Sana'a University
Faculty of Engineering
Department: Electrical Engineering
Title of the Program: Communication Engineering and Networks

28.Course Specification of Engineering Probability and Statistics

I. Course Identification and General Information:

1.	Course Title:	Engineering Probability and Statistics				
2.	Course Code & Number:	BR131				
3.	Credit hours:	C.H				Total
		Th.	Tu.	Pr.	Tr.	
		2	2	-	-	3
4.	Study level/ semester at which this course is offered:	Level 3- Semester 1				
5.	Pre –requisite (if any):	Mathematical Analysis, Linear Algebra (BR121) and Mathematics 2 (FR003)				
6.	Co –requisite (if any):	None				
7.	Program (s) in which the course is offered:	Communication Engineering and Networks				
8.	Language of teaching the course:	English				
9.	Location of teaching the course:	Faculty of Engineering - Electrical Department				
10.	Prepared By:	Asst. Prof. Dr. Mohammed Abdul Karim Al-Suraby				
11.	Date of Approval					

II. Course Description:

This course provides an introduction to probability and statistics. This course covers the role of probability and statistics in engineering. It includes the concepts of probability; random variables; probability distributions (discrete; continuous and joint probability distributions) and their mathematical expectation; transformations of variables; central limit theorem and statistical estimation and hypothesis testing.

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	III. Course Intended learning outcomes (CILOs) of the course	Referenced PILOs
a1	Define the basic concepts of probability, statistics, random variables, probability distribution, covariance, correlation coefficient and transformations of variables.	A1
a2	Recognize the law of large numbers and the central limit theorem, the estimation, statistical hypotheses and testing.	A1
b1	Evaluate the Probability Density Function (PDF) of a random variable from a series of independent observations.	B2
b2	Analyze and interpret engineering data by using statistical concepts.	B2
c1	Calculate various moments of common random variables including at least means, variances and standard deviations and calculate the distribution of a function of a random variable.	C1 and C4
c2	Apply statistical methodology and tools in the engineering problem-solving process and apply the concepts of random variables to engineering applications.	C1 and C4
d1	Engage independent lifelong learning.	D2
d2	Effective use of information resources	D5

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1- Define the basic concepts of probability, statistics, random variables, probability distribution, covariance, correlation coefficient and transformations of variables.	▪ Active lectures ▪ Tutorials	▪ Homework reports, ▪ Assignments reports, ▪ Quizzes and Written ▪ Exam
a2- Recognize the law of large numbers and the central limit theorem, the estimation, statistical hypotheses and testing.	▪ Active lectures ▪ Tutorials	▪ Homework reports, ▪ Assignments reports, ▪ Quizzes and Written ▪ Exam

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(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1- Evaluate the PDF of a random variable from a series of independent observations.	▪ Active lectures, ▪ Tutorials ▪ Exercises	▪ Homework Assignments reports
b2- Analyze and interpret engineering data by using statistical concepts.	▪ Active lectures, ▪ Tutorials ▪ Exercises	▪ Homework Assignments reports

© Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c1- Calculate probabilities and various moments of common random variables including at least means, variances and standard deviations and calculate the distribution of a function of a random variable.	▪ Active lectures, ▪ Tutorials ▪ Exercises	▪ Homework Assignments reports
c2- Apply statistical methodology and tools in the engineering problem-solving process and apply the concepts of random variables to engineering applications.	▪ Active lectures, ▪ Tutorials ▪ Exercises	▪ Homework Assignments reports

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1- Engage independent lifelong learning.	▪ Tutorials ▪ Exercises	▪ Homework Assignments reports.
d2- Effective use of information resources	▪ Tutorials ▪ Exercises	▪ Homework Assignments reports.

