

**EENG 4350/5318: Biosensors and Biomedical Data Analysis**  
**Fall 2019 Syllabus**

**Instructor Information:**

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**Office Hours:**

Monday : 11:30PM to 12:00PM  
Wednesday : 11:30PM to 12:00PM  
Additional Hours : By appointment

**Course Description:**

The objective of this course is to study the Basic physiology, Bioelectric signals, basic biosensors, wearable sensors, bio-amplifiers, time-frequency analysis, ARMA models, Principal Component Analysis, Introduction to nonlinear systems and signals. Analysis of Electrocardiogram, electroencephalogram, activity, heart rate, galvanic skin response and temperature signals.

The primary student learning objectives are:

1. Understand basic physiology and fundamentals of biosignal processing.
2. Understand the difference between stationary and nonstationary signals. The significance of nonstationarity in biomedical signals
3. Implement Time frequency Analysis of various biosignals
4. Modeling of biosignals using autoregressive and moving average models (ARMA)
5. Principal Component Analysis and signal reduction
6. Basic concept of nonlinear systems
7. Understand nonlinear signals
8. Utilizing MATLAB to analyze different biosignals.
9. Write laboratory reports with experimental data collected using wearable sensors demonstrating analytics and written communication skills.

**Recommended Textbook:**

Eugene N Bruce, **Biomedical Signal Processing and Signal Modeling**, John Wiley & Sons, 2001. ISBN-13: 978-0471345404 ISBN-10: 0471345407

**Students must bring their laptop with MATLAB installed. All the assignments/projects will be completed using MATLAB**

## **Evaluation and Grading:**

The course grade will be based on the following activities:

**1. Assignments (30%):**

There will be six assignments and it should be submitted through Canvas using pdf or word format. No late submissions allowed. Collaboration on assignments is strongly encouraged, however expecting a disclaimer statement at the end of your assignments if you have discussed with the students in the class or someone outside. All resources, including materials obtained from internet should be properly acknowledged.

**2. Projects (40%):**

There will be four projects as given in the outline. Students will complete these projects in class and no collaboration allowed.

**3. Midterm Exam (15%):**

There will be a midterm exam of duration 3 hour as mentioned in the outline

**4. Final Exam (15%):**

Final exam as per University Schedule

## Course Outline:

Schedule	Topics	Assignments
Week 1: (August 26)	Review of Basic Concepts	Review Syllabus
Week 2: (September 2)	Laplace Transform, z-Transform and Fourier Transform Continuous time vs discrete time systems Time domain analysis	Assignment 1 due on 9/7/2019
Week 3: (September 9)	Frequency domain analysis Filters	Project 1 on 9/11/19
Week 4: (September 16)	Fourier Series and Fourier transform Sampling of continuous time signals	Assignment 2 due on 9/21/19
Week 5: (September 23)	Basic Physiology & Bioelectric Signals	Project 2 on 9/25/19
Week 6: (September 30)	Time Frequency Analysis	Assignment 3 due on 10/12/19
Week 7: (October 7)	Review of topics studied in Week 1 through Week 6	
Week 8: (October 14)	ARMA Models	Midterm on 10/16/19
Week 9: (October 21)	Sensors, bio-amplifiers	Assignment 4 due on 10/26/19
Week 10: (October 28)	Nonlinear signal analysis	Project 3 on 10/30/19
Week 11: (November 4)	ECG Analysis	Assignment 5 due on 11/09/19
Week 12: (November 11)	EEG Analysis	Project 4 on 11/13/16
Week 13: (November 18)	Activity, Heart rate and GSR analysis	
Week 14: (November 25)	Review	Assignment 6 due on 11/30/16
Week 15: (December 2)	Final Exam	