ANSC 448 / IB 487 / STAT 458
Mathematical Modeling in Life Sciences
Course Outline Spring 2018

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Course description: Introduction to deterministic and stochastic mathematical models for the life sciences, statistical methods for fitting and testing models, and computer simulation programs. Applications to populations, processes, and products of animals, plants, and humans. Three or 4 hours credit. Students desiring 4 hours credit do additional work in some area of mathematical modeling in the life sciences.

Prerequisites: Prerequisite: IB 150; a course in calculus, and a course in computer sciences; or consent of instructor.

Class schedule: Lecture: M, W 11 (22 LIAC); Laboratory F 11-12:50 (22 LIAC)

In ACES Library: Thornley, J.H.M., and J. France. 2007. Mathematical Models in Agriculture: Quantitative Methods for the Plant, Animal and Ecological Sciences, 2nd Ed.

Exams: There will be two lecture/take-home exams during the semester (due **5 PM Friday 16 February** and **5 PM Friday 16 March**) and a final exam (**Friday 4 May 1:30-4:30 PM**). For students registered for 3 hours, lecture exams are 20% and 30%, and the final exam is 50% of the course grade. For students registered for 4 hours, lecture exams are 15 and 25%, the final exam is 35%, and the project is 25% of the course grade. Improperly giving or receiving aid on an examination will not be tolerated and will be dealt with severely.

Class exercises: There will be class exercises assigned during the semester. Their purpose is to assist you in studying and to provide guidance of what to expect on exams. These exercises will not be graded but you may hand them in for comment prior to each exam. Joint work and discussion of class exercises are encouraged.

Projects: All students are expected to do an individual or group project and present an oral report in some area of mathematical modeling in the life sciences. Students registered for 4 hours credit are expected to prepare a written report; the project with reports is 25% of the course grade. Written project reports are due by the last day of instruction (**Wednesday 2 May)**.

Hint for success: Because of the mathematical nature of this course, it is important that you study course materials and exercises carefully and faithfully, proving to yourself that you understand the material during each session. You cannot be successful by only studying just before the exams. You must do mathematical modeling regularly to understand it.

Course Schedule Spring 2018

Class	Day	Date	Topic
1	Wed	17-Jan	Introduction
2	Fri	19-Jan	Deterministic models of growth and decline
3	Mon	22-Jan	Limited population growth
4	Wed	24-Jan	Growth of individual organisms
5	Fri	26-Jan	Logistic growth in animals and plants
6	Mon	29-Jan	Multiphasic and allometric growth
7	Wed	31-Jan	Deterministic genetic selection models
8	Fri	2-Feb	Simple stochastic models: Binomial and Normal
9	Mon	5-Feb	Simple stochastic models: Poisson and Uniform
10	Wed	7-Feb	Probability
11	Fri	9-Feb	Linear models and least squares
12	Mon	12-Feb	Weighted regression
13	Wed	14-Feb	Alternatives to least-squares
14	Fri	16-Feb	First exam
15	Mon	19-Feb	ANOVA
16	Wed	21-Feb	Goodness-of-fit criteria
17	Fri	23-Feb	Fitting nonlinear models
18	Mon	26-Feb	Nonlinear models and residual analysis
19	Wed	28-Feb	Photosynthesis in plants
20	Fri	2-Mar	Lactation yield in dairy animals
21	Mon	5-Mar	Egg production in chickens
22	Wed	7-Mar	Embryonic mortality
23	Fri	9-Mar	Nonreturn rate in dairy cattle
24	Mon	12-Mar	Differential equations in STELLA
25	Wed	14-Mar	Numerical integration of differential equations
26	Fri	16-Mar	Second Exam
	Mon	19-Mar	Spring Break
	Wed	21-Mar	Spring Break
	Fri	23-Mar	Spring Break
27	Mon	26-Mar	Differential equations
28	Wed	28-Mar	Compartmental models
29	Fri	30-Mar	Compartmental models
30	Mon	2-Apr	Kinetics
31	Wed	4-Apr	Equations in modeling programs
32	Fri	6-Apr	Ligand-receptor interaction, RIA, and ELISA
33	Mon	9-Apr	Epidemiology
34	Wed	11-Apr	Species-competition
35	Fri	13-Apr	Predator-prey and host-parasitoid models
36	Mon	16-Apr	Ruminal digestion
37	Wed	18-Apr	Digestion and passage models
38	Fri	20-Apr	Subcellular/cellular models
39	Mon	23-Apr	Tissue/organ and metabolic models
40	Wed	25-Apr	Broken-line regression and response surface models
41	Fri	27-Apr	Animal, enterprise, farm models/Student presentations
42	Mon	30-Apr	Student presentations
43	Wed	2-May	Student presentations/Reports due
	Fri	4-May	Final Exam (1:30-4:30 p.m.)