

# BMED7055 Biosignal Processing

## (Fall, 2015)

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Class Hours	Tue/Thu 15:00-16:15
Classroom	Room 314 (Seminar Room #1), College of Medicine

### 1. Description

Learn how to measure biosignals such as ECG, EEG, EMG, ENG, blood pressure, blood flow, respiration, temperature, etc. Understand how sensors produce electrical signals. Study analog signal processing techniques including amplifiers, filters, and others. Analyze noises and interferences and learn numerous circuit design methods to suppress or reject them. Study analog-to-digital conversion techniques and numerous digital biosignal processing methods. Learn algorithms for real-time processing and also off-line post-processing.

### 2. Prerequisites

Medical Instrumentation, Electric Circuit, Electronic Circuit, Signal and System

### 3. References

Title	Authors	Publisher
Bioelectromagnetism	Malmivuo, Plonsey	<a href="http://www.bem.fi/book/index.htm">http://www.bem.fi/book/index.htm</a>
Medical Instrumentation: Application and Design	Webster	Wiley
Analog Signal Processing	Pallas-Areny, Webster	Wiley
Biosignal and Biomedical Image Processing	Semmlow	Marcel Dekker
Lecture notes, papers, etc.	<a href="http://www.ejwoo.com">http://www.ejwoo.com</a>	

Websites	<a href="http://ocw.utm.my/course/view.php?id=38">http://ocw.utm.my/course/view.php?id=38</a> <a href="http://www.eecg.toronto.edu/~johns/ece512/ece512.html">http://www.eecg.toronto.edu/~johns/ece512/ece512.html</a> <a href="http://www.analog.com/en/education/education-library/scientist_engineers_guide.html">http://www.analog.com/en/education/education-library/scientist_engineers_guide.html</a> <a href="http://www.analog.com/en/index.html">http://www.analog.com/en/index.html</a> <a href="http://www.umiacs.umd.edu/~ramani/">http://www.umiacs.umd.edu/~ramani/</a> <a href="http://www.ece.rutgers.edu/~orfanidi/intro2sp/">http://www.ece.rutgers.edu/~orfanidi/intro2sp/</a> <a href="http://ocw.mit.edu/courses/media-arts-and-sciences/mas-836-sensor-technologies-for-interactive-environments-spring-2011/index.htm">http://ocw.mit.edu/courses/media-arts-and-sciences/mas-836-sensor-technologies-for-interactive-environments-spring-2011/index.htm</a>
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#### 4. Grading Plan

Midterm	Final	Homework and Project
35%	35%	30%

#### 5. Schedule

Week	Topics
1	Bioelectromagnetism
2	Biopotentials
3	Analog and digital signals
4	Amplifier
5	Analog filter
6	Noise and interference
7	Designs to suppress or reject noise and interference
8	Analog-to-digital conversion and mixed signal system
9	Midterm and project
10	System design for mixed signal system
11	Basics of digital biomedical signal processing
12	Digital filter
13	Spectral analysis
14	Optimal and adaptive filter
15	PCA and ICA
16	Final and project