SYSTEMS DYNAMICS AND CONTROL

1	Course Title:	SYSTEMS DYNAMICS AND CONTROL	
2	Course Code:	END3039	
3	Type of Course:	Optional	
4	Level of Course:	First Cycle	
5	Year of Study:	3	
6	Semester:	5	
7	ECTS Credits Allocated:	3.00	
8	Theoretical (hour/week):	2.00	
9	Practice (hour/week):	0.00	
10	Laboratory (hour/week):	0	
11	Prerequisites:	Without Prerequisites	
12	Language:	Turkish	
13	Mode of Delivery:	Face to face	
14	Course Coordinator:	Öğr.Gör.Dr. MESUT ŞENGİRGİN	
15	Course Lecturers:	-	
16	Contact information of the Course Coordinator:	E-Mail: İbrahim@uludag.edu.tr Phone: 0 224 294 19 72 Address: U.Ü., Müh.–Mim. Fakültesi, Makine Müh. Bölümü, 16150 Görükle/Bursa	
17	Website:	http://www20.uludag.edu.tr/~mtd/Mak3002.htm	
18	Objective of the Course:	Develop an understanding of the elements of classical control theory and the concept of feedback as applied to the industrial control and automation systems. Drive mathematical model of systems and analyze dynamic behaviors of systems with the concepts of transfer functions and block diagrams. In particular analyze the transit and steady state characteristics of various types of the systems. Concept of control algorithms, controller design, and properties of PID controllers. Describe and analyze frequency response of the control systems.	
19	Contribution of the Course to Professional Development:		
20	Learning Outcomes:		
		1	Be familiar with the inputs, outputs, and components of a control system. Understand the difference between open-loop and closed-loop (feedback) control systems and understand the advantages of feedback control.
		2	Apply the mathematical methods such as differential equations and Laplace transformation to engineering subjects.
		3	Model various engineering systems, including mechanical, electrical, thermal and fluid systems.
		4	Understand the role of the transfer function and block diagram forms in the system dynamics and the control systems modeling.
		5	Understand the concept of the transient and steady state behavior parameters of the control systems and their effects on the system performances.
		6	Determine system stability and stability limits for certain classes of feedback systems.

	7	Understand the concepts of the proportional, integral and derivative control actions and apply them to the design of industrial controllers.
	8	To use MATLAB/Simulink with facility to aid in the analysis and design of control systems
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21	Course Content:

Course Content:

Week	Theoretical	Practice
1	Introduction and general evaluation of the course.: What are the control and the automatic control.	
2	Introduction of open-loop, closed-loop and feedback control systems. Application cases.	
3	Laplace transformations: definition, standard input functions and their Laplace transforms.	
4	Inverse Laplace transformations.	
5	System dynamics and introduction to modeling: transfer functions and classification of systems according to their transfer functions and their dynamic behaviors.	
6	Block diagrams, their characteristics and reductions.	
7	Reduction of block diagram with disturbances and effect of feedback on to the disturbances.	
8	Transfer functions of mechanical, electrical, fluid and thermal systems and their dynamic behavior characteristics.	
9	Repeating courses and midterm exam	
10	Transient response characteristics of the systems and steady state behavior of the systems.	
11	Steady state errors constants and steady state errors.	
12	Stability of linear systems, Routh-Hurwitz stability criteria and application of the criteria to feedback control systems.	
13	Basic control actions and controller design, PID controller and its main features.	
14	Tuning methods of PID and controller design in MATLAB/Simulink environment.	

22	Textbooks, References and/or Other Materials:	1. Automatic Control: System Dynamics and Control Systems (in Turkish) İbrahim YÜKSEL, 7th. Edition, Nobel 2011 2. Automatic Control Systems, Benjamin C. Kuo (translated into Turkish by A. Bir), Literatür, 1999 3. Solved Problems of Automatic Control, System Dynamics and Control Systems (in Turkish) , İbrahim YÜKSEL, Mesut ŞENGİRGİN, Gürsel ŞEFKAT, 2nd. Edition, Dora 2011 4. Analysing and Solution of Engineering Sysetms with MATLAB (in Turkish) İbrahim YÜKSEL, 3rd. Edition, Nobel 2004 5. Modern Control System, R. C. Dorf & R.H. Bishop, 10th.Edition, 1994, Prentic Hall, 6. Control System Design, G. C. Goodwin, S.F. Graebe, M.E. Salgado, 2001, Prentic Hall 7. Feedback Control Systems, J. Van De Vegte, Prentice Hall International Edition, 3rd Edition 2002 8. Modeling, Analysis, and Control Dynamic Systems, W.J. Palm III, John Wiley & Sons. Inc., 1999
23	Assesment	

TERM LEARNING ACTIVITIES	**NUMBER**	**WEIGHT**
Midterm Exam	1	26.00
Quiz	2	14.00
Home work-project	1	10.00
Final Exam	1	50.00
Total	5	100.00
Contribution of Term (Year) Learning Activities to Success Grade		50.00
Contribution of Final Exam to Success Grade		50.00
Total		100.00
Measurement and Evaluation Techniques Used in the Course		

24 ECTS / WORK LOAD TABLE

Activites	Number	Duration (hour)	Total Work Load (hour)
Theoretical	14	2.00	28.00
Practicals/Labs	0	0.00	0.00
Self study and preperation	14	3.00	42.00
Homeworks	1	5.00	5.00
Projects	0	0.00	0.00
Field Studies	0	0.00	0.00
Midterm exams	1	5.00	5.00
Others	2	3.00	6.00
Final Exams	1	10.00	10.00
Total Work Load			96.00
Total work load/ 30 hr			3.20
ECTS Credit of the Course			3.00

25	CONTRIBUTION OF LEARNING OUTCOMES TO PROGRAMME QUALIFICATIONS															
	PQ1	**PQ2**	**PQ3**	**PQ4**	**PQ5**	**PQ6**	**PQ7**	**PQ8**	**PQ9**	**PQ10**	**PQ11**	**PQ12**	**PQ13**	**PQ14**	**PQ15**	**PQ16**
ÖK1	3	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0
ÖK2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ÖK3	4	5	3	2	0	0	0	0	0	0	0	0	0	0	0	0
ÖK4	3	5	3	3	0	0	0	0	0	0	0	0	0	0	0	0
ÖK5	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
ÖK6	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
ÖK7	2	2	4	3	0	0	0	0	0	0	0	0	0	0	0	0
ÖK8	3	3	5	2	0	0	0	0	0	0	0	0	0	0	0	0
LO: Learning Objectives PQ: Program Qualifications																
Contribution Level:	**1 very low**		**2 low**		**3 Medium**			**4 High**			**5 Very High**					