STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
(-)	**1010615221010618567**

Field of study	Profile of study (general academic, practical)	Year /Semester
Mechanical Engineering	**general academic**	**1 / 2**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Motor Vehicles	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
Second-cycle studies	**part-time**

No. of hours					No. of credits
Lecture: **9**	Classes: **-**	Laboratory: **9**	Project/seminars: **-**		**2**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
other	**university-wide**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**2 100%**
Technical sciences	**2 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	The student has academic level knowledge in area of vehicle dynamics, vehicle structure and subsystem design and functioning, metrology and numerical computation methods
2	**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.
3	**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.

Assumptions and objectives of the course:

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.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Has knowledge of goals, types and methods of planning vehicle experimental testing - [M2_W18]
2. Has knowledge of essential vehicle dynamics sensors and measuring equipment - [M2_W19]
3. Has knowledge of methods of signals recording and data analysis in various domains - [M2_W05]

Skills:

1. Is able to evaluate possibilities to conduct experiments and is able select measuring tools in area of vehicle testing - [M2_U09]
2. Is able to plan and execute simple experimental test with use of modern computer measuring techniques - [M2_U10]
3. Is able to make analysis measuring data with use of computer data processing - [M2_U10]

Social competencies:

1. Is aware of capabilities and limitations of measuring techniques - [M2_K01, M2_K02]
2. Is aware of the need of appropriate and correct analysis of measurement data for obtaining proper results of experiments - [M2_K02]
3. Is aware of relation between experimental tests, simulation tests and theoretical background for analysis and designing vehicle dynamic properties - [M2_K01]

Assessment methods of study outcomes

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.

Course description

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 form vehicle experimental testing. Methods and software.

Frequency domain analysis of signals form 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.

Basic bibliography:

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 bibliography:

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. Cegieła: Matlab - obliczenia numeryczne i ich zastosowanie, Wydawnictwo Wakom, Poznań, 1996

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	9
2. Participation in laboratories	9
3. Preparation for laboratories/report preparation	18
4. Preparation for written exam	18
5. Participation in written test	1

Student's workload

Source of workload	hours	ECTS
Total workload	55	2
Contact hours	18	1
Practical activities	27	1