Pomona College
Department of Mathematics

Mathematics 31S. Calculus II with Applications to the Life Sciences.
Fall 2016

Course Outline

Time and Place:	MWF 11:00 am - 10:50 am Millikan 2393
Instructor:	Dr. Adolfo J. Rumbos
Office:	Andrew 2287.
Phone/e-mail:	ext. 18713 / arumbos@pomona.edu
Office Hours:	MWF 10:05 am - 10: 50 am, TR 10:00 am – 11:00 am, or by appointment
Courses Website:	http://pages.pomona.edu/~ajr04747/
Text:	*Calculus for the Life Sciences* by Sebastian J. Schreiber, Karl J. Smith, and Wayne M. Getz
Prerequisites:	Math 30 (grade of C- or better)

Course Description. In this course we study integral and differential calculus in the context of problems arising in the life sciences. We will be dealing mainly with problems that come up in population biology concerning the description of the evolution in time of the size of the population of a given species, as well as the interaction of several species living in a common environment. Analysis of this type of problems leads naturally to *differential equations*. These are expressions involving an unknown function (which one seeks to find) and its derivatives. We will spend the first part of the course learning how to analyze the differential equations that come up in the study of the problems mentioned above. Some of the equations can be solved using integral calculus, but others cannot be solved easily, and so the best one can do is to use approximations, in particular, linear approximations, to analyze them. We will see that sometimes those approximate solutions to the equations actually tell us a lot about the system we are studying.

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: Friday, December 16 9:00 am

Math 31S **Fall 2016**

Tentative Schedule of Lectures and Examinations

Date			Topic
W	Aug.	31	A conservation principle: One-compartment dilution
F	Sep.	2	Recovering a function from its rate of change
M	Sep.	5	What is a differential equation?
W	Sep.	7	Review of integration: **The Fundamental Theorem of Calculus**
F	Sep.	9	The natural logarithm function
M	Sep.	12	The natural logarithm function (continued)
W	Sep.	14	The exponential function
F	Sep.	16	The exponential function (continued)
M	Sep.	19	Solving first order differential equations
W	Sep.	21	Separation of variables
F	Sep.	23	Linear first order differential equations
M	Sep.	26	Linear first order differential equations with constant coefficients
W	Sep.	28	Applications of first order differential equations
F	Sep.	30	Qualitative analysis of a first order equation.
M	Oct.	3	Qualitative analysis (continued)
W	Oct.	5	Models of population growth
F	Oct.	7	Models of population growth (continued)
M	Oct.	10	Review
W	Oct.	12	**Exam 1**
F	Oct.	14	The logistic model of population growth
M	Oct.	17	**Fall recess: No Classes**
W	Oct.	19	The logistic model (continued)
F	Oct.	21	Solving the logistic model: Partial fractions
M	Oct.	24	Partial fractions (continued)
W	Oct.	26	Linearization
F	Oct.	28	Integration by parts
M	Oct.	31	Integration by parts (continued)
W	Nov.	2	Principle of linearized stability
F	Nov.	4	Systems of differential equations

Date		Topic
M	Nov. 7	Solving systems of differential equations
W	Nov. 9	Phase-plane analysis: nullclines, equilibrium points and stability
F	Nov. 11	Phase-plane analysis (continued)
M	Nov. 14	Population models of two interacting species
W	Nov. 16	Predator-Prey models: The Lotka-Volterra equations
F	Nov. 18	
M	Nov. 21	Predator-prey models continued
W	Nov. 23	Competition and cooperation
F	Nov. 25	**Thanksgiving recess**
M	Nov. 28	The principle of competitive exclusion.
W	Nov. 30	Review
F	Dec. 2	**Exam 2**
M	Dec. 5	Review
W	Dec. 7	Review
F	Dec. 16	**Final Examination**