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IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact hours
1.	Introduction to Statistics and Data Analysis	a1, c2, d1 and d2	▪ Statistical Inference, Samples, Populations, and the Role of Probability. ▪ Measures of Location (The Sample Mean and Median). ▪ Measures of Variability. ▪ Discrete and Continuous Data. ▪ Statistical Modeling, Scientific Inspection and Graphical Diagnostics.	1	2
2.	Probability	a1, c1, d1 and d2	▪ Sample Space and Events. ▪ Axioms, Interpretations, and Properties of Probability. ▪ Conditional Probability, Independence, and the Product Rule.	2	4
3.	Discrete Random Variables and Probability Distributions	a1, b1, c1, d1 and d2	▪ Concept of a Random Variable. ▪ Probability Distributions for Discrete random variables. ▪ Expected Values. ▪ The Uniform; Binominal and Poisson Probability Distributions.	3	6
4.	Continuous Random Variables and Probability Distributions	a1, b1, c1, d1 and d2	▪ Probability Density Functions. ▪ Cumulative Distribution Functions and Expected Values. ▪ The Uniform Distribution. ▪ The Normal Distribution. ▪ The Lognormal Distribution. ▪ The Exponential and Gamma Distributions.	3	6

5.	Functions of Random Variables; Joint Probability Distributions and Random Sample	a1, a2, b1, c1, c2, d1 and d2	▪ Transformations of Variables. ▪ Joint Probability Distributions for Two Random Variables. ▪ Conditional Probability Distributions. ▪ Covariance and Correlation. ▪ The Central Limit Theorem.	3	6
6.	Statistical Estimation and Hypotheses Testing	a1, a2, b1, b2, c1, c2, d1 and d2	▪ Statistical Inference. ▪ Classical Methods of Estimation. ▪ Statistical Hypotheses. ▪ Testing of Hypotheses.	2	4
Number of Weeks /and Units Per Semester				**14**	**28**

B - Tutorial Aspect:				
Order	**Tutorial Skills List**	**Number of Weeks**	**Contact Hours**	**Learning Outcomes**
1.	**Introduction to Statistics and Data Analysis** • The Sample Mean and Median. • Measures of Variability. • Statistical Modeling, Scientific Inspection and Graphical Diagnostics	**2**	**4**	**a1, c2, d1 and d2**
2.	**Probability** • Sample Space and Events. • Probability and Events. • Conditional Probability. • Total Probability.	**2**	**4**	**a1, c1, d1 and d2**
3.	**Discrete Random Variables and Probability Distributions** • Random Variables. • Probability Distributions. • Expected Values. • The Uniform; Binominal and Poisson Probability Distributions.	**3**	**6**	**a1, b1, c1, d1 and d2**
4.	**Continuous Random Variables and Probability Distributions** • Probability Density Functions. • Cumulative Distribution Functions and Expected Values. • The Uniform; Normal; Lognormal; Exponential and Gamma Distributions	**3**	**6**	**a1, b1, c1, d1 and d2**
5.	**Functions of Random Variables; Joint Probability Distributions and Random Sample** • Transformations of Variables. • Joint Probability Distributions for Two Random Variables. • Conditional Probability Distributions. • Covariance and Correlation.	**2**	**4**	**a1, a2, b1, c1, c2, d1 and d2**

	• The Central Limit Theorem.			
6.	**Statistical Estimation and Hypotheses Testing** • Statistical Inference. • Classical Methods of Estimation. • Statistical Hypotheses. • Testing of Hypotheses.	**2**	**4**	**a1, a2, b1, b2, c1, c2, d1 and d2**
Number of Weeks /and Units Per Semester		**14**	**28**	

V. Teaching strategies of the course:

- Active Lectures.
- Tutorials.
- Exercises and Homework.

