



KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

DEPARTMENT OF MATHEMATICS

STAT 416: Stochastic Processes for Actuaries Term 232

Instructor: Dr. Brahim Mezerdi

Office: Building 5 – Room 330

Phone: 2189

Email: brahim.mezerdi@kfupm.edu.sa

Office Hours: UT 11:00 – 12:00 and 09:00 – 10:00 or by appointment

Time: UTR 12:00 PM – 12:50 PM

Place: Building 63 – Room 022

Textbook: Sheldon M. Ross, Introduction to Probability Models, 11-th edition (2014)

Additional References:

- **Rick Durrett**, Essentials of Stochastic Processes (1999) ISBN 0-387-98836-X

Course Description:

Basic classes of stochastic processes. Poisson (regular, compound, compound surplus, and nonhomogenous) and renewal processes with applications in simple queuing systems and Actuarial Science. Discrete and continuous time Markov chains. Birth-Death and Yule processes. Branching models of population growth processes. Discrete processes in option pricing models and the binomial model. Arithmetic and geometric Brownian motions, and applications of these processes to pricing of options both in discrete and continuous time.

Course Objectives

1. Enable students to describe the properties of Poisson processes
2. Enable students to describe the properties of discrete and continuous Markov chains
3. Enable students to use Stochastic process models to real applications.

Assessment for this course is based on class activities (Quizzes), a midterm exam and a comprehensive final exam, as described in the following table.

Grading Policy:

	Date	Time	Place	Materials	Percentage
Major Exam I	TBA	TBA	TBA	TBA	25 %
Major Exam II	TBA	TBA	TBA	TBA	25 %
Final Exam	TBA	TBA	TBA	Comprehensive	35 %
Project					8 %
Class Work				It is based on quizzes, class tests or other class activities determined by the instructor.	7 %

Academic Integrity: All KFUPM policies regarding ethics and academic honesty apply to this course.

Important Attendance Notes:

- In accordance with University rules, **9 unexcused absences 12 excused-unexcused absences** will automatically result in a grade of **DN**.
- Attendance on time is very important. Mostly, attendance will be checked within the first five minutes of the class. Entering the class after that, is considered as one late, and every two times late equals to one absence. The student has to be available until the end of the class.

Suggested Problems:

- ✓ Suggested problems will be posted on the BLACKBOARD towards the end of each chapter.

Cheating in Exams:

Cheating or any attempt of cheating by use of illegal activities, techniques and forms of fraud will result in a grade of **DN** in the course along with reporting the incident to the higher university administration. Cheating in exams includes (but is not limited to)

- Looking at the papers of other students
- Talking to other students
- Using mobiles or any other electronic devices **including Smart Watch**

Missing an Exam: In case a student misses an exam (Exam I, Exam II, or the Final Exam) for a legitimate reason (such as medical emergencies), she/he must bring an official excuse from Students Affairs. Otherwise, she/he will get zero in the missed exam.

The Usage of Mobiles in Class: Students are not allowed to use mobiles for any purpose during class time. Students who want to use electronic devices to take notes must take permission from their instructor. Violations of these rules will result in a penalty decided by the instructor.

Syllabus – A rough weekly guideline

Week #	Date	Section	Material	Notes
1	Jan 14 - 18	Chapt 1	Introduction to Probability theory Events, sigma fields, probability spaces	
2	Jan. 21 - 25	Chapt 2	Discrete and continuous random variables Expectation, variance,	
3	Jan. 28 – Feb. 01	Chapt 2	Random vectors, joint distributions, covariance, independence of random variables.	
4	Feb. 4 – 8	Chapt 3	Conditional probability and conditional expectation Properties and examples	
5	Feb. 11 – 15	Chapt 4	Markov chains Chapman – Kolmogorov Equation Classification of States	
6	Feb. 18 – 21	Chapt 4	Limiting Probabilities Some applications Mean time Spent in Transient States	
Thursday Feb. 22: Saudi Founding Day Holiday				

7	Feb. 25- 29		Branching Processes Time Reversible Markov Chains,	
8	March 3 - 7	Chapt 5	The Exponential distribution The Poisson Process	
9	March 10 – 14	Chapt 5	The Poisson Processes Generalization of the Poisson Processes	
10	March 17 – 21	Chapt 6	Continuous-Time Markov Chains Birth and Death Processes	
11	March 24 – 28	Chapt 7	Renewal theory and applications	
March 29- April 18: Eid El Fitr Holidays				
12	April 21 - 25	Chapt 7	Queuing Theory Exponential Models	
13	April 28 – May 2	Chapt 9	Option pricing for discrete models The binomial model in finance	
14	May 5 – 9	Chap 9	Brownian Motion Geometric Brownian motion Continuous time processes	
15	May 12 - 16	Chapt 10	Pricing European Options The Black Scholes equation and formula	
16	May 19		Normal Thursday Class (Revision/ Catching up)	Normal Thursday Class
Final Exam (Comprehensive): As posted on the Registrar Website				

Communication:

- For regular announcements, students are advised to check Blackboard regularly.