COURSE DESCRIPTION CARD - SYLLABUS

Course name
Computer support for experiment [S1FT2>KWE]

Course

Field of study
Technical Physics

Year/Semester
3/5

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
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

1. Basic knowledge in physics, electronics, and computer science. 2. Ability to use a computer and gather information from indicated sources. 3. Awareness of the need to expand one's competencies and responsibility for created technical solutions.

Course objective

1. To impart knowledge to students on electronic and computer solutions serving the operation of experimental and measurement works. 2. To develop students' skills in creating functional measurement systems based on modern hardware and software solutions. 3. To foster responsibility for the created engineering systems among students.

Course-related learning outcomes

Knowledge:
The student who completes the course will:
W01. Know the features of analog and digital signals and the basic parameters of transmission and processing systems for these signals
W02. Know the parameters and applications of basic laboratory instruments, vision systems, and

actuators and how to connect them to computer hardware
W03. Understand methods for measuring basic electrical and non-electrical physical quantities and potential sources of measurement uncertainties in computer systems
W04. Know how to implement simple electronic circuits that assist in computer-supported experimentation (e.g., amplifying, differentiating, integrating circuits)

Skills:
The student who completes the course can:
U01. Use, with understanding, indicated sources of engineering knowledge (basic literature) and continuously acquire up-to-date knowledge from other sources (e.g., books, industry journals, equipment manufacturer documentation)
U02. Plan the selection of appropriate elements and modules for computer measurement systems (e.g., connectors, wires, sensors, measurement and interface cards)
U03. Create computer software to perform basic control operations and service measurement systems
U04. Prepare technical documentation illustrating the operation of created measurement software

Social competences:
The student who completes the course:
K01. Is aware of dangers to users of computer experiment support systems and the need for using protective mechanisms and facilitating the operation of created systems

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written/Oral Exam; Grading: 3 (50.1%-70.0%), 4 (70.1%-90.0%), 5 (from 90.1%).
Assessment of work and activity during laboratory exercises:
Student works with significant assistance from the instructor with understanding of the acquired knowledge. Student can solve assigned tasks only in a template manner. Student is unable to analyze problems beyond the basic curriculum. Student demonstrates limited engagement during the course of the activities (3).
Student works independently with sporadic assistance from the instructor with understanding of the acquired knowledge. Student can solve assigned tasks correctly. Occasionally, student is able to analyze problems beyond the basic curriculum. Student shows engagement during the course of the activities (4).
Student works fully independently with a deep understanding of the acquired knowledge. Student can solve assigned tasks in a creative and often non-template manner. Student is capable of analyzing problems beyond the basic curriculum. Student shows significant engagement during the course of the activities (5).

Programme content

Sources of knowledge in computer-aided experimentation,
Analog versus digital signal. Technical solutions for transmitting both types of signals.
Analog-digital conversion,
Digital-analog conversion,
Digital systems and interfaces,
Digital experiment support systems,
Computer-controlled laboratory equipment,
Universal and specialized computer measurement cards,
Measurement sensors,
Vision systems,
Control of loads and positioning systems,
Programming of computer measurement systems,
Ergonomics and safety in creating and operating computer-supported experiment systems.

Course topics

Sources of knowledge in computer-aided experimentation (e.g., books, industry journals, equipment manufacturer documentation).
Analog versus digital signal. Technical solutions for transmitting both types of signals.

Analog-digital conversion: Parameters and configuration of A/D converters and their applications in experimental work.
Digital-analog conversion: Parameters and configuration of D/A converters and their applications in experimental work.
Digital systems and interfaces: Types of digital systems, digital interfaces and communication buses and their applications in experimental work.
Digital experiment support systems: Modular systems, embedded systems, microcontroller systems, real-time systems.
Computer-controlled laboratory equipment (e.g., generators, multimeters, oscilloscopes).
Universal and specialized computer measurement cards: A/D and D/A converter cards, digital interface cards, laboratory instrument cards.
Measurement sensors: Sensors for electrical quantities, sensors for selected non-electrical quantities, signal conditioning.
Vision systems.
Control of loads and positioning systems.
Programming of computer measurement systems: Standard commands for programmable devices (SCPI), graphical programming language LabVIEW.
Ergonomics and safety in creating and operating computer-supported experiment systems.

Teaching methods

Lecture: Multimedia presentation.
Laboratory Exercises: Practical exercises in creating software for computer-supported experimentation.

Bibliography

Basic:
1. K. Hejn, A. Leśniewski. Systemy pomiarowe. WPW, Warszawa 2017
2. W.Nawrocki. Komputerowe systemy pomiarowe. WKŁ, Warszawa 2007
3. W. Tłaczała. Środowisko LabVIEW w eksperymencie wspomaganym komputerowo. WNT, Warszawa 2020
4. M.Chruściel. LabVIEW w praktyce. BTC, Legionowo 2008
5. A.Jurkowski, M.Maćkowski, S.Michalak, J.Pająkowski, M.Wawrzyniak. Komputerowe systemy pomiarowe. Ćwiczenia laboratoryjne. WPP, Poznań 2007

Additional:
1. R. Kwiecień. Komputerowe systemy automatyki przemysłowej. Helion, Gliwice 2013
2. S. Tumański. Technika pomiarowa. PWN, Warszawa 2019
3. W.Nawrocki. Sensory i systemy pomiarowe. WPP, Poznań 2006
4. W.Tłaczała, L.Tykarski. Elektronika w eksperymencie fizycznym. WPW, Warszawa 1998.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50