Math 5365–001: Biomathematics
Spring 2017, PKH 311, TTh 11:00 AM–12:20 PM

Instructor: Dr. Christopher Kribs
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Office Hours: before class & by appointment

Prerequisite: MATH 3318
Text: Brauer & Castillo-Chávez, *Mathematical models in population biology and epidemiology*, 2nd edition, Springer, New York, 2012.
Course home page: `http://mathed.uta.edu/kribs/5365.html`
Last day for withdrawal: March 31
Final exam period: Tuesday, May 9, 11:00 AM–1:30 PM (note time)
Course content (from the Graduate Catalog): Mathematical techniques used in modeling such as perturbation theory, dimensional analysis, Fourier analysis, and differential equations. Applications to morphogenetics, population dynamics, compartmental systems, and chemical kinetics.

This semester's offerings will focus on using dynamical systems to model population dynamics.

LEARNING OUTCOMES: The successful student will be able to:

- *analyze qualitative behavior of nonlinear dynamical systems* including systems of ordinary differential equations, difference equations, and (to a more limited extent) delay differential equations, and integral equations;
- *apply standard dynamical systems qualitative analysis techniques* including linearization, characteristic equations, the Jury criteria, Routh-Hurwitz criteria, Poincaré-Bendixson Theorem, Dulac's Criterion, Laplace transforms;
- *apply standard dynamical systems quantitative analysis techniques* to approximate solutions, generate stochastic simulations and distributions, and fit parameter values to data;
- *develop mathematical models of biological phenomena using dynamical systems*;
- *interpret results of dynamical systems analysis in population biological terms*;
- *communicate effectively and clearly* the analysis and interpretation(s) of such models.

GRADES: Course grades will be determined (using a standard ten-point scale) by graded homework assignments including a modeling project and a class presentation. Further details on individual assignments will be provided throughout the semester. Students are expected to keep track of their performance throughout the semester and seek guidance from available sources (including the instructor) if their performance drops below satisfactory levels.

POLICIES:

Expectations for class time: This class meets every Tuesday and Thursday (except spring break) from January 17 to May 9. Students are expected not only to attend, but to actively participate in, class discussions, in order to maximize learning and help the instructor gauge the pace, and to seek help (from the instructor or others) on homework problems *before* the class session at which they are due. Class time will be available to address misconceptions and confusions common to many students in the class, but it is often not possible to devote time to going over every problem on which anyone had difficulty. As a sign of respect for your peers and our common work, please keep

all cellular phones, computers, and other electronic devices turned off during class. In emergencies cell phones may be set to vibrate only, and brief calls taken in the hallway outside.

Expectations for out-of-class study: The general rule of thumb for college courses is that for every hour spent in class, a student should spend 3 hours per week outside of class working on the course (thus a 9-hour load is considered full-time: $9 \times 4 = 36$). This includes time spent reading, studying, working on homework, consulting the instructor or tutors, etc. If you find yourself spending significantly more on this class, consult the instructor proactively to address the issue.

Attendance: Class attendance has been shown to be directly correlated with students' grades in general. Although there is no explicit penalty for absences, students who miss class remain responsible for understanding the topics, vocabulary, techniques, and notation used in class (as much as possible this will be consistent with the text). Students are also expected to make every effort to arrive on time (important announcements are often made at the beginning of class and not repeated), and to minimize disruption if they arrive late.

Late papers: Each student is allowed one late submission during the semester. The paper must be submitted before the beginning of the class period following that in which it was due. Papers not submitted by the end of class time on the due date are considered late. Submission of a late paper constitutes the student's agreement that this is the one allowed late assignment.

Electronic submissions: Each student is allowed one electronic submission during the semester. Electronic submissions must include all details necessary for grading. (If the electronic submission is made late, then it is both the only late paper and the only electronic submission.)

Everything else: Class policy on drops, withdrawals, academic honesty, grade grievances, and disabilities follows the University policy on these matters. Copies can be obtained upon request.

