1- <u>Course Specification of Advanced Probability and Statistics</u>
<u>Course Code (CCE549)</u>

I.	General Information About the Course:				
1.	Course Title:	Advanced Probability and Statistics			
2.	Course Code and Number:	CCE549			
3.	Credit Hours:	Credit Hours			Total
		Lecture	Practical	Seminar/Tutorial	
		3	-	-	3
4.	Study Level and Semester:				
5.	Pre-requisites (if any):	Probability and Statistic for Engineers			
6.	Co-requisites (if any):	None			
7.	Program (s) in which the course is offered:	M. Sc. Program In Computer and Control Engineering			
8.	Language of teaching the course:	English			
9.	Study System:	Courses & Thesis			
10.	Prepared By:	D. Mohammed Abdul Karim Al-Suraby			
11.	Reviewed by:	Assoc. Prof. Dr. Farouk Al-Fahaidy			
12.	Date of Approval:	----			

Course Description:
The course introduces graduates with the advanced concepts and theories

in probability and statistics. It covers the concept of probability density function, cumulative distribution function, and introduces the concept of a random variable. Different theoretical probability distributions, both discrete and continuous are introduced, and their properties are studied. It also introduces functions of one or two random variables, derived random variables, Hypothesis Testing, Estimation of Random Variable, Regression, and Correlation.

Course Intended Learning Outcomes (CILOs):

Upon successful completion of Advanced Probability and Statistic Course, the graduates will be able to:

a1 - Describe the advanced concepts and theories of probability and statistics.

a2 - Understand different central limit theorems, their mutual implications and applications and
the concept of conditional expectation.

b1 - Evaluate different probability distributions.

b2 - Interpret results of any statistical data analysis.

c1 - Employ suitable analysis technique for new research.

c2 - Apply the concept of hypothesis testing and statistical quality control.

c3 - Use statistical concepts for analyzing and interpreting engineering data.

d1- Present results of statistical analyses correctly and intelligibly.

d2 - Ability to Critically reviewing of own scientific work and of original publications; interpretation of statistical analyses in the context of diverse scientific fields.

Alignment of Course Intended Learning Outcomes (CILOs) to Program Intended Learning Outcomes (PILOs)	
CILOs	**PILOs**
Knowledge and Understanding: Upon successful completion of the Advanced Probability and Statistics Course, the graduates will be able to:	. **Knowledge and Understanding: Upon successful completion of the MSc. In Computer and Control Engineering Program, the graduates will be able to:**
a1. **Describe the advanced concepts and theories of probability and statistics.**	**A1. Demonstrate deep understanding of Computer and control engineering as well as knowledge of applied mathematics and engineering science to the field of computing and intelligent control**
a2. **Understand different central limit theorems, their mutual implications and applications and the concept of conditional expectation**	**A1. Demonstrate deep understanding of Computer and control engineering as well as knowledge of applied mathematics and engineering science to the field of computing and intelligent control**
Cognitive/ Intellectual Skills: Upon	**Cognitive/ Intellectual Skills:**

	successful completion of the Advanced Probability and Statistics Course, the graduates will be able to:	Upon successful completion of the MSc. In Computer and Control Engineering Program, the graduates will be able to:
b1.	Evaluate different probability distributions	B1. Evaluate, select and apply appropriate principles, methodologies, techniques, tools and packages to the analysis, specification, development and evaluation of computing and engineering systems
b2.	Interpret results of any statistical data analysis	B2. Identify, formulate, analyze and solve Research and complex engineering problems
Professional and Practical Skills: Upon successful completion of the Advanced Probability and Statistics Course, the graduates will be able to:		. Professional and Practical Skills: Upon successful completion of the MSc. In Computer and Control Engineering Program, the graduates will be able to:
c1.	Employ suitable analysis technique for new research	C2. Use and apply advanced methodology and skills to the formulation and practice

		of computer science, engineering and control systems
c2.	Apply the concept of hypothesis testing and statistical quality control	C2. Use and apply advanced methodology and skills to the formulation and practice of computer science, engineering and control systems
c3.	Use statistical concepts for analyzing and interpreting engineering data	C3. Employ acquired knowledge into a philosophical and intellectual frame that can be applied to computer engineering and control systems and process design and implementation
Transferable Skills: Upon successful completion of the Advanced Probability and Statistics Course, the graduates will be able to:		. Transferable Skills: Upon successful completion of the MSc. In Computer and Control Engineering Program, the graduates will be able to:
d1.	Present results of statistical analyses correctly and intelligibly	D1. Prepare complete thesis and reports, present ideas clearly and defend them
d2.	Ability to Critically	D3. Conduct independently

	reviewing of own scientific work and of original publications; interpretation of statistical analyses in the context of diverse scientific fields	and communicate research that advances and extends computing knowledge and scholarship in relate

