AYDIN ADNAN MENDERES UNIVERSITY
COURSE INFORMATION FORM

Course Title	Robust Control								
Course Code	EEE523		Couse Level	Second Cycle (Master's Degree)					
ECTS Credit	8	Workload	200 *(Hours)*	Theory	3	Practice	0	Laboratory	0
Objectives of the Course	This course aims to present robust control analysis and design methods.								
Course Content	Classical control design methods, introduction to robust control. The importance of robust stability. Introduction to affine linear, interval, multilinear and nonlinear parameter uncertainties in control systems. Hermite-Biehler theorem, segment lemma, vertex lemma and Rantzer theorem. Kharitonov, edge and mapping theorems. Nyquist, Nichols, and Bode envelopes of uncertain systems. Controller design techniques for systems with parameter uncertainty. Robust performance. Stability analysis of nonlinear control systems with parameter uncertainty. Lur'e, Popov and Circle criteria. Quantitative Feedback Theory (QFT) and control theory.								
Work Placement	N/A								
Planned Learning Activities and Teaching Methods	Explanation (Presentation), Demonstration, Discussion, Case Study, Project Based Study, Individual Study, Problem Solving								
Name of Lecturer(s)									

Assessment Methods and Criteria		
Method	Quantity	Percentage (%)
Midterm Examination	1	30
Final Examination	1	30
Assignment	4	20
Project	1	20

Recommended or Required Reading	
1	S. P. Bhattacharyya, H. Chapellat and L.H. Keel, Robust Control: The Parametric Approach, Prentice Hall, 1995
2	B.R. Barmish, New Tools for Robustness of Linear Systems, MacMillan, 1994
3	I S. Skogestad and I. Postlethwaite, Multivariable Feedback Control: Analysis and Design, Wiley, 1996.

Week	Weekly Detailed Course Contents	
1	Theoretical	Classical control design methods
2	Theoretical	Definition and advantages of robust control
3	Theoretical	Advantages of robust stability in control systems
4	Theoretical	Affine linear, interval, multilinear and nonlinear control systems parameter uncertainties
5	Theoretical	Affine linear, interval, multilinear and nonlinear control systems parameter uncertainties
6	Theoretical	Hermite-Biehler theorem, segment lemma, vertex lemma and Rantzer theorem
7	Theoretical	Hermite-Biehler theorem, segment lemma, vertex lemma and Rantzer theorem
8	Intermediate Exam	Midterm Exam
9	Theoretical	Kharitonov, edge and mapping theorems and applications
10	Theoretical	Nyquist, Nichols, and Bode envelopes of uncertain systems
11	Theoretical	Controller design techniques of systems with parameter uncertainty
12	Theoretical	Robust performance
13	Theoretical	Stability analysis of nonlinear control systems with parameter uncertainty. Lur'e, Popov and Circle criteria
14	Theoretical	Quantitative feedback theory (QFT). and control theory
15	Theoretical	Matlab tools and case studies
16	Final Exam	Final Exam

Workload Calculation				
Activity	Quantity	Preparation	Duration	Total Workload
Lecture - Theory	14	4	3	98
Assignment	4	10	3	52
Project	1	11	3	14

Midterm Examination	1	15	3	18
Final Examination	1	15	3	18
			Total Workload (Hours)	200
			[Total Workload (Hours) / 25*] = **ECTS**	8
**25 hour workload is accepted as 1 ECTS*				

Learning Outcomes	
1	To learn robust control methods
2	To analyze control systems with parameter uncertainty
3	To learn Hermite-Biehler theorem, segment lemma, vertex lemma and Rantzer theorem.
4	To learn Kharitonov, edge and mapping theorems, Nyquist, Nichols and Bode envelopes of uncertain systems
5	To learn stability analysis of nonlinear control systems with parameter uncertainty, Lur'e, Popov and Circle criteria.

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