ESOGÜ Electrical-Electronics Engineering Department

COURSE CODE: 151227520-151247520 **COURSE TITLE:** Vehicle Control Systems

Semester	Weekly Hours		COURSE			
	Theoretical	Practical	Credits	ECTS	Type	Language
7	3	0	3	5	Compulsory ( ) Elective (x)	Turkish ( ) English (x)

Write the credit (for non-credit courses weekly hours) below (If necessary distribute the credits.).

Math and Basic Science	Electrical Engineering [mark (√) if there is high design content]	General Education	Humanities
	( )		

Assessment	THEORETICAL-PRACTICAL COURSES			LABORATORY COURSES		
	Type	Number	%	Activity Type	Number	%
Midterm	Midterm			Quiz		
	Quiz			Lab performance		
	Homework	5	30	Report		
	Project	1	30	Oral exam		
	Other (……)			Other (……)		
Final		1	40			
Makeup exam (Oral/Written)						

Prerequisites	A priori knowledge of MATLAB/Simulink is recommended. Otherwise, students could practise this program from www.engin.umich.edu/group/ctm
Brief content of the course	Review of system dynamics and control. Vehicle dynamics modeling. Vehicle dynamics control. Road and driver models. Engine modeling and control. Modeling and control of powertrain systems. Other in-vehicle electronic control systems. Communication protocols. Hardware-in-the-Loop simulations.
Objectives of the course	The automotive industry has made an increasing use of closed loop control technology for better performance, comfort and safety in the products in the last years. After a review on system dynamics and control theory, the students can get detailed information on, 1. tire motion control applications like ABS and ASR, 2. lateral motion control applications of the vehicle body like ESP and vertical motion control applications of the vehicle body like active (and semi-active) suspension systems 3. warning and/or control system applications based on sensing and fusing environmental data like active distance control and heading control, 4. engine and powertrain control applications like idle speed control, anti-knocking control, lambda control, gearbox control 5. parts and devices for control, communication protocols and hardware-in-the-loop simulations.
Contribution of the course towards professional education	
Outcomes of the course	1. Understanding control problems in road vehicles, getting thorough information on solution techniques. 2. Getting detailed information on the state-of-the-art technology of control applications in road vehicles 3. Being to be able to make models of automotive subsystems with system dynamics theory, building control systems for these subsystems and performing computer aided analyses for these systems with e.g. MATLAB/Simulink and/or ADAMS/Car. 4. Being able to make detailed literature surveys on automotive control applications, making scientific contributions to selected publications in the form applying own control techniques and publish these new achievements to the scientific community
Textbook of the course	1. Kiencke, U. ve Nielsen, L. (2000). Automotive Control Systems for Engine, Driveline and Vehicle. Springer-Verlag (SAE). Berlin.
Other reference books	1. Li, L. ve Wang, F.Y. (2007). Advanced Motion Control and Sensing for Intelligent Vehicles. Springer. 2. Bonnick, A.W.M. (2001). Automotive Computer Controlled Systems.

	Butterworth Heinemann. 3. Rajamani, R. (2006). Vehicle Dynamics and Control. Springer. 4. Guglielmino, E., Sireteanu, T., Stammers, C.W., Ghita, G. ve Giuclea, M. (2008). Semi-active Suspension Control. Springer. 5. Ribbens, W.B. (1998) - Understanding Automotive Electronics. Newnes. 6. Gillespie, T. D., (1992) Fundamentals of Vehicle Dynamics, SAE. 7. Marek et. al. (2003) Sensors for Automotive Technology. Wiley VCH. 8. Harrison, M. (2004) Vehicle refinement - Controlling Noise and Vibration in Road Vehicles. SAE International. 9. Denton, T. (2006) Advanced Automotive Fault Diagnosis. Elsevier Butterworth Heinemann. 10. Fijalkowski, B.T. (2011) Automotive Mechatronics, Operational and Practical Issues, Volume 1 & 2, Springer. 11. Dorf, R.C. and Bishop, R.H., (1995) Modern Control Systems, Addison-Wesley Publishing Company. 12. Jazar, R., N., (2008) Vehicle Dynamics, Springer. 13. Rill, G., (2003) Vehicle Dynamics Lecture Notes, Fachhochschule Regensburg
Required material for the course	MATLAB/Simulink

WEEKLY PLAN OF THE COURSE	
Week	**Topics**
1	Review of system dynamics and control
2	Introduction to road vehicle modeling. Coordinate systems. Tire models.
3	Modeling of road vehicle longitudinal dynamics
4	Antilock braking systems. Control algorithms.
5	Antiskid systems. Control algorithms.
6	Modeling of vehicle lateral dynamics. Yaw stabilization.
7	Modeling of vehicle lateral dynamics. Anti-roll(over) systems.
8	Automatic control systems of vehicle longitudinal dynamics (e.g. adaptive cruise control). Automatic control systems of vehicle lateral dynamics (e.g. heading control). Road and driver models.
9	Modeling of vehicle vertical dynamics. Suspension systems. Modeling of suspension systems.
10	Active and semi-active suspensions. Control algorithms
11	Engine modeling. Engine control systems. Engine control applications.
12	Modeling of powertrain elements. Controlling drivetrains.
13	Intelligent Transportation Systems. Accident-free and sustainable transportation.
14	Electronic control devices. Protocols. Hardware-in-the-loop (HIL) simulations..
15,16	Final

NO	OUTCOMES OF THE PROGRAMME	4	3	2	1
1	Adequate knowledge of mathematics, science and Electrical and Electronic Engineering; ability to practice theoretical and practical knowledge of these areas into modeling and solving complex problems of Electrical and Electronic Engineering				
2	Ability to identify complex engineering problems in Electrical and Electronic Engineering and related fields, for this purpose having skills to formulate, select and apply appropriate methods.	**x**			
3	Having skills to apply modern design methods to design a complex system, process, equipment or product that should work under realistic conditions and constraints and satisfy specific requirements concerning the Electrical and Electronic Engineering.				
4	Having skills to develop, select and apply modern techniques and tools needed to analyze and solve complex applications in Electrical and Electronic Engineering, skills to use information technology effectively.	**x**			

5	Skills to design and conduct tests, collect data, analyze results, and interpret data for the experimental investigation of complex problems in Electrical and Electronic Engineering				
6	Ability to function effectively as an individual and as a member of teams within the discipline and in multidiscipline areas.				
7	Communicating effectively in oral and written form both in Turkish and English. Effective report writing and understanding written reports, preparing design and manufacturing reports, making effective presentations, skills to give and receive clear and concise instructions.				
8	Awareness of the necessity of lifelong learning, access to information, monitoring developments in science and technology and the ability to self-renewing				
9	Understanding of professional and ethical responsibility				
10	Information on project management, change management and risk management practices, awareness on entrepreneurship and innovation, knowledge on sustainable development.				
11	Information about universal and societal effects of engineering applications on health, safety and environment; awareness of the legal consequences of engineering solutions.				

Scale for assessing the contribution of the course to the program outcomes:

4: High **3: Medium** **2: Low** **1:None**

Name of Instructor(s):

Signature(s):

Date: 26/03/2012