COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
MODERN CONTROL ENGINEERING	**ESYE552**		**3+0**	**3**	**10**

Prerequisites	

Language of Instruction	English
Course Level	M. S.
Course Type	Compulsory
Course Coordinator	
Instructors	Assist. Prof. Uğur Yıldıran
Assistants	
Goals	Teaching modern control techniques based on state space models and optimal control theory
Content	State space models, analysis of systems in state space representation, controllability, observability, state feedback controller synthesis, calculus of variations, optimal control, Linear Quadratic Regulator (LQR)

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
Ability to perform analysis of linear system models in state space form	5	1	A, C
Ability to perform controllability and observability analysis of linear system models in state space form	1	1	A, C
Ability to synthesize state feedback controllers for linear systems	12	1	A, C
Ability to use calculus of variations for finding open-loop optimal control	2	1	A, C
Ability to design optimal state feedback controllers based on LQR principle	4	1	A, C

Teaching Methods:	1: Lecture, 2: Paper Discussion, 3: Lab, 4: Case-Study
Assessment Methods:	A: Testing, B:Paper Summary, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	INTRODUCTION	Textbook
2	STATE SPACE MODELS	Textbook
3	SOLUTION OF STATE SPACE EQUATIONS	Textbook
4	CONTROLLABILITY	Textbook
5	OBSERVABILITY	Textbook
6	STATE FEEDBACK CONTROLLER SYNTHESIS	Textbook
7	OBSERVER SYNTHESIS	Textbook
8-9	REVIEW OF FINITE DIMENSIONAL OPTIMIZATION PROBLEMS	Textbook
10	CALCULUS OF VARIATIONS	Textbook
11-12	SOLUTION OF OPTIMAL CONTROL PROBLEMS USING CALCULUS OF VARIATIONS	Textbook
13-14	LINEAR QUADRATIC REGUALTOR	Textbook

RECOMMENDED SOURCES	
Textbook	Donald E. Kirk, "Optimal Control Theory: An Introduction", Dover Publications
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	Homework questions on state space theory, controllability, observability, state feedback controller synthesis and observer synthesis, calculus of variations and optimal control
Exams	Midterm exams, final exam

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	83
Assignment	6	17
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	Ability to reach knowledge in breadth and depth through scientific research in Industrial and Systems Engineering field; to have extensive knowledge about current techniques and procedures together with their constraints.					**x**	
2	Ability to complement and apply knowledge by scientific methods utilizing limited or missing data; to use knowledge in different disciplines effectively by blending them.				**x**		
3	Ability to formulate Industrial and Systems Engineering problems; to develop novel and original ideas and procedures for their solutions and to use innovative procedures in solutions.						
4	Awareness of new and developing applications in Industrial and Systems Engineering; ability to investigate and learn these applications when required.				**x**		
5	Ability to design and apply analytical, and modeling and experimental based research; to solve and interpret complex situations encountered in this process.					**x**	
6	Ability to lead multi-disciplinary teams; to develop solution approaches in complicated situations and to take responsibility.						
7	Ability to develop novel and/or original ideas and methods; to develop						

	innovative solutions for the design of systems, parts or the processes.					
8	Ability to communicate orally or in writing the process and the results of Industrial and Systems Engineering studies systematically and openly in national or international platforms.					
9	Ability to master a foreign language (English) at the European Language Portfolio B2 General Level to communicate orally or in writing.					
10	Ability to recognize social, scientific and ethical values in the process of collection, interpretation and publishing of data, and in all professional activities.					
11	Ability to visualize social and environmental dimensions of Industrial and Systems Engineering applications and to observe these dimensions in professional practice.					
12	Ability to develop appropriate methodology and procedures for the modeling, improvement, control and design of complex systems for a specified target.					**x**

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding exam hours: 13x Total course hours)	13	3	39
Hours for off-the-classroom study (midterms)	2	20	40
Hours for off-the-classroom study (final)	1	30	30
Midterm examination	2	2	4
Homework	6	24	144
Final examination	1	3	3
Total Work Load			260
Total Work Load / 25 (h)			10,4
ECTS Credit of the Course			10