KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICS
STAT 416: Stochastic Processes for Actuaries (241)

Instructor: Dr. Kroumi Dhaker

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Office Hours: UTR 2:00 PM – 4:00 PM or by appointment
Time: UTR 10:00 AM – 11:00 AM
Place: Building 76 – Room 2126

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

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

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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. Actuarial risk models, simulation. Arithmetic and geometric Brownian motions, and applications of these processes such as in computation of resident fees for continuing care retirement communities, and pricing of financial instruments.

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

Grading Policy:

	Date	Time	Place	Materials	Percentage
Exam I	TBA	TBA	TBA	(Chapters 1,2,3,4)	25%
Exam II	TBA	TBA	TBA	(Chapters 5,6,7)	25%
Final Exam	TBA	TBA	TBA	Comprehensive	35%
Absences + Participation					5%
Class Work	It is based on quizzes, class tests or other class activities determined by the instructor.				10%

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

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

Important Attendance Notes:
- ➤ In accordance with University rules, **9 (NINE) unexcused absences** or **12 (TWELVE) 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.

Grading:
Your course grade will be based on the total of points accumulated on class work two major exams, and Final Exam. The following scale gives the cut-off points for the course grades.

Letter grade	A+	A	B+	B	C+	C	D+	D	F	DN
Cut-off	90%	85%	80%	75%	67%	60%	55%	50%	<50%	≥ 9

Syllabus – A rough weekly guideline

Week #	Date	Section	Material
1	Aug 25 – 29	Chapter 1 Chapter 2 Chapter 3	Introduction to Probability theory (review) Random variables (review) Conditional Probability and Conditional Expectation (review)
2	Sep 01 – 05	4.1 4.2 4.3	Introduction, Chapman – Kolmogorov Equation Classification of States
3	Sep 08 – 12	4.3 4.5 4.6	Limiting Probabilities Some applications Mean time Spent in Transient States
4	Sep 15 – 19	4.7 4.8	Branching Processes Time Reversible Markov Chains,

			National Day Holidays	
	Sep 22 – 23			
5	Sep 24 – 26	5.1	Introduction	
		5.2	The Exponential distribution	
		5.3	The Poisson Process	
6	Sep 29 – 03	5.3	The Poisson Processes (cont.)	
		5.4	Generalization of the Poisson Processes	
7	Oct 06 – 10	6.1	Introduction	
		6.2	Continuous-Time Markov Chains	
		6.3	Birth and Death Processes	
8	Oct 13 – 17	6.4	The Transition Probability	
		6.5	Limiting Probabilities	
		6.6	Time Reversibility	
9	Oct 20 – 24	7.1	Introduction,	
		7.2	Distribution of $N(t)$	
		7.3	Limit Theorems and their Applications	
10	Oct 27 – 31	7.4	Renewal Reward Processes	
		7.5	Regenerative Processes	
		7.6	Semi-Markov Processes	
		7.7	The Inspection Paradox	
11	Nov 03 – 07	7.8	Computing the Renewal Function	
		7.9	Applications to Patterns	
		7.10	The Insurance Ruin Problem	
	Nov 10 – 14		**Midterm Break**	
12	Nov 17 – 21	8.1	Introduction	
		8.2	Preliminaries	
		8.3	Exponential Models	
13	Nov 24 – 28	8.4	Network of Queues	
		8.5	The System M/G/1	
		8.6	Variation on the M/G/1	
		8.7	Model G/M/1	
14	Dec 01 – 05	10.1	Brownian Motion	
		10.2	Hitting Times	
		10.3	Variations on Brownian Motion	
15	Dec 08 – 12	10.4	Pricing Stock Options	
		10.5	The Maximum of Brownian Motion with Drift	
16	Dec 15 – 16		Revision	
	Final Exam (Comprehensive): As posted on the Registrar Website			

Suggested Problems

Chapter	Suggested Problems
Chapter 1	1, 11, 14, 21, 29, 33, 40
Chapter 2	6, 9, 16, 33, 36, 39, 68
Chapter 3	2, 3, 9, 12, 15, 19, 23, 38, 54, 58
Chapter 4	1, 2, 5, 6, 8, 14, 18, 21, 23, 25, 28, 30, 36, 46, 52, 54, 56, 57, 60, 61, 63, 64, 66
Chapter 5	2, 4, 9, 14, 20, 23, 38, 39, 42, 43, 44, 59

Chapter 6	2, 3, 6, 13, 14, 15, 16, 18, 20, 22, 23, 24
Chapter 7	2, 6, 7, 8, 9, 10, 12, 27, 37, 38, 39
Chapter 8	1, 3, 6, 8, 16, 18, 29, 31, 39