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	Modelling and Simulation in Automotive Industry		
Lecturer (for lectures)	Antić S. Dragan, Perić Lj. Staniša		
Lecturer/associate (for exercises)	Danković B. Nikola		
Lecturer/associate (for OFE)			
Number of ECTS	5	**Course status (obligatory/elective)**	Elective
Prerequisites			
Course objectives	The course aims to take the student's existing knowledge of basic mechanics and modelling and simulation of dynamical systems and apply them to road vehicles, in particular, vehicle subsystems, vehicle ride and handling behaviour. The key to the course material is the understanding of various dynamical equations of motion governing vehicle behaviour as well as computer simulation.		
Course outcomes	At the end of the course students will be able to: model the dynamics of vehicle subsystems and provide fundamental recommendation to design and improve the function of the subsystems based on computer simulation; develop a model for vehicle lateral and longitudinal dynamics, as well as vehicle ride behaviour; apply fundamental simulation techniques to analyze vehicle dynamic behaviuor including validation.		
Course outline			
Theoretical teaching	Introduction to the basic mathematical and mechanics concepts relevant for analyzing vehicle dynamics. Modelling and simulation of vehicle subsystems: tire; steering; suspension; gearbox; engine. Modelling and simulation of vehicle ride: vehicle/driver motions; vehicle vibration (frequency, dumping); suspension behavior of quarter car model, design and practical issues (springs, dumpers); road surface inputs and human response. Modelling and simulation of vehicle handling: understeer and oversteer; modelling and simulation of tires, their force and moment behavior. Modelling and simulation of ABS, ESP. Graphical methods of vehicle modeling. Case studies of modelling and simulation of vehicle ride and handling.		
Practical teaching (exercises, OFE, study and research	Introduction to the Matlab software environment related to automotive industry. Modelling and simulation of tire subsystem. Modelling and simulation of steering subsystem. Modelling and simulation of suspension subsystem. Modelling and simulation of gearbox subsystem. Modelling and simulation of engine subsystem. Modelling and simulation of vehicle handling. Quarter car model. Modeling and simulation of ABS. Modeling and simulation of ESP.		
Textbooks/references			
1	Dragan Antić, Bratislav Danković, “Modelling and simulation of dynamical systems” (in Serbian), Faculty of Electronic Engineering in Nis, 2001.		
2	Dragan Antić, “Handbook on modelling and simulation of dynamical systems” (in Serbian), Faculty of Electronic Engineering, 2006.		
3	Uwe Kiencke, Lars Nielsen, "Automotive Control Systems: For Engine, Driveline, and Vehicle", Springer Verlag, 2005.		
4	Reza N. Jazar, "Vehicle Dynamics: Theory and Application", Springer Verlag, 2008.		
5	A. Galip Ulsoy, Huei Peng, Melih Çakmakci, "Automotive Control Systems", Cambridge University Press, 2012.		

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, Auditory Exercises, 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**	20
Colloquia	30		
Projects			