ENGR 8980, Advanced Topics in Bioengineering:

Mathematical Biology

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Course website: `http://www.math.uga.edu/~caner/08engr8980`

Office Hours: Wednesday between 11am-noon; or anytime by appointment.

Text: A Course in Mathematical Biology, *G. Vries, T. Hillen, M. Lewis, B. Schönfisch,* SIAM
We will cover additional material including some papers, lecture notes and material from the following books; however you do not need to check out these books, I will provide any necessary additional material:
- Handbook of Stochastic Methods, *by C. W. Gardier*, Springer
- Computational Cell Biology, *by C. Fall, E Marland, J. Wagner, J. Tyson*, Springer
- Systems Biology in Practice, *by E. Klipp, R. Herwig, A. Kowald, C. Wierling*, Wiley
- Nonlinear Dynamics and Chaos, *by S. Strogatz*, Wiley
- Mathematical Biology I, *by J. D. Murray*, Springer
- Essential Mathematical Biology, *by Nicholas F. Britton*, Springer

Objective: The course will provide students with mathematical and computational tools necessary to model, analyze and control a variety of biological and ecological systems.

Prerequisites: It is highly recommended that students have taken a prior differential equations course, as well as a matrix algebra course. We will use Matlab and XPP for simulation and analysis, however no prior knowledge or experience is necessary.

Topics: Population dynamics, sensitivity analysis, phase-plane analysis, biochemical kinetics, metabolic pathways, approximate kinetics, bifurcation analysis, stochastic simulation methods, Gillespie's algorithm, Langevin equation, biochemical networks, graph theoretic methods, neuroscience, gene regulation, genetic networks, agent based modeling and systems biology.

Course style: In general, each class lecture will be a "powerpoint style" presentation, which will be posted on the course website in `pdf` format after wards. One of the important objectives of this course is to successfully communicate a biological or ecological problem across disciplines, and to collaborate on a biological problem with colleagues from various disciplines. I hope this course is going to attract students from various disciplines. We will form interdisciplinary student groups (2-3 people) that will work on a project together as a team. Projects can be based on any biological problem that utilize the methods covered in this course. Each team will prepare a report and present their projects on the last day of classes.

Evaluation: Home works will be posted on the course website along with some reading material. Please check the course website frequently to access homework assignments and additional course material, such as lecture notes and papers. The course grade will be based on homework assignments (60%) and final group presentation and reports (40%). Groups of 2-4 students will be determined by mid semester and each group will work on a project.

All academic work must meet the standards contained in "A Culture of Honesty". Students are responsible for informing themselves about those standards before performing any academic work.

The course syllabus is a general plan for the course; deviations announced to the class by the instructor may be necessary.