

Wright State University
Department of Electrical Engineering
Course Syllabus

EE 761

Random Variables and Random Processes

Fall, 2010

Logistics: Lecture: 4:10 –5:50 (M,W); 286 Millett

Instructor: Dr. Fred Garber, 312 Russ 775-5037 fred.garber@wright.edu

Office Hours: 3:00 – 4:10 (M,W), or by appointment.

Texts: H. Stark and J. W. Woods, *Probability and Random Processes with Applications to Signal Processing*. Third Ed. Prentice-Hall, 2002.
B. Hajek, *An Exploration of Random Processes for Engineers*.
www.ifp.illinois.edu/~hajek/Papers/randomprocesses.htm, 2009.

WWW: Course material may be found at:
<http://www.engineering.wright.edu/~fdgarber/761/default.html>

Grading: (tentative)

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| Homework | 5% |
| Quizzes & Projects | 70% |
| Final Exam | 25% |

Content: This course is primarily concerned with the formulation of random variable and random process representations and analyses. The goal of this course is to provide the fundamental understanding and analytical tools necessary to successfully address the many noisy-signal or signal plus noise problems encountered in engineering. A tentative outline of topics to be covered appears overleaf.

Quizzes: Quizzes are closed-book, closed-notes, given (approximately) on a weekly basis. The best $N - 1$ out of N quizzes will count as the quiz grade. *No make-up quizzes will be given.*

Miscellaneous: Homework problems will be assigned and collected on a regular basis; certain of these problems will be graded and/or discussed. You are responsible for all assignments, changes of assignments, announcements of event dates, and other course-related events which occur in class.

COURSE OUTLINE

Introduction Ch. 1

What is a random process and why study them?

Review of Probability Ch. 1

Axiomatic definitions, Joint, conditional and total probabilities, Bayes' theorem and applications, Useful distributions

Random Variables Ch. 2

Probability distributions and densities; Continuous, discrete and mixed RV's; Conditional and joint distributions

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| <i>Functions of Random Variables</i> | Ch. 3 |
| Functional forms; Finding statistics | |
| <i>Expectations and Introduction to Estimation</i> | Ch. 4 |
| Expectations; Moments and moment generating functions; Characteristic functions; Bounds and approximations | |
| <i>Random Vectors and Parameter Estimation</i> | Ch. 5 |
| Covariance matrices; Maximum-likelihood estimation | |
| <i>Random Sequences</i> | Ch. 6 |
| Discrete-time linear systems; WSS sequences; Markov sequences | |
| <i>Random Processes</i> | Ch. 7 |
| Definitions and examples; Continuous-time systems with random inputs; WSS processes and LTI systems; Periodic and cyclostationary processes | |
| <i>Stochastic Calculus (time permitting)</i> | Ch. 8 and Hajek |

Collateral and Supplemental Reading:

Second-order processes:

- M. B. Pursley, *Random Processes in Linear Systems*, Prentice-Hall, 2002.
- R. M. Gray and L. D. Davisson, *Random Processes: A Mathematical Approach for Engineers*. Englewood Cliffs: Prentice-Hall, 1986.
- J. B. Thomas, *An Introduction to Applied Probability and Random Processes*. New York: Wiley, 1971.
- H. J. Larson and B. O. Schubert, *Probabilistic Models in Engineering Sciences, Volume I & II: Random Variables and Stochastic Processes*. New York: Wiley, 1979.
- A. Papoulis, *Probability, Random Variables, and Stochastic Processes*. New York: McGraw-Hill, 1984.
- E. Wong, *Introduction to Random Processes*. New York: Springer-Verlag, 1983.

Markov processes:

- S. Karlin and H. M. Taylor, *A First Course in Stochastic Processes*. New York: Academic Press, 1975.
- L. Kleinrock, *Queueing Systems, Volume I: Theory*. New York: Wiley, 1975.
- E. Çinlar, *Introduction to Stochastic Processes*. Englewood Cliffs: Prentice-Hall, 1975.
- S. M. Ross, *Stochastic Processes*. New York: Wiley, 1983.
- H. M. Taylor and S. Karlin, *An Introduction to Stochastic Modeling*. New York: Academic Press, 1984.

Advanced texts on second-order processes:

- A. D. Wentzell, *A Course in the Theory of Stochastic Processes*. New York: McGraw-Hill, 1981.
- E. Wong and B. E. Hajek, *Stochastic Processes in Engineering Systems*. New York: Springer-Verlag, 1985.