Presentations

As one of the course assignments, each student should select a paper from the published literature on population dynamics modeling, in consultation with the instructor, prepare a *one-page* written summary review of the article (see below), and develop a short presentation on the article, to be given at the end of class on one of the days after spring break (date to be reserved first come, first served, written review due with presentation). The paper may involve topics not yet covered in class, so reading it thoroughly may require consulting the instructor or others.

The written review should contain the following paragraphs: (1) a summary of the article topic, explicitly including the research question to be answered through mathematical modeling, (2) a summary of the modeling and analysis techniques employed in the article, (3) a summary of the results of the analysis, (4) to what extent the article used modeling to answer the research question successfully, and what the answers were. Diagrams OK but no computations.

Tentative calendar

Beginning after spring break, lectures will leave time for presentations (q.v.).

Wk	Topic	Wk	Topic
1	Modeling, ODEs	9	Bifurcations, normal forms
2	Difference eqns	10	Modeling contact rates
3	Delay & integral eqns	11	Cell models, sociology
4	ODE systems, predator-prey	12	Parameter estimation
5	Global analysis tools	13	Stochastic models
6	Epidemic models, R_0	14	Singularities, timescale arguments
7	Compartmental models	15	Periodic epidemic models
8	Sys. w/ fixed delays	16	Final projects due

This calendar and syllabus may be updated as necessary throughout the semester.

University Policies

Attendance: At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator in student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. See the course-specific policy in the syllabus. However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients "begin attendance in a course." UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an engagement online via Blackboard. This date is reported to the Department of Education for federal financial aid recipients.

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).

Disability Accommodations: UT 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), The Americans with Disabilities Amendments Act (ADAAA),* and *Section 504 of the Rehabilitation Act.* 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 disability. Students are responsible for providing the instructor with official notification in the form of **a letter certified** by the Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting: **The Office for Students with Disabilities, (OSD)** www.uta.edu/disability or calling 817-272-3364. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability. **Counseling and Psychological Services, (CAPS)** www.uta.edu/caps/ or calling 817-272-3671 is also available to all students to help increase their understanding of personal issues, address mental and behavioral health problems and make positive changes in their lives.

Non-Discrimination Policy: The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit uta.edu/eos.

Title IX: The University of Texas at Arlington ("University") is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. *For information regarding Title IX, visit* www.uta.edu/titleIX or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or jmhood@uta.edu.

Academic Integrity: 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.*

UT Arlington faculty members may employ the Honor Code in their courses by 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. Additional information is available at https://www.uta.edu/conduct/. *Papers involving plagiarism will receive an indelible grade of zero.*

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.

To obtain your NetID or for logon assistance, visit https://webapps.uta.edu/oit/selfservice/. If you are unable to resolve your issue from the Self-Service website, contact the Helpdesk at helpdesk@uta.edu or (817)272-2208.

Campus Carry: Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit http://www.uta.edu/news/info/campus-carry/

Student Feedback Survey: At the end of each term, students enrolled in face-to-face and online classes categorized as "lecture," "seminar," or "laboratory" are directed to complete an online 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 via the SFS database is aggregated with that of other students enrolled in the course. Students' anonymity will be protected to the extent that the law allows. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law and aggregate results are posted online. Data from SFS is also used for faculty and program evaluations. 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.

Grade Grievances: Any appeal of a grade in this course must follow the procedures and deadlines for grade-related grievances as published in the current graduate catalog.

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 make arrangements to assist individuals with disabilities.

Student Support Services: UTA 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.

The IDEAS Center (2nd Floor of Central Library) offers free tutoring to all students with a focus on transfer students, sophomores, veterans and others undergoing a transition to UT Arlington. To schedule an appointment with a peer tutor or mentor email IDEAS@uta.edu or call (817) 272-6593.

Emergency Phone Numbers: In case of an on-campus emergency, call the UTA Police Department at **817-272-3003**, or dial 911.