Alignment of Knowledge and Understanding CILOs:

Knowledge and Understanding CILOs		Teaching Strategies	Assessment Strategies
a1.	Describe the advanced concepts and theories of probability and statistics.	Lectures Seminars Self-Learning Independent study Active learning Computer hands-on sessions	Written Exam Assignments Laboratory report
a2.	Understand different central limit theorems, their mutual implications and applications and the concept of conditional expectation	Lectures Seminars Self-Learning Independent study Active learning Computer	Written Exam Assignments Laboratory report

		hands-on sessions	

Alignment of Intellectual Skills CILOs:			
Intellectual Skills CILOs		Teaching Strategies	Assessment Strategies
b1.	Evaluate different probability distributions	Lectures Analysis and Problem Solving Self-Learning Simulation exercises Independent study Brain storming Presentations	Written Exam Assignments Laboratory report
b2.	Interpret results of any statistical data analysis	Lectures Analysis and Problem Solving Self-Learning Simulation exercises Independent study Brain storming Presentations	Written Exam Assignments Laboratory report Survey
Alignment of Professional and Practical Skills CILOs:			
Professional and Practical Skills CILOs		Teaching Strategies	Assessment Strategies
c1.	Employ suitable analysis technique for new research	Lectures Analysis Independent study Simulation	Seminar report Written research proposal Laboratory

			exercises	report Survey
c2.	Apply the concept of hypothesis testing and statistical quality control	Lectures Analysis Independent study Simulation exercises	Seminar report Written research proposal Laboratory report Survey
c3.	Use statistical concepts for analyzing and interpreting engineering data	Lectures Analysis Independent study Simulation exercises	Seminar report Written research proposal Laboratory report Survey

Alignment of Transferable (General) Skills CILOs:		

Transferable (General) Skills CILOs		Teaching Strategies	Assessment Strategies
d1.	Present results of statistical analyses correctly and intelligibly	Independent study Presenting reports Brainstorming Presenting researches Publish research papers	Written research proposal Written report Presentation Survey
d2.	Ability to Critically reviewing of own scientific work and of	Independent study Presenting reports Brainstorming	Written research proposal Written report

	original publications; interpretation of statistical analyses in the context of diverse scientific fields	Presenting researches Publish research papers	Presentation Survey

	Course Content				
Theoretical Aspect					
Order	Topic List / Units	Sub -Topics List	Number of Weeks	Contact Hours	Course ILOs
1	Axioms of probability	Axioms of Probability Basic Theorems	2	6	a1
		Continuity of Probability Function Random Selection of Points from Intervals			
2	Discrete Random Variables	Random Variables Probability Mass Function Cumulative Distribution Functions	2	6	a2, b1
		Expected Value of a Derived Random Variable Variance and Standard Deviation			
3	Continuous Random Variables	Continuous Sample Space Probability Density Function	2	6	a1, a2, b1
		Expected Values			

		Gaussian Random Variables			
4	Multiple Random Variables	Joint Cumulative Distribution Function Joint Probability Mass Function Joint Probability Density Functions	1	3	a1, a2, b1
5	Midterm Exam	All previous topics	1	3	a1, a2, b1
6	Multiple Random Variables (Cont.)	Independence Two Random Variables Expected Value of a Function of Two Random Variables	2	6	a1, a2, b1
		Covariance and Correlation Multivariate Probability Function			
7	Hypothesis Testing and Estimation of Random Variable	Binary Hypothesis Testing Multiple Hypothesis Test	2	6	a1, a2, b1, b2, c1, c2, d1, d2
		Minimum Mean Square Error Estimation Linear Estimation of Random Variables from Random Vectors			

		Introduction Classification of States			
8	Markov Chain	Limiting Probabilities Mean Time Spent in Transient States	3	6	a1, a2, b1, b2, c1, c2, d1, d2
		Time Reversible Markov Chain Markov Chain Monte Carlo Methods			
9	Final Exam	All topics	1	3	a1, a2, b1, b2, c2, c3
Number of Weeks /and Contact Hours Per Semester			16	48	

