ECE 8570 Theoretical Neuroscience I

Course Description: Neurobiology basics including morphological, biochemical and biophysical properties of nerve cells. Membrane potential, action potential, ion channel dynamics and GHK equation, dynamical properties of excitable membranes. Dynamical system concepts including equilibria, stability, eigenvalues and phase portraits. Conductance based models including minimal and multi-dimensional; Bifurcations of equilibrium state and of the spiking state; Neuronal excitability; Simple models such as integrate and fire, resonate and fire and Izhikevich models; adaptation and bursting in cells. Extensive examples using software packages.

Prerequisites: Undergraduate linear systems and control courses, or consent of instructor

Instructor: Satish S. Nair, 229 EBW (882-2964; nairs@missouri.edu)

Credits/ Class hours: 3 credits; Mon 2-3:15 pm, Thurs 4-5:15 pm, EBW 145

+ Notes hosted at website, incl. documents related to the software modeling package NEURON (available free online).

References: *Principles of Computational Modelling in Neuroscience* by Sterratt, Graham, Gillies and Willshaw, Cambridge University Press

Grading:

- Homeworks: 20%
- Quizzes: 10%
- One Mid-Term Exam: 30%
- Final Exam: 40%

Letter grades: A-F (curve grading)

Academic dishonesty: Academic honesty is fundamental to the activities and principles of a University. Any effort to gain an advantage not given to all students is dishonest whether or not the effort is successful. The academic community regards academic dishonesty as an extremely serious matter, with consequences that range from probation to expulsion. When in doubt about plagiarism, paraphrasing, quoting, or collaboration, consult the course instructor. If you are caught cheating on an exam or assignment, you will either receive a grade of zero for the exam/assignment, or an F for the course. Weekly assignments are individual assignments, so do not copy someone else's assignment.

If you are caught committing academic dishonesty, your actions will be reported to the Provost's office, according to university policy.

Special needs: If you need accommodations because of a disability, if you have emergency medical information to share with me, or if you need special arrangements in case the building must be evacuated, please inform an instructor immediately. Please see an instructor privately after class, or during office hours. To request academic accommodations (e.g. a note-taker) students must register with Disability Services, AO38 Brady Commons, 882-4696. It is the campus office responsibility to review documentation provided by students requesting academic accommodations, and for accommodations planning in cooperation with students and instructors, as needed and consistent with course requirements. For other MU resources for students with disabilities, click on "Disability Resources" on the MU homepage.