FLORIDA ATLANTIC UNIVERSITY

COURSE CHANGE REQUEST
Graduate Programs

Department CEECS

College Engineering and Computer Science

UGPC Approval _____
UFS Approval _____
SCNS Submittal _____
Confirmed _____
Banner _____
Catalog _____

***Current* Course Prefix and Number**	***Current* Course Title**
EEE 5286	Biosignal Processing

*Syllabus must be attached for **ANY** changes to current course details. See Guidelines. Please consult and list departments that may be affected by the changes; attach documentation.*

Change title to:

Change prefix

From: **To:**

Change course number

From: **To:**

Change credits*

From: **To:**

Change grading

From: **To:**

Academic Service Learning (ASL) **

Add ☐ **Remove** ☐

* Review Provost Memorandum
** Academic Service Learning statement must be indicated in syllabus and approval attached to this form.

Change description to:

Change prerequisites/minimum grades to:

Graduate standing for CEECS students, and instructor's approval for students from other major.

Change corequisites to:

Change registration controls to:

Please list existing and new pre/corequisites, specify AND or OR and include minimum passing grade.

Effective Term/Year for Changes:	**Terminate course? Effective Term/Year for Termination:**
Spring 2021	

Faculty Contact/Email/Phone Hanqi Zhuang/zuang@fau.edu/ 297-3413

Approved by		***Date***
Department Chair	Hanqi Zhuang — Digitally signed by Hanqi Zhuang Date: 2020.10.21 15:49:19 -04'00'	
College Curriculum Chair	Francisco Presuel-Moreno — Digitally signed by Francisco Presuel-Moreno DN: cn=Francisco Presuel-Moreno, o=Florida Atlantic University, ou=Ocean and Mechanical Engineering, email=fpresuel@fau.edu, c=US Date: 2020.10.22 11:59:40 -04'00'	
College Dean	MCardei — Digitally signed by Mihaela Cardei DN: cn=Mihaela Cardei, o=Florida Atlantic University, ou, email=mcardei@fau.edu, c=US Date: 2020.10.25 19:48:18 -04'00'	10/25/2020
UGPC Chair		
UGC Chair		
Graduate College Dean		
UFS President		
Provost		

Email this form and syllabus to UGPC@fau.edu 10 days before the UGPC meeting.

Department of Computer & Electrical Engineering and Computer Science
Florida Atlantic University
Course Syllabus

1. Course title/number, number of credit hours	
Biosignal Processing / EEE 5286	# of credit hours = 3
2. Course prerequisites, corequisites, and where the course fits in the program of study	
Prerequisites: Graduate standing for CEECS students, and instructor's approval for students from other major.	
3. Course logistics	
Term: *Class location and time:*	
4. Instructor contact information	
Instructor's name *Office address* *Office Hours* *Contact telephone number* *Email address*	
5. TA contact information	
TA's name *Office address* *Office Hours* *Contact telephone number* *Email address*	
6. Course description	
This course covers the generation of bioelectrical signals, their acquisition, modeling and analysis. Modeling and analysis tools cover adaptive filtering, time-frequency analysis, model-based spectral analysis, stochastic signals and signal representation in orthogonal bases: wavelet transforms.	
7. Course objectives/student learning outcomes/program outcomes	
Course objectives	This course provides a comprehensive overview of techniques of processing bioelectrical signals. It is problem-based and programming oriented. Students are expected to code in MATLAB or Python at a level where they can use programming to verify and demonstrate concepts. Demonstration of work will be done with synthetically generated waveforms and real data.
Student learning outcomes & relationship to ABET 1-7 outcomes	1
8. Course evaluation method	
Program-based assignments 60% Project 20% Class participation quizzes 20%	For the project, the students will identify a scientific article for review and implementation. The students will prepare a 10-page technical report to discuss the problem in the paper, the methods applied, implementation of the method in

	the paper, and their results. Also the students will propose a new approach to address the problem and compare their results with the methods found in the paper. The students will deliver a 15-minutes presentation and present their final work to the class for further discussions with their peers.

9. Course grading scale

Grade	Total (%)
A	90 – 100
A-	87 – 89
B+	83 – 86
B	80 – 82
B-	77 – 79
C+	73 – 76
C	70 – 72
C-	67 – 69
D+	63 – 66
D	60 – 62
D-	51 – 59
F	50 – 0

Note that the minimum grade required to pass the course is C.

10. Policy on makeup tests, late work, and incompletes

Incomplete grades are assigned only if there is a solid evidence of medical or otherwise serious emergency situation incomplete grades will not be given.