Practical Aspect				
Order	Practical / Tutorials topics	Number of Weeks	Contact Hours	Course ILOs
1				
2				
Number of Weeks /and Contact Hours Per Semester				

No.	Tutorial	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1				
2				
Number of Weeks /and Units Per Semester		**15**	**30**	

Tutorial Aspect:

. Teaching Strategies:

Lectures

Seminars

Self-Learning

Independent study

Active learning

Computer hands-on sessions

Simulation exercises

Brain storming

Presentations

Presenting researches

Publish research papers

. Assessment Methods of the Course:

Written Exam

Assignments

. Assessment Methods of the Course:
Laboratory report
Survey
Presentation

Tasks and Assignments:					
No	Assignments/ Tasks	Individual/ Group	Mark	Week Due	CILOs (symbols)
1	Assignments: Assignments 1: Discrete Random Variable, Assignments 2: Continues Random Variable, Assignments 3: Multiple Random Variable, Assignments 4: Hypothesis Test & Estimation for Random	Individual	15	3rd to 14th	a1,a2, b1, b2, c1, c2, c3. d1, d2

	Variable, Assignments 5: Markov Chain,				
2	Mini/Major Project	-	-		
3	Case studies	-	-		
	Total Score		15		

Learning Assessment:					
No.	Assessment Tasks	Week due	Mark	Proportion of Final Assessment	CILOs
1	Tasks and Assignments	3rd to 14th	15	10%	a1,a2, b1, b2, c1, c2,
2	Quizzes	5th , 10th	15	10%	a1,a2, b1,
3	Midterm	7th	30	20%	a1, a2, b1
4	Final Exam (Theoretical)	16th	90	60%	a1, a2, b1, b2, c2, c3
	Total			100%	

| Learning Resources: |
| --- |
| |
| **Required Textbook(s):** |
| Roy D. Yates, David J. Goodman (2014), Probability and Stochastic Processes, 3rd Edition, U.S.A, Wiley.
Sheldon M. Ross (2010), Introduction to Probability Models, 10th Edition, U.S.A, Elsevier. |
| **Essential References:** |
| S. Ross(2002) : A First Course in Probability, 6th Edition, India, Pearson Education.
Sheldon M. Ross (1996), Stochastic Processes, 2nd Edition, U.S.A, John Wiley & Son. Inc. |
| **Electronic Materials and Web Sites *etc.*** |
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	الضوابط والسياسات المتبعة في المقرر Course Policies
	بعد الرجوع للوائح الجامعة يتم كتابة السياسة العامة للمقرر فيما يتعلق بالآتي:
1	**سياسة حضور الفعاليات التعليميةClass Attendance:**
	يلتزم الطالب بحضور 75% من المحاضرات ويحرم في حال عدم الوفاء بذلك.
	يقدم أستاذ المقرر تقريرا بحضور وغياب الطلاب للقسم ويحرم الطالب من دخول الامتحان في حال
	تجاوز الغياب 25% ويتم اقرار الحرمان من مجلس القسم.
2	**الحضور المتأخرTardy:**
	يسمح للطالب حضور المحاضرة إذا تأخر لمدة ربع ساعة لثلاث مرات في الفصل الدراسي، وإذا تأخر
	زيادة عن ثلاث مرات يحذر شفويا من أستاذ المقرر، وعند عدم الالتزام يمنع من دخول المحاضرة.
3	**ضوابط الامتحانExam Attendance/Punctuality:**
	لا يسمح للطالب دخول الامتحان النهائي إذا تأخر مقدار (20) دقيقة من بدء الامتحان
	إذا تغيب الطالب عن الامتحان النهائي تطبق اللوائح الخاصة بنظام الامتحان في الكلية.
4	**التعيينات والمشاريعAssignments & Projects:**
	يحدد أستاذ المقرر نوع التعيينات في بداية الفصل ويحدد مواعيد تسليمها وضوابط تنفيذ التكليفات
	وتسليمها.
	إذا تأخر الطالب في تسليم التكليفات عن الموعد المحدد يحرم من درجة التكليف الذي تأخر في
	تسليمه.
5	**الغشCheating:**
	في حال ثبوت قيام الطالب بالغش في الامتحان النصفي أو النهائي تطبق عليه لائحة شؤون الطلاب.
	في حال ثبوت قيام الطالب بالغش او النقل في التكليفات والمشاريع يحرم من الدرجة المخصصة
	للتكليف.
6	**الانتحالPlagiarism:**
	في حالة وجود شخص ينتحل شخصية طالب لأداء الامتحان نيابة عنه تطبق اللائحة الخاصة بذلك
7	**سياسات أخرىOther policies:**

