MATHEMATICS 5355.001
BIOMATHEMATICS II
SPRING 2015

Professor: Dr. Linda Allen; Office: Math 117 I
Office Hours: TR: 11:00 a.m.–12:00 p.m., 2:00 p.m.–3:00 p.m.
. or by appointment.

Class Meeting Time and Room: TR: 12:30 p.m.–1:50 p.m, Math 115

Course Website: www.math.ttu.edu/∼linallen/Math5355Spring2015.html

Textbook: *An Introduction to Stochastic Processes with Applications to Biology* Second Ed. by L. J. S. Allen and supplementary textbooks and articles.

Main Topics Covered:

Chapter 1: Review of Probability
Chapter 2: Discrete-Time Markov Chains
Chapter 3: Biological Applications of Discrete-Time Markov Chains*
Chapter 4: Discrete-Time Branching Processes
Chapter 5: Continuous-Time Markov Chains
Chapter 6: Continuous-Time Birth and Death Chains
Chapter 7: Biological Applications of Continuous-Time Markov Chains*
Chapter 8: Diffusion Processes and Stochastic Differential Equations
Chapter 9: Biological Applications of Stochastic Differential Equations*
*selected topics

Expected Learning Outcomes: The goals of this course are to become familiar with the theory of stochastic processes and to apply this theory to study models of biological systems. 1) Students will review topics from probability theory, useful to the study of stochastic processes, including discrete and continuous random variables, probability distributions and densities, generating functions, and summary statistics. 2) Students will learn about mathematical properties of discrete-time Markov chains (DTMC), including recurrent, transient, periodic and aperiodic chains, transition matrix, and the basic limit theorem for ergodic Markov chains. Applications to random walks, logistic growth, and epidemic processes will be studied. 3) Students will learn about discrete-time and continuous-time branching processes, useful in predicting probability of extinction (absorption) or persistence in stochastic population models. 4) Students will learn about mathematical properties of continuous-time Markov chains (CTMC), including recurrent, transient, and non-explosive chains, forward and backward Kolmogorov equations, and the basic limit theorem for ergodic Markov chains. Important applications of continuous-time Markov chains will be given to simple birth, death and immigration processes and to multivariate processes such as epidemic and competition processes. 5) Students will learn about mathematical properties of diffusion processes, Markov processes continuous in state and in time, Brownian motion, forward and backward Kolmogorov differential equations, and stochastic differential equations (SDE). Applications to populations, epidemics, enzyme kinetics and population genetics processes will be studied. 6) Students will develop several MaTLaB programs to numerically compute sample paths of the various stochastic processes (DTMC, CTMC and SDE).

Methods of Assessment of Learning Outcomes: Continuous formative assessment of the progress of the course will occur via ongoing communication between the instructor and the students. To this end, all students are encouraged to ask questions during class and to seek the instructor's help outside of class when needed. Formal assessment occurs through two exams, regularly assigned homework, written and oral project and attendance. (See descriptions below.)

Exams, Homework, Project: There will be two exams. Homework will be assigned regularly and collected on Tuesday. A written and oral project on a topic of your choice is required. Suitable projects can be found in the mathematical biological literature and must be approved by the instructor. Techniques for model analysis and simulation must relate to techniques learned in this course. The grade for the course will be based on exams, homework, oral and written project and attendance. There will be no make-up on exams, homework or projects except in cases of illness or participation in a university-sponsored event.

Assessment: The assessment of student progress will include (1) Two exams (45%), (2) Homework (40%), (3) Project (15%), (4) Attendance (borderline grades).

Assignment	Date
Exam 1	Thursday, February 19
Exam 2	Thursday, April 2
Abstract & References	Thursday, April 9
Written Project	Monday NOON, May 11
Oral Presentation	Tuesday, May 12 (1:30 p.m.-4:00 p.m.)

Important Dates and Facts:

1. Monday, January 19, Martin Luther King Jr Day
2. Friday, January 30, Last day of student-initiated drop **without** academic penalty
3. Saturday-Sunday, March 14-22, Spring vacation
4. Wednesday, March 25, Last day of student-initiated drop **with** academic penalty
5. Monday, April 6, Easter Monday
6. Tuesday, May 5, Last day of classes
7. **Civility in the Classroom**: Texas Tech University endeavors to foster a classroom climate of mutual respect among students and between students and teacher. Mutual respect means that we should be tolerant of different ideas and varying opinions about topics of discussion in class, that we address each other respectfully and without interrupting while others are speaking, and that we do not engage in disruptive behavior in class. Signs of disrespect include, but are not restricted to: ringing cell phones (students must turn them off or leave them home), reading a newspaper or other material that is not part of a class assignment while in class, talking with classmates during class, eating and drinking in class, and similar disruptive behaviors. Students who engage in disruptive behavior will be warned. Repeated disruptive behavior may result in the student being asked to leave the classroom.
8. **Academic Honesty**: The TTU Code of Student Conduct, which you should have received when you enrolled in the university, contains a lengthy list of prohibited behaviors, among which is Academic Dishonesty. Please note that cheating and plagiarism (a form of cheating) are included among the actions that are subject to disciplinary action. *Plagiarism*: The appropriation or imitation of the language, ideas, and thoughts of another author, and representation of them as ones original work. The Random House College Dictionary, revised edition. New York: Random House, 1975, p. 1014. 1. The use, by paraphrase or direct quotation, of the published or unpublished work of another person without full and clear acknowledgement; 2. the unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials. Student Affairs Handbook, Texas Tech University, Lubbock, Texas, 1998-99, p. 22. Plagiarism and cheating are not tolerated and will result in a grade of 0 on exams or on work that contains plagiarized material. In addition, a grade of F may be awarded for the course. Any cases of plagiarism or cheating will be reported to the Honors College and the responsible academic dean (i.e., Arts & Sciences, Business Administration, Engineering, etc.) for such disciplinary action as they see fit to administer.
9. **Accommodation of Students with Disabilities**: Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructors office hours. Please note instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided. For additional information, you may contact the Student Disability Services office in 335 West Hall or 806-742-2405.
10. **Student Absence for Observation of Religious Holy Days**: A student who is absent from classes for the observation of a religious holy day shall be allowed to take an examination or complete an assignment scheduled for that day within a reasonable time after the absence if, not later than the fifteenth day after the first day of the semester, the student had notified the instructor of each scheduled class that the student would be absent for a religious holy day.