Fall 2021

BIOL 432-101: Introduction to Computational Neuroscience

Horacio Rotstein

Fall 2021 Course Syllabus: Biol35

Course Title:	Introduction to Computational Neuroscience
Textbook:	"An Introductory Course in Computational Neuroscience" by P. Miller – MIT Press (2018), 1st edition, ISBN: 978-0262038256
Recommended Books:	"Mathematical Foundations of Neuroscience" by G. B. Ermentrout & D. H. Terman – Springer (2010), 1st edition - ISBN: 978-0-387-87707-5. "Foundations of Cellular Neurophysiology" by D. Johnston & S. Wu – The MIT Press (1995) - ISBN: 0-262-100053-3. "Dynamical Systems in Neuroscience: The Geometry of Excitability and Bursting" by E. M. Izhikevich – The MIT Press (2007), 1st edition – ISBN: 0-262-09043-8. "Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems" by P. Dayan & L. Abbott – The MIT Press (2001) , 1st edition– ISBN: 0-262-04199-5. "Biophysics of Computation: Information Processing in Single Neurons" by C. Koch – Oxford University Press (1999) – ISBN: 0-19-510491-9
Prerequisites:	Permission by instructor
Website:	http://web.njit.edu/~horacio/IntroCompNeuro/IntroCompNeuroF20.html

Week	Topic	Assignment
1	Introduction to Mathematical and Computational Neuroscience Passive membrane properties – The passive membrane equation	See course website
2	Ordinary differential equations (ODEs): Review of analytical methods Ordinary differential equations (ODEs): Review of numerical methods and Matlab	"
3	Dynamics of the passive membrane The passive membrane equation	"
4	Integrate-and-fire models The Hodgkin-Huxley model	"
5	Hodgkin-Huxley type models with additional ionic currents The cable equation	"
6	Introduction to dynamical system methods for neural models Reduced one- and two-dimensional neural model	"
7	One-dimensional neural models: Phase-space analysis	"

8	Two-dimensional neural models: Phase-space analysis I	"
9	Two-dimensional neural models: Phase-space analysis II	"
10	Sub-threshold oscillations: Two and Three dimensional models Bursting	"
11	Synaptic dynamics	
12	Overview on network dynamics	"
13	Student Presentations	"
14	Student Presentations	"
15	Student Presentations	

IMPORTANT DATES	
FIRST DAY OF SEMESTER	Sep 1, 2021
LAST DAY TO ADD/DROP	Sep 8, 2021
THANKSGIVING RECESS	Nov 25-28, 2021
LAST DAY TO WITHDRAW	Nov 10, 2021
LAST DAY OF CLASSES	December 10, 2021
FINAL EXAM PERIOD	December 15-21, 2021

Grading Policy (tentative)

Assignment Weighting	
Homework, Quizzes & Class Participation	40
Midterm Exam / Project	30
Final Project / Presentation	30

Tentative Grading Scale	
A	90 -- 100
B+	85 – 89
B	80 – 84
C+	75 – 79
C	70 – 74
D	60 – 69
F	0 -- 59

Course Policies: See course website

COVID-19 Safety Requirements
All persons physically present in any department facility or classroom shall comply fully with the NJIT COVID-19 safety policy at all times. Masks must be worn before entry to all department facilities, and social distancing guidelines must be followed. Individuals who are unable to wear a face mask due to medical reasons should contact the Office of Disability Services or Human Resources. Students who enter a classroom without wearing a mask properly, or remove their mask, will be cautioned by the instructor. The same is true for students who disregard the seating order or guidelines for social distancing. Students with obvious symptoms of respiratory illness should not come to campus and will be asked to leave. Students who do not comply with a request by a department instructor to adjust their behavior, in accordance with the University Policy, will be subject to disciplinary actions. Instructors have the right to expel the student or terminate the class session at which any student fails to comply with the University Policy.

Important Departmental and University Policies

- Academic Integrity Code is Strictly Enforced
- Prerequisites Requirements are Enforced
- Attendance is Required in Lower-Division Courses
- Exam Policies (No Make Up Exams and More)
- Cell Phone and Pager Use Prohibited in Class
- Drop Date (November 11, 2019) is Strictly Observed
- Complete DMS Course Policies (math.njit.edu/students/undergraduate/policies_math)

Prepared by Prof. Horacio G. Rotstein, May 12, 2021