أي سياسات أخرى مثل استخدام الموبايل أو مواعيد تسليم التكليفات ..... الخ
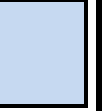
Academic Year: First

<u>**Course Plan (Syllabus)**</u>**: Advanced Probability and Statistics**

Information about Faculty Member Responsible for the Course:								
Name	**Dr. Mohammed Abdul Karim Al-Suraby**	**Office Hours**						
Location &Telephone No.	**Sana'a University, +967773351310**	**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**
E-mail	**m.alsuraby@su.edu.ye**						

General information about the course:	
Course Title	**Advanced Probability and Statistics**
Course Code and Number	**CCE549**
Credit Hours	**Credit Hours**

	Lecture	**Practical**	**Seminar/Tutorial**	**Total**
	3	**-**	**-**	**3**

Study Level and Semester	**1st Level, 1st Semester**
Pre-requisites	**Probability and Statistics for Engineers**
Co –requisite	**None**
Program (s) in which the course is offered	**Computer and Control Engineering**
Language of teaching the	**English**

course	
Location of teaching the course	**Faculty of Engineering, Sana'a University**

Course Description:
The course introduces graduates with the advanced concepts and theories in probability and statistics. It covers the concept of probability density function, cumulative distribution function, and introduces the concept of a random variable. Different theoretical probability distributions, both discrete and continuous are introduced, and their properties are studied. It also introduces functions of one or two random variables, derived random variables, Hypothesis Testing, Estimation of Random Variable, Regression, and Correlation.

Course Intended Learning Outcomes (CILOs):
Upon successful completion of the Advanced Probability and Statistics course, graduate students will be able to:

a1. Describe the advanced concepts and theories of probability and statistics.

a2. Understand different central limit theorems, their mutual implications and applications and the

concept of conditional expectation.

b1. Evaluate different probability distributions.

b2. Interpret results of any statistical data analysis.

c1. Employ suitable analysis technique for new research.

c2. Apply the concept of hypothesis testing and statistical quality control.

c3. Use statistical concepts for analyzing and interpreting engineering data.

d1. Present results of statistical analyses correctly and intelligibly.

d2. Ability to Critically reviewing of own scientific work and of original publications; interpretation of statistical analyses in the context of diverse scientific fields.

Course Content:				
Theoretical Aspect:				
Order	**Units**	**Sub Topics**	**Week Due**	**Contact Hours**
1	Axioms of probability	Axioms of Probability Basic Theorems	1st	3
		Continuity of Probability Function Random Selection of Points from Intervals	2nd	3
2	Discrete Random Variables	Random Variables Probability Mass Function Cumulative Distribution Functions	3rd	3
		Expected Value of a Derived Random Variable Variance and Standard Deviation	4th	3
3	Continuous Random Variables	Continuous Sample Space Probability Density Function	5th	3
		Expected Values Gaussian Random Variables	6th	3

4	**Multiple Random Variables**	**Joint Cumulative Distribution Function** **Joint Probability Mass Function** **Joint Probability Density Functions**	7th	3
5	**Midterm Exam**	**All previous topics**	8th	3
5	**Continuous Random Variables (Cont.)**	**Independence Two Random Variables** **Expected Value of a Function of Two Random Variables**	9th	3
		Covariance and Correlation **Multivariate Probability Function**	10th	3
6	**Hypothesis Testing and Estimation of Random Variable**	**Binary Hypothesis Testing** **Multiple Hypothesis Test**	11th	3
		Minimum Mean Square Error Estimation **Linear Estimation of Random Variables** **from Random Vectors**	12th	3
7	**Markov Chain**	**Introduction** **Classification of States**	13th	3
		Limiting Probabilities **Mean Time Spent in Transient States**	14th	3
		Time Reversible Markov Chain **Markov Chain Monte Carlo Methods**	15th	3

