COURSE DESCRIPTION CARD - SYLLABUS

Course name
Sensors and diagnostics in vehicles [S1Elmob1>SiDwP]

Course

Field of study
Electromobility

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

dr inż. Jarosław Jajczyk
jaroslaw.jajczyk@put.poznan.pl

Lecturers

Prerequisites

Basic knowledge of electrical engineering, electronics and metrology. Linking physical phenomena with the principles of operation of technical devices. Interpretation of electrical diagrams. Connecting electrical circuits. Collaboration in a team (laboratory group). Awareness of the importance and need to use electrical and electronic devices in the work of an engineer. Ability to expand one's competences.

Course objective

Getting to know theoretical and practical problems related to the functioning of sensors and diagnosing electrical and electronic systems used in motor vehicles.

Course-related learning outcomes

Knowledge:
He knows how to use physical phenomena and knowledge of mechanics, electricity and metrology to understand the functioning of sensors and carry out diagnostics of car accessories. Can determine the operational parameters of devices found in motor vehicles, using measuring equipment and diagnoscopes. He knows and understands the fundamental dilemmas of modern civilization related to the mass use of vehicles.

Skills:
He can test and diagnose elements, systems and devices related to the functioning of vehicles. Is able to plan and carry out experiments, including measurements of basic measurable quantities characteristic for sensors used in vehicles and for electrical systems used in them. Can, with the use of appropriately selected methods and tools, make a critical analysis and assess the correct functioning of the tested elements and systems. He can use technical documentation and descriptions of research procedures contained therein.

Social competences:
Understands the importance of knowledge in solving problems in the field of diagnostics and vehicle operation, and the need for its continuous supplementing and expansion. Is aware of the need to use sensors in electrical and electronic systems in vehicles and the use of meters and diagnoscopes in testing the correct operation of electrical components and systems of vechicles. Has the ability to communicate the acquired knowledge in an understandable way.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: the knowledge acquired during the lecture is verified during the written test or on the Moodle platform, which consists of 25-35 questions (test and open) with different scores. Passing threshold: 50% of points. The issues on the basis of which the questions are developed will be sent to students by e-mail using the university's e-mail system.
Laboratory: skills acquired during laboratory exercises are verified on the basis of reports made by students at home after the exercises (at least two) and a test or oral answer.

Programme content

Construction, functional properties, technical parameters, design solutions and methods of testing and diagnosing sensors in vehicles. Diagnostics of electronic vehicle systems.

Course topics

Lecture:
Structure, functional properties, technical parameters, design solutions and methods of testing and diagnosing converters of non-electrical quantities into electrical quantities used in automotive systems. Analyzes of physical and operational properties of sensors of: linear and angular displacements, rotational speed, crankshaft position, temperature, pressure, air flow meters, accelerations, vibrations (e.g. detonation sensors), force and lambda probes. Test and functional diagnostics of automotive electrical and electronic systems. Functional properties and technical solutions of automotive computer diagnoscopes as well as testers and diagnostic devices used for testing and servicing electrical equipment of vehicles. Typical faults and procedures for technical diagnostics of automotive electrical and electronic devices. Interpretation of the results of diagnostic tests.
Laboratory:
Research and analysis of sensor parameters: rotational speed and crankshaft position, air flow meters, lambda sensors, pressure, temperature, vibration sensors, linear and angular positions; tests and diagnostics of alternators and batteries, diagnosis with computer diagnoscopes through the unified diagnostic connector of the integrated Motronic and Mono-Motronic combustion engine control systems, as well as other automotive systems.

Teaching methods

Lecture:
Lecture with multimedia presentation (including: drawings, photographs, animations, sound, films) supplemented with examples given on the board. Presenting a new topic preceded by a reminder of related content, known to students from other subjects. Taking into account various aspects of the presented issues, including: economic, ecological, legal, social, etc.
Laboratory:
Demonstrations of practical nuances specific to the realised issues, working in teams.

