EE 806 — DETECTION and ESTIMATION THEORY   **Spring 2004**

Instructor: Phil Schniter, Assistant Professor
760 Dreese Labs, 247-6488, schniter@ee.eng.ohio-state.edu

Web Page: `http://eewww.eng.ohio-state.edu/~schniter/ee806/index.html`
Contains homework, solutions, and relevant handouts. Course announcements, homework hints and modifications will be posted on this page – check it regularly.

Lectures: MWF 3:30pm–4:18pm, 264 Dreese Labs

Office Hours: To be announced...

Content: The basics of detection and estimation theory will be covered. Topics include: Bayes, Minimax and Neyman-Pearson hypothesis testing; composite hypothesis tests; generalized likelihood tests; signal detection in noise; Bayesian parameter estimation; estimator properties; and maximum-likelihood parameter estimation.

Prerequisites: Random variables and processes (EE 804 and EE 805 or equivalent)

Text: H. Vincent Poor, *Signal Detection and Estimation*, 2nd Ed., Springer, 1994.

References: The following books have been requested to be on reserve at the Science and Engineering Library.

1. *Communications and Networks*: A Survey of Recent Advances, Blake & Poor (Springer-Verlag: 1986)
2. *Abstract Inference*, Grenander (Wiley: 1981)
3. *Elements of Signal Detection and Estimation*, Helstrom (Prentice Hall: 1995)
4. *Statistical Theory of Signal Detection*, 2nd ed., Helstrom (Pergamon: 1968)
5. *Testing Statistical Hypotheses*, Kallenberg (CWI: 1984)
6. *Theory of Point Estimation*, Lehmann (Wiley: 1983)
7. *Detection, Estimation, and Modulation Theory*, Van Trees (Wiley: 1971)
8. *Statistical Signal Processing, Detection and Estimation Theory*, Scharf (Addison-Wesley:1990)
9. *Digital Processing of Random Signals: Theory and Methods*, Porat (Prentice Hall: 1994)

Grading: The course grade will be based on homework, projects, a midterm covering material in Chapters 2 and 3 of Poor, a comprehensive final exam covering material in Chapters 2,3 and 4 of Poor as well as class participation.

Late Policy: No late material (projects, homework, etc.) will be accepted unless **prior** arrangements have been made. Arrangements need to be made at least **24 hours** in advance. Any emergency situations will be handled on a case by case basis.

Attendance: The student is responsible for all assignments, changes of assignments, announcements, lecture notes *etc.* I will not be giving out my lecture notes. If you have missed a lecture, please get notes from a classmate.

Other: All examinations in this course will be administered in accordance with the EE Honor System. Homework problems will be assigned and collected on a regular basis; but only certain of these problems will be graded. The student is responsible for all assignments, changes of assignments, and announcements given in class.

Outline:

1. Chapter 2 of Poor - Elements of Hypothesis Testing ($\sim$ 9 lectures)
   (a) Bayesian Hypothesis Testing
   (b) Minimax Hypothesis Testing
   (c) Neyman-Pearson Hypothesis Testing
   (d) Composite Hypothesis Testing

2. Chapter 3 of Poor - Signal Detection in Discrete Time ($\sim$ 8 lectures)
   (a) Deterministic Signals
   (b) Stochastic Signals
   (c) Chernoff Bounds

3. Chapter 4 of Poor - Elements of Parameter Estimation ($\sim$ 12 lectures)
   (a) Bayesian Parameter Estimation
   (b) Minimum-Variance Unbiased Estimators
   (c) Properties of Estimators
   (d) Maximum-Likelihood Parameter Estimation