



# Course Specification

— (Postgraduate)

**Course Title:** Stochastic Processes

**Course Code:** 202597-3

**Program:** M.Sc. in Statistics

**Department:** Mathematics and Statistics

**College:** Science

**Institution:** Taif University

**Version:** 2023

**Last Revision Date:** 7/4/1445



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## A. General information about the course:

### 1. Course Identification:

1. Credit hours: (3)

### 2. Course type

A.  University  College  Department  Track

B.  Required  Elective

3. Level/year at which this course is offered: ( Third Level)/Second Year

### 4. Course general Description:

This course contains some very important topics in statistics. These topics are:

Computing expectation, variance and probability by conditioning - Introduction to stochastic processes - Markov chains –classification - Stationary distributions of a Markov chains – Homogenous and nonhomogeneous Poisson process – Birth-death process – Brownian motion process – Standard Brownian motion process – Geometric Brownian motion process – Brownian motion with drift.

5. Pre-requirements for this course (if any):

6. Pre-requirements for this course (if any):

### 7. Course Main Objective(s):

After careful study of this course, student should be able to do the following:

1. Determine expectation, variance and probability by conditioning.
2. Understand stochastic processes.
3. Understand Markov chains.
4. Understand stationary distributions of a Markov chains.
5. Understand homogenous and nonhomogeneous Poisson process.
6. Understand birth-death process.
7. Understand Brownian motion process and standard Brownian motion process.
8. Understand geometric Brownian motion process.
9. Understand Brownian motion with drift.

### 2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	3	100%





No	Mode of Instruction	Contact Hours	Percentage
2	E-learning		
3	Hybrid <ul style="list-style-type: none"> <li>• Traditional classroom</li> <li>• E-learning</li> </ul>		
4	Distance learning		

### 3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	
3.	Field	
4.	Tutorial	
5.	Others (specify).....	
	<b>Total</b>	

## B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
<b>1.0</b>	<b>Knowledge and understanding</b>			
1.1	<b>Knowledge and Understanding</b>	<b>K1</b>	<ul style="list-style-type: none"> <li>• Lectures</li> <li>• Group discussions</li> </ul>	<ul style="list-style-type: none"> <li>• Quizzes</li> <li>• Exams</li> <li>• Assignments</li> </ul>
1.2	<b>Recognize</b> stochastic processes.	<b>K1</b>	<ul style="list-style-type: none"> <li>• Lectures</li> <li>• Group discussions</li> </ul>	<ul style="list-style-type: none"> <li>• Quizzes</li> <li>• Exams</li> <li>• Assignments</li> </ul>
1.3	<b>Recognize</b> Markov process.	<b>K2</b>	<ul style="list-style-type: none"> <li>• Lectures</li> <li>• Group discussions</li> </ul>	<ul style="list-style-type: none"> <li>• Quizzes</li> <li>• Exams</li> <li>• Assignments</li> </ul>
1.4	<b>Outline</b> Poisson process.	<b>K3</b>	<ul style="list-style-type: none"> <li>• Lectures</li> <li>• Group discussions</li> </ul>	<ul style="list-style-type: none"> <li>• Quizzes</li> <li>• Exams</li> <li>• Assignments</li> </ul>





Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
<b>2.0</b>	<b>Skills</b>			
2.1	<b>Apply</b> the studied methods to find expectation, variance and probability by conditioning.	<b>S2</b>	<ul style="list-style-type: none"> <li>Lectures</li> <li>Group discussions</li> </ul>	<ul style="list-style-type: none"> <li>Quizzes</li> <li>Exams</li> <li>Assignments</li> </ul>
2.2	<b>Evaluate</b> , and compare between models.	<b>S4</b>	<ul style="list-style-type: none"> <li>Lectures</li> <li>Group discussions</li> </ul>	<ul style="list-style-type: none"> <li>Quizzes</li> <li>Exams</li> <li>Assignments</li> </ul>
<b>3.0</b>	<b>Values, autonomy, and responsibility</b>			
3.1	<b>Participate</b> effectively within groups and independently.	<b>V1</b>	Projects	Through the oral presentation of the projects.
3.2	<b>Express</b> mathematical and statistical ideas orally and in writing	<b>V4</b>	Projects	Through the oral presentation of the projects.

### C. Course Content:

No	List of Topics	Contact Hours
1-3	<b>Computing expectation, variance and probability by conditioning, Introduction to stochastic processes.</b>	9
4-6	<b>Markov chains, Classification, Stationary distributions of a Markov chains</b>	9
7-9	<b>Homogenous and nonhomogeneous Poisson process, Birth-death process.</b>	9
10-12	<b>Brownian motion process, Standard Brownian motion process.</b>	9
13-15	<b>Geometric Brownian motion process, Brownian motion with drift.</b>	9
<b>Total</b>		<b>45</b>

### D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
<b>1</b>	Quizzes + Homeworks+ oral presentation +written	Continues	30%



No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
	test+ group project		
2	Final exam	16 th	70%

\*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

## E. Learning Resources and Facilities:

### 1. References and Learning Resources:

Essential References	<b>Robert G. Gallager, Stochastic Processes Theory for Applications, 2013, Cambridge University Press.</b>
Supportive References	Oliver Knill, <b>Probability and Stochastic Processes with Applications, 2009, Overseas Press.</b>
Electronic Materials	
Other Learning Materials	<b>Blackboard system</b>

### 2. Educational and Research Facilities and Equipment Required:

Items	Resources
<b>facilities</b> (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	<b>Lecture halls, containing white boards, and electronic monitors - The seats fit the number of students - Laboratories equipped with suitable numbers of computers</b>
<b>Technology equipment</b> (Projector, smart board, software)	<b>Data Show</b>
<b>Other equipment</b> (Depending on the nature of the specialty)	<b>Wi-Fi internet connections</b>

## F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
<b>Effectiveness of teaching</b>	<b>Students</b>	Indirect
<b>Effectiveness of students assessment</b>	<b>Students</b>	Indirect
<b>Quality of learning resources</b>	<b>Peer reviewer</b>	Direct
<b>The extent to which CLOs have been achieved</b>	<b>Students</b>	Indirect
<b>Other</b>		

**Assessor** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))

**Assessment Methods** (Direct, Indirect)





### G. Specification Approval Data:

COUNCIL /COMMITTEE	DEPARTMENT OF MATHEMATICS AND STATISTICS
REFERENCE NO.	
DATE	7-4-1445H

قسم الرياضيات والإحصاء  
Mathematics and Statistics  
Department