8	Final Exam	All topics	16th	3
Number of Weeks /and Contact Hours Per Semester				48

Practical Aspect				
Order	**Practical / Tutorials topics**	**Number of Weeks**	**Contact Hours**	**Course ILOs**
1	**NONE**			
2				
3				
4	•			
5				
6	•			
Number of Weeks /and Contact Hours Per Semester				

Training/ Tutorials/ Exercises Aspects:

Order	Tutorials/ Exercises	Week Due	Contact Hours
1	**NONE**		
2			
3			
4			
5			
6	•		
7			
8			
9			
10			
11			
12			
13			
14			
Number of Weeks /and Contact Hours Per Semester			

Teaching Strategies:
Lectures
Seminars
Self-Learning
Independent study
Active learning
Computer hands-on sessions

Simulation exercises

Brain storming

Presentations

Presenting researches

Publish research papers

Assessment Methods of the Course:
Written Exam   **Assignments**   **Laboratory report**   **Survey**   **Presentation**

Tasks and Assignments:

No	Assignments	Individual /Groups	Mark	Week Due
1	**Assignments:** **Assignments 1: Discrete Random Variable,** **Assignments 2: Continues Random Variable,** **Assignments 3: Multiple Random Variable,**	**Individual**	**15**	**3rd to 14th**

	Assignments 4: Hypothesis Test & Estimation for Random Variable, Assignments 5: Markov Chain,			
2	Mini/Major Project	-	-	
3	Case studies	-	-	
	Total Score		15	

Learning Assessment:

No	Assessment Method	Week Due	Mark	Proportion of Final Assessment %
1	Tasks and Assignments	Weekly	3rd to 14th	10%
2	Quizzes	5th , 10th	15	10%
3	Midterm Exam	7th	30	20%
4	Final Exam (Theoretical)	16th	90	60%
	Total المجموع		150	100 %

Learning Resources:

Required Textbook(s):

Roy D. Yates, David J. Goodman (2014), Probability and Stochastic Processes, 3rd Edition, U.S.A, Wiley.

Sheldon M. Ross (2010), Introduction to Probability Models, 10th

Edition, U.S.A, Elsevier	
Essential References:	
S. Ross(2002) : A First Course in Probability, 6th Edition, India, Pearson Education. **Sheldon M. Ross (1996), Stochastic Processes, 2nd Edition, U.S.A, John Wiley & Son. Inc.**	
Electronic Materials and Web Sites etc.	

الضوابط والسياسات المتبعة في المقرر Course Policies	
بعد الرجوع للوائح الجامعة يتم كتابة السياسة العامة للمقرر فيما يتعلق بالآتى:	
سياسة حضور الفعاليات التعليمية **Class Attendance:** يلتزم الطالب بحضور 75% من المحاضرات ويحرم في حال عدم الوفاء بذلك. يقدم أستاذ المقرر تقريرا بحضور وغياب الطلاب للقسم ويحرم الطالب من دخول الامتحان في حال تجاوز الغياب 25% ويتم اقرار الحرمان من مجلس القسم.	**1**
الحضور المتأخر **Tardy:** يسمح للطالب حضور المحاضرة إذا تأخر لمدة ربع ساعة لثلاث مرات في الفصل الدراسي، وإذا تأخر زيادة عن ثلاث مرات يحذر شفويا من أستاذ المقرر، وعند عدم الالتزام يمنع من دخول المحاضرة.	**2**
ضوابط الامتحان **Exam Attendance/Punctuality:** لا يسمح للطالب دخول الامتحان النهائي إذا تأخر مقدار (20) دقيقة من بدء الامتحان	**3**

	إذا تغيب الطالب عن الامتحان النهائي تطبق اللوائح الخاصة بنظام الامتحان في الكلية.
4	**التعيينات والمشاريع:Assignments & Projects:** **يحدد أستاذ المقرر نوع التعيينات في بداية الفصل ويحدد مواعيد تسليمها وضوابط تنفيذ التكليفات وتسليمها.** **إذا تأخر الطالب في تسليم التكليفات عن الموعد المحدد يحرم من درجة التكليف الذي تأخر في تسليمه.**
5	**الغش:Cheating:** **في حال ثبوت قيام الطالب بالغش في الامتحان النصفي أو النهائي تطبق عليه لائحة شؤون الطلاب.** **في حال ثبوت قيام الطالب بالغش او النقل في التكليفات والمشاريع يحرم من الدرجة المخصصة للتكليف.**
6	**الانتحال:Plagiarism:**