



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Vehicle safety systems [S2Elmob1-PAiME>SBwP]

Course

Field of study
Electromobility

Year/Semester
1/2

Area of study (specialization)
Alternative Fuels and Energy Storage

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Knowledge of fundamental concepts in the field of vehicle dynamics. Familiarity with vehicle subsystems, their construction, and basic functionalities. Understanding of the basics of automation and control systems.

Course objective

Familiarizing students with safety aspects in vehicles - passive, active, and post-accident safety. Understanding the basic sources of threats to life and health and increasing the risk of losing control over vehicle movement. Acquiring knowledge about the fundamental physics of active and passive safety systems. Learning about technical solutions in the areas of passive, active, and post-accident safety.

Course-related learning outcomes

Knowledge:

1.Has an extended and systematized knowledge in the field of designing algorithms and programming microcontrollers used in vehicles.

2. Possesses knowledge about development trends and new achievements in the area of electromobility.
3. Has an expanded and in-depth knowledge in the field of modeling, analysis, and synthesis of elements and systems characteristic of hybrid and electric vehicles.

Skills:

1. Can gather information (in Polish and English) from various sources, interpret, critically evaluate, analyze, and synthesize it, as well as draw conclusions, formulate, and justify opinions.
2. Can plan and conduct experiments involving computer simulations and measurements of electrical and non-electrical quantities in electric and hybrid vehicle systems and their charging infrastructure.
3. Can apply appropriate analytical, simulation, and experimental methods when determining functionalities and designing systems for electric vehicles, assessing their suitability and limitations beforehand, and adapting them to the specificity of the problem or the need to consider unforeseen operating conditions.

Social competences:

1. Understands that knowledge and skills in the field of technology quickly devalue, requiring continuous updating.
2. Is aware of the need to develop professional expertise and adhere to professional ethics principles.
3. Understands the importance of popularizing activities related to the latest achievements in the field of vehicle safety systems.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Credit on the basis of a written colloquium at the last lecture class. The written test consists of answering closed questions and several open questions requiring a synthetic, multi-sentence answer. The test will be passed after obtaining at least 50% of the points. Answers are scored from 0 to 1 point for each question, 0.5 of the grade is determined by randomly controlled lecture attendance.

Passing of the laboratory depends on the average of the partial grades of the reports of each class - for passing it is necessary to hand in the reports of all classes and attendance at laboratory classes.

Programme content

Lectures:

Analysis of various types of vehicle safety, including passive, active, and post-crash systems, and a discussion on technologies that enhance safety, such as ABS, ESP, cruise control, ADAS, and vehicle structure.

Laboratories:

Practical computer classes illustrating the operation and control of vehicle safety systems through modeling vehicle dynamics and analyzing the functioning of systems like ABS, ESP, cruise control, and suspension control systems in MATLAB/Simulink.

Course topics

LECTURES:

1. Types of vehicle safety - passive safety, active safety, and post-accident safety, factors of danger in the areas of passive, active, and post-accident safety.
2. Protection against collision effects - body structure, passenger restraint systems (seatbelts, airbags, curtains).
3. Passive protection against loss of vehicle control - anti-lock braking system (ABS) and traction control system (ASR).
4. Active protection against loss of vehicle control and directional stability - Electronic Stability Program (ESP), Lane Departure Warning System (LDWS), and Lane Keeping Assist (LKA).
5. Cruise control and adaptive cruise control - control and technical solutions, levels of autonomous driving.
6. Controlled suspensions - theory of vertical dynamics and control for improved comfort and safety.
7. Advanced Driver Assistance Systems (ADAS) and post-accident safety systems.

LABORATORIES:

Laboratory 1 - Introduction to computer computation and simulation environments

Laboratory 2 - Modeling passenger loads during collisions

Laboratory 3 - Modeling and analysis of the ABS system's functionality

Laboratory 4 - Modeling and analysis of active control for stability and directional control - ESP system

Laboratory 5 - Modeling and analysis of cruise control and adaptive cruise control functionality

Laboratory 6 - Modeling of suspension dynamics control system

Laboratory 7 - Final assessment session

Teaching methods

Multimedia Presentation,

Laboratory: classes in the Computer Room using models of the functioning of selected safety systems in vehicles (prepared in Matlab/SIMULINK) allowing analysis of the ideas of their functioning and simulation quantitative analysis.

Bibliography

Basic:

1. Gajek A., Juda Z. Czujniki, Wydawnictwa Komunikacji i Łączności, Warszawa 2011

2. Herner A., Riehl H.J. Elektrotechnika i elektronika w pojazdach samochodowych, Wydawnictwa Komunikacji i Łączności, Warszawa 2013

3. Konrad Reif Ed., Automotive Mechatronics, Automotive Networking, Driving Stability Systems, Electronics, Springer Viewieg, 2015

4. Bosch informator techniczny, Czujniki w pojazdach samochodowych, Wydawnictwa Komunikacji i Łączności, Warszawa 2012

Additional:

1. Robert Bosch, Czujniki w pojazdach samochodowych, Wydawnictwa Komunikacji i Łączności, 3 Warszawa 2014

2. Bosch, Mikroelektronika w pojazdach samochodowych, Wydawnictwa Komunikacji i Łączności, Warszawa 2017

3. Bosch, Układy bezpieczeństwa i komfortu jazdy: elektrotechnika i elektronika samochodowa - informator techniczny, Wydawnictwa Komunikacji i Łączności, Warszawa 2016

4. Bosch, Konwencjonalne i elektroniczne układy hamulcowe, Wydawnictwa Komunikacji i Łączności, Warszawa 2013

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	25	1,00