

College of Science Department of  
Mathematics Course syllabus:  
Stochastic process  
First semester 2020/2021

1. Instructor Information:

Instructor Name	Ahmad M. H. Al-khazaleh		
Office Hours			
Office Number and Telephone Extension	2153		
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2. Course Description:

Markov chains, transition probability, classification of states, branching and queueing chains, stationary distributions of Markov chain, Poisson processes, continuous-time Markov processes.

3. Course Information

<b>Course Code:</b> 401434	<b>Course Title:</b> Stochastic process	<b>Level:</b> Forth year
<b>Delivery Mode:</b> Lecture	<b>Pre-requisite:</b> 401331	<b>Day(s) and Time:</b>
<b>Academic year:</b> 2020-2021	<b>Semester:</b>	<b>Credit Hours:</b> 3

4. Course Objectives:

1. Calculate conditional probability, conditional expectation, and conditional variance
2. Define Markov chains in discrete and continuous time.
3. Describe continuous time Markov chains and birth and death processes

5. Intended Student Learning Outcomes

1. Make use of the knowledge of mathematical techniques conditional probability.
2. Students should be able to apply conditional expectation, and conditional variance.
3. Students should be able to know the concepts Markov chains in discrete and continuous time.
4. Students should be able to know Chapman-Kolmogorov equations. Classify Markov chains in discrete and continuous time as recurrent and transient states, periodicity and irreducibility. Calculate transition probabilities. Compute limiting probabilities for Markov chains. Calculate absorption probabilities and the expected time to absorption for Markov chains.

6. Course Content:

Week	Chapter	Subject	Pages and Assignments
1 – 3	<u>Chapter 1</u> Introduction	1. Stochastic Modeling 2. Probability Review 3. The Major Discrete Distributions 4. Important Continuous Distributions 5. Some Elementary Exercises 6. Useful Functions, Integrals, and Sums	
4-7	<u>Chapter 2</u> Conditional Probability and Conditional Expectation	1. The Discrete Case 2. The Dice Game Craps 3. Random Sums 4. Conditioning on a Continuous Random Variable	
8 – 11	<u>Chapter 3</u> Markov Chains: Introduction	1. Definitions 2. Transition Probability Matrices of a Markov Chain 3. Some Markov Chain Models 4. First Step Analysis 5. Some Special Markov Chains 6. Functional of Random Walks and Success Runs 7. Branching Processes	
12-14	<u>Chapter 4</u> The Long Run Behavior of Markov Chains	1. Regular Transition Probability Matrices 2. Examples 3. The Classification of States 4. The Basic Limit Theorem of Markov Chains 5. Reducible Markov Chains	

7. Assessment:

Assessment	Grade Proportion	Week/Dates
<b>Class Work (Quizzes, Homework and Attendance of the lecture)</b>		
<b>First exam</b>	<b>25 %</b>	<b>7<sup>th</sup> Week</b>
<b>Second exam</b>	<b>25 %</b>	<b>12<sup>th</sup> Week</b>
<b>Final exam</b>	<b>50 %</b>	<b>End of Semester</b>
<b>Total</b>	<b>100 %</b>	

8. Text Book:

<b>The main reference</b>	<b>Introduction to Probability Models</b>
<b>Author(s)</b>	<b>Sheldon M. Ross</b>
<b>Publisher</b>	Elsevier
<b>Year</b>	2014
<b>The edition</b>	11 <sup>th</sup> edition
<b>The reference website</b>	

9. References and additional resources:

1)	An Introduction To Stochastic Modeling, Howard M. Taylor and Samuel Karlin Third Edition 1998 Academic Press
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