Late assignment/quiz submissions will not be graded and the student will receive a ***zero*** for that assignment. There are no make ups for the assignments/quizzes.

The following applies to the project: after 1 day, the students will lose 25% and after 2 days, 50% of marks. The student will receive a ***zero*** after the 2nd day of due date.

11. Special course requirements

All assignments are due by 11:59 PM on the due date. However, it is recommended that you submit your work by 9:00 pm in case you encounter any technical difficulties.

1. Canvas registration is required.
2. The instructor will regularly post materials/announcements on Canvas. It is student's responsibility to regularly check Canvas and their FAU email for the most recent information.
3. Participation in University-approved activities or religious observances, with prior notice, will not be penalized.
4. Students need a reliable internet condition capable of streaming Webex lectures, taking quizzes on Canvas, etc. Recommended: Broadband Internet connection with a speed of 4 Mbps or higher. To function properly, Canvas requires a high-speed Internet connection (cable modem, DSL, satellite broadband, T1, etc.). The minimum Internet connection speed to access Canvas is a consistent 1.5 Mbps (megabits per second) or higher.

5. Students should have an operational computer system equipped with Windows 10 or macOS Sierra (or higher), Microsoft Office, web browser, a webcam, speakers, and microphone, which should be compatible with the most recent version of Cisco Webex, etc.
6. All quizzes/assignments will be submitted to Canvas. You must be able to scan answers, combine and upload them to Canvas as needed.
7. All questions must be sent publicly through Canvas, on the FAQ Discussion Board, so other students also benefit from the answers. Only personal or confidential matters should be sent via email to the professor, all others will be ignored.

More details will be announced throughout the semester. It is students' responsibility to review and follow communications posted by the instructor.

HARDWARE & SOFTWARE REQUIREMENTS

Hardware

- Dependable computer
- Computer speakers
- Headset with microphone
- Webcam
- Printer
- Printer paper
- Ink
- Scanner

Software

- Microsoft 365 Suite
- MATLAB or Python programing software
- Reliable web browser (recommended Chrome)
- Canvas mobile app: Download instructions for iOS device or Android device
- Adobe Reader
- Adobe Flash Player

Internet Connection

- Recommended: Broadband Internet connection with a speed of 4 Mbps or higher.
- To function properly, Canvas requires a high-speed Internet connection (cable modem, DSL, satellite broadband, T1, etc.). The minimum Internet connection speed to access Canvas is a consistent 1.5 Mbps (megabits per second) or higher.

12. Classroom etiquette policy

Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see University Regulation

4.001. If your college has particular policies relating to cheating and plagiarism, state so here or provide a link to the full policy—but be sure the college policy does not conflict with the University Regulation.

Due to the casual communication common in the online environment, students are sometimes tempted to relax their grammar, spelling, and/or professionalism; however, please remember you are adult students and professionals—your communication should be appropriate. You are expected to use correct spelling and grammar and write in complete sentences. Also, please note that in the online environment you do not have the advantage of voice inflection or gestures. As a result, sarcasm can come across very negative, so this form of communication should be avoided. When writing on the discussion board or responding to classmates' posts, please remember that you are responding to the ideas of the writer: keep your communication professional and on-topic.

13. Attendance policy statement

Students are expected to attend all of their scheduled University classes and to satisfy all academic objectives as outlined by the instructor. The effect of absences upon grades is determined by the instructor, and the University reserves the right to deal at any time with individual cases of non-attendance.
Students are responsible for arranging to make up work missed because of legitimate class absence, such as illness, family emergencies, military obligation, court-imposed legal obligations or participation in University-approved activities. Examples of University-approved reasons for absences include participating on an athletic or scholastic team, musical and theatrical performances and debate activities. It is the student's responsibility to give the instructor notice prior to any anticipated absences and within a reasonable amount of time after an unanticipated absence, ordinarily by the next scheduled class meeting. Instructors must allow each student who is absent for a University-approved reason the opportunity to make up work missed without any reduction in the student's final course grade as a direct result of such absence.

14. Disability policy statement

In compliance with the Americans with Disabilities Act Amendments Act (ADAAA), students who require reasonable accommodations due to a disability to properly execute coursework must register with Student Accessibility Services (SAS) and follow all SAS procedures. SAS has offices across three of FAU's campuses – Boca Raton, Davie and Jupiter – however disability services are available for students on all campuses. For more information, please visit the SAS website at www.fau.edu/sas/.