Bibliography

Basic:
1. Praca zbiorowa: Czujniki w pojazdach samochodowych. Informatory techniczne Bosch, WKiŁ, Warszawa 2014.
2. Gajek A., Juda Z., Czujniki, WKiŁ, Warszawa 2008.
3. Gustof P.: Badania techniczne z diagnostyką pojazdów samochodowych, Wydawnictwo Politechniki Śląskiej, 2013.
4. Rudnicki M.: Diagnostyka i naprawa samochodowych instalacji elektrycznych - samochody z grupy VAG - Skoda (E-book), Wiedza i Praktyka, 2013.
5. Heiko P.: Układy bezpośredniego wtrysku benzyny w praktyce warsztatowej: budowa, działanie, diagnostyka, WKiŁ 2016.
6. Denton T.: Automobile electrical and electronic systems, Arnold, London 2012.
7. Herner A., Riehl H. J.: Elektrotechnika i elektronika w pojazdach samochodowych, WKiŁ, Warszawa 2014.
8. Pacholski K.: Elektryczne i elektroniczne wyposażenie pojazdów samochodowych, WKiŁ, Warszawa 2014.
9. Ocioszyński J.: Elektrotechnika i elektronika pojazdów samochodowych : podręcznik dla technikum, WSiP, Warszawa 2013.
10. Kasedorf J.: Układy wtryskowe i katalizatory, WKiŁ, Warszawa 1998.

Additional:
1. Bednarek K., Bugała A., Budzińska N., Wielogórski M., Stanowiska do badań i prezentacji funkcjonowania czujników prędkości obrotowej oraz położeń liniowych i kątowych, Poznan University of Technology Academic Journals, Electrical Engineering, No 100, Poznań 2019, s. 199-210, DOI: 10.21008/j.1897-0737.2019.100.0018.
2. Szymkowiak M., Bednarek K., Jajczyk J., Bugała A., Koncepcja stanowiska do badań czujników Halla położeń liniowych i kątowych, Poznan University of Technology Academic Journals, Electrical Engineering, No 105, Poznań 2020, s. 95-110, DOI: 10.21008/j.1897-0737.2020.105.0008.
3. Bednarek K., Bałchanowski T., Aspekty dydaktyczne oraz techniczne projektu i budowy stanowiska do badań samochodowych układów zapłonowych, Poznan University of Technology Academic Journals, Electrical Engineering, No 82, Poznań 2015, s. 243-252.
4. Bednarek K., Bugała A.: Własności użytkowe akumulatorów kwasowo-ołowiowych, Poznan University of Technology Academic Journals, Electrical Engineering, No 92, Poznań 2017, s. 47-60.
5. Sitek K.: Diagnostyka samochodowa, Wydawnictwo AUTO, Warszawa 1999.
6. Kowalski B.: Badania i diagnostyka samochodowych urządzeń elektrycznych, WKiŁ, Warszawa 1981.
7. Bednarek K., Bugała A., Budzińska N., Wielogórski M., Didactic means in knowledge and practical skills shaping in the technical education processes, ITM Web of Conferences, vol. 28, 01022-1 - 01022-2 (2019), DOI 10.1051/itmconf/20192801022.
8. Bednarek K., Bałchanowski T., Educational and technical aspects of the design and construction of the test bench for testing the automotive ignition systems, in: Computer Applications in Electrical Engineering, edited by R. Nawrowski, Publishing House of Poznan University of Technology, vol. 13, Poznan 2015, p. 197-208.
9. Filipiak M., Jajczyk J.: Diagnostyka radarowego systemu ACC, Poznan University of Technology Academic Journals, Electrical Engineering, Issue 88, ISSN 1897-0737, Published by Poznan University of Technology (2016), Perfekt Druk, pp. 227-237.
10. Jajczyk J., Filipiak M.: Badanie układu turbodoładowania w silnikach spalinowych ZS, Poznan University of Technology Academic Journals, Electrical Engineering, Issue 92, ISSN 1897-0737, Published by Poznan University of Technology (2017), Perfekt Druk, s. 73-82

Breakdown of average student's workload

	Hours	ECTS
Total workload	112	4,00
Classes requiring direct contact with the teacher	62	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	50	2,00