Pomona College
Department of Mathematics

Mathematics 36. Mathematical and Computational Methods for the Life Sciences
Spring 2010

Course Outline

Time and Place:	MWF 11:00 am - 11:50 am Millikan 213
Instructor:	Dr. Adolfo J. Rumbos
Office:	Andrew 259.
Phone / e-mail:	ext. 18713 / arumbos@pomona.edu
Office Hours:	MWF 9:00 am-9:50 am or by appointment
Text:	*Mathematical Models in Biology* by E. S. Allman and J. A. Rhodes Cambridge University Press, 2004.
Course Website:	**http://pages.pomona.edu/~ajr04747/**
Prerequisites:	Math 31 (Calculus II) or 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, three 50-minute examinations, plus a comprehensive final examination. The grades will be computed as follows:

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

Final Examination.

Time: Tuesday, May 11 9:00 am Place: Millikan 213

Math 36 **Spring 2010**

Tentative Schedule of Topics and Examinations

Date			Topic
W	Jan	20	A problem from microbial genetics: bacterial resistance
F	Jan	22	Modeling bacterial growth: discrete approach
M	Jan	25	Logistic difference equation
W	Jan	27	Numerical analysis of the logistic equation: Introduction to MATLAB
F	Jan	29	Qualitative analysis of the logistic difference equation: cobweb analysis
M	Feb	1	Equilibrium points and stability
W	Feb	3	Principle of linearized stability
F	Feb	5	Oscillations and chaos
M	Feb	8	Modeling bacterial growth: continuous approach
W	Feb	10	Exponential growth
F	Feb	12	Logistic growth: Qualitative Analysis
M	Feb	15	Existence, uniqueness and long term behavior of solutions
W	Feb	17	Review
F	Feb	19	**Exam 1**
M	Feb	22	Examples: Linear first order models
W	Feb	24	Principle of linearized stability
F	Feb	26	Qualitative analysis: equilibrium points, stability and linearized stability
M	Mar	1	Solving the logistic equation
W	Mar	3	Solving the logistic equation (continued)
F	Mar	5	Random variables and distributions
M	Mar	8	Probability distributions in genetics
W	Mar	10	Probability distributions in genetics (continued)
F	Mar	12	Probabilistic models
M	Mar	15	*Spring Recess*
W	Mar	17	*Spring Recess*
F	Mar	19	*Spring Recess*
M	Mar	22	Probabilistic models (continued)
W	Mar	24	Random Processes
F	Mar	26	*Cesar Chavez Day* (observed)
M	Mar	29	The Poisson process
W	Mar	31	Review
F	Apr	2	**Exam 2**
M	Apr	5	The Poisson process (continued)
W	Apr	7	Goodness of fit
F	Apr	9	Goodness of fit (continued)

Date			**Topic**
M	Apr	12	Modeling the development of resistance
W	Apr	14	Modeling the development of resistance (continued)
F	Apr	16	Modeling the development of resistance (continued)
M	Apr	19	The Luria-Delbrück experiment: average number of resistant bacteria
W	Apr	21	The Luria-Delbrück distribution
F	Apr	23	The Luria-Delbrück distribution: Goodness of fit
M	Apr	26	Problems and examples
W	Apr	28	Review
F	Apr	30	**Exam 3**
M	May	3	Review
W	May	5	Review
Tu	May	11	**Final Examination**