AYDIN ADNAN MENDERES UNIVERSITY
COURSE INFORMATION FORM

Course Title	Linear System Theory I								
Course Code	EEE501		Couse Level	Second Cycle (Master's Degree)					
ECTS Credit	7	Workload	175 *(Hours)*	Theory	3	Practice	0	Laboratory	0
Objectives of the Course	System concept having great importannce in engineering sciences is studied in two titles as linear systems and nonlinear systems. Although systems in nature generally exhibit nonlinear behavior, since they can be linearized under some conditions and for some regions by some approximations, theory of linear systems have great importance. In this manner, nonlinear systems frequently observed in nature can be solved by the point of linear system theory. In this respect, theory of linear systems is being studied in this course.								
Course Content	Mathematical description of systems; linear and nonlinear systems; linearization; Linear Time Invariant (LTI) and Linear Time Varying (LTV) systems; continuous-time and discrete-time systems; state-space equations and solutions of linear systems; linear algebra; canonic forms; stability, controllability and observability of systems and applications to linear systems.								
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)	Assoc. Prof. Coşkun DENİZ								

Assessment Methods and Criteria		
Method	Quantity	Percentage (%)
Midterm Examination	1	30
Final Examination	1	40
Project	1	30

Recommended or Required Reading	
1	Chen C.T., Linear System Theory and Design, HRW, 1984.
2	G. Strang, Linear Algebra and its Applications, 4th Ed. Brooks/Cole, 2006.
3	Kailath T., Linear Systems, Prentice Hall, 1980.
4	C.A. Desoer, Notes for a Second Course on Linear Systems, Van Nostrand Reinhold, 1970.
5	S. Axler, Linear Algebra Done Right, Springer, 1997.
6	Decarlo R.A., Linear Systems: A state variable approach with numerical implementation, Prentice Hall, 1989.

Week	Weekly Detailed Course Contents	
1	Theoretical	Mathematical description of systems: Causality, Linear and nonlinear systems, time independent and time dependent systems, state-space equations, linearization. Chen, Ch.1, Introduction & Ch.2
2	Theoretical	Mathematical description of systems (continuing): state-space equations of linear systems and transfer function, concepts of zero-input response and zero-state response, continuous-time and discrete-time systems, transformation of linear continuous systems to discrete systems, problem solutions and Matlab applications. Chen, Ch.2
3	Theoretical	Linear algebra: Basis, representation and orthonormalization, systems of linear equation systems and their solutions, linear independence. Chen, Ch.3
4	Theoretical	Linear algebra (continuing): Similarity transformations, rotation matrices and their applications. Chen, Ch.3
5	Theoretical	Linear algebra (continuing): Eigen values and eigenvectors, diagonal forms and Jordan forms. Chen, Ch.3
6	Theoretical	Linear algebra (continuing): Square matrix functions, Cayley-Hamilton theorem, Lyapunov equation. Chen, Ch.3
7	Theoretical	Linear algebra (continuing): Quadratic forms, positive definiteness, singular value decomposition, norm of matrices, problem solutions and applications. Chen, Ch.2
8	Intermediate Exam	Midterm Exam
9	Theoretical	State-space equations and realization: Linear & Time Invariant (LTI) continuous systems and their solutions, state-space equations of LTI discrete systems and their solutions. Chen, Ch.4
10	Theoretical	State-space equations and realization (continuing): LTI equivalent systems, equivalent state-space equations of LTI systems and equality transformations. Chen, Ch.4

11	Theoretical	State-space equations and realization (continuing): Canonic forms in the LTI systems, magnitude scaling of Op-amp circuits, realizations. Chen, Ch.4
12	Theoretical	State-space equations and realization (continuing): Linear & Time Varying (LTV) continuous and discrete systems and their solutions, equivalent LTV systems and their transformations, time dependent realizations. Chen, Ch.4
13	Theoretical	Stability: Input-output stability of LTI systems, applications to the systems and problem solutions. Chen, Ch.5
14	Theoretical	Stability (continuing): Stability in LTV systems. Chen, Ch.5
15	Theoretical	Controllability and observability: controllability matrix, observability matrix, canonic decompositions, applications to the systems and problem solutions. Chen, Ch.6
16	Final Exam	Final Exam

Workload Calculation

Activity	Quantity	Preparation	Duration	Total Workload
Lecture - Theory	14	4	3	98
Project	1	38	3	41
Midterm Examination	1	10	3	13
Final Examination	1	20	3	23
			Total Workload (Hours)	175
			[Total Workload (Hours) / 25*] = **ECTS**	7

**25 hour workload is accepted as 1 ECTS*

Learning Outcomes

1	To learn the classification, nature, and concepts of systems and be able to do the mathematical description of systems.
2	To be able to linearize nonlinear systems.
3	To acquire the required linear algebra concepts, applications, and skills required for the linear system theory.
4	To learn the theory of linear systems and be able to apply to the systems.
5	To improve understandings in analyses and engineering design of systems.

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	5	5	5	5	5
P2	5	5	5	5	5
P3	5	5	5	5	5
P4	5	5	5	5	5
P5	5	5	5	5	5
P6	5	5	5	5	5
P7	5	5	5	5	5