

# ECE 7001: Stochastic Processes, Detection, and Estimation

## Course Description

Stochastic processes; detection and decision theory; hypothesis testing, parameter estimation; and applications to communications and signal processing.

**Prior Course Number:** ECE 805 and 806

**Transcript Abbreviation:** Sto Proc Det Est

**Grading Plan:** Letter Grade

**Course Deliveries:** Classroom

**Course Levels:** Graduate

**Student Ranks:** Masters, Doctoral

**Course Offerings:** Spring

**Flex Scheduled Course:** Never

**Course Frequency:** Every Year

**Course Length:** 14 Week

**Credits:** 3.0

**Repeatable:** No

**Time Distribution:** 3.0 hr Lec

**Expected out-of-class hours per week:** 6.0

**Graded Component:** Lecture

**Credit by Examination:** No

**Admission Condition:** No

**Off Campus:** Never

**Campus Locations:** Columbus

**Prerequisites and Co-requisites:** Prereq: 6001 (804).

**Exclusions:** Not open to students with credit for 806.

**Cross-Listings:**

**Course Rationale:** Existing course.

**The course is required for this unit's degrees, majors, and/or minors:** No

**The course is a GEC:** No

**The course is an elective (for this or other units) or is a service course for other units:** Yes

**Subject/CIP Code:** 14.1001

**Subsidy Level:** Doctoral Course

## Course Goals

Learn mathematical properties of stochastic processes
Learn the theory of likelihood-ratio based hypothesis testing and signal detection in noise
Learn the theory of optimal parameter estimation; properties of estimators; and learn the tools for analysis of the efficacy of parameter estimators
Learn to design and analyze optimal and sub-optimal detection and estimation algorithms under realistic conditions

## Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Detection theory, decision theory, and hypothesis testing	8.0							
Parameter estimation	8.0							

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Stochastic processes, characterization, white noise and Brownian motion	5.0							
Autocovariance, crosscovariance and power spectral density	3.0							
Stochastic processes through linear systems	3.0							
Karhunen-Loeve and sampled signal expansions	4.0							
Detection and estimation from waveform observations, Wiener filters	8.0							

## Grades

Aspect	Percent
Homework Assignments	15%
Midterm Exam	35%
Final Exam	50%

## Representative Textbooks and Other Course Materials

Title	Author
<i>Signal Detection and Estimation</i>	Poor

## ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
***	a	An ability to apply knowledge of mathematics, science, and engineering.
**	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
***	c	An ability to design a system, component, or process to meet desired needs.
	d	An ability to function on multi-disciplinary teams.
***	e	An ability to identify, formulate, and solve engineering problems.
	f	An understanding of professional and ethical responsibility.
**	g	An ability to communicate effectively.
	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
	i	A recognition of the need for, and an ability to engage in life-long learning.
	j	A knowledge of contemporary issues.
***	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

## Additional Notes or Comments

Updated course description, prereqs, exclusions, and goals to match university format.

Deleted text Probability, Random Variables, and Stochastic Processes by Papoulis and Pillai 3/26/12

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