Wright State University
Department of Electrical Engineering
Course Outline

EE 762 **Detection and Estimation** **Spring, 2006**

Logistics: Lecture: 4:10 –5:50 (M,W); 302 RC

Instructor: Dr. Fred Garber, 311 Russ 775-5037 `fred.garber@wright.edu`

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

WWW: Course material may be found at:
http://www.engineering.wright.edu/~fdgarber/762/default.html

Text: H. V. Poor, *An Introduction to Signal Detection and Estimation*. Second Ed. New York: Springer-Verlag, 1994.

Grading: (tentative)

Homework	5%
Projects	25%
Quizzes	50%
Final Exam	20%

Content: This course is primarily concerned with the theoretical formulation of statistical decision theory. The goal of this course is to provide the fundamental understanding and analytical tools necessary to successfully address the many signal detection and parameter estimation problems encountered in electrical 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 exam dates, and other course-related events which occur in class.

COURSE OUTLINE

Introduction — Ch. 1, Notes

- General formulation of Statistical Decision Theory

Elements of Hypothesis Testing — Ch. 2

- Cost and risk functions
- Classes of decision rules (Bayesian, Minimax, Neyman-Pearson)
- Randomized decision rules
- Composite hypothesis testing

Signal Detection in Discrete Time — Ch. 3

- Observation Models and Detector Structures
- Performance Evaluation
- Sequential Detection
- Nonparametric and Robust Detection

Elements of Parameter Estimation — Ch. 4

- Bayesian Formulation
- Nonrandom Parameter Estimation
- Maximum-Likelihood Estimation and Extensions

Elements of Signal Estimation — Ch. 5

- Kalman-Bucy Filtering
- Wiener-Kolmogorov Filtering

Signal Detection in Continuous Time — Ch. 6

- Representation of Random Processes
- Detection of Deterministic and Random Signals

Signal Estimation in Continuous Time — Ch. 7

- Estimation of Signal Parameters
- Linear and Nonlinear Filtering

Collateral and Supplemental Reading:

Detection Theory:

T. S. Ferguson, *Mathematical Statistics: A Decision Theoretic Approach.* New York: Academic Press, 1967.

C. W. Helstrom, *Statistical Theory of Signal Detection.* New York: Pergamon Press, 1968.

E. L. Lehmann, *Testing Statistical Hypotheses.* New York: Wiley, 1959.

I. Selin, *Detection Theory.* Princeton, N. J.: Princeton University Press, 1965.

Estimation Theory:

P. R. Kumar and P. Varaiya, *Stochastic Systems: Estimation, Identification, and Adaptive Control.* Englewood Cliffs: Prentice-Hall, 1986.

J. M. Mendel, *Lessons in Digital Estimation Theory.* Englewood Cliffs: Prentice-Hall, 1987.

M. D. Srinath and P. K. Rajasekaran, *An Introduction to Statistical Signal Processing with Applications.* New York: Wiley, 1979.

H. L. Van Trees, *Detection, Estimation, and Modulation Theory: Part I.* New York: Wiley, 1968.

Filtering Theory:

B. D. O. Anderson and J. B. Moore, *Optimal Filtering.* Englewood Cliffs: Prentice-Hall, 1979.

Advanced Topics:

P. J. Huber, *Robust Statistics.* New York: Wiley, 1981.

A. Wald, *Sequential Analysis.* New York: Wiley, 1947.

H. L. Van Trees, *Detection, Estimation, and Modulation Theory: Part II.* New York: Wiley, 1971.

H. L. Van Trees, *Detection, Estimation, and Modulation Theory: Part III.* New York: Wiley, 1971.