Jordan University of Science and Technology

Faculty of Engineering

Electrical Engineering Department

EE705 Random Processes - JNQF Level: 9

First Semester 2024-2025

Course Catalog
3 Credit Hours. Probability. Random variables. Distribution and density functions. Expectation. Functions of random variables. Moments and characteristic functions. Random vectors. Sequences of random variables and convergence. Limit theorems. Stochastic processes: basic notions. Stationarity. Ergodicity. Poisson and Gaussian processes. Second order processes. Representation theorems. Markov processes and chains.
Teaching Method: On Campus

Text Book	
Title	Probability Random Variables and Stochastic Processes
Author(s)	A. Papoulis and S. Pillai
Edition	4th Edition
Short Name	Required Textbook
Other Information	McGraw-Hill, 2002

Course References

Short name	Book name	Author(s)	Edition	Other Information
Ref. 1	Probability and Stochastic Processes: A Friendly Introduction for Electrical and Computer Engineers	R. D. Yates and D. J. Goodman	3rd Edition	Wiley, 2014
Ref. 2	Probability, Statistics, and Random Processes For Electrical Engineering	A. LeonGarcia	3rd Edition	Prentice Hall, 2008
Ref. 3	Introduction to Probability	D. P. Bertsekas and J. N. Tsitsiklis	2nd Edition	Athena Scientific, 2002
Ref. 4	Introduction to Probability Models	Sheldon Ross	12th Edition	Academic Press

Instructor	
Name	**Dr. Ibrahim Ghareeb**
Office Location	E1L3
Office Hours	Sun : 08:00 - 08:30 Sun : 09:30 - 10:30 Sun : 13:30 - 14:30 Tue : 08:00 - 08:30 Tue : 09:30 - 10:30 Wed : 08:00 - 09:30 Thu : 08:00 - 08:30 Thu : 09:30 - 10:30
Email	ghareeb@just.edu.jo

Class Schedule & Room
Section 1: Lecture Time: Tue : 10:30 - 13:30 Room: U

Tentative List of Topics Covered		
Weeks	**Topic**	**References**
Weeks 1, 2, 3, 4, 5, 6, 7	Random variables: Borel sets, measureable function, probability distributions, probability densities, common discrete and continuous distributions, functions of random variables, expectations, the Gaussian distribution and the central limit theorem, random vectors, sequences of random variables;	**Chapter 1-7** From **Required Textbook**
Weeks 8, 9, 10, 11	Stochastic processes: stationary and wide-sense stationary processes, Cyclostationary processes, mean and autocorrelation functions, power spectra, the Wiener-Khinchine relation, ergodicity, linear transformations, white noise processes, Gaussian processes, and the Poisson process;	**Chapter 9-11** From **Required Textbook**
Weeks 12, 13	Markova processes and chains: The Markovian property, transition probabilities, the Chapman-Kolmogorov equation, state properties and classification, stationary distributions, recurrence properties,etc.;	**Chapter 15** From **Required Textbook**
Week 14	Elementary queueing theory: basic concepts, Birth-Death processes, the Poisson arrival process and its properties, the M/M/1 queue, Latte?s result.	**Chapter 16** From **Required Textbook**

Mapping of Course Outcomes to Program Outcomes and NQF Outcomes	**Course Outcome Weight (Out of 100%)**	**Assessment method**

Learn the basic concepts of probability theory (e.g., random experiments, axioms of probability, conditional probability, and statistical independence). [1SO1] [1L9K1]	10%	Second Exam, Final Exam, First Exam
Express discrete random variables by using CDFs, PMFs; calculate expected value of random variables. Students also learn Markov and Chebyshev inequalities. [1SO1] [1L9K1]	15%	Second Exam, Final Exam, First Exam
Identify continuous random variables, expected values, their joint PDFs, conditional probabilities, conditional expectations, correlation, and covariance. Probability generating function, moment generating function and characteristic functions; properties and applications. [1SO1] [1L9K1]	15%	Second Exam, Final Exam, First Exam
Understand multiple random variables including joint CDFs, PMFs, PDFs; marginal PMFs, PDFs; independent random variables, derived distributions, and conditional probability models. Convergence of random variables; basic results, inequalities (Markov and Chebyshev), law of large numbers (weak and strong), central limit theorem. [1SO1] [1L9S2]	20%	Final Exam
Understand the basic concepts and applications of Random vectors and covariance matrix. Random processes; stationarity, WSS. Autocorrelation, cross correlation, power spectral density. Filtering of WSS processes. Basic notion of ergodicity. Wiener processes, Markov processes. [1SO2] [1L9S3]	20%	Final Exam
Understand Markov chains and their transient behavior. [1SO1] [1L9K2]	10%	
Identify and understand the applications of Queueing models - Little's law, M/M/1, M/M/m, M/M/m/m, M/G/1 queuing systems, priority queuing [1SO1] [1L9K1]	10%	

Relationship to Program Student Outcomes (Out of 100%)						
SO1	SO2	SO3	SO4	SO5	SO6	SO7
80	20					

Relationship to NQF Outcomes (Out of 100%)			
L9K1	L9K2	L9S2	L9S3
50	10	20	20

Evaluation	
Assessment Tool	**Weight**
Second Exam	25%
Final Exam	50%
First Exam	25%

Policy

Homework Requirement:	- Homework problems will be posted on Moodle. - Homework assignments must be electronically submitted via Moodle. Only one pdf file should be submitted for every homework assignment. You can submit latex pdf files, word converted pdf files, or scanned images which are converted to pdf. - Late homework assignments are not acceptable under any circumstances. - It is encouraged to discuss homework assignments with other students. However, each student is required to submit his/her own personal work.
Project:	Students are required to build a stochastic model (Queueing Model, Markov Chain) related to a real-life problem, find an interesting application of MC or Queueing theory, and use the results of the class to answer a question. The answer should be validated through computer simulations. The students first need to submit a proposal by Week 11, and a final report and presentation during the last week of classes.

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