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|  FLORIDA ATLANTIC UNIVERSITY | NEW/CHANGE PROGRAM REQUEST Graduate Programs | UGPC Approval _____ UFS Approval _____ Banner _____ Catalog _____ |
| | Department Computer and Electrical Engineering and Computer Science College Engineering and Computer Science | |
| Program Name PhD in Electrical Engineering | <input type="checkbox"/> New Program* <input checked="" type="checkbox"/> Change Program* | Effective Date (TERM & YEAR) Fall 2021 |
| <p>Please explain the requested change(s) and offer rationale below or on an attachment.</p> <p>This proposal adds a new concentration in Neuroengineering to the PhD in Electrical Engineering program. This concentration is motivated by the research expertise and activity of some of the biomedical engineering faculty in the CEECS department.</p> | | |
| <p><small>*All new programs and changes to existing programs must be accompanied by a catalog entry showing the new or proposed changes.</small></p> | | |
| Faculty Contact/Email/Phone Hanqi Zhuang/zhuang@fau.edu/561-297-3413 | Consult and list departments that may be affected by the change(s) and attach documentation College of Science, College of Medicine, Brain Institute | |
| Approved by Department Chair <u>Hanqi Zhuang</u> <small>Digitally signed by Hanqi Zhuang Date: 2020.12.09 14:01:52 -05'00'</small> College Curriculum Chair <u>Francisco Presuel-Moreno</u> <small>Digitally signed by Francisco Presuel-Moreno DN: cn=Francisco Presuel-Moreno, ou=Florida Atlantic University, ou=Ocean and Mechanical Engineering, email=fpresuel@fau.edu, c=US Date: 2020.12.09 18:28:49 -05'00'</small> College Dean <u>M. Cardei</u> <small>Digitally signed by M. Cardei DN: cn=M. Cardei, ou=Florida Atlantic University, ou= email=mcardei@fau.edu, c=US Date: 2020.12.10 09:05:00</small> UGPC Chair _____ UGC Chair _____ Graduate College Dean _____ UFS President _____ Provost _____ | Date _____ _____ 12/10/2020 _____ _____ _____ _____ | |

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

Doctor of Philosophy with Major in Electrical Engineering: Neuroengineering Concentration

Students in the Ph.D. with Major in Electrical Engineering have the option of pursuing a concentration in Neuroengineering. See below for details.

Admission Requirements

Applicants should meet all the admission requirements for the Ph.D. with Major in Electrical Engineering program.

Degree Requirements

Applicants should meet all the degree requirements for the Ph.D. with Major in Electrical Engineering program. In addition, the following requirements should be met.

1. Graduate coursework counted for the Ph.D. program must contain at least three graduate courses that focus on theoretical and/or applied neuroengineering. Such courses include the Engineering courses Neural Engineering, Computational modeling of biological neural networks, Introduction to Bioengineering, Biosystems Modeling and Control, Bioinformatics: Bioengineering Perspectives, Information Theory, Tissue Engineering, Stem Cell Engineering, Biomaterials, Introduction to Microfluidics and BioMEMS, Introduction to Robotics, Nanobiotechnology, Robotic Applications and Orthopedic Biomechanics, Biosignal Processing; Computer Science courses such as Introduction to Neural Networks, Artificial Intelligence, Data Mining and Machine Learning; and Science courses such as Neuroscience 1 and 2, Cognitive Neuroscience, Human/Functional Neuroanatomy, Neurophysiology, and Computational Neuroscience. Additional courses may be approved by the dissertation advisor. Graduate courses completed during the master's degree program may also be used to meet this requirement.
2. The student's Ph.D. dissertation research and scholarship must have a strong emphasis on one or more areas of neuroengineering, including but not limited to applied and/or theoretical areas.

From:William Kalies <WKALIES@fau.edu>
Sent:Tuesday, February 2, 2021 1:07 AM
To:Mihaela Cardei <mcardei@fau.edu>
Subject:Re: Neuroengineering concentrations and related courses

Hello Mihaela

The Neuroengineering concentration and new course proposals were sent to the departments of Biological Sciences, Psychology, and Physics, as well as the Center for Complex Systems and Brain Sciences, as the those in the College of Science that would potentially be affected by the proposals. After the withdrawal of EEE 6266, these departments support the proposal for the new concentration and the new courses BME 6390 and BME 6718.

Bill

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Bill Kalies
Associate Dean for Graduate Studies
Charles E. Schmidt College of Science
Professor of Mathematical Sciences

Florida Atlantic University
777 Glades Rd, SE-43, Room 242
Boca Raton, FL 33431
tel: 561-297-1107

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On Jan 8, 2021, at 9:49 AM, Mihaela Cardei <mcardei@fau.edu> wrote:

Hello Bill,

Happy New Year!

