Pomona College
Department of Mathematics

Mathematics 36. Mathematical and Computational Methods for the Life Sciences
Fall 2007

Course Outline

Time and Place:	MWF 10:00 am - 10:50 am Millikan 207
Instructor:	Dr. Adolfo J. Rumbos
Office:	Andrew 259.
Phone / e-mail:	ext. 18713 / arumbos@pomona.edu
Office Hours:	MWF 9:15 am-9:50 am; Tu 9:15 am-10:50 am, 2:30 pm-3:30 pm or by appointment
Text:	*Mathematical Models in Biology* by E. S. Allman and J. A. Rhodes Cambridge University Press, 2004.
Prerequisites:	Passing score in Math 32 placement exam.

Course Description. The main goal of this course is the exploration of mathematical topics that have relevance in the study of biological systems. The topics will range from difference and differential equations to probability and stochastic processes. The mathematics is motivated by biological questions and developed in that context. Emphasis will be placed on the process of mathematical modeling; this consists of (1) translation of questions in Biology into mathematical formalism (variables, parameters, functions, equations, etc.); (2) formulation of mathematical problems (e.g., Can a given equation or system of equations be solved? What are the properties of the solutions?); (3) analysis of the mathematical problem; and (4) translation back into the Biological situation. Another important aspect of the course will be computation and data analysis; this provides a link between the mathematical models and the actual biological systems under consideration.

The specific topics to be covered are listed in the attached **Tentative Schedule of Lectures and Examinations**.

Assigned Readings and Problems. Readings and problem sets will be assigned at every lecture. Homework assignments will be collected on an alternate basis. Students are strongly encouraged to work on every assigned problem. **Late homework assignments will not be graded**.

Grading Policy. Grades will be based on the homework, two 50-minute examinations, plus a comprehensive final examination. The grades will be computed as follows:

homework	20%
Two 50-minute exams	50%
final examination	30%

Final Examination.

Time: Monday, December 17 9:00 am

Place: Millikan 207

Math 36 **Fall 2007**

Tentative Schedule of Lectures and Examinations

Date			Topic
W	Sep.	5	A problem from microbial genetics: bacterial resistance
F	Sep.	7	Modeling bacterial growth: discrete approach
M	Sep.	10	Logistic difference equation
W	Sep.	12	Numerical analysis of the logistic equation: Introduction to MATLAB
F	Sep.	14	Qualitative analysis of the logistic difference equation: cobweb analysis
M	Sep.	17	Equilibrium points and stability
W	Sep.	19	Principle of linearized stability
F	Sep.	21	Oscillations and chaos
M	Sep.	24	Modeling bacterial growth: continuous approach
W	Sep.	26	Exponential growth
F	Sep.	28	Logistic growth
M	Oct.	1	Existence and uniqueness of solutions
W	Oct.	3	Global existence and long-term bahavior
F	Oct.	5	Qualitative analysis: equilibrium points, stability and linearized stability
M	Oct.	8	Linear first order models
W	Oct.	10	Solving the logistic equation
F	Oct.	12	Problems and examples: One-compartment models
M	Oct.	15	Review
W	Oct.	17	**Exam 1**
F	Oct.	19	Random variables and distributions
M	Oct.	22	**Fall recess: No Classes**
W	Oct.	24	Probability distributions in genetics
F	Oct.	26	Probability distributions in genetics (continued)
M	Oct.	29	Probabilistic models
W	Oct.	31	Probabilistic models (continued)
F	Nov.	2	Problems and examples
M	Nov.	5	Modeling bacterial mutations
W	Nov.	7	Random Processes
F	Nov.	9	The Poisson process

Date		Topic
M	Nov. 12	The Poisson process (continued)
W	Nov. 14	Goodness of fit
F	Nov. 16	Goodness of fit (continued)
M	Nov. 19	Modeling the development of resistance
W	Nov. 21	Modeling the development of resistance (continued)
F	Nov. 23	**Thanksgiving recess**
M	Nov. 26	The Luria-Delbrück experiment: average number of resistant bacteria
W	Nov. 28	The Luria-Delbrück distribution
F	Nov. 30	The Luria-Delbrück distribution: Goodness of fit
M	Dec. 3	Problems and examples.
W	Dec. 5	Review
F	Dec. 7	**Exam 2**
M	Dec. 10	Review
W	Dec. 12	Review
M	Dec. 17	**Final Examination**