.*

  - *The students, who fail to fulfill the attendance requirement, will be excluded from the final exams and the grade of NA will be given.*

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