האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

The Hebrew University of Jerusalem

Syllabus

Theoretical Neuroscience: Dynamics of Neuronal Networks in the Brain - 76908

Last update 05-07-2018

HU Credits: *4*

Degree/Cycle: *2nd degree (Master)*

Responsible Department: *Brain Science: Computation & Information Proc.*

Academic year: *0*

Semester: *2nd Semester*

Teaching Languages: *English*

Campus: *E. Safra*

Course/Module Coordinator: *Dr. Yonatan Loewenstein*

Coordinator Email: *yonatan.loewenstein@mail.huji.ac.il*

Coordinator Office Hours:

Teaching Staff:
Prof Yonatan Loewenstein,
Mr. Yoav Rubinstein

Course/Module description:
Neural Networks 1 presents basic principles in theoretical study of neural networks, focusing on neuronal dynamics.

Course/Module aims:
The aim of the course is to provide students with basic concepts of storage and processing of information in neural networks, to equip them with analytical and numerical methods in the study and application of neural network models. In particular, the course focuses on concepts and methods of dynamics and their application to neural networks.

Learning outcomes - On successful completion of this module, students should be able to:
Students should be able to find fixed points and perform stability analysis on non-linear systems.

Students should be able to demonstrate understanding of associative memory models via Hopfield Networks, feature selectivity via Ring Models, decision making models, and the balanced state network.

Attendance requirements(%):
0

Teaching arrangement and method of instruction: Frontal lectures and exercises, together with home assignments, which will be composed of both analytical questions as well as numerical simulations.

Course/Module Content:
-Linear and non-linear dynamics of rate models of neural network dynamics.

- Hopfield Model for associative memory

- Ring Model for feature selectivity

- Adaptation and Stochastic Models for Perceptual Rivalry

- Decision Making Networks

- Asynchronous Irregular Spiking by Balanced State Networks

Required Reading:
There is no required reading.

Additional Reading Material:
Theoretical Neuroscience – Computational and Mathematical Modeling of Neural Systems, P. Dayan and L. F. Abbott, MIT Press, 2001.

Introduction to the Theory of Neural Computation, J. Hertz, A. Krogh, R. G. Palmer, Addison-Wesley, 1991

Modeling Brain Function, D.J. Amit, Cambridge University press, 1989

Nonlinear Dynamics and Chaos, S.H. Strogatz,Perseus Publishing, 2006

Course/Module evaluation:
End of year written/oral examination 70 %
Presentation 0 %
Participation in Tutorials 0 %
Project work 0 %
Assignments 30 %
Reports 0 %
Research project 0 %
Quizzes 0 %
Other 0 %

Additional information: