THE COLLEGE OF STATEN ISLAND
DEPARTMENTS OF MATHEMATICS/BIOLOGY
COURSE OUTLINE

MTH/BIO 415 (GRAD 761) MATHEMATICAL BIOLOGY

SPRING 2006
4CR/4HR

Textbook
Mathematical Models in Biology (Classics in Applied Mathematics
by Leah Edelstein-Keshet
Paperback: 586 pages
Publisher: SIAM: Society for Industrial and Applied Mathematics; New Ed edition
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Note: Each Topic will be covered over the week(s) indicated. In many cases, sections in the book will be supplemented by handouts.

Week	**Textbook Sections**	**Topics**
I	1.1	Introduction to building models: Scaling example. Introduction to MATLAB. Theory of difference equations.
II-III	2.1-2.8, 3.1	Non-linear difference equations: recognition, steady states, stability Graphical methods, Applications to population dynamics. Cobwebbing using MATLAB. Density dependence in single-species populations. Chaos and its biological relevance.
III-IV	1.3-1.7	Difference equations continued. Application to seed banks and insect populations. Age and stage structure.
V	3.2-3.5	Host-parasitoid systems. The Nicholson-Bailey model and extensions. Discussion of applications.

VI-VIII	4.1-4.11	Continuous processes and ordinary differential equations.: Algal growth in a chemostat. Building resource-saturation into the model. Dimensional analysis. Scaling. Linearization of nonlinear equations. Local stability analysis. Systems of equations. e.g. albatross foraging behavior-use in epidemiological models- e.g. spread of AIDS. Use of MATLAB to solve systems of differential equations. ODE23/ODE45
MIDTERM EXAM		
X-XI		**Spring Break**
IX, XI-XII	5.1-5.6 8.1-8.9 6.1-6.6 7.1-7.4	Phase plane methods; oscillatory systems. Neurons and neuronal models. Limit cycles, oscillations and excitable systems. Application of continuous models to population dynamics. Single and competing species models. Predator-prey models. Models for molecular events: Michaelis-Menten kinetics. Sigmoidal behavior and its implications.
XIII-XV	9.1-9.7 10 Handout	Role of spatial variation in biological systems. Diffusion models. More complex spatial patterns. Introduction to reaction-diffusion models. Brief introduction to stochastic models.
XVI	**Final Project**	Presentations