

In the Name of GOD

Isfahan University of Medical Sciences  
Department of Biomedical Engineering

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BSP

Biomedical Signal Processing

Spring 2018

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**Course information**

**Lecturer:** Hossein Rabbani

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**Lectures:** 10–12, 10–12, Saturday, Monday

**TA:** Sahar Jorjandi

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TA hours will be announced in class and/or posted on the web site.

**Website:** <https://app.schoolology.com>, Access Code: 8H29J-S7CZR

**Course Outline:** This course is about Biomedical Signal Processing. This course has several principal sections. In the first section we have a short review on biomedical signals and applications of preliminary signal processing approaches for biomedical signal analysis. In the second part, we have an extensive discussion about estimation theory. This section includes ML, MAP and LS estimators, ARMA models, power spectral density (PSD) estimation methods. In the next part we introduce some useful filtering methods for non-stationary signals. This needs to have some discussions about Wiener filter, adaptive filter and iterative and recursive least square filters. Finally, we present the basic idea of pattern recognition including feature extraction, and classification methods.

**Course objectives:** By the end of the course you should be able to follow and apply advanced signal processing methods for medical applications. Also you must be able to design signal processing algorithms to solve real-world problems involving biomedical signals.

**Course Prerequisites:** Discrete-Time Signal Processing

**Assessments:** Your knowledge and understanding of the course material will be tested in the assignments, final exam and final project.

**Assignments:** There will be several homework and lab assignments. These will be available on the

<https://app.schoolology.com>,

and you must submit them before the announced deadline. Assignments may be submitted either by posting them in the lecture office, or by emailing the prepared file to the lecturer.

**Final Project:** Each student must choose a project according to the course outline based on a recently published paper. Students should select an appropriate paper, discuss with the instructor, and get approval **before the final class meeting**. Alternatively, a list of some open projects/papers you may choose from will be provided at the website of class. Students will be expected to make a presentation of their project and prepare a report. Grades for the projects will be based on implementation (in MATLAB or ...), clarity of report, your ability to justify the results, depth of analysis and discussion.

**Final Exam:** TBA

**Final grade:** The final grade will be based on the 75% of the mark of the final exam, plus 25% of the mark of the assignments, plus 10% of the mark of the final project.

**Useful Textbooks:**

- *System Theory and Practical Applications of Biomedical Signals*, Baura, Wiley, 2001.
- *Biomedical Signal Analysis: A Case Study Approach*, Rangayyan, IEEE, 2002.
- *Biomedical Signal Processing*, Akay, Academic Press, 1994.
- *Biomedical Signal Processing, Time and Frequency Domains Analysis V.1*, Cohen, CRC, 1986.
- *Biomedical Signal Processing, Compression and Automatic Recognition V.2*, Cohen, CRC, 1986.
- *Biomedical Signal Processing and Signal Modeling*, Bruce, Wiley, 2001.
- *Nonlinear Biomedical Signal Processing: Fuzzy Logic, Neural Networks And New Algorithms V.1*, Akay, IEEE, 2000.
- *Nonlinear Biomedical Signal Processing, Dynamic Analysis And Modeling V.2*, Akay, IEEE, 2000.
- *Time Series Analysis*, Madsen, Chapman and Hall, 2008.
- *Time Frequency and Wavelets in Biomedical Signal Processing*, Akay, IEEE, 1998.
- *Probability, Random Variables and Stochastic Processes*, Papoulis and Unnikrishna, McGraw-Hill, 2001.
- *Fundamentals of Statistical Signal Processing, Estimation Theory V.1*, Kay, Prentice Hall, 1998.
- *Statistical Digital Signal Processing and Modeling*, Hayes, Wiley, 1996.
- *Digital Signal Processing: Principles, Algorithms, and Applications*, Proakis, Dimitris, Manolakis, Prentice Hall, 1996.
- *An Introduction to Identification*, Norton, Academic Press, 1986.
- *Pattern Recognition*, Theodoridis, Academic Press, 1999.
- *Statistical and Adaptive Signal Processing*, Manolakis, McGraw-Hill, 2000.

Note that there are several recently published biomedical signal processing books in the library.