COURSE DESCRIPTION CARD - SYLLABUS

Course name

Mechatronics in autonomous vehicles

Course

Field of study

Mechanical and Automotive Engineering

Year/Semester

3/6

Area of study (specialization)

Autonomous vehicles

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

polish

Form of study

part-time

Requirements

elective

Number of hours

Lecture

18

Laboratory classes

9

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

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Prerequisites

The student has a basic knowledge of the basics of electrical engineering and electronics.

The student is able to integrate the obtained information, interpret it, draw conclusions; can connect simple electrical and electronic circuits

The student is aware of the importance of the technical efficiency of the vehicle and understands the technical aspects and consequences of the failure for road safety.

Course objective

Getting to know the theoretical and practical problems related to the construction, functioning and diagnosis of electrical and electronic systems of motor vehicles and familiarization with modern diagnostic equipment.

Course-related learning outcomes

Knowledge

1. Has knowledge in the field of physics, including the basics of classical mechanics, optics, electricity and magnetism, solid state physics, quantum and nuclear physics, necessary to understand specialist lectures in the field of the theory of construction materials and materials science, theory of machines and mechanisms, theory of electric drives and mechatronic systems .

2. Has basic knowledge of the standardized rules of recording structures and engineering graphics.

3.Has extended basic knowledge necessary to understand specialist subjects and specialist knowledge about the construction, construction methods, manufacturing and operation of a selected group of working, transport, thermal and flow machines covered by the diploma path.

Skills

1. Can obtain information from literature, the Internet, databases and other sources. Can integrate the obtained information, interpret and draw conclusions from it, and create and justify opinions.

2. Can properly use modern equipment for measuring major physical quantities, used in machine research and production control.

3.Can draw a diagram and a simple machine element by hand in accordance with the rules of technical drawing.

Social competences

1. 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.

2.Is ready to fulfill social obligations and co-organize activities for the benefit of the social environment.

3.Is ready to fulfill professional roles responsibly, including:

- observing the rules of professional ethics and requiring this from others, - caring for the achievements and traditions of the profession.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture based on exam and the laboratory on the basis of the results of the current control of the preparation and evaluation of reports.

Programme content

The lectures and laboratory exercises cover the following topics:

- Basic information on the construction and drawing of electrical wiring diagrams in vehicles on a selected example.

- Design and operation of power systems, including operation and characteristics of alternators.

- Construction and operation of vehicle energy storage systems, including familiarization with the most commonly used battery solutions.

- Construction, operation and testing of lighting components, including control and start-up systems.

- Construction and operation of starting systems, starters and start-stop systems.

- Solutions of ignition systems and their components in motor vehicles

- Reading schematics of electronic circuits using modern software.

- Basic engine control systems.

- Application and testing of communication buses on the example of the CAN bus.

- External communication systems with vehicle controllers via the diagnostic socket.

- Identification of the location of components in the vehicle based on information from the software.

- Construction and operation of pressure / position / speed / acceleration sensors

- Testing of selected engine components containing electronic systems.

- Testing of selected mechatronic systems of the vehicle with the use of diagnostic testers.

- ABS system on vehicles with hydraulic brake systems

- ABS system on vehicles with air brake systems

- Operation of traction control systems

- Vehicle directional stability (ESP) control system (2w)

- Automatic gearbox control

- Vehicle suspension control

The idea of mechatronic systems. Examples and areas of application of mechatronic systems in means of transport. Control in mechatronic systems - definitions, open and closed control, components of the control system and their roles, the role of the process in control systems as a control object, the idea of feedback, automatic control and modern control methods. Construction of mechatronic active safety systems. Wheel speed sensors, yaw rate sensors, lateral and vertical acceleration sensors. Actuators in control of braking system - electrohydraulic modulator, electropneumatic modulator. Shock absorbers with electronically controlled damping. Structure and design of mechatronic passive safety systems.

Construction of crash sensors and protection devices. Construction of actuators - gas generators, seat belt pretensioners.

Teaching methods

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

2. Laboratory - building systems and testing their operation - experimental method.

Bibliography

Basic

1. Dyga G., Trawiński G.: Diagnostyka układów elektrycznych i elektronicznych pojazdów samochodowych, WiSP, Warszawa 2014r.

2. Fundowicz P., Radzimierski M., Wieczorek M.:Podstawy elektrotechniki i elektroniki pojazdów smochodowych, WiSP, Warszawa 2015r.

3. Ocioszyński J., Zespoły elektryczne i elektroniczne w samochodach, WNT, Warszawa 1999r.

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

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

Additional

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

2. Serwis motoryzacyjny; miesięcznik dla naprawiających i badających pojazdy, PISKP, Warszawa 2018r.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	27	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	48	2,0

[1] delete or add other activities as appropriate