ECE Department  
University of Arizona  

ECE 639: Detection and Estimation  
Spring 2010

Course Objectives  
This course is designed to provide the student with a solid foundation in the principles of detection and estimation. The student should complete the class with advanced skills useful for graduate research or industry positions in statistical signal processing. Many principles will be demonstrated through application to practical problems of interest in radar, array processing, and digital communication.

Instructor  
Nathan A. Goodman, Associate Professor  
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Scheduled Time  
Tuesdays and Thursdays, 3:30 – 4:45 PM

Office Hours  
Mondays, 4:00 – 5:00 PM  
Tuesdays, 2:30 – 3:30 PM

Textbooks  

Supplemental Texts  
Detection, Estimation, and Modulation Theory, Part 1, H.L. Van Trees  
DEMT, Part 4: Optimum Array Processing, H.L. Van Trees

Prerequisites  
ECE 503.

Homework  
Homework will be assigned several times throughout the semester and will be due 1-2 weeks later. Some homework assignments may include reading a technical paper and writing a brief summary or they may include a short programming assignment.
**Exams**  
No makeup exams will be offered.

**Final Exam**  
Scheduled for Thursday, December 16, 2:00 PM – 4:00 PM.

**Grading**  
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<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Homework</td>
<td>15%</td>
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<tr>
<td>Computer Assignments</td>
<td>35%</td>
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<td>Midterm Exam</td>
<td>25%</td>
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<td>Final Exam</td>
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**Class Web Page**  
The course web page will be the best way to convey announcements and assignments. The web page will have administrative announcements, homework assignments, and test solutions. I will email the class when new assignments are posted. The web page is:

http://www.ece.arizona.edu/~ece639

**Tentative Course Outline**

I. Estimation Fundamentals (Estimation, Ch. 1-3)  
   Estimator bias and variance; performance bounds (CRLB).

II. Classical Estimation (Estimation, Ch. 5-7)  
   Minimum-variance and maximum-likelihood estimation.

III. Bayesian Estimation (Estimation, Ch. 10-12)  
   MAP estimation; minimum MSE estimation; nuisance parameters; Bayesian CRB.

IV. Detection Fundamentals (Detection, Ch. 1-3)  
   Background info; Bayesian detection; Neyman-Pearson criterion; minimum probability of error; ROCs; binary and multiple hypothesis testing; LRT.

V. Simple Hypothesis Testing (Detection, Ch. 4-5)  
   Deterministic signals; Random signals with known properties (pdfs).

VI. Composite Hypothesis Testing (Detection, Ch. 6-9)  
   Deterministic signals with unknown parameters; Bayesian and GLRT approach; random signals with unknown parameters; unknown noise parameters.

VII. Other Topics (time permitting)
**Academic Integrity:** The University’s Code of Academic Integrity (Section 2.1a) is based on the guiding principle that a student’s submitted work must be the student’s own. This policy will be applied to all work submitted for a grade, including exams, projects, and homework. Copying previously posted solutions or solution manuals is strictly forbidden; anyone violating this policy will receive zero credit for homework for the entire semester. All work must be original. The minimum penalty for submitting work that is not your own is an E grade. Repeated violations may result in expulsion from the university.

**Study Groups:** Working in study groups can be beneficial if everyone participates. Therefore, while working in study groups is allowed and even encouraged, all work submitted for a grade must be your own. When this rule is violated, the guilty student will receive a grade of zero on the offending item. Cheating will not be tolerated.