15. Counseling and Psychological Services (CAPS) Center

Life as a university student can be challenging physically, mentally and emotionally. Students who find stress negatively affecting their ability to achieve academic or personal goals may wish to consider utilizing FAU's Counseling and Psychological Services (CAPS) Center. CAPS provides FAU students a range of services – individual counseling, support meetings, and psychiatric services, to name a few – offered to help improve and maintain emotional well-being. For more information, go to http://www.fau.edu/counseling/

16. Code of Academic Integrity policy statement

Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see University Regulation 4.001. If your college has particular policies relating to cheating and plagiarism, state so here or provide a link to the full policy—but be sure the college policy does not conflict with the University Regulation.

17. Required texts/reading

To reduce costs for our students, we strongly encourage you to explore the adoption of open educational resources (OER), textbooks and other materials that are freely accessible. We also encourage you to clearly state in the syllabus if course materials are available on reserve in the Library.

N/A

18. Supplementary/recommended readings

Bioelectrical Signal Processing in Cardiac and Neurological Applications by Leif Sornmo and Pablo Laguna. Elsevier Academic Press, ISBN: 978-0-12-437552-9, 2005

R.M. Rangayyan, Biomedical Signal Analysis: A Case-Study Approach, 1st Edition IEEE and Wiley, 2002

A.V. Oppenheim and A.S. Willsky with S. Hamid, Signals and Systems, 2nd Edition, Prentice Hall, 1996.

A.V. Oppenheim and R.W. Schafer with J. Buck, Discrete-Time Signal Processing, 3rd Edition, Prentice Hall, 2010.

Yossi Farjoun. *18.S997 Introduction To MATLAB Programming.* Fall 2011. Massachusetts Institute of Technology: MIT OpenCourseWare, https://ocw.mit.edu. License: Creative Commons BY-NC-SA.

Guttag, J., 2016. Introduction to computation and programming using Python: With application to understanding data. MIT Press.

Demonstration of work will be done with synthetically generated waveforms and real data, which is available from the public database: http://www.physionet.org/

19. Course topical outline, including dates for exams/quizzes, papers, completion of reading

Introduction
Basics of Bioelectrical Signals – Chapter 1 – Bioelectrical signals – Signal acquisition and analysis – Databases/simulation
The Electrocardiogram Signal Processing – Chapter 6 – Electrical activity of the heart – Generation and recording of an ECG (Depolarization/repolarization, recording techniques, ECG waves and time intervals) – Noise and artifacts – Clinical applications (resting ECG, Intensive care monitoring, ambulatory monitoring, stress test, high-resolution ECG)

ECG Signal Processing – Chapter 7 – Baseline wander filtering (linear filtering, time-varying/time, Polynomial fitting) – Powerline interface (linear/non-linear filtering, estimation subtraction) – Muscle noise filtering – QRS detection – Wave delineation – Data compression	
Evoked Potentials – Chapter 4 – Evoke potential modalities – Noise characteristics & noise reduction methods (ensemble averaging, linear filtering) – Single trial analysis by Basis functions (orthogonal expansion, Karhunen-Loeve expansion, modeling with damped sinusoids) – Adaptive filtering using Basis functions – Instantaneous LMS algorithm, block LSM algorithm – Wavelets transform – Multi-resolution signal analysis – Denoising using wavelet filtering	
The Electroencephalogram (EEG) – Chapter 2 – The nervous system (neurons, the cerebral cortex) – The EEG signals (Rhythms and waveforms, categorization of EEG activity) – Recording techniques – Applications of EEG (epilepsy, sleep disorder, brain-computer interface)	
EEG Signal Processing- Chapter 3 – Modeling the EEG signals (deterministic and stochastic signals, stochastic models, nonlinear modeling of the EEG) – Artifacts in EEG (characteristics, processing, cancellation) – Non-parametric spectral analysis (Fourier-based power spectrum analysis/ spectral parameters) – Model-based spectral analysis – EEG segmentation – Spectral measure error – The Periodogram approach – The whitening approach – Joint time-frequency analysis – The short-time Fourier transform – The ambiguity function – The Wigner-Ville distribution – Cohen's class time-frequency distributions	

The Electromyogram -Chapter 5 – The electrical activity of muscles (action potentials and motor units) – Recording of myoelectric signals – EMG applications – Amplitude estimation using signal model and ML estimation – Spectral analysis of the EMG signal – Conduction velocity estimation (two-channel and multi-channel time delay estimation) – Modeling and intramuscular EMG (the MUAP train amplitude and power spectrum) – Intramuscular EMG signal decomposition (feature extraction and clustering)
Students' project presentations

This course uses Canvas: http://canvas.fau.edu for notes, assignments, announcements and all course information (restricted to enrolled students)

Students need to check FAU email regularly