

## ECE 667-101 Fall, 2009      **Bio-Control Systems**

**Prerequisite:** ECE431 Systems and Virtual Instrumentation or ECE601 linear Systems.

**Course description:** The course provides an introduction to dynamic and control in biological systems, with particular emphasis on engineering aspects of biological oscillators/waves which govern the basic operations of all living organisms and especially higher order life forms. A combination of theoretical and simulation tools will be applied to analyze the qualitative and quantitative properties of selected biological systems. Feedback and control mechanisms in selected biological systems will be introduced. Real time signal acquisition and processing are also addressed. The students are expected to complete a term project and make a presentation at the last class.

**Instructor:** Dr. Timothy Chang, Department of Electrical & Computer Engineering

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**Office hours:** 2:30-3:30PM Tuesdays/Thursdays, 5:00-5:30PM Tuesday (or by appointment)

### **A. Tentative Schedule:**

- Week 1: Introduction to Systems Theory and Applications in Biological Systems
- Week 2: Review of frequency response: Bode and Nyquist diagrams
- Week 3: Transients and steady states in forced and self oscillations
- Week 4: Graphical methods
- Week 5: Describing function analysis and limit cycles
- Week 6: Electronic circuitual realization of oscillators
- Week 7: Simulation studies/**Midterm exam**
- Week 8: Real time signal acquisition and processing
- Week 9: Biological oscillators
- Week 10: Perturbed and coupled oscillators
- Week 11: Biological feedback mechanisms
- Week 12: Control methods
- Week 13: Case studies in selected bio-systems
- Week 14: **Project presentation**

**B. Text:** Feedback Control Systems, 4<sup>th</sup> Ed., Phillips and Harbor, Prentice Hall, 2000.

Lecture notes to be downloaded from instructor's web site

**C. References:** J. Murray, Mathematical Biology I, Springer, 3<sup>rd</sup> Ed.

**D. Grading scheme:** Assignment 10%, Mid-term 30%, final 30%, project 30%.

**E. Important Dates:** 10/13 Midterm, 11/24 Tuesday on a Thursday schedule, 12/15 Final exam.

**F. Software:** Matlab/Simulink

NJIT Honor Code will be upheld, and that any violations will be brought to the immediate attention of the Dean of Students.