Our College has prepared proposals for adding the Neuroengineering concentration to the PhD in Electrical Engineering and to the PhD in Mechanical Engineering programs, as well as three new course proposals:

EEE 6266 Medical Imaging

BME 6390 Neural Engineering

BME 6718 Computational Modeling of Biological Neural Networks

Please find attached all these proposals. Please let us know whether the College of Science has any objections for the proposed curriculum items.

Thank you,
Mihaela

From:Marc Kantorow <MKANTORO@health.fau.edu>
Sent:Tuesday, January 19, 2021 4:09 PM
To:Mihaela Cardei <mcardei@fau.edu>
Cc:Janet Robishaw <jrobishaw@health.fau.edu>; Massimo Caputi <MCAPUTI@health.fau.edu>; Bridget Smith <BSTATLER@health.fau.edu>
Subject:FW: Neuroengineering concentrations and related courses

Hi Mihaela,
Hope all is well. Our committee raised no objections to the proposal and new courses.
Let us know if we can be of further assistance.
All the best,
Marc

Marc Kantorow PhD, FARVO
Associate Dean for Graduate Programs
Professor of Biomedical Science
Charles E. Schmidt College of Medicine
Florida Atlantic University
Boca Raton, FL USA 33431
mkantoro@health.fau.edu
561-297-2910

From:Mihaela Cardei <mcardei@fau.edu>
Date:Friday, January 8, 2021 at 9:51 AM
To:Marc Kantorow <MKANTORO@health.fau.edu>
Cc:Hanqi Zhuang <zhuang@fau.edu>, Manhar Dhanak <dhanak@fau.edu>
Subject:Neuroengineering concentrations and related courses

Hello Marc,

Happy New Year!

Our College has prepared proposals for adding the Neuroengineering concentration to the PhD in Electrical Engineering and to the PhD in Mechanical Engineering programs, as well as three new course proposals:
EEE 6266 Medical Imaging
BME 6390 Neural Engineering
BME 6718 Computational Modeling of Biological Neural Networks

Please find attached all these proposals. Please let us know whether the College of Medicine has any objections for the proposed curriculum items.

Thank you,
Mihaela

From: Mihaela Cardei <mcardei@fau.edu>
Sent: Wednesday, January 13, 2021 8:15 AM
To: Randy Blakely <rblakely@health.fau.edu>
Cc: William Kalies <WKALIES@fau.edu>; Hanqi Zhuang <zhuang@fau.edu>; Manhar Dhanak <dhanak@fau.edu>
Subject: Re: COECS – Neuroengineering concentrations

Great, thank you for your feedback Randy.

Best regards,
Mihaela

From: Randy Blakely <rblakely@health.fau.edu>
Sent: Tuesday, January 12, 2021 8:26 PM
To: Mihaela Cardei <mcardei@fau.edu>
Cc: William Kalies <WKALIES@fau.edu>; Hanqi Zhuang <zhuang@fau.edu>; Manhar Dhanak <dhanak@fau.edu>
Subject: Re: COECS – Neuroengineering concentrations

Hi Mihaela

Thanks for the follow up. Yes, those course title change requests went in some time ago, surprised it hasn't been accomplished yet. My suspicion for the two courses being different was just as Ramin explained. I am not sure a student would get the difference from reading the text which as I noted was significantly duplicated. I like what he wrote in his email and would suggest that he work that into his text. Regardless, it's great to see them going on the books
Randy

Randy D. Blakely, Ph.D.
Executive Director, FAU Brain Institute
Professor of Biomedical Science
Charles E. Schmidt College of Medicine
Florida Atlantic University
Room 109, MC-17
5353 Parkside Dr.
Jupiter, FL 33458
Tel: 561-799-8100
email: rblakely@health.fau.edu
<http://www.blakelylab.org>



From: Mihaela Cardei <mcardei@fau.edu>
Date: Monday, January 11, 2021 at 10:10 AM
To: Randy Blakely <rblakely@health.fau.edu>
Cc: William Kalies <WKALIES@fau.edu>, Hanqi Zhuang <zhuang@fau.edu>, Manhar

Dhanak <dhanak@fau.edu>

Subject:Re: COECS – Neuroengineering concentrations

Hello Randy,

Thank you for your reply and for taking time to review the items. We have approved them in the college and are ready to submit for approvals to the university level.

Thank you for letting me know about the upcoming course title changes. "Cellular and Molecular Neuroscience" and "Systems and Integrative Neuroscience" are not in the catalog as of now. Therefore, we will have to keep Neuroscience 1 & 2 in the proposal and change them as soon as the catalog is updated.

The Neuroengineering Concentration for the ME Major document doesn't list the extent of elective courses as with the one in EE. It has a note "Additional courses may be approved by the dissertation advisor" that gives flexibility to the advisor and student to derive a plan of study including courses from other departments and colleges as electives.

BME 6390 and BME 6718 are being proposed by Dr. Ramin Pashaie. He changed the title of the special topics course "Brain Modeling" to "Computational Modeling of Biological Neural Networks". He confirmed that the two courses are different, please see below his explanation email*.

Regarding the PhD in Neuroscience program, master's "along the way" (MALW) is a great idea ([https://fau.edu/graduate/docs/Masters Along the Way Instructions.pdf](https://fau.edu/graduate/docs/Masters_Alone_the_Way_Instructions.pdf)). MS in Bioengineering is the closest, and we could also consider MS ME and MS EE. We will have to check and confirm with the Graduate College since the document indicates that "The MALW must be in the same field as the doctoral program". The master programs in our college are 30 credits. Non-thesis (10 courses) may be an easier path. For thesis, we cannot use the same research for the MS and PhD. Even if the area is the same, the research problem that they address must be different.

Thank you,
Mihaela

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\* Here is the email from Dr. Pashaie:

Hi Mihaela and Hanqi,

Neural engineering and Computational Modeling for Biological Neural Networks are completely different topics.

Neural engineering concentrated on development of devices (such as electrodes or prosthetic platforms) that can record from brain or stimulate brain circuits. For example, we see people who have lost an arm and the arm is replaced by a robotic system which reads signals from neurons and transform those to commands for the artificial limb. This is about implementation of brain machine interface (BMI) platforms.

Computational modeling concentrates on building mathematical and computational models for the dynamics of a cell or network of cells. For example, a mathematical model for how an ion channel functions under different membrane voltages or how an electric signal propagates along the body of a nerve cell. We study with mathematical tools how neurons get connected to each other and how learning takes place in biology again by using engineering and mathematics.

These two courses can be offered with minimum or zero overlap. The syllabus that I provided for neural engineering has a little overlap with computational modeling. The reason is that I first prepared the syllabus for computational modeling and at the time I didn't know that we will go for neural engineering any time soon. Therefore, I included just some minimum neural engineering related topics that I thought are very beneficial for students who don't have a chance to take a neural engineering course. It is possible to modify the syllabus of computational modeling and remove any form of overlap with neural engineering.

Hope this is helpful. Please let me know if you need more information.

Sincerely Yours,  
Ramin

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**From:**Randy Blakely <rblakely@health.fau.edu>  
**Sent:**Sunday, January 10, 2021 2:50 PM  
**To:**Mihaela Cardei <mcardei@fau.edu>  
**Cc:**William Kalies <WKALIES@fau.edu>; Hanqi Zhuang <zhuang@fau.edu>; Manhar Dhanak <dhanak@fau.edu>  
**Subject:**Re: COECS – Neuroengineering concentrations

Hi Mihaela

Thanks for sending these items along. Nice to see the effort progressing. Just a few notes

- Neuroscience 1 is being renamed Cellular and Molecular Neuroscience, with the same course code.
- Neuroscience 2 is being renamed Systems and Integrative Neuroscience, with the same course code.
- The Neuroengineering Concentration for the ME Major document doesn't list the extent of elective courses as with the one in EE (many would be the same). Is this due to heavier core coursework?
- 6390 and 6718 look identical and have duplicated text for Course Evaluation Method. At least on paper, the two courses don't appear well enough differentiated. Are these courses listed as distinct courses due to having different kinds of students? Have both already been approved?

I wonder if you have considered the pathway by which Neuroscience PhD students, training with Engineering faculty, could obtain a Masters degree in Engineering? After they do their Core courses, it is conceivable that the three electives they take prior to being examined for their PhD thesis proposal could be ones acceptable for a Masters, with a couple courses taken after qualification leading to the

Masters? Can you see a curricular path that might work for this? Could a defense of their PhD thesis proposal, written as a thesis document, satisfy the thesis requirement for the Engineering Masters?

Randy

Randy D. Blakely, Ph.D.  
Executive Director, FAU Brain Institute  
Professor of Biomedical Science  
Charles E. Schmidt College of Medicine  
Florida Atlantic University  
Room 109, MC-17  
5353 Parkside Dr.  
Jupiter, FL 33458  
Tel: 561-799-8100  
email: [rblakely@health.fau.edu](mailto:rblakely@health.fau.edu)  
<http://www.blakelylab.org>



**From:** Mihaela Cardei <mcardei@fau.edu>  
**Date:** Friday, January 8, 2021 at 9:48 AM  
**To:** Randy Blakely <rblakely@health.fau.edu>  
**Cc:** William Kalies <WKALIES@fau.edu>, Hanqi Zhuang <zhuang@fau.edu>, Manhar Dhanak <dhanak@fau.edu>  
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Thank you,  
Mihaela