



Full Syllabus



Course Title

Mathematical modelling of neurons and networks

Lecturer

Dr. Lee Susman

Semester

B

Course requirements

Homework assignments and final project

Final grade components

40% homework assignments, 60% final project

Course schedule

Class no.	Subject
1	Introductory examples for neural network dynamics – in theory and in empirical data
2	Intro to dynamical systems theory: one-dimensional dynamics
3	Intro to dynamical systems theory: dynamics in two or more dimensions
4	Survey of modelling scales: single cells (Hodgkin-Huxley), spiking networks, rate networks
5	Random rate networks: dynamics; transition to chaos; balanced networks; structure and randomness (low-rank perturbations to random networks)
6	Excitatory/Inhibitory network models
7	Models of cognitive function: Hopfield model for associative memory; ring model for feature encoding; line attractor for evidence integration
8	Network mechanism for navigation, short-term memory, and decision-making. Attractor dynamics inferred from neural data: continuous attractor mechanisms for orientation in space.
9	Learning in brains
10	Learning in machines
11	Discrete attractor mechanisms as a basis for short-term memory and its use during decision-making.

Optional course reading



TEL AVIV אוניברסיטת תל אביב
UNIVERSITY תל אביב

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Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry, and Engineering,
Steven Strogatz

Theoretical Neuroscience, Dayan & Abbott

Comments