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Introduction to Statistics and Data Analysis ▪ The Sample Mean and Median. ▪ Measures of Variability. ▪ Statistical Modeling, ▪ Scientific Inspection and Graphical ▪ Diagnostics	a1, c2, d1 and d2	1st	1.5
2.	Probability ▪ Sample Space and Events. ▪ Probability and Events. ▪ Conditional Probability. ▪ Total Probability.	a1, c1, d1 and d2	2nd and 3rd	3
3.	Discrete Random Variables and Probability Distributions ▪ Random Variables. ▪ Probability Distributions. ▪ Expected Values. ▪ The Uniform; Binominal and Poisson ▪ Probability Distributions.	a1, b1, c1, d1 and d2	4th, 5th and 6th	3

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4.	Continuous Random Variables and Probability Distributions ▪ Probability Density Functions. ▪ Cumulative Distribution Functions ▪ and Expected Values. ▪ The Uniform; Normal; Lognormal; ▪ Exponential and Gamma Distributions.	a1, b1, c1, d1 and d2	8th, 9th and 10th	3
5.	Functions of Random Variables; Joint Probability Distributions and Random Sample ▪ Transformations of Variables. ▪ Joint Probability Distributions for Two Random ▪ Variables. ▪ Conditional Probability Distributions. ▪ Covariance and Correlation. ▪ The Central Limit Theorem.	a1, a2, b1, c1, c2, d1 and d2	11th and 12th	3
6.	Statistical Estimation and Hypotheses Testing ▪ Statistical Inference. ▪ Classical Methods of Estimation. ▪ Statistical Hypotheses. ▪ Testing of Hypotheses.	a1, a2, b1, b2, c1, c2, d1 and d2	13th and 14th	1.5
	Total			**15**

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VII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Homework and Assignments	Weekly	15	10%	a1, a2, b1, b2, c1, c2, d1 and d2
2.	Quizzes	6^{th}, 10^{th} and 13^{th}	15	10%	a1, a2, b1, c1 and c2
3.	Med -Term Exam	7^{th}	30	20%	a1, b1 and c1
4.	Final Exam	16^{th}	90	60%	a1, a2, b1, b2, c1 and c2
	Total		**150**	**100%**	

VIII. Learning Resources:

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).

1. Roland E. Walpole (2012), Probability and Statistics for Engineers and Scientists – 9^{th} Edition, USA, Prentice Hall.
2. Jay L. Devore (2012), Probability and Statistics for Engineering and Sciences - 8th Edition, USA, Brooks /Cole Cengage Learning.

2- Essential References.

1. Douglas C. Montgomery- George C. Runger (2018), Applied Statistics and Probability for Engineers - 7th Edition, USA, Wiley.
2. Alberto Leon Garica (2008) Probability, Statistics and Random Process for Electrical Engineering- 3th Edition, USA, Prentice Hall.

3- Electronic Materials and Web Sites *etc*.

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IX. Course Policies:	
1.	**Class Attendance:** A student should attend not less than 75 % of total hours of the subject; otherwise he will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring an approved statement from university Clinic
2.	**Tardy:** For late in attending the class, the student will be initially notified. If he repeated lateness in attending class he will be considered as absent.
3.	**Exam Attendance/Punctuality:** A student should attend the exam on time. He is Permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam-
4.	**Assignments & Projects:** The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time-
5.	**Cheating:** For cheating in exam, a student will be considered as failure. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty-
6.	**Plagiarism**: Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proved a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university.
7.	**Other policies:** - Mobile phones are not allowed to use during a class lecture. It must be closed, otherwise the student will be asked to leave the lecture room - Mobile phones are not allowed in class during the examination. Lecture notes and assignments my given directly to students using soft or hard copy

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Reviewed By	**Vice Dean for Academic Affairs and Post Graduate Studies: Asst. Prof. Dr. Tarek A. Barakat** **President of Quality Assurance Unit: Assoc. Prof. Dr. Mohammed Algorafi** **Name of Reviewer from the Department: Asst. Prof. Dr. Nasser H. Almofari**
	Deputy Rector for Academic Affairs Asst. Prof. Dr. Ibrahim AlMutaa **Assoc. Prof. Dr. Ahmed Mujahed** **Asst. Prof. Dr. Munasar Alsubri**

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