# Spring 2025 Course Syllabus: Biol636

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| **Course Title:** | Advanced Computational Neuroscience |
| **Textbook:** | "Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems" by P. Dayan & L. Abbott – The MIT Press (2001) – ISBN: 0-262-04199-5.<br><br>"Introduction to Modeling Cognitive Process", by Tom Verguts – The MIT Press (2022) – ISBN 9780262045360 |
| **Recommended Books:** | "An Introductory Course in Computational Neuroscience" by P. Miller – MIT Press (2018), 1st edition, ISBN: 978-0262038256<br><br>"An Introduction to Modeling Neuronal Dynamics" by C. Borgers - Springer (2017), 1st edition - ISBN 978-3-319-51171-9<br><br>"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.<br><br>"Mathematical Foundations of Neuroscience" by G. B. Ermentrout & D. H. Terman – Springer (2010), 1st edition - ISBN: 978-0-387-87707-5. |
| **Prerequisites:** | Biol635 or Permission by instructor |
| **Website:** | http://web.njit.edu/~horacio/Biol636/AdvancedCompNeuroS25.html |

| Week | Topic | Assignment |
|---|---|---|
| 1 | Review of biophysical models of single neurons | See course website |
| 2 | Data analysis and spike-train statistics | " |
| 3 | Biophysical (conductance-based) models of synapses and networks / Cognitive Models | " |
| 4 | Firing rate models of neuronal networks | " |
| 5 | Response of neurons to periodic inputs: resonance and entrainment / Synchronization / Central Pattern Generators | " |
| 6 | Parameter estimation, model testing | " |
| 7 | Synaptic plasticity and Homeostasis | " |
| 8 | Learning | " |
| 9 | Memory | " |
| 10 | Decision making | " |
| 11 | Reinforcement learning, unsupervised learning, Bayesian models | |
| 12 | Project development/presentations | " |

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| **13** | Project development/presentations | “ |
| **14** | Project development/presentations | “ |
| **15** | Project development/presentations | |

| IMPORTANT DATES | |
|---|---|
| FIRST DAY OF SEMESTER | Jan 21, 2025 |
| LAST DAY TO ADD/DROP | Jan 27, 2025 |
| SPRING RECESS | March 16-22, 2025 |
| LAST DAY TO WITHDRAW | April 7, 2025 |
| LAST DAY OF CLASSES | May 7, 2025 |
| FINAL EXAM PERIOD | May 10-16, 2025 |

**Grading Policy (tentative)**

| Assignment Weighting | |
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| Class Projects | 40 |
| Class Participation | 20 |
| Final Project / Presentation | 40 |
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| Tentative Grading Scale | |
|---|---|
| A | 90 -- 100 |
| B+ | 85 – 89 |
| B | 80 – 84 |
| C+ | 75 – 79 |
| C | 70 – 74 |
| D | 60 – 69 |
| F | 0 -- 59 |
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**Course Policies:** See course website

**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 is Strictly Observed
- Complete DMS Course Policies (math.njit.edu/students/undergraduate/policies_math)

Prepared by Prof. Horacio G. Rotstein, November 18, 2024