

# ECSE 4500 Probability for Engineering Applications (PEA)

## Course Syllabus

**Catalog description:** Axioms of probability, joint and conditional probability, random variables, probability density and distribution functions, functions of random variables, statistical averages, empirical distributions, parameter estimation, regression, tests of hypotheses, and Markov chains. Applications to engineering data such as device characteristics, failure rates, image processing and network traffic. (Introduction to statistics.)

**Class hours and locations:** Lectures: 12:30 – 1:50 pm, Mondays and Thursdays, Ricketts 203  
Wednesday problem sessions: Section 1: 10:00-11:50 am, Sage 3713; Section 2: 12:00-1:50 pm, Sage 3713; and Section 3, 2:00-3:50 pm, Sage 3704.

### Instructors:

Prof. John W. Woods, ECSE Department. Office JEC 6018, telephone 518-276-6079, email [woods@ecse.rpi.edu](mailto:woods@ecse.rpi.edu), fax 518-276-6261. Office hours: Wednesdays 3-5, or by appointment.

Prof. George Nagy, ECSE Department. Office JEC 6020, telephone 518-276-6078, email [nagy@ecse.rpi.edu](mailto:nagy@ecse.rpi.edu), Office hours: Mondays 12-1, Thursdays 4-5, or by appointment.

**Prerequisite:** ECSE 2410 Signals and Systems, or equivalent.

**Required Textbook:** H. Stark and J. W. Woods, *Probability and Random Processes with Applications in Signal Processing*, 3<sup>rd</sup> Edition, Prentice-Hall/Pearson, 2003.

**References:** A. Leon-Garcia, *Probability, Statistics, and Random Processes for Electrical Engineering*, 3<sup>rd</sup> Ed., Pearson/Prentice-Hall, 2008. A. Papoulis and S. U. Pillai, *Probability, Random Variables, and Stochastic Processes*, 4<sup>th</sup> Ed., McGraw-Hill, 2002, D. C. Montgomery et al, *Engineering Statistics*, 2<sup>nd</sup> Edition, Wiley 2001.

**Course Schedule:** The course will consist of two 80 minute lectures per week plus one 60 minute problem session. There will be about 10 problem sets (homework). There will be two in-class Tests and one Final Exam in the official Exam week. Tests and Exams will be closed book with one sheet of notes allowed. No calculators, cell phones, or personal assistants.

**Pop Quizzes:** There will be two short quizzes scheduled *randomly* by the instructors. They will consist of two questions: one on the just prior reading assignment and one on the just prior lecture. Their purpose is to encourage students to keep current in the course.

**Lecture Schedule:** Prof. Woods will give the first 19 lectures on probability. Prof. Nagy will give the last seven lectures on statistics.

Lecture   Date   Topic

1. 1/14 Introduction and Axioms
2. 1/17 Fields, Sets, Independence, and Conditional Probability
3. 1/24 Total Probability, Bayes' Theorem, combinations and permutations
4. 1/28 Bernoulli trials and Binomial probability law
5. 1/31 Poisson law and random points in time, Multinomial distribution
6. 2/4 Random variables, probability distribution functions and density functions
7. 2/7 Discrete random variables and probability mass functions
8. 2/11 Joint and conditional probability distribution and density functions
9. 2/14 Function of a random variable
10. 2/19 Function of two random variables
11. 2/21 Vector functions of two random variables
12. 2/25 Review lecture
- 2/28 Test 1
13. 3/3 Expected value of random variable
14. 3/6 Conditional Expectation

### **Spring Break**

15. 3/17 Moment functions
16. 3/20 Chebyshev and Schwartz inequalities
17. 3/24 Review lecture
- 3/27 Test 2
18. 3/31 Characteristic Functions
19. 4/3 Laws of Large Numbers
20. 4/7 Central Limit Theorems
21. 4/10 Descriptive Statistics
22. 4/14 Sampling Distribution
23. 4/17 Point Estimation
24. 4/21 Interval Estimation
25. 4/24 Hypothesis Testing
26. 4/28 Inferences based on two samples

**Final Exam** in official Exam Week

**Grading:** Course grades will be determined on the basis of the point system shown below. All work is to be your own. Unexcused absence from a quiz or exam will count as zero for that grade item. We expect to award grades A, B, C, and D as follows: top 30% A, next 30% B, next 30% C, etc. Within each grade category, the +/- option will be employed to more finely represent your achievement in probability.

<b>Item</b>	<b>points</b>
pop quizzes	20 (10 each)
problem sets	20 (around 2 each)
Test 1	25
Test 2	25
Final Exam	30
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<b>Total</b>	120 points

**Academic Integrity:** In general all work is to be your own. One exception is the homework problem sets where collaboration is possible, and even encouraged in some cases. For example, you should try to do as much of the problem set on your own as possible, and only then seek help from others. If you find out how to do a homework problem from a colleague, then please work your own solution following this method rather than simply copying the colleague's solution. In the final analysis, your purpose should be to gain understanding from doing the problem sets, not simply obtaining answers. This will serve you best in the exams. The other exception is the problem sessions, where collaborative work is encouraged.

Any collaboration on either a Test or the Final Exam is considered cheating. Any student determined to have cheated will receive zero credit for that grade item.