Introduction to Theoretical Neuroscience
Larry Abbott, Stefano Fusi, Ashok Litwin Kumar, Ken Miller

Meetings:  
Tuesdays  
Lecture 12.30 – 2.00  
Recitation 2.00 – 3.30  

Thursdays  
Math Supplement 12.30 – 2.00  
Lecture 2.00 – 3.30  

TAs:  
Ella Batty (erb2180)  
Danil Tyulmankov (dt2586)  
Ramin Khajeh (rk2899)  
Marjorie Xie (mx2183)  
Salomon Muller (szm2106)  


Webpage: https://ctn.zi.columbia.edu/courses  

January  
22 Math Intro: Differential Equations (Ashok)  
24 Electrical Properties of Neurons, Integrate-and-Fire (Larry) - Assign 1  
Calculus Review (Dan)  
29 Adaptation, Izhikevich Model, Phase-Planes, Stability Analysis (Larry)  
Recitation (Ramin)  
30 Assign 1 Due  
31 The Hodgkin-Huxley Model (Larry)  
Taylor Series, Linearization (Dan)  

February  
5 Synapses, Short-Term Plasticity, Release Probability (Stefano) - Assign 2  
Recitation (Ramin)  
7 Probability / Poisson spiking, Central Limit Theorem/Gaussian (Larry)  
Combinatorics (Dan)  
12 Probability / Encoding I (Ken) - Assign 3  
Recitation (Ramin)  
13 Assign 2 Due  
14 Linear Algebra I (Ken)  
Linear Algebra 0 (Dan)  
19 Linear Algebra II (Ken) Assign 4  
Recitation (Marjorie)  
20 Assign 3 Due  
21 Dimensional Reduction I (Ken)  
Lagrange Multipliers (Dan)  
26 Dimensional Reduction II (Ashok) - Assign 5  
Recitation (Marjorie)  
27 Assign 4 Due  
28 COSYNE  

March  
5 COSYNE  
Recitation (Marjorie)  
7 Receptive Fields, GLMs, and Maximum Likelihood (Ashok)  
Multivariant Calculus (Dan)  
12 Spike and Rate Networks I (Larry)  
Recitation (Marjorie)  
13 Assign 5 Due  
14 Spike and Rate Networks II (Stefano) - Assign 6  
19 Spring Break  
21 Spring Break  
26 E/I Networks I (Ken)  
Recitation (Salomon)  
28 E/I Networks II (Ken) – Assign 7  
Convolution (Dan)
April
2  Decision-Making Networks (Stefano)
   Recitation (Salomon)
3  Assign 6 Due
4  Recurrent Networks - Hopfield and Random (Larry) - Assign 8
   Fourier Transforms (Dan)
9  Optimization I (Ashok)
   Recitation (Salomon)
10 Assign 7 Due
11 Optimization II (Ashok) - Assign 9
16 Perceptron and Decoding (Stefano)
   Recitation (Salomon)
17 Assign 8 Due
18 Learning in Recurrent Networks (Larry)
23 Multilayer Perceptrons (Ashok) - Assign 10
   Recitation (Ella)
24 Assign 9 Due
25 Deep Learning I (Stefano)
   Bifurcations (Dan)
30 Deep Learning II (Stefano)
   Recitation (Ella)

May
1  Assign 10 Due
2  Reinforcement Learning (Stefano) - Assign 11
   Information Theory (Dan)
7  Recitation (Ella)
8  Assign 11 Due