Specification for the book of courses

Study program	Control Systems		
Module	Computer Control Systems and Measurement Techniques		
Type and level of studies	Master studies		
The name of the course	Control Systems in Vehicles		
Lecturer (for lectures)	Mitić B. Darko, Perić Lj. Staniša		
Lecturer/associate (for exercises)	Sibinović D. Vladimir		
Lecturer/associate (for OFE)			
Number of ECTS	5	**Course status (obligatory/elective)**	Elective
Prerequisites			
Course objectives	The aim of the course is to familiarise students with the control issues of the automotive subsystems that influence the general behaviour of the whole vehicle. The course will cover control system design and numerical simulation of automotive subsystems such as brake system, ride & handling systems (suspension, steering, ESP), and power-train (transmission, clutch, launch control, electronic differential). The course will start with the most widely used control structure in automotive applications and end with the advanced control topics that include system constraints in the design and the driver system closed loop control. This course will also address the design, control and implementation of these systems using the platform of MATLAB and SIMULINK.		
Course outcomes	Upon completion of this course students will be able to: • formulate and solve control engineering tasks related to the most representative automotive systems using the Control Theory methodology. • model and simulate complex automotive systems in computer interactive environment, using modern numerical analysis and simulation tools.		
Course outline			
Theoretical teaching	Introduction to vehicle control and basis of systems control engineering. Vehicle as a system, controlled by tyre forces and internal suspension loads, with interfaces to the driver and the traffic environment. Control of lateral dynamics. Control of longitudinal dynamics. Control of vertical dynamics. Applications of dynamics control systems. Assistance systems in commercial vehicles. Development of control systems for automotive applications. Power steering (EPS, EHPS). Integrated vehicle (body) control. Suspension control. Introduction to traction and brake control (ESP, ESC, DSC, ABS). Development of mathematical models in continuous- and discrete-time domain. Advanced control algorithms (fuzzy, neural network, sliding mode) designed and applied in automotive applications.		
Practical teaching (exercises, OFE, study and research	Coordinates and Notation for Vehicle Dynamics. Longitudinal Vehicle Motion. Lateral Vehicle Motion. Vertical Vehicle Motion. Linear Vehicle Model. Nonlinear Vehicle Model. Design of model for ABS, ESP. Design of advanced control methods for automotive control systems. Simulation in Matlab and Simulink packages. Real-time experiments.		
Textbooks/references			
1	Uwe Kiencke, Lars Nielsen, "Automotive Control Systems: For Engine, Driveline, and Vehicle", Springer Verlag, 2005.		
2	Reza N. Jazar, "Vehicle Dynamics: Theory and Application", Springer Verlag, 2008.		
3	A. Galip Ulsoy, Huei Peng, Melih Çakmakci, "Automotive Control Systems", Cambridge University Press, 2012.		
4			
5			

Number of classes of active education per week during semester/trimester/year				
Lectures	**Exercises**	**OFE**	**Study and research work**	**Other classes**
2	2	0		
Teaching methods	Lectures; Computer Exercises; Consultations			

Grade (maximum number of points 100)			
Pre-exam duties	**Points**	**Final exam**	**Points**
Activity during lectures	10	**Written exam**	20
Exercises	20	**Oral exam**	30
Colloquia			
Projects	20		