MATHEMATICS 5355
BIOMATHEMATICS II
Spring 2017

Professor: Dr. Angela Peace; Office: Math 243; Math Office Phone: 806-834-1014
Office Hours: MW: 12:30 p.m.–2:00 p.m., or by appointment.

Class Meeting Time and Room: MW: 2:00 p.m.–3:20 p.m, Math 108

Course Website: www.math.ttu.edu/∼anpeace/MATH5355.html

Textbook: *An introduction to stochastic processes with applications to biology* by LJS Allen and supplementary material.

Main Topics Covered:

Chapter 1: Review of Probability
Chapter 2: Discrete-Time Markov Chains
Chapter 3: Biological Applications of Discrete-Time Markov Chains*
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 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 exams, homework, written and oral project and attendance. (See descriptions below.)

Exams, Homework, Project: There will be two exams. Homework will be assigned and collected weekly. 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 includes: (1) Two exams (40%), (2) Homework (20%), (3) Project (40%)

Assignment	**Date**
Exam 1	Monday, February 27
Project Proposal	Monday, March 20
Exam 2	Monday, April 24
Written Project	Monday, May 8
Oral Presentation	Friday, May 12 (1:30 p.m.-4:00 p.m.)

Important Dates and Facts:

1. January 18, Last day of student-initiated drop **without** academic penalty
2. March 12-18, Spring Break
3. March 29, Last Day to Declare Pass/Fail Intentions
4. May 9, Last day of classes
5. **Civility in the Classroom**: Texas Tech University is a community of faculty, students, and staff that enjoys an expectation of cooperation, professionalism, and civility during the conduct of all forms of university business, including the conduct of student–student and student–faculty interactions in and out of the classroom. Further, the classroom is a setting in which an exchange of ideas and creative thinking should be encouraged and where intellectual growth and development are fostered. Students who disrupt this classroom mission by rude, sarcastic, threatening, abusive or obscene language and/or behavior will be subject to appropriate sanctions according to university policy.
6. **Academic Integrity**: It is the aim of the faculty of Texas Tech University to foster a spirit of complete honesty and high standard of integrity. The attempt of students to present as their own any work not honestly performed is regarded by the faculty and administration as a most serious offense and renders the offenders liable to serious consequences, possibly suspension. Scholastic dishonesty includes, but it not limited to, cheating, plagiarism, collusion, falsifying academic records, misrepresenting facts, and any act designed to give unfair academic advantage to the student (such as, but not limited to, submission of essentially the same written assignment for two courses without the prior permission of the instructor) or the attempt to commit such an act.
7. **Observance of Religious Holy Day**: "Religious holy day" means a holy day observed by a religion whose places of worship are exempt from property taxation under Texas Tax Code 11.20. A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. A student who is absent from classes for the observance 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. A student who is excused may not be penalized for the absence; however, the instructor may respond appropriately if the student fails to complete the assignment satisfactorily.
8. **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, please contact Student Disability Services in West Hall or call 806-742-2405.