UNIWERSYTET GDAŃSKI

Course title
Zaawansowana elektroniczna diagnostyka chemiczna/Advanced microcontroller-based chemical diagnostics

ECTS code
13.3.1019

Name of unit administrating study
Faculty of Chemistry

Studies

Field of study	Type	Form	
Chemical Business	Master	Full-time studies	

Teaching staff
dr hab. Cezary Czaplewski, prof. UG

Forms of classes, the realization and number of hours

A. Forms of classes, in accordance with the UG Rector's regulations
lecture, laboratory classes

B. The realization of activities
In-class learning

Number of hours
Lecture 15 h, laboratory classes 45 h

ECTS credits

classes - 60 h
tutorial classes - 30 h
student's own work - 60 h
TOTAL: 150 h - 6 ECTS

The academic cycle
First year, summer semester

Type of course
obligatory

Language of instruction
Polish

Teaching methods
Lecture with multimedia presentation.
Work in the computer laboratory (building, programming and use of microcontroller based devices for physicochemical measurements) combined with the analysis of the measurement results and discussion.

Form and method of assessment and basic criteria for evaluation or examination requirements

A. Final evaluation, in accordance with the UG study regulations
Course completion (with a grade), exam

B. Assessment methods
- oral exam
- completion of the final project (building, programming and testing of a selected microcontroller-based device used in chemical diagnostic)
- completion of all assigned projects during classes in the computer lab
- written report for each assigned project

C. The basic criteria for evaluation

- correctness of the reports on assigned projects; the final grade of the lab. is based on the partial grades received from each report; failure to complete the experimental part means failing the laboratory exercises

- pass mark for the final project (lecture)

- pass mark for the oral exam (lecture)

- the final grade of the lecture is based on partial grades from the project and oral exam (50% of the contribution to the grade)

Required courses and introductory requirements

a. Formal requirements Information technology

b. Prerequisites none

Aims of education

Introduction to the construction and programming of microelectronic devices based on the Arduino microcontroller and their use for physicochemical measurements in the chemical diagnostics. Developing skill of unassisted designing experiments and interpretation of the obtained results of physicochemical measurements.

Course contents

Programming microcontrollers in the Arduino environment: using variables, conditional instructions, loop instructions, defining your own functions. Building, programming and testing electronic devices based on the Arduino microcontroller. The use of microcontroller based devices in chemical diagnostics for measurements of physicochemical quantities such as temperature, humidity, concentration of selected chemical substances. The use of analog and digital sensors. Construction, programming and calibration of the breathalyzer with a digital display or a display based on a set of LEDs and a sensor that changes resistance depending on the concentration of ethyl alcohol vapors. Construction and programming of the sensor detecting methane and other flammable gases. The use of a color sensor and RGB diode to build a colorimeter. Calibration of the constructed colorimeter according to Lambert-Beer law for various dilutions of several dyes. Construction, programming and calibration of a pH meter. Construction, programming and calibration of the conductivity meter. Construction and programming of a syringe pump using a stepper motor controlled by the Arduino microcontroller. Programming the communication of Arduino microcontrollers with a computer using Python scripts for the analysis and visualization of measurement results (complex data structures on the example of a list, matplotlib library for drawing charts, elements of object-oriented programming and numerical methods).

Bibliography of literature

Literature required to pass the course

B. Extracurricular readings

Python. Wprowadzenie, M. Lutz, Helion, 2009

Arduino dla początkujących. Podstawy i szkice. Monk Simon, Helion, 2014