مركز الاعتماد وضمان الجودة
ACCREDITATION & QUALITY ASSURANCE CENTER

The University of Jordan

Accreditation & Quality Assurance Center

COURSE Syllabus:
Stochastic Processes

1	Course title	**Stochastic Processes**
2	Course number	**(0301334)**
3	Credit hours (theory, practical)	**3**
	Contact hours (theory, practical)	**3**
4	Prerequisites/corequisites	**0301333**
5	Program title	**B.Sc.**
6	Program code	
7	Awarding institution	**The University of Jordan**
8	Faculty	**Science**
9	Department	**Mathematics**
10	Level of course	**Elective**
11	Year of study and semester (s)	**3rd year, 2nd semester and 4th year, first semester.**
12	Final Qualification	**B.Sc. in Mathematics**
13	Other department (s) involved in teaching the course	**None**
14	Language of Instruction	**English**
15	Date of production/revision	**14/11/2017**

16. Course Coordinator:

Office numbers, office hours, phone numbers, and email addresses should be listed.

Dr. Ahmad Alzghoul

17. Other instructors:

Office numbers, office hours, phone numbers, and email addresses should be listed.

18. Course Description:

As stated in the approved study plan.
Markov chains, transition probability, classification of states, branching and queueing chains, stationary distributions of Markov chain, Poisson counting processes, continuous-time Markov processes.

A- Aims:

1. Computing conditional probability, conditional expectation, and conditional variance for ordinary and compound distributions.
2. Define Markov chains in discrete and continuous time.
3. Describe Counting Processes and inter-arrival times, especially Poisson and compound Poisson processes.
4. Describe continuous time Markov chains and birth and death processes.

B- Intended Learning Outcomes (ILOs):

Successful completion of the course should lead to the following outcomes:

A. Knowledge and Understanding Skills: Student is expected to

A1. Define conditional probability and be able to

(a) Compute conditional probabilities for discrete and continuous distributions.

(b) Compute conditional expectation and conditional variance for compound distributions.

A2. Classify Markov chains and be able to

a) Find Chapman-Kolmogorov equations.
b) Classify Markov chains in discrete and continuous time as recurrent and transient states, periodicity and irreducibility.
c) Calculate transition probabilities.
d) Compute limiting probabilities for Markov chains.
e) Calculate absorption probabilities and the expected time to absorption for Markov chains.
f) Compute probability of extinction in branching processes.

A3. Define Poisson and counting processes and be able to

a. Find inter-arrival and waiting time distributions.

b. Compute waiting time probability and waiting time mean.

c. Compute waiting time probability and mean for compound Poisson process.

A4. Define continuous-time Markov chains and be able to

a) Compute Birth and Death rates and transition probabilities.
b) Find the transition probability function.
c) Compute limiting probabilities of continuous-time Markov chains

B. Intellectual Analytical and Cognitive Skills: Student is expected to

B1. Choose proper Stochastic model and conduct proper calculations for different applications.
B2. Model discrete and continuous Markov chains, Poisson and compound Poisson, and Birth-Death processes.

C. Subject- Specific Skills: Student is expected to

C1. Propose proper Stochastic models for real-life applications.

D. Creativity /Transferable Key Skills/Evaluation: Student is expected to

D1. Develop real-life problems to satisfy proper Stochastic models and do necessary analysis to make some predictions and other inferences.

20. Topic Outline and Schedule:

1.

Topic	Week	Instructor	Achieved ILOs	Evaluation Methods	Reference
Computing conditional mean, conditional variance, and conditional probabilities.	2		A1(a), A1(b)		
Poisson and binomial compounding distributions.	3		A1(a), A1(b)		
Markov Chains, definition and examples of Markov chains. Chapman-Kolmogorov equations.	4		A2(a)		
Classifications of states	5-6		A2(b), A2(c)		
Limiting distributions	7		A2(d)		
Exponential distribution and its properties and Poisson Counting process.	8-9		A2(e)		
Properties of Poisson Process	10		A3(a), A3(b), A3(c)		
Generalization of the Poisson Process; non-homogeneous and compound Poisson processes.	11		A3(a), A3(b), A3(c)		
Continuous-time Markov chains, birth-death process	12-13		A4(a), A4(b)		
Transition probabilities	14		A4(a), A4(b)		
Limiting probabilities	15		A4(c)		

21. Teaching Methods and Assignments:

Development of ILOs is promoted through the following <u>teaching and learning methods</u>:

In order to succeed in this course, each student needs to be an active participant in learning – both in class and out of class.

- The instructor will spend most of the class time on presenting the new material as well as on discussing homework problems.
- Group work in this class is encouraged.
- To actively participate in class, you need to prepare by reading the textbook and to do all assigned problems before class. (Problems will be assigned each class period, then to be discussed the following period).
- You should be prepared to discuss your homework at each class meeting.
- You are encouraged to work together with other students and to ask questions and seek help from your professor, both in and out of class.
- Students are also encouraged to use computer software supplements.

22. Evaluation Methods and Course Requirements:

Opportunities to demonstrate achievement of the ILOs are provided through the following <u>assessment methods and requirements</u>:

ILO/s	Learning Methods	Evaluation Methods	Related ILO/s to the program
	Lectures	Exam	

23. Course Policies:

1. Attendance is absolutely essential to succeed in this course. You are expected to attend every class; please notify your instructor if you know you are going to be absent. All exams must be taken at the scheduled times. Exceptions will be made only in extreme circumstances, by prior arrangement with the instructor.
2. If a student is absent for more than 10% of the lectures without an excuse (of sickness or due to other insurmountable difficulty), then the student shall be barred from sitting for the final examination. Also he/she will get a failing grade in this course.
3. Medical certificates for excuses of exam absences should be introduced to the University Physician for authorization. These authorized certificates should also be presented to the Dean of the Faculty within two weeks of the student's ceasing to attend classes.
4. Test papers shall be returned to students after correction ,where the student mark is considered final after a lapse of one week following their return.
5. Cheating is prohibited, where University cheating regulations will be applied on any student who cheats in exams or on home works.

24. Required equipment:

Mathematica Software and Data Show.

25. References:

A- Required book (s), assigned reading and audio-visuals:

Ross, S. M. Introduction to Probability Models, tenth edition, Elsevier, 2010.

B- Recommended books, materials, and media:

B1. Taylor, H. M., Karlin, S. An Introduction to Stochastic Modeling, third edition, 1998.

B2. Hoel, Port, and Stone. Introduction to stochastic Processes, Houghton Mifflin, 1972.

26. Additional information:

Name of Course Coordinator: Dr. Ahmad Alzghoul Signature: ---------- Date: 9.2.2016

Head of curriculum committee/Department: ..... Signature: ----------

Head of Department: ..... ignature: ----------

Head of curriculum committee/Faculty: ..... Signature: ----------

Dean: ..... Signature: ----------

Copy to:
Head of Department
Assistant Dean for Quality Assurance
Course File