

Mathematical Modeling in Ecology
MATH / BIOL 2350 section 001
HONR-SC 2303 section 001
Fall, 2011
TuTh 12:30 – 1:50 PM
Pickard Hall, Room 111

Instructors: Dr. James P. Grover (grover@uta.edu, 817-272-2405, Life Sciences 468)
Dr. Hristo Kojouharov (hristo@uta.edu , 817-272-5763, Pickard Hall 441)

Office Hours: Dr. Grover Tu Th 3:00-5:00 PM, F 10:00-11:00 AM or by appointment
Dr. Kojouharov Tu Th 11:00-11:50 AM or by appointment

Description of Course Content: An introductory course in mathematical modeling techniques in biology with emphasis on construction and interpretation of models in ecology and epidemiology. Computational tools will allow students to work with mathematical models chosen from areas such as optimization, statistics, and difference and differential equations. The goals of this course will include teaching programming skills and illustrating how biological knowledge is used to construct simulation rules in this computational approach.

Student Learning Outcomes: Students will become competent in constructing mathematical models representing problems in ecology and epidemiology, by formulating questions, describing biological phenomena verbally and mathematically, and analyzing the equations that result. Students will become familiar with some of the classical mathematical models in ecology and epidemiology. Students will analyze and derive predictions from simple mathematical models formulated as difference and differential equations, using mathematical and computational tools.

Course Prerequisites: BIOL 1441 and MATH 1426, or permission of the instructors.

Required Textbook: Otto, S.P. and Day, T. 2007. *A Biologist's Guide to Mathematical Modeling in Ecology and Evolution*. Princeton University Press, Princeton, New Jersey.

Other Requirements: Students will need access to a computer with the program MATLAB installed. The Mathematics Department provides a computing facility for this purpose and others may be available on campus. Students will need access to a computer with an internet connection and web browser to obtain various course materials.

Supplementary Material: Instructors will make additional readings available to students as needed.

Course web page: <http://www.uta.edu/math/utter/course2350/>

Grading Policy: Grades are based on weekly homework problems, and on course projects. There are no exams. There is no extra credit.

Homework problems	50%
Projects	50%

Attendance Policy: Attendance is required. Attendance will be taken in each class. In order to encourage students to attend, students having up to one unexcused absence will have five additional points added to their final raw score for the course grade. Beyond one unexcused absence, this 5-point attendance bonus will be reduced by 2 points for each further unexcused absence from lecture.

Homework Policy: Homework assignments will usually be assigned weekly on Thursdays, and written reports will be due the following Thursday. Homework will be an important part of the learning experience in this course, providing a basis for discussions in class. Therefore, all assignments should be completed and brought to class on the due date. Teamwork is encouraged, but each student should prepare their own written report to bring to class when the assignment is due.

Projects: Each student will also complete a course project. The project will be assigned at the end of the second lecture topic in the course outline. It will involve examining and analyzing a biological situation, identifying variables that form the basis of a mathematical model of the biological situation, and explaining relationships among the variables. Students will also be expected to explore some of the consequences and predictions of their model, and discuss modifications to improve it. Students will work in small groups and prepare a written

report and an oral presentation. The report and presentation should summarize the model, the steps taken to analyze it, the conclusions reached, and the possible improvements to the model. A good project report will have an introduction stating the research questions, a description of the model that is used to address these questions, a presentation of analyses, a statement of the findings and conclusions of the analyses, and a description of modifications to improve the model. Project topics will be chosen in consultation with the course instructors by October 18, 2011. A rough draft / progress report on the course project will be due November 10, 2011. Guidance for this report will be given in class. Feedback on project progress will be given in class on November 15, 2011. The oral presentations of the course project will take place during the last week of classes (December 6 and 8, 2011). The written report of the course project will be due on December 1, 2011. The project report will be graded for technical correctness and the clarity and accuracy of its written explanation of how the model relates to the biology. The grade on the project will constitute 50% of the course grade.

Late Work: Written reports for homework assignments should be brought to class on the date assigned. The assignment should be completed to the greatest extent possible. For this class, students are allowed to bring a partially completed problem to class to discuss with instructors and other students. Homework assignments will be scored according to three criteria: (1) the thoroughness and correctness of mathematical analysis; (2) the thoroughness, clarity, and accuracy of verbal descriptions of mathematical analysis and biological context; (3) the extent to which the written report brought to class prepares the student for discussions that take place during class.

Grade disputes: The instructors are willing to review the scoring of homework assignments and projects, but requests to do so must be made *within two weeks of the date that graded work is distributed in class*.

Drop policy: Withdrawal from the course must follow all pertinent University and Departmental regulations and deadline dates. Students who are supported by scholarships from the UTTER Program are expected to make satisfactory progress in this class to maintain their scholarship support. Any student experiencing difficulties leading them to consider dropping the course should talk to the instructors to obtain their advice and help in avoiding any negative consequences. The last date to drop a class and receive a grade of W is November 4, 2011.

Students will not be automatically dropped for non-attendance. Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. Contact the Financial Aid Office for more information.

Incomplete grades: A grade of incomplete will only be assigned for students who are physically unable to complete the course due to serious illness or injury.

Other issues: Class participation is an important aspect of this course, so be considerate of other students and arrive on time. Turn off cell phones and pagers.

Schedule of Lecture Topics

We will try to cover these topics during the semester. However, we will be flexible and will emphasize the topics covered in the first four chapters of the textbook, doing the remainder as time allows.

Topic	Reading
Introduction to mathematical modeling in biology	Chapter 1
How to construct a model	Chapter 2
Deriving classical models	Chapter 3
The mathematics of functions and approximations	Primer 1
Numerical and graphical analysis of models	Chapter 4
Equilibria and stability	Chapter 5

Important University Policies:

Americans with Disabilities Act: The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the Americans with Disabilities Act (ADA). All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies

for obtaining disability-based academic accommodations can be found at www.uta.edu/disability or by calling the Office for Students with Disabilities at (817) 272-3364.

Academic Integrity: It is the philosophy of The University of Texas at Arlington that academic dishonesty is a completely unacceptable mode of conduct and will not be tolerated in any form. All persons involved in academic dishonesty will be disciplined in accordance with University regulations and procedures. Discipline may include suspension or expulsion from the University. According to the UT System Regents' Rule 50101, §2.2, "Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts."

Student Support Services Available: The University of Texas at Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. These resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals to resources for any reason, students may contact the Maverick Resource Hotline at 817-272-6107 or visit www.uta.edu/resources for more information.

Electronic Communication Policy: The University of Texas at Arlington has adopted the University "MavMail" address as the sole official means of communication with students. MavMail is used to remind students of important deadlines, advertise events and activities, and permit the University to conduct official transactions exclusively by electronic means. For example, important information concerning registration, financial aid, payment of bills, and graduation are now sent to students through the MavMail system. All students are assigned a MavMail account. Students are responsible for checking their MavMail regularly. Information about activating and using MavMail is available at <http://www.uta.edu/oit/email/>. There is no additional charge to students for using this account, and it remains active even after they graduate from UT Arlington.

Final Review Week: A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week unless specified in the class syllabus. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. Classes are held as scheduled during this week and lectures and presentations may be given.

After Hours Safety Escort: The Sam Mav Escort service provides a service to assist students, faculty, staff and campus visitors to reach their destinations after regular business hours. The hours of service are 7:00 p.m. to 1:00 a.m., Sunday through Saturday. 817-272-3381.