AYDIN ADNAN MENDERES UNIVERSITY
COURSE INFORMATION FORM

Course Title	Detection & Estimation Theory								
Course Code	EEE532		Couse Level	Second Cycle (Master's Degree)					
ECTS Credit	8	Workload	200 *(Hours)*	Theory	3	Practice	0	Laboratory	0
Objectives of the Course	The main objective of this course is to introduce the principles of statistical detection and estimation theory to the students. In this context, detection of both deterministic and random signals will be studied. Using approaches like Bayesian and maximum likelihood, parameter estimation from noisy signals will be realized.								
Course Content	Hypothesis testing: Bayesian, minimax and Neyman-Pearson approaches, Detection of deterministic and random signals, General Minimum Variance Unbiased Estimation, Cramer Rao Lower Bound, Maximum likelihood estimation.								
Work Placement	N/A								
Planned Learning Activities and Teaching Methods	Explanation (Presentation), Discussion, Project Based Study, Individual Study, Problem Solving								
Name of Lecturer(s)									

Assessment Methods and Criteria		
Method	Quantity	Percentage (%)
Midterm Examination	1	25
Final Examination	1	35
Assignment	5	20
Project	1	20

Recommended or Required Reading	
1	S. M. Kay: Fundamentals of Statistical Signal Processing, Vol. 1, Estimation Theory.
2	S. M. Kay: Fundamentals of Statistical Signal Processing, Vol.2 Detection Theory.
3	An Introduction to Signal Detection and Estimation, H. Vincent Poor

Week	Weekly Detailed Course Contents	
1	Theoretical	Detection Theory in Signal Processing. The Detection Problem
2	Theoretical	Statistical Decision Theory, Neyman-Pearson Theorem
3	Theoretical	Minimum Bayes Risk Detector - Binary Hypothesis.
4	Theoretical	Deterministic Signals with Unknown Parameters
5	Theoretical	Random Signals with Unknown Parameters
6	Theoretical	Unknown Noise Parameters, White Gaussian Noise. Colored WSS Gaussian Noise.
7	Theoretical	GLRT and Rao Test
8	Intermediate Exam	Midterm Exam
9	Theoretical	Bayesian estimation theory
10	Theoretical	Minimum variance unbiased estimators
11	Theoretical	Cramer Rao Lower Bound (CRLB). CRLB for Signals with White Gaussian Noise
12	Theoretical	Maximum likelihood estimation, Least squares estimation
13	Theoretical	Minimum mean square error (MMSE) estimation,
14	Theoretical	Maximum a posteriori probability (MAP) estimation
15	Theoretical	Wiener and Kalman filtering
16	Final Exam	Final Exam

Workload Calculation				
Activity	Quantity	Preparation	Duration	Total Workload
Lecture - Theory	14	3	3	84
Assignment	5	5	0	25
Project	1	20	0	20
Individual Work	14	3	0	42

Midterm Examination	1	12	2	14
Final Examination	1	13	2	15
			Total Workload (Hours)	200
			[Total Workload (Hours) / 25*] = **ECTS**	8
**25 hour workload is accepted as 1 ECTS*				

Learning Outcomes	
1	To be familiar with detection concept and to apply detection theory in signal processing
2	To identify detection problems for deterministic and random signals
3	To be able to apply the Bayesian, minimax or Neyman-Pearson methods to detect signals
4	To be able to construct an estimation problem and specify the likelihood function
5	To be able to design minimum variance unbiased and maximum likelihood estimators

Programme Outcomes *(Electrical and Electronics Engineering Master)*	
1	Developing and intensifying knowledge that requires expertise in the area of Electrical-Electronics Engineering, and gaining the skills necessary to analyze and solve problems using this knowledge
2	Grasping the inter-disciplinary interaction related to Electrical-Electronics Engineering, interpreting and forming new types of knowledge by combining the knowledge from Electrical-Electronics Engineering and the knowledge from various other disciplines
3	Developing new approaches to solve the complex problems arising in Electrical-Electronics Engineering, coming up with solutions while taking responsibility and carrying out a specific study independently
4	Assessing the knowledge and skill gained in the area of Electrical-Electronics Engineering with a critical view
5	Transferring the current developments and one’s own work in Electrical-Electronics Engineering, to other groups in written, oral and visual forms
6	The ability to control the collecting, interpreting, practicing and announcing processes of the Electrical-Electronics Engineering related to data taking into consideration scientific, cultural and ethical values and the ability to teach these values to others
7	Developing application plans concerning the subjects related to Electrical-Electronics Engineering and the ability to evaluate the end results of these plans within the frame of quality processes

Contribution of Learning Outcomes to Programme Outcomes *1:Very Low, 2:Low, 3:Medium, 4:High, 5:Very High*

	L1	L2	L3	L4	L5
P1	4	4	4	4	4
P2	4	4	4	4	4
P3	4	4	4	4	4
P4	4	4	4	4	4
P5	4	4	4	4	4
P6	4	4	4	4	4
P7	4	4	4	4	4