COURSE DESCRIPTION CARD - SYLLABUS

Course name
Microprocessor systems in vehicles [S2Elmob1>UMwP]

Course

Field of study
Electromobility

Year/Semester
1/1

Area of study (specialization)
–

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
30

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge in the field of mathematics, physics, basics of electrical engineering and electronics, including digital. Ability to understand and interpret the knowledge provided in the classes. The ability to effectively self-educate in the field related to the chosen field of study. Awareness of the need to expand one's competences, readiness to cooperate within the team.

Course objective

In-depth knowledge of theoretical and practical problems related to the construction of microprocessor elements, subassemblies and systems and the basics of their programming and design, in particular interfaces and communication protocols for vehicle applications.

Course-related learning outcomes

Knowledge:
1. has extensive knowledge in the field of designing algorithms and programming microcontrollers used

in vehicles
2. has systematic knowledge of current achievements and development trends in the field of communication interfaces used in data exchange protocols with vehicle components

Skills:
1. can develop a program algorithm and program microcontrollers with communication interfaces in a high-level language
2. knows how to operate digital oscilloscopes in order to verify and test the proposed software solutions

Social competences:
1. is aware of the importance of the latest scientific and technical achievements in solving research and practical problems and, if necessary, being supported by expert opinions

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired during the lecture is verified by a test lasting approx. 45-60 minutes, consisting of 10-15 questions (test and open-ended), scored differently. 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.
The skills acquired during laboratory classes are verified on the basis of a final colloquium, consisting of the task of implementing the microcontroller software with peripheral systems and/or mini-projects implemented during the classes. Passing threshold: 50% of points. In addition, the final evaluation of the laboratories takes into account: rewarding knowledge necessary to implement the problems in a given area of laboratory tasks, rewarding the increase in the ability to use the principles and methods learned, assessment of knowledge and skills related to the implementation of the exercise task.
In addition, the student can earn additional points for activity during classes, and in particular for: proposing to discuss additional aspects of the issue, the effectiveness of applying the acquired knowledge when solving a given problem, the ability to cooperate as part of a team practically implementing a detailed task in the laboratory, comments related to the improvement of teaching materials, diligence aesthetics of the developed tasks as part of self-study.

Programme content

The module program covers issues related to the structure, principles of operation, automotive applications and programming: microprocessors, microcontrollers, selected communication interfaces, memory and peripheral components.

Course topics

The lecture program includes the following topics: microprocessors, microcontrollers, components: interfaces, memories (array, programmable), communication systems, peripheral components. Microprocessor systems: buses, addressing. Microprocessor
spinal. Oscillator and clock signal distribution systems. Ways to reduce power. Special microcontroller operating modes. RESET signal. RESET sources. Systems that supervise the correct operation of the microcontroller. Watchdog. Signal processing. Design and programming of microprocessor control systems for exemplary applications in the areas of production, operation and measurements in vehicles, in particular in communication / data exchange tasks. Analysis, implementation and verification of data exchange protocols with components (e.g. accelerometer, Bluetooth, temperature sensors, etc.) of the vehicle using communication interfaces (USART / I2C / SPI / CAN).
The laboratory program includes the following issues:
Use of selected microcontrollers, programming using a high-level language, testing using digital oscilloscopes. Working with catalog notes, demoboard systems and additional components used in electromobility. Presenting innovative solutions in the field of microprocessor technology, used in the latest solutions in various industries. Elements of design and principles of programming in a high-level language of microprocessor systems that perform specific tasks. Using students' knowledge from other subjects, initiating discussions, asking questions to increase students' activity and independence.

Teaching methods

Lecture: a multimedia presentation containing drawings, diagrams, photos, supplemented with practical

examples on the board, slides and computer programs, which makes it easier to combine theory with practice. Lecture supplemented with additional materials provided to students for independent study. Lecture conducted on-line with using synchronous access methods.
Laboratories: Work at physical stations with microcontrollers, vehicle components (actuators, sensors, communication buses) and specialized software on PCs. Using, if necessary, tools enabling students to perform tasks at home (microprocessor system emulator, specialized software for programming microcontrollers). Classes at the university supplemented with materials for independent performance of tasks on the available free software packages.

Bibliography

Basic:
1. Paprocki K., Mikrokontrolery STM32 w praktyce, Wyd. BTC, 2014.
2. Kurczyk A., Mikrokontrolery STM32 dla początkujących, Wyd. BTC, 2019.
3. Galewski M., STM32 Aplikacje i ćwiczenia w języku C, Wyd. BTC, 2019.
4. Krzyżanowski R., Układy mikroprocesorowe, Mikom, Warszawa 2004.

Additional:
1. Francuz T., Język C dla mikrokontrolerów, od podstaw do zaawansowanych aplikacji, Helion, Gliwice 2011,
2. Tatjewski P., Sterowanie zaawansowane obiektów przemysłowych. Struktury i algorytmy, Akademicka Oficyna Wydawnicza EXIT, Warszawa, 2002.
3. Gay W., Beginning STM32: Developing with FreeRTOS, libopencm3 and GCC, Wyd. Apress, 2018.
4. Piasecki A., Trzmiel G., Remote building control using the bluetooth technology, Monograph Computer Applications in Electrical Engineering, Poznan University of Technology 2016, vol. 14, pp. 457-468.
5. Trzmiel G., Kurz. D., Smoczyński W., The use of the EMG signal for the arm model control, ITM Web of Conferences, vol. 28, 2019 (01024), 15.07.2019, DOI: https://doi.org/10.1051/itmconf/20192801024.
6. Internet: specialist literature, catalog cards, standards.

Breakdown of average student's workload

	Hours	ECTS
Total workload	83	3,00
Classes requiring direct contact with the teacher	45	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	38	1,50