Faculty of Engineering and Technology
Department of Electrical and Computer Engineering
First Semester 2024/2025

Course number and name*: ENEE2307 –* Engineering Probability and Statistics
Credits and contact hours: Credit: 3 (Lecture: 3, Lab.: 0)

Textbook:
- Probability and Statistics for Engineers and Scientists (9th Edition) by Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying E. Ye

References:
- Elements of Engineering Probability and Statistics by Rodger E. Ziemer
- P. Meyer, Introductory probability and statistical applications.
- T. Soong, Probabilistic Modeling and Analysis in Science and Engineering.
- Larsen and Marx, An introduction to mathematical statistics and its applications.
- Dudewics and Mishra, Modern mathematical statistics.
- P. Peebles, Probability, random variable, and random signal principles.
- Probability and Statistics for Engineers, Fifth Edition, By: Richard A. Johnson.

Specific course information
Description:
This is an introductory course in probability and statistics intended for engineering students. During the course, real-world problems, drawn from different engineering disciplines, will be modeled and solved using basic probability principles. An introduction to engineering statistics and estimation theory will also be provided.

Prerequisites: Math1321

Specific goals for the course
Upon the successful completion of this course a student should:
- Understand the fundamental concepts of probability theory.
- Understand the basic probability principles concerning a single and multiple random variables.
- Learn the common discrete and continuous probability distribution functions and their properties.
- Be able to use the probability distributions in solving real-world engineering problems.
- Understand the basic principles of statistics.
- Understand the main probabilistic concepts in estimation theory and engineering decision making.

(ABET) Relationship of course to Electrical Engineering Program Student Outcomes:
(a) Ability to apply mathematics, science and engineering principles.
(e) Ability to identify, formulate and solve engineering problems.

Brief list of topics to be covered

Fundamental Concepts of Probability: definitions of probability, set operations, axioms of probability, discrete and continuous probability functions, conditional probability, theorem of total probability, Bayes' Theorem, independent events, repeated independent trials, permutations and combinations, sampling with and without replacement.

Single Random Variables and Probability Distributions: the Random variable concept, probability mass and probability density functions, cumulative distribution function, common continuous and discrete density functions (uniform, exponential, Rayleigh, Gaussian, binomial, geometric, hyper-geometric, Poisson process). Expectation, characteristic function and moments, transformations of discrete and continuous random variables.

Probability Distributions for More than One Random Variable: the joint cumulative distribution function and the joint probability density function, marginal and conditional density functions, statistical independence, density function for a sum of two independent random variables and the convolution integral, density function for a sum of several independent random variables, the central limit theorem, expected value of a function of several random variables, jointly Gaussian random variables, transformation of multiple random variables, linear transformation of Gaussian random variables.

Elementary Statistics: observed data and graphical representation. Sample mean and sample variance. Regression techniques (linear, polynomial, exponential). Convergence of the sample mean to the mean.

Estimation Theory and Applications: desirable qualities of point estimators. Method for obtaining estimators (the maximum likelihood technique). Finding interval estimators for the mean (variance known, variance unknown) and variance (mean known, mean unknown). Properties of maximum likelihood estimators.

Engineering Decisions (if time permit): Bayes' hypothesis testing (decision strategy) and illustrative examples, classical decision theory (type I and type II errors, one-sided and two-sided hypothesis testing, the operating characteristic curve).

Introduction to Random Processes (if time permit)

Tentative Evaluation and Grades: (PS: No make-up exams)

Class work (quizzes and participation):	15%
Midterm Exam:	40%
Final Exam:	45%

Missed Quizzes: Four quizzes will be given during the course, out of which the highest three will be counted. **Makeups of missed quizzes will NOT be possible**.
Exact time of each quiz will be announced at least one week in advance.

Missed Midterm: Makeups of missed midterm exams are only possible in extremely exceptional situations, provided there is an extremely compelling reason (such as verifiable medical emergencies).

Course Policy: It is the responsibility of each student to adhere to the principles of academic integrity. Academic Integrity means that the student should be honest with him/herself, fellow students, instructors, and the University in matters concerning his or her educational endeavors. **Cheating will not be tolerated in this course.** University regulations will be pursued and enforced on any cheating student.