Rutgers University, Department of Electrical and Computer Engineering
ABET COURSE SYLLABUS
COURSE: 14:332:226

Course Catalog Description: 14:332:226 - Probability and Random Processes (3) Probability and its axioms, conditional probability, sequential experiments, independence, counting, discrete, continuous and mixed random variables and distributions, functions of random variables, expectations, multiple random variables and joint distributions, central limit theorem, weak law of large numbers, estimation of random variables, Random processes and their characterization.

Pre-Requisite Courses: *14:332:221*

Co-Requisite Courses: None

Pre-Requisite by Topic: Calculus

Textbook & Materials: R.D. Yates and D.J. Goodman, *Probability and Random Processes*, 2nd Ed, John Wiley, 2004.

References: *MatLab: Student Version*, Current Edition, The MathWorks, Inc..

Overall Educational Objective:

1. To develop the logical basis of probability theory
2. To develop skills necessary to solve practical problems in probability and random processes

Course Learning Outcomes: A student who successfully fulfills the course requirements will have demonstrated:

1. an ability to describe a random experiment in terms of an procedure, observation, and a probability model.

2. an ability to characterize probability models by employing counting methods and basic probability mass function and probability density function canonical models for discrete and continuous random variables.

3. an ability to evaluate first and second moments and cumulative distribution functions for both discrete and continuous random variables.

4. an ability to characterize functions of random variables

5. an ability to characterize jointly multiple discrete and continuous random variables

6. an ability to describe conditional and independent events and conditional random variables.

7. an ability to describe independent events and independent random variables and their sums.

8. an ability characterize stochastic processes with an emphasis on stationary random processes.

How Course Outcomes are Assessed:

Weekly Quizzes (20 %)

Two Mid-Term Exams (30 %)
Final Exam (50 %)

N = none S = Supportive H = highly related

Outcome	Level	Proficiency assessed by
(a) an ability to apply knowledge of Mathematics, science, and engineering	H	HW Problems, Quizzes, Exams
(b) an ability to design and conduct experiments and interpret data	S	Design Problems in HW and Exams
(c) an ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	H	HW Problems, Quizzes, Exams
(d) an ability to function as part of a multi-disciplinary team	N	
(e) an ability to identify, formulate, and solve ECE problems	H	HW Problems, Quizzes, Exams
(f) an understanding of professional and ethical responsibility	N	
(g) an ability to communicate in written and oral form	S	HW Problems, Quizzes
(h) the broad education necessary to understand the impact of electrical and computer engineering solutions in a global, economic, environmental, and societal context	N	
(i) a recognition of the need for, and an ability to engage in life-long learning	S	Home-work, discussions during lectures
(j) a knowledge of contemporary issues	N	
(k) an ability to use the techniques, skills, and modern engineering tools necessary for electrical and computer engineering practice	H	HW Problems, Quizzes, Exams
Basic disciplines in Electrical Engineering	H	HW Problems, Quizzes, Exams
Depth in Electrical Engineering	S	HW Problems, Quizzes, Exams
Basic disciplines in Computer Engineering	H	HW Problems, Quizzes, Exams
Depth in Computer Engineering	S	HW Problems, Quizzes, Exams
Laboratory equipment and software tools	S	HW Problems, Mid-Term Exams
Variety of instruction formats	S	Lecture, office hour discussions

Topics Covered week by week:

Week 1: Experiments, models, probability axioms, conditional probability, independent events
Week 2: Sequential experiments, tree diagrams, counting methods, independent trials
Week 3: Discrete random variables; probability mass function (PMF), cumulative distribution function (CDF)
Week 4: Expected values, functions of one discrete random variable, variance and standard deviation, conditional PMF
Week 5: Review & First Midterm Exam
Week 6: Continuous random variables, probability density function (PDF), expectation
Week 7: Gaussian random variables, delta functions and mixed random variables, functions of continuous random variables, derived distributions, conditional PDF
Week 8: Pairs of random variables; joint and marginal PMF, joint CDF, joint and marginal PDF
Week 9: Functions of a pair of random variables, expected values, covariance and correlation, conditioning by an event
Week 10: Conditioning by a random variable, independent random variables, bivariate Gaussian random variables
Week 11: Review & Second Midterm Exam
Week 12: Multiple random variables; marginal distributions, independent and identically distributed (IID) random sequences, weak law of large numbers
Week 13: Distributions of sums of random variables; convolution, moment generating function, central limit theorem
Week 14: Random processes; the random process model, types of random processes, stationarity, autocorrelation

Computer usage: MATLAB exercises

Laboratory Experiences: (including major items of equipment and instrumentation used) None

Design Experiences: ~ 60% Homework problems focus on the design and analysis of probability models.

Independent Learning Experiences: 1. Homework 2.Testing (Quizzes, Exams) 3. Computer-aided Simulation,

Contribution to the Professional Component:
(a) College-level mathematics and basic sciences: 1 credit hours
(b) Engineering Topics (Science and/or Design): 2 credit hours
(c) General Education: 0 credit hours
Total credits: 3
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