Fall 2025 Course Syllabus

Biol635

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:	NJIT Catalog or Permission by instructor
Website:	http://web.njit.edu/~horacio/IntroCompNeuro/IntroCompNeuroF25.html

Week	Topic	Assignment
1	General Discussion about the course 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 (MATLAB, Python)	"
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	Reduced models and reduction of dimensions	“
7	Introduction to dynamical system methods for neural models	“
8	One-dimensional neural models: Phase-space analysis I	“
9	Two-dimensional neural models: Phase-space analysis II	“
10	Sub-threshold and mixed-mode oscillations, resonance, entrainment, bursting	“
11	Synaptic dynamics & short-term plasticity	
12	Network dynamics: small networks	“
13	Network dynamics: large networks	“
14	Student Presentations	“
15	Student Presentations	“

IMPORTANT DATES	
FIRST DAY OF SEMESTER	Sep 2, 2025
LAST DAY TO ADD/DROP	Sep 8, 2025
THANKSGIVING RECESS	Nov 27 - 30, 2025
LAST DAY TO WITHDRAW	Nov 11, 2025
LAST DAY OF CLASSES	December 11, 2025
READING DAYS	December 12, 2025
FINAL EXAM PERIOD	December 14-20, 2025

Grading Policy (tentative)

Assignment Weighting	
Homework, Quizzes, Mini Projects & 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.