



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Experimental vehicle testing

### Course

Field of study

Year/Semester

Construction and operation of means of transport

1/2

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)

9

9

0

Tutorials

Projects/seminars

0

0

### Number of credit points

2

### Lecturers

Responsible for the course/lecturer:

Responsible for the course/lecturer:

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### Prerequisites

Knowledge: The student has academic level knowledge in area of vehicle dynamics, vehicle structure and subsystem design and functioning, metrology and numerical computation methods

Skills: The student is able to use computer, spreadsheets application and do basic programming. Is able to use the languages: native and international (English) at a level sufficient to enable understanding of technical texts. Is able to use literature, Internet and software tools for solving basic problems concerning use of science-technical computing software.

Social competencies: Understands the need and knows the possibilities of lifelong learning. Is aware of and understands the importance and impact of non-technical aspects of mechanical engineering activities and its impact on the environment and responsibility for own decisions.



## Course objective

To make students familiar with knowledge allowing to master methods of testing and measuring vehicle dynamics, in particular vehicle prototypes, analysis of obtained data with relation to applicable standards (in particular ISO standards). Indication of importance of experimental vehicle testing as a verification method of simulation models and as a source of new knowledge.

## Course-related learning outcomes

### Knowledge

1. Has knowledge of goals, types and methods of planning vehicle experimental testing
2. Has knowledge of essential vehicle dynamics sensors and measuring equipment
3. Has knowledge of methods of signals recording and data analysis in various domains

### Skills

1. Is able to evaluate possibilities to conduct experiments and is able select measuring tools in area of vehicle testing
2. Is able to plan and execute simple experimental test with use of modern computer measuring techniques
3. Is able to make analysis measuring data with use of computer data processing

### Social competences

1. Is aware of capabilities and limitations of measuring techniques
2. Is aware of the need of appropriate and correct analysis of measurement data for obtaining proper results of experiments
3. Is aware of relation between experimental tests, simulation tests and theoretical background for analysis and designing vehicle dynamic properties

## 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 scored from 0 to 1 point.

## Programme content

Basic concepts and definitions, experiments planning, measurement uncertainty. Types of measured signals used in vehicle experimental testing. Sensors and acquiring and recording equipment used in measurements and tests of motor vehicles. Time domain analysis of signals from vehicle experimental testing. Methods and software. Frequency domain analysis of signals from vehicle experimental testing. Methods and software. Methods of experimental testing vehicle and its subsystems. Public road tests, test during vehicle operation. Experimental tests on proving grounds. Tests of vehicle dynamic performance. Tests of vehicle maneuverability and stability. Sensors, methodology of testing and data processing. Standards. Tests of vehicle suspensions, ride comfort and safety. Sensors, methodology of



testing and data processing. Standards. Tests of road vehicle noise emission. Sensors, methodology of testing and data processing. Standards. Laboratory testing of vehicles - static and quasi-static tests. Vehicle testing with use of test benches (electrohydraulic vibration excitators). Passive safety tests. Methodology of tests, equipment, test stands, standards and other regulations. Test stand tests of vehicle subsystems and components. Testing of engines, driveline components, brakes, suspensions, steering systems, wheels and tires. Method of Remote Parameter Control. Road vehicles and its components homologation (type approval, certificate of conformity) issues.

### 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 stations as well as equipment for data recording and sensors

### Bibliography

#### Basic

1. Orzełowski S.: Eksperymentalne badania samochodów i ich zespołów, WNT Warszawa, 1995
2. Sitek K., Syta S.: Badania stanowiskowe i diagnostyka, WKŁ, Warszawa, 2011

#### Additional

1. Czajka J.H. : Pomiary drgań i hałasu na stanowiskach pracy w transporcie, OWPW, Warszawa 2000
2. P. Drozdowski: Wprowadzenie do Matlaba, Wydawnictwo PK, Kraków, 1995
3. Segers J.: Analysis Techniques for Racecar Data Acquisition, SAE International, 2008
4. Osiecki J., Gromadowski T., Stępiński B.: Badania pojazdów samochodowych i ich zespołów na symulacyjnych stanowiskach badawczych, WITE, Radom 2006
5. Kilar H.: Homologacja pojazdów samochodowych, WUPS, Szczecin 2005
6. Zakrzewski J. Czujniki i przetworniki pomiarowe, WPŚ, Gliwice 2004
7. Zalewski, R. Cegięła: Matlab - obliczenia numeryczne i ich zastosowanie, Wydawnictwo Wakom, Poznań, 1996



### Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,0
Classes requiring direct contact with the teacher	18	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) <sup>1</sup>	42	1,0

<sup>1</sup> delete or add other activities as appropriate