# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Advanced sensory systems [S2Elmob1-SSP>ZSS]

## Course

Field of study
Electromobility

Year/Semester
2/3

Area of study (specialization)
Car Onboard Systems

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

The student should have knowledge of electrical metrology, electronics and microprocessor technology. He should know the basics of the C ++ language and connect simple measuring systems based on diagrams. He should work effectively in a group.

## Course objective

Understanding the principles of operation, configuration and programming of intelligent sensors and AFE systems

## Course-related learning outcomes

Knowledge:
1. He has extensive and systematized knowledge in the field of designing algorithms and programming microcontrollers used in vehicles as well as standards and the use of communication interfaces to exchange data with vehicle components.
2. Has extensive knowledge of diagnostic methods, including non-invasive, sensor technology, signal processing and analysis of measurement data.
3. Has extensive knowledge in the field of measurements of electrical quantities and selected non-

electrical quantities also with the use of remotely controlled systems. Has in-depth knowledge of the development of experimental results.

Skills:
1. He is able to plan and carry out experiments involving computer simulations and measurements of electrical and non-electrical quantities in electric and hybrid vehicle systems and their charging infrastructure.
2. He is able to design, manufacture and integrate into ICT, electronic, power electronic and drive systems and systems for hybrid and electric vehicles, including traction vehicles.
3. Is able to determine the directions of further learning, organize the process of self-education and indicate the directions of professional development of other people.

Social competences:
1. He understands that in the area of technology, knowledge and skills are rapidly devaluing, which requires their constant supplementation.
2. He understands the importance of popularizing activities regarding the latest achievements in the field of electromobility and the need to fulfill social obligations.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Written test (passing threshold: above 50%) or control thesis in the form of a project
Laboratory classes: Initial assessment of knowledge needed to solve laboratory tasks. Continuous assessment in all laboratory classes and rewarding activity and skills improvement. Assessment of the final reports from laboratory classes.

## Programme content

Basic information about measurement sensors. Construction and principle of operation of the intelligent sensor and the AFE (Analog Front to End) system.
Wired and wireless digital communication interfaces: I2C, SPI, 1-WIRE, RS232C, Bluetooth, WiFi. Software terminals for data transmission
Sharing measurement data on websites

## Course topics

Update: 20.06.2024
Lecture: The basic of principle of operating of measurement sensors. The conditioning of signal from sensor. Integrated conditioners of measuring signals with analog output. Wired and wireless standards of data transmission using in sensory systems including car onboard sensory systems. Using of intelligent sensors with digital inteface. The principles of operation and programming AFE (Analog Front to End) systems. Application of microcontrollers in sensory systems.
Laboratory classes: Issues of communication and programming of intelligent measuring sensors and AFE systems.

## Teaching methods

Lecture: Multimedia presentations with examples shown on the board and demonstration experiments. Indicating the practical aspect of the issues discussed. Solving issues of a design nature. Assessment of student activity during classes.
Laboratory classes: Team work. Practical implementation of experiments supported by multimedia presentations. Discussion of reports by the teacher.

## Bibliography

Basic:
1. Mielczarek W., Szeregowe interfejsy cyfrowe, Wyd. Helion, Gliwice 1993.
2. Nawrocki W., Sensory i systemy pomiarowe, Wyd. Politechnik Poznańskiej, Poznań 2006????.
3. Bogusz J., Lokalne interfejsy cyfrowe w systemach cyfrowych. Wyd. BTC, Warszawa 2004
4. Baranowski R., Mikrokontrolery AVR ATmega w praktyce. Wyd. BTC, Warszawa 2005
5. M. Miłek, Metrologia elektryczna wielkości nieelektrycznych, Wyd. UZ, Zielona góra, 2006.

6. A. Gajek, Z. Juda, Czujniki samochodowe, WKŁ, Warszawa 2011.
7. Kniat J. Programowanie obiektowe w języku C++. Wydawnictwo Politechniki Poznańskiej, Poznań 1995.
8. Sibigtroth J.M. Zrozumieć małe mikrokontrolery, Wydawnictwo BTC, Warszawa 2003.
9. Pełka R. Mikrokontrolery architektura, programowanie, zastosowania. WKiŁ, Warszawa 1999.

Additional:
1. Zieliński T., Cyfrowe przetwarzanie sygnałów. WKiŁ, Warszawa 2005.
2. P. Horowitz, W. Hill Sztuka elektroniki. Cz. 1 i 2, WKiŁ. Warszawa, 2013.
3. U. Tietze, Ch. Schenk, Układy półprzewodnikowe, WNT, Warszawa, 2009.
4. Hajduk Z., Mikrokontrolery w systemach zdalnego sterowania. Wydawnictwo BTC. Warszawa 2005.
5. Hulewicz A., Cysewska-Sobusiak A., Bołtrukiewicz M., Wireless transmission of photoplethysmographic signals, Elektronika, nr 8-9/2004, s.142-145.
6. Hulewicz A., Bołtrukiewicz M., Prokop D., Cysewska-Sobusiak A., Mikroprocesorowe urządzenie do numeracji pakietów UDP, Pomiary Automatyka Kontrola, nr 9/2005, s. 34-36.
7. Bołtrukiewicz M., Generator cyfrowy do współpracy z czujnikami pomiarowymi, Elektronika, nr 6/2008, str. 180-181.

## 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 |