MA665:	**Introduction to Modeling and Data Analysis in Neuroscience (Fall 2020)**
Instructor:	Mark Kramer (mak@math.bu.edu)
Course Hours:	September 3, 2020 – October 22, 2020
	Tuesday & Thursday, 12:30-1:45 PM, Zoom
Office Hours:	By appointment
Textbook:	None
Course Website:	https://github.com/Mark-Kramer/BU-MA665-MA666
Prerequisites:	Graduate standing or consent of instructor.

This course is intended to introduce neuroscience graduate students to mathematical concepts in neuroscience. We will use experimental observations in neuroscience to motivate the study of mathematics. The course will focus on five fundamental topics in mathematical neuroscience, with emphasis on quantifying neurophysiological time series and developing mathematical models of the activity observed. An important component of the course is an introduction to scientific computing. Completing the material in this course will provide you with the minimum requirements for an introduction to a subset of topics in computational neuroscience.

Course goals

To introduce mathematical concepts encountered in neuroscience research and more advanced neuroscience graduate courses. To teach basic programming skills. To think about problems in neuroscience in quantitative ways.

Course requirements

The main requirement in this course is effort. I expect your full effort during our course meetings, and outside of the course, to meet the course objectives. As part of this course, you may work together in teams, but must submit your own solutions to all assignments.

Grades

To earn an A in MA665, you will be asked to complete assignments covering the following topics:

- Programming proficiency
- The integrate and fire neuron, and its extensions
- The Hodgkin-Huxley neuron
- The evoked response potential, and bootstrap resampling
- The power spectrum

Effort towards understanding and solving each problem is more important than reporting the correct solution.

Schedule

We will begin with Topic 1, and progress in the order of topics listed below. Our goal is to complete all 5 topics by the end of MA665. Often I will ask you to view lectures and complete readings outside of class. We will then discuss programming challenges and your questions during class.

Topic 1

Sept 3:	Introduction
Sept 8,10:	Programming Proficiency

Topic 2

Sept 15:	Class discussion: The integrate and fire neuron, and its extensions
Sept 17,22:	Conceptual and computer challenges

Topic 3

Sept 24:	Class discussion: The Hodgkin-Huxley neuron
Sept 29, Oct 1:	Conceptual and computer challenges

Topic 4

Oct 6:	Class discussion: The event-related potential
Oct 8,15:	Conceptual and computer challenges: The event-related potential

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Topic 5

Oct 20:	Class discussion: The power spectrum
Oct 22:	Conceptual and computer challenges: The power spectrum

MA666:	**Advanced Modeling and Data Analysis in Neuroscience (Fall 2020)**
Instructor:	Mark Kramer (mak@math.bu.edu)
Course Hours:	October 27, 2020 – December 10, 2020
	Tuesday & Thursday, 12:30-1:45 PM, Zoom
Office Hours:	By appointment
Textbook:	None
Course Website:	https://github.com/Mark-Kramer/BU-MA665-MA666
Prerequisites:	Graduate standing or consent of instructor.

Course goals

The goal of this course is further study of topics in computational neuroscience. We will continue to focus on three broad areas of computational neuroscience: (1) computer programming, (2) data analysis, (3) modeling. You are encouraged to continue working collaboratively with your peers.

Course requirements

The main requirement in this course is effort. I expect your full effort during our course meetings, and outside of the course, to meet the course objectives. As part of this course, you may work together in teams, but must submit your own solutions to all assignments.

Grades

To earn an A, the general requirements are: attend all lectures, complete all assignments. Effort towards understanding and solving each problem is more important than reporting a correct solution.

Schedule (tentative)

Topic 6

Oct 27:	Class discussion: The coherence
Oct 29,Nov 3:	Conceptual and computer challenges: The coherence

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Topic 7

Nov 5:	Class discussion: Cross-frequency coupling
Nov 10,12:	Conceptual and computer challenges: Cross-frequency coupling

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Topic 8

Nov 17:	Class discussion: Spike-field coherence
Nov 19, 24:	Conceptual and computer challenges: Spike-field coherence

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Topic 9

Dec 1,3:	Class discussion: ING and PING
Dec 8,10,:	Conceptual and computer challenges: ING and PING

Topic 9 (Alternative)

Dec 1, 3:	Class discussion: Networks in neuroscience
Dec 8, 10:	Conceptual and computer challenges: Networks in neuroscience

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