COURSE DESCRIPTION CARD - SYLLABUS

Course name

Vehicle dynamics control systems

Course

Field of study	Year/Semester
Mechanical and Automotive Engineering	2/3
Area of study (specialization)	Profile of study
Motor vehicles	general academic
Level of study	Course offered in
Second-cycle studies	polish
Form of study	Requirements
part-time	compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
18	9	0
Tutorials	Projects/seminars	
0	0	

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

Prerequisites

Knowledge:The student has knowledge of vehicle dynamics fundamentals and vehicle dynamics simulation methods. The student has knowledge of fundamentals of control theory.

Skills: The student Is able use the languages: native and international at a level sufficient to enable understanding of technical texts. Is able to obtain information from the literature, internet, databases and other sources. Can integrate the information to interpret and learn from them, create and justify opinions. The student is able to use learned mathematical and physical theories to build and analyze of simple mathematical models of vehicle dynamics.

Social competencies: Understands the need and knows the possibilities of lifelong learning..

Course objective

This course is designed to provide the student with knowledge of physical principles of processes control in motor vehicles. The second objective of the course is to learn state of the art in automotive control systems and future trends. Students should know a typical construction of common automotive control systems and principles of their working.

Course-related learning outcomes

Knowledge

Has extended knowledge of mathematics in the field of numerical methods used in optimization tasks, computer simulation, linear algebra, interpolation and approximation.

Has extended knowledge in the field of computer science, concerning computer programming and engineering calculation programs in the field of computer simulation of physical systems.

Has extensive knowledge of selected departments of technical mechanics related to the selected specialization.

Skills

He can estimate the potential threats to the environment and people from the designed working machine and vehicle from a selected group.

He can develop a technical description, offer and design documentation for a complex machine from a selected group of machines.

Can perform a medium complex design of a working machine or its assembly using modern CAD tools, including tools for spatial modeling of machines and calculations using the finite element method.

Social competences

He is ready to critically assess his knowledge and received content.

Is ready to recognize the importance of knowledge in solving cognitive and practical problems and to consult experts in case of difficulties in solving the problem on its own.

It is ready to fulfill social obligations, inspire and organize activities for the benefit of the social environment.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written test, which is based on answers related to the selection of given answers and open questions. Credits will be given after achieving at least 50% of points. Answers are scores from 0 to 1 point.

Programme content

History of development, state of the art, and development perspectives of active safety systems.

Structure, configuration and principles of operation of particular vehicle dynamics control systems. Various types of sensors of vehicle dynamics and their principles of operation.

ABS system - physical principles of operation, ABS system BOSCH ABS 2S, 2E, ABS system BOSCH ABS 5 and subsequent systems, ABS systems of Teves (Continental Teves) - MKII, MKIV and subsequent systems.

ABS systems of commercial vehicles with pneumatic braking systems (WABCO, KNORR)

Traction control systems - TCS (ASR, ASC+T and other).

Stability control systems (ESP) - idea of functioning and control algorithms, sensors necessary to ESP operation, structure and design of electro-hydraulic modulator.

Electronic brake force distribution and brake assist systems (EBD i BA).

Electro-hydraulic brakes (EHB - example: Sensotronic Brake Control),

Electro-mechanical brakes.

Adaptive Cruise Control systems.

Gear shifting control systems of automatic and automated gearboxes - conventional hydraulic control systems, electro-hydraulic and electro-mechanical control systems.

Suspension control systems - goals, concepts and algorithms, existing solutions, adaptive, semi-active and active suspensions.

Designing of control systems - hardware and software tools , hardware in the loop simulation (HIL)

Teaching methods

1. Lecture with a multimedia presentation - a combination of an information and problem lecture;

2. Laboratory exercises with the use of Matlab / Simulink systems, dSpace and laboratory stands of varoious vehicle control systems (ABS, semiactive shock absorber, auttoatic transmission)

Bibliography

Basic

1. Reński A.: Bezpieczeństwo czynne samochodu. Zawieszenia oraz układy hamulcowe i kierownicze. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2011

2. Reif, K.: Automotive Mechatronics Automotive Networking, Driving Stability Systems, Electronics, Springer 2015

Additional

1. Bosch Automotive Handbook ?8th edition, Bentley Publishers, 2010

2. Rajamani R.: Vehicle Dynamics and Control, Springer 2012

3. Savaresi S., Poussot-Vassal Ch.,Spelta C. Sename O., Dugard L. :Semi-Active Suspension Control Design for Vehicles, Butterworth-Heinemann, 2010

4. Ślaski G.: Studium projektowania zawieszeń samochodowych o zmiennym tłumieniu, Wydawnictwo Politechniki Poznańskiej, Rozprawy. Nr 481. ISSN 0551-6528, Poznań 2012

Breakdown of average student's workload

	Hours	ECTS
Total workload	45	3,0
Classes requiring direct contact with the teacher	27	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	18	1,0

[1] delete or add other activities as appropriate