Syllabus for NEURL-UA 302-011/012 (NEURL-GA 3042-001/004)
Spring 2015
Introduction to Theoretical Neuroscience

This syllabus is subject to change. Changes will be announced in class and by email.

1. Course logistics

Instructor
Prof. Wei Ji Ma, weijima@nyu.edu, 212 992 6530
Office: Meyer 1101

Teaching assistant
Dr. Francis Song, francis.song@nyu.edu
Office: Silver Building, 7th floor, NW corner.

Classes
Lecture Thursdays 2-4 pm
Recitation Fridays 2-3 pm
Both lecture and recitation will be held in Room 815 of Meyer Hall (4 Washington Place).

Questions
- There will be no set office hours.
- Please schedule appointments with Francis and me at least 24 hours in advance.
- Francis and I will not answer content-related questions by email.

Prerequisites
- Introduction to Neural Science – can be waived, email the instructor.
- Calculus 1 or equivalent – cannot be waived.

Materials
- There is no textbook, but if you want to go deeper into the material, "Theoretical Neuroscience" by Peter Dayan and Larry Abbott (MIT Press) is recommended.
- You need to bring a laptop to recitation. If you don't have one, let us know.

2. Course description

This course will introduce concepts and techniques related to the modeling of neural systems and

behavior at an elementary level. The course will span the breadth of neuroscience, from ions to behavior. For each of those areas, we will focus in on one model or calculation and study that in depth. We will also discuss modern applications of theoretical neuroscience. Throughout the course, we will use both math and numerical simulations. Several tutorials will be integrated into the course: on the programming language Python, differential equations, and probability.

3. Grading

The course grade will consist of: 20% participation, 55% homework, 12.5% project presentation, and 12.5% project report. There will be no midterm or final.

Participation

- Attendance is mandatory. Your participation grade will be based on attendance, as well as on participation during lecture and recitation.
- To request an excused absence, please email Francis and me in advance.

Homework

- There will be 12 homework sets. Only the 10 best ones will be counted for the grade.
- Homework is due at the start of class (Thursday 2 pm) or by email to Francis. Late homework will not be accepted and count as 0.
- If you handwrite, write clearly!
- Collaboration on homework is permitted but joint submissions or copying each other's work are not and might result in a grade of 0.
- If you think your homework has been graded incorrectly, please contact Weiji.

Project

- You will pair up to do literature research and own exploration on a topic in theoretical neuroscience.
- The range of available topics will reflect the scope of the course; your own topic suggestions are also welcome.
- You will start working on the project around week 10.
- The project has to have math and simulation components
- Oral presentations of 10+2 minutes on May 7.
- Written report due end of day on May 14. Five pages double-spaced, not including figures

Letter grades

- All numerical grades will be on a scale from 0 to 10.

- Your numerical score will be turned into a letter grade according to the following scale: 9-10 A; 8.7-8.9 A-; 8.4-8.6 B+; 8-8.3 B; 7.7-7.9 B-; 7.4-7.6 C+; 7.0-7.3 C; 6.7-6.9 C-; 6.4-6.6 D+; 6-6.3 D; 5.7-5.9 D-; 0-5.6 F.

4. Overview of classes

Day	What	HW due	Topic
Thu Jan 29	Class 1		Logic and logistics of course. Quantities in the brain
Thu Feb 5	Class 2	**1**	The neuron as an electrical circuit
Thu Feb 12	Class 3	**2**	Exponential relaxation
Thu Feb 19	Class 4	**3**	Spiking and Leaky integrate-and-fire neuron
Thu Feb 26	Class 5	**4**	Making spiking-neuron models more realistic
Thu Mar 5	Class 6	**5**	Rate neurons
Thu Mar 12	Class 7	**6**	Population codes: encoding
Thu Mar 19	No class		
Thu Mar 26	Class 8	**7**	Population codes: decoding
Thu Apr 2	Class 9	**8**	Behavior
Thu Apr 9	Class 10	**9**	Perception and Bayesian inference
Thu Apr 16	Class 11	**10**	Behavioral models of learning
Thu Apr 23	Class 12	**11**	Neural models of learning
Thu Apr 30	Class 13	**12**	Circuits and graphs
Thu May 7	Class 14		**Student project presentations**, wrap up

Listed are lecture dates. Recitation is always the day after lecture.