Dynamical Systems in Biology

MATH / BIOL 3350-001
HONR-SC 3304-001
Spring 2014
TuTh 12:30PM-1:50PM

Pickard Hall, Room 111

Instructors: Dr. Hristo Kojouharov (hristo@uta.edu, 817-272-5763, Pickard Hall 441)
Dr. James P. Grover (grover@uta.edu, 817-272-2405 or -9495, Life Sciences 468 or 206B)

Office Hours: Dr. Kojouharov — Tuesday and Thursday 2:00 PM – 3:00 PM, or by appointment
Dr. Grover — Monday 3:00-5:00 PM, Tuesday 2:00-3:00 PM, Friday 10:00-11:00 AM, or by appointment

Description of Course Content: An introductory course in the existence and properties of solutions of differential and difference equations, qualitative analysis methods, and numerical solution of differential equations using finite-difference methods. Laboratory work will include use of Matlab in solving biologically motivated mathematical problems.

Student Learning Outcomes: Students will become competent in analyzing and deriving predictions from discrete-time and continuous-time models in ecology and epidemiology. Students will become familiar with some of the mathematical and computational tools for determining the equilibria and their stability properties of difference and differential equations, and for obtaining analytical and numerical solutions to single- and multiple-variable models.

Course Prerequisites: C or better in BIOL/MATH 2350, 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/course3350/

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

Homework problems	50%
Mini-Projects	50%

Attendance Policy and Other Issues: Regular attendance is *required*. This course requires you to be an *active* participant. Class participation is an important aspect of this course, so be considerate of other students and arrive on time. Please turn off cell phones, tablets, and other electronic devices.

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. Some assignments will be completed by pairs of students identified by the instructors. Communication is encouraged, but each student or pair of students should complete their own written report to bring to class when the assignment is due.

Mini-Projects: Mini-projects will be assigned regularly throughout the semester and you will have two weeks to complete them. They will involve examining and analyzing a biological situation, identifying variables that form the basis of a mathematical model of the biological situation, explaining relationships among the variables, analyzing the model, and clearly stating the findings and conclusions of the analyses. Students will work in groups of 3 or 4 to complete the mini-projects and will be required to provide written reports.

Late Work: Written reports for homework assignments and mini-projects 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.

Expectations for Out-of-Class Study: Beyond the time required to attend each class meeting, students enrolled in this course should expect to spend at least an additional 9 hours per week of their own time in course-related activities, including reading required materials, completing assignments, working on projects, etc.

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. Any appeal of a grade in this course must follow the procedures and deadlines for grade-related grievances as published in the current undergraduate catalog; see http://wweb.uta.edu/catalog/content/general/academic_regulations.aspx#10

Drop policy: Withdrawal from the course must follow all pertinent University and Departmental regulations and deadline dates (see below). 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. **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 (http://wweb.uta.edu/aao/fao/). All university and departmental policies governing course withdrawal will be applied. Students should be aware of relevant regulations regarding withdrawal and deadline dates.

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. Students facing difficulty completing the course should consult the instructor at the earliest opportunity.

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 Chapters 4-8 of the textbook, doing the remainder as time allows.

Topic	Reading
Numerical and graphical analysis of models	Chapter 4
Equilibria and Stability Analyses--One-Variable Models	Chapter 5
General Solutions and Transformations--One-Variable Models	Chapter 6
Linear Algebra	Primer 2
Equilibria and Stability Analyses--Linear Models with Multiple Variables	Chapter 7
Equilibria and Stability Analyses--Nonlinear Models with Multiple Variables	Chapter 8
General Solutions and Transformations--Models with Multiple Variables	Chapter 9

Important University Policies:

University Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. 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. For more information, contact the Office of Financial Aid and Scholarships (http://wweb.uta.edu/ses/fao).

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: All students enrolled in this course are expected to adhere to the UT Arlington Honor Code:

> *I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*
> *I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

Instructors may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University.

Student Support Services: UT 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. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at www.uta.edu/resources.

Electronic Communication: UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students

are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at http://www.uta.edu/oit/cs/email/mavmail.php.

Student Feedback Survey: At the end of each term, students enrolled in classes categorized as lecture, seminar, or laboratory shall be directed to complete a Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit http://www.uta.edu/sfs.

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. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Emergency Exit Procedures: Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist handicapped individuals.