UNIVERSITY of NICOSIA

Course Code	Course Title	ECTS Credits
ECE-533	Detection and Estimation Theory	8
Department	**Semester**	**Prerequisites**
Engineering	Fall or Spring	ECE-332, MATH-280
Type of Course	**Field**	**Language of Instruction**
Elective	Engineering	English
Level of Course	**Year of Study**	**Lecturer(s)**
2st Cycle	1st	Dr Ioannis Kyriakides
Mode of Delivery	**Work Placement**	**Co-requisites**
Face-to-face	N/A	None

Objectives of the Course:

The main objectives of the course are to:

- explain the general detection problem
- identify the Neyman-Pearson theorem
- identify the concept of minimum variance unbiased estimators
- explain the concept of minimum probability of error
- identify detection performance for deterministic and random signals
- identify the Cramer-Rao lower bound
- explain maximum likelihood estimation
- explain the Bayesian philosophy
- explain Kalman and particle filtering

Learning Outcomes:

After completion of the course students are expected to be able to:

- formulate detection problems
- use the Nayman-Pearson criterion to calculate optimum detector configurations
- apply detection rules to deterministic and random signals with both known and unknown parameters
- derive the Cramer-Rao lower bound
- use maximum likelihood estimation
- use Kalman filtering
- use particle filtering

Course Contents:

- The detection problem
- Statistical decision theory
- Deterministic signals – known and unknown parameters
- Random signals – known and unknown parameters
- Unknown noise parameters
- Non-Gaussian noise

- Minimum variance unbiased estimation

- Cramer-Rao lower bound
- Maximum likelihood estimation
- The Bayesian philosophy
- General Bayesian estimators
- Kalman filtering
- Particle filtering

Learning Activities and Teaching Methods:

Lectures, in-class assignments.

Assessment Methods:

Homework, in-class assignments, projects, exams, final exam.

Required Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
Steven M. Kay	Fundamentals of Statistical Signal Processing, Volume 2: Detection Theory	Prentice-Hall	1998	978-0135041352
Steven M. Kay	Fundamentals of Statistical Signal Processing, Volume 1: Estimation Theory	Prentice-Hall	1993	9780133457117

Recommended Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
Harry L. Van Trees	Detection, Estimation, and Modulation Theory, Part I	Wiley-Interscience	2